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Commonwealth of Australia.

Department of Trade and Customs.

FISHERIES.

Zoological Results of the Fishing Experiments carried on by F.I.S. "Endeavour," 1909-10 under (H. C. Dannevig, Commonwealth Director of Fisheries).

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WITH THE COMPLIMENTS OF

THE HONORABLE LITTLETON E. GROOM,

Minister of State for Trade and Customs.

Department of Trade and Customs,
Melbourne, 1914

I. Report on the Hydroida collected in the Great Australian Bight and other Localities.

BY

W. M. BALE, F.R.M.S.,

Late Senior Inspector of Excise, Victoria.

Plates I.-VII.

I.—REPORT ON THE HYDROIDA.

I.—Introduction.

The Hydroids described in the present Report were obtained by the "Endeavour" at various localities, the most important collection having been dredged in the Great Australian Bight in 1911, no less than seven species out of thirteen then collected being here described as new. A noteworthy feature is the robust character of some of the Plumularians found in this locality, two of the *Aglaopheniæ* and one *Plumularia* reaching fully two feet in height, and comprising an enormous number of individual polypes. The locality, therefore, offers a promising ground for future research among its little-known Hydroid fauna, hitherto practically unexplored.

The following is a list of the species observed, with localities:—

Campanularia pumila, *sp. nov.*—Great Australian Bight.
Sertularella divaricata (*Busk*)—Hunter Group and Great Australian Bight.
Sertularia macrocarpa, *Bale*—Bass Strait.
,, maplestonei, *Bale*—Hunter Group.
,, unguiculata, *Busk*—Bass Strait.
Diphasia subcarinata (*Busk*)—Great Australian Bight.
Synthecium subventricosum, *sp. nov.*—Great Australian Bight.
Plumularia buskii, *Bale*—Great Australian Bight.
,, procumbens, *Spencer*—Great Australian Bight.
,, asymmetrica, *sp. nov.*—Great Australian Bight.
Kirchenpaueria producta, *Bale*—Bass Strait.
Halicornopsis elegans (*Lamarck*)—Great Australian Bight.
Aglaophenia megalocarpa, *sp. nov.*—Great Australian Bight.
A. dannevigi, *sp. nov.*—Great Australian Bight.
A. billardi, *sp. nov.*—Great Australian Bight.
A. tasmanica, *sp. nov.*—Oyster Bay, Tasmania.
A. decumbens, *sp. nov.*—Bass Strait.
Halicornaria intermedia, *sp. nov.*—Oyster Bay, Tasmania.
,, birostrata, *sp. nov.*—Great Australian Bight.
,, urceolifera (*Lamarck*)—Great Australian Bight

The specimens from the Great Australian Bight were received by me in January 1912, and the others at various times prior to that date. Much of the delay in presenting this Report has been due to the time occupied in correspondence with friends in Europe, especially Dr. A. Billard, of Paris, and Dr. C. Hartlaub, of Heligoland, both of whom I have to thank for their kindness in comparing specimens with type forms in European Museums.

II.—DESCRIPTION OF THE GENERA AND SPECIES.

Family CAMPANULARIIDÆ.

Genus Campanularia, *Lamarck*.

Campanularia pumila, *sp. nov.*

(Plate i., figs. 6—8.)

Hydrorhiza slender, filiform, overrunning other hydroids and giving origin at intervals to short very slender peduncles, more or less irregularly undulated at both ends, and sometimes in the intermediate portions; a more distinct spherical segment just below the hydrotheca.

Hydrothecæ small, cylindrical, constricted just above the base, month with about eight truncate teeth, the truncate ends very slightly sinuated; teeth a little incurved, peristome often doubled or tripled.

Gonosome:—?

This exceedingly delicate species has unbranched peduncles of varying length, commonly about as long as the hydrothecæ, and not very strongly undulated. The hydrothecæ are from ·37 to ·44 mm. in length, and ·12 to ·15 in width, the length depending largely on the number of successive renewals of the border. In one calycle the first peristome was about the middle of its length, and the second immediately below the third and final one. In each case the teeth of the second or third circlet corresponded in number and position with those of the original series.

On account of the delicacy and the shrivelled condition of the hydrothecæ I was not able in all cases to count the marginal teeth. In two or three the number was undoubtedly eight, another seemed to have seven, while in no case could the number have varied much from these. In regard to form, the denticulation of the border is precisely as that of *C. spinulosa* would be if the little spines, which in that species spring from the angles of the teeth, were wanting. At the "floor" of the hydrotheca there is a circlet of excessively minute bright points.

Loc.:—Great Australian Bight, parasitic on *Synthecium subreutricosum*, 40 to 100 fathoms.

Family SERTULARIIDÆ.

Genus Synthecium, *Allman*.

Synthecium subventricosum, *sp. nov.*

(Plate i., figs. 3—5.)

Hydrophyton usually under one inch in height, monosiphonic, pinnate, many of the pinnæ anastomosing with other parts of the polypidom or continued into stolons; stem-internodes (except at the base) long, each usually bearing a pair of opposite hydrothecæ at its base and summit, with a pair of opposite pinnæ in the middle; those at the base short, bearing a pair of opposite hydrothecæ only. Pinnæ divided into stout internodes, each supporting a pair of hydrothecæ; the first hydrotheca on the proximal side of each pinna much higher than its fellow, those on successive internodes less uneven, till at about the third to the fifth internode they become opposite.

Hydrothecæ tubular, stout, lower part vertical and often somewhat ventricose, distal part curved outward, free part short, aperture circular, margin a little sinuated at the sides and very slightly everted, looking upwards and outwards.

Gonothecæ small, nearly globular, with five to six transverse ridges interrupted in the middle on opposite sides, month prominent, conical, aperture small.

Polypidom thin, colourless and transparent, more or less tangled owing to the anastomosing of the pinnæ.

This species is allied to *S. patulum*, from which it may readily be distinguished by the larger, and especially the stouter, hydrothecæ, with their tendency to a ventricose condition, and the distinctly sub-alternate arrangement of those on the proximal parts of the pinnæ. In *S. patulum* it is not unusual for the first hydrotheca on the proximal side of each pinna to be set a little higher than its opposite neighbour; here, however, the irregularity is much more pronounced. Each successive pair comes nearer to a strictly opposite condition, which is sometimes attained by the third pair, sometimes only by the fourth or fifth. Even after this however irregularities are not uncommon, and in some cases the more distal pairs deviate from the normal arrangement in the contrary direction to the proximal.

In comparing my specimens of *S. subventricosum*, *S. patulum*, and *S. orthogonium*, I find differences in the prevailing arrangement of the internodes in all three. *S. patulum* generally has from one to three short proximal internodes, each of which supports a single pair of hydrothecæ; above these the internodes are long, and each bears a pair of pinnæ close to the summit, with a pair of hydrothecæ about the middle. *S. orthogonium*

also has long internodes, with a pair of pinnæ close to the top, but the first few internodes bear no hydrothecæ: the next two or three have usually a pair of hydrothecae in the middle, as in *S. patulum*, and the rest have mostly two pairs instead of one. *S. subventricosum* has, like *S. patulum*, two or three short internodes bearing hydrothecæ only, the rest being arranged like the upper internodes of *S. orthogonium*, with two pairs of hydrothecæ coming between every two pairs of pinnæ. Here however the nodes come between the two pairs of hydrotheeæ, so that an internode supports a pair of pinnæ in the middle, with a pair of hydrothecæ at the top and another pair at the bottom (the two pairs therefore being pretty close together). There are however in many cases less pronounced nodes just above the pinnæ, in addition to those described. Both in this species and *S. patulum* the joints between the proximal short internodes are apt to be indistinct.

How far these characters are to be relied upon is at present impossible to determine, but many irregularities certainly occur; however the other characters will easily suffice to distinguish *S. subventricosum* from either of the others.

The gonangia are very small, about ·75 mm. long and the same in width, very little if at all compressed, and their markings are of the same type as those of *S. elegans*, but without the extreme regularity indicated by Allman's figures. The alternating ridges (which in all the specimens seen numbered five or six), are like those of *Sertularella divaricata* and its allies, having a delicate free-edged expansion or flounce running round them.

It may be remarked in passing that the arrangement of the stem-internodes described above will, if found to be sufficiently constant supply a definite mark of distinction between *S. patulum* and *S. orthogonium*, two species which in regard to the form and arrangement of the hydrothecæ approach each other closely. All my specimens of *S. patulum* have the proximal internodes short, without pinnæ, while all those of *S. orthogonium* have them long, with pinnæ only. The latter arrangement is similar to that indicated by Marktanner-Turneretscher for his specimens of *S. campylocarpum*, Allman. Allman described that species as having no hydrothecæ on the stem except an "occasional pair." Marktanner-Turneretscher says, however, that in his specimens the upper internodes bear two pairs of hydrothecæ as well as a pair of pinnæ, though the lower ones bear pinnæ only. I must admit my inability to find anything to distinguish *S. campylocarpum* from the earlier *S. orthogonium*. Both Campenhausen and Marktanner-Turneretscher say that the hydrothecæ of the specimens which they refer to *S. campylocarpum* are like those of *S. orthogonium*, and neither observer furnishes any reason for assigning them to the

former species rather than to the latter. Campenhausen's figure of the hydrotheeæ serves perfectly for *S. orthogonium*, and Allman's figure of the gonangium of his species seems to be only an idealized representation of that of Busk's species, which varies greatly in the degree of development of the transverse ridges.

A feature sometimes very noticeable in *S. subventricosum* is the presence of a distinct lining or inner layer of the hydrotheca-wall, which in many cases has so far become separated from the outer perisarc as to constitute a distinct inner tube, running from the base to the summit of the hydrotheca, and not fitting closely to the outer wall throughout, but more or less detached from it at intervals; especially in such parts as the slight inflation commonly found at the base, and the angle at the upper part of the adcauline side. In the middle portion of the hydrotheca and near the aperture it is usually so intimately united to the outer wall as to be indistinguishable, but it may separate at any portion and become conspicuous through its irregularly crumpled condition. It is observable in many specimens from which all trace of the hydranths and cœnosarc has disappeared, while in other instances no trace of it can be distinguished. It may be connected with the regeneration of the hydranths, though it is often not to be detected in hydrothecæ of which the border has been reduplicated, while it is frequently very distinct in specimens where regeneration does not appear to have taken place.

In many of the hydrotheeæ of *S. subventricosum* are found ova, 220-230 μ in length, 165-180 μ in width, perfectly elliptical, yellow in colour, and situated exactly in the bend of the hydrothecæ, to the diameter of which their own is nearly equal. Some are quite fresh-looking, others empty and shrivelled. The polypidoms in which these were found were quite empty otherwise, all traces of the original soft parts having disappeared, both from the trophosome and the gonangia. In a specimen of *S. patulum*, probably from Port Phillip, I found what appeared to be the remains of similar bodies. It would be a singular instinct which should lead some animal to select especially the empty polyparies of *Synthecium* wherein to deposit its eggs, but I can suggest no other explanation.

Loc.:—Great Australian Bight, on large Plumularians, 40 to 100 fathoms.

Genus Diphasia, *Agassiz*.

Diphasia subcarinata *(Busk)*.

Sertularia sub-carinata, Busk, Voy. "Rattlesnake," i., 1852, p. 390.

Diphasia sub-carinata, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 102, pl. iv., fig. 1, pl. xix., fig. 18; Kirkpatrick, Sci. Proc. Roy. Dublin Soc., vi. (N.S.), 1890, p. 604; Ritchie, Austr. Mus. Mem., iv., 1911, p. 850.

One of the specimens of *Aglaophenia megalocarpa* had a colony of this species over-running the stem. The hydrothecæ however differ from those of all other specimens which I have seen in having the third (lowest) marginal tooth quite obsolete, so that there is only a bidentate border.

The usual condition of *D. subcarinata* is unbranched, but branched specimens often occur. In such cases the branches spring from normal internodes of the primary shoot, generally below a hydrotheca, but in some cases above; and the arrangement of the hydrothecæ in opposite pairs is the same on the primary shoot as on the branches.

In most specimens there is, inside the angle of flexure of the hydrotheca, a slight transverse ridge or thickening, the rudiment of that which in a more fully developed form is found in the corresponding position in *Sertularia crenata*.

Loc.:—Great Australian Bight, 40 to 100 fathoms.

Genus Sertularia, *Linn.* (in part.)

The *Sertulariæ* collected by the "Endeavour"—*S. macrocarpa*, *S. maplestonei*, *S. unguiculata*—all belong to a well-defined group, of which *S. elongata* may be taken as the type, and which includes also among Australian species *S. recta*, *S. pulchella*, *S. geminata*, *Thuiaria heteromorpha*, and possibly a few others. *S. macrocarpa* was placed by Schneider in his "Dynamena-group," and *S. maplestonei* and *S. elongata* in the "Thuiaria-group," though the three species are identical in habit; and in neither case do the characters of these species conform to the descriptions given by Schneider.

In the Dynamena-group the hydrothecæ are opposite, with only one pair on an internode, and the side branches, when present, spring from one or both sides of a normal internode The essential point is that the giving-off of branches does not in any way disturb the order of the hydrothecæ on the primary shoot, consequently the arrangement is precisely the same on the stem and branches. Typical examples are *S. gracilis*, and *S. pumila*, the first of which generally gives off its branches singly, while in *S. pumila* they are often in opposite pairs. *Diphasia subcarinata* is a common Australian example of this —the most primitive—mode of branching. The ramification of *S. macrocarpa* has no resemblance to this type, but, as I indicated in my original description, agrees precisely with that of *S. elongata* and *S. maplestonei*. The reference of these species to the Thuiaria-group is equally untenable, as they do not bear "from several to many" hydrothecæ on each internode, but Schneider fully recognised that the groups were not sharply defined, and that many species were intermediate.

All the above-named species (with many others) agree in the arrangement of the stem-internodes. Every such internode gives origin at the base to a pinna, which has a single *unpaired* hydrotheca in the axil. Higher up, it bears the regular pair of hydrothecæ, only it will be observed that in most cases the one on the same side as the pinna is higher than the corresponding one on the opposite side, being as it were crowded out of its normal position owing to the presence below it of the pinna with its axillary hydrotheca. In attenuated individuals of some of the species, where the internodes are much elongated, the difference of level may be so great that the paired condition is not at first noticeable.

The mode of ramification just described contrasts strongly with that of the Dynamena-group, and the existence of an entirely different arrangement of the hydrothecæ on the pinnæ, as compared with those on the stem, marks a distinct advance in organisation.

This arrangement of the stem-internodes, (which is especially typical of the genus *Sertularia*), is not confined to the group under consideration, but is found in a number of small delicate forms such as *S. tenuis*, *S. inflata*, and *S. biscuspidata*. They differ from the *S. elongata* group not only in their more delicate texture and small size, but in the fact that their pinnæ are wholly divided into internodes of equal value, and exhibit no tendency towards the production of internodes of the second or third order. They are thus more closely allied to the Dynamena-group, and indeed are typical *Dynamenæ* as understood by Kirchenpauer. The distinction between them and Schneider's Dynamena-group may be well illustrated by the comparison between *S. gracilis* and *S. tenuis*. Both these species are very similar in the form of the hydrothecæ as well as the gonangia, and both may exist in the unbranched condition. But when *S. gracilis* produces side branches the arrangement of the hydrothecæ on the stem is unaltered, and the stem and branches are exactly alike. *S. tenuis* on the other hand, when producing side branches, invariably has them in the form of alternate pinnæ, with the complete differentiation of stem and pinnæ, as in the *S. elongata* group.

The peculiar characteristic of *S. elongata* and its allies consists in the general tendency for the older internodes of the pinnæ (or some of them) to bear two or three or even more pairs of hydrothecæ, while on the distal portions one pair is the rule. The prevalence of longer or shorter internodes in particular specimens examined has led to untenable distinctions being drawn, such as the reference of some members of the group to *Thuiaria* and others to *Sertularia*. *S. elongata*, the most abundant species, may serve to illustrate the habit of the group. In the smallest

form, which is also the commonest, and which may average about three-quarters of an inch in height, the whole of the pinnæ may be composed of internodes bearing a single pair. Generally, however, from two to four pinnæ, about the centre, may have a couple of pairs on the first internode, but on no others. So, as the hydrophyton is more robust, we find a larger proportion of the internodes supporting two or more pairs. In the largest specimen which I have in a preparation I find one of the median pinnæ with four pairs on the first internode, two each on the second, third, and fourth, and one on each of the other eight. The nearest pinna on the opposite side has one internode with four pairs, two with two pairs each, and ten with one pair. No other pinna commences with more than three pairs. It is very probable that in larger specimens the development of the longer internodes may be carried still further.

It may be observed, in regard to *S. elongata*, that in these distinctions there is no question of a mere difference of age. The robust forms are on a larger scale than the others from the root up, the hydrothecæ being in proportion to the general size of the polypidom. Further, it is evident that the ultimate height is approximately determined by the time the shoot is half grown, for we find that only a very few pinnæ about the middle reach the maximum development, the succeeding ones then commencing to diminish.

In fairly large specimens of *S. maplestonei* the most ordinary arrangement is for the longest internodes to bear four, or even five pairs, then follow from one to three internodes of two pairs each, and finally from one to five or six with only one pair. In other parts of the same specimen the first internode may bear two or three pairs, and all the rest one pair; and an internode of the second order often comes between two of the first. There seems more tendency than in *S. elongata* for the longer internodes to persist nearly to the end of the pinnæ. I have not met with specimens corresponding with the smallest forms of *S. elongata*, in such it might be expected that internodes of the first order would be more prevalent.

In *S. bidens* the habit is similar to that of *S. maplestonei*, but in such specimens as I have seen the tendency is towards shorter internodes, and in a small specimen all the internodes, with very few exceptions, are of the first order.

S. pulchella has the arrangement much the same as the last.

In *S. geminata* many pinnæ consist mainly of internodes of the second order, others almost entirely of single pairs.

In the commonest form of *S. macrocarpa* all the internodes may have a single pair only, but in other specimens internodes of the second order prevail throughout.

In *S. recta* I have seen no internodes with more than one pair, but I have met with two specimens only, both very small.

S. unguiculata stands by itself in its excessive variability. By far the most abundant form is about the same size as the small variety of *S. elongata* and is a typical *Sertularia*, with very few exceptions to the rule that each internode supports a single pair. Somewhat larger forms differ from these exactly as described under *S. elongata*, to which this species is, so far, strictly parallel, but beyond these we meet with a series of varieties leading up to forms in which there are no short internodes, and a pinna may support a great number of hydrothecæ divided between one or two internodes only. Such forms are in every respect (except in the stem-internodes) typical *Thuiaria*, yet it is impossible to find any distinct line of demarcation between them and the ordinary varieties.

Thuiaria heteromorpha, according to Allman's account, scarcely differs from *S. unguiculata* except in the absence of the bidentate margin of the hydrotheca. It is not known however if it exhibits such an extreme tendency to variability as is found in the allied species. Allman, recognizing that the hydroid combined the characters of more than one genus, placed it under *Thuiaria*, on the ground that the characters of that genus predominated. Among these characters he included the arrangement of the stem-internodes, but in this he was mistaken, as the arrangement is that of a typical *Sertularia*, only that the internodes are *double*, each being formed by the complete coalescence of two of the stem-internodes described in the foregoing remarks. In *S. unguiculata* single and double internodes occur on the same shoot, and often mixed indiscriminately, and I have little doubt that further examination will prove that the same condition occurs in Allman's species. As I shall presently show there is also a characteristic Thuiarian stem-internode, different in arrangement from that found in the group we are considering.

All the preceding forms are undoubtedly, in my opinion, true *Sertulariæ*, being distinguished from *Thuiaria* by the paired condition of the hydrothecæ, both on the stem and the pinnæ, and by the presence, and frequently the preponderance, of internodes with a single pair. The occurrence of internodes of higher orders on all but the smallest specimens is exactly similar to what takes place in *Sertularella divaricata*. Here the rule is that every internode bears a single hydrotheca, but in specimens of elongated habit we find that not only on the stem, but on parts of the pinnæ, several hydrothecæ may be borne on a single internode. But no one proposes therefore to remove the species from the genus *Sertularella*. In a typical *Thuiaria* the hydrothecæ are not paired but biserial, and an internode very often bears unequal numbers on the two sides;

it even happens sometimes that they may be closer on one side than the other, twelve on one side for example occupying as much space as thirteen on the other. Allman first referred to *Thuiaria* such species as his *T. sertularioides*, a true *Sertularia*, solely on the ground that several pairs of hydrothecæ were carried on a single internode. He afterwards retracted this determination, but some observers have adhered to it, often however somewhat arbitrarily, applying the rule in some cases and not in others. The fact is that in some of the most typical species of *Sertularia* the occurrence of internodes of the second and third order is common, and such is the case with *S. pumila* itself, which nevertheless is always regarded as a typical representative of the genus.

In the few Australian species of *Thuiaria* known to me—*T. lata*, *T. fenestrata*, *T. quadridens*, *T. sinuosa*, *T. subarticulata*—I find a uniform type of stem-division. Each internode supports a pinna and three hydrothecæ, but the arrangement is quite different from that which exists in *S. elongata* and its allies. the pinna is given off from the middle of the internode, there is a hydrotheca below and another above it, and a single one on the opposite side. There is no paired arrangement, so that the unpaired condition of the hydrothecæ is common to the stem and pinnæ. In one or two of these species the nodes may be indistinguishable on the older parts of the stem, but the arrangement of the pinnæ and the hydrothecæ is as described, and on the more recently-formed portions the internodes are distinct. Some of the hydroids here associated are now ranked by most observers under the genus *Sertularella*: to me, however, they appear a thoroughly homogeneous group, and I am quite unable to find any distinction of sufficient importance to justify their separation. *T. lata* and *T. quadridens* doubtless have a very *Sertularella*-like aspect, owing to the regular alternation of the hydrothecæ, which is a necessary result of the narrowness of the pinnæ forcing them into that position. In the broader forms of *T. quadridens*, where the two series have room to develop independently of each other, the arrangement is sometimes subalternate rather than strictly alternate. Those varieties of *S. divaricata* in which several hydrothecæ are carried on a single internode approximate very closely to *T. lata*, yet there is a radical difference readily perceived by studying the development in the terminal portions of the pinnæ. Even in those forms of *S. divaricata* in which the *Thuiaria*-like structure is most apparent—var. *subdichotoma* for example—the newly-formed portions are, so far as I have seen, divided into the single-celled internodes characteristic of the genus. But the nodes, though unmistakeable, are very slightly marked, and as the perisarc thickens with growth many of them become obliterated. This

is what takes place also in *Thuiaria sertularioides*, and the recognition of which led Allman to remove the species from *Thuiaria*, in which genus he had at first placed it. In *Thuiaria*, internodes bearing several hydrothecæ are strictly normal, and are developed continuously in the first instance, not formed by the coalescence of a number of originally single-celled internodes as in the varieties of *S. divaricata*. Of course I do not dispute, that these or other forms of *Sertularella* may also develop continuous multiple-celled internodes, thus linking the two genera, but I have never seen an undoubted *Sertularella* in which the typical single-celled internodes were not present in some portions of the polypidom, nor in which the structure was such as to forbid the assumption that *all* the internodes had originated in the same manner. Very commonly the stem of *Sertularella divaricata* is divided by strongly marked nodes into internodes of three hydrothecæ, but between the component hydrothecæ of these internodes are often distinguishable less pronounced constrictions, which evidently remain to indicate where the original nodes have become almost obliterated; while in other varieties of the same species all remain equally distinct. In *Thuiaria*, even in such a species as *T. lata*, not only are the internodes without these vestigial joints, but it is usually obvious that they have never been so divided, on account of the hydrothecæ following each other so closely. Where nodes do occur therefore they necessitate a gap between the hydrothecæ on either side of them which is permanent, and the fact that the hydrothecæ on an internode are so closely crowded and without gaps between them is evidence that the internode has been developed without interruption.

It will of course be apparent from the foregoing remarks that I am here adhering to the principle of classification which bases the generic characters primarily on the grouping of the hydrothecæ, in short that I retain the genera precisely as they were almost universally understood when my earlier papers were written. The majority of observers, while retaining in the main the same principle, have modified the genera in various directions in partial accordance with Levinsen's views, according to which the structure of the individual hydrothecæ (especially the operculum) is of principal importance. I have been reluctant to discard the old classification so long as systematists give it any countenance, especially in view of the fact that many of the Australian species are so imperfectly known that it would be impossible to classify them on Levinsen's system. Even in *S. elongata*, our commonest species, nothing is yet known of the operculum, while in various species which have been often examined, competent observers like Nutting and Levinsen are unable to agree as to the actual structure of this appendage.

While these sheets are passing through the press, however, I have been favored by Professor Levinsen with a copy of his important paper, just issued, entitled "Systematic Studies on the Sertulariidæ." In this work he re-states and elaborates his views as to the primary importance of the operculum in classification, and insists that the mere arrangement of the hydrothecæ is of no generic value whatever. This paper demands the most careful study, and, if its author's conclusions are vindicated, will result in the complete breaking-down of the old generic boundaries and a drastic re-arrangement which, while retaining the old names, will employ them in a sense having no relation to their former meaning. Meanwhile, so long as we continue to accord primary importance to the growth-characters, I think we should do so consistently, hence my objection for example to the reference of *Thuiaria lata* to *Sertularella*. If Levinsen's views be adopted that reference will undoubtedly be correct, but if a systematist accepts (as the majority do) the arrangement of the hydrothecæ as his principal criterion in discriminating between *Sertularia*, *Thuiaria*, *Selaginopsis*, etc., I cannot see why the same principle should not apply to the case in point.

I may add that in Levinsen's system *S. macrocarpa*, *S. maplestonei*, and similar species are referred to a new genus—*Odontotheca*.

SERTULARIA MACROCARPA, *Bale*.

Sertularia macrocarpa, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 80, pl. v., fig. 2, pl. xix., fig. 11; Marktanner-Turneretscher, Ann. k.k. naturhist. Hofmuseums Wien, v., 1890, p. 232; Jäderholm, Bihang k. svenska vet.-akad. Handlingar, 21, 1896, p. 13; Schneider, Zoolog. Jahrb., x., 1897, p. 523; Calkins, Proc. Boston Soc. Nat. Hist., xxviii., 1899, p. 359.

Two varieties of this species were noted. In the first, which is similar to the original type, the hydrothecæ have their upper side at right angles with the hydrocaulus only on the proximal portions of the pinnæ, but elsewhere they are distinctly ascending, this character becoming more and more pronounced as they approach the distal extremity of the pinna, where they are almost tubular, and directed upward as much as outward. Beyond the last pair the hydrocaulus is commonly continued into a long tubular prolongation, often of three or four internodes, bearing in some cases one or two hydrothecæ, often more or less deformed, but mostly without any. The pinna-internodes each support a single pair of hydrothecæ. The other variety has the stem-internodes longer, the pinnæ comprising internodes bearing each two pairs of hydrothecæ, which may persist throughout, or

may be succeeded by a few internodes with a single pair. The upper hydrothecæ have not the subtubular ascending habit found in the type form, nor do the pinnæ run out into long tubular prolongations. A similar variety has been found at Portland.

The jointing of the base of the pinnæ varies greatly in this species. In some individuals the apophysis has a very strongly-marked transverse node in the middle, then it is separated from the pinna by a conspicuous oblique joint, the pinna running down to a sharp point in front of the apophysis, which is continued upward into a similar point. But specimens occur in which these joints are scarcely marked, or even indistinguishable, so that the pinna appears continuous with the stem. Intermediate forms are found, and even in the same specimen the joints may vary considerably in distinctness.

The two species which most resemble *S. macrocarpa* in the form of the hydrothecæ are *S. bidens* and *S. recta*. *S. bidens* is smaller in all its parts, with sharper teeth on the hydrotheca-margin; it is also distinguished by the presence of a small chitinous projection inside the apocauline wall of the hydrotheca, and the absence of the distinct tooth inside the aperture; while the gonangia are of totally distinct forms in the two species.

The likeness to *S. recta* is, in regard to the trophosome, rather closer. The unusual feature of the latter species, noted in my first specimen, is also found in the only other example which I have seen, namely the situation of the two series of hydrothecæ in a single plane, so that there is no distinction of anterior and posterior aspect to the polypidom. I do not however lay too much stress on this, knowing that in some hydroids there is much inconstancy in this particular. The pinnæ of *S. recta* stand off from the internodes at right angles, while those of *S. macrocarpa* form a somewhat smaller angle with the stem. The stem-internodes of *S. recta* are however more strongly zig-zag, so that the inclination of the pinnæ to the general axis of the stem is much the same in the two species. In *S. macrocarpa* the axillary hydrothecæ diverge from the stem at about the same angle as do the pinnæ, so that they lie along the latter; in *S. recta* they stand out midway between the stem and the pinnæ. The internal tooth found in the hydrotheca of *S. macrocarpa* is not present in *S. recta*. I have had some doubt as to whether the two species might not prove to be connected, but according to Bartlett's observations the gonangia of *S. recta* are wholly unlike the large smooth form of those of *S. macrocarpa*, being furnished with annular transverse ridges similar to those found in many species of *Sertularella*.

Loc.—Bass Strait.

SERTULARIA MAPLESTONEI, *Bale.*

Sertularia maplestonei, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 70, pl. vi., fig. 4, pl. xix., fig. 2; Marktanner-Turneretscher, Ann. k.k. naturhist. Hofmuseums Wien, v., 1890, p. 231.

(Not *Thuiaria maplestonei*, Billard, Arch. Zool. Exp. (4), vii., 1907, p. 349, fig. v.)

These specimens are, so far as the trophosome is concerned, quite similar to those originally described; but the gonangia differ in the development of the angles at the sides of the orifice, which are prolonged upwards into erect tubular horns, attaining in some instances as much as one-fourth the length of the body of the gonangium.

Billard unites *S. bidens* with *S. maplestonei* under the name of *Thuiaria maplestonei*. The two species are undoubtedly closely allied, but the different forms of the hydrothecæ in our specimens justifies, I think, their separation, at least pending the discovery of intermediate forms. My specimens of both species show the small internal process near the base of the hydrothecæ, but I cannot find in any instance the double process higher up on the same side, as seen by Warren and Billard in their African specimens of *S. bidens*. Nor can I find the internal tooth below the margin on the adcauline side, though in some cases the hydrotheca-wall is thickened at this part so as to resemble, in side view, a projecting tooth, a feature common to a number of species.

As to the generic position of these species, I refer to my preceding remarks under *Sertularia*. Their habit is in all respects similar to that of *S. elongata*.

Loc.:—Hunter Group, 15 fathoms; Bass Strait.

SERTULARIA UNGUICULATA, *Busk.*

Sertularia unguiculata, Busk, Voy. "Rattlesnake," 1852, p. 394; Bale, Cat. Austr. Hyd. Zooph., 1884, p. 76, pl. vi., fig. 9-12, pl. xix., fig. 8; *id.*, Proc. Roy. Soc. Vict., vi., (N.S.), 1893, p. 100; Marktanner-Turneretscher, Ann. k.k. naturhist. Hofmuseums Wien, v., 1890, p. 231; Farquhar, Trans. N.Z. Inst., xxviii., 1896, p. 459.

Sertularia, sp. ?, Coughtrey, Ann. Mag. Nat. Hist. (4), xvii., 1876, p. 29 (note), pl. iii.

Thuiaria ambigua, D'A. W. Thompson, Ann. Mag. Nat. Hist. (5), iii., 1879, p. 111, pl. xix., fig. 2, 2a; Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 25.

Desmoscyphus unguiculata, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 144, pl. xvii., fig. 5-7.

Dynamena australis, Kirchenpauer, Verhand. K. L.-C. Akad., xxxi., 1864, p. 11, fig. 5 a-c.

Sertularia australis, D'A. W. Thompson, Ann. Mag. Nat. Hist. (5), iii., 1879, p. 105, pl. xvii., fig. 4, 4a; Bale, Cat. Austr. Hyd. Zooph., 1884, p. 72, pl. viii., figs. 7, 8.

Desmoscyphus pectinatus, Allman, "Challenger" Report., Zool., xxiii., Hydroida, Pt. 2, 1888, p. 71, pl. xxxiv., figs., 1—1b.

Sertularia Challengeri, Nutting, Amer. Hydroids, The Sertularidæ, 1904, p. 54, pl. ii., fig. 1, 2; Billard, Ann. Sci. Nat. (9), xi., 1910, p. 19, fig. 6.

? *Thuiaria heteromorpha*, Allman, Journ. Linn. Soc., Zool., xix., 1885, p. 147, pl. xx., fig. 1-5.

(Not *Sertularia australis*, Bale, Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, p. 93.)

Two forms of this most variable of the *Sertulariæ*, collected in Bass Strait, represent perhaps the extreme limits of the species in two opposite directions; one, the ordinary small form, about three-quarters of an inch in height, with the most widely divergent hydrothecæ found in any of the varieties; the other, more attenuated in habit than any which I have previously met with, reaching five or six inches in height, and with the hydrothecæ narrow and but slightly divergent.

I have referred previously to the small form (which is the most abundant) as having the internodes of the pinnæ bearing only one pair of hydrothecæ, with the exception of one or two of the proximal internodes on a few of the pinnæ, which bear two pairs. The stem-internodes are short, somewhat zig-zag, with the nodes strongly marked, and the hydrothecæ forming the pair are pretty close to each other; indeed towards the upper part of the stem they are often opposite and in contact, just as on the pinnæ. Throughout the polypidom the hydrothecæ have the upper portion strongly divergent; often the bend outward is quite abrupt, and beyond it the outer side rises in a sweeping upward curve, which is continued to the point of the long outer tooth. The aperture is elliptic and characteristically directed forward and outward, not upward as in *S. macrocarpa* and similar species. The hydrothecæ on the pinnæ are strictly in opposite pairs, and in contact in the front.

Somewhat larger forms differ in the greater prevalence of internodes of the second, third, and higher orders; and with the longer internodes is associated a much less divergent condition of the hydrothecæ borne by them, though in the distal portions, where only a single pair occupies an internode, they may differ little or not at all from those of the smaller form. The stem-internodes, or many of them, are long, supporting two pinnæ and six hydrothecæ, and are especially characteristic of the species. In the smallest variety the stem-internodes are arranged in the typical Sertularian fashion, that is to say each internode bears at its base a pinna with its axillary hydrotheca, and above it a pair of hydrothecæ, usually sub-alternate. In the larger forms we find that a stem-internode generally has on one side a pinna with three hydrothecæ above it, and on the other a hydrotheca near the base, then a pinna, and above the pinna two hydrothecæ. This arrangement was mentioned by Busk (from whom I received a drawing of it), and by later observers, and naturally appeared somewhat bizarre to those who did not notice that the long internodes were simply equivalent to two of the shorter ones united. The nodes are oblique, sloping alternately to right and left when the internodes are single, but in a series of the double internodes, every alternate node being suppressed, the nodes all slope in the same direction. It is not implied that the double internodes are formed from two originally single ones by the obliteration of the dividing node, as often occurs in *Sertularella* and elsewhere; they are, I have no doubt, formed continuously in the first instance. In the smallest forms single stem-internodes are the rule, and often occur exclusively; some of the larger varieties have only the double type, others have single and double ones interspersed without definite order, or more commonly double ones at the base and middle, and single ones near the summit.

Among other varieties we find some in which the pinna-internodes are still longer, and single-paired internodes are few or entirely wanting; even the distal hydrothecæ may be much less divergent, and a transition to the genus *Thuiaria* is shown by the hydrothecæ on the proximal portions of the pinnæ, which are often neither opposite nor distinctly paired, but may vary from opposite to alternate, while they are separated in front. One pinna may have internodes with sixteen or eighteen pairs, all opposite or nearly so, while another on the same stem may have them almost exactly alternate. Another specimen has pinnæ consisting of a single internode, and bearing over twenty pairs of hydrothecæ, all strictly opposite, in contact in front, and with only the mouth portion divergent, in short, not distinguishable from a *Thuiaria*.

The larger specimens collected by the "Endeavour" differ from other varieties in their attenuated condition. The stem-

internodes, which are of the double type, are very long, and the two hydrothecæ forming each pair are often widely separated, so that their paired condition is not obvious. The internodes of the pinnæ do not support many pairs—only two or three in the specimens examined—and many of the distal internodes are single-paired; but the pairs are far apart and the hydrothecæ themselves narrow and but little divergent. The teeth are much shorter than in more typical forms.

In most varieties the nodes of the stem are well-marked and constricted, but I have seen specimens in which they are faint and not accompanied by any constriction, so that they are scarcely noticeable.

I have now little doubt that the *Dynamena australis* of Kirchenpauer is identical with the smallest variety of this species. I formerly identified with *D. australis* a hydroid which I had previously regarded as a pinnate form of *S. loculosa* but which I now believe to be *S. inflata* (Versluys), though there is a doubt on the subject until the gonangia are known. Kirchenpauer's description, so far as it goes, agrees entirely with my specimens; and though his figure shows the hydrothecæ too divergent for average examples it agrees passably with some in my possession. Thompson's account is equally applicable, especially in its reference to the internodes of the pinnæ supporting either one or two pairs of hydrothecæ; a feature not noticed by Kirchenpauer.

Sertularia challengeri, Nutting (*Desmoscyphus pectinatus*, Allman), seems also to be no other than the present species. Allman's figure, which represents the pinnæ as divided throughout into single-paired internodes, is not very distinctive, but with the description, may well indicate the small variety. Nutting's description and figure, representing the proximal end of the pinna with more than one pair, is more characteristic, and leaves little doubt as to the identity of the specimen figured.*

Thuiaria heteromorpha, Allman, seems to be distinguished from *S. unguiculata* only by the hydrothecæ, of which the proximal ones are said to have the margin entire, while the distal ones have the border running out into a single point. I am doubtful whether it is not a form of the present species with abbreviated teeth, approaching the slender variety obtained by the "Endeavour." It has the characteristic stem-internodes of the double type.

Loc.—Bass Strait.

* Dr. Kirkpatrick, after referring to Allman's type, now confirms this identification.

Genus Sertularella, *Gray.*

Sertularella divaricata *(Busk.)*

(Plate ii., figs. 1—9.)

Sertularia divaricata, Busk, Voy. Rattlesnake, 1852, p. 388.

Sertularella divaricata, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 110, pl. iii., fig. 9, pl. xix., fig. 20; *id.* Proc. Linn. Soc. N. S. Wales, (2), iii., 1888, p. 761, pl. xvi., figs. 1—2 (var. *dubia*), p. 761, pl. xvi., figs. 3—4 (var. *subdichotoma*); Schneider, Zool. Jahrb, 10, 1897, p. 525; Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, pp. 23, 27, 38, pl. iii., figs. 15—20; Ritchie, Mem. Austr. Mus., iv., 1911, p. 839 (var. *subdichotoma*).

Sertularella subdichotoma, Kirchenpauer, Abh. Nat. Ver. Hamb., viii., 1884, p. 46, pl. xvi., figs. 1—1b; Hartlaub, Abh. Nat. Ver. Hamb., xvi., 1900, p. 33—38, pl. i., figs. 3, 4, 6—9, 11—16, pl. ii., figs. 10—17, 51—52, pl. iii., figs. 3, 4, 13, 14; *id.* Voy. "Belgica," 1904, p. 6; *id.* Zool. Jahrb., Suppl. vi., Band iii., 1905, p. 629, figs. V^3, W^3; Jäderholm, Arkiv för Zoologi k. svenska Vetenskapsakad., i., 1903, p. 278, ii., 1904, p. 3, vi., 1910, p. 4; *id.* Schwed. Südpolarexp., 1901—3, vi., 1905, p. 25, pl. ix., fig. 8; Nutting, Amer. Sertularidae, 1904, p. 96, pl. xxii., figs. 8—12; Vanhöffen, Deutsche Südpolarexp., 1901—3, xi., Zool. iii., 1911, p. 326, fig. 41 a—e.

Sertularella Johnstoni, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 109 (in part), pl. iii., fig. 7, pl. xix., fig. 21; *id.* Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, p. 93 (in part); *id.* Proc. Roy. Soc. Vict., vi., N.S., 1893, p. 102; Billard (in part), Ann. Sci. Nat. (9), xi., 1910, p. 13.

(Not *Sertularia Johnstoni*, Gray, Dieff. N. Zealand, ii., 1843 p. 294).

Hydrocaulus monosiphonic, pinnate or bipinnate, or with irregular subdichotomous ramification; the more regular forms with the pinnæ alternate, three hydrothecæ between every two pinnæ on the same side.

Internodes of the stem usually bearing from one to three hydrothecæ; those of the pinnæ generally bearing only one each, but in some varieties often having more than one, especially on the proximal portions of the pinnæ. Many of the pinnæ terminating in long twisted tendrils, which may become attached to other parts of the polypidom.

Hydrothecæ tubular or sub-conical, both series in one plane, or directed more or less forward, and varying considerably in the extent to which they are divergent laterally, often with a somewhat abrupt bend outward; margin with three teeth, one superior and two lateral, and an operculum of three pieces; no internal teeth. An apparent oblique septum crossing the interior of many of the hydrothecæ.

Gonothecæ large, borne on the pinnæ, surrounded by a number of prominent annular ridges except on the back, which is smooth and appressed to the pinna; the extreme distal portion of the gonotheca projecting forward and having the ridges completely annular; aperture excentric, very variable in width, with the lip more or less everted or funnel-shaped.

Under *S. divaricata* I include the species originally described by me under that name, with vars. *dubia* and *subdichotoma* (the latter being synonymous with *S. subdichotoma*, K.) and the variety which I formerly described as the Bass Strait form of *S. johnstoni*, but which, in accordance with Hartlaub's classification, must be considered distinct from that species; together with such varieties as are so closely allied to the foregoing as to preclude, in my opinion their specific separation. The species, so constituted, is extremely variable, in fact out of nine preparations which I possess from various localities no two are completely alike.

The points of difference are—the ramification, the presence or absence of a distinct joint between every two hydrothecæ, the length of the internodes and consequent distance apart of the hydrothecæ, their position in one or two planes, their lateral divergence and whether such divergence is abrupt or gradual, and the extent to which they are adnate; and, as regards the gonangia, their size and form, the number and prominence of their annulations, and especially the size and form of the mouth. The presence of an apparent septum in the hydrotheca, and the tendency of many of the ramules to run out into twisted tendrils, which may become attached to other portions of the polypidom, are characters which, I believe, are found more or less frequently in all the varieties.

The essential character of *S. subdichotoma*, as described by Kirchenpauer, was the irregular ramification as opposed to the pinnate habit of *S. divaricata*. The gonangia were not in question, as neither Busk nor Kirchenpauer were acquainted with the gonangia of *S. divaricata*, and it may be pointed out that it is quite as likely as not that Busk's original species may have had gonangia similar to those of the var. *subdichotoma*, Hartlaub, finding that the ramification was too inconstant to

serve as a specific distinction, and accepting my identification of *S. divaricata* as a form with wide-mouthed gonangia, has practically made the possession of a narrow funnel-shaped lip the prime character of *S. subdichotoma*. My examination of numerous specimens shows that neither of these types of gonangium has any exclusive connection with any particular form of trophosome.

In considering the trophosome only, and disregarding the unimportant distinctions between regular and irregular ramification, the varieties may be grouped in two series. In one, which includes the type and var. *subdichotoma*, the internodes are long, and the hydrothecæ therefore are wide apart, and as a rule (though with many exceptions) in one plane and not very widely divergent laterally. The stem-internodes commonly bear about three hydrothecæ, and even on the pinnæ many of the nodes are indistinct or wholly wanting. In the second group the internodes are more distinct and mostly shorter, and the hydrothecæ closer together, their lateral divergence is greater and they are mostly adnate for a less proportion of their length; they are rarely in the same plane, but the two series are in planes which meet at an angle often as small as 90°. The general habit is mostly more bushy and compact than in the first group, but there is no abrupt or considerable gap between the two.

Proceeding now to consider the differences in the gonosome, which are more important, as the case for the separation of *S. subdichotoma* rests upon them, we find that the varieties may here again be separated into two series, but not coinciding with the two series as determined by the trophosome. In one group, of which *S. divaricata* is typical, the aperture of the gonangium is large, with a wide everted lip, more ample in some varieties than in others; in the other series, which includes *S. subdichotoma*, there is a much smaller orifice with a funnel-shaped lip. In four specimens of the first group the diameter of the orifice ranges from ·13 to ·19 mm., in four of the second from ·044 to ·059, while in one form it varies between ·074 and ·089. This last variety, while obviously approaching *S. subdichotoma*, is so far intermediate as to suggest the probability of finding, with further material, a complete range of connecting forms.

The following is a summary of the characters of the nine different specimens of which I have preparations, accompanied by the average dimensions in millimetres.

1. *S. divaricata*, Port Stephens. This is the form which I described as typical in 1884, as it bears the closest resemblance to Busk's description and drawing of any which I have seen. It also agrees well with Hartlaub's account and figures. It has alternate pinnæ arranged in the fashion typical of the species, but with many irregularities, and it is often in parts bipinnate.

The stem-internodes usually bear three hydrothecæ; those of the pinnæ mostly support only one, though the larger pinnæ, which themselves bear secondary pinnæ, tend towards the same structure as the stem. The internodes vary much in length, the distal ones which I measured averaged about ·49 mm., but on the older part some of them reached about ·75 (in all cases the measurements are of internodes with a single hydrotheca only). The hydrothecæ themselves measured from the base to the top of the lateral teeth about ·40, and their diameter at the base of the free portion about ·21. They are adnate about two-thirds of their height, and mostly directed slightly forward, though in other parts of the same colony they may be in the same plane. They are moderately divergent laterally, and occasionally the outward bend is rather abrupt. The free part is tubular, not distinctly conical. The gonangia average about 1·40 to 1·50 in length by ·89 in width; the annulations, of which there are about nine, are very prominent; the aperture has an internal diameter of about ·16 to ·18, with an everted lip about ·19 to ·22 across, and having an irregular ragged edge, as shown by Hartlaub.

2. Great Australian Bight, 1911.—The habit is similar to the last, but the hydrothecæ are a fraction larger (·41 by ·22), with the free part very slightly conical; they are more frequently in a single plane, but many are distinctly directed forward. Some of the single internodes reached about ·90; the distal ones are of the same length as those of No. 1. The gonangia are wanting.

3. Var. *dubia*, Bale, Bondi Bay.—The ramification is pinnate, but irregularities are frequent. The internodes are short, the distal ones only about ·30 and the proximal ·38. The hydrothecæ average ·37 by ·18, and may be in one plane or somewhat directed forward. The gonangia measure about 1·18 by ·67, and differ considerably from all the other varieties, being of greater diameter from back to front and having the top sloping very much downward, so that the summit rises at the back well above the level of the aperture, which is far forward. The annulations number eleven or even twelve, and are more regular and closer than in the other varieties. The aperture is very wide, about ·18 to ·19, and the basin-shaped lip has a diameter of about ·28.

4. Port Phillip, 1890.—The ramification is fairly regular, the internodes strongly marked and somewhat longer than those of var. *dubia*, the hydrothecæ the smallest of any of the varieties (·31 by ·15), and in their more conical form as well as their size they come nearest to *S. johnstoni*. The gonangia, however, are not at all like those of that species. They are about 1·33 by ·74, with eight or nine strong annulations; the aperture is about ·13 to ·15, and the basin-shaped lip reaches ·24 to ·30.

5. Hunter Group.—Similar in habit to Nos. 1 and 2, but rather more slender and with smaller hydrothecæ, which are adnate for a greater part of their length and are mostly in the same plane. Proximal internodes about ·80, distal ·34, hydrothecæ ·37 by ·18, gonangia 1·48 by ·84, with the aperture ·15 or ·16 and the very large and high basin-shaped lip from ·30 to ·37. Annulations about ten.

6. Var. *subdichotoma*, Bale, = *S. subdichotoma*, K., Port Jackson.—Ramification irregular, internodes very long in the proximal portions, distal ones about ·41. Even on the pinnæ many of the nodes are indistinguishable, so that an internode bears several hydrothecæ. As a rule the hydrothecæ are in the same plane, yet on the same shoot some of the branches may have them distinctly directed forward. They are adnate most of their length, with the free part contracted and sub-conical. In some cases the distal extremities were carried out horizontally owing to successive renewals. The gonangia differ little from those of the type except in the distinctive narrow aperture, which measures only about ·059, while the funnel-shaped lip is about ·10 to ·15 across. They measure 1·33 to 1·48 in length, with a diameter of ·67, and have nine or ten annulations.

7. Port Phillip, 1881 (*S. johnstoni*, Bass Strait var., Bale).—This form is of compact bushy habit, distinctly pinnate. The internodes are short, about ·40 on the proximal portions, and ·33 on the distal, and even on the stem they usually bear only one hydrotheca. The hydrothecæ are about ·33 by ·19, free for nearly half their length, with the free part very slightly sub-conical. They are commonly in two planes about 90° apart, only here and there is a branch on which their forward direction is but slight. They are widely divergent laterally. The gonangia are similar to those of var. *subdichotoma*, measuring 1·18 by ·67, with about nine annulations; an aperture of ·044 to ·059, and the lip ·10 to ·15.

8. Port Phillip, 1889.—Nearly like the last. Proximal internodes ·59, distal ·37; hydrothecæ ·38 by ·21; gonangia 1·33 by ·64, with about nine annulations; aperture ·074 to ·089, lip ·13 to ·16.

9. Great Australian Bight, 1911.—Internodes short, ·44 to ·30; hydrothecæ ·33 by ·18; gonangia 1·26 by ·81; aperture ·044 to ·059, lip ·089 to ·15. This form is principally distinguished by the gonangia, which are more top-shaped than the others, and have the annulations, which number about nine, much less prominent, especially the upper ones. The narrow funnel-

shaped lip, which in the other forms rises out of a basin-like concavity formed by the topmost annulation, is here prominently borne on the convex summit of the gonangium, which rises clear above the annulation.

For comparison with the foregoing I add descriptions of the other two closely allied species which I possess, *S. johnstoni* and *S. pygmæa*.

S. johnstoni, New Zealand (Pl. II., fig 10).—This specimen is pinnate, similar in habit to the smaller varieties of *S. divaricata*, and with the internodes, at least on the pinnæ, bearing single hydrothecæ. The latter are sub-conical, adnate a little more than half their height, and directed a little towards the front. They are smaller than those of any of the varieties of *S. divaricata*, being about ·27 mm. in length by ·16 in diameter. In the other characters of the trophosome I find nothing to distinguish the species from *S. divaricata*. The gonangia, however, differ from those of that species in being smaller and of narrower proportions, and in having the annular ridges closer, more numerous, and less prominent. Their length is from about 1·04 to 1·11 mm., their diameter from ·47 to ·52, and the annulations number twelve or thirteen. The aperture is about ·089 in width, and the neck is tubular and rather thick, and in its position distinctly eccentric.

S. pygmæa (Pl. II., fig. 11).—This is distinguished from *S. johnstoni* primarily by the simple habit. The length of the internodes is slightly less,—about ·27 as against ·31,—but their angular form and the narrow, very oblique, and strongly twisted joints are more distinctive. The hydrothecæ average about ·27 by ·16 mm., are less conical than those of *S. johnstoni*, and are mostly in the same plane. The gonangia are about as wide as those of *S. johnstoni*, but considerably shorter, their length being from about ·74 to ·81 mm., and their annulations number about eleven. In their general appearance they resemble those of *S. divaricata* more than those of *S. johnstoni*, owing to the form and prominence of the annulations, which are especially prominent towards the summit. The top one has the perisarc much thickened, forming a deep cylindrical basin, from the bottom of which rises the tubular neck, nearly filling it up. The neck is similar to that of *S. johnstoni*, but owing to the depth of the concavity in which it is situated it rises above the annulation only slightly, or not at all. The gonangia are not closely appressed to the hydrocaulus, as in the allied species, consequently instead of most of the adcauline side being smooth, the annulations completely surround the gonangium, except for a short distance above the base. The aperture is central.

Hartlaub says in his key to the species that *S. divaricata* has gonangia like those of *S. subdichotoma* but with shorter tube. The shortness is apparently proportionate rather than absolute, for according to the figures the greater width in *S. divaricata* is the most conspicuous difference. The wide bowl-shaped mouth of No. 5 in the foregoing list is in fact higher than any of the narrow funnel-shaped forms. My identification of the var. *subdichotoma* with *S. subdichotoma*, K., is verified by Hartlaub.

Comparison of the nine forms which I have described convinces me that they must all be referred to *S. divaricata*, unless we take such a restricted view of the species as would result in other forms, as well as var. *subdichotoma*, being accorded specific rank. Var. *dubia*, owing to the difference in the gonangia, seems to me to be at least as distinct as var. *subdichotoma*, and in some measure to make an approach to *S. johnstoni*.

No. 7, which is practically identical with var. *subdichotoma* so far as the gonangium is concerned, resembles it perhaps least of all the varieties in the trophosome. Some of the forms which have been referred to *S. subdichotoma* should probably be ranked under the typical *S. divaricata*, *e.g.* the form mentioned by Jäderholm in his report on the Swedish South Polar Expedition, which he says has a wide aperture, a characteristic of the type, not of var. *subdichotoma*.

Several other species have been founded on distinctions which seem scarcely sufficient to take them out of range of *S. divaricata*, as here defined. *S. magellanica*, M.-T. is considered by Hartlaub to be synonymous with *S. subdichotoma*, and *S. cumberlandica*, Jäderholm, is referred by Vanhöffen to the same form. These, and a number of others closely related, are not included among the synonyms, as I have had no opportunity of examining them.

I formerly suggested that it might be found necessary to unite *S. divaricata* to *S. johnstoni*. For the present I regard them as different species, rather on Hartlaub's authority than from my own observations, as I have seen no specimens of *S. johnstoni* other than that described above, which appears to me sufficiently distinct. But according to New Zealand observers *S. johnstoni* seems to vary considerably. Hilgendorf's account is rather contradictory. He describes the gonangia as large, with from six to ten ridges, but he also states that the gonangia of *Thuiaria subarticulata* have six to eight ribs "exactly as in *S. johnstoni* though here the ribs are much fewer."

Billard ranks *S. divaricata* as a synonym of *S. johnstoni*, but as he does not include *S. subdichotoma* also among the synonyms, he evidently considers it a distinct species. Assuming such to be the case, the inclusion of *S. divaricata* would be untenable, since the most intimate relationship of *S. divaricata* is with *S. subdichotoma*, not with *S. johnstoni*.

The accurate and detailed description by Hartlaub leaves little room for further remarks on the structure of the species. The principal point on which my observations do not agree precisely with those of Hartlaub is in regard to the jointing of the hydrocaulus. I have not found, either in *S. divaricata* or *S. johnstoni* that the normal condition is for the internodes to support several hydrothecæ. Setting aside the question as to the original condition of the internodes—to which I have referred on a former page—I have found in the polypidoms of *S. johnstoni* and of most of the varieties here ranked under *S. divaricata* that the typical condition of the genus—one hydrotheca to each internode — is the rule, and the opposite condition quite exceptional. In *S. divaricata*, type, longer internodes are more frequent, and in var. *subdichotoma* they preponderate, so that often the only parts where single-celled internodes are to be found are the latest-formed distal portions. Here the perisarc is extremely thin and delicate, contrasting strongly with the much thicker portions which are but little older, and it can easily be understood how readily the faintly-marked nodes may disappear in the process of growth. There are no internal teeth in the hydrotheca, but the apocauline wall is often thickened at the margin between the lateral teeth, which gives it when seen in side view almost the aspect of an internal marginal tooth. The oblique internal septum is not comparable to the permanent intrathecal ridge of *S. crenata* or the Plumularians, but seems to be an almost membranous film of extreme delicacy, easily detached, and leaving a slight mark on the hydrotheca wall after its disappearance.

The gonangia are more complicated structures than those of the *rugosa*-group, where the annular ridges are simple undulations of the gonangium-wall. Here they are more or less thickened, forming a ring of a cup-like form, from within the margin of which rises the next undulation, while the ring is extended in the form of a narrow flounce-like film, projecting upward. Just below this the perisarc is generally marked with delicate wavy striæ, or sometimes faint reticulations. At the summit of the gonangium, which leans forward away from the hydrocaulus the ridges are completely annular, but on the lower part they are wanting at the back. After passing round the sides of the gonangium they generally take an upward course and gradually

thin out and disappear. The back is smooth or with a few irregular lines, or sometimes so closely fitted against the branch above it that the perisarc takes the exact print of the hydrotheca at the back.

Loc.—Hunter group, 15 fathoms; Great Australian Bight, 40 to 100 fathoms.

Family PLUMULARIIDÆ.

Genus Plumularia, *Lamarck* (in part).

Plumularia buskii, *Bale*.

Plumularia Buskii, Bale, Cat. Austr. Hyd. Zooph., 1884, p. 125, pl. x., fig. 3, pl. xix., figs. 34—35; Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, pp. 94, 108. Hartlaub, Zool. Jahrb., xiv., 1901, p. 374, pl. xxii., figs. 22, 32, 36. Ritchie, Proc. Zool. Soc., 1910, p. 832. Thornely, Rept. to the Govt. of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar, Suppl. Rept. viii., 1904, p. 120.

Several specimens of this species were obtained, which do not differ in any important particular from those already described, and on some of them the characteristic female gonangia were present. I have formerly described these as three-sided, with one wide and two narrow sides, the edges being rounded, but it would perhaps be more correct to describe them as having a turgid dorsum and a more flattened ventral surface. The longitudinal ridge of the dorsum often rises higher at the summit of the gonangium than does the opposite side. The two series of large moveable sarcothecæ which run up the dorsal surface are somewhat irregularly arranged; they generally number five or six in each series, with a single one near the top and in the central line.

The similarity of the gonangia to those of *P. obconica*, Kirchenpauer (in which however there are said to be at most about half as many sarcothecæ), led me to ask Dr. Hartlaub to compare a specimen with Kirchenpauer's types, which he has very kindly done. He found the types insufficiently preserved to admit of certain identification, but he was able to satisfy himself that if not actually identical with *P. buskii* they bore an exceedingly close resemblance to it, notwithstanding the difference of Kirchenpauer's figures. The plicate condition of the hydrothecæ noted by that observer is almost certainly the mere effect of drying, and the sarcothecæ agree with those of *P. buskii*, and not with Kirchenpauer's figures. The small sarcotheca behind the hydrotheca was not distinguishable, but this may have been due to the bad state of the specimens.

P. armata, Allman, is an allied species, Allman's figures, which represent the anterior sarcothecæ as extremely slender bodies being, according to Billard, unlike the actual structure, which resembles that of *P. campanula*. The gonothecæ are remarkably like those figured by Kirchenpauer, having only four to six sarcothecæ disposed in a sinuous line down the dorsum. Dr. Hartlaub does not mention the gonothecæ of *P. obconica*, so it is probable that he did not observe them. If *P. obconica* is the same as *P. buskii*, Kirchenpauer's figures of the gonotheca must be as incorrect as those of the trophosome, or else it must vary remarkably.

Both Kirchenpauer and Allman expressly state that the male gonothecæ are without nematophores; those of *P. buskii* have two near the base.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Plumularia procumbens, *Spencer*.

Plumularia procumbens, Spencer, Trans. Roy. Soc. Vict., ii., 1891, p. 130, pls. xxi.—xxiii. Bale, Proc. Roy. Soc. Vict., vi. (N.S.), 1893, p. 115, pl. v., figs 11-12.

The material included a single specimen of *P. procumbens* a species which is quite different in habit from any other of the Australian Plumulariæ. When in fluid or balsam the hydrocladia are scarcely visible to the naked eye, so delicate and minute are they, but the multitude of small branchlets, springing from all sides of the larger branches, give the zoophyte a peculiar bushy or bristly aspect that is very characteristic. As in most other species the short intermediate internodes of the hydrocladia bear each a nematophore, therein differing from the original specimens, collected in Port Phillip by the late Mr. J. B. Wilson, in which, with rare exceptions, these short internodes were unarmed. The pitcher-shaped hydrothecæ are quite minute, and the supracalycine sarcothecæ are in proportion very large, their length being about the same as that of the hydrothecæ.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Plumularia asymmetrica, *sp. nov.*

(Plate iv., figs 2-3).

Hydrophyton about two feet in height, polysiphonic, with numerous ascending branches facing in the same direction, each springing from an internode of the primary jointed stem

immediately above a hydrocladium; ultimate branches pinnately arranged, divided into internodes of very varying lengths, each bearing from one to many alternate short hydrocladia, which are supported on short processes of the branch making with it an angle of about 35°-40°, and which are divided by slightly oblique joints into internodes, each of which bears a hydrotheca and has about five strong internal annular ridges.

Hydrothecæ lying along the internode, sub-tubular, curving slightly upward and in the distal part recurved towards the internode; a strong intrathecal ridge springing from the front of the hydrotheca a little below the middle, and directed somewhat forward; distal part of the hydrotheca (about one-third of its length) free, but with the whole of the lower side sinuated down to the hydrocladium, the two sides of the free part asymmetrical, one being rounded off, the other produced forward into a large angular lobe.

Sarcothecæ bithalamic, canaliculate, moveable, the terminal cups narrow; one, on an angular prominence of the hydrocladium, below each hydrotheca, one at each side above (under the free part of the hydrotheca), two abreast on each of the processes supporting the hydrocladia, one behind and one in front of the rachis just below each axil, and others at irregular intervals along the rachis. A crateriform prominence on each hydrocladium-process.

Gonosome.—Gonothecæ on the apophyses of the hydrocladia, small (about twice the length of the hydrothecæ), regularly pear-shaped, tapering gradually to the base and slightly flattened at the top, delicate and colourless, almost membranous. A cluster of rounded highly refractive granules near the aperture.

Colour.—Light fawn.

I received two specimens of this remarkable species (perhaps the largest of the genus), both nearly two feet in height. One comprised a main stem and comparatively few branches, all on the upper half, while the other was branched profusely for about the upper three-fourths of its height, having a lateral spread of over a foot near the summit. The base of this specimen is a dense spongy fibrous mass of conical form, between two and three inches in diameter at the area of attachment, and of about the same height. From the apex of this rise two stems, each about one-fifth of an inch in diameter, one however is broken off short, the other bearing the polypidom described above, which, as the branches tend to spread laterally, assumes a flabellate form. The hydrothecæ differ from those of all other species known to

me in the singular irregularity of the lateral lobes, which is very prononnced in most of them. The sarcothecæ are exceedingly thin and transparent, yet endure treatment with boiling liquor potassæ without injury. Their greatest diameter is about the middle rather than at the extremity. Those which are most often wanting are the pair below the axils, each of which springs from a rounded thin area, which, in the newer parts of the branches, looks like a perforation. The two sets of hydrocladia are in the same plane, and the first of the supplementary tubes which form the polysiphonic stem commonly runs up the *front* of the primary tube.

The ramification, as displayed in the small pinnately-arranged branchlets, is very singular. Each one is supported by the primary tube immediately above a hydrocladium. Its cavity however is not directly continuous with that of the parent branch, with which it communicates only indirectly, by a narrow passage leading into the apophysis of the hydrocladium immediately below it. On its distal side the base of the new branch gives origin to a supplementary tube running up the parent branch, and between this tube and the cavity of the new branch the communication is uninterrupted.

The only closely related form which I know of is *P. hertwigi*, Stechow, from Japan. In that species the hydrothecæ have nearly the same general form as those of *P. asymmetrica*, but the lateral lobes are equal, while there is no intrathecal ridge. A more remote affinity exists between *P. asymmetrica* and *P. alata*, Bale, which two species however exhibit the two extremes of size among the *Plumularicæ*.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Genus Aglaophenia, *Lamouroux*.

Aglaophenia crucialis, *Lamouroux*.

Aglaophenia crucialis, Lamouroux, Hist. Polyp. Coral. Flex., 1816, p. 169.

Plumularia crucialis, Blainville, Man. d'Act., 1834, p. 478.

Anisocalyx crucialis, Costa, Fauna del regno di Napoli, Zoofiti Napoli, 1838, p. 19.

Aglaophenia crucialis, Billard, Comp. Rend. Acad. Sci., cxlviii., 1909, p. 1063; An. Sci. Nat., Zool. (9), ix., 1909, p. 331. Ritchie, Mem. Austr. Mus., iv., 16, 1911, p. 864, pl. lxxxvi., fig 1.

(Not *Aglaophenia crucialis*, Kirchenpauer, Abh. Nat. Ver. Hamb., v., 1872, pl. i., fig 8. Bale, Cat. Austr. Hyd. Zooph., 1884, pl. xviii., fig 8.)

(Not *Thecocarpus crucialis*, A. Billard, Ann. Sci. Nat., Zool. (9), v., 1907, p. 328, figs. 3, 4.)

The *Aglaophenia crucialis* of Lamouroux, an inadequately described species, was supposed by earlier writers (not however by De Blainville) to be identical with the *Plumularia brachiata* of Lamarck, and the synonymy was generally accepted until Dr. Billard ascertained by examining the original types that they were distinct species. As two or three Hydroids described in the present paper, as well as *A. macrocarpa*, previously described by me, are very closely allied to *A. crucialis*, some reference to that species may be of interest as a preliminary to treating of the forms before us.

I am not aware that any full description of the typical *A. crucialis*, or any figure of the structure, has been published. Billard, concluding from the figures and description of *A. macrocarpa* that it was identical with *A. crucialis*, contented himself with announcing the synonymy. Ritchie, in his Report on the "Thetis" Collection, gives a photograph of the polypidom, and many details of the structure. Dr. Billard informs me that he thinks from Ritchie's description that his specimens were typical. A form differing somewhat from the others is recorded, but Ritchie considered it only a variety; it is said to be distinguished from the rest by its more dumpy hydrotheeæ and internodes. Lamouroux' description only states that the polypidom is sparsely branched, with the branches in opposite pairs, and that the colour is a light fawn. Ritchie's figure and description indicate that the branches are divaricate at a wide angle and that they may be re-branched to the third degree, while the two series of branches are in planes meeting at a wide angle. The branches arise from the hydrocladiate tube. The hydrotheeæ are as in *A. macrocarpa*, but the margin varies considerably "the characteristic broad lateral lobe especially exhibiting stages of decrease in size, so that in some specimens it has become obsolete." The corbulæ are described as resembling those of *A. macrocarpa*, but the margins of the leaflets "frequently rise into very pronounced crests."

A sketch of one of the best-preserved hydrothecæ of Lamouroux' type, for which I have to thank Dr. Billard, shows the border nearly like that of *A. macrocarpa*, while the median sarcotheca more resembles that of the form which I have named *A. tasmanica*.

Of the species hereinafter described *A. tasmanica* and *A. billardi* were successively submitted by me to Dr. Billard in order to obtain his opinion as to their identity or otherwise with *A. crucialis*. After carefully examining them he considered that the first, while differing from *A. crucialis* in some minor particulars, might be considered specifically identical with it, and that the second could be regarded as a distinct species, though very closely allied. I have, however, judged it more convenient to consider *A. tasmanica* also distinct, at least provisionally, and subject to its reduction to the rank of a variety (either of *A. crucialis* or *A. billardi*), should further investigation show the advisability of such a classification. I should indeed have no hesitation in regarding *A. tasmanica* as distinct from *A. macrocarpa*, if these forms only were in question, but it is at present doubtful how far they may be linked by intermediate forms such as Ritchie seems to have observed. Not only have I had no opportunity of observing typical forms of *A. crucialis*, but I have not seen a complete specimen of *A. macrocarpa*, but only two fragments, that from which I originally described it, and another which Mr. R. Etheridge, Junr., was good enough to send me recently from the Australian Museum for comparison. Moreover, these two specimens differed considerably in colour and ramification, though identical otherwise. The first had, as I indicated in my original description, no opposite branches, but two on the same side, while it was of a deep red-brown colour, almost black in the stem and branches. The other specimen has two pairs of opposite branches, and is almost colourless. It is just possible, however, that the colour may have been discharged by the fluid in which it had been preserved, especially as a *Halicornaria* parasitic upon it—*H. thetidis*, Ritchie—appeared equally bleached. But Ritchie does not mention the colour, either of *H. thetidis* or *A. crucialis*.

Aglaophenia billardi, *sp. nov.*

(Plate iii., fig 3; Plate vi., fig 3.)

Hydrophyton polysiphonic, about a foot in height, sparingly branched above; branches mostly in opposite pairs, both series in one plane and all facing one way, forming angles with the stem of about 45°; each branch springing from an internode of the primary jointed stem and replacing a hydrocladium. Hydrocladia alternate, one on each internode, both series directed slightly towards the front and rising at angles of about 40°, nodes slightly oblique.

Hydrothecæ long, at an angle of about 30°, nearly cylindrical in their distal half, narrowed towards the base, a slight fold or ridge near the base on the adcauline side, directed a little

forwards; some with a blunt rounded tooth projecting into the cavity from the front, a little above the base; border with a sharp pointed anterior tooth, and a triangular tooth on each side near the front, generally a minute undulation between the anterior and the lateral teeth, the rest of the border slightly sinuous at the sides (mostly with two slight undulations between the lateral tooth and the lateral sarcotheca), not forming elevated lobes; an angular lobe at each side behind the lateral sarcotheca, back excavated, adnate. Hydrothecal internodes with septal ridges opposite the intrathecal fold and the base of the lateral sarcothecæ.

Mesial sarcothecæ slightly over half the length of the hydrothecæ, adnate most of their length, but with a short free projecting portion, terminal and lateral apertures confluent, forming an oblique canaliculate aperture. Lateral sarcothecæ tubular, directed forward and outward, scarcely projecting beyond the hydrotheca-margin; aperture small, round, canaliculate. Cauline sarcothecæ broad, completely open above, two on the rachis at the base of each hydrocladium.

Gonangial pinnæ mostly in pairs, with the first five or six internodes bearing sarcothecæ only; corbula (female) long, consisting of up to between thirty and forty pairs of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets, which unite to form a closed corbula; the distal margin of each leaflet continued a little beyond the line of union so as to form a free-edged narrow extension or wing, bordered with sarcothecæ and continued upwards into a large crest above the corbula, having both edges free and bordered with sarcothecæ; a lateral spur or secondary leaflet projecting outwards and forwards from the distal edge of each rib just above the origin, bearing two series of sarcothecæ (up to four or five on each side), but no hydrothecæ: (male) narrower, with the lateral spurs very short, and the superior crests very slightly developed or entirely wanting.

Colour.— Light fawn.

Several specimens were examined, attaining about a foot in height. The stems are rather slender, in proportion to their height, and the branches are confined to about three inches at the top, where there are two or three pairs, about two to three inches long. One had four pairs, but the lowest pair was already bare of hydrocladia. The hydrocladia were somewhat shorter than those of *A. tasmanica* (up to about half an inch).

A pair of branches originates from two successive internodes, and they are therefore not opposite in the strict sense, though to the naked eye, and when swathed, as they soon are, by the enveloping supplementary tubes, they appear practically opposite. They spring slightly towards the front, but soon bend back sufficiently to bring both series virtually into one plane. The occurrence of unpaired branches may be due in some cases to the production of a single one only, but more often probably, to the loss of one of a pair. As in all the allied forms seen by me, the proximal part of a branch consists of several short internodes (in this species sometimes as many as a dozen), each of which bears a median sarcotheca only. Ritchie's statement that in *A. crucialis* the branches bear on their proximal internodes a series of *hydrothecæ* only, is probably a slip.

The hydrothecæ nearly resemble those of *A. tasmanica* except in their size and proportions. Their length averages about ·45 mm. as against ·37, but their median width in front view is only about ·15, while that of *A. tasmanica* is about ·19. A little variation occurs in the marginal outline, but in the most typical specimens there is a minute denticle or undulation between the anterior tooth and each of the lateral ones, while between these and the lateral sarcothecæ the border is nearly straight except for two small convexities. The margin differs from that of the next species in the presence of the angular lobes behind the lateral sarcothecæ.

The anterior sarcothecæ are shorter, but more prominent than those of *A. tasmanica*, but in these characters, as well as in the canaliculate aperture, they agree with those of *A. macrocarpa*.

Some later specimens, received from the Australian Museum, enable me to supplement the account of the gonosome, and to recognize in the structure of the corbulæ an instance of sexual dimorphism not previously noticed. Torrey and Ann Martin, have pointed out that in a number of species which are known to possess two forms of corbulæ those containing the female gonophores are completely closed, except for a series of apertures at the bases of the leaflets, while in the male type the leaflets are separated for a portion of their length, or even throughout. In *A. billardi* the corbulæ of both sexes are, so far as I have seen, closed throughout (always excepting the series of large openings at the bases of the leaflets), but there is a great difference in the extent to which the protective armature is developed. In the female corbula the distal sides of the leaves are continued past the line of union with the next leaf and turned outward, being continued into a free lateral wing which is widened upward in the form of a large spreading secondary leaf, rising above the

corbula and curving forward over it, and having its edges fringed with sarcothecæ. The lateral spur-like projections from the distal edges of the corbula-ribs near the base are large and prominent, and are armed with eight or ten, or even more, sarcothecæ. In the Museum specimens, however, I found narrower corbulæ, with the lateral spurs reduced to short stumps carrying only three or four sarcothecæ, while the free borders of the leaves were very narrow and the superior foliaceous extensions entirely wanting, or only very slightly developed. In some specimens fortunately the gonophores were sufficiently preserved to enable the sex to be recognized, and in all such cases I found that the corbulæ with the large secondary leaves contained female gonophores in various stages of development, and in some cases planulæ ready to emerge, while all those of the other type contained male sporosacs.

I have no doubt that a similar differentiation will be found in the other species nearly allied to *A. billardi*. In *A. tasmanica* I have found the female gonophores present in corbulæ which even exceed those of *A. billardi* in the extent to which the secondary structures are developed, but I have not yet seen the male corbulæ. Ritchie mentions that in his specimens of *A. crucialis* "the margins of the leaflets frequently rise into very pronounced crests." In *A. macrocarpa* I have seen only one specimen with corbulæ, which, from analogy with those of *A. billardi*, are probably male. It may be noted too that in these corbulæ the distal portions of the leaves do not quite meet in parts, so that a number of small openings are left between them, as in some of the forms mentioned by Torrey. *A. dannevigi* has corbulæ which differ among themselves in a fashion corresponding to that of *A. billardi*, though not in such a marked degree, and in this case also the difference is presumably sexual. In another (undescribed) species, not at all closely related to any of the foregoing, the sexes are easily distinguishable, and here also the female corbulæ are marked by the far greater development of the structures in question. It is evident that none of the species which possess these appendages can be considered sufficiently known until both sexes have been identified.

In *A. billardi* (as also in *A. tasmanica*) the substance of the corbula-leaves, like that of the hydrothecæ, is nearly or quite colourless, and the crests have a somewhat flaccid appearance, being often bent about irregularly, yet the perisarc is really very thick, or rather it consists of two laminæ forming a hollow wall, and separated by a considerable interval. The corbula reaches a great length, one or two specimens which I observed measur-

ing between 17 and 18 mm., and comprising about thirty-six pairs of leaflets; many however, are less than half this length.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Aglaophenia tasmanica, *sp. nov.*

(Plate iii., fig. 2; Plate vi., fig. 2.)

Hydrophyton polysiphonic, about a foot in height, sparingly branched above; branches mostly in opposite pairs, both series in one plane and all facing one way, forming angles with the stem of about 50°; each branch springing from an internode of the primary jointed stem and replacing a hydrocladium. Hydrocladia alternate, one on each internode, both series directed towards the front and rising at angles of about 40°, nodes slightly oblique.

Hydrothecæ at an angle of about 30°, nearly cylindrical in their distal half, narrowed towards the base, a slight fold or ridge near the base on the adcauline side, directed a little forwards; some with a blunt rounded tooth projecting into the cavity from the front, a little above the base; border with a sharp pointed anterior tooth, and a triangular tooth on each side near the front, the rest of the border rather sinuous at the sides but not forming elevated lobes; no angular lobes behind the lateral sarcothecæ; back excavated, adnate. Hydrothecal internodes with septal ridges opposite the intrathecal fold and the base of the lateral sarcothecæ.

Mesial sarcothecæ two-thirds to six-sevenths as long as the hydrothecæ, closely adnate throughout, aperture simple, perpendicular to the hydrotheca or slightly oblique. Lateral sarcothecæ tubular, directed forward and outward, scarcely projecting beyond the hydrotheca-margin; aperture small, round, canaliculate. Cauline sarcothecæ broad, completely open above, two on the rachis at the base of each hydrocladium.

Gonangial pinnæ mostly in pairs, with the first three or four internodes bearing sarcothecæ only. Corbula (female) long, consisting of up to about fifteen pairs (or more?) of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets, which unite to form a closed corbula; the distal margin of each leaflet continued a little beyond the line of union so as to form a free-edged narrow extension or wing, bordered with sarcothecæ and continued upwards into a very large crest above the corbula, having both edges free and bordered with sarcothecæ; a lateral spur or secondary leaflet projecting outwards and

forwards from the distal edge of each rib just above its origin, bearing two series of sarcothecæ (up to six or seven on each side) but no hydrothecæ.

Colour.—Light fawn.

Two or three specimens were obtained, the largest being about a foot in height, and dividing into two main stems, one of which is broken off. It is about 3 mm. thick near the base and 2 mm. above the division. The existing stem is bare for about half its height to the lowest remaining branches, where the hydrocladia also commence. There is first a single branch, then a pair, about 18 mm. higher a second pair, and a third pair about 50 mm. above the second. One of the branches of the second pair is longer than the others (about 110 mm); about 25 mm. up it bears a very small branch, 12 mm. higher a larger one (on the same side), then two opposite pairs at pretty regular intervals. All the branches face in the same direction and commence with several internodes bearing median sarcothecæ only. The hydrocladia often attain 20 to 25 mm. in length.

The hydrothecæ are very similar to those of *A. billardi*, but differ in their proportions, as described under that species. The mesial sarcotheca is closely adnate throughout, not projecting as in all the allied forms.

Only the female corbulæ were seen. They resemble those of *A. billardi* but are usually more luxuriantly developed, the superior crests, as well as the lateral spurs, being larger, and supplied with a greater number of sarcothecæ.

Loc.—Oyster Bay, Tasmania, 20 fathoms.

I now proceed to summarize the differences and resemblances between the three forms which I have examined, namely *A. macrocarpa*, *A. tasmanica* and *A. billardi*, with, so far as I can ascertain, the corresponding particulars for *A. crucialis*.

As to ramification, the general type is the same in all these species, the branches being mostly in pairs and practically opposite. In reality each pair springs from two successive internodes of the hydrocladiate tube. Too much reliance must not be placed on the paired condition, as unpaired branches are often found. In well-grown specimens the lower part of the stem is denuded of both branches and hydrocladia.

In *A. crucialis* the hydrocaulus seems, considering the size of the polypidom, rather slender, at least in the distal portion, which retains the hydrocladia. The pairs of branches are widely

divergent from the stem or the parent branch; Ritchie says "almost at right angles," but his photograph shows much variation in this respect, from 90° to about 60°, while some of the secondary branches have an angle of only about 45°. It is to be noted that before an accurate notion can be obtained as to the character of the branching in most species they must, if dry, be immersed in water to make them resume their natural form. According to Ritchie, the two series of branches, are in two planes meeting at a wide angle.

A. tasmanica is a good deal like *A. crucialis* in habit, my specimens having comparatively slender stems about a foot high, and bare about half way up. The branches have an angle of about 50° or 55°. Both series are in one plane and all face in the same direction.

A. billardi is very similar to the last; in my specimens the hydrocladia and branches are confined to the top three inches, the stems being about a foot in height. The branches are less divergent, being at angles of about 45°, otherwise the habit is much the same.

Of *A. macrocarpa* the best specimen is about three inches in height and broken off both above and below. It bears on the upper half two pairs of branches, and has the hydrocladia extending down to about the origin of the first pair. The stem and branches, especially the former, are much stouter and more rigid than any which I have seen on the hydrocladiate portions of the other species.

The branches, though subject to much irregularity, are mostly in opposite pairs, and not in the same plane; they diverge from the sides of the stem at angles of about 55° or 60°, and are also, at their origin, directed well forward, so as to take them out of the plane of the stem; they soon, however, take a characteristic curve upward, becoming erect, and even in some cases incurved in the distal portions (Pl. i., figs. 1 and 2). The habit thus differs from that of the two other species, in which the whole polypidom is flat and the branches straight and comparatively slender. Associated with the habit of *A. macrocarpa*, however, is a further peculiarity, namely that the anterior aspect of the branches, from which the hydrocladia spring, faces that of the stem or parent branch, contrary to the condition in *A. tasmanica*, *A. billardi*, and indeed in all species known to me in which the polypidom occupies a single plane, where the stem and all the branches normally face the same way, so that such species are easily seen, even by the naked eye, to have a "back" and a "front" to the polypidom as a whole.

Which of these types of growth characterises the typical *A. crucialis* it is at present impossible for me to determine.

In regard to colour, *A. crucialis*, *A. tasmanica* and *A. billardi* agree in being of a light fawn-brown. My original specimen of *A. macrocarpa* is of a very dark red-brown, and other specimens in the Australian Museum are described as "dark brown," but as already mentioned the specimen lent to me by the Curator is very pale, whether naturally or from the operation of some bleaching agent is unknown.

The general form of the hydrothecæ is very similar in all these species. In *A. macrocarpa* they range from ·29 to ·33 mm. in length, in *A. tasmanica* from ·35 to ·39, and in *A. billardi* from ·41 to ·48, the last-named being, however, narrower in front view than either of the others. *A. crucialis* ranges according to Billard, from ·31 to ·34 mm., but Ritchie says from ·27 to ·34. In *A. macrocarpa* each side of the border has near the front a single triangular tooth, and between it and the lateral sarcotheca there is a large smooth-edged convex lobe, sometimes much developed. In *A. tasmanica* and *A. billardi* (as seen in exact side view), this lobe is not visible, and the border between the lateral tooth and the lateral sarcothecæ is straight, except for slight sinuations, as mentioned in the descriptions. The two angular lobes, which in *A. billardi* are situated behind the lateral sarcothecæ, are not developed in *A. macrocarpa* and *A. tasmanica*. The intrathecal tooth, first noted by Ritchie, is found in many of the hydrothecæ of both *A. tasmanica* and *A. billardi*, though in both it is often wanting; in *A. macrocarpa* I have not found it so far.

There is a characteristic difference between the mesial sarcotheca of *A. tasmanica* and those of the other two forms. In *A. macrocarpa* and *A. billardi* this organ rises at a wider angle than does the front of the hydrotheca, so that the terminal portion is distinctly prominent, the sarcotheca does not much exceed half the length of the hydrotheca, and the aperture is more or less oblique, being obviously formed by the transverse terminal aperture cutting into the lateral one. In *A. tasmanica* the sarcotheca, though considerably longer, does not project, but continues adnate to the hydrotheca throughout its length, it is often slightly swollen at the end, and it is abruptly truncate at an angle perpendicular or nearly so to the hydrotheca. The lateral sarcothecæ do not differ much; those of *A. macrocarpa* are conspicuously directed outward, the others somewhat less so.

The hydrotheca of *A. crucialis*, according to Billard, most resembles that of *A. macrocarpa*, but Ritchie describes the lateral lobes as obsolete in many of his specimens. I do not find much variation in this particular in any of the forms described above, if care is taken that the hydrothecæ are viewed in exact profile, though *A. tasmanica* and *A. billardi* may exhibit such lobes when lying obliquely. The mesial sarcotheca, in Dr. Billard's sketch, resembles that of *A. tasmanica*, except that the aperture is more obliqne.

Refcrence to the descriptions of the corbulæ of *A. tasmanica* and *A. billardi* will show that there is no difference except such as is due to the somewhat more luxuriant growth of the former, as evidenced in the fuller development of the lateral spurs, and also of the superior crests. In *A. macrocarpa* the male corbulæ only have been observed, and these in but a single specimen; their leaflets do not meet continuously, but on the upper part of the corbula they become separate at intervals, *both* edges being fringed with sarcothecæ at those parts.

So far as *A. tasmanica*, *A. billardi*, and *A. macrocarpa* are concerned the foregoing descriptions will I think suffice for their discrimination, but *A. crucialis*, as described by Mr. Ritchie, seems to combine some of the characters which differentiate these forms, *e.g.*, the size of the hydrothecæ, the form of the hydrotheca-margin, and the structure of the corbula. It is not stated whether the differences referred to are found in the same colonies; if so an extent of variability would be indicated which might require that *A. tasmanica* at least should be recognized as within the range of variation of *A. crucialis*; otherwise it is possible that more than one type is represented in the specimens. But undoubtedly the three forms which I have described are amply distinguished from one another, so far as present information shows, whatever may be their relations with Lamouroux' species, not yet completely elucidated.

Aglaophenia dannevigi, *sp. nov.*

(Plate iii., fig. 4; Plate vi., fig. 4.)

Hydrophyton polysiphonic, two feet or more in height, stems thick, densely and profusely branched from near the base to the summit; young branches mostly in opposite pairs, their anterior aspect facing that of the parent branch, ascending at an angle of about 20° laterally, and projecting forward at about the same angle; each branch springing from an internode of the primary

jointed stem and replacing a hydrocladium. Hydrocladia alternate, one on each internode, both series directed slightly towards the front and rising at an angle of about 40°; nodes slightly obliqne.

Hydrothecæ at an angle of about 40°, nearly cylindrical in their distal half, narrowed towards the base; a very slight fold or ridge near the base on the adcauline side, directed a little forward; border with a large pointed straight or slightly incurved anterior tooth, and a large triangular tooth near the middle of each side; an angular lobe at each side behind the lateral sarcotheca; back excavated, adnate. Hydrothecal internodes with the two septal ridges usually scarcely indicated, but with the thickenings at the base of the intrathecal fold and the lateral sarcothecæ conspicuous.

Mesial sarcothecæ about three-fourths the length of the hydrothecæ and adnate throughout, aperture oblique. Lateral sarcothecæ tubular, directed forward and slightly outward, scarcely projecting beyond the hydrotheca-margin, aperture small, round, canaliculate. Cauline sarcothecæ broad, completely open above, very thin, two on the rachis at the base of each hydrocladium.

Gonangial pinnæ generally in pairs, each replacing a hydrocladium, with the first four or five internodes bearing sarcothecæ only. Corbulæ (female) long, cylindrical, consisting of up to about twenty pairs of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets which unite to form a closed corbula; the distal margin of each leaflet continued a little beyond the line of union so as to form a free-edged narrow extension or wing bordered with sarcothecæ and mostly more or less widened upward, especially in those about the middle of the corbula, which expand into a wide lobe with sarcothecæ on both edges; a large stout lateral spur projecting outward and forward from the distal edge of each rib just above its origin and bearing about six sarcothecæ but no hydrothecæ; the end of the rachis projecting a little beyond the corbula, curved upward, armed with sarcothecæ: (male) rather narrower, with the free lobes of the leaflets only slightly developed or entirely wanting, lateral spurs much smaller; the main leaflets becoming gradually shortened and finally separate in the distal part of the corbula, till at the end they are abbreviated close down to the lateral spurs.

Colour.—Bright chestnut brown.

The original example of this magnificent species is by far the finest specimen of any Hydroid which I have met with. It springs from a dense spongy mass of hydrorhizal filaments, measuring about four inches in one direction by one and a half in another, and two inches high to a point where it subdivides; the two divisions extending upwards for about three inches further, around the bases of the two main trunks on which the colony is borne. One of these trunks, before emerging from the spongy mass, has already divided into half a dozen branches, each averaging about $2\frac{1}{2}$ mm. in diameter; the other, which commences to branch a little higher up, is about 9 mm. through. The polypidom, which slightly exceeds two feet in height, is branched and re-branched most exuberantly, and is bare only near the base, the hydrocladiate portion forming a dense bush about fifteen inches in lateral spread, and between two and three inches through in the dried specimen.

As in the last two species a pair of branches originates from two successive internodes of the hydrocladiate tube, but they are here much less divergent, rising at angles of as little as 20°, while they stand out in front in a plane of about the same angle. Thus a branch of three or four inches in length may have about three pairs, each of which lies in a plane cutting that of the parent branch at about 20°. When dry they are usually more divergent, and in any case there is considerable variation, but most of the young branches are as described. When older they tend to diverge more, and the thicker branches are apt to be very irregular, partly by the process of development, and often no doubt through some of the branches being lost. A very noteworthy character is the reversal of the aspect of the young branches, so that their hydrocladia have the front facing the front of the parent branch, hence the polypidom has not a distinct anterior and posterior aspect, like *A. tasmanica* and *A. billardi*, in which the branches all face in the same direction. The peculiar mode of branching in the present species results in the young branches coming between the branch from which they spring and the penultimate branch, it is easily understood therefore how through the repetition of this process the ramification will become very dense. In some cases a very small branch is found springing from a part of an old thick branch otherwise bare, apparently a new growth; the inference would be that such branches must spring from the supplementary tubes by which the primary stem is enclosed, but I have not been able to verify this. The hydrocladia reach a length of about three-quarters of an inch. As in the allied forms the branches commence with a series of internodes (about half a dozen) bearing only sarcothecæ.

The minute structure indicates a distinct relationship with the *A. crucialis* group, notwithstanding the total difference in habit.

The hydrothecæ are of the same type, making however a somewhat wider angle with the supporting internode. The median tooth is longer and thicker, the lateral teeth larger and more in the middle; the two angular lobes behind the lateral sarcotheeæ as in *A. billardi*. The aperture of the anterior sarcotheca is oblique. The lateral sarcothecæ are only slightly divergent laterally, and they seem to differ somewhat from the other forms, especially in a slight thickening at the foot of the front wall. The intrathecal fold is excessively feeble, but the thickening at its base, as also at the base of the lateral sarcothecæ, is very pronounced, owing to its deep colour, nevertheless the annular septal ridges which usually originate at these points are generally absent, though occasionally slightly indicated, especially in the less mature hydrocladia.

The first specimen obtained was without the gonosome, but a second example, collected in the autumn, bore numerous corbulæ, and others received still more recently from the Australian Museum, show that there is in this species a distinction between the sexes similar in character to that which exists in the last two. The female corbulæ have the superior free lobes very robust, but not nearly so large as in those of *A. billardi* and *A. tasmanica;* they do not form large overlapping crests, but mostly rise only about as high as the upper surface of the corbula. The lateral spurs are long and stout, but with fewer sarcothecæ than those of the other species, where they are set closer together. The end of the gonocladium forms a stout prolongation curving up round the end of the corbula like the prow of a boat. The male corbulæ have the protective structures less developed, but they are also distinguished, in all the specimens examined, by the leaflets becoming so much reduced at the distal end of the corbula that the latter narrows away to the point so as to have a caudate aspect to the naked eye. For most of its length the corbula is closed, though here and there interstices may be seen where the leaves fail to meet; towards the end however, the much abbreviated leaflets are separate. The fragmentary appearance of the corbula at this part at first seemed to me the result of decay, but finding it general and apparently limited to the male corbulæ, I am now inclined to regard it as normal, more especially as the few corbulæ which I have seen of *A. macrocarpa*, the most nearly allied species, agree in this particular.* Between the male corbulæ of these two species I

*A similar condition of the open male corbula of *A. diegensis* is figured by Torrey and Ann Martin in their paper on "Sexual Dimorphism in Aglaophenia," University of California Publications, Zoology, vol. 3, p. 48, fig. 2.

find very little difference, except in regard to the sarcothecæ. In *A. dannevigi* the line of union of two leaflets in the middle of the corbula generally bears about three, in *A. macrocarpa* there are five or six in the corresponding position, the sarcothecæ being smaller and closer together. In the latter species they are usually widest in the middle, with the aperture small and circular, but having a deep narrow lateral sinuation; in the former they are cup-like, expanding up to the apertnre, which is very wide and oblique, with the margin smooth or somewhat irregular. These distinctions are very definite in the specimens before me, but whether they are constant is hardly a matter of certainty while so few examples of *A. macrocarpa* are available.

The female corbulæ were in many cases crowded with gonophores, but the male were empty. They evidently open by the splitting of the upper side along the median line, and in the narrower distal portion.

In all the foregoing species the corbulæ, like the branches, originate in two successive internodes of the rachis, taking the place which would otherwise be occupied by two hydrocladia. They also follow the same rule as the branches in regard to the direction in which they face. Thus in *A. billardi* and *A. tasmanica* the corbula faces mainly forward, like the branches, which all front in the same direction; while in *A. dannevigi* and *A. macrocarpa*, where the branches have their anterior aspect turned towards the rachis from which they spring, the corbulæ have a corresponding direction. When therefore a fertile specimen is laid on a slide with the hydrocladia facing upward, the corbulæ will, unless twisted from their normal position, face downward towards the slide.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Aglaophenia megalocarpa, *sp. nov.*

(Plate iv., fig. 1; Plate vi., fig. 5.)

Hydrophyton polysiphonic, two feet or more in height, with numerous branches, mostly on the upper half; branches alternate or irregular, forming an angle with the stem of about 45-50°; each branch springing from an internode of the primary jointed stem, opposite to a hydrocladium. Hydrocladia alternate, one on each internode, both series directed slightly towards the front and rising at an angle of about 40°; nodes slightly oblique.

Hydrothecæ appearing doubled on themselves, being divided by a strong intrathecal ridge which starts from the back angle of the lateral sarcothecæ and proceeds backwards parallel with

the hydrocladium half way through the hydrotheca, having its free edge thickened and giving origin to a faintly indicated fold which crosses the upper part of the hydrotheca towards the anterior tooth; distal part of the hydrotheca set at an angle of about 40° to the internode; border with a median anterior tooth, which is bifid, the smaller point somewhat incurved, the larger forming an acute crest above it; two large teeth on each side, and a third narrow pointed one at the junction with the lateral sarcotheca; back entire, adnate. Hydrothecal internode with two very short septal ridges (often scarcely indicated), one opposite the proximal extremity of the hydrotheca, the other about the middle of the internode.

Mesial sarcothecæ about half the length of the hydrothecæ, adnate throughout, terminal and lateral apertures confluent, forming an oblique canaliculate aperture. Lateral sarcothecæ sub-tubular, sharply recurved, completely open in front, margin on a level with that of the hydrotheca or slightly projecting. Cauline sarcothecæ broader than laterals, completely open above, two on the rachis at the base of each hydrocladium and a third at the back of each axil. A crateriform prominence on each hydrocladium-process.

Gonangial pinnæ with the first three or four internodes bearing nearly normal hydrothecæ, generally followed by one or two bearing more modified hydrothecæ (mostly without mesial sarcothecæ). Corbula very long (sometimes over 18 mm.), curved, consisting of up to nearly forty pairs of broad leaflets, which unite to form a closed corbula, the junction-lines smooth, marked by slightly thickened ridges. Basal part of each leaflet with a row of sarcothecæ along the lower and distal margins, just above which is an opening filled by a small modified hydrotheca A very large broad rounded secondary leaf rising from the upper part of each corbula-leaf, free except at the base, directed obliquely forward and fringed with sarcothecæ. A row of sarcothecæ usually running up each leaf of the corbula proper, starting from the point where the secondary leaflet originates.

Colour.—Red-brown.

This fine species is unique in several of its characters, notably in the form of the hydrothecæ and the direction of the intrathecal ridge, and in the enormous corbulæ. In its height (fully two feet), it vies with the last species, but is a slender form, with comparatively few branches. In the larger of the two colonies examined a spongy root-mass, some two inches in diameter, gives origin to half a dozen distinct stems, averaging about 2 mm. in diameter, of which three attain the maximum height. The

branches, which mostly occur on the upper half or two-thirds of the stem, are usually in two series and alternate, nearly in the same plane, and attaining up to eight or ten inches in length; they often face in the same direction but this character seems inconstant. Secondary branches are abundant, and a few small ones of the third order were observed. There is however, much irregularity in the ramification, especially in the distance apart of the branches, which may be from one to three or four inches. The proximal part of a branch may include as many as twenty internodes on which only sarcothecæ are borne. While the branches have their origin in the hydrocladiate tube they do not, as in all the preceding species, take the place of a hydrocladium, but, at least in the few young branches which I examined, they are supported on the same internode with a hydrocladium, and opposite to it.

No other species, so far as I am aware, shares in the peculiar construction of the hydrotheca which is found in the form before us. The aperture by which the cavity of the hydrotheca communicates with that of the internode is not situated as usual at the proximal end of the hydrotheca, but at the opposite extremity, just under and between the lateral sarcothecæ. Above this entry is the intrathecal ridge, which runs directly backwards half through the hydrotheca, and around which the latter is abruptly recurved, being thus divided into two compartments, a narrow proximal one, and a much wider distal one. The hydranth therefore will be completely doubled upon itself around the intrathecal ridge. It is interesting to note that the lateral sarcothecæ are doubled back in a somewhat similar fashion, their openings into the internode being far forward so that the sarcostyles will be recurved like the hydranths. In the presence of a sarcotheca behind each axil we have a feature usually characteristic of *Halicornaria*. The two cauline sarcothecæ on the front of the rachis are set further apart than in most species, the inferior one being close to the lower end of the internode.

The corbulæ are beautiful structures, varying in length from about half to three-quarters of an inch, one specimen measuring seven-eighths, or considerably larger, I believe, than any other species is known to possess. They are when mature of a deep reddish-brown colour, and of firm robust texture, not subject to distortion in drying. The openings near the base of the leaflets are very small and entirely occupied by the modified hydrothecæ, which do not in any way resemble those on the hydrocladia, being very small, straight, and tubular, with the margin irregularly crenate, and accompanied by a pair of very similar lateral sarcothecæ. A striking feature of the corbula is the double series of large convex secondary leaflets which rise from the surface

of the primary corbula-leaves, arching over and overlapping those in front of them. Similar structures, but much less regular and symmetrical, occur in *A. crucialis* and other species, where they are formed by a development of the free margins of the component leaves; here however, they originate independently, and are not continuations of the margins. The lines of union of the corbula-leaves are smooth, and not bordered by rows of sarcothecæ, but such a row usually runs up the leaflet from the point at which the crest-leaflet starts.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Aglaophenia decumbens, *sp. nov.*

(Plate iv., fig. 4; Plate vi., fig. 6.)

Hydrophyton lax, slender, polysiphonic, about four or five inches in height, sparingly branched; branches springing from the supplementary tubes, mostly in the distal portions of the colony, irregular, forming angles with the stem of about 45°. Hydrocladia slender, alternate, one on each internode, both series directed towards the front, and rising at an angle of about 40°, nodes transverse.

Hydrothecæ long, parallel with the hydrocladium, a slight fold or ridge near the base on the adcauline side, directed a little forwards; border with a median anterior tooth, bent outward, and four nearly equal regular shallow triangular teeth on each side, the last pair behind the lateral sarcothecæ; back adnate. Hydrothecal internodes with curved septal ridges opposite the intrathecal fold and the base of the lateral sarcothecæ.

Mesial sarcothecæ a little longer than the hydrothecæ, directed very much forward, free part projecting beyond the hydrotheca-margin, tubular, with distinct terminal and lateral apertures, and an aperture communicating with the interior of the sarcotheca. Lateral sarcothecæ subtubular, directed forward and outward, rising about as high as the hydrotheca-margin; terminal and lateral apertures distinct or united. Cauline sarcothecæ large, canaliculate, two on the rachis at the base of each hydrocladium.

Gonosome—?

Colour.—Light brown, stem and branches darker.

There is some doubt as to whether this species is identical with the *A. brevicaulis*, Kirchenpauer. That species is described as having a very thick but short stem, from the summit of which spring several long slender branches, but the figure conveys the

idea rather of a group of five or six stems with their bases all bound together in a fascicle by hydrorhiza-like filaments. The present specimen resembles a single one of these stems, and it has one or two filaments adhering an inch or so above the point at which it has been broken off. A characteristic feature is the condition of the anterior tooth of the hydrotheca, which is everted and stands immediately opposite the lateral orifice of the anterior sarcotheca, just as in Kirchenpauer's species. On the other hand the form of the hydrotheca in Kirchenpauer's figure is very different, being much shorter. Dr. Hartlaub obligingly undertook to examine Kirchenpauer's type, but the specimen turned out to be merely *A. divaricata*. That species certainly has the hydrothecæ more like the figure in their general form, but they do not have the anterior tooth everted ordinarily, and the habit-figure does not resemble *A. divaricata*. The figure of the hydrotheca is bad, whether intended for *A. divaricata* or the present species, and under the circumstances it is impossible to say whether Kirchenpauer has described an aberrant form of *A. divaricata*, or whether an error has been made in labelling the type specimen.

The whole polypidom is lax and slender, the compound stem consisting of few tubes. As in *A. divaricata* the branches spring from the accessory tubes, and commence with a series of about ten internodes bearing sarcothecæ only. The internodes of the hydrocladia are unusually slender. In some parts of the colony the anterior teeth of the hydrothecæ were without the characteristic outward bend, but as this bend is found in the portions where the perisarc is most perfectly preserved, I conclude that it is the typical form.

Loc.—Bass' Strait.

Genus Halicornaria, *Busk.*

Halicornaria birostrata, *sp. nov.*

(Plate iv., fig. 5; Plate vii., fig. 6.)

Hydrocaulus monosiphonic (unbranched ?) about five inches in height; hydrocladia alternate, one on an internode, at an angle of about 45°, and both series directed towards the front; nodes transverse or scarcely oblique.

Hydrothecæ long, tubular, proximal part parallel with the internode, distal part recurved upward, a narrow anterior intrathecal ridge immediately below the aperture; border entire in front and behind, a large angular lobe at each side about the

middle, everted horizontally, and a less pronounced lobe further back; back of hydrotheca free, more elevated than the front, so that the aperture is oblique; the aperture into the hydrocladium with two or three minute denticles on the margin. No septal ridges in the internode.

Mesial sarcothecæ as long as the hydrothecæ or longer, free for more than half their length, the free part diverging widely from the hydrotheca and overhanging its aperture; free portion sometimes single but more often dividing into two distinct tubular branches, which diverge widely from each other laterally; terminal apertures small, lateral aperture large, adjoining the hydrotheca. Lateral sarcothecæ saccate, adnate, with a small tubular aperture directed forwards and outwards, distinct from the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonothecæ about three times the length of the hydrothecæ, campanulate, truncate, membranous, springing from the bases of the hydrocladia.

Colour.—Light fawn, stems darker.

The specimens comprised numerous shoots, all unbranched, and are to the naked eye indistinguishable from *H. urceolifera*, which is also found on *A. megalocarpa*. In the form of the hydrothecæ and the mesial sarcothecæ it is quite distinct from all the known Australian species, but it has the characters, common to all of them, of the monosiphonic habit, the absence of septal ridges in the internode, the sarcothecæ at the back of the axils, and the denticles on the margin of the opening from the internode to the hydrotheca, which, by analogy with *sarcopore*, might be termed *hydropore*.

The most striking characteristic of the species consists in the bifurcated mesial sarcothecæ. There is much variation in these appendages, some only forking close to the ends, others much further back, and many remaining simple. As a rule those near the two extremities of the hydrocladia are the less developed. The lateral sarcothecæ have the tubular mouth longer and directed more forward as they approach the ends of the hydrocladia; a condition found also in many other species.

The position of the intrathecal ridge, between the hydrothecalip and the mesial sarcotheca, has not been observed in any Australian species described hitherto, though common in *Aglaophenia* and *Lytocarpus*. The oblique aperture of the

hydrothecæ is also peculiar, in being lowest on the anterior side, the obliquity in this type of hydrotheca being usually in the opposite direction. In side view there is visible a small linear mark on the adcauline wall of the hydrotheca which is seen in front view to be caused by a rather thick band crossing the floor of the hydrotheca from side to side, and forming apparently the rudiment of a posterior ridge.

The gonothecæ are of a thin membranous character, quite colourless, and so delicate that all of them have become more or less shrivelled and distorted in drying. It is evident however, that they are of the same flat-topped type as we find in *H. longirostris* and *H. urceolifera*.

On one of my specimens a few of the lowest internodes support two hydrocladia each, which are nearly opposite. As I could find no other similar specimens among those which I examined, I conclude that the condition was abnormal.

Loc.—Great Australian Bight, on stems of *Aglaophenia megalocarpa*, 40 to 100 fathoms.

HALICORNARIA URCEOLIFERA *(Lamarck)*, *var.* SCANDENS, *var. nov.*

(Plate v., fig. 4; Plate vii., fig. 5.)

Plumularia urceolifera, Lamarck, Anim. sans Vert., ii., 1816, p. 125.

Aglaophenia urceolifera, Kirchenpauer, Abh. Nat. Ver. Hamburg, v., 1872, p. 29.

Halicornaria urceolifera, Billard, Ann. Sci. Nat, Zool. (9), v., 1907, p. 324, fig. 1.

Hydrocaulus monosiphonic (unbranched?), about five inches in height; hydrocladia alternate, one or two on an internode, at an angle of about 45°, and both series directed towards the front; nodes transverse.

Hydrothecæ cup-shaped, deep, set at an angle of about 40°, without intrathecal ridge; border with a small anterior tooth which, along with the part of the hydrotheca-wall immediately below it, is abruptly bent inward, the first tooth on each side large, erect, a large triangular tooth or lobe near the middle on

each side, everted almost horizontally, and another lobe, more rounded, adjoining each lateral sarcotheca; back entire, adnate: the aperture into the hydrocladium with a few minute denticles on the margin. No septal ridges in the internode.

Mesial sarcothecæ about two-thirds the length of the hydrothecæ, projecting free portion short, but with the terminal and lateral apertures generally distinct; terminal aperture very small, circular, rarely replaced by two still smaller, side by side. Lateral sarcothecæ adnate, saccate, with one or two tubular apertures, one directed downwards at right angles with the hydrotheca, the other, when present, directed upwards and forwards, but commonly merged completely in the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonothecæ about three times the length of the hydrothecæ, campanulate, truncate. "Ses vessies, courtes urcéolées et nombreuses, sont sessiles sur le rachis, entre les pinnules" (Lamarck).

Colour.—Light fawn, stems darker.

The description and figures of *H. urceolifera* given by Billard sufficiently resemble these specimens to permit of their reference to Lamarck's species, though the type specimen seems to be a larger form (25 centimetres in height), and there are some minor differences. The hydrothecæ are broader, in front view, than those of any other species known to me. A very characteristic feature, in side view, is the abrupt bending-in of that portion of the hydrotheca which includes the anterior tooth, while the two teeth next to it remain erect. The front view is no less distinctive, the three teeth referred to appearing in that aspect as nearly equal and very near together, contrasting strongly with the nearly allied species, *H. prolifera* and others, which in front view show the median tooth standing alone, with the first pair of laterals sloping outwards and comparatively distant. The median tooth is not thickened nor crested, but merely a lobe of the hydrotheca-wall. The lateral sarcothecæ much resemble those of *H. ascidioides*, but the free front margin is often cut back so far as to obliterate the upper circular aperture. In those near the ends of the hydrocladia the lower aperture becomes gradually more distinctly tubular, and directed more forward. The mesial sarcothecæ have the terminal and lateral apertures generally distinct, a rather exceptional condition when the apertures are so closely approximated as in this species. The single circular terminal aperture seemed at first to mark a dis-

tinction between the specimens and Billard's figure, which shows two such apertures; close examination of a number of specimens however revealed a few instances in which the single orifice was replaced by two abreast, exactly as Billard shows them.

The modification of the hydrothecæ at the proximal ends of the hydrocladia, common to many species, is in certain specimens of *H. urceolifera*, carried further than I have seen it elsewhere. The first hydrotheca presents a smooth even rim with all trace of denticulation wanting, except as regards the anterior tooth, which is not at all reduced. The next hydrotheca is less modified, and so on successively, the normal form not being attained till the fourth, or even the fifth hydrotheca.

I have not seen the gonothecæ, but Billard's figure shows that they are of the obconic truncate form frequent in the genus.

Later specimens received from the Australian Museum differ somewhat from that described above, and appear to agree pretty closely with Lamarck's type. The present form may conveniently be distinguished as *var. scandens*, from its climbing habit, which apparently is not shared by the larger form.

The species has not, I believe, been observed hitherto since Lamarck described it from the Indian Ocean in 1816.

Loc.—Great Australian Bight, on stems of *Aglaophenia megalocarpa* and *A. billardi*, 40 to 100 fathoms.

Halicornaria intermedia, *sp. nov.*

(Plate v., fig. 2; Plate vii., fig. 4.)

Hydrocaulus monosiphonic, about 8-10 inches in height, dividing dichotomously once or several times; branches in one plane and facing the same way, divergent at an angle of about 75°; hydrocladia alternate or sub-alternate, two on an internode, at an angle of about 65°-70°, both series nearly in the same plane; nodes slightly oblique.

Hydrothecæ sub-cylindrical, broader near the base, set at an angle of about 60° and almost facing the front; a strong intrathecal ridge proceeding from about the middle of the front of the cell obliquely downwards to about its centre, border entire in front or with an indistinct median tooth, and a broad free rounded lobe behind, three teeth on each side, the centre one large and everted, the others more or less tending towards an obsolete condition; the aperture into the hydrocladium with a few minute denticles on the margin. No septal ridges in the internode.

Mesial sarcothecæ adnate to the hydrothecæ as far as the margin; free part short, slender, curved forward, terminal and lateral apertures distinct. Lateral sarcothecæ adnate, saccate, with two circular apertures, one directed forward, the other upward; both often more or less confluent with the wide lateral aperture. Cauline sarcothecæ similar to the laterals, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonosome—?

Colour.—Reddish-brown.

This species closely resembles *H. baileyi* and *H. furcata*, between which it is to some extent intermediate. It may have to be classed ultimately as a variety of *H. furcata*, when our knowledge of the two forms is more extended; at present it may be provisionally regarded as a distinct species.

A large colony of it was found accompanying *Aglaophenia tasmanica*, but whether it had commenced as a parasite on that species, after the fashion of so many of its congeners, was impossible to determine, the stems being matted together with other growths. It divides in a purely dichotomous fashion, and in most cases with considerable regularity, each division bifurcating again at the same distance as its fellow from the previous bifurcation. One specimen has divided four times, all at regular distances, so that the final number of divisions is sixteen.

In the widely divergent branches and hydrocladia, the latter being almost at right angles, it nearly resembles *H. furcata*, and both species differ from *H. baileyi*, in which the hydrocladia are more ascending as well as more directed forwards. The hydrothecæ of the three species are much alike, but those of *H. furcata* are broader in front view (in proportion to their length), than in either of the others. The internodes are longer in *H. intermedia* than in the others, and the hydrothecæ on the proximal parts of the hydrocladia, with their internodes, are rather broader in front view than the more distal ones.

In *H. baileyi* the base of each mesial sarcotheca springs directly from the back of the next hydrotheca, in the other two species there is a distinct interval between: in other words the back of the hydrotheca does not quite extend to the end of the internode. In the "Catalogue of the Australian Hydroid Zoophytes" it is stated in error, under *H. baileyi*, that *H. furcata* is similar in this respect; they are, however, figured correctly. The central lateral teeth of the hydrotheca are some-

what shorter and less everted in *H. intermedia* than in the other species, and the border is not quite so low at the sides. In all three species the first hydrotheca on each hydrocladium differs from the rest in having the aperture quite horizontal, and the lateral teeth nearly obsolete, one generally more so than the other.

Each species has its own characteristic condition of the axils at the bifurcations. In *H. furcata* each axil is generally occupied by a hydrocladium of one internode, the hydrotheca on which is without a mesial sarcotheca. This hydrocladium springs from the back of the axil; the usual cauline sarcothecæ in front are wanting, but there is a pair at the back, seated one on each side of the base of the hydrocladium, and facing outwards. Of *H. intermedia* I examined a number of specimens, but in none were these short hydrocladia present; there are however, in all cases a pair of divergent cauline sarcothecæ behind the axil, approximate at the base or completely united and confluent, but in either case communicating with the interior of the hydrocaulus by a single large orifice. *H. baileyi* has behind the axil in the only specimen available for examination a pair of sarcothecæ close together at the base, narrower than in *H. intermedia* and directed more upward; it has also a sarcotheca in front below the axil, and below this a perforation with a fragmentary border, probably also a more rudimentary sarcotheca.

The most salient feature which distinguishes *H. intermedia* from its nearest ally, *H. furcata*, is its large size and robust habit, with its long hydrocladia, reaching about 18 mm. in length (those of *H. furcata* being much shorter). In the minute structure of *H. intermedia* the greater length of the hydrothecal internodes, and the consequent less crowded condition of the hydrothecæ, furnish the most striking distinction. The internodes average about ·41 mm., and those of *H. furcata* about ·31. The difference is not so much in the hydrothecæ as in the internodes, accordingly it will be observed that in a front view the hydrothecæ of *H. furcata* are closer together, the proximal ends of the hydrothecæ being just over the nodes, while in *H. intermedia* there is an intervening space. I have not seen in *H. furcata* the noticeable narrowing of the hydrothecæ and their internodes, which in *H. intermedia* occurs towards the ends of the hydrocladia, and the hydrothecæ of the latter species do not so completely face the anterior side of the polypidom.

The colony of *H. intermedia* consisted of a good many shoots, and among the specimens which I examined I did not observe

much variation; of *H. furcata* and *H. baileyi*, however, I have seen no specimens except the one of each from which I originally described them.

Loc.—Oyster Bay, Tasmania, 20 fathoms.

Genus Halicornopsis, *Bale.*

Halicornopsis elegans *(Lamarck).*

Plumularia elegans, Lamarck, Anim. sans Vert., ii., 1816, p. 129.

Aglaophenia elegans, Lamouroux, Hist. Polyp. Cor. Flex., 1816, p. 169; Encyclop. Méth., Zooph., 1824, p. 16.

Aglaophenia avicularis, Kirchenpauer, Abh. Nat. Ver. Hamburg, v., 1872, p. 33, pls. i. and iii., fig. 3.

Halicornopsis avicularis, Bale, Journ. Micro. Soc. Vict., ii,, 1881, p. 26, pl. xiii., fig. 3; Cat. Austr. Hyd. Zooph., 1884. p. 185, pl. x., figs. 1, 2, pl. xix., fig. 32; Trans. and Proc. Roy. Soc. Vict., xxiii., 1887, pp. 90, 101. Marktanner. Turneretscher, Ann. k.k. Hofmus. Wien, v., 1890, p. 279.

Azygoplon rostratum, Allman, Rep. Sci. Results "Challenger" Exp., Zool., vii., 1883, p. 54, pl. xix, fig. 1-3.

Halicornopsis elegans, Billard, Ann. Sci. Nat., Zool., (9) v., 1907, p. 323; Comp. Rend., cxlvii., 1908, p. 940; Ann. Sci. Nat., Zool., (9), ix., 1909, p. 329; *Ibid*, (9) xi., 1910, p. 44. Ritchie, Mem. Austr. Mus., iv., 1911, p. 855, pl. lxxxix., fig. 1.

The first account of this species which was of any value was that of Kirchenpauer, who described it as new in 1872, under the name of *Aglaophenia avicularis*. Later it was successively described as new by myself and Allman, under the respective names of *Halicornopsis avicularis* and *Azygoplon rostratum*; but Billard, in 1907, announced from his examination of the type specimens that it was identical with the *Plumularia elegans*, Lamarck, a species which had been described both by Lamarck and Lamouroux, but not in such a way as to render it identifiable. None of the descriptions were complete and correct in all particulars, while one important feature—the presence of a median sarcostyle behind the hydrotheca—remained unnoticed till pointed out by Ritchie; and I have further observed, in

examining specimens collected by the "Endeavour" in the Great Australian Bight, that this sarcostyle is not always naked, as described by Ritchie, but is, sometimes at least, protected by a sarcotheca of the most rudimentary form.

The hydrophyton, in the young state, is monosiphonic, but afterwards becomes fascicled in the older portions. The branches, which are not in any regular order, spring from the internodes of the stem or older branches, not taking the place of a hydrocladium, but originating opposite one. There is much irregularity in the arrangement of the first few internodes of a branch. Following the stem-process which supports the branch, there is frequently but one very short internode bearing a sarcotheca only, before the hydrocladia-bearing internodes commence; in other cases the first internode is much longer, with two or three median sarcothecæ, and sometimes a hydrocladium also. The process itself has usually two sarcothecæ, both on a level and widely apart; sometimes only one is present however, and in Ritchie's specimens there were three.

The hydrocladiate tube is mostly composed of single or double internodes, supporting respectively one or two of the alternate hydrocladia. In some specimens the shorter internodes predominate, in others the longer, and frequently the two forms are interspersed at random, while in other cases all the internodes may be alike. I have observed instances in which the first two or three hydrocladiate internodes of a branch are more elongated still, supporting each three hydrocladia.

The hydrocladia are at an angle of 45° or somewhat less, and are directed somewhat forward. Their internodes have the perisarc, at the distal extremity, produced a little forward so as to form a thin, delicate, collar-like extension, surrounding the node, and continued into two narrow webs which run backward along the upper side of the internode, to join the sides of the hydrotheca. Midway between these, and under the back of the hydrotheca, is situated the sarcopore. This orifice is obvious enough in a front view of the hydrocladium, but owing to the back of the hydrotheca being immediately above it, it appears closed in, and resembles a circular thin area, for which I mistook it until Ritchie called attention to its true nature. On one of the "Endeavour" specimens, which, when cleaned with liquor potassæ and mounted in glycerine, was absolutely colourless and of glassy transparency, I was able not only to verify Ritchie's observation, but to discover a distinct sarcotheca (if the term may be applied to a structure so rudimentary), just over the orifice. As seen in front view it is simply a tongue-shaped flap of the perisarc, of excessive delicacy and tenuity, visible through the back of the hydrotheca, and usually projecting slightly

beyond it. In lateral view, being seen edge-wise, it appears strictly linear, and is arched over the sarcopore in an almost semi-circular form. Careful examination discloses the presence of this structure in several of my other specimens, but there are some in which I have not succeeded in finding it.

Apart from these peculiarities the hydrotheca differs considerably from that of ordinary Statopleans. Its rostrum is formed, not, as is usual, by the anterior sarcotheca, but by a prolongation of the hydrotheca itself, somewhat as in *Aglaophenia formosa* (Busk). Here, however, the front of the rostrum is closed in by a thin wall, which is continued downward into the cavity of the hydrotheca, forming an anterior intrathecal ridge, and terminating in a thickened margin. In the first hydrotheca of each hydrocladium this rostrum is commonly much reduced. On each side of the hydrotheca-margin there is a small rounded lobe, and running from the intrathecal ridge to this lobe is a broad curvilinear band, distinguished from the rest of the hydrotheca by a difference in thickness (the band being apparently thinner). The back of the hydrotheca is broadly sinuated.

The anterior sarcotheca is short, and situated opposite the base of the rostrum; at first sight it would appear to originate from the internode and to run up the front of the hydrotheca, as in an ordinary *Aglaophenia*; closer observation, however, shows that what might be taken for the proximal part of the sarcotheca is really a process from the internode, not specially devoted to the sarcotheca, but forming the channel of communication between the cavity of the hydrocaulus and that of the hydrotheca, which connect by means of a small opening into the hydrotheca (the *hydropore*) situated at the top of this process. Opposite to this opening, and crowning the summit of the process, is the sarcotheca, which is short, scoop-shaped, and entirely open on the inner side. The position of the hydrotheca is similar to that seen in some *Plumularidæ (e.g. P. goldsteini)*, in which the widening of the proximal end of the internode, to embrace the base of the hydrotheca, is carried to such an extent as to form a distinct process, in the axil of which the hydrotheca is situated.

The cauline sarcothecæ are small and inconspicuous. There is one on the rachis, just above the hydrocladium, another, often very difficult to make out, on the base of the latter, while a third, as Ritchie has pointed out, is found in the axil.

The gonothecæ, which are borne on the bases of the hydrocladia, and are often turned alternately to left and right, are somewhat irregularly ovate thick-walled capsules, showing

no trace of operculum or orifice. In places where they have been detached a small basin-shaped portion of the base is often left behind, it would seem probable therefore that the opening so formed may be the normal channel of exit of the contents.

The colour of the zoophyte varies a good deal, ranging from a very light brown to a reddish tint. The hydrothecæ measure from the point of the rostrum to the furthest point of the adcauline side from ·34 mm. (in the proximal ones) to ·52 mm. Single internodes of the rachis range from ·33 to ·59 mm., double ones from ·52 to 1·2 mm., hydrothecal internodes from ·3 to ·36 mm.

Though decidedly Statoplean in habit, the species seems, in its minute structure, at least as nearly allied to the Eleutheroplea. The situation of the hydrotheca in the axil of a process from the internode, is, as already mentioned, a distinctly Plumularian character, and the mesial sarcotheca is also very similar to those of some of the Eleutheroplea. And in the median sarcostyle behind the hydrotheca we have a character by which the species is closely allied to some of the species of *Plumularia*, as well as to the series of forms which have been grouped under the genus *Kirchenpaueria*.

Loc.—Great Australian Bight, 40 to 100 fathoms.

Genus Kirchenpaueria, *Jickeli*.

Kirchenpaueria producta *Bale*.

Plumularia producta, Bale, Journ. Micro. Soc. Vict., ii., 1881, p. 39, pl. xv., fig. 3; Cat. Austr. Hydr. Zooph., 1884, p. 133, pl. x., fig. 4; Trans and Proc. Roy. Soc. Vict., xxiii., 1887, p. 96. Inaba, Zool. Mag. (Tokyo), No. 34, 1891, p. —— figs. 69-70.

Azygoplon productum, Bale, Proc. Linn. Soc. N.S. Wales, (2) iii., 1888, p. 774, pl. xix., fig. 1-5.

Kirchenpaueria producta, Bale, Proc. Roy. Soc. Vict., (N.S.) vi, 1893, p. 111.

Halicornaria producta, Torrey. Univ. California Publ., i., 1902, p. 75, pl. x., fig. 95.

Diplocheilus productus, Torrey, Univ. California Publ., ii., 1904, p. 35. Stechow, Abh. math.-phys. Klasse k. Bayer Akad. Wissensch., I. Suppl. Band, 1909, pp. 88, 89.

One or two specimens were found growing on some of the larger Hydroids, and not differing in any important particular from the type.

In some examples of this species, which I have examined since my descriptions were published, I find the opening of the hydrotheca, as seen in front view, less narrowed than I have figured it. In most cases however, the sides of the hydrotheeæ, owing to their excessive delicacy, are more or less bent or distorted, even when they have never been dried, so that it is not easy to find specimens which have kept their shape perfectly. But I have not in any case found the aperture distinctly circular, as in *K. mirabilis*.

Torrey retains for this species and *K. mirabilis*, on grounds which I consider untenable, the generic name of *Diplocheilus*, Allman, in which he has been followed by several other observers; while Billard on the other hand has argued in favour of relegating them to the genus *Plumularia*.

Torrey's remarks are as follows—"According to Jickeli's figure the hydroid for which he erects the genus is an eleutheroplean plumularian—probably a *Plumularia*—with nematophores broken away. The frequent absence of nematophores in species which characteristically possess them and the absence of any other distinguishing characters remove the slender claims to priority over *Diplocheilus* which have been made for this inadequate genus."

With the statement that Jickeli's figure represents an Eleutheroplean I fully agree, but I do not infer, as Torrey apparently does, that *K. producta* is therefore not referable to the genus; on the contrary, I am now convinced that the species is not only an Eleutheroplean but a true *Plumularia*, unless the characters assigned by Jickeli to his genus suffice for its separation.

The further statement that the figure represents a specimen with the nematophores broken off is unwarranted. In reality all the species which are known to agree with Jickeli's in possessing naked sarcostyles agree with it also in being unprovided with lateral sarcothecæ.

The remark that "the absence of any other distinguishing characters" (that is other than the absence of the lateral nematophores), removes the claim to priority of the genus is equally unfortunate. Other characters are *not* absent, indeed it is precisely on these other characters, namely the possession of

naked sarcostyles and the rudimentary condition of the anterior sarcothecæ, that the genus was founded, Jickeli laying no stress on the absence of the lateral sarcothecæ. But Torrey, while disallowing Jickeli's genus on the ground of its inadequacy, proceeds to re-establish the genus *Diplocheilus*, basing it on precisely the same characters that Jickeli established his genus upon. Such a position is of course untenable, and it is obvious that if *Kirchenpaueria* is inadequate *Diplocheilus*, being completely synonymous with it, must be equally inadequate.

But if observers ultimately agree to accept the genus, then, notwithstanding that Jickeli's account of it is clear, correct, and unmistakable, while Allman founded his genus on a misinterpretation of structure, priority, if ascertainable, must decide which name is to stand. I have not been able to settle this question. The prefatory note to Allman's "Report on the Hydroida dredged by H.M.S. 'Challenger' during the years 1873-76; part i., Plumularidæ" is dated the 20th July, 1883, but I have no means of ascertaining how long a period elapsed between that date and the actual time of publication. Nor can I find the precise date of publication of Jickeli's paper in the "Morphologisches Jahrbuch," though there is a notice of it in the "Journal of the Royal Microscopical Society" for August 1883. The probability is that Jickeli has priority, but in any case the merit of correctly defining the genus rests with him, and is ample warrant for preferring the name given by him until the question of priority can be settled.

The following species are referable to the genus *Kirchenpaueria*, *Plumularia pinnata* (Linn.), *P. similis*, Hincks, *P. hians*, Marktanner-Turneretscher, *P. producta*, Bale, *Diplocheilus mirabilis*, Allman, and *D. allmani*, Torrey. While they all agree in the possession of naked sarcostyles and the absence of the lateral nematophores, the last three differ from the others in having an intrathecal ridge, anterior in position, just below the lip. It was on a misinterpretation of this ridge in *D. mirabilis* that Allman founded his genus; there is however nothing peculiar about its form, which is precisely the same as found in many Statopleans and in some typical *Plumulariæ*, for example in *Lytocarpus philippinus*, *Aglaophenia plumosa*, and *Plumularia balei*, Bartlett. The presence of the intrathecal ridge is mentioned by Torrey in his description of the genus, but it has never been regarded by observers as of generic importance, and all the larger genera of the Plumularidæ,—*Aglaophenia*, *Lytocarpus*, *Halicornaria*, and *Plumularia*—comprise species both with and without this characteristic.

Whether the genus *Kirchenpaueria* is sufficiently distinct or whether all the species should, as Billard suggests, be referred to *Plumularia*, is a question which I leave to others to determine, though the fact that these few species agree among themselves and differ from all the other forms of *Plumularia* in such important characters, must have some weight. To one feature however,—the form of the anterior sarcothecæ—I attach no importance. They are—in *K. producta* and *K. mirabilis*—merely the ordinary fixed anterior sarcothecæ, modified by the terminal loculus being very widely expanded and very shallow; in short, they are saucer-shaped rather than cup-shaped. Jickeli calls them dish-shaped continuations of the perisarc. Moreover they vary, and I have seen them in *K. producta* scarcely differing from the ordinary form found in such species as *P. campanula*. In the case for the retention of the genus it is doubtless a weak point that it rests on the concurrence of two distinct features—the presence of naked sarcostyles and the absence of the supracalycine nematophores—and that there appears to be no necessary reason why these characteristics should always be found associated, as however, they are in all the species yet known.

Loc.—Bass Strait.

EXPLANATION OF PLATE I.

Fig. 1. *Aglaophenia macrocarpa*, Bale, from an incomplete specimen in the Australian Museum, to show ramification. Natural size.

Fig. 2. The same, seen laterally.

Fig. 3. *Synthecium subventricosum*, sp. nov.; x 40.

Fig. 4. *Synthecium subventricosum*, sp. nov.; x 40.

Fig. 5. *Synthecium subventricosum*, sp. nov.; x 40. Gonotheca.

Fig. 6. *Campanularia pumila*, sp. nov.; x 40.

Fig. 7. *Campanularia pumila*, sp. nov.; x 40. With double and triple peristome.

Fig. 8. *Campanularia pumila*, sp. nov.; x 80. With double peristome.

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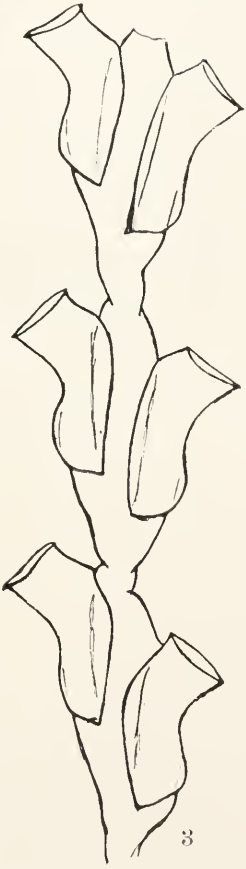

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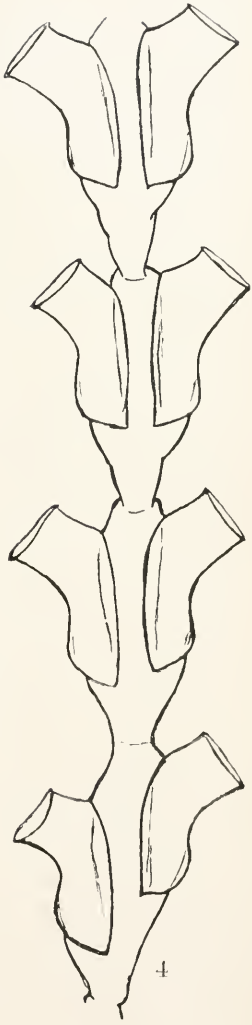

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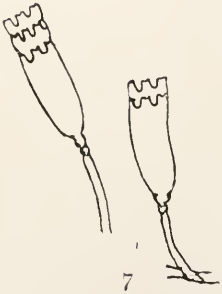

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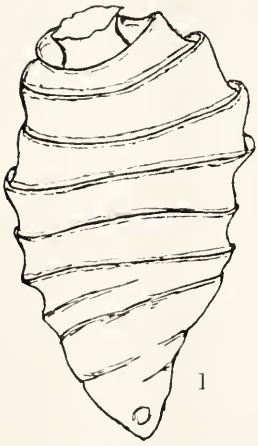
W. M. Bale, del.

EXPLANATION OF PLATE II.

Gonothecæ of *Sertularella divaricata* (Busk), and allied forms ; x 40.

Fig. 1. *Sertularella divaricata* (Busk). Port Stephens.
Fig. 2. *Sertularella divaricata*, *var. dubia*, Bale. Bondi.
Fig. 3. The same.
Fig. 4. *Sertularella divaricata*, *var.* Port Phillip, 1890.
Fig. 5. *Sertularella divaricata*, *var.* Hunter Group.
Fig. 6. *Sertularella divaricata*, *var. subdichotoma*, Bale, (= *S. subdichotoma* Kirchenpauer.)
Fig. 7. *Sertularella divaricata*, *var.* Port Phillip, 1881. (= *S. johnstoni*, Bass Strait variety, Bale).
Fig. 8. *Sertularella divaricata*, *var.* Port Phillip, 1889.
Fig. 9. *Sertularella divaricata*, *var.* Great Australian Bight.
Fig. 10. *Sertularella johnstoni* (Gray). New Zealand.
Fig. 11. *Sertularella pygmæa*, Bale. Port Phillip.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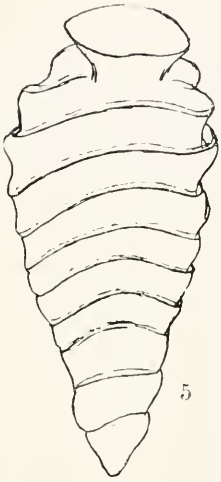
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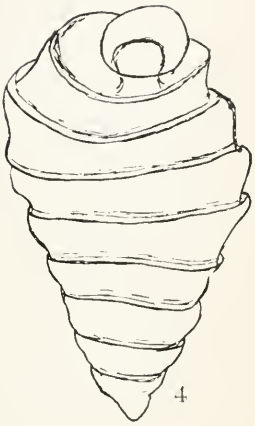
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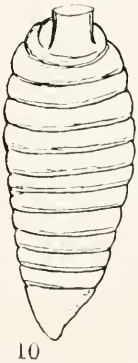
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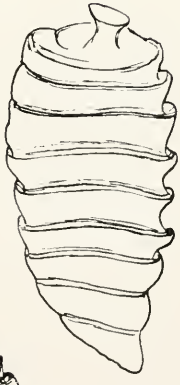
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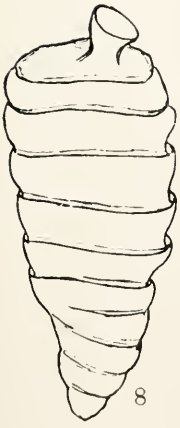
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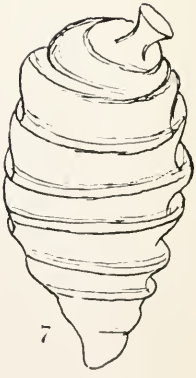
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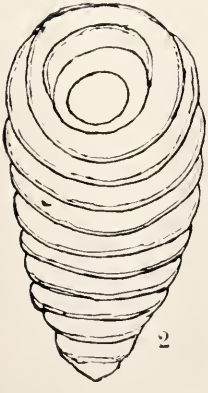
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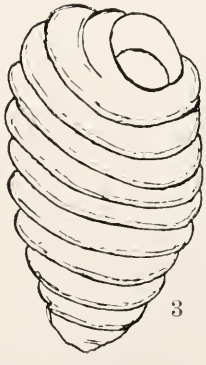
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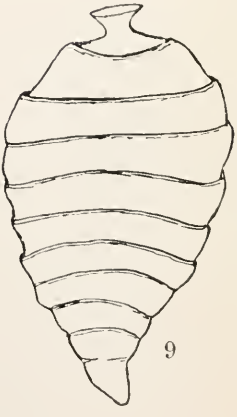
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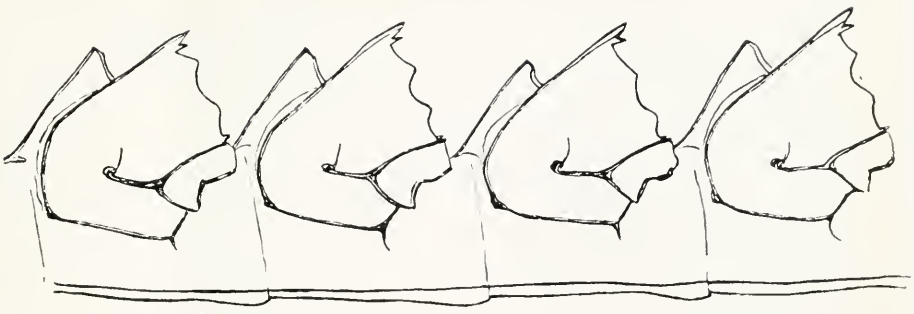
W. M. Bale, del.

EXPLANATION OF PLATE IV.

Fig. 1. *Aglaophenia megalocarpa*, sp. nov.
Fig. 2. *Plumularia asymmetrica*, sp. nov. Front view.
Fig. 3. *Plumularia asymmetrica*, sp. nov. Side view.
Fig. 4. *Agloaphenia decumbens*, sp. nov.
Fig. 5. *Halicornaria birostrata*, sp. nov.

Figs. 1-5 x 80.



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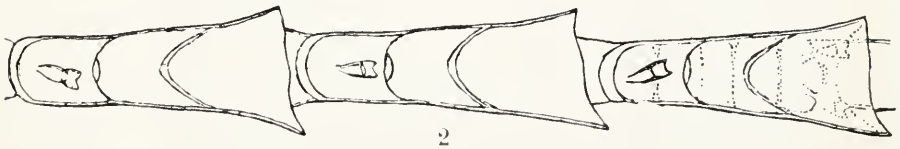

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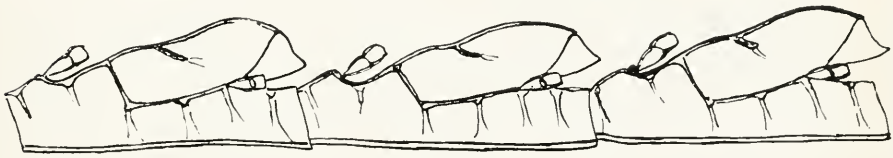

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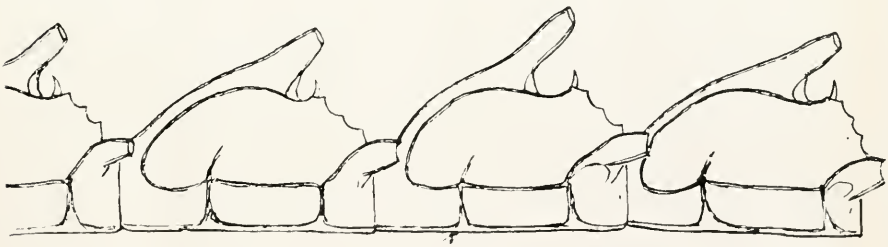

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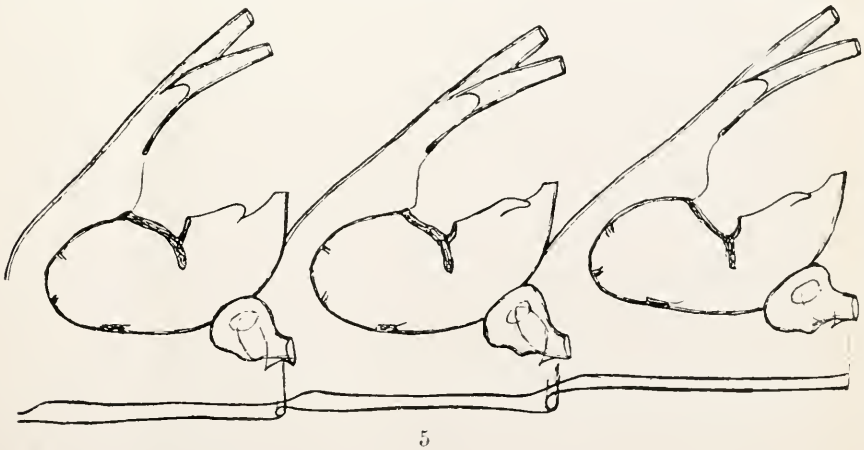

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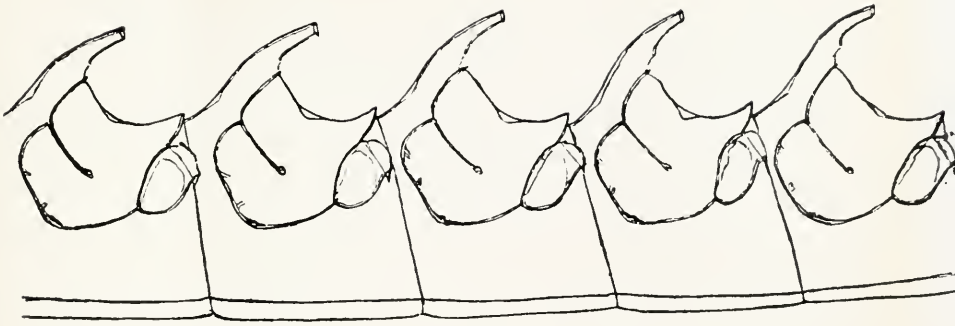
W. M. Bale, del.

EXPLANATION OF PLATE V.

Fig. 1. *Halicornaria baileyi*, Bale.
Fig. 2. *Halicornaria intermedia*, sp. nov.
Fig. 3. *Halicornaria furcata*, Bale.
Fig. 4. *Halicornaria urceolifera* (Lamarck)
Figs. 1-4 x 80.



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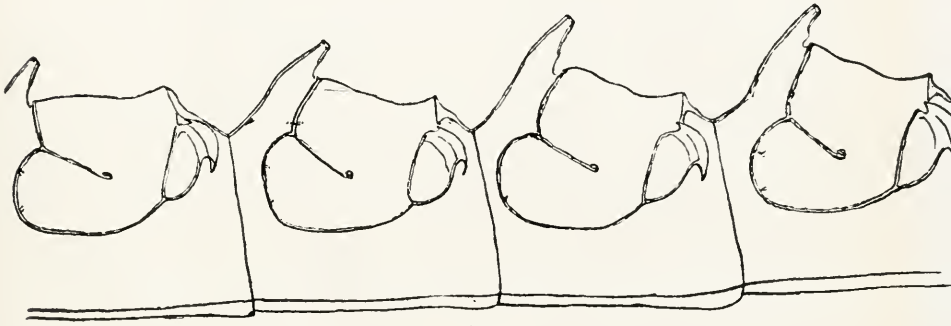

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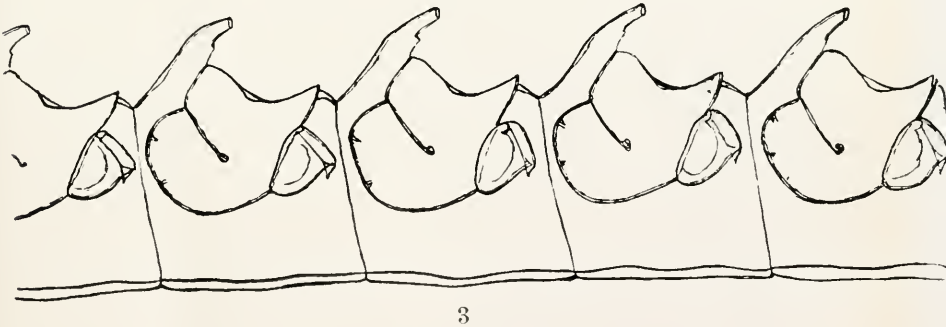

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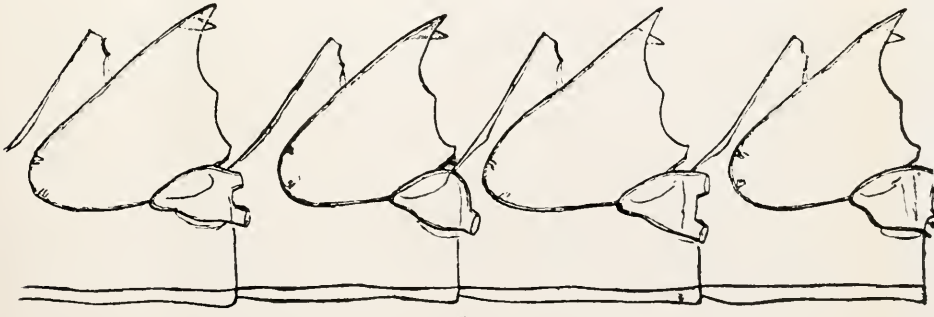

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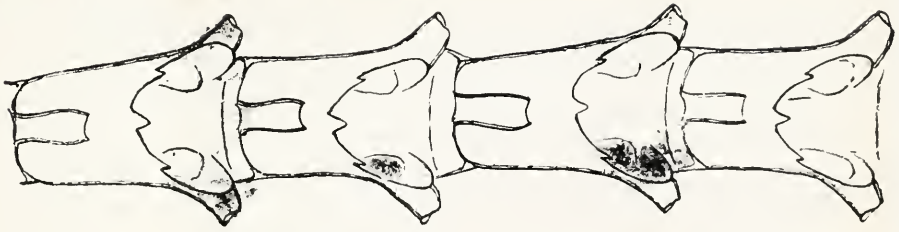
W. M. Bale, del.

EXPLANATION OF PLATE VI.

Fig. 1. *Aglaophenia macrocarpa*, Bale.
Fig. 2. *Aglaophenia tasmanica*, sp. nov.
Fig. 3. *Aglaophenia billardi*, sp. nov.
Fig. 4. *Aglaophenia dannevigi*, sp. nov.
Fig. 5. *Aglaophenia megalocarpa*, sp. nov.
Fig. 6. *Aglaophenia decumbens*, sp. nov.
Figs. 1-6 x 80.



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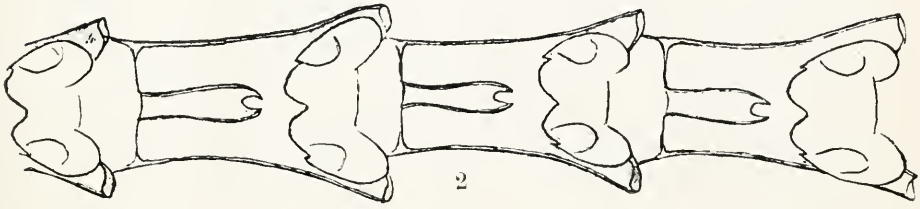

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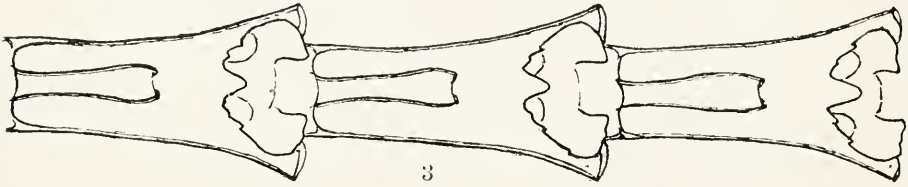

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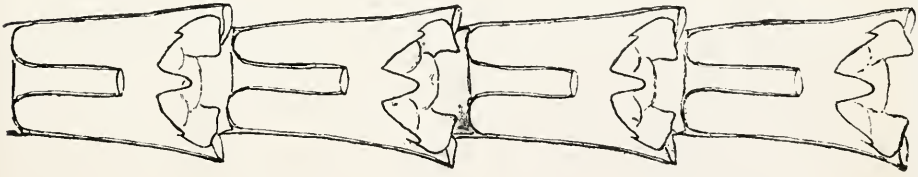

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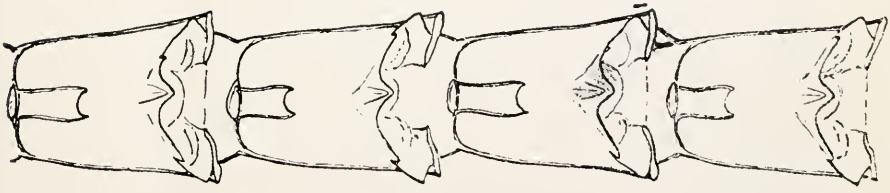

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W. M. BALE, del.

EXPLANATION OF PLATE VII.

Fig. 1. *Halicornaria baileyi*, Bale.

Fig. 2. *Halicornaria furcata*, Bale.

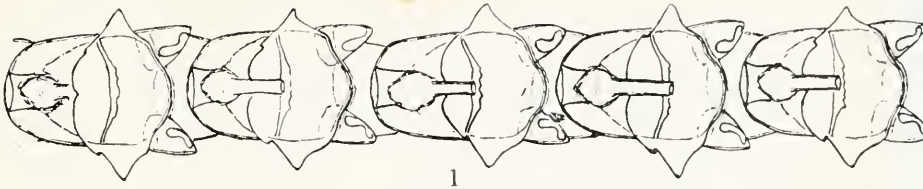
Fig. 3. *Halicornaria intermedia*, sp. nov.
Proximal end of hydrocladium.

Fig. 4. *Halicornaria intermedia*, sp. nov.
Distal portion of hydrocladium.

Fig. 5. *Halicornaria urceolifera* (Lamarck).
The specimen figured is of the maximum width; the hydrocladia are usually narrower, often no wider than those of *H. furcata*.

Fig. 6. *Halicornaria birostrata*, sp. nov.

Figs. 1-6 x 80.



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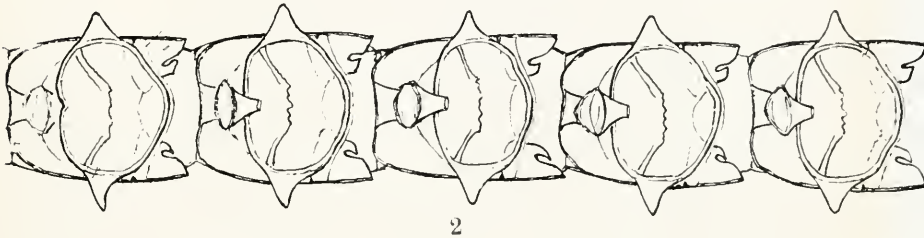

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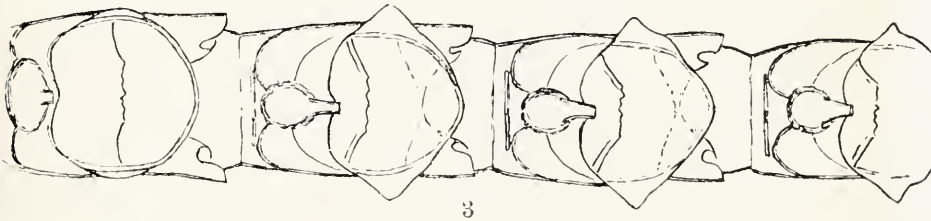

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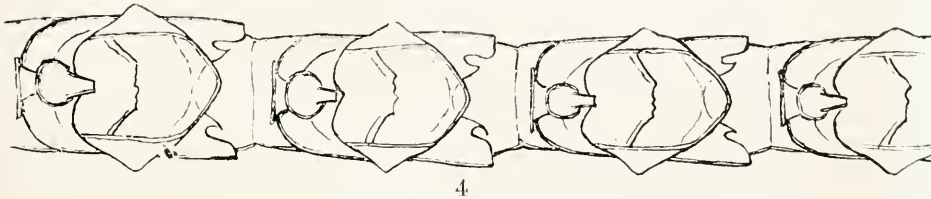

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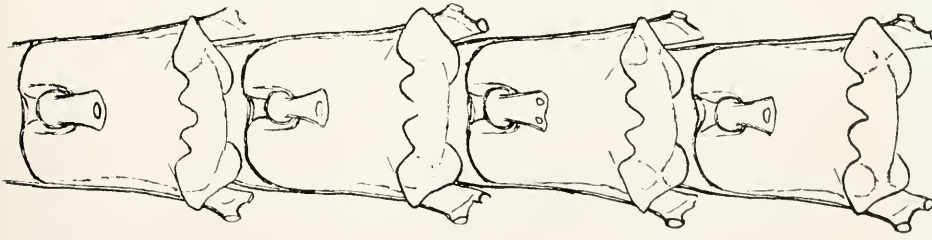

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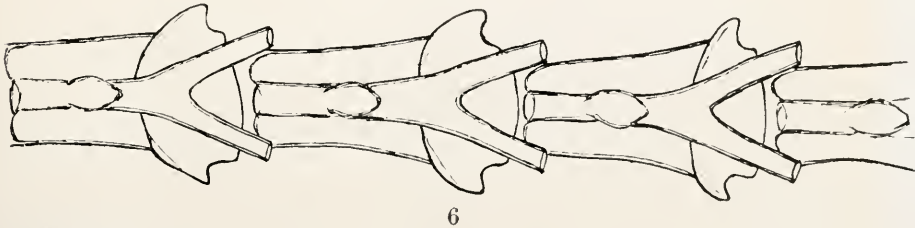

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W. M. Bale, del.

II. Mollusca.

(Continued from Vol. I., p. 114.)

BY

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Assistant Curator and Conchologist,

Australian Museum,

Sydney.

(Plates viii.-xii.)

II.—MOLLUSCA.

1. From the Great Australian Bight.

The following notes are based on a parcel of shells trawled in the Great Australian Bight, between E. Long. 126° and 129°.. in depths of from eighty to a hundred and twenty fathoms, during February, March and April of the present year (1913). This repeated a series collected a little to the eastward in the previous year and on which Dr. J. C. Verco has furnished an excellent and beautifully illustrated report.[1] Only shells of large size are retained by the meshes of the trawl, so that the consignment contained comparatively little material for discussion.

Charonia nodifera, *var.* euclia, *var. nov.*

(Plate viii., fig. 1.)

Triton nodiferum, Lamarck, Hist. Nat. Anim. s. Vert., VII 1822, p. 178.

There was a shell which quaint old Humphrey called "the red and brown clouded Trompet from New South Wales." This, for nearly a century, authors continuously, from Chemnitz to Angas, had agreed to distinguish from the Mediterranean Conch-shell. But on the contrary, Tryon[2] united the larger, nodose, buff and brown European *Triton nodiferum* to the comparatively small, broad, smooth and reddish Australian *Triton australe* (=*Septa rubicunda*, Perry, 1811). His authority has been accepted by most Australian Conchologists such as Hutton, Tate, Pritchard, Gatliff and Verco. Yet it seems to me that the other view, as expressed in the "Challenger" Report, was correct, and that the difference in size, shape, colour and sculpture, entitled *C. nodifera* to be held apart. Confusion of nomenclature has obscured the references in literature, but it appears that the territory of *C. rubicunda* is South-east Australia, Tasmania, New Zealand and the Kermadec Islands. Although as a synonym of *C. rubicunda* Australian lists have included *C. nodifera* by mistake, yet as an independent species

1 Verco—Trans. Roy. Soc. S. Austr., 1912, pp. 206-231, pls. x.-xvi.

2 Tryon—Man. Conch., iii., 1881, p. 10.

it is now advanced for admission. The anatomical details given by Parker and Haswell[1] for *Triton nodiferus* refer to *Charonia rubicunda*.

From a depth of a hundred fathoms in the Great Australian Bight, Dr. Verco has recorded a form of *Cymatium rubicundum*, Perry,[2] representatives from there and from further west prompted the present enquiry. I regard these shells as a variety not of *C. rubicunda* but of *C. nodifera*. The Australian outlier is rather nearer the Japanese *C. sauliæ*, Reeve, than the European expression of the species. Compared with specimens from Marseilles, the West Australian variety has stronger wrinkles on the arch of the inner lip, but weaker transverse folds on the base of the columella near the canal, it is more slender especially as regards the spire, and the nodules are closer and more prominent. From *C. sauliæ*, as figured by Lischke,[3] the Australian shells differ by more slender form, by smaller, closer and more prominent nodules, but agree generally in the armature of the aperture. The example here figured is 22 centimm. long and half as broad, and for this West Australian variety I now propose the name of *C. nodifera* var. *euclia*. Since writing the above a series has been received from the "Endeavour," trawled off the South East Coast.

Reviewing the whole group, Dr. W. H. Dall separated from the other Tritons, a genus *Septa*, distinguished by an operculum with a subcentral internal nucleus and by a laterally extended rachidian tooth with a median inflection in front, but without basal plates. Recently Mathews and Iredale[4] have shown that *Septa*, Perry originally had for its type, *Septa scarlatina*, Perry (=*Murex rubecula*, Linn.) and not *Triton tritonis*, as was generally supposed. Commenting on this discovery, Dr. Dall remarks[5] that "the first name available for the group typified by *Murex tritonis*, L., seems to be *Nyctilochus* of Gistel, 1848." On further investigation Iredale found *Nyctilochus* to apply to *Cymatium* or *Fusus* and recommended *Charonia*, Gistel, as proposed for *Murex tritonis*, L. alone[6] This name is accordingly here adopted.

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1 Parker and Haswell—Textbook of Zoology, i., 1910, pp. 721-732, figs. 608-618.

2 Verco—Trans. Roy. Soc. S. Austr., xxxvi., 1912, p. 218.

3 Lischke—Jap. Mar. Conch., ii., 1871, p. 33, pls. i. & ii.

4 Mathews and Iredale—Vict. Nat., xxix., 1912, p. 9.

5 Dall.—Nautilus, xxvi., 1912, p. 58.

6 Iredale—Nautilus, xxvii., 1913. p. 55.

ANCILLA COCCINEA, *sp. nov.*

(Plate x., fig. 3.)

From eighty or ninety miles west of Eucla and in from seventy five to a hundred and forty fathoms, Dr. Verco reported a salmon coloured *Ancilla*, which he identified as *A. mucronata*, Sowerby. Three more specimens from corresponding depths a little further west have reached me.

It is now suggested that subsequent writers have transferred this name of Sowerby's from one species to another and that the form discovered by Dr. Verco should properly be regarded as undescribed. *A. mucronata* was introduced by Sowerby in 1830 and was figured from a single specimen of unknown origin. As the same author afterwards remarked in the "Thesaurus," it seemed related to *A. australis*, Sowerby,[1] *A. rubiginosa*, Swainson, and to *A. angustata*, Sowerby. For *A. mucronata*, and as from Tasmania, Reeve has figured another species different from Sowerby's in form, colour, and especially in the grooving of the base. I think that *A. mucronata*, Reeve[2] not Sowerby, is a growth stage of *A. australis*, Sowerby, in which the "mucronate" apex becomes so by projecting from the mass of callus which envelopes the spire.[3] Another form of this species is *A. pyramidalis*, Reeve. Though Tasmania was given by Reeve as the habitat of his *A. mucronata*, no one has since found it there. Since the "Challenger" Expedition procured it in Queen Charlotte Sound, New Zealand, the Dominion may be regarded as the proper locality. Tenison Woods[4] thought that it occurred as a Tertiary fossil at Table Cape, Tasmania, but subsequent writers referred the fossil to *A. pseudaustralis*, Tate.[5] My conclusion is that Reeve misinterpreted the "mucronata" of Sowerby, substituting for it a form of *A. australis*, and perpetrated a second error by ascribing the substitute to Tasmania instead of to New Zealand.

The original figure of *A. mucronata* differs from the West Australian species by having an internal furrow ending in a spur on the lip, by three or four broad spiral furrows on the base, by lacking the inferior brightly coloured callus zone, by

1 Sowerby—Species Conch., 1830, Ancillaria, p. 8, pl. ii., figs. 47-48; *Id.*, Thes. Conch., iii., 1859, p. 63.

2 Reeve—Conch. Icon., xv., 1864, Ancillaria, pl. iv., fig. 10.

3 Harris—Brit. Mus. Cat. Austr. Tert. Moll., 1897, p. 77.

4 Ten. Woods—Proc. Roy. Soc. Tasm., 1877 (1879), p. 30.

5 Pritchard—Proc. Roy. Soc. Vict., viii.; (n.s.), 1896, p. 104.

possessing a much broader unglazed median area, a thinner deposit of upper callus and a broader contour. Nearest to the novelty is *A. australis*, but that New Zealand shell is far smaller, comparatively broader and more solid and coloured slate and brown. *A. montrouzieri*, Souverbie,[1] from New Caledonia is smaller, comparatively more slender and of paler colour. The relations of this group are rather with the dead than with the living, for it was represented in the Australian Tertiary by such fossils as, *A. hebera*, Hutton, *A. pseudaustralis*, Tate, *A. lanceolata*, Tate, *A. ligata*, Tate, *A. papillata*, Tate, and *A. semilævis*, Ten. Woods.

The new species may be characterised as follows :—

Shell large, solid, ovate-fusiform, whorls probably eight. Colour :—the central area of the body whorl is orange, bounded above and below by a white spiral line, beneath the lower one is a narrow belt of brilliant cadmium orange, followed by pure white on the base and pillar. Above the upper white spiral is a broad space of cadmium orange shading off into buff on the upper part of the spire. Sculpture :—the central zone of the body whorl is unglazed, and is bounded by an incised spiral line above and below, anterior to this is a narrow belt of callus limited by another incised line, the latter issuing at the centre of the notch. Above the unglazed central zone there is a broad and thick deposit which envelopes the spire, concealing the sutures, and from which the apical whorl alone projects. Aperture narrow, ovate, effuse anteriorly, the posterior angle blocked by a pad of callus, from which a thin glaze spreads over the inner lip. Columella grooved and twisted. Canal short and broad. No furrow within, or spur upon the lip. Length, 45 mm., breadth, 19 mm.

Hab. Great Australian Bight, west of Eucla, 75 to 140 fathoms.

Genus Altivasum, *gen. nov.*

A new genus of the family Turbinellidæ, distinguished by elevate spire, hollow axis, and three plaits on the lower columella.
Type :—Latirus aurantiacus, Verco.

The affinities of the new genus are with *Vasum* and in that genus it is more like the tall *V. ceramicum* than the typical short spired *V. turbinellum* or *V. muricatum*. But from either form the greater number of whorls, the smaller proportion of the body whorl, the perforation and especially the reduction and

1 Souverbie—Journ. de Conch., viii., 1860, pp. 207, 824. pl. xi., fig. 3.

displacement of the columella plaits distinguish *Altivasum*. Judging from literature, *V. capitellum*, Linne, makes the nearest approach to the new genus, but I have no specimens to decide if it should be included, or not.

Chascax, referred by its author to the Muricidæ, has a strong, if apparently superficial resemblance to *Altivasum*. Though its author denied[1] to it any columella plaits, Tryon[2] has affirmed their existence. Several years ago Mr. J. Dennant showed me an undescribed Victorian Tertiary shell which from my recollection might belong to this genus.

The type species, *Latirus aurantiacus*, was described from a young shell 46 mm. long, dredged alive by Dr. Verco in Backstairs Passage, S.A. Afterwards he dredged in St. Vincent Gulf two others, one of which had lost four or five whorls and had four remaining in a length of 57 mm. This was taken alive. The other was a very worn example of an older shell, and had about four whorls remaining in a length of 88mm. Dr. Verco kindly lent these to me for comparison with "Endeavour" material.

Between that here figured and the one illustrated by Dr. Verco, great difference appears. That is partly due to the difference between youth and age, a difference here unusually great. But the "Endeavour" shells are beset with prominent spines which are absent from the eastern shells. The South Australian specimens agree in having fewer and bolder ribs than those from West Australia, so that it is difficult to decide whether here are one or two species. I prefer to take the conservative view that the differential characters are probably variable and that a fuller series will unite these extremes.

The "Endeavour" series are therefore described under the name of—.

Altivasum aurantiacum, *Verco, sp.*

(Plate ix., fig. 2.)

Latirus aurantiacus, Verco, Trans. Roy. Soc. S. Austr., xix., 1895, pp. 89, 107, pl. ii., figs. 1, 1a. *Id.*, Melvill, Journ. of Conch., xiii., 1911, p. 167. Not *Latirus aurantiacus*, Montfort, Conch. Syst., ii., 1810, p. 531.

Shell large, for its size rather light and thin, ovate-acuminate, broadly and deeply perforate. Colour uniform salmon red. Whorls eleven, gradate, slowly increasing, angled at the suture,

1 Watson—Proc. Zool. Soc., 1873, p. 361, pl. 36, fig. 30.

2 Tryon—Man. Conch., iii., 1881, p. 89.

contracted at the base then produced to the canal. Apex mucronate, of two smooth whorls. Epidermis thin, membranous and easily shredded. Sculpture:—low broad radial ribs ascend the spire obliquely at the rate of about a dozen to a whorl, but vanish on the last. There are eight spiral cords, the four lower are wider spaced than those above, of which two ascend the spire. Each cord carries distant high vaulted scales, sometimes projecting as long spines, those on the shoulder and the base being most developed, set at the rate of twelve or fifteen to a whorl. Besides, there is an unarmed spiral beneath the suture and another margining the umbilicus. Perforation broad and deep, expanding finally and penetrating as a spiral tube to the earlier whorls, its surface is spirally grooved and transversely scaled. Aperture elliptical, outer lip fimbriated by incipient scales, inner lip spread above on the preceding whorl for a short space, then projecting free for the rest of its course. Above, the aperture is slightly channeled, below it passes into a short narrow and recurved canal. Deep within the aperture, and low on the columella, appear three strong well spaced plaits, of which the lowest nearly overlies the umbilical margin of the former whorl. Length, 130; breadth, 65 mm.

Hab.—Four empty shells were trawled in from 80 to 120 fathoms in the Great Australian Bight, between Long. 126° and 129° E., Feb.—April, 1913. A few specimens of coral, apparently a *Cylicia*, are attached to one, and on another are Polyzoa, which suggest that the mollusc lived on hard ground.

2. From North and South of Gabo Island.

Genus Foramelina, *gen. nov.*

A genus related to *Melina*, in which the byssus instead of escaping by a lateral notch, penetrates the right valve by a median subumbonal orifice and groove. A suture extends from the perforation posteriorly to the edge of the hinge. Adductor muscle single, concentrated and reduced. Ligamental furrows narrow and crowded. Type:—*F. exempla.*

An affinity with *Anomia* is suggested by the perforation, but convergence has probably here as with *Pedum* reached similar results from unlike origins. The multivincular ligament and general appearance of the shell indicate rather that this is a derivative from the stock of *Melina*. In typical species of that genus the byssal notch forms a pouch and if the byssus had pressed more on one valve than on the other, further advance might have enclosed the byssus in a tube. With a transition form, *M. percrassa*, Tate,[1] an approach seems to be made to such a

1 Tate—Trans. Roy. Soc. S. Austr., xxxiii., 1899, p. 277.

state, for Tate writes of it that the byssal sinus lies altogether in the left valve and is consequently very long and narrow. The suture from the hole to the edge traces the path travelled by the byssus of *Foramelina*.

A French Jurassic fossil which united the hinge of *Melina* to the perforation of *Anomia*, was described by D'Orbigny[1] as *Hypotrema*. Resembling the Australian shell in this eccentric combination, it differed by being what its author termed "pleuroconch," that is having a deep lower and a flat upper valve. In D'Orbigny's opinion the perforation contained a muscle, not a byssus as in *Foramelina*. So though *Hypotrema* is nearer than any other genus that I can find in literature to the shell under review, it cannot be regarded as identical.

Even more like the Australian shell is *Pulvinites argentea*, Conrad,[2] from the Upper Cretaceous of the Mississippi Valley. But the reference of Conrad's fossil to the genus *Pulvinites* is doubtful.

FORAMELINA EXEMPLA, *sp. nov.*

(Plate xi.-xii., figs. 6-7-8.)

Shell equivalve, equilateral, large, flat, discoidal, margin irregular in outline. Valves thick, composed of brittle, imbricating lamellæ which both include and are overlaid by a thin membranous epidermis, where eroded of a silvery sheen, interior a dark bronze. Perforation in the right valve about 10 mm. in diameter, median and subumbonal, internally with a raised margin, externally excavated as an oblique furrow ascending to the vertex. From the margin of the perforation a suture leads to the anterior extremity of the hinge plate. Byssus a dense bundle of threads about half an inch long. Hinge line about 43 mm. long. Area much eroded above and traversed by about twenty-two narrow ligamental grooves which slightly radiate from above. Externally the hinge gapes when the valves are closed as in *Melina*. Adductor small, subcircular, about its own breadth below the perforation. Byssal retractor rather larger than the adductor and immediately above it in the left valve. Pallial margin entire, about half an inch within the ventral margin. Height, 120 : length, 130 mm.

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1 D'Orbigny—Journ. de Conch., iv., 1853, p. 432, pl. 10; Fischer—Man. Conch., 1886, p. 933, fig. 702.

2 Conrad—Journ. Acad. Nat. Sci. Philad. (2), iii., 1858, p. 333, pl. 33, fig. 5; *Op. cit.*, iv., 1860, p. 298, pl. 46, fig. 51.

Hab.—A living specimen and a separate right valve were trawled Sept.-Oct. 1913, in 100—250 fath., south from Gabo Island. With them were associated *Argobuccinum retiolum*, *Cypræa umbilicata*, Sowerby, *Scaphella papillosa* var. *kenyoniana*, Brazier, and *S. magnifica*, Chemnitz.

Cassidea stadialis, *sp. nov.*

(Plate x., fig. 4.)

Cassidea turgida, Hedley (not Reeve), Mem. Austr. Mus., iv., 1903, p. 330, pl. xxxvi., fig. 1.

A pair of this species, taken by the "Thetis" Expedition, was doubtfully referred to *C. turgida*, Reeve. Now that my acquaintance with it has been improved by examining numerous similar specimens from a wide range of localities, I consider it as distinct and undescribed. From *C. turgida* it differs as already remarked by larger size and a smooth inner lip. Some might regard it as a form of *C. pyrum*, Lamarck, the interpretations of which are various. Tryon went to the extreme of regarding *C. pyrum* as identical with *C. paucirugis*, Menke, and as a variety of *C. achatina*, Lamk. It is well to select Kiener's *Cassis*, fig. 25, as the proper expression of *C. pyrum* rather than Kiener's fig. 30 or Reeve's discordant figures in the "Conchologica Iconica." I cannot exactly match Kiener's fig. 25 with an actual specimen, but it is approached by examples from New Zealand. By this standard *C. stadialis* differs from *C. pyrum* by larger size, absence of angles or tubercles on the shoulder, absence of spiral grooves on the base and presence of wrinkles on the columella lobe.

It may be characterised thus:—

Shell large, thin, smooth, inflated, ovate-acuminate. Colour vinaceous pink, traversed by four evanescent spiral bands of rufous blotches, apex lemon, mouth white except on the outer lip, where four pair of chestnut splashes represent the spiral bands of the exterior whorls, five plus a smooth two-whorled protoconch. Sculpture:—the body whorl is quite smooth, the antipenultimate and previous whorls are decussated by fine dense spiral threads and oblique growth lines, these disappear on the penultimate. Canal short, recurved, separated from the body whorl by a broad impressed furrow which winds beneath the columella lobe into a capacious spiral false umbilicus. At the tip of the canal opens a minute axial perforation. Outer lip slightly but abruptly ascending at the insertion, moderately expanded and reflected. Inner lip

reduced above to a thin smear of callus, below expanded into a broad sinuous lobe adnate to the canal. Above are a few faint wrinkles. Columella armed with about eight plications, the upper short and deep seated, the lower running out almost to the margin of the lobe and doubling by intercalation. Specimen figured, 90 mm. long and 60 broad; another, 100 mm. long, 70 mm. broad.

Hab.—Between Green Cape and Gabo Island, 50 to 100 fathoms.

With it were associated, *Cassidea thomsoni*, Brazier; *Fasciolaria australasia*, Perry; *Fusinus novæ-hollandiæ*, Reeve; *Penion maximus*, Tryon; *P. waitei*, Hedley; *Charonia nodifer*, var. *euclia*, Hedley; *Scaphella fusiformis*, Swainson; *Pecten bifrons*, Lamarck; *Cardita raouli*, Angas; and *Chione chemnitzii*, Hanley.

Argobuccinum retiolum, *sp. nov.*

(Plate xi., fig. 5.)

Shell ovately fusiform, large, light and thin, spire elevated, body whorl two thirds of total length. Colour pale buff, within the aperture an ochraceous margin. Whorls in all specimens seen have a broken apex, on the best preserved example seven whorls remain, inflated, parted by deeply contracted sutures. Sculpture:—varices are irregular in position and development, two, one or none to a whorl. The general surface is neatly retienlated, on the last whorl twenty-two spiral cords interseet thirty-five radials and project as small tubercles at the crossing point, between the main cords run minute interstitial threads; the penultimate carries twenty-seven radials and nine spirals. Fragments remain of a thin olivaceous epidermis. Aperture ovate, outer lip protected by a varix outside, simple within. At the posterior angle a low, deep seated, entering ridge. Inner lip with a thin callus margin. Canal open, short, broad, bent slightly upwards and to the right. Length, 130 mm.: breadth, 60 mm.

This species belongs to the small subgenus *Priene*, hitherto limited to America. From *Triton scaber*, King,[1] the type of that subgenus, the Australian shell differs by its larger size, more elongate form, longer canal and more open sculpture. It makes the seventh member of the genus found in Australia, the others

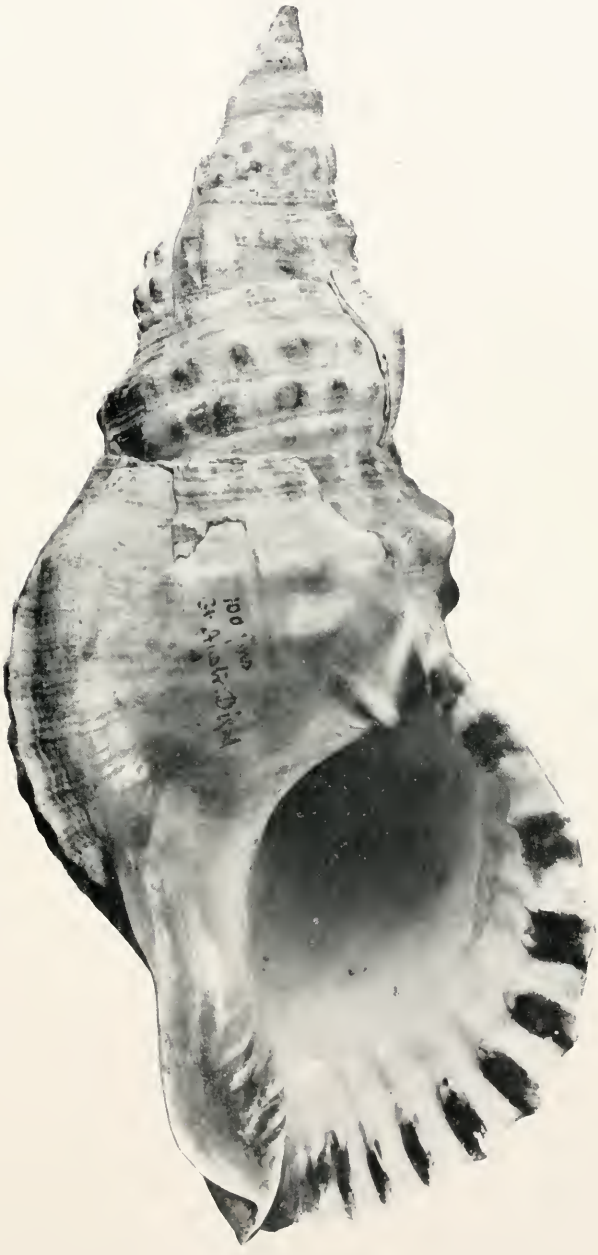
1 King—Zool. Journ., v., 1831, p. 348.

being, *A. australasia*, Perry, 1811, *A. bassi*, Angas, 1869, *A. epitrema*, Tenison Woods, 1877, *A. fraterculum*, Dunker, 1871, *A. succinctum*, Linne, 1771, and *A. tumidum*, Dunker, 1872.

Hab.—A few specimens from 50-100 fathoms between Green Cape and Gabo Island; a few more including the type, from 100-250 fathoms south of Gabo Island. In the British Museum I noticed a unique broken specimen, about four inches long, marked *Ranella*, sp., which was taken by the "Challenger" Expedition at Station 164B., off Sydney, in 410 fathoms. Probably it is the species under discussion.

EXPLANATION OF PLATE VIII.

Fig. 1. *Charonia nodifera*, Lamarck, var *euclia*, Hedley.



1

C. Clutton, photo., Austr. Mus.

EXPLANATION OF PLATE IX.

Fig. 2. *Altivasum aurantiacum*, Verco.

2

P. Clarke, del., Austr. Mus.

EXPLANATION OF PLATE X.

Fig. 3. *Ancilla coccinea*, Hedley.

Fig. 4. *Cassidea stadialis*, Hedley.

4

3

P. CLARKE, del., and C. CLUTTON, photo., Austr. Mus.

EXPLANATION OF PLATE XI.

Fig. 5. *Argobuccinum retiolum*, Hedley.

Fig. 6. *Foramelina exempla*, Hedley, dorsal aspect; valves closed in natural apposition, and a tuft of byssus protruding from the orifice.

5

6

C. CLUTTON, photo., Austr. Mus.

EXPLANATION OF PLATE XII.

Fig. 7. *Foramelina exempla*, Hedley; exterior.

Fig. 8. Interior of the same (right) valve.

7

8

C. Clutton, photo., Austr. Mus.

III. Report on some Fishes obtained by the F.I.S. "Endeavour" on the Coasts of Queensland, New South Wales, Victoria, Tasmania, South and South-Western Australia.

PART II.

BY

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Plates xiii.-xxxiv.; Text figs. 1-15.

REPORT ON THE FISHES.

Part 2.

I.—Introduction.

Inclusive of both the marine and fresh-water forms, there are about one thousand eight hundred and forty species of fishes at present known from Australia. Though this number includes many which will ultimately prove to be mere synonyms of the others, yet it is almost certain that a complete list of the fishes occurring in our waters will exceed two thousand. In their excellent check-list of the fishes of Oceania [1], Jordan and Seale list one thousand seven hundred and four species, of which four hundred and forty seven are Hawaiian [2], and about four hundred and eighty occur at Samoa [1]. The relatively small islands of Japan provide one thousand two hundred and thirty species [3], while the fishes of North and Middle America, which are much better known, number three thousand two hundred and sixty three [4].

Taking into consideration the length of the Australian coast-line, and its extent from far into the tropics to the cooler temperate regions, we may expect to find a richness of marine fauna equal to that of any other part of the world of similar size. By far the greater proportion of those already recorded are known from the eastern and south-eastern parts of the continent, no collecting having been systematically carried out on the northern and western coasts. The present number one thousand eight hundred and forty, therefore, can only be accepted, as indicative of an extraordinary variety of fish-life occurring on our coasts, much of which remains to be discovered.

Further, our knowledge of the deep-sea fishes is particularly meagre, being based on a few scattered hauls made by the "Challenger Expedition" [5], and more recently by the "Woy Woy" [6]. The "Endeavour," however, has lowered a

1 Jordan & Seale—Bull. U.S. Bur. Fish., xxv., 1906, pp. 173-455.
2 Jordan & Evermann—Bull. U.S. Fish. Comm., xxiii., pt. i., 1905.
3 Jordan, Tanaka & Snyder—Journ. Coll. Sci. Tokyo, xxxiii., Art. 1, 1913.
4 Jordan & Evermann—Bull. U.S. Nat. Mus., No. 47, pt. iv., 1900.
5 Günther—"Challenger" Rept., Zool., i., 880, and xxii., 1887.
6 McCulloch—Rec. Austr. Mus., vi., 1907, p. 346.

large commercial trawl into 450 fathoms and several lesser depths in the Great Australian Bight, and, as might be expected, has captured a wonderfully rich collection of new or little known fishes. Many of these are generically and even specifically identical with the species known from similar depths in other parts of the world, though they have not been previously recognised from Australian waters, and they give some idea of the large number of species which will have to be added to the Australian list when this section of our fauna is better known.

It may be mentioned here that such of these deep-sea fishes as have been examined bear a marked resemblance to those described from Japan, Hawaii, and the Indian Ocean, while a few are apparently identical with species occurring in the Mediterranean and the neighbouring Atlantic Ocean. Some of them are also known to occur in shallow water in New Zealand where so many deep sea types are occasionally cast up on the beaches.

The following are dealt with in this Report:—

Oxynotus bruniensis, Ogilby; Southern Australia. Near *O. centrina*, Linnæus; Mediterranean and neighbouring Atlantic.

Scymnorhinus licha, Bonnaterre; Mediterranean and neighbouring Atlantic, Japan, New Zealand and Southern Australia.

Squatina tergocellata, sp. nov.; Southern Australia. Near *S. africana*, Regan; Natal.

Polyipnus tridentifer, sp. nov.; Southern Australia. Near *P. spinosus*, Günther; Indian and Western Pacific Oceans.

Neoscopelus macrolepidotus, Johnson; Atlantic, Indian, and Pacific Oceans, New Zealand and Southern Australia.

Centriscops humerosus, Richardson; Southern Australia and New Zealand.

Notopogon lilliei, Regan; Southern Australia and New Zealand.

Hyperoglyphe johnstonii, Morton; Southern Australia and New Zealand.

Beryx decadactylus, Cuvier & Valenciennes; Madeira, Japan, and Southern Australia.

Hoplostethus intermedius, Günther; Southern Pacific and Southern Australia.

Hoplostethus mediterraneus, Cuvier & Valenciennes; Mediterranean and Madeira, Japan and Southern Australia.

Hoplostethus gigas, sp. nov.; Southern Australia.

Plagiogeneion macrolepis, sp. nov.; Southern Australia. Near *P. rubiginosus*, Hutton; New Zealand.

Cyttosoma boops, Gilchrist; South Africa and Southern Australia.

Allocyttus verrucosus, Gilchrist; South Africa and Southern Australia.

Neocyttus rhomboidalis, Gilchrist; South Africa and Southern Australia.

Hoplichthys haswelli, McCulloch; Southern and South-eastern Australia.

Hoplichthys ogilbyi, sp. nov.; Southern Queensland. Near several Indian and Pacific Ocean species.

Chirolophius laticeps, Ogilby; Southern Queensland.

Halieutæa brevicauda, Ogilby; Southern Queensland. Near *H. fumosa*, Alcock; Indian seas.

Of the other species referred to in this Report, little need be said here. Their representation in the "Endeavour" collections has enabled me to extend their known distribution in some cases, and to prepare complete descriptions and figures in others. In all, fourteen species are described as new, and two genera are proposed for known species. Variations of others are also noted and figured.

An item requiring special reference here is the status of a paper by Mr. J. Douglas Ogilby, entitled "Endeavour Series, No. 1—On some New Fishes from the Queensland Coast." This was read before the Royal Society of Queensland in November 1910, and was to have been published in Vol. XXIII. of the "Proceedings" of that Society. It was set up in type, and author's reprints were issued and distributed before it was withdrawn from publication for reasons stated on page 85 of the same volume. It is fully quoted in the "Zoological Record" for 1911 as though it had appeared in the "Proceedings," but, of course all the references there given are unfortunately incorrect. The only copies of the paper extant therefore are a few of the author's reprints which were distributed by him before its withdrawal, so it becomes a matter of opinion as to whether the paper has been published or not.

I have accordingly treated it from both points of view, quoting it and using the new names as though they had appeared according to the rules of nomenclature, while redescribing and figuring the actual specimens. so far as is possible, on which the names are based.

Mr. Ogilby was on board the "Endeavour" during the greater part of the time she was in Queensland waters, and his paper deals with some of the more striking fishes which attracted his attention. Some of his descriptions were prepared on board the ship, and the type specimens were forwarded to Sydney without labels or other identification marks, and without being again examined by him. The preparation of a second description of such specimens as can be identified as his types has enabled me to rectify errors in the original diagnoses which were doubtless the result of their hurried preparation. The following species were described as new—*Raja polyommata*, *Saurida filamentosa*, *Maccorhamphosus lancifer*, *Dentex spariformis*, *Pentapus aucifilum*, *Upeneoides filifer*, *Sillago auricomis*, *Chærodon frenatus*, *Chærodon ambiguus*, *Chærodon monostigma*, *Antigonia rubicunda*, *Neosebastes incisipinnis*, *Scorpæna grandisquamis*, *Apistus macrolepidotus*, *Minous versicolor*, *Erosa iridea*, *Paracentropogon scorpio*, *Paracentropogon vespa*, *Hyalorhynchus pellucidus*, *Lepidotrigla umbrosa*, *Lepidotrigla grandis*, *Lepidotrigla argus*, *Lepidotrigla calodactyla*, *Dactyloptena papilio*, *Acnoglossus cacatuæ*, *Uranoscopus terræreginæ*, *Callionymus affinis*, *Chirolophius laticeps* and *Halieutæa brevicauda*. The last two are redescribed and figured here, and *Hyalorhynchus pellucidus* is shown to be synonymous with *Elates thompsoni*, Jordan and Seale. Figures of others have been prepared, and will be published later.

In conclusion, I have to thank Mr. H. C. Dannevig, Commonwealth Director of Fisheries, for valuable information on the occurrence of the specimens forwarded for examination.

Family SQUALIDÆ.

Genus Oxynotus, *Rafinesque*.

Oxynotus bruniensis, *Ogilby*.

(Plate xiii.)

Centrina bruniensis, Ogilby, Rec. Austr. Mus., ii., 1893, p. 62.
Id., Regan, Ann. Mag. Nat. Hist. (8), ii., 1908, p. 42.
Centrina salviani, Hutton, Trans. N. Zeal. Inst., xxii., 1890, p. 276.

Six examples, 585-600 mm. long, exhibit some variation in the form and size of the fins. The spines of both dorsals differ in length in each specimen, and the extreme height of the first dorsal is equal to the distance from the tip of the snout to either the first or the last gill-opening; the hinder margin may be concave, or straighter as in the specimen figured. The membrane of the tail is damaged in two of the specimens, and consequently that fin appears to be a little smaller than in the more perfect one which is figured.

Regan has suggested the identity of *O. bruniensis* and *O. centrina*, but a comparison of the Australian specimens with a Mediterranean example of the latter species, shows the two to be quite distinct. In *O. bruniensis*, the body is very much deeper, and the interspace between the two dorsal fins is narrower than in *O. centrina*. The scales of the Mediterranean species are smaller, of uneven size, and densely crowded, whereas they are larger and more uniform in size in *O. bruniensis*, and separated from one another so that the bare skin is visible between them. Finally the spiracle is quite different in the two species, being smaller and round, and less than half as wide as the eye in *O. bruniensis*, while it is larger, oval, and more than half as wide as the eye in *O. centrina*.

For the opportunity of comparing the Australian specimens with a European one, I have to thank M. Jules Richard, Director of the Musée Océanographique, who forwarded specimens of this and other fishes to the Australian Museum.

Locs.—Eastern edge of Bass Strait, 100-220 fathoms; December, 1912.

Great Australian Bight, 80-120 fathoms; April, 1913.

Great Australian Bight, Long. 127-128° E., 160-200 fathoms; June, 1913.

Family SCYMNORHINIDÆ.

Genus Scymnorhinus, *Bonaparte*. [1]

Scymnorhinus licha, *Bonnaterre*.

(Plate xiv., fig. 1; Fig. 1.)

Squalus licha, Bonnaterre, Encycl. Meth., Ichth., 1788, p. 12.

Scymnus lichia, Parker, Trans. N. Zeal. Inst., xv., 1883, p. 223, pls. xxxi-xxxii.

Dalatias licha, Jordan & Fowler, Proc. U.S. Nat. Mus., xxvi., 1903, p. 637 (synonymy).

Scymnorhinus lichia, Regan, Ann. Mag. Nat. Hist. (8), ii., 1908, p. 54.

1 For notes on the use of *Scymnorhinus* rather than *Dalatias*, Rafinesque, see Garman—Mem. Mus. Comp. Zool., xxiv., 1899, p. 31.

Head, from end of snout to first gill-opening, 6.47 in the total length; its breadth behind the spiracles 1.6 in its length. Depth of body at origin of first dorsal, 1.34 in the head. Snout almost equal to the eye in length, a little less than half the interocular width, and 5.67 in the head. Preoral portion of head 3.14, aperture of mouth 2.79, interocular space 2.66, and least depth of the caudal peduncle 5 in the head. Width of spiracle two-thirds the diameter of the eye,

Body elongate, rather robust. Head short and broad, flat above, the lower profile forming a deep curve from the snout to the mouth. Snout obtusely pointed anteriorly but widening rapidly to the nostrils which form an angle on each side of it about the middle of its length. Eyes large, a little nearer the spiracle than the tip of the snout, and placed in the upper half of the head. Mouth very slightly curved, the centre of the upper lip below, or a little behind the middle of the eye; upper lid continued backward in a broad curve on either side to below the spiracle, forming an oblique groove behind each angle of the mouth. Nostrils wide, opening anteriorly on the sides of the snout with large circular apertures, their lower halves each with a broad, free, skinny lobe in front. Spiracle very broad, $2\frac{1}{4}$-$2\frac{3}{4}$ in the interval separating them. First to fourth gill-slits subequal in width; about as wide as the spiracle; the fifth is a little wider than the others and extends a little round the anterior base of the pectoral.

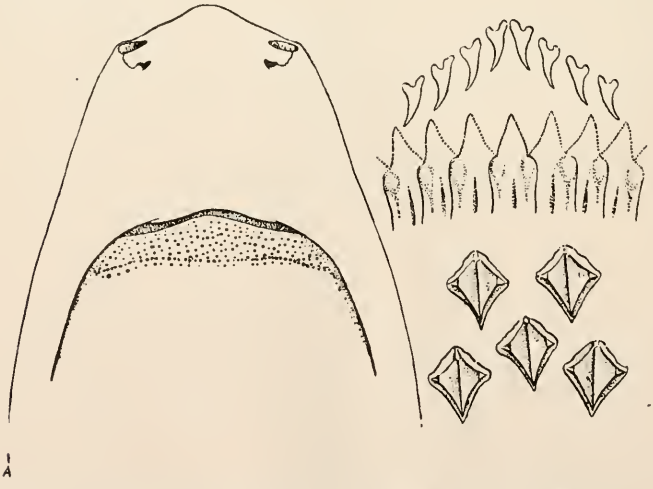

Fig. 1—Under side of head, teeth, and scales of *Scymnorhinus licha*.

Teeth of the lower jaw divided into two portions, the upper one triangular and minutely serrated: lower portion quadrate, the outer surface with two tumid swellings at its upper angles,

and three impressed grooves, the median of which is the deepest. The lateral teeth are very slightly oblique. Either one or two rows may be functional, and about five more are reversed inside the mouth. The upper teeth are much smaller, narrow and pointed, and not serrated. They are arranged in about seven oblique rows of which three are functional.

Skin everywhere covered with small, rough scales which are diamond-shaped, the hinder half being larger than the anterior portion. The posterior angle is raised from the skin as a stout spine from which a median ridge extends to the front of the scale, and two lateral ones are parallel with its sides; the junctions of the ridges at the anterior and lateral angles of the scale are marked by small triangular areas. A lateral line can be traced from the inner angle of each spiracle along the upper half of the body to the middle of the caudal peduncle, whence it extends along the tail and descends to the lower side of the vertebral column near its tip.

Profile of the back rising evenly from the snout to the first dorsal, which originates about midway between the tip of the snout and the posterior base of the second dorsal, or rather nearer the latter; the distance separating the two fins equals about five times the length of the base of the first. The two dorsals are subequal in size or the second may be a trifle the larger. The tip of the first is rounded, and the posterior angle is either not produced or only slightly so; the second differs only in having the posterior angle more or less produced. Pectorals a little larger than the dorsals and their margins rounded without any angles; their tips do not reach backward to the origin of the first dorsal, the interval between the verticles of the two points being either a little greater or less than the length of the eye. Ventrals originating far in advance of the second dorsal, their posterior point of insertion below the anterior portion or the middle of that fin; their outer angles are rounded, and the posterior ones are slightly produced, though more so in the males than in the female specimens. Caudal fin large and broad, the inferior lobe not produced backward; inferior margin oblique, forming a sharp angle at its junction with the posterior lobe.

Colour.—Brown with a very few small blackish spots, which are round and irregularly scattered. Lips whitish in formalin.

Described from a male example, 1140 mm. long. Eight others are preserved, 500-1390 mm. long, of which two are females and six are males. Beyond some slight variation in the relative sizes and positions of the fins, all are quite similar. The scales of the smaller specimens are less worn than those of the adults, and the posterior portion is consequently rather longer and more acute.

Professor T. Jefferey Parker examined an example of *Scymnorhinus* from New Zealand waters in 1882 which he identified as *S. licha*. In using that name for the specimens described above, I do so only because the descriptions of the Mediterranean species are so incomplete, that, in the absence of typical specimens to compare with, it is impossible to determine whether they are specifically identical or distinct. The Australian Museum collection includes a skull of *S. licha* from the Mediterranean, of which the teeth are similar to those of the Australian specimens.

Though not particularly spiny, the scales of this shark are extremely rough to the touch, and ones skin becomes unpleasantly scraped when specimens are much handled.

Locs.—Great Australian Bight, Long. 127-128° E., 160-200 fathoms; May & June, 1913.

Great Australian Bight, Long. 128-129° E., 200-300 fathoms.

Family SQUATINIDÆ.

Genus Squatina, *Duméril*.

Squatina tergocellata, *sp. nov.*

(Plate xv.; Fig. 2.)

Head, from snout to level of posterior angles of gill-openings, 4.32 in the total length to the middle of the caudal fin: its length is 1.12 in its width, which is 3.85 in the total. Eye 3 in the interocular space, which is 2.69 in the length of the head. Width of mouth, including the tips of the maxillaries 1.49, height of first dorsal 2.77 in the head. Length of pectoral from anterior to posterior angle 2.59, length of tail to middle of caudal fin 2.51 in the total length; width of tail at its base 3.63 in its length.

The skinny fold on each side of the head forms a very short, indistinct lobe anteriorly, which terminates in front of the angle of the mouth; remaining portion of nearly equal width throughout. Inner nasal lobes very large and divided into two portions;

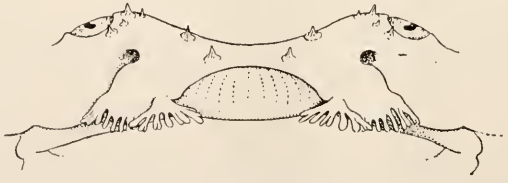

Fig. 2—Front view of head of *Squatina tergocellata*.

the innermost part forms a ramose flap on a short stalk, and the other portion is broader with a ramose border. Outer nasal

lobes hidden beneath the others, their margins fringed. Interocular space concave, its width a little greater than that between the inner angles of the spiracles. Snout and supraorbital regions armed with stout, spiniform tubercles; a series of three runs from the snout to the antero-superior angle of the orbit, and one or two smaller ones are grouped around the base of the last; another one is in front of the eye, and three more are placed between the postero-superior margin of the orbit and the spiracle. Teeth strong, in two rows anteriorly and in three on the sides of each jaw. Tongue triangular, pointed in front.

Back covered with minute tricarinate denticles, of which the median ones are somewhat enlarged, and form a series which extends backward nearly to the first dorsal. They are present on the proximal portions of the pectorals and ventrals, but the remaining parts of the upper surface of these fins is naked; their anterior edges are covered with microscopic, imbricate denticles which extend onto their lower surfaces, and form, on the pectoral, an inferior band which is about half as wide as the interocular space. Head granular above and in front of the eyes, and on its sides. Tail uniformly covered with minute denticles above. Lower surface of head and body naked, that of the tail closely covered with imbricate denticles which do not extend forward to its base.

Outer angle of pectoral much greater than a right angle, the posterior rounded; the distance between the anterior extremity and the posterior angle of the base is rather more than half the total length of the fin. Ventrals reaching a little beyond the origin of the first dorsal. Base of the first dorsal a little more than half its height, which is greater than the interspace between the two fins. Second dorsal a little lower than, but otherwise similar to the first. Posterior margin of the caudal deeply notched; the upper lobe is truncate behind, becoming oblique before its junction with the lower lobe, which is obliquely truncate.

Colour.—Light yellowish-brown, closely covered with small, round, blue spots. Upper surface with eight dark-edged, and dark-spotted ocelli, of which four are in a row across the back behind the head, the two outer ones being the larger and placed on the pectoral fins; the four others are in a line with the front of the ventrals, the two inner ones the larger, and the others on the hinder portions of the pectoral and not so marked as the first. Several other paired brown rings are placed at intervals along the back. Described from a single female specimen, 420 mm. long from the snout to the middle of the caudal.

This species appears to be closely allied to *S. africanus*, Regan[1], but has much more complex nasal lobes, longer pectorals, and a different colour pattern. There is also a

1 Regan—Ann. Natal Govt. Mus., i., pt. 3, 1908, p. 248.

slightly enlarged median series of dorsal tubercles, which, however, may be lost with age. It differs from the only species recorded from Australia, *S. australis*, Regan [1], in having the dorsal denticles tricarinate, and the greater part of the pectorals and ventrals naked; the tubercles on the snout are much larger and differently arranged, the interspace between the spiracles is less than the interocular width, and the colour marking is altogether different.

Loc.—Great Australian Bight, Long. 127-128° E., 160-200 fathoms; June, 1913.

Family AETOBATIDÆ.

Genus Aetobatus, *Blainville.*

Aetobatus australis, *Macleay.*

(Fig. 3.)

Aetobatus australis (Macleay), McCulloch, Zool. Results "Endeavour," i., pt. 1, 1911, p. 15—synonymy.

Through the kindness of Mr. E. R. Waite, I have been able to compare a New Zealand example of *Aetobatus tenuicaudatus*, Hector [2], with others of *A. australis* from New South Wales. In general form, colour markings, and all other external characters they are identical, but the teeth apparently afford

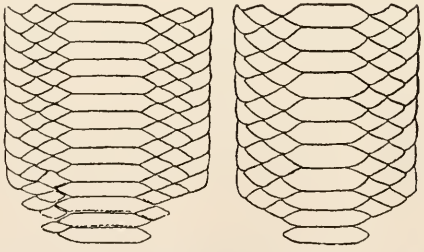

Fig. 3—Teeth of *Aetobatus tenuicaudatus* (left) and *A. australis* (right.)

specific characters. Those of the New Zealand species are narrower in a longitudinal direction, and more numerous than in *A. australis*; the differences are illustrated in the accompanying figures.

1 Regan—Ann. Mag. Nat. Hist. (7), xviii., 1906, p. 438.
2 Hector—Trans. N. Zeal. Inst., ix., 1877, p. 468, pl. x. *Id*, Waite, Rec. Cantb. Mus., i., pt. 2, 1909, p. 152, pl. xxiii.

Family ARGENTINIDÆ.

Genus Argentina, *Linnæus.*

Argentina elongata, *Hutton.*

Argentina elongata (Hutton), McCulloch, Zool. Results "Endeavour," i., pt. 1., 1911, p. 18.

A single specimen from eighty miles west of the meridian of Eucla, Southern Australia, is of interest as showing that this species occurs in Western Australian waters. It was trawled in 80-120 fathoms.

Family STERNOPTYCHIDÆ.

Genus Polyipnus, *Günther*

Polyipnus tridentifer, *sp. nov.*

(Plate xvi.; Fig. 4.)

D. 13-14; A. 17-18; P. 13; V. 7; C. 19. Height of body 1.60-1.67 in the length to the hypural; head, from tip of upper jaw to operculum, 3.2-3.26 in the same. Eye 5.52-5.88, pectoral fin 3.54-3.67, highest dorsal ray 3.54-3.67 and highest anal ray 4.92-5.25 in the length. Depth of caudal peduncle 1.78-1.80, and longest gill-raker 1.78 in the eye.

General form similar to that of *P. nuttingi*, Gilbert, though a little more elongate posteriorly. The crests defining the inter-orbital space are finely denticulated, and form, near their hinder ends, a more or less distinct process with spines pointing forwards and backwards. The post-temporals end in three very large spines on each side, of which the upper is the longest, and the lower one is bent downwards; the middle one is a little smaller than the others. The preopercular angle is armed with a strong spine, near which the margins of both limbs are a little serrated. Cleft of mouth vertical. Both the maxillary and mandible are very broad. The inferior mandibular margin is a little serrated, and the lower angle is formed by a broad spine. Anterior margin of the maxillary sloping forward when the mouth is closed, and forming a sharp angle with the inferior one which may be a little hooked; inferior margin granular. A broad supplemental bone is present with a smaller scale-like lamella overlying its upper portion. Premaxillaries granular exteriorly, with a series of depressible teeth which are in two rows anteriorly. Mandibular teeth similar. Vomer with several irregular, longitudinal rows of small depressible teeth, and there may be one or two small ones on the anterior end of the palatines.

Gill-membranes united, free from the isthmus, with nine branchiostegals, of which the anterior are very slender and the hinder ones broad. The gill-rakers are slender, and there are about twelve on the lower limb of the first arch.

Dorsal fin preceded by a rather large, raised bone, which forms several spines and keels; it is placed midway between the snout and the hypural or somewhat nearer the latter. The dorsal rays are bifurcate, and the fourth or fifth is the longest. Adipose dorsal of moderate size. The anal commences below or behind the middle of the dorsal; the fourth or fifth ray is the longest, and the following ones are bifurcate. Pectorals narrow and elongate, reaching nearly to the verticle of the base of the ventrals; the third or fourth upper rays are the longest, and most of them are bifurcate. Ventrals inserted below the anterior dorsal rays; all its rays are divided, and the first is broader than the others. Caudal forked.

Below and in front of the pectoral there is a large fan-like expansion of the coracoid bone, which is coarsely striated, the striæ ending in small teeth on the margin. The clavicles form a small, double spine at their symphysis on the ventral edge. Very few scales are left upon the body, only a few of the stronger ones covering the photophores remaining. Those along the ventral edge bear some coarse striæ, and their lower margins are denticulated. Those above the anal are smooth, but the four on the caudal peduncle are rough like the ventral ones.

The arrangement of the photophores is as usual in the genus. By far the largest is the one occupying the greater portion of the cheek. There is a small one on the upper part of the operculum behind the eye. Six are in the gill-membrane on each side anteriorly, and one underneath the lower part of the operculum. There are six on the chest in front of the pectoral, and ten before the ventral. Five are on the side between the pectoral and the ventral, and two much higher up. Five in front of the anal, and fifteen to seventeen above it in an unbroken row; four more are separated from these by a short space on the caudal peduncle.

Colour.—Back blackish brown, with minute darker specks; a small triangular patch descends onto the sides anteriorly. A small iridescent, blackish spot before the eye, and the upper portion of the operculum is black. Eye brownish black, the pupil surrounded by a golden ring which spreads out into a broad patch below, and is sharply defined from the rest of the eye. The fleshy area enclosed by the post-temporal is blackish above and silver below, the junction of the two forming a very sinuous curve. All the photophores strongly outlined with deep black.

Described from three specimens, 87-89 mm. long from the snout to the end of the tail. The collection includes an excellent series of ninety seven specimens, 42-93 mm. long, which exhibit considerable variation in the form of the post-temporal spines.

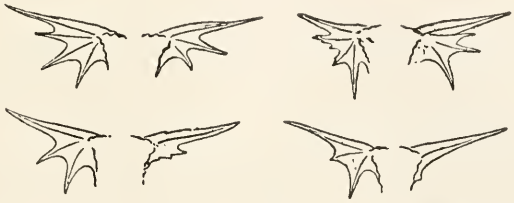

Fig. 4—*Polyipnus tridentifer.* Variation of post-temporal spines.

Normally there are three spines as described above, but they are often either deformed or not developed, and may be quite different on each side of the same individual as in the accompanying figures. The variations are not connected with the age of the specimens, the spines being equally developed in young and old specimens.

Young specimens are a little deeper than the larger ones, the depth being 1.54 as against 1.75 in the length; the latter measurement is taken from the most elongate specimen of the series. There appears to be but very little variation in the arrangement of the photophores, though those above the anal are a little more uneven in some than in others. In all the remaining characters the specimens are very similar to one another.

This species is very near to *P. spinosus*, Günther[1] but has more dorsal and anal rays and a greater number of anal photophores. It is also more elongate, and the post-temporal spines, though variable, are much more developed than in that species. The same differences distinguish it from *P. stereope*, Jordan & Starks [2], which also has a smaller eye. It resembles *P. nuttingi*, Gilbert[3] in general form, but has more anal photophores and a different colour-pattern; in that species also the post-temporal spines are but little developed. *P. laternatus*, Garman [4], the only other species, is not a true *Polyipnus* according to Gilbert [5].

Loc.—Great Australian Bight, Long. 129°28′E., 350-450 fathoms; May 14, 1913.

1 Günther—"Challenger" Rept., Zool., xxii., 1887, p. 170, pl. li., fig. b.
2 Jordan & Starks—Bull. U.S. Fish. Comm., 1902 (1904), p. 581, pl. ii., fig. 3.
3 Gilbert—Bull. U.S. Fish. Comm., 1903 (1905), p. 609, pl. lxxiii.
4 Garman—Mem. Mus. Comp. Zool., xxiv., 1899, p. 238.
5 Gilbert—*Loc. cit.* p. 610.

Family MYCTOPHIDÆ.

Genus Neoscopelus, *Johnson*.

Neoscopelus macrolepidotus, *Johnson*.

(Plate xvii.)

Neoscopelus macrolepidotus, Johnson, Proc. Zool. Soc., 1863, p. 44, pl. vii. *Id.*, Goode & Bean, Oceanic Ichth., 1895, p. 93, pl. xxix., fig. 108-109. *Id.*, Alcock, Cat. Ind. Deep-sea Fish., 1899, p. 164 (references).

Scopelus macrolepidotus, Günther, Brit. Mus. Cat. Fish., v. 1864, p. 414, and "Challenger" Rept., Zool., xxii., 1887, p. 196.

The collection includes two specimens, 200-230 mm. long, which do not quite agree with any of the published figures of this species. In Johnson's plate, the ventrals are shown as inserted below the fourth dorsal ray, whereas in my specimens they commence vertically beneath the origin of the dorsal. The relative positions of the adipose dorsal and the anal are better shown in Goode & Bean's figure, the former being placed well before the end of the latter; but it is not so far forward as in Jordan and Starks' figure of the closely allied *N. alcocki*. In all other details my specimens appear to be identical with *N. macrolepidotus*.

Colour.—When first received their general colour was deep pink, the scales having silvery reflections, and the ventral surface on which the photophores are placed was violet black. Eyes and photophores silvery gold, and the exposed bones of the head burnished silver. Fins pink like the body.

Loc.—Great Australian Bight, Long. 129° 28′E., 350-450 fathoms; 14th May, 1913.

Family MACRORHAMPHOSIDÆ.

Genus Centriscops, *Gill*.

Centriscops humerosus, *Richardson*.

Centriscus humerosus, Richardson, Voy. "Erebus & Terror," Fish., 1846, p. 56, pl. xxxiv., fig. 5-6. *Id.*, Günther, Brit. Mus. Cat. Fish., iii., 1861, p. 522.

Centriscops humerosus, Gill, Proc. Acad. Nat. Sci. Philad., 1862, p. 234, footnote.

Centriscops humerosus, var *obliquus*, Waite, Rec. Cantb. Mus., i., pt. 3, 1911, p. 170, pl. xxvi.

Centriscops obliquus, Waite, Rec. Cantb. Mus., i., pt. 4, 1912, p. 318.

Centriscus (Limiculina) humerosus, Fowler, Proc. Acad. Nat. Sci. Philad., 1907 (1908), p. 426.
(Not *Centriscops humerosus*, McCulloch, Zool. Results "Endeavour," i., pt. 1, 1911, p. 24, fig. 9, and pl. v. *Id.*, Waite, Rec. Cantb. Mus., i., pt. 3, 1911, p. 169, = *Notopogon lilliei*, Regan.)

The collection includes thirty-three specimens, 152-245 mm. long from the end of the snout to the tips of the middle caudal rays. The smallest agree perfectly with Richardson's figure, while the largest are well represented by Waite's plate of *C. obliquus*. The form of the body is very variable, but the dorsal hump is always much more pronounced in old than in young specimens. The ventral profile may form either a very deep curve or only a shallow one, and the slope from the vent to the caudal peduncle, together with that from the dorsal spine, is much more abrupt in some than in others. The dorsal spine is always much shorter in adults, and the snout is a little variable in length. The eye increases in size with age, and becomes surrounded with more or less numerous spinules.

All the specimens had the oblique bands shown in Waite's figure, but they have become indistinct or have been lost during preservation. When first received, some retained patches of a deep rose-pink colour and the oblique bars were yellowish; the pink was broken up into an angular network on the head and in front of the pectorals.

The principal difference between *C. obliquus* and *C. humerosus* lies in the presence or absence of the oblique colour-bands, but I regard this as entirely due to the state of preservation of the two type specimens. All the differences in form between them are fully accounted for by the changes which this species undergoes with growth.

Locs.—Great Australian Bight, Long 129°28′ E., 350-450 fathoms; 14th May, 1913.

Great Australian Bight, Long. 126°45¼′ E., 130-320 fathoms.

Genus NOTOPOGON, *Regan*.

NOTOPOGON LILLIEI, *Regan*.

Notopogon lilliei, Regan, Ann. Mag. Nat. Hist. (8), xiii., 1914, pp. 14, 20.

Centriscops humerosus, McCulloch, Zool. Results "Endeavour," i., pt. 1, 1911, p. 24, fig. 9, and pl. v. *Id.*, Waite, Rec. Cantb. Mus., i., pt. 3, 1911, p. 169 (not of Richardson).

D. vi-vii. 15-16; A. 17-19; P. 16-17; V.I. 4; C. 9. Head 1.93-2.27 in the length to the hypural; height, in front of the ventrals, 2.46-2.11 in the same. Eye 3.75-6.11 in the head, and 2.12-4 in the snout, which is 1.76-1.50 in the head. Second dorsal spine 1.42-3.58, caudal fin 2.72-2 88 in the head. Interorbital space 1.6-1.3 in the eye.

All the exposed bones of the head are finely striated, and the skin is covered with extremely minute longitudinal scales. The snout is directed slightly upwards. A striated bony ridge passes along the snout to the upper orbital margin, where it spreads out into a fan-shaped bone; it is followed by a series of small, roughened bones, which extend over the upper border of the preoperculum, and which are broader and less distinct than in *Centriscops humerosus*. A second ridge passes below the nostrils to the front edge of the eye, and forms the lower orbital border. The nostrils are placed close together in a smooth area, a little in advance of the eye.

The profile of the back arises in front of the eye, and ascends rapidly to a point above the operculum, where, in young specimens, it forms a slight angle, and then runs almost straight to the dorsal spine. In adults, this point is marked by a crest of stout bristles, behind which the profile rises still higher before turning towards the spine. The back is never greatly humped as in *C. humerosus*. The ventral profile forms a more or less even curve between the snout and the caudal peduncle. In front of the ventrals its edge is very sharp, and is formed of five bony scutes which are almost hidden in the skin in all but the smallest specimens; the posterior scute ends in a spine or several spinules. A ridge is present on either side of the median line, which extends backwards to the end of the ventral fin; its posterior scutes are armed with spines. Two or three more scutes are on the median line between the tips of the ventrals and the vent.

The scales covering the body are exceedingly fine and velvety, though they are proportionately larger in the young than in the adults; they cannot be distinguished from one another as in *C. humerosus*. There are two series of bony plates on the sides of the back above the pectoral fin, the upper consisting of four plates and the lower of three; these are smaller, and more oblique than in Richardson's species, and there is no sign of any smaller ones on either side of the profile of the back.

First dorsal spine minute. The second is very long in the young, and short and stout in adults ; it is coarsely striated, and is armed with more or less numerous spines on its hinder edges. The following spines are largely hidden in the skin, only their tips projecting ; they are striated, and decrease in size backwards. Third or fourth dorsal rays longest, and either a little, or much longer than the base of the soft portion of the fin ; all the rays are simple except the last which may be so deeply divided as to count as two. The base of the anal is longer than that of the dorsal, and it commences much, and terminates a little in advance of that fin. The third or fourth rays are the longest, and equal to one-half or three-quarters of the length of the base. Caudal rays simple, the upper ones often a little longer than the others. Pectoral rays simple, the third the longest, once and a half to more than twice as long as the eye. Ventrals small, one half to three-quarters as long as the eye ; the spine is rather small, and the four rays are branched.

Colour.—Uniform sandy-yellow in formalin. Some notes on the colours of fresh specimens are given in my previous paper quoted above.

Described from two specimens 70 and 270 mm. long. The young differ from the adults in having the body less elevated, and the snout shorter. The second dorsal spine is very much longer, the eye larger, and the crest of bristles on the back is not developed. Both forms are figured in my first "Endeavour Report."

N. lilliei differs from *C. humerosus* in lacking the prominent hump on the back, and in having a more slender snout. The scales are minute and velvety instead of larger and rough, and the enlarged scutes are not so numerous, less prominent, and differently arranged. *C. humerosus* also lacks the tuft of bristles on the back, and its colour marking is quite different to this species.

Mr. Waite has very kindly compared specimens of *C. cristatus* which I forwarded to him, with those he described as *C. humerosus*, and he informs me that they undoubtedly all belong to the same species. He has also enabled me to examine one of his "Nora Niven" examples which does not differ from those described above.

Locs.—The largest of the specimens described was trawled sixty miles south of Cape Everard, Victoria, in 60-70 fathoms. The other was obtained off Storm Bay, Tasmania.

Family SYNGNATHIDÆ.

Genus Hippocampus, *Rafinesque.*

Hippocampus abdominalis, *Lesson.*

Hippocampus abdominalis (Lesson), McCulloch, Zool. Results "Endeavour," i., pt. i., 1911, p. 29, pl. vi., fig. 1.

Hippocampus graciliformis, McCulloch, *Loc. cit.*, fig. 2.

Two specimens, 110-120 mm. long, though more like *H. abdominalis* form than that of *H. graciliformis*, nevertheless leave no doubt that the latter is but the young of the former. The form of the coronet and cephalic spines is intermediate between the two as is the development of the tubercles, and to a lesser degree, the breadth of the abdomen. The length of the snout is different in both specimens. They are pure white in formalin with chocolate-brown spots and crossbars, which vary greatly in their arrangement; the dorsal fin has a rather broad dark edge.

Loc.—Investigator Strait, South Australia, 12-20 fathoms; February, 1912.

Family STROMATEIDÆ.

Genus Hyperoglyphe, *Günther.*

Hyperoglyphe, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 337 (*Diagramma porosa*, Richardson).

Eurumetopos, Morton, Proc. Roy. Soc. Tasm., 1887 (1888), p. 77. *Id.*, Waite, Trans. N. Zeal. Inst, xliv., 1912, p. 202 (*E. johnstonii*, Morton).

Regan[1] regarded *Hyperoglyphe* as a synonym of *Leirus*, Lowe, but it seems to be separable from that genus by the constant form of its first dorsal fin, of which the spines are very strong, and the median ones are higher than those following them.

In his definition of *Hyperoglyphe*, Günther has described the teeth as arranged in villiform bands on the jaws, but they really form single rows as noted by Richardson in the original description of *H. porosa.*

Eurumetopos, Morton, is evidently the adult form of *Hyperoglyphe.* I have compared my examples of *E. johnstonii* with Richardson's description and figure of *H. porosa*, and find no important differences between them. Though all are of large

1 Regan—Ann. Mag. Nat. Hist. (7), x., 1902, p. 195.

size, 527-1072 mm. long, my specimens prove that the body becomes more elongate with age, the depth being 2.81-3.42 respectively in the length from the snout to the hypural. In the type of *H. porosa*, which is only $5\frac{1}{2}$ inches long, the depth is $2\frac{1}{2}$ in the same length. The latter also has the margins of the preorbital and several opercular bones serrated, while they are nearly smooth in *Eurumetopos*, though there are distinct indications of serrations in the smallest of my specimens.

As *Eurumetopos*, the genus has been defined by Waite *(loc. cit.)*, to whom I am indebted for drawing my attention to its probable identity with *Hyperoglyphe*.

Hyperoglyphe johnstonii, *Morton*.

(Plate xviii.)

Eurumetopos johnstonii, Morton, Proc. Roy. Soc. Tasm., 1887 (1888), p. 77, with plate. *Id.*, Waite, Trans. N. Zeal. Inst., xliv., 1912, p. 200, pl. xii.

The type of this species was found on the beach at Bridgewater, Tasmania It was brought to Sydney by Mr. A. Morton, and while here, a photograph was taken of it which is the original of the very imperfect plate illustrating his paper. An excellent print of it, and a second stuffed specimen 635 mm. long, which was received from him is in the Australian Museum collection.

Four specimens, 527-1072 mm. long, taken by the "Endeavour" agree perfectly with both the photograph and the skin, but show considerable variation in the depth of the body as noted above. The largest specimen has a rather more tumid snout than the others, and the pectoral fins may be either about three-fourths the length of the head or a little longer than it; the first anal spine is extremely small, and more or less hidden in the skin.

Waite has recently described and figured a large example, 954 mm. long, from the Chatham Islands, New Zealand. He also had another smaller one, 537 mm. long, from the market in Christchurch, of which a cast is in the Australian Museum. His figure agrees better with my smaller specimens than the larger ones, though in none of mine is the curve of the back so pronounced as he shows it. I therefore publish a photograph of a specimen in the flesh, 900 mm. in length.

H. johnstonii is possibly the adult form of *H. porosa*, Richardson[1] which is known only from the type specimen, $5\frac{1}{2}$ inches long, and some very small ones 25-30 mm. long which

1 Richardson—Zool. "Erebus & Terror," Fishes, 1845, p. 26, pl. xvi., fig, 5-6

were obtained by the "Challenger"[1]. The "Endeavour" specimens differ from Richardson's description and figure chiefly in having the preorbital and various opercular bones almost entire instead of serrated, the dorsal originating behind instead of above the base of the pectoral, and the pectoral much more elongate.

Loc.—The specimens examined were taken in the trawl with several others of similar size in the Great Australian Bight, Lat. 33°18′S, Long. 126°42′E., in 130-170 fathoms. Their eating quality proved very good, the flesh being white and flaky. They were forwarded to Sydney in ice, and the largest weighed 41 lbs. after being thawed out.

Family BERYCIDÆ.

Genus Beryx, *Cuvier*.

Beryx decadactylus, *Cuvier & Valenciennes*.

Beryx decadactylus, Cuvier & Valenciennes, Hist. Nat. Poiss., iii., 1829, p. 222. *Id.* Günther, "Challenger" Rept., Zool., xxii., 1887, p. 33, pl. vi. (skeleton.)

Beryx splendens, Lowe, Cambr. Phil. Trans., vi., 1839, pl. iii. (not description).

Three large examples, 460-500 mm. long, agree with Lowe's excellent figure of this species, and with the proportions and such external parts as are shown in Günther's plate. When first received in ice, the entire body and fins were of a uniform carmine pink, each scale and the opercular bones being shot with a beautiful silvery blue iridescence.

Loc.—Eastern slope of Bass Strait, between Gabo and Flinders Island, outside the 100 fathom line.

Family TRACHICHTHYIDÆ.

Genus Hoplostethus, *Cuvier & Valenciennes*.

Hoplostethus, Cuvier & Valenciennes, Hist. Nat. Poiss., iv., 1829, p, 469 *(H. mediterraneus*, Cuv. & Val.)

The identification of the several species of this genus offers many difficulties, partly owing to the fact that they have nearly all been described from young specimens, and again because their scanty representation in collections has prevented any systematic

1 Günther—"Challenger" Rept., Zool., xxxi., 1889, p. 11, pl. ii., fig. F (head).

study of their variation. Some of the differences indicated in the following key may therefore prove to be invalid.

a. Body elongate, height about 3 in length; 4 dorsal spines.....*elongatus* [1].

aa. Body deeper, height 2-2½ in length; 5-7 dorsal spines.

b. 17 dorsal rays.....*atlanticus*.

bb. 13-15 dorsal rays.

c. Superficial bones of head delicate and narrow.

d. 5 dorsal spines; 15-19 abdominal scutes.....*pacificus*.

dd. 6 dorsal spines; 9-13 abdominal scutes.....*mediterraneus & intermedius*.

cc. Superficial bones of head coarse and broad....*gigas*.

HOPLOSTETHUS MEDITERRANEUS, *Cuvier & Valenciennes*,

var. latus, *var. nov.*

(Fig 5.)

Hoplostethus mediterraneus, Cuvier & Valenciennes, Hist. Nat. Poiss., iv., 1829, p. 469, pl. xcvii. *Id.*, Goode & Bean, Oceanic Ichthyol., 1895, p. 189, fig. 208. *Id.*, Alcock, Cat. Indian Deep-sea Fish., 1899, p. 34, and Illustr. Zool. Investig., Fishes, 1895, pl. xiv., fig. 3.

D.vi./13; A.iii./9; V.i./6; P.12-14; C.v-vi/21/v-vi. L.Lat. c.28. Abdominal scutes 11-12. Height of body at origin of dorsal 1.90-2.05 in the length from the snout to the hypural. Length of head, to end of bony operculum, 2.65-2.85 in the same. Orbit 2.33-2.63 in the head, and wider than the interorbital space which is 2,85-3.05 in the same. Sixth dorsal spine 1.87-2.05, longest ray 1.45-1.61, and third anal spine 2.41-2.26 in the head. Base of anal fin 1.94-1.90 in that of the dorsal.

The above are the proportions of three specimens, 100-126 mm. long, which are evidently very similar to *H. mediterraneus*, as originally described and figured by Cuvier and Valenciennes. They differ however in being deeper and rounder, and in having only nine instead of ten anal rays. According to Goode and Bean, the number of rays in the dorsal and anal fins is subject to considerable variation (D.12-15; A.8-9), but in forty-five specimens, representing three species, I find them to vary very little. In the

1 *Trachichthys elongatus*, Günther ("Challenger" Rept., Zool., xxii., 1887, p. 22) agrees in all its important structural details with *Hoplostethus*. Ogilby has placed it in *Paratrachichthys*, Waite (Ogilby, Mem. Qld. Mus., i., 1912, p. 43) but it has no affinity with that genus.

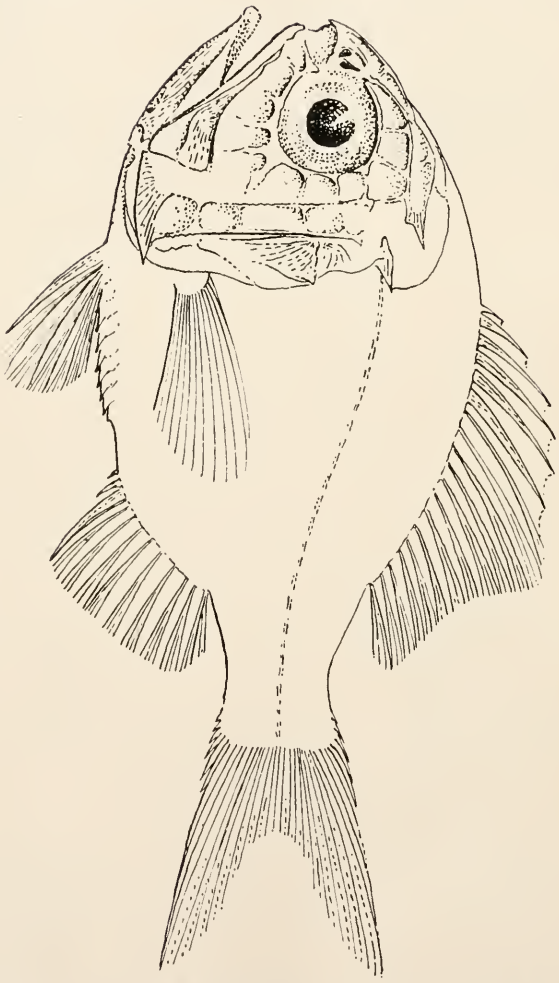

Fig. 5. *Hoplostethus mediterraneus* var. *latus*, McCulloch.

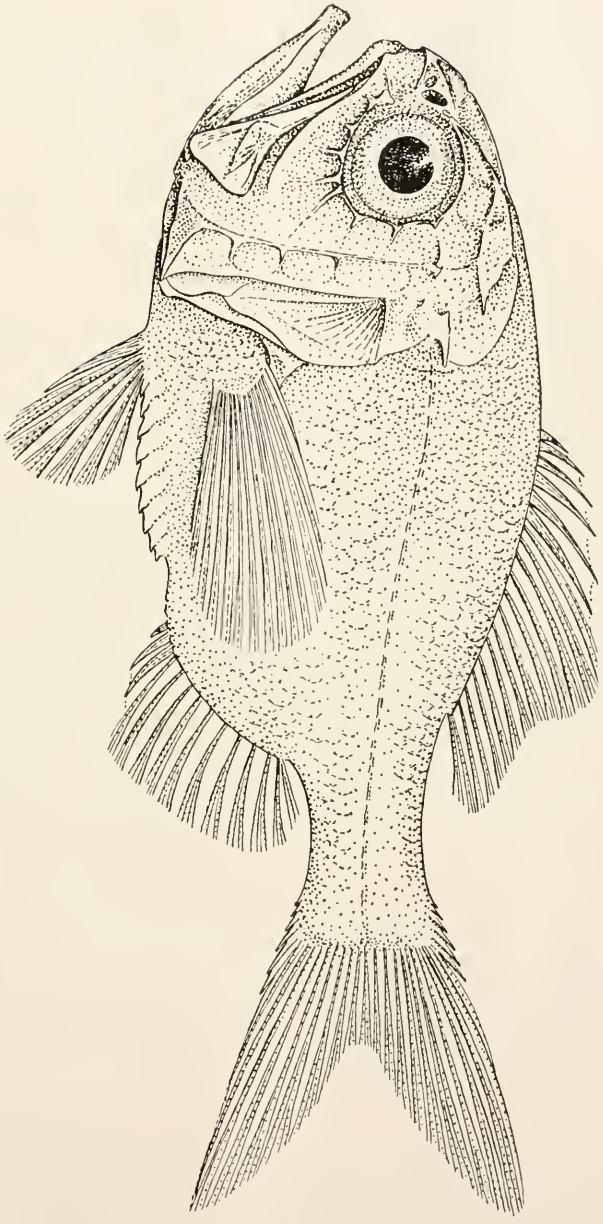

Fig. 6. *Hoplostethus intermedius*, Hector.

several figures of *H. mediterraneus*, also, the proportions of the body are shown to differ considerably, which suggests that more than one species is confused under that name. I have therefore figured a Southern Australian example, 129 mm. long, which may be regarded as a variety of the European form until representative specimens of the two can be compared.

Locs.—Nine specimens are in the collection from the following localities.—

Great Australian Bight, Long. 126°45′E., 190-320 fathoms; 4th April, 1913.

Great Australian Bight, Long. 126-127°E., Lat. 33°20′S., 80-100 fathoms; March, 1912.

HOPLOSTETHUS INTERMEDIUS, *Hector*.

(Fig. 6.)

Trachichthys intermedius Hector, Trans. N. Zeal. Inst., vii., 1875, p. 245, pl. xi. *Id.*, Günther, "Challenger" Rept., Zool., xxii., 1887, p. 24, pl. v., fig. D. *Id.*, McCulloch, Rec. Austr. Mus., vi., 1907, p. 349.

D.vi./13; A.iii./10; V.i./6; P. 15-16; C.vi./21/v-vi. L. Lat. 28-29. Abdominal scutes 9-13. Depth of body at origin of dorsal 2.11-2.27 in the length from the snout to the hypural; head, to the opercular spine, 2.64-2.8 in the same. Eye 2.61-3.11, orbit 2.5-2.57 in the head. Interorbital space 1-1.31, snout 1.61-1.63 in the eye. Breadth of the maxillary 1.5-1.61, and longest gill-raker 1.38-1.75 in the eye. Sixth dorsal spine 2.5-2.66, longest ray 1.71-1.75, and third anal spine 3.11-3.5 in the head. Base of anal fin 1.67-1.77 in that of the dorsal.

The foregoing are the proportions of six specimens, 102-173 mm. long from the snout to the end of the middle caudal rays. There are twenty two others in the collection, all taken together in the one haul, which do not exhibit any variation in their characters. They are easily distinguished by their more elongate form from the others which I have identified as a variety of *H. mediterraneus*; they also have always ten instead of nine anal rays, counting the last double one as one in both cases, and the length of the base of the anal is more than half that of the dorsal.

Mr. C. Tate Regan has very kindly compared one of the "Endeavour" specimens with the example in the British Museum which was described and figured by Günther and he informs me they are referable to the same species. Günther

counted forty scales along the lateral line, but this is obviously an error. As both the type and the "Challenger" specimen are rather small, and the figures of them are wanting in detail, I have prepared a drawing of my largest specimen, which is reproduced in fig. 6.

Loc.—Great Australian Bight, Long. 129°28′E., 350-450 fathoms; 14th May, 1913.

Hoplostethus gigas, *sp. nov.*

(Plate xix.)

Br. 8; D. v-vii./13-14; A. iii./9-10; V. i./6; P. 15; C. vi./21/vi.; L. Lat. 28-30. Head 2.89-3.03, depth, 2.16-2.26 in the length to the hypural. Eye 3.43-3.88, bony orbit 3.12-3.58, interorbital space 2.94-3.23 and snout 3.88-3.97 in the head. Last dorsal spine 2.55-3.12, longest ray 2.09-2.37, and third anal spine 3.14-3.58 in the head. Snout 1-1.14, breadth of maxillary 1.2-1.31, longest gill-raker 1.33-1.55 in the eye.

Body compressed, covered with moderately large scales, which are a little less than half as wide as the enlarged ones on the lateral line. They are very rough and have a broad striated border; their margins are more or less distinctly ctenoid. The dorsal profile between the head and the first dorsal spine is raised into an obtuse keel formed of slightly enlarged, and very rough scutes. Eight to nine very large abdominal scutes, which are coarsely striated and end in large spines.

Head rough, exposed surfaces of the bones finely granular; the spaces between them are covered with thin, transparent membrane. Operculum with coarsely granular radiating striæ, and without distinct spines. Præoperculum with a double border, the angle with a spine in the smallest specimen, which is lacking in the others. Eye very large, in the upper half of the head. Interorbital space convex. Mouth oblique, maxillary reaching to a little behind the posterior margin of the eye; its upper half is formed of an oblong, roughened, supplemental bone. Nostrils directly before the upper part of the eye; the anterior is about half as large as the posterior. Lower jaw projecting, with two bony tubercles at the symphysis. Suprascapular exposed, its upper margin curved and denticulated, and there is a strong spine overhanging the origin of the lateral line; below this there is a second more or less distinct spine.

Teeth villiform, in bands along the whole length of the premaxillaries and mandible. A broad band, of moderate length, on each palatine; none on the vomer. At the junction of the basibranchial bones and each gill arch there is a large patch of

strong villiform teeth, the patches increasing in size backwards; the gill arches are also provided with teeth anteriorly. Large patches of similar teeth occur in the back of the throat. Gill-rakers long and flattened, denticulated along their inner edges; there are thirteen along the lower limb of each arch. Gill-membranes free from the isthmus.

Dorsal spines increasing regularly in length to the last, which is much shorter than the anterior rays; all are rough with coarse striæ. The soft dorsal is more than twice as long as the spinous portion, and its rays decrease evenly backwards. The anal is similar in form to the dorsal, but it is considerably shorter than the soft portion of that fin. Pectorals rather long and narrow, $1\frac{1}{2}$-$1\frac{2}{3}$ in the length of the head, and not quite reaching the verticle of the vent; its margin is more or less rounded. The ventrals reach from half to two thirds of their distance from the vent; the spine is broad and striated. Caudal forked, with six striated spines on either side which are quite distinct from the rays.

Colour.—Yellowish white in formalin; when first received all the fins had traces of deep rose pink.

Described from eleven specimens, 350-525 mm. long. They were trawled in the Great Australian Bight. They possibly represent the adult form of the smaller ones which I have identified as a variety of *H. mediterraneus*, but differ so greatly from them that, in the absence of intermediate examples, they are best regarded as distinct.

Loc.—Great Australian Bight, Lat. 33°18′S., Long. 126°42′E., in 130-170 fathoms.

Family SERRANIDÆ.

Genus Diploprion, *Cuvier & Valenciennes.*

Diploprion bifasciatum, *Cuvier & Valenciennes.*

Diploprion bifasciatum (Kuhl & Van Hasselt), Cuvier & Valenciennes, Hist. Nat. Poiss., ii., 1828, p. 137, pl. xxi. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, ii., 1878, p. 346. *Id.*, Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx.i., 1879, p. 340. *Id.*, Jordan & Richardson, Proc. U.S. Nat. Mus., xxxvii., 1910, p. 427, fig. 2 (references).

Two specimens, 200-215 mm. long, from Western Australia, between Cape Naturaliste and Geraldton, do not differ from others in the Australian Museum from Cape York, Queensland, and China. Macleay and Klunzinger have recorded the species from Port Darwin.

Family CHEILODIPTERIDÆ.

Genus Amia, *Gronow.*

Amia conspersa, *Klunzinger.*

Apogon conspersus, Klunzinger, Arch. Nat., xxxviii.i., 1872, p. 18, and Sitzb. Akad. Wiss. Wien, lxxx.i., 1879, p. 344, pl. iii., fig. 2. *Id.*, Steindachner, Sitzb. Akad. Wiss. Wien, lxxxviii.i., 1883 (1884), p. 1066, pl. i., fig. 1, 1a. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 8.

Vincentia waterhousii, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 245, and ii., 1873, p. 60. *Id.*, Macleay, Proc. Linn. Soc. N S. Wales, v., 1881, p. 350.

Though the seventeen specimens examined differ somewhat from Castelnau's description of *Vincentia waterhousii*, I think it probable that that species is identical with *A. conspersa* as stated by Steindachner.

Steindachner also regarded *Apogon opercularis*, Macleay, as synonymous with Klunzinger's species, but I have examined the types of the former and find that they differ in having much smaller mouths, and somewhat shorter and much broader maxillary bones ; the direction of the dark band passing from the eye to the preoperculum is also constantly different.

Loc.—Investigator Strait, South Australia, 12-20 fathoms; February, 1912.

Family ERYTHRICHTHYIDÆ.

Genus Plagiogeneion, *Forbes.*

Plagiogeneion, Forbes, Trans. N. Zeal. Inst., xxii., 1890, p. 273 (*Therapon rubiginosus*, Hutton).

This genus is closely allied to *Erythrichthys*, Temminck & Schlegel, and *Emmelichthys*, Richardson, but differs in the form of its dorsal fin, and in having twelve spines. It is very similar to *Erythrichthys* but the dorsal is not so deeply notched, and the penultimate spine is as long as the last instead of being shorter than it ; the teeth of both, if present, are microscopic, and are apparently variable, though they are probably more distinct and more persistent in *Plagiogeneion*. *Emmelichthys* has the posterior dorsal spines isolated, and the body more slender than in the other two genera ; it also appears to be always without teeth in the jaws or palate. The three may be readily distinguished as follows :—

a. Posterior dorsal spines isolated, thirteen in number. *Emmelichthys*.

aa. Posterior dorsal spines connected by membrane.

b. Eleven dorsal spines, the posterior ones low, and the last longer than the penultimate one .... *Erythrichthys*.

bb. Twelve dorsal spines, the penultimate one as long as the last, and not very low..... ..*Plagiogeneion*.

PLAGIOGENEION RUBIGINOSUS, *Hutton*.

Therapon rubiginosus, Hutton, Trans. N. Zeal. Inst., viii., 1876, p. 209.

Plagiogeneion rubiginosus, Forbes, Trans. N. Zeal. Inst., xxii., 1890, p. 273. *Id.*, Waite, Trans. N. Zeal. Inst., xlv., 1913, p. 218 pl. vii., and Rec. Cantb. Mus., ii., pt. 1, 1913, p. 18.

A single large specimen, 365 mm. long, differs from Waite's description of this species only in a few minor details. The height is 2.98 in the length to the hypural; the ventral spine is inserted below the third dorsal one instead of in advance of the first; and the base of the second dorsal is less than half the length of the spinous portion. I count 71 scales to the hypural, the remainder—about ten—being on the base of the tail.

Loc.—Eastern slope of Bass Strait, between Gabo and Flinders Islands, outside one hundred fathom line.

PLAGIOGENEION MACROLEPIS, *sp. nov.*

(Plate xx.)

D. xii. 11; A. iii. 10; V. i. 5; P. 18-19; C. 17; l. lat. 49-50; l. tr. 8-9/1/18. Head 3.38-3.71 in the length to the hypural; depth 3.16-3.43 in the same. Eye 3-3.33 in the head; interorbital width varying from slightly less, to a little greater than the diameter of the eye, and 3.07-3.35 in the head. Snout 1.41-1.50 in the eye, and 4.25-4.75 in the head. Greatest breadth of the maxillary 2-2.12 in the eye. Caudal peduncle 3.33-3.64, fourth dorsal spine 1.7-1.96, second dorsal ray 2.85-3.07, and second anal ray 2.59-2.83 in the head. Pectoral as long as, or a little longer than the head, and 3-4 in the length of the body.

Body moderately elongate and compressed; it is deepest at the verticle of the ventrals, thence tapering towards the tail. The lower profile is a little more convex than the back. Head obtusely conical; mouth oblique. Maxillary very broad, its posterior margin either truncate or a little rounded; it reaches backward to below the end of the first third of the eye. Lower jaw projecting, chin prominent. Suborbital very narrow.

Hinder preopercular margin either straight or concave, extending obliquely backward and downward, the angle broadly rounded; its margin is entire though striated. Operculum with two flat spines which are almost hidden by the scales. A single row of exceedingly minute teeth in the front of each jaw is usually present, though they cannot always be detected. Palate and tongue toothless. Gill-rakers long and slender, about twenty six on the lower limb of the first arch; the longest are about half as long as the diameter of the eye.

The scales are finely ciliated, and the surface near their hinder margins is roughened; they are smaller above the lateral line than on the sides. They extend forward onto the snout and preorbital bone, and also cover the maxillary and lower jaw, together with all the opercles. Base of the pectoral scaly, and there is a long axillary scale above the base of each ventral. The scales form a triangular shield on the base of each caudal lobe, and the dorsal and anal fins are provided with scaly sheaths which are most developed posteriorly. Lateral line roughly following the line of the back, but nearer to it posteriorly than in front; it extends beyond the hypural onto the bases of the middle caudal rays.

Dorsal fin originating over, in front of, or a little behind the insertion of the ventrals. The spines are moderately strong, and the third or fourth is the longest; the following ones decrease regularly backwards, the last being not longer than the penultimate one. The second dorsal ray is the highest; the base of the soft dorsal is very much less than half that of the spinous portion. Anal originating below the anterior dorsal rays, and terminating level with or behind that fin. The spines are rather stronger than those of the dorsal, and the third is the longest, but is much shorter than the anterior rays. Pectoral falcate. Ventral spine long and slender; the outer ray the longer. Caudal deeply forked.

Colour.—Yellowish in formalin, probably pinkish during life, with longitudinal rows of yellow spots along the series of scales.

Described from three specimens, 192-325 mm. long from the snout to the middle caudal rays. They are the largest, the smallest, and a median sized example of a series of twenty three specimens, the last mentioned being the type, which is figured.

P. macrolepis differs from *P. rubiginosus* in having much larger and less numerous scales; the vomer also appears to be toothless, though microscopic villous teeth are perhaps present in some specimens.

Loc.—Great Australian Bight, west of Eucla, Lat. 33°20′S., Long. 126-127°E., 70-120 fathoms; March, 1912.

Family LETHRINIDÆ.

Genus Pentapus, *Cuvier & Valenciennes.*

Pentapus vitta, *Quoy & Gaimard.*

(Plate xxi.)

Pentapodus vitta, Quoy & Gaimard, Voy "Uranie et Physicienne," Zool., 1824, p. 294, pl. xliv., fig. 4.

Pentapus vitta, Cuvier & Valenciennes, Hist. Nat. Poiss., vi., 1830, p. 264. *Id.*, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 381. *Id.*, Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 12. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 384. *Id.*, Waite. Rec. Austr. Mus., iv., 1902, p. 185.

? *Mænoides auro-frenatus*, Richardson, Icones Piscium, 1843, p. 8, pl. v., fig. 2.

Smaris porosus, Richardson in Stokes, Discov. in Austr., i., 1846, p. 489, pl. iii.

D. x. 9; A. iii. 7; P. 16; V. i. 5; C. 17; L. lat. 47-49. Height of body before the ventrals 3-3.16, length of head 3.3 in the length to the hypural. Eye 4.2-4.4 in the head and narrower than the interorbital width, which is 3.1-3.2 in the same. Snout 2.6-2.7, and breadth of caudal peduncle 2.8-2.9 in the head. Fifth dorsal spine 2.5-2.7, seventh ray 2.3, third anal spine 3.9-4.4, and pectoral 1.45 in the head.

Body compressed. The snout is rather pointed and its upper profile is a little convex. Maxillary not reaching back to the verticle of the eye. Nostrils small, and placed in the hinder half of the snout, the anterior with a small skinny lobe. Preorbital edge entire. Preopercular angle broadly rounded, its hinder border smooth or crenulate. Operculum with a single small spine, the margin rounded. Premaxillaries with a band of villiform teeth which is broad anteriorly and becomes very narrow on the sides; two rather large and one small canine on each side of the symphysis. Mandible with villiform teeth anteriorly and a single row of larger ones on each side; each ramus with a canine in front. Vomer and palatines toothless.

Scales with finely ciliated edges. They are largest between the lateral line and the dorsal fin, and much smaller below it and on the caudal peduncle. They extend forward on the upper surface of the head to between the nostrils, and cover the cheek and all the opercles. The preorbital, snout, and lower jaw are naked and porous. The bases of the dorsal and anal are protected by

low scaly sheaths in which they can be partly hidden. The scales cover the basal portion of the pectoral, and a considerable part of the caudal. Ventral with an enlarged axillary scale.

Third, fourth, and fifth dorsal spines longest, subequal; the following ones decrease a little in length, but the rays increase in height to the seventh. Third anal spine longest, but much shorter than the rays which are highest anteriorly. Ventrals inserted behind the pectorals, the spine rather long and slender and the first ray produced. The fourth upper ray of the pectoral is the longest and the margin of the fin is rounded.

Colour.—A broad dark band extends from the eye to the operculum, and sloping upwards, reaches the lateral line below the soft dorsal and runs along it to the tail. The scales at the base of the dorsal are blackish, and there is a longitudinal series of dark spots between these and the lateral line. A narrow, dark stripe commences below the soft dorsal and runs backwards to the caudal above the broad lateral band; a similar stripe below the band joins the upper one on the tail. A narrow bar crosses the anterior portion of the snout, and there is a trace of another from the postero-superior angle of the eye.

Described from two specimens, 190-194 mm. long. They differ from the descriptions and figure of *P. vitta* in having only 49 scales along the lateral line. Quoy & Gaimard's figure shows about 70, while Cuvier & Valenciennes counted 56, and Günther 60. But Monsieur R. Despax, of the Paris Museum, has very kindly examined the type specimen for me, and finds only 49 scales as in mine. I sent him a specimen similar to that figured on Plate xxi, which he compared with the type, and he informs me it does not differ from it in any important details.

Castelnau noted the close resemblance of *Smaris porosus*, Richardson, and *P. vitta*. Richardson's description and figure agree so well with my specimens that I have no doubt of the identity of the two species.

It is probable that *Mœnoides auro-frenatus*, Richardson, is another synonym of Quoy & Gaimard's species. It was described from a very imperfect drawing which has the general characteristics of a *Pentapus*, and the colour-marking of *P. vitta*, but the scales are shown much too large, and the dark lateral band is pale yellow. The fish from which the drawing was prepared was said to have been taken at Talc Bay, Australia, but I can find no such place, though there is a Talc Head near the entrance to Port Darwin.

Locs.—*P. vitta* is recorded from Shark Bay (Quoy & Gaimard, and Cuvier & Valenciennes); Victoria, Port Essington and Houtman Abrolhos (Günther); Swan River (Castelnau); Man-

durah (Waite); King George Sound (Richardson, as *Smaris porosus*); Talc Bay (Richardson, as *Mœnoides auro-frenatus*). The two specimens described above are from Fremantle and Mandurah, and the "Endeavour" collection includes a specimen from between Geraldton and Cape Naturaliste.

PENTAPUS SETOSUS, *Cuvier & Valenciennes.*

Pentapus setosus, Cuvier & Valenciennes, Hist. Nat. Poiss., vi., 1830, p. 270. *Id.*, Bleeker, Nat. Tydschr. Nederl. Ind., i,i., 1851, p. 175, and Atl. Ichth., viii., 1876-7, p. 101, pl. cccxxiv., fig. 1. *Id.*, Günther, Brit. Mus. Cat. Fish., i., 1859, p. 382. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 385.

Pentapus paradiseus, Günther, Brit. Mus. Cat. Fish., i., 1859., p. 383. *Id.*, Alleyne & Macleay, Proc. Linn. Soc. N.S. Wales, i., 1877, p. 272. *Id.*, Macleay, *Loc. cit.*, p. 385.

Dentex filifer, Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 12. *Id.*, Macleay, *Loc. cit.*, p. 383.

Fifteen specimens, 80-210 mm. long from the snout to the middle caudal rays, agree very well with Bleeker's description and figure of *P. setosus*, and with Günther's description of *P. paradiseus*. They also appear to be identical with *Dentex filifer*, Castelnau, of which the number of dorsal spines has been misprinted as two instead of ten, and altered by Macleay to twelve.

All the "Endeavour" specimens, and all others I have seen, have the caudal filament well developed so that this is not a sexual character as suggested by Günther. The blue markings on the head and body are very dark in examples preserved in formalin instead of being lighter than the ground colour as in many spirit specimens. The young have a broad dark band from the snout which passes through the eye in a straight line to the base of the caudal; on either side of this is a narrow, rather indistinct one separated from it by a yellowish stripe. The dark bands are wanting in the larger specimens.

The presence of a caudal filament, and the different colour marking readily distinguishes this species from *P. vitta*, in which the dark lateral band is always present, and inclines obliquely upwards towards the lateral line.

Through the kindness of Mr. J. D. Ogilby, I am able to add a note on a deformed example of this species which is included in the collection of the Queensland Museum. It agrees in every

detail with the "Endeavour" specimens except that it is very much shorter and deeper than normal specimens; the greatest depth is 2.45 in the length from the snout to the hypural. It was obtained at Murray Island, Torres Strait.

I have compared the specimens of *P. setosus* and *P. paradiseus* recorded by Macleay from Port Jackson and Cape Sidmouth, with those of the "Endeavour" collection, and find no differences between them. If the Port Jackson example be properly localised, it must be regarded as a chance visitor to this harbour since the species is ordinarily confined to Queensland waters on the eastern Australian Coast. Other specimens are in the Australian Museum from Moreton Bay and Dunk Island, Queensland, and I have examined one in the collection of the Western Australian Museum from Port Hedland, North Western Australia.

Locs.—The "Endeavour" specimens were caught on Rock-cod Shoal, eleven miles south-west from Masthead Island of the Capricorn Group, Queensland, and in the Great Sandy Strait, off Point Inskip, 10-12 fathoms, 27th July, 1910.

Family CEPOLIDÆ.

Genus Cepola, *Linnæus.*

Cepola australis, *Ogilby.*

(Plate xxxiv., fig. 1.)

Cepola australis, Ogilby, Proc. Linn. Soc. N.S. Wales, xxiv., 1899, p. 185.

I have compared four specimens of this species with four others of *C. tænia*, Linnæus, and one of *C. aotea*, Waite, and find that they differ as follows.

a. Lower jaw without an anterior supplementary band of teeth..... .....*tænia.*
aa. Lower jaw with an anterior supplementary band of teeth.
b. D. 70-74; A. 65-69..... .....*aotea.*
bb. D. 57-60; A. 48-55..... .....*australis.*

It must be noted that all my four specimens of *C. australis* have an inter-maxillary dark spot, though it is much larger and more conspicuous in some than in others; it was wanting in the type specimen. Some specimens, also, have very much longer bodies than the others, the head being from $7\frac{1}{2}$-$9\frac{1}{2}$ in the length to the hypural.

Locs.—The "Endeavour" collection includes two from the following localities.—

Shoalhaven Bight, New South Wales, 42 fathoms.
Investigator Strait, South Australia.

Family CHÆTODONTIDÆ.

Genus Vinculum, *gen. nov.*

A Chætodon with ten dorsal spines of which the middle ones are the highest. Scales very small, seventy-five or more between the operculum and the hypural. Second anal spine stronger, but not longer than the third.

This genus differs from *Chætodon* in having very much smaller scales and fewer dorsal spines. The small scales also separate it from *Microcanthus*, and *Hemitaurichthys*, Bleeker, while the first-named also has the third anal spine much shorter than the second.

Vinculum sexfasciatum, *Richardson.*

(Plate xxii.)

Chætodon sexfasciatus, Richardson, Ann. Mag. Nat. Hist., x., 1842, p. 26. *Id.*, Günther, Brit. Mus. Cat. Fish., ii, 1860, p. 35. *Id.*, Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 13. *Id.*, Castelnau, Proc. Linn. Soc. N.S. Wales, iii., 1879, p. 350. *Id.*, Klunzinger, Sitzb. Akad. Wiss. Wien., lxxx.i., 1879, p. 360. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 388. *Id.*, Kershaw, Vict. Nat., xxviii., 1911, p. 95.

This species is well described by Richardson. The scales are so small and irregular that I have been unable to satisfactorily count the number between the operculum and the hypural, but there are between seventy-five and ninety.

Locs.—The "Endeavour" specimen is 250 mm. long, and was obtained in Doubtful Island Bay, West Australia in 20-25 fathoms. I have examined two others, one of which is from Albany, West Australia, and the other is one of those recorded from Mordialloc, Port Phillip by Kershaw. The last is the specimen figured.

Family VELIFERIDÆ.

Genus Velifer, *Schlegel.*

Velifer multiradiatus, *Regan.*

(Plate xxiii.)

Velifer multiradiatus, Regan, Proc. Zool. Soc., 1907, p. 633.

D. 43; A. 34; P. 15; V. 9; C. 19; l. lat. 42. Body strongly compressed, broadly ovate, its depth at the origin of the anal 1.67 in the length from the preorbital to the hypural. Head 3.48 in the same. Eye 3 in the head, and about one fourth longer than the snout; it is a little narrower than the interorbital width, which is 2.64 in the head. Depth of caudal pedunele equal to the length of the snout. Pectoral 1.28 in the head.

The dorsal and ventral profiles are about equally arched; the line from the snout to the first dorsal spine is almost straight, that to the ventral fin is slightly concave below the month and convex before the fin. The greatest height is at the base of the third or fourth dorsal ray, and the lowest point is just before the anal. The snout is tumid and fleshy, and is pitted with minute pores. The nostrils are two oval openings separated by a small free lobe, and are a little nearer the end of the snout than the eye. When closed, the mouth is entirely hidden beneath the preorbital bone, but it is very protractile. Maxillary short and rather broad posteriorly, not reaching backwards to the orbital border; lips thick and fleshy. Teeth apparently wanting.

The whole body is covered with rather small, cycloid scales, which are not very adherent; they also extend onto the head and lower jaw, leaving only the snout bare. Skinny sheaths, covered with scales, cover the bases of the dorsal and anal fins, and the first half of the caudal is also scaly. The lateral line is a little arched anteriorly, thence straight to the middle of the caudal pedunele; there are about forty-two perforated scales along its length, but there appear to be a greater number in a longitudinal row.

The anterior dorsal rays increase rapidly in length to the sixth, which is broad and greatly produced; the following ten become regularly shorter, but the next six are broken off in my specimens. The remaining rays form a rounded second dorsal, of which the greater number are divided at the tips. The first anal ray is very short, but is followed by about fifteen longer ones resembling those of the first dorsal, of which the fourth and fifth are the longest, the others decreasing regularly backwards; the posterior eighteen rays form a second rounded fin as in the dorsal. The ventrals are elongate, and consist of eight branched rays, and one

broad simple one in front. The caudal is deeply forked. The upper pectoral rays are the longest, and the margin is rounded. Nearly all the fin-rays are articulated, though the joints are very widely spaced and difficult to see. The first five of the dorsal may be true spines, but the sixth and those following it are simple rays. The anal has apparently one spine, all the rest being rays. There is no ventral spine.

Colour.—Apparently silvery in life, with traces of darker cross-bands. A dark bar crosses the cheek below the eye, and a second one descends from the hinder border of the preoperculum to before the ventrals. Indications of four or five more occur on the back, and a striking blackish spot covers the bases of the anterior rays of the second dorsal and the back below them. The first dorsal is partly dusky, and the anterior portion of the anal is blackish. The ventrals are dusky with a round black spot in the middle of their length, and their tips blackish. Each lobe of the caudal is crossed by three broad oblique dark bars.

Described from two specimens, 96-108 mm. long, from the preorbital to the middle caudal rays. The larger one belongs to the Western Australian Museum, and was collected at Fremantle; the other was trawled by the "Endeavour" somewhere between Cape Naturaliste and Geraldton. Both are imperfect, and the accompanying figure has been prepared partly from one and partly from the other. The larger specimen retains sufficient of its scales to show their disposition, but they cannot be counted, and are therefore only approximately correct in my drawing. The form of the fins is best shown in the small example, but the rays connecting the first and second portions of the dorsal and anal are damaged in both specimens.

A third and larger specimen, 117 mm. long, differs from the others in being somewhat more elongate and in having the fins proportionately lower. It was collected in Doubtful Island Bay, on the southern coast of West Australia, in 20-25 fathoms.

Family ZEIDÆ.

Genus Cyttosoma, *Gilchrist.*

Cyttosoma, Gilchrist, Marine Invest. S. Afr., iii., 1904, p. 6 (*C. boops*, Gilchrist).

Body compressed, back abruptly elevated behind the head. The scales on the sides are small, imbricate, cycloid and deciduous; on the nape and top of the head, and along the ventral profile they are adherent, juxtaposed, and tubercular, and more or less rough with upstanding spinules. Those along the

bases of the dorsal and anal fins are slightly enlarged and spinate. A few enlarged scales may be present below the anterior dorsal spines.

Jaws very protractile, the intermaxillary processes received into a broad cavity extending backwards to above the middle of the orbits. Superficial bones of the head a little roughened: the operculum with a strong, transverse, spinate ridge. Preorbital very narrow. Microscopic teeth may be present on the lower jaw; upper jaw, vomer, palatines and tongue toothless. A single dorsal fin with six to eight spines, and about thirty rays. Anal with three spines and about twenty nine rays. Ventral with one spine, and usually seven rays. Seven branchiostegals.

Cyttosoma boops, *Gilchrist.*

Cyttosoma boops, Gilchrist, Marine Invest. S. Afr., iii., 1904, p. 6, pl. xxiii., and *Loc. cit.*, iv., 1907, p. 150.

Br. 7; D. vi-viii. 29-31; A. iii. 28-30; V.i. 7; P. 19-20; C. 13; L. lat. c. 100. Height, at origin of dorsal fin, 1.57 in the length to the hypural; head 2.73 in the same. Snout 2.23 in the eye, which is 1.65 in the head. Interorbital width 1.72 in the eye. Second dorsal spine 1.4, first anal spine 2.11, longest dorsal and anal rays 1.5 in the eye.

Supraorbital bones rough with serrated ridges; suborbital, preoperculum, preorbital, and mandibular also granular. Upper part of operculum crossed by a strong raised ridge which is denticulated, or it may form a cluster of spinules Interorbital space bounded on either side and posteriorly by the supraorbital bones; the median portion is somewhat triangular. Nostrils rather small, close together, the posterior placed directly in front of the eye; they are protected above by a granular bone. Eye very large, about once and two-thirds as wide as the interorbital space. Cheeks and interorbital space scaly, snout naked; lower part of operculum with rudimentary scales. Lips broad and fleshy. Maxillary oblique when the mouth is closed, its hinder margin truncate, the lower portion rounded. Very minute teeth may be present in front of the lower jaw; all the other mouth-parts toothless.

Scales of the sides very small, imbricate, and deciduous. On the nape and ventral profile they are juxtaposed and tubercular, the tubercles being either low and smooth or strongly spinate. Several enlarged scales usually remain below the anterior dorsal spines; according to Gilchrist, others also occur along the sides and below the abdominal regions, though these are missing in all my specimens. The scales along the bases of the dorsal and

anal fins are slightly enlarged, adherent, and strongly spinate. The lateral line is arched anteriorly, but descends to the median line of the body and runs along the middle of the caudal peduncle.

Dorsal spines of moderate strength and coarsely carinate; the second is the longest, the others decreasing evenly backwards. The rays are simple, and increase in length to about the eighteenth. Anal similar to the dorsal. Ventral rounded, inserted a little in front of the pectoral; the spine is long and carinate and the rays are divided. Pectoral short and broadly rounded, its rays simple. Caudal a little rounded, or with the outer rays very slightly produced.

Colour.—Brownish. Some specimens have more or less numerous small brown ocelli on the dorsal and anal rays. Iris golden. The membrane behind the maxillaries black.

Described from a specimen 207 mm. long from the snout to the end of the caudal fin. Twenty-eight others, 145-205 mm. long, vary a little in the form of the body, the back being more abruptly elevated in some than in others. The depth at the origin of the dorsal may be either 1.49 or 1.70 in the length to the hypural, and some specimens have a small patch of microscopic, villous teeth attached to the skin behind the vomer, which, however, are very different to the true vomerine teeth of *Neocyttus* or *Allocyttus*.

Loc.—Great Australian Bight, Long. 129°28'E., 350-450 fathoms; 14th May, 1913.

Genus ALLOCYTIUS, *gen. nov.*

Body compressed, covered with rather small scales with strongly ctenoid margins which are turned outwards; they are imbricate on the sides and hinder half of the body only, those on the nape and abdomen being simply juxtaposed, angular, and each having a small raised tubercle in its centre. Some enlarged flat scales are irregularly arranged in two rows on the sides below the pectorals; none below the origin of the dorsal fin.

Jaws very protractile, the intermaxillary processes received into a broad oblong cavity extending backwards to above the middle of the orbits. Superficial bones of the head with granules and course ridges, those of the operculum forming a radiating series. Preorbital of moderate width. Small teeth in one or two series on the jaws and vomer; palatines and tongue toothless. A single dorsal fin with about six, rather weak spines, and thirty-one rays. Anal with two or three spines, and about twenty-eight rays. Ventral with one spine and six rays. Branchiostegals seven.

Type.—*Cyttosoma verrucosum*, Gilchrist, var. *propinquus*, var. nov.

Boulenger[1] considers that *Cyttosoma verrucosum* is possibly the adult form of *Oreosoma*, Cuvier & Valenciennes[2], and if his view is correct, the above genus is unnecessary. There are, however, several important differences between *Allocyttus (Cyttosoma) verrucosus* and *O. atlanticum*, which seem to me to indicate that they are not generically identical, though closely related.

O. atlanticum was, until recently, known from only a few very small examples, but Waite[3] has lately described and figured a New Zealand specimen 80 mm. long, which does not differ in its essential characters from the smaller ones. Though there is a great difference in size between my smallest specimen of *Allocyttus*, 253 mm., and Waite's example, it is nevertheless difficult to suppose that a fish could undergo such a remarkable change of form as would be necessary to alter it from *Oreosoma* to *Allocyttus*, particularly as it retains its larval characters unchanged up to a length of 80 mm. *Oreosoma* has a stout body which is trigonal in section, while *Allocyttus* is compressed. The large conical tubercles of the small fish are altogether differently arranged to the flat scales which are supposed to represent them in *Allocyttus*, the lower ones being below the ventral fins. None of the scales are imbricate in *Oreosoma*, but are six-sided and form a mosaic, whereas only a portion of them are so arranged in *Allocyttus*, the remainder being imbricate.

I therefore believe that the unknown adult form of *Oreosoma* will prove to be generically distinct from *Cyttosoma verrucosum*, and therefore propose *Allocyttus* for the latter. It differs from *Cyttosoma* and *Pseudocyttus* in having vomerine teeth and ctenoid, adherent scales, while the structure of the scales separates it from *Neocyttus*. These genera may be readily distinguished by the following key:—

a. No vomerine teeth. Scales deciduous, cycloid, or with minute soft points.
  b. Some enlarged flat scales below the origin of the dorsal and on the sides of the abdomen. Back abruptly elevated behind the head. Preorbital very narrow..... *Cyttosoma*.

1 Boulenger—Compt Rendu Acad. Sci. Paris, cxxxvii., 1903, p. 523.
2 Cuvier & Valenciennes—Hist. Nat. Poiss., iv., 1829, p. 515, pl. xcix.
3 Waite—Trans. N.Z. Inst., xliv., 1912, p. 197, pl. xi.

bb. No enlarged scales. Back not abruptly elevated. Preorbital of moderate width.....*Pseudocyttus.*

aa. Vomerine teeth present. Scales adherent, strongly ctenoid.

c. Scales nearly uniform, without any enlarged flat scales on the sides of the abdomen.... ..*Neocyttus.*

cc. Scales before the dorsal and on the ventral regions tubercular; some enlarged flat scales on the sides of the abdomen .....*Allocyttus.*

ALLOCYTTUS VERRUCOSUS, *Gilchrist,*

VAR. PROPINQUUS, *var. nov.*

(Fig. 7.)

Oreosoma, sp. Boulenger, Compt. Rendu Acad. Sci. Paris, cxxxvii., 1903, p. 523.

Cyttosoma verrucosum, Gilchrist, Marine Invest. S. Afr., iv., 1908, p. 151, pl. xl.

Br. 7; D. vi. 30-32; A. ii-iii, 28-29; V.i. 6; P. 19; C. 13; L. lat. c. 87-93. Height, at origin of dorsal fin, 1.62 in the length to the hypural; head 2.5 in the same. Length of snout a little less than the interorbital width, and 1.79 in the eye; the latter is 2.14 in the head. Second dorsal spine 2.15, longest dorsal ray 1.26 in the eye.

The dorsal profile is convex from the snout to a point some distance before the dorsal fin, where it rises more or less obliquely to the base of the first spine. From there it descends rapidly in a slightly convex line to the caudal peduncle. The ventral profile is almost similar to that of the back.

The exposed preorbital, supraorbital and suborbital bones, together with the operculum, preoperculum, suboperculum, mandibular and maxillary are rough with granules and coarse ridges; the preoperculum and suborbital are perforated by several large pores covered with skin. The interorbital space is bounded on either side and posteriorly by the supraorbital bones; the median portion is an oblong scaly space which receives the posterior processes of the intermaxillaries when the mouth is closed. The nostrils are large and close together, the posterior the largest and placed directly in front of the eye, they are protected above by a granular bone. Eye extremely large, about once and a half as wide as the interorbital space. The cheeks are covered with scales, each bearing a low elevation in its centre. A few incomplete scales are also present on the lower

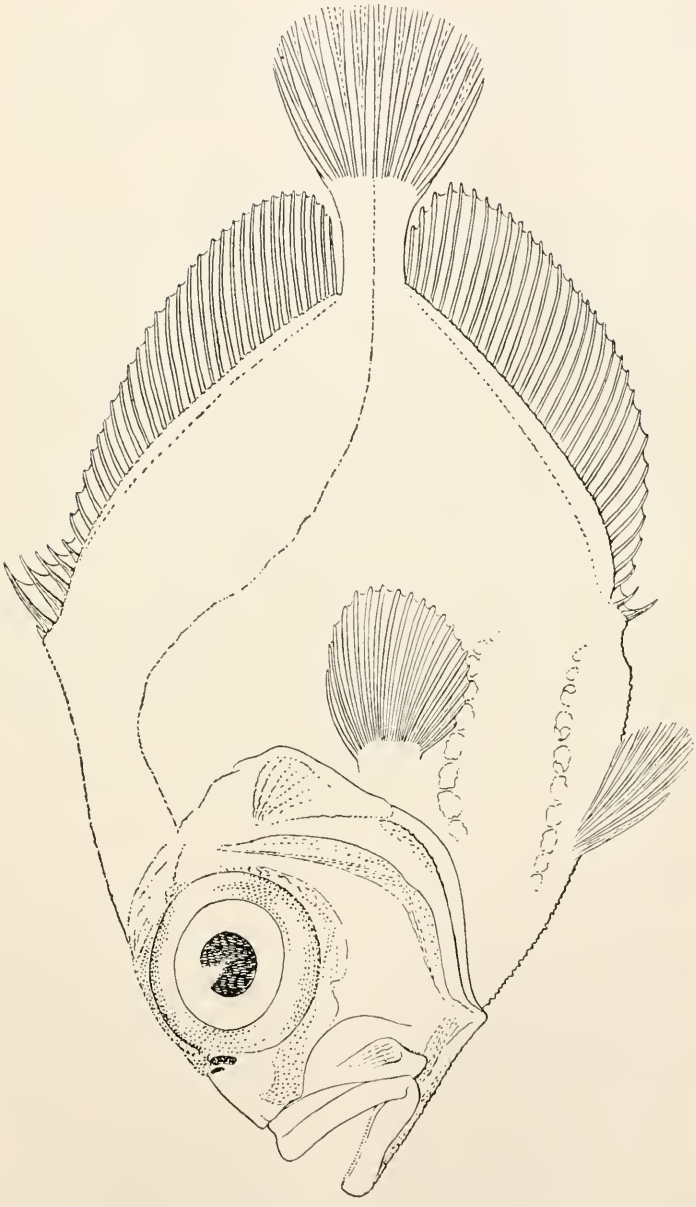

Fig. 7. *Allocyttus verrucosus*, var. *propinquus*.

half of the operculum. Anterior portion of snout naked Lips broad and fleshy. Maxillary very oblique when the mouth is closed; its posterior margin is a little excavated, and the lower angle somewhat produced. Teeth small and conical, forming two irregular rows on the front of each jaw, and one on the sides; the symphysis of the upper jaw is toothless. Similar teeth form a series across the head of the vomer.

Scales of the sides of the body usually flat and imbricate, with their margins turned outwards and armed with several very strong teeth. On the nape and upper portion of the head, as well as on the sides of the abdomen, they each have a median tubercle which may be either low and blunt or acute; on the ventral profile the scales are particularly rough owing to the great development of the tubercles and marginal spines. On the side, below the pectoral there are two rows of enlarged flat scales which are irregular both in position and number, though there appear to be about eight in each row. The lateral line is more or less arched anteriorly, but descends to the median line of the body and runs straight along the middle of the caudal peduncle. The scales at the bases of the dorsal and anal fins are slightly enlarged, and have their free edges strongly spinate.

The dorsal spines are rather weak and deeply grooved; the first is very small, the second the longest, and the others decreasing evenly backwards. The rays are all simple and increase in length backwards to about the twentieth. The anal spines are shorter than the dorsal ones, but the rays are similar to, though a little longer than those of that fin. Ventrals inserted slightly before the pectorals; the spine is long and weak, and the rays are divided with their margin rounded. Pectoral short and broadly rounded, its rays simple. Caudal rays branched, with their margin rounded.

Colour.—Brownish in formalin, the fins and naked skinny parts darker than the rest.

Described from a specimen 280 mm. long from the snout to the end of the caudal fin. Seven others, 253-325 mm. long, were trawled with it which show some little variation in the form of the body. In the larger examples the dorsal profile is less elevated before the dorsal fin than in the smaller ones, and some are a little longer proportionately than others. The lengths of the rays are also subject to some variation.

Gilchrist's short description gives but few details, but it would seem that the Australian specimens differ from the African ones in being somewhat longer, and in having the back elevated before the dorsal fin instead of continuous with the line of the

neck. Both these characters vary somewhat, and it may prove that they are not worthy of recognition by even a varietal name.

Loc.—Great Australian Bight, 129°28′E., 350-450 fathoms; 14th May, 1913.

Genus Neocyttus, *Gilchrist.*

Neocyttus, Gilchrist, Marine Invest. S. Afr., iv., 1907, p 153 (*N. rhomboidalis*, Gilchrist.)

Body compressed and elevated, covered with rather small ctenoid scales, which are mostly imbricate; on the nape, head, and ventral profile their edges are turned outwards and strongly spinate, making these parts very rough. They do not bear any central tubercles, nor are there any enlarged flat scales on the sides as in *Allocyttus* and *Cyttosoma*.

Jaws very protractile, the intermaxillary processes received into a broad, oblong cavity extending backwards to above the middle of the orbits. Superficial bones of the head with coarse granules and ridges; those of the operculum forming a radiating series. Preorbital of moderate width. Small teeth in the jaws and on the vomer; palatines and tongue toothless. A single dorsal fin with seven or eight strong spines and about thirty-four rays. Anal with three or four spines, and about thirty-one rays. Ventral with one spine and six rays. Seven branchiostegals.

Neocyttus rhomboidalis, *Gilchrist.*

var. gibbosus, *var. nov.*

(Fig. 8.)

Neocyttus rhomboidalis, Gilchrist, Marine Invest. S. Afr., iv., 1907, p. 153, pl. xlii.

Br. 7; D. vii-viii. 33-35; A. iii-iv. 31-33; V.i. 6; P. 19-21; C. 12-13; L. lat. c. 104. Height, at origin of dorsal, 1.47 in the length to the hypural; head 2.67 in the same. Eye 2.12 in the length of the head. Snout 2.16 in the eye and a little more than half the interorbital width, which is 1.18 in the eye. Second dorsal 2.07, longest dorsal ray 2.37, first anal spine 2.30 and longest anal ray 2.59 in the head.

The exposed preorbital, supraorbital and suborbital bones, together with the operculum, preoperculum, suboperculum, mandibular and maxillary are rough with granules and coarse ridges; the preoperculum and suborbital are perforated by large

pores, the openings being covered by membrane. Interorbital space bounded on either side by the supraorbital bones; the median portion is an oblong, scaly space, which receives the posterior processes of the premaxillaries when the mouth is closed. Nostrils close together, the posterior the larger, and placed directly in front of the eye; they are protected above by a granular bone. Eye large, about once and a quarter as wide as the interorbital space. Cheeks, interorbital space and snout covered with scales with upstanding denticulated margins; lower half of operculum similarly scaly. Lips of moderate breadth and fleshy. Maxillary very oblique when the mouth is

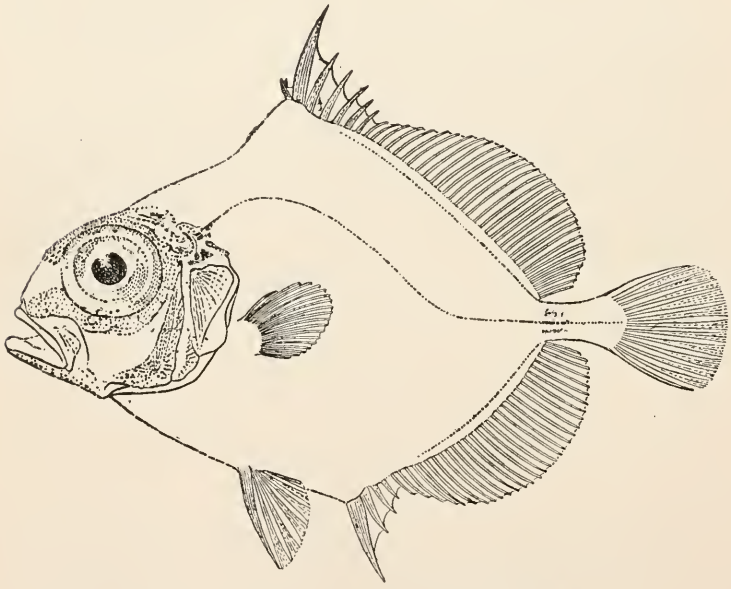

Fig. 8. *Neocyttus rhomboidalis*, var. *gibbosus*.

closed; its hinder margin more or less excavate, and the lower angle produced. Teeth minute and conical, in one or two rows in front of the jaws and in one on the sides; maxillary symphysis toothless. Similar teeth form a series across the head of the vomer.

Scales of the sides flat and imbricate, with their margins strongly ctenoid. On the nape and lower part of the abdomen their edges are turned outwards and are strongly spinate. Lateral line more or less arched anteriorly, but descending to the

median line of the body and running along the middle of the caudal peduncle. The scales along the bases of the dorsal and anal fins are not larger than those of the sides, and their edges are strongly spinate.

Dorsal spines strong and coarsely carinate; the second is much the longest and the following ones decrease evenly backwards. The rays are all simple and increase in length to about the eighteenth; their basal portions are armed with minute spinules on either side. Anal similar to the dorsal though the spines and rays are a little shorter. Ventrals rounded, inserted below or behind the pectorals; the spine is long and carinate, and the rays are divided. Pectoral short and broadly rounded, its rays simple. Caudal slightly rounded, the rays branched.

Colour.—Silvery, the membrane of the soft dorsal, anal, and ventral blackish. The skin on the sides of the mouth and the gill-membranes are black. Iris golden with a dark inner ring.

Described from a specimen 270 mm. long from the snout to the end of the caudal fin. Eight other examples, 203-280 mm. long, were obtained with it, and show some little variation in the depth and form of the body. The back is more abruptly elevated before the dorsal fin in some than in others, but all differ in this respect from the typical form, in which the line from the head to the first dorsal spine is but little concave. Eight of my specimens have four anal spines, and one has three.

Gilchrist has described the rays of the dorsal, anal, and pectoral fins as covered with minute ctenoid scales. These "scales" are merely the articulations of the rays which are armed with minute spinules on either side.

Loc.—Great Australian Bight, Long. 129°28′E., 350-450 fathoms; 14th May, 1913.

Family PLEURONECTIDÆ.

Genus Ammotretis, *Günther*.

Ammotretis rostratus, *Günther*.

Long-snouted Flounder.

Ammotretis rostratus, Günther, Brit. Mus. Cat. Fish., iv., 1862, p. 458. *Id.*, Klunzinger, Arch. Nat., xxxviii.i., 1872, p. 40, and Sitzb. Akad. Wiss. Wien, lxxx.i., 1879, p. 407.

Id., Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 128. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 127, and 1890 (1891), p. 36. *Id.*, Waite, Mem. Austr. Mus., iv., 1899, p. 123. *Id.*, Stead, Ed. Fish. N.S. Wales, 1908, p. 103, pl. lxx.

Ammotretis rostratus vel *adspersus*, Kner, Reise "Novara," Zool., i., 1868, p. 286, pl. xiii., fig. 4. *Id.*, Ogilby, Cat. Fish. N.S. Wales, 1886, p. 48.

Rhombosolea bassensis, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 167. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 132. *Id.*, Lucas, Proc. Roy. Soc. Vict. (2), ii., p. 34.

Ammotretis zonatus, Macleay, Proc. Linn. Soc. N.S. Wales, vii., 1882, p. 367, and ix., 1884, p. 50.

Ammotretis macleayi, Ogilby, Proc. Linn. Soc. N.S. Wales, x., 1885, p. 121-2.

Peltorhamphus bassensis, Waite, Rec. Austr. Mus., vi., 1906, p. 198, pl. xxxiv.

Having carefully compared and counted the fin rays and scales of fourteen examples of this variable species, 135-325 mm. long, I find they have the following characters. D. 76-86; A. 51-56; P. 9-12; V. dex. 7; V. sin. 3-6; L. lat. 80-90; L. tr. $34\text{-}38\frac{1}{1}46\text{-}50$. Depth $1\frac{8}{10}\text{-}1\frac{4}{7}$, head $3\frac{3}{4}\text{-}4\frac{1}{2}$ in the length from the upper jaw to the hypural. Scales of upper side ctenoid. Maxillary not reaching the level of the orbital margin. Origin of the lateral line more or less below the level of the upper margin of the upper eye. Gill-rakers of the first arch of the lower side large, tubercular. Colour ranging from blackish to light brown with darker dots; upper pectoral more or less blackish.

I have re-examined the specimen figured in Waite's paper, and find that I have drawn the scales too large, there being only 68 along the lateral line whereas there should be 80. The nostrils are shown as if connected which is incorrect, while the fourteenth to eighteenth rays are not longer than those immediately following them; they are really similar to what I have shown in my figure of *A. tudori*.

Locs.—*A. rostratus* is recorded from Tasmania, Victoria, and New South Wales northwards to Port Jackson. The "Endeavour" also trawled it in South Australian waters:—

Off the East coast of Flinders Island, Bass Strait, 40 fathoms.

Off the mouth of the Murray River, South Australia, 20 fathoms.

Marsden Point, Kangaroo Island, South Australia.

Flinders Island, Investigator Group, South Australia, 37 fathoms.

I have also examined specimens from near Sydney, Queenscliff in Victoria, and from northern Tasmania.

Ammotretis elongatus, *sp. nov.*

(Plate xxvii.)

D. 74-75; A. 50-51; P. 8-10; V. dex. 13; V. sin. 3-4. Depth $2\frac{1}{4}$, head $4\frac{3}{4}$ in the length from the upper jaw to the hypural. Eye equal to its distance from the tip of the upper jaw, and $4\frac{3}{4}$-5 in the length between that point and the end of the operculum. Pectorals of equal length, nearly half as long as the head. Caudal about as long as the head. Longest dorsal and anal rays about $1\frac{3}{4}$ in the head.

Scales of the upper side almost all cycloid, only a few on the head and near the margins of the body being ctenoid; on the lower side the ctenoid scales are more numerous. The scales extend over the greater part of all the rays except those of the pectoral and the anterior dorsal and ventral ones. The lateral line is almost straight, being only very slightly curved over the pectoral; its origin is a little below the upper margin of the upper eye. There are about ninety pores, and as many scales along its length as far as the hypural, and from thirty-three to thirty-nine on either side of it across the widest part of the body.

Lower eye a little in advance of the upper. Maxillary not reaching back to the orbital margin; lower lip with a few simple tentacles. Nostrils tubular, the anterior of both sides with posterior lobes. Teeth much smaller than in *A. rostratus* and *A. tudori*, in a band on the lower sides of each jaw. Gill-rakers of the first arch small, tubercular.

Dorsal commencing on the tip of the rostral hook, the anterior rays free, simple, and serrated; the fourteenth to eighteenth rays are longer than those immediately following them. Left pectoral of similar form and size to the right. Right ventral in a line with, and joined to the anal, the anterior rays somewhat similar to those of the dorsal. Middle caudal rays longest, the margin rounded.

Colour.—Light sandy-coloured with minute black dots over the head, body, and fins.

Described from two specimens 195-215 mm. long.

A. elongatus is distinguished from all other species of the genus by its comparatively narrow form. It has also thirteen rays in the right ventral, its scales are mostly cycloid, and its type of colouration is different from the others.

Loc.—Investigator Strait, South Australia, or the area south of Kangaroo Island.

AMMOTRETIS TUDORI, *sp. nov.*

(Plate xxvi.)

D. 77-82; A. 54-58; P. 10-11; V. dex. 10; V. sin. 6. Depth $1\frac{7}{10}$-$1\frac{9}{10}$, head $4\frac{1}{4}$-$4\frac{1}{3}$ in the length from the upper jaw to the hypural. Eye equal to or less than its distance from the tip of the upper jaw, and $4\frac{1}{2}$-5 in the length between that point and the end of the operculum. Upper pectoral $1\frac{2}{3}$-$1\frac{8}{10}$ in the head; the lower only a little longer than the eye. Caudal equal to or a little shorter than the head. Longest dorsal and anal rays about $1\frac{3}{4}$ in the head.

Upper side mostly covered with ctenoid scales which become almost cycloid towards the middle of the body in large specimens; on the lower side they are nearly all cycloid, sometimes ctenoid towards the edges. They extend over the greater part of all the rays except those of the pectoral and the anterior dorsal and ventral ones. The lateral line is nearly straight between the tail and the pectoral, but is slightly curved or inclined upwards over the latter fin. Its origin is on the same level as the upper margin of the upper eye. There are about eighty or ninety pores, and the same number of scales along its length as far as the hypural, and from thirty-five to forty on either side of it across the widest part of the body.

Eyes on almost the same level, or the upper a little in advance of the lower. Maxillary not reaching backwards to the orbital margins; lower lip with a row of fringed tentacles. Nostrils tubular, the anterior of both sides with posterior lobes. Teeth similar to those of *A. rostratus*, in a narrow band on the lower sides of each jaw. Gill-rakers of the first arch reduced to minute tubercles.

Dorsal commencing on the tip of the rostral hook, the anterior rays free, simple, and serrated; the thirteenth to fifteenth rays are longer than those immediately following them. Left pectoral much smaller than the right, the first ray with a large fleshy tubercle at its tip. Right ventral in a line with and joined to the anal, the anterior rays somewhat similar to those of the dorsal. Middle caudal rays longest, the margin rounded or obtusely pointed.

Colour.—Light sandy-coloured or greyish, with or without numerous darker spots on the head, body and fins. Upper pectoral light coloured like the body.

Length 135-235 mm.

This species is distinguished from *A. rostratus* in having ten instead of seven rays in the right ventral, and in the left pectoral being much shorter than the right and having a curiously modified ray. The gill-rakers are also much smaller, and the origin of the lateral line is somewhat differently situated, while the type of colouration also appears to be different. *A. guntheri*, Hutton and *A. nudipinnis*, Waite, differ from both *A. rostratus* and *A. tudori* in having no scales on the dorsal and anal fins.

I am glad to have the opportunity of associating with this interesting new species the name of the Honorable F. G. Tudor, late Minister for Trade and Customs, under whose direction these Reports were originated. Although only five specimens have been preserved, it is probable that the species will be found to be sufficiently abundant to form a valuable addition to the list of edible Australian flounders.

Locs.—Off the East coast of Flinders Island, Bass Strait.

Spencer Gulf, South Australia, 20 fathoms.

Flinders Island, Investigator Group, South Australia, 37 fathoms.

AMMOTRETIS MACROLEPIS, *sp. nov.*

(Fig. 9.)

D. 90; A. 59; P. 8-10; V. dex. 12; V. sin. 5. Depth $1\frac{8}{10}$, head $4\frac{1}{6}$ in the length from the upper jaw to the hypural. Eye twice as long as its distance from the tip of the upper jaw, and $3\frac{2}{3}$ in the length between that point and the end of the operculum. Upper pectoral longer than the lower, $1\frac{3}{4}$ in the head. Caudal longer than the head. Longest dorsal and anal rays as long as the pectoral.

All the scales are ctenoid but those of the upper side are more strongly toothed than the lower ones. They extend over the greater part of all the rays except those of the pectoral and the anterior dorsal and ventral ones. Lateral line almost straight, its origin on the same level as the upper margin of the upper eye. There are about sixty-six pores and as many scales along its length to the hypural, and twenty-four above and thirty below it across the widest part of the body.

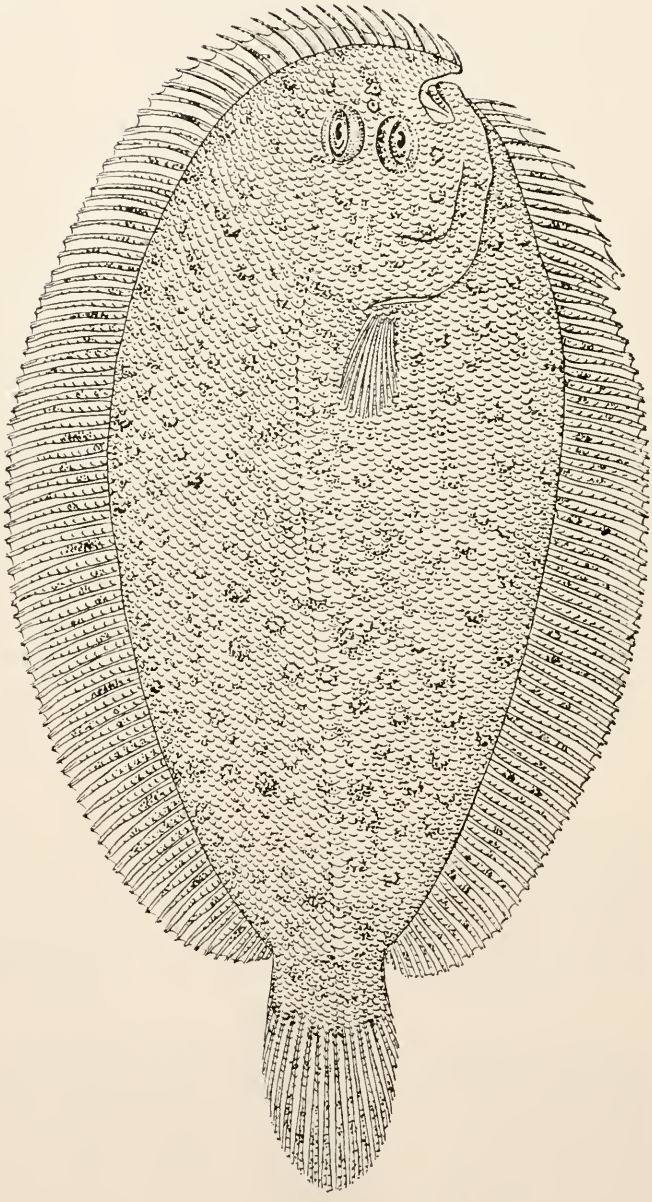

Fig. 9. *Ammotretis macrolepis.*

Upper eye slightly in advance of the lower. Maxillary extending backwards to behind the orbital margin; lower lip with a few small tubercles. Nostrils tubular, the anterior of both sides with posterior lobes. Teeth in a band on the lower side of each jaw. Gill-rakers of the first arch reduced to minute tubercles.

Dorsal commencing on the tip of the rostral hook, the anterior rays free and simple. Left pectoral shorter than the right, the the first ray very short, with a small fleshy tubercle at its tip. Right ventral in a line with and joined to the anal, its anterior rays somewhat like those of the dorsal. Middle caudal rays the longest, the margin obtusely pointed.

Colour.—Pinkish, with numerous small dark grey ocelli on the head and body. Fins dotted with dark grey.

Described from a single specimen 98 mm. long.

A. macrolepis is most nearly allied to *A. tudori*, and it is with hesitation that I venture to separate it from that species. It differs in having such larger scales and rather more numerous dorsal, anal, and ventral rays. The maxillary also reaches well beyond the anterior orbital margin.

Loc.—East coast of Flinders Island, Bass Strait, 40 fathoms.

The following is a key to the species of *Ammotretis*.—

a. Width more than half the length from the upper jaw to the hypural.

b. Rays of dorsal and anal fins scaly above.

c. Pectorals of equal length; right ventral with 7 rays ..... *rostratus*.

cc. Lower pectoral shorter than the upper; ventrals with 10-12 rays.

d. Maxillary not reaching to orbital margin; l. lat. 80-90 ..... *tudori*.

dd. Maxillary reaching beyond orbital margin; l. lat. 66 ..... *macrolepis*.

bb. Dorsal and anal rays without scales above.

e. Rostral hook long; interorbital space wide; body with large blotches ..... *nudipinnis*.

ee. Rostral hook small; interorbital narrow; body with spots forming lines ..... *guntheri*.

aa. Width less than half the same length ..... *elongatus*.

Family BOTHIDÆ.

Genus Lophonectes, *Günther*.

Lophonectes gallus, *Günther*.

Lophonectes gallus, Günther, "Challenger" Rept., Zool., i., 1880, p. 29, pl. xv., fig. b (reversed). *Id.*, Ogilby, Cat. Fish. N.S. Wales, 1886, p. 48. *Id.*, Waite, Mem. Austr. Mus., iv., 1899, p. 124.

Lophorhombus cristatus, Macleay, Proc. Linn. Soc. N.S. Wales, vii., 1882, p. 14, and ix., 1884, p. 52.

D. 87-93; A. 72-78; V. 6. Depth $2\frac{1}{4}$-$2\frac{1}{2}$, length of head $4\frac{1}{2}$-5 in the length to the hypural. Snout $\frac{4}{7}$-$\frac{3}{4}$ in the eye. Lower eye in advance of the upper, $3\frac{1}{4}$-4 in the head. Maxillary reaching to or slightly beyond the anterior orbital margin. Several bony tubercles are more or less developed on the snout and chin. Dorsal commencing opposite the anterior nostril on the lower side of the head; second to fifth ray always prolonged, except in very young specimens, $\frac{4}{7}$-$1\frac{2}{3}$ as long as the head. Left pectoral larger than the right $\frac{4}{7}$-$\frac{8}{10}$ as long as the head. Left ventral in a line with the anal. Middle caudal rays longest, $\frac{3}{4}$-$1\frac{1}{6}$ in the head. Lateral line strongly arched over the pectoral, thence straight to the end of the caudal. Light sandy coloured to dark brown, with or without darker markings the most conspicuous of which, when present, are three blotches on the lateral line. Vertical fins finely dotted with brown. Left ventral usually blackish posteriorly with a light edge.

Locs.—This species has been recorded from New South Wales between Jervis Bay and the Manning River, from 10-84 fathoms. The "Endeavour" collection includes forty specimens, 100-193 mm. long from New South Wales, Victoria, South Australia and Tasmania.

Between Newcastle and Port Stephens, New South Wales, 22-60 fathoms.

Shoalhaven Bight, New South Wales, 15-45 fathoms.

36 miles off Cape Everard, Victoria, 75 fathoms; May 28th, 1910.

Off the East coast of Flinders Island, Bass Strait, 40 fathoms.

Entrance to Oyster Bay, Tasmania.

Off the mouth of the Murray River, South Australia, 20 fathoms; August 17th, 1909.

Genus PSEUDORHOMBUS, *Bleeker.*

PSEUDORHOMBUS SPINOSUS, *sp. nov.*

(Plate XXV.)

D. 74-76; A. 56-57; V. 6; P. dex., 1,11, P. sin., 1,9-10; C. 17; L. lat. to hypural 80 Depth 2.21-2.27, head 3.62-3.8 in the length to the hypural. Eye 4.8-5.2, maxillary 2.13-2.18, snout 4-4.3 in the head. The dorsal profile is not notched on the snout; there is a broad space between it and the eye which is equal to about two-thirds the diameter of the latter. Lower eye very slightly in advance of the upper; in one specimen there is a small fleshy tentacle on a slender stalk over each eye. Interorbital space narrow, consisting of a raised bony ridge. Mouth strongly arched, the maxillary reaching to below the hinder third or fourth of the eye. Teeth rather large and widely spaced anteriorly, weaker posteriorly; those of the lower jaw larger than the upper ones. Gill-rakers palmate, as long as broad, about one-fifth as long as the eye; there are nine or ten on the lower limb of the first arch, and their free margins are rounded with four to six projecting spinules.

Dorsal fin commencing on the snout before the level of the nostrils, the anterior rays broad and partly free; the longest rays, which are behind the middle of the fin, are about as long as the space between the tip of the snout and the hinder margin of the eye. Anal preceeded by a strong, fixed spine of which only the tip projects beyond the flesh; the form of the fin and the lengths of the rays are similar to those of the dorsal. Upper pectoral reaching across the arch of the lateral line, its base nearly horizontal, the longest rays $1\frac{1}{2}$-$1\frac{2}{3}$ in the head; lower pectoral $2\frac{1}{3}$ in the same. Ventrals almost similar in form, the second ray $2\frac{1}{2}$-$3\frac{1}{5}$ in the head. Caudal somewhat pointed, the middle rays 1.14-1.27 in the head.

Scales small, cycloid on both sides; they are imbricate below, but only the tips project beyond the skin above. Snout, jaws, and interorbital space naked. The scales extend onto the rays of the dorsal, anal and caudal fins on both sides, and onto the base of the left ventral. The lateral line is broadly arched above the pectoral, and there are about eighty pores between the operculum and the hypural; a supplementary branch is given off in the direction of the back above the operculum, and another extends forward above the outer border of the upper eye.

Colour.—Light grey with three conspicuous dark ocelli surrounded by lighter dots, the arrangement of which may be seen in the figure; the whole upper side of the head and body is closely covered with numerous more or less complete darker rings and spots. The fins are spotted and blotched with brown.

The presence of a preanal spine in this species suggests that it is not a true *Pseudorhombus*, but dissection shows that it is merely the end of a large modified interhaemal spine which is equally developed in *P. arsius*, though its tip does not perforate the skin in that species. The cycloid scales, also, offer a striking contrast to the ctenoid ones of *P. arsius*, but those of *P. tenuirastrum* are intermediate between the two extremes. The palmate gill-rakers, however, are very different to what I have seen in any other species of the genus.

Described from two specimens 225-274 mm. long. The smaller, which is selected as the type, is in the Australian Museum collection, and is the specimen figured; it is from Houtman Abrolhos, Western Australia. The larger one was taken by the "Endeavour" between Cape Naturaliste and Geraldton, Western Australia.

PSEUDORHOMBUS TENUIRASTRUM, *Waite*.

Paralichthys tenuirastrum, Waite, Mem. Austr. Mus., iv., pt. 1, 1899, p. 121, pl. xxviii.

Pseudorhombus tenuirastrum, Ogilby, Mem. Qld. Mus., i., pt. 1, 1912, pp. 43, 45.

D. 73-77; A. 59-63; V. 6; P. sin. 1,10-12, P. dex. 1,9-11 C. 17; L. lat. to hypural 73-80. Depth 2-2.3, head 4.2-4.8 in the length to the hypural. Dorsal profile more or less deeply notched on the snout, only a narrow space between it and the eye. Dorsal fin commencing on the lower side of the snout on the same level as the anterior margin of the upper eye. Upper eye on a level with or slightly in advance of the lower, 4-4.6 in the head. Teeth very small, close together. Maxillary broadly expanded behind, reaching almost to or a little behind the middle of the eye. Gill-rakers slender, 4-6 times as long as broad, with spines on their anterior edges. Scales cycloid above and below, the upper ones with a minute rough patch well within the anterior margin.

In drawing up the above diagnosis, I have minutely compared twenty specimens, 137-280 mm. long, including the types of the species. The Australian Museum collection includes a young example which was dredged in Port Jackson.

Locs.—North-east of Richmond River Heads, New South Wales, 16-18 fathoms.

Shoalhaven Bight, New South Wales, 15-45 fathoms.

Off the east coast of Flinders Island, Bass Strait.

Ogilby notes its occurrence in Queensland waters but gives no special locality.

Pseudorhombus multimaculatus, *Günther*.

(Plate xxiv.)

Pseudorhombus multimaculatus, Günther, Brit. Mus. Cat. Fish., iv., 1862, p. 427. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 125. *Id.*, Ogilby, Ed. Fish. N.S. Wales, 1893, p. 157, pl. xxxviii.

Paralichthys novæ-cambriæ, Ogilby, Proc. Linn. Soc. N.S. Wales, xxiii., 1898, p. 296. *Id.*, Waite, Mem. Austr. Mus., iv., pt. 1, 1899, p. 120, fig. 9.

Pseudorhombus novæ-cambriæ, Ogilby, Proc. Roy. Soc. Qld., xxi., 1908, p. 25, and Mem. Qld. Mus., i., 1912, pp. 43, 45.

D. 68-71; A. 51-56; P. dex. 1+9-1+11; P. sin. 1+10-1+11; V. 6; C. 15+2; L. lat., to hypural, 66-73. Depth 1.7-1.8, head 3.4-3.9 in the length to the hypural. Dorsal profile notched on the snout, usually only a narrow space between it and the eye. Dorsal commencing on the lower side of the snout, on a level with, or slightly before the front margin of the eye. Eyes nearly on the same level, or the upper one slightly in advance of the lower, $4\frac{3}{4}$-$5\frac{1}{4}$ in the head. Teeth small, close together. Maxillary expanded behind, with a few small scales, and reaching to below the hinder half or almost to the hinder border of the eye. Gill-rakers short and broad, once to twice as long as broad. Scales ctenoid above, cycloid below.

The small-toothed flounder of New South Wales was originally identified as *P. multimaculatus*, Günther, but Ogilby later separated it as a distinct species, *P. novæ-cambriæ*. He pointed out a number of differences between the two, most of which appear to me to be variable. My specimens scarcely differ from Günther's description, though the tail is always more or less angular instead of rounded, and longer than described, while the gill-rakers are never half as long as the eye. Mr. C. Tate Regan, however, has very kindly compared specimens I sent him from near Sydney with the types of *P. multimaculatus*, and informs me he has no doubt they are that species.

Locs.—The above definition was drawn up from five specimens from New South Wales, 202-338 mm. long; another from Moreton Bay, and one from Fremantle do not differ from the local examples.

Family HOPLICHTHYIDÆ.

Genus Hoplichthys, *Cuvier & Valenciennes.*

Hoplichthys haswelli, *McCulloch.*

Hoplichthys haswelli, McCulloch, Rec. Austr. Mus., vi., pt. 5, 1907, p. 351, pl. lxiv.

A splendid series of one hundred and five specimens of this species, 160-420 mm. long, exhibits considerable variation in the form and armature of the head. The young differ from the larger examples principally in wanting most of the spiniferous ridges of the head, only the larger ones being present. The eyes are much larger, being 4.5 in the head as against 7.33. The interorbital space is very narrow in small specimens, its width being only about one-third the diameter of the eye though equal to it in the largest examples. One specimen 215 mm. long, is particularly interesting since it appears to have retained some of its juvenile characters. It has very few spiny ridges on the head, and the interorbital width is only 4.76 in the eye. A very young specimen, 77 mm. long, has a much broader and rounder snout than the others, and only the largest of the cephalic spines are developed. It has the following proportions:— Head, including the opercular flap, 2.58 in the length to the hypural. Eye 4.85 in the head and 1.57 in the snout. Interorbital space 2.1 in the eye.

Most of the specimens are mottled with more or less definite darker spots, and some show traces of four greyish cross-bars on the back. The first dorsal has a dark blotch in its hinder half, and the second has several rows of black spots between the rays. The margin of the caudal is black.

Locs.—Off Bermagui, New South Wales, 70-80 fathoms; 17th July, 1912.

South from Gabo Island, Victoria, 96-108 fathoms; 20th July, 1911.

36 miles off Cape Everard, Victoria, 70-100 fathoms; 28th May, 1910, and August, 1911.

East from East Sister Island, Bass Strait, 90 fathoms; 23rd April, 1910.

Great Australian Bight, Long. 126°30′E., 100 fathoms; March, 1913.

Great Australian Bight, Long. 126°45′E. 130-320 fathoms.

HOPLICHTHYS OGILBYI, *sp. nov.*

(Plate xxviii., fig. 1-1a.)

Br. 7; D.vi. 15; A.i. 16; P. 12+4; V.i. 5; lateral plates 27. Head, from tip of snout to end of opercular flap, 3.36 in the length to the hypural. Depth before the ventrals 3.8, width 2.23 in the head. Eye 4.66, snout 3, second dorsal spine 3.8, first dorsal ray 3, longest pectoral ray 1.3, inner ventral ray 2.23, middle caudal rays 1.63 in the head.

Snout rounded, tip of lower jaw not visible from above. Sides of head formed of four spinate lobes, the spines increasing in size backwards. The first lobe also bears one or two strong spines projecting forward on the side of the snout. The last spine of the second lobe is almost on a level with the anterior margin of the eye, and that of the third with the posterior margin. The fourth lobe includes the strong preopercular spine and a second smaller one given off near the base of the latter. All the exposed bones of the head are very rough with tuberculiform spines or granules which are arranged in rows radiating from larger central spines or clusters of spines. The fleshy area around the eye is margined on its outer side by several clusters of strong curved spines, of which the most prominent are two terminating two ridges, which run obliquely backwards and outwards. There is an upstanding group of spines behind the eye, on the occiput, and on the humeral plate on each side, and and two smaller ones occur on the preoperculum and anterior part of the operculum. The relative positions of these and other head structures may be seen in the figures.

The maxillary is broadly expanded behind, its length is 3.3 in the head, and it does not nearly reach the level of the front margin of the eye. All the bones on either side of, and behind the jaws are very rough, and there is a row of spines behind the maxillary. The teeth are microscopic, and are arranged in narrow bands on the jaws, which are interrupted at the symphyses. They form a narrow arched band on the vomer, without any backward processes as in *H. haswelli*. The palatine band is narrow, almost linear.

Body entirely scaleless. The lateral plates cover the greater part of the back, leaving only a narrow space between them and the base of the dorsal fin; they extend well down onto the sides. They support a row of strong, sub-equal recurved spines, near the bases of which may be several much smaller ones; their surfaces are very rough with minute granular spines, and there is a denticulated ridge extending obliquely forward on the upper anterior margin of each. The posterior margins are deeply cleft behind the large spines.

The first dorsal originates between the hinder margins of the opercles ; its spines are very weak, and the second is the longest. The rays of the second dorsal are bifid ; in one specimen they increase slightly in length backwards, and in the other they decrease. The anal is similar but lower, and commences well in advance of and terminates behind the second dorsal. The upper pectoral rays are very long but the lower ones decreasc rapidly in length. The second free ray is the longest and reaches back to the base of the first anal ray ; all are connected at their bases by membrane. The ventrals reach backward to the vent, and the caudal is subtruncate in one specimen, and has the middle rays produced in the other.

Colour.—Apparently pink or yellow in life, with some very indefinite darker spots and lines ; the back is crossed by six indistinct darker bands, of which the first is below the spinous dorsal, and the last on the base of the tail. The first dorsal is blackish with several darker wavy cross lines, and the pectorals have some irregular rows of dusky spots. Some very indefinite spots can also be traced on the second dorsal and the caudal. Described from two specimens, 150-197 mm. long.

This species is very similar to *H. langsdorfii*, as figured by Cuvier and Valenciennes [1], but according to those authors and also to Regan [2], the lateral plates are armed with two large subequal spines whereas they have only one each in my specimens. From *H. regani*, Jordan, which was described and figured by Jordan and Richardson [3] as *H. langsdorfii*, mine differ in both the form and armature of the head, the size of the eye, and the lengths and colour-marking of the dorsal and anal rays. Through the kindness of Dr. Barton W. Evermann, I am able to compare this species with a co-type of *H. citrinus*, Gilbert [4] from which it differs in having a much smaller eye, and strong upstanding spines on the upper surface of the head ; the interorbital width is also broader and the lateral scutes rougher. The same characters also distinguish it from *H. acanthopleurus*, Regan [2]. *H. platophrys*, Gilbert [5] and *H. gilberti*, Jordan and Richardson [6] both differ in having the lateral margins of the head straighter and less spinate, while the broad interorbital space distinguishes the former from all the others.

1 Cuvier and Valenciennes—Hist. Nat. Poiss., iv., 1829, p. 264, pl. lxxxi.

2 Regan—Trans. Linn. Soc. (2), xii., 1908, p. 239.

3 Jordan and Richardson—Proc. U.S. Nat. Mus., xxxiii., p. 645, fig. 5.

4 Gilbert—Bull. U.S. Fish. Comm. for 1903, pt. ii., 1905, p. 640, fig. 249.

5 Gilbert—*Loc. cit.*, p. 642, fig. 250.

6 Jordan and Richardson—*Loc. cit.*, p. 647, fig. 6.

The new species is very different from the only other Australian member of the genus, *H. haswelli*, mihi.[7] It has a much smaller and more spinate head, and the lateral margins are divided into lobes. The anal commences in advance of the second dorsal instead of behind it, and the teeth are very much smaller and differently arranged.

I have much pleasure in associating the name of Mr. J Douglas Ogilby with this pretty Queensland species.

Loc.—36½ miles N. 12°E. of Cape Moreton, Queensland, 73 fathoms; September, 9th, 1910.

Family PLATYCEPHALIDÆ.

Genus Elates, *Jordan & Seale.*

Elates thompsoni, *Jordan & Seale.*

(Plate xxviii., fig. 2-2a.)

Elates thompsoni, Jordan & Seale, Bull. U. S. Fish. Bur., xxvi., 1907, p. 39, fig. 12.

Hyalorhynchus pellucidus, Ogilby, New Fish. Queensland Coast, 1911, p. 118.

D. i.v. 13; A. 13; P. 19-21; V. i. 5; C. 14-15; L. lat. 90-99. Head from tip of snout to end of opercular flap 3.35 in the length to the hypural. Depth before the first dorsal 4.6, width 2.7, eye 4.8, snout 2.87, first dorsal spine 2.42, first ray 2.3 in the head.

Body elongate, depressed, the width much greater than the depth. Under surface of anterior half flat. Snout flat, width at angle of maxillary 1.23 in its length. Maxillary reaching the level of the hinder nostril, 3.37 in the head. Lower jaw much longer than the upper. A single large sabre-like spine at the angle of the preoperculum, which is deeply grooved above and below, and is longer than the orbit, being 4 in the head. Three small spines on the bony stay of the cheek, the first just behind the level of the anterior nostril, the second below the pupil, and the last below the hinder margin of the orbit. A rather strong spine on the upper anterior margin of the orbit, and a series of about ten very small ones at the postero-superior margin. A small nuchal spine on each side. Interorbital space narrow, concave, its width less than half that of the pupil. Broad bands of minute teeth on the jaws and very narrow ones on the

7 McCulloch—Rec. Austr. Mus., vi., pt. 5, 1907, p. 351, pl. lxiv.

vomer and palatines. Tongue broad, spatulate, its end truncate or slightly emarginate. Gill-rakers slender, 2.3 in the eye; fourteen on the lower limb of the first arch.

Body covered with small ctenoid scales, which extend forward to the occiput above, and onto the operculum and postorbital portion of the preoperculum. The lateral line is raised but not spiniferous; it extends along the middle of the body and onto the caudal rays, and pierces 90-99 scales between the operculum and the hypural. The rows of scales are rather more numerous there being about 133 between the occiput and the hypural.

First dorsal spine small and isolated; the second is the longest and strongest, and is grooved on either side. First ray of second dorsal placed somewhat nearer the hypural than the tip of the snout; the sixth to the twelfth are widely spaced and joined by membrane only at the base. Anal originating before and terminating behind the dorsal. Upper pectoral ray 2.7, fourth ventral ray about 2 in the head. Ventral spine strong and grooved and placed below the middle of the pectorals. Caudal slightly forked, the upper lobe much the larger and longer, usually with a filament which may be longer than the rest of the fin.

Colourless in formalin; some indefinite markings above the lateral line, and a subdermal row of large dark longitudinal spots directly below it. Head with clusters of minute grey dots forming indefinite spots. Dorsal and caudal fins with blackish spots, the latter also with a large blotch on the lower lobe.

Length of largest specimen, from tip of lower jaw to end of middle caudal rays, 185 mm.

Professor J. O. Snyder has very kindly compared three of the Pine Peak specimens, which were obtained with the types of *Hyalorhynchus pellucidus*, Ogilby, with a co-type of *Elates thompsoni*, Jordan & Seale. He writes that he "finds them to belong to the same species, no important differences appearing."

Locs.—Seventy-five specimens were preserved from the following localities:—

Pine Peak, Queensland, S.59°E.; August, 1910.

Twelve miles north-east of Bowen, Queensland, 19-25 fathoms; August, 1910.

Genus Thysanophrys, *Ogilby*.

Thysanophrys cirronasus, *Richardson*.

Platycephalus cirronasus, Richardson, Voy. "Erebus & Terror," Fishes, 1848, p. 114, pl. li., fig. 7-10. *Id.*, Günther, Brit. Mus. Cat. Fish., ii., 1860, p. 186. *Id.*, Maclcay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 586. *Id.*, Stead, Ed. Fish. N.S. Wales, 1908, p. 113.

D. viii.-ix. 11-12; A. 11-12; P. 20-21; V. i. 5; C. 10-11; lateral line to hypural 53-54. Head $2\frac{1}{3}$-$2\frac{1}{2}$ in the length to the hypural, with very large spines and smooth upstanding ridges which terminate in spines; intermediate areas not rough or spiny, covered with fleshy skin. Traces of some very rudimentary scales on the operculum, none on the preoperculum. Eye $1\frac{1}{2}$-$1\frac{3}{4}$ in the snout, usually with a small tentacle above. Interorbital space deeply concave, half, or less than half the length of the eye. Maxillary reaching to below the anterior third or nearly to the middle of the eye. Bony stay of cheek without spines; preoperculum with two stout, but short subequal spines. Teeth minute, subequal, inner ones a little larger than the others. They form a broad band on the upper jaw, and a narrower one on the lower; two short, parallel bands on the vomer, and a long narrow one on each palatine.

Scales before the dorsal fin rudimentary; those of the lateral line enlarged and thickened but not spiny. Caudal rounded. Colour reddish with darker marbling; some dark patches at the bases of the dorsal fins which tend to form cross-bars. Fins with violet lines and spots.

Loc.—This species is only known from New South Wales. I have examined seven specimens from near Sydney and one from Bulli. The largest is 385 mm. long.

Genus Insidiator, *Jordan & Snyder*.

Insidiator, Jordan & Snyder, Proc. U.S. Nat. Mus., xxiii., 1900, p. 368 (*Platycephalus rudis*, Günther).

Grammoplites, Fowler, Journ. Ac. Nat. Sci. Philad., xii., 1904, p. 550 (*Platycephalus scaber*, Linnæus).

Thysanophyrys, Jordan & Richardson, Proc. U.S. Nat. Mus., xxxiii., 1908, p. 631 (not of Ogilby).

This genus differs from *Thysanophrys* in having no enlarged and thickened scales on the lateral line, and in having scales on the head and nape. The definition given by Jordan & Richardson under *Thysanophrys* really applies to *Insidiator*.

Head broad and much depressed, armed with spines and serratures. Angle of preoperculum with two or more spines; no antrorse spine on its lower face. Teeth usually villiform, sometimes cardiform; in bands on the jaws and palatines, and two separate groups on the vomer which are set lengthwise along the shaft of the bone. Scales large or small, in 30 (*I. grandisquamis*, Regan) to 110 (*I. nematophthalmus*, Günther) rows. Lateral line smooth, or armed with spines, partially or for its whole length.

The following key will assist in the determination of the Australian species.

a. Eyes smaller and round, the interorbital space about equal to their vertical diameter.

b. Tail with two large dark blotches. Infraorbital ridge with one spine.....*bosschei*.

bb. Tail without dark blotches. Infraorbital ridge with four spines.....*malayanus*.

aa. Eyes larger, elliptical, the interorbital space less than their vertical diameter.

c. Anterior third of lateral line with distinct, upstanding spines.

d. Upper preopercular spine very large, about as long as the eye.....*macracanthus*.

dd. Upper preopercular spine much shorter than the eye.

e. Infraorbital ridge expanded outwards posteriorly, overhanging the cheek. .....*tuberculatus*.

ee. Infraorbital ridge not overhanging the cheek posteriorly.....*jugosus*.

cc. Anterior third of lateral line with indistinct prostrate spines.....*harrisii*.

ccc. Only a few anterior lateral line scales with spines.

f. Teeth of palate enlarged, cardiform.....*diversidens*.

ff. Teeth villiform.

g. An orbital tentacle. Dorsal and caudal with blackish lines.....*nematophthalmus*.

gg. No orbital tentacle. Fins without blackish lines.....*parilis*.

INSIDIATOR BOSSCHEI, *Bleeker*.

Platycephalus Bosscheis, Bleeker, Nat. Tijdschr. Nederl. Indie, xxi., 1860, p. 140.

Platycephalus Bosschei, Bleeker, Atl. Ichth., ix., 1877, pl. ccccxix., fig. 3-3a.

Platycephalus isacanthus, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 585 (not of Cuv. and Val.)

D. ix. 12-13; A. 12; P. 20; V. i. 5; C. 9-11. Head 3.23-3.37 in the length to the hypural. Eye small, rounded, 6.09-6.81 in the head, and 2.21-2.57 in the snout. Interorbital space concave, $\frac{2}{3}$-$\frac{3}{4}$ the diameter of the eye. Maxillary not quite reaching the middle of the eye. Head with rather low ridges which terminate in spines. A large anterior ocular spine; supraocular ridges ending in two or three spines of which the posterior is the largest. The cranial ridges follow directly behind these, and each terminates in a strong spine; there are some indistinct ridges radiating backwards from the terminal supraocular spine. A short median ridge without a spine. The ridge from behind the eye to the suprascapular bears four spines; the suprascapular has one spine and the scapular may or may not be armed. Bony stay of cheek with one spine below the hinder margin of the eye. Preopercular spines short and subequal, the upper acute, the lower obtuse. Teeth minute, subequal, forming a broad band on the upper jaw and a narrower one on the lower; two short and broad, parallel bands on the vomer, and a long narrow one on each palatine.

Scales moderate, ctenoid, in sixty three or ninety three rows above the lateral line according to the direction in which they are counted. They extend forward onto the nape, and onto the opercles and postorbital part of the preopercles. Those of the lateral line are not differentiated from the others. Caudal rounded.

Colours after long preservation.—Brown above, with indications of darker cross-bands: the head and sides of the body are closely speckled and marbled with lighter and darker markings. Lips and cheeks with broad brown cross-bars. Spines and rays of dorsal fins, caudal, pectoral, and hinder ones of anal with rows of brown spots. Ventrals darker with whitish wavy lines. Caudal with two characteristic brown blotches, one at the postero-superior angle and the other covering the whole lower margin.

In the small eyes and colour-markings this species is very similar to *T. malayanus*, but it is easily distinguished by its smaller scales, in lacking the posterior spines on the bony stay of the cheeks, and in having two large dark blotches on the tail.

Locs.—Described from three specimens, 257-315 mm. long, in the Macleay Museum, from Port Darwin, Northern Territory, and Palm Islands and Cape Grenville, Queensland. They are those identified by Macleay as *Platycephalus isacanthus*, Cuvier & Valenciennes, but they differ from that species in having very much smaller eyes and in general colour-marking, etc. They agree very well with Bleeker's description and figure of his *P. bosschei*.

INSIDIATOR MALAYANUS, *Bleeker*.

Platycephalus malayanus, Bleeker, Nat. Tijdschr. Ned. Ind., v., 1853, p. 498; and Atl. Ichth., ix., 1877, pl. ccccxix., fig. 2-2a. *Id.*, Günther, Brit. Mus. Cat. Fish., ii., 1860, p. 184.

D. ix. 12; A. 12; P. 20; V. i. 5; C. 11; L. lat., to hypural, 53. Head almost 3 in the length to the hypural, with small spines and low ridges terminating in spines; supraocular ridge with about six spines posteriorly, and not followed by a series of radiating ridges. Well formed scales cover the operculum and the upper part of the preoperculum. Eye small, $1\frac{1}{2}$ in the snout, without tentacles. Interorbital space flat, only the supraocular edges raised, and two-thirds the diameter of the eye. Maxillary reaching to below the anterior fourth of the eye. Bony stay of cheek with four spines, of which three are behind the eye; preoperculum with two spines, the lower very small or rudimentary. Teeth minute, subequal, the inner ones a little larger than the others. They form a broad band on the upper jaw and a narrower one on the lower; two widely separated elliptical groups on the vomer, and a long narrow one on each palatine.

Scales before the dorsal fin well developed; those of the lateral line are only half the size of the others. There are 51 or 65 rows above the lateral line according to the direction in which they are counted, and 53 pierced scales on the line itself; owing to the intercalation of an extra row of scales between each of the others anteriorly, one counts about seventy four rows along the middle of the sides. Caudal rounded. Sandy yellow, with three indistinct cross bands, of which the anterior is much the widest. Head variegated with regular wavy bands and

spots which have fine darker edges. Back speckled with minute brown dots. Spines and rays of all the fins except the anal with oblique rows of brown spots.

Loc.—Described from a single specimen, 228 mm. long, which I collected at Murray Island in Torres Strait, which agrees well with Bleeker's description and figure.

INSIDIATOR MACRACANTHUS, *Bleeker*.

Platycephalus macracanthus, Bleeker, Versl. Akad. Amsterdam (2), iii., 1869, p. 253, and *Loc. cit.*, xix., 1879, p. 22, also Atl. Ichth., ix., 1877, pl. ccccxxix., fig. 1. *Id.*, Day, Fish. India, 1878, p. 276, pl. lix., fig. 3.

D. ix. 11-12; A. 12; P. 19-20; V. i. 5; C. 11; L. lat. 53-54. Head 2.8-2.9 in the length to the hypural. Eye 3.9-4.5 in the head and 1.1-1.2 in the snout, which is 3.1-3.6 in the head. Interorbital width 2.6-4 in the eye.

Upper surface of head with large bony plates, which are rough with granular ridges radiating from large upstanding spines. A large anterior orbital spine; hinder half of supraorbital ridge coarsely denticulated. Bony stay of cheek arising in a star-like cluster of ridges on the preorbital, and armed along its length with numerous spines; these may be either very strong or rather weak, and the two largest are placed below the eye. Preoperculum usually with three spines, of which the upper is very large and strong; and is usually about as long as the eye. Interorbital space concave. Maxillary reaching to below the anterior third or fourth of the eye. Teeth minute, subequal, forming a broad band on the upper jaw, and a narrower one on the lower. There are two short and widely separated bands on the vomer, and a long, very narrow one on each palatine. No orbital tentacle.

Lateral line scales not enlarged, those of the anterior third armed with rather strong spinules. Well formed scales cover the operculum and postorbital part of the preoperculum. There are 54-55 and 71-77 rows of scales above the lateral line according to the direction in which they are counted.

Colour.—Brownish above, lighter below, the scales of the ventral surface sometimes margined with blackish dots. First dorsal dusky with black spots; second lighter with rows of dark spots. Pectorals light-coloured above and dusky below, or dusky with a large light spot on the upper half. Ventrals and caudal dusky with lighter margins. Anal white.

A series of thirty-two specimens, 128-204 mm. long, exhibits two well marked forms which may be sexual. In one, repre-

sented by seven specimens, the spines on the infraorbital ridge are very strong and overhang the cheek below them. The first dorsal, pectoral, and ventral fins, as well as the under surface, are much darker than in the others, and the pectoral always has a light oval spot on its upper half. This form agrees well with Bleeker's figure as regards the armature of the head, but not in the colour. The second form only differs in having the spines on the suborbital ridge smaller, and the colouration of the fins lighter; the light patch on the pectorals is also absent. It is represented by the remaining twenty-five specimens, which agree perfectly with an example from Dr. Day's collection in the Australian Museum, from Madras.

Loc.—All the "Endeavour" specimens were trawled seven to twenty miles off Bowen, Queensland, in 15-35 fathoms, on a muddy bottom; August 2 and 3, 1910.

INSIDIATOR TUBERCULATUS, *Cuvier & Valenciennes.*

(Plate xxix.; Fig. 10.)

Platycephalus tuberculatus, Cuvier & Valenciennes, Hist. Nat. Poiss., iv., 1829, p. 258. *Id.*, Günther, Brit. Mus. Cat. Fish., ii., 1860, p. 186. *Id.*, Day, Fish. India, 1878, p. 275, pl. lx., fig. 5.

D. viii.-ix. 11; A. 11; P. 20-22; V. i. 5; C. 11; L. lat. 52-53. Head 2.6 in the length to the hypural. Eye 3.6-3.8 in the head, and equal to, or a little shorter than the snout, which is 3.2-3.6 in the head. Interorbital width 3-3.6 in the eye. Third dorsal spine 2.06-2.7 in the head.

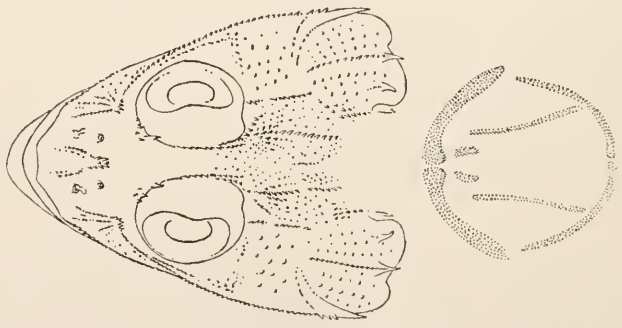

Fig. 10. Upper view of head and teeth of *Insidiator tuberculatus*.

Head rough, with all the exposed ridges minutely serrated. Two or three anterior orbital spines; supraorbital margin elevated, consisting of a single row of denticles anteriorly, and one or two behind. Interorbital space concave. The whole

upper surface of the cranium is roughened with small granular spines, the arrangement of which, together with the ridges, is shown in the accompanying figure. Ridges on the upper surface of the snout denticulated, and terminating in a cluster of spines between the posterior nostrils. Preorbital with an indistinct series of radiating ridges, from which the infraorbital one extends backwards to the preopercular spine; this is minutely and evenly serrated along its whole length, and it projects outwards so as to overhang the cheek below it. Preoperculum with 3-5 spines, of which the upper is much the longest, and is equal to about one half the length of the eye; no antrorse spine. Opercular ridges serrated, terminating in large spines.

Both nostrils tubular, the anterior with a skinny tentacle; no supraocular tentacle. Teeth extremely minute, forming a broad band on the upper jaw and a narrow one on the lower. They are a little larger on the palate, and are arranged in two widely separated, parallel groups on the vomer, and a long narrow band on each palatine.

Body covered with rather large, coarsely ctenoid scales. On the operculum and postorbital portion of the preoperculum they are deeply imbedded and almost rudimentary. Lateral line scales similar to, but smaller than the others, and the first 15-20 are armed with strong spines.

Origin of the dorsal just behind the end of the head; the anterior spine is well developed, and the third is the longest. The second ray is the highest, and may be either a little shorter than, or longer than the longest spine; the following rays gradually decrease in length. Anal originating a little behind, and terminating well behind the second dorsal; the rays are subequal in length. The ventrals reach the base of the second or third anal ray; the spine is moderately strong, and the inner ray is simple. Pectorals broadly rounded, reaching beyond the middle of the first dorsal. Caudal slightly rounded.

Colour in formalin.—Brownish above, with traces of the usual dark cross-bands: some more or less definite spots on the sides of the head and body. Dorsal and caudal fins with small rounded spots which may be indistinct, the first dorsal with a broad dusky margin. Pectorals and ventrals with striking dark spots which coalesce into large blotches, and with broad white margins. Anal white.

Loc.—Described from eight specimens, 50-116 mm. long, trawled in Platypus Bay, Queensland, in 7-9 fathoms. The smallest differs from the others only in having the head somewhat less rough between the ridges. They agree perfectly with a specimen from Dr. Day's collection in the Australian Museum, as well as with his description and figure.

INSIDIATOR JUGOSUS, *sp. nov.*

(Plate xxx., fig. 2; Fig. 11.)

D. viii-ix. 11-12; A. 11-12; P. 21-22; V. i. 5; C. 12-13; L. lat. 52-53. Head, from tip of snout to end of opercular flap, 2.54-2.62 in the length to the hypural. Breadth of body 1.72-1.95, depth 2.55-2.97 in the head. Eye 4-4.57 in the head, and 1.21-1.42 in the snout, which is 3.25-3.42 in the head. Interorbital space 2.88-3 in the eye. Third dorsal spine 2.82-2.4, second dorsal ray 2.46-2.78, caudal fin 1.7-1.94, longest pectoral ray 2.12-2.40, fourth ventral ray 1.42-1.56, and tenth anal ray 3.36-3.82 in the head. Caudal peduncle 1.5-1.73 in the eye.

Head rough, with some small spines on the upper parts, and all the exposed ridges finely denticulated. A strong spine, surrounded by several smaller ones on the antero-superior margin of each orbit; supraocular margin elevated, consisting of a single row of denticles anteriorly and several rows behind. Interorbital space deeply concave. Preorbital with a radiating series of denticulated ridges, from which the infraorbital series extends backwards to the preoperculum which bears a slightly enlarged spine below the hinder margin of the eye. Preoperculum with two, sometimes three spines, the upper one the larger though its length is less than the width of the interorbital space; no antrorse spine on the lower surface. Operculum with two strong spines, the lower terminating an oblique denticulated ridge. Cranium with a series of three or four ridges diverging backwards from the base of a small spine behind the eye on each side; besides these there are several other spines and ridges, the arrangement of which can be seen in the figure.

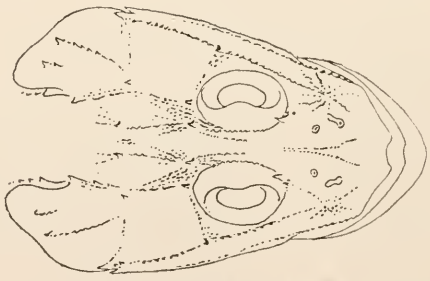

Fig. 11. *Insidiator jugosus.*

Anterior nostril with a short tentacle, posterior nostril tubular; no supraocular tentacle. Opercular membrane with a large tongue-like lobe below the preopercular spines. Teeth minute, closely set in a broad band on the upper jaw, with some larger inner ones near the symphysis. On the lower jaw they are

uniform and arranged in a narrow band. They are somewhat larger on the vomer, and form two widely separated, rather elongate patches which are broader in front than behind. Palatines each with a long narrow band, the anterior teeth the largest. Tongue spatulate, truncate or emarginate anteriorly.

Body covered with moderately large ctenoid scales which extend forward onto the operculum, and postorbital portion of the preoperculum. The scales of the lateral line are raised but not enlarged; the anterior eight to fifteen bear very small spines. There are fifty-two rows above the lateral line, but they are more numerous below it owing to the interpolation of an extra row between each of the others anteriorly. There are five scales between the lateral line and the first dorsal spine.

Origin of the first dorsal fin between the ends of the opercles. First spine separated from the others and only joined to the base of the second by membrane; the other spines are weak, and the third is the longest. Second dorsal ray longest, the others gradually decreasing in length. Anal commencing a little behind, and terminating well behind the second dorsal; its rays are shorter than those of that fin, and they gradually increase in height to the penultimate one. Caudal broadly rounded. Ventral reaching to the second or third anal ray; the spine is weak, and the inner ray is simple. Pectoral broadly rounded; the fourth or fifth upper ray is the longest, and reaches to a little behind the middle of the first dorsal.

Colour in formalin.—Greyish or brownish above, white below. Back with four dark cross-bands, of which the first is very broad and corresponds with the base of the first dorsal, or it may be indistinctly divided into two. The next two are narrower, and cross the base of the second dorsal, and the third is on the caudal peduncle. Lips and cheeks with brown cross-bars, the most prominent of which is a broad double one below the eye. All the fins, with the exception of the anterior part of the anal, bear oblique rows of large brown spots.

Described from ten specimens, 139-206 mm. long, from off Hervey Bay, Queensland. The largest example is selected as the type.

Locs.—In all, thirty-three specimens were preserved from the following localities in Queensland.

Near Bowen.

Hummocky Island, S.7°E., seven miles; July 30, 1910.

Thirteen miles S. East from Cape Capricorn; July 29, 1910.

Off Hervey Bay; July 27, 1910.

Mouth of Wide Bay; July 15, 1910.

Four others are in the Australian Museum collection, of which three were trawled in Port Jackson, and one in Port Stephens, New South Wales.

INSIDIATOR HARRISII, *sp. nov.*

(Plate xxx., fig. 1; Fig. 12.)

Br. 7; D. ix. 11-12; A. 11-12; P. 20-25; V. i. 5; C. 11-13; L. lat. 53. Head 2.61-2.86 in the length to the hypural. Eye 4.24-4.48 in the head, and 1.2 in the snout, which is 3.71-3.53 in the head. Interorbital width 3.22-4.16 in the eye. Third dorsal spine 2.76-2.46 in the head.

The ridges of the head are moderately prominent and smooth, and end in low spines. A strong anterior orbital spine; posterior half of supraorbital ridge with eight to ten small denticles. Interorbital space moderately concave. Two post-ocular spines on each side, from the inner of which a series of low, radiating ridges extends backwards towards two medio-lateral spines on the cranium; from the outer ones a sinuous ridge runs backwards to the suprascapular, which is armed with about three spines. One or more very small spines on the ridges between the anterior nostrils. Bony stay of the cheek arising in a star-shaped cluster of bony ridges on the preorbital: it is armed with two distinct spines, one a little before the middle of the eye, and the other behind its hinder margin: several smaller denticles may also be present. Preoperculum armed with two short spines, the upper the longer, its length less than the width of the interorbital space; a slightly projecting angle of the bone below these perhaps represents a third spine. Opercular ridges smooth, terminating in spines.

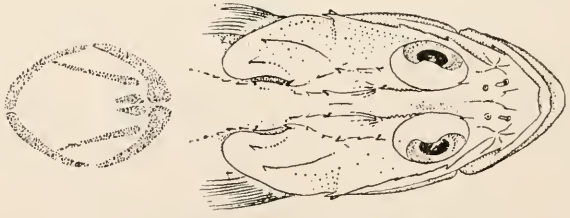

Fig. 12. *Insidiator harrisii.* Head and teeth.

Anterior nostril with a short tentacle, the posterior tubular; no supraocular tentacle. A skinny lobe may or may not be present on the lower border of the operculum. Teeth minute, granular and subequal, forming a broad band on the upper jaw, and a narrower one on the lower; two parallel groups on the vomer, and a rather narrow band on each palatine.

Body covered with rather large ctenoid scales, which extend forward onto the operculum and postorbital part of the preoperculum. Lateral line scales similar to those of the body, the anterior three or four with strong spines, and the ten following with very minute, almost prostrate spines. There are about fifty-three or seventy-six rows of scales above the lateral line, according to the direction in which they are counted.

Origin of the first dorsal between the ends of the opercles. The anterior spine is joined to the base of the second by a low membrane, and the third is the highest. The second dorsal ray is the highest, a little shorter or rather longer than the longest spine; the following rays gradually decrease in length. Anal commencing a little behind, and terminating well behind the second dorsal; its rays are shorter than those of that fin, and gradually increase in height to the penultimate one. Caudal rounded. Ventral reaching to, or a little beyond the origin of the anal, its spine very weak and the inner ray simple. Pectoral broadly rounded, reaching to below the middle of the first dorsal fin.

Colour in formalin.—Greyish above with very indefinite traces of darker cross-bands; head and back finely speckled with brown dots. Spines and rays of the dorsal fins with small brown dots. Anal whitish, posterior rays with dark spots. Pectorals and ventrals spotted. Caudal dusky, with large blackish brown spots.

I have much pleasure in associating with this new species, the name of my friend Dr. R. Hamlyn-Harris, Director of the Queensland Museum, to whom I am indebted for much valuable assistance when working at the collections under his charge.

This species may be *I. batuviensis*, Bleeker [1], but appears to differ in having only fifty-three instead of sixty scales on the lateral line, and two preopercular spines instead of three. It is also very similar to *I. isacanthus*, Cuvier & Valenciennes [2], which likewise has sixty scales and a somewhat smaller eye.

Locs.—Described from two specimens, 183-204 mm. long, of which one is from near Pine Peak, Queensland, and the other from Moreton Bay. Five others are in the collection which were trawled off Bowen in about 16 fathoms.

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1 Bleeker—Nat. Tidschr. Ned. Ind., iv., 1853, p. 460, and Atl. Ichth., ix, 1877, pl. ccccxx., fig. 4, 4a.

2. Cuvier & Valenciennes—Hist. Nat. Poiss., iv., 1829, p. 246. *Id.* Sauvage, Bull. Nouv. Arch. Mus. Paris, ix., 1873, p. 55, pl. vii., fig. 1, 1a.

INSIDIATOR DIVERSIDENS, *sp. nov.*

(Plate xxxi., fig. 1; Fig. 13.)

Br. 7; D. i,vii, i-ii., 11; A. 12; P. 18-19; V. i, 5; C. 12-13; L. lat. 52-53. Head 2.52-2.70 in the length to the hypural. Eye 4.04-4.78 in the head, and 1.21-1.52 in the snout, which is 3.03-3.33 in the head. Interorbital width 2.71-4.2 in the eye. Third dorsal spine 2.65-2.75, breadth before the pectorals 1.83-2.02, and depth 3.38-4.04 in the head.

The ridges of the head are strong and a little denticulated, and terminate in strong spines. A strong anterior orbital spine; hinder half or two-thirds of the supraorbital ridge with about ten strong denticles. Interorbital space concave. Two postocular spines on each side, from the inner of which a series of prominent, radiating ridges extends backward. A small median and two medio-lateral ridges on the cranium, each of the latter armed with a strong spine. Between the outer postocular spine and that above the articulation of the preopercle, are several minute denticles, and there is another large spine before the suprascapular one. Ridges on anterior portion of snout minutely serrated. Bony stay of cheek arising in a star-shaped cluster of ridges on the preorbital; it is rather coarsely serrated along its whole length, and there are two or three spines, the first on the preorbital, the second before the middle of the eye, and the third before the posterior orbital margin. Preoperculum armed with two spines, the upper much the longer, its length considerably more than the width of the interorbital space; a third smaller spine springs from its upper surface near the base. Opercular ridges smooth, terminating in spines.

Fig. 13. *Insidiator diversidens.* Head and teeth.

Anterior nostril with a short tentacle, the posterior tubular. No supraocular tentacle, and no skinny lobe on the lower border of the operculum. Teeth larger than usual in the genus. They are arranged in a band on the upper jaw which is narrow on the sides and broader anteriorly; the inner ones are larger than the outer, and those near the symphysis are elongate and cardiform. They are smaller on the lower jaw, and are arranged in two

rows in front and singly on the sides, with some microscopic, villiform ones at their bases. They are cardiform on the vomer, and form two rather elongate, parallel patches, several series wide. A long, equally broad band of similar teeth is present on each palatine.

Body covered with rather large ctenoid scales, which extend onto the operculum and postorbital portion of the preopercnlum. Lateral line scales similar to those of the body, the anterior three or four with spines. There are about seventy and eighty-six rows above the lateral line according to the direction in which they are counted.

Origin of the first dorsal just behind the head; the anterior spine minute, the third the highest. The second dorsal ray is the highest, and is about the same length as, or shorter than the longest spine: the following rays gradually decrease in length. Origin of anal a trifle behind that of the second dorsal, and its termination far behind that fin; its rays are much shorter and subequal in length. Upper caudal rays longer than the lower, the margin subtruncate. Ventrals reaching to the base of the second anal ray, the spine rather weak and the inner ray simple. Pectoral broadly rounded, reaching beyond the middle of the first dorsal fin.

Colour in formalin.—Brownish above, with traces of the usual darker cross-bands. Sides of head and body with more or less distinct, large, brown spots. Dorsal fins with dusky spots, which coalesce to form a broad dark margin on the spinous portion. Anal white. Pectorals and ventrals dusky and spotted. Caudal with some very striking black blotches posteriorly and near the base.

This species closely resembles *I. harrisii*, but may be at once distinguished by its much larger teeth and longer snout. The maxillary also reaches backward only to the anterior fourth or the front margin of the eye; the ridges of the head, especially the radiating ones on the cranium, are stronger; and the caudal is truncate instead of rounded, and has a more striking colouration.

Locs.—Described from three specimens, 252-286 mm. long, from seven miles S.21°W. of Port Stephens Lighthouse, New South Wales, in 48 fathoms.

Insidiator nematophthalmus, *Günther.*

Platycephalus nematophthalmus, Günther, Brit. Mus. Cat. Fish., ii., 1860, p. 184; and Journ. Mus. Godeff., v., 1876, p. 166, pl. cvii., fig. e. *Id.*, Bleeker, Atl. Ichth., ix., 1877, pl. ccccxx., fig. 3. *Id.*, Macleay, Proc. Linn. Soc. N.S.

Wales, ii., 1878, p. 356. *Id.*, Klunzinger, Sitzb. Akad. Wiss. Wien., lxxx.i., 1879, p. 367. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 586.

Platycephalus staigeri, Kent, Great Barrier Reef, 1893, p. 292, pl. lxiii., fig. 6 (not of Castelnau).

D. viii-ix. 11; A. 11; P. 19-20; V. i. 5; C. 11; L. lat. 54. Head $2\frac{3}{4}$-$2\frac{9}{10}$ in the length to the hypural, with spines and ridges which terminate in spines. Supraocular ridge usually with four spines posteriorly, and followed by a series of radiating ridges. Well formed scales cover the operculum, and postorbital portion of the preoperculum. Eye about one and a half in the snout, with a large branched tentacle above. Interorbital space deeply concave, two-fifths to almost one-half the diameter of the eye. Maxillary reaching to below the anterior third or nearly to the middle of the eye. Bony stay of cheek with one or two weak spines; preoperculum with two short spines which are subequal, or the upper is a little the longer. Teeth minute, subequal, the inner ones a little larger than the others. They form a broad band on the upper jaw, and a narrower one on the lower; two parallel bands on the vomer, and a narrow one on each palatine.

Scales before the dorsal fin well developed; those of the lateral line not enlarged and scarcely distinguished from the others posteriorly. There are from 95-110 and 63-65 rows above the lateral line according to the direction in which they are counted. Candal more or less rounded.

Upper surfaces brown or blackish and sharply separated from the light colour of the lower surface on the sides of the head and body. Some striking brown spots below the eye. Seven distinct bands cross the back, of which three correspond with the first dorsal, three with the second, and one or sometimes two are on the caudal peduncle. All the fins are spotted and variegated with brown and white, and the dorsal and caudal are crossed by fine blackish streaks.

The above diagnosis is drawn up from nine specimens, 225-300 mm. long.

Locs.—Five were preserved in the "Endeavour" collection from off Hervey Bay, Queensland, July 27th, 1910. Others are in the Australian Museum from Moreton Bay, and Murray Island, Torres Strait.

Insidiator parilis, *sp. nov.*

(Plate xxxi., fig. 2; Fig. 14.)

Platycephalus japonicus, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 585 (? not of Tilesius.)

Br. 7; D. viii-ix. 11; A. 11; P. 20-21; V. i. 5; C. 11; L. lat. 54. Head 2.7-2.8 in the length to the hypural. Eye 4.7-5.7 in the head, and 1.6-1.7 in the snout, which is 2.8-3.2 in the head. Interorbital space 3.1-4.5 in the eye. Third dorsal spine 2.5 in the head.

The ridges of the head are prominent and smooth, and terminate in strong spines. A strong anterior orbital spine; posterior half of supraorbital ridge with about four small spines. Interorbital space deeply concave. Two postocular spines on each side, from the inner of which a series of radiating ridges extends backwards. A low median ridge and a prominent mediolateral spine on each side of it. From the outer postocular spine a broken ridge extends backwards to the suprascapular which is armed with three strong spines. Snout unarmed. Bony stay of cheek with two spines, the first a little before the middle of the eye and the second below its hinder margin. Preoperculum armed with two short spines of which the upper is slightly the longer, and about equal to the width of the interorbital space. Opercular ridges smooth, terminating in strong spines.

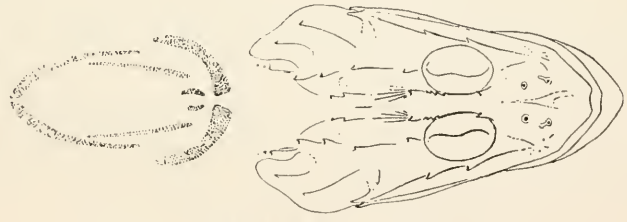

Fig. 14. *Insidiator parilis.* Head and teeth.

Anterior nostril with a short tentacle, posterior tubular; no supraocular tentacle. A large skinny lobe on the lower border of the operculum. Teeth minute, subequal, the inner ones a little larger than the others. They form a broad band on the upper jaw and a narrower one on the lower; two parallel bands on the vomer and a narrow one on each palatine.

Body covered with ctenoid scales which extend forward onto the operculum and postorbital portion of the preoperculum; those of the lateral line are not enlarged and are unarmed. There are 90-105 or 60-67 rows above the lateral line according to the direction in which they are counted.

Origin of the first dorsal just behind the end of the head; the anterior spine is well developed and the third is the highest. The rays are lower than the longest spine and are subequal in length. Anal beginning and ending behind the soft dorsal; its rays are lower than those of that fin and gradually increase in length to the penultimate one. Caudal rounded. Ventrals reaching to the base of the second anal ray; the spine is weak and the inner ray is simple. Pectoral broadly rounded and reaching to beyond the middle of the first dorsal fin.

Colour.—Upper surface blackish or brown, sharply separated from the light colour of the lower surface on the sides of the head and body. Seven rather distinct bands cross the back, of which three correspond with the first dorsal, three with the second, and one is on the caudal peduncle. The lower jaw, cheeks and sides of the body are marked with striking brown spots of which the most prominent forms a band below the eye. All the fins are variegated with brown and white but the dorsal and caudal are not crossed by fine black lines; the basal half of the first dorsal transparent, the outer portion blackish.

It is with much hesitation that I venture to supply this species with a new name. It is closely allied to several species including *I. japonicus*, Tilesius, and *I. quoyi*, Bleeker, but apparently differs from all in the relative sizes of the eye and the snout, and in the colour marking. It may be at once distinguished from *I. tentaculatus*, Ruppell, of which I have a specimen for comparison, by its much larger eye, while it differs from *I. nematophthalmus*, Günther, in having a longer snout, but no orbital tentacle and in lacking the characteristic black lines of the dorsal and caudal fins.

Locs.—Described from three specimens 148-295 mm. long, of which two are from Port Darwin, and the other is from Mapoon, Gulf of Carpentaria. One of these is the specimen which Macleay identified as *Platycephalus japonicus*.

Family TRIGLIDÆ.

Genus Pterygotrigla, *Waite*.

Pterygotrigla picta, *Günther*.

Trigla picta, Günther, "Challenger" Rept., Zool., i., 1880, Shore Fishes, p. 24, pl. xiii., fig. a.

Pterygotrigla andertoni, Waite, Proc. N. Zeal. Inst., 1910, p. 26.

Pterygotrigla picta, Waite, Rec. Cantb. Mus., i., pt. 3, 1911, p. 252, pl. lv.

The " Endeavour " collection includes five specimens, 175-325 mm. long, while a co-type of *P. andertoni* from the Bay of of Plenty, New Zealand, is in the Australian Museum. They differ from Günther's figure only in being less spotted, though the New Zealand specimen is better marked than the Australian ones. The inner surfaces of the pectoral fins are either uniform black with broad white margins, or more or less spotted with white; the ventrals, anal and caudal fins are without markings or have indefinite traces of darker spots. Two of my specimens have eight instead of seven dorsal spines, and all have twelve rays instead of eleven as in Günther's specimen.

Apart from its colour marking, *P. picta*, is very similar to *P. polyommata*, Richardson, but has much larger bony-plates surrounding the dorsal spine, and a broader interorbital space.

Locs.—25 miles South-west of Cape Everard, Victoria, 83-98 fathoms; 21st April, 1910.

Eastern edge of Bass Strait, between Babel Island and Gabo Island, Victoria, 60-100 and 100-220 fathoms; December, 1912.

PTERYGOTRIGLA POLYOMMATA, *Richardson*.

Pterygotrigla polyommata (Richardson), Waite, Mem. Austr. Mus., iv., pt. 1, 1899, p. 108.

Locs.—Four specimens were preserved from the following localities:—

Eastern edge of Bass Strait, between Babel Island and Gabo Island, Victoria, 60-100 fathoms; December, 1912.

Off the East coast of Flinders Island, Bass Strait, 40 fathoms.

Oyster Bay, Tasmania, 40-60 fathoms.

FAMILY PINGUIPEDIDÆ.

Genus PARAPERCIS, *Bleeker*.

Percis, Bloch & Schneider, Syst. Ichth., 1801, p. 179 (*P. maculata*, Bl. & Schn. Preoccupied).

Parapercis, Bleeker, Versl. K. Akad. Amst., xvi., 1864, p. 361 (*Sciæna cylindrica*, Bloch,—*fide* Weber, " Siboga " Exped., lvii., 1913, p. 518).

Neopercis, Steindachner, Denkschr. Akad. Wiss. Wien., xlix., 1884, p. 212 (*N. ramsayi*, Steindachner).

Chilias, Ogilby, Proc. Roy. Soc. Qld., xxiii., 1910, p. 40 (*Percis stricticeps*, de Vis).

According to the definitions of the genera *Parapercis* and *Neopercis*, the former has the palatine bones smooth, while they bear teeth in the latter. These characters, however, are not constant, since I find small but distinct teeth in several Queensland examples of *P. cylindrica* which is the type of *Parapercis*. Further, in two specimens of *P. ramsayi*, on which *Neopercis* is based, palatine teeth are present in one and absent in the other, as is proved by dissecting out the bone from the flesh.

Another character, the form of the spinous dorsal, has also been used to differentiate the two genera, but this is likewise invalid. The median spines should be longer than the others in *Parapercis*, while they increase in length backwards in *Neopercis*. In *P. allporti*, however, which has no palatine teeth, the posterior spines are not shorter than the preceding ones.

Chilias, Ogilby, was formed for *Percis stricticeps*, de Vis, but as I have already shown,[1] some of the characters on which it was founded are not present in that species.

Nevertheless, though the characters attributed to these several genera have proved either incorrect or inconstant, yet others may be found which subdivide the large, natural genus *Parapercis* into several smaller groups. In the following key, therefore, I have maintained *Parapercis*, *Neopercis*, and *Chilias* as subgenera, the characters here given being constant in the large series of specimens examined.

Key to the Australian species of PARAPERCIS.

a. Last dorsal spine shorter than the preceding ones.

b. Lateral line following the curve of the back; cheek scales large ..... sub. gen. PARAPERCIS.

c. Cross-bands very distinct; longitudinal stripe, if present, indistinct ..... *cylindrica*.

cc. Cross-bands less distinct; a well marked, wavy longitudinal stripe ..... *haackei*.

bb. Lateral line extending along middle of sides posteriorly; cheek scales minute ..... sub. gen. CHILIAS.

d. No blue lines crossing upper surface of head; outer caudal rays not filiform.

e. Lower jaw much longer than the upper ... *stricticeps*.

ee. Jaws subequal ... *polyophthalmus*[2] and *xanthozona*[3]

1 McCulloch—Rec. Austr. Mus., ix., pt. 3, 1913, p. 386.

2 McCulloch—Rec. Austr. Mus., ix., pt. 3, 1913, p. 386, as *P. hexophthalma* (nec. Cuv. & Val.)

3 Weber—Zool. Forschr. Austr., v., 1895, p. 267.

dd. Narrow blue lines between the eyes and crossing the snout: outer caudal rays filiform..... *nebulosus.*

aa. Posterior dorsal spines not shorter than the preceding ones.....snb. gen. NEOPERCIS.

f. Cross-bars of back indistinct: five large dark blotches below the lateral line; lateral line not following the curve of the back.....*ramsayi.*

ff. Cross-bars of back distinct: no dark blotches below the lateral line.

g. Seven bars from the base of the dorsal; lateral line following the curve of the back.....*allporti.*

gg. Eleven bars from the base of the dorsal; lateral line not following the curve of the back..... *binivirgata.*

PARAPERCIS (PARAPERCIS) HAACKEI, *Steindachner.*

(Plate xxxiv., fig. 2.)

Percis haackei, Steindachner, Sitzb. Akad. Wiss. Wien., lxxxviii.i., 1883 (1884), p. 1070.

D. v. 22; A. 19; P. 13-15; L. lat. 50-53, extending onto base of caudal; L. tr., counted obliquely backwards from origin of anal, 12-13+1+3. Head $3\frac{2}{3}$, height at origin of anal $4\frac{1}{2}$-$5\frac{1}{4}$ in the length to the hypural. Eye equal to or a little shorter than the snout, $3\frac{1}{4}$-$3\frac{2}{3}$ in the head. A band of villiform teeth in each jaw, with an outer row of larger curved canines anteriorly; a curved band on the vomer, and a narrow one on each palatine. Median dorsal spines longer than the others.

Colour.—Sandy coloured in formalin, with a broad, dark, wavy band from the eye to the base of the upper caudal rays, which covers the lateral line for the greater part of its length. Nine grey cross-bars between the pectoral and the caudal, which are most distinct below. Sides of head with some indefinite grey marks; upper lip with two dark spots, lower blackish on the sides. Throat and gill-membranes with or without dark cross-bars. A large dark spot on the anterior dorsal; second dorsal with a row of dark spots somewhat above the middle of its height, and usually with a spot on the base of each ray above the cross-bars on the body. Anal with a dark median band, and a row of spots on the bases of the rays. Caudal dusky below, with, or without indefinite cross-bands.

Ten specimens, 80-95 mm. long, differ from the original description of *N. haackei* in having small, but distinct palatine teeth. Dr. Steindachner has, however, kindly compared one of

the "Endeavour" specimens with his type, and has verified my identification: he further adds that he has overlooked the palatine teeth, which are also present in the type.

Loc.—Investigator Strait, South Australia, 12-20 fathoms: February, 1912.

PARAPERCIS (CHILIAS) NEBULOSUS, *Quoy & Gaimard.*

Percis nebulosa, Quoy & Gaimard, Voy. "Uranie," 1825, p. 349. *Id.*, Günther, Brit. Mus. Cat. Fish., 1860, p. 237. *Id.* Castelnau, Proc. Linn. Soc. N.S. Wales, iii., 1879, p. 351. *Id.*, Maclcay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 563.

Percis emeryana, Richardson, Icones Piscium, 1843, p. 4, pl. i., fig. 1.

Percis coxii, Ramsay, Proc. Linn. Soc. N.S. Wales, viii., 1883, p. 179.

Percis concinna, de Vis, Proc. Linn. Soc. N.S. Wales, ix., 1884, p. 546.

Parapercis nebulosus, Waite, Mem. Austr. Mus., iv., pt. i., 1899, p. iii., and Rec. Austr. Mus., vi., 1905, p. 75. *Id.*, Ogilby, Proc. Roy. Soc. Qld., xxiii., 1910, p. 40.

Fifteen specimens, 170-270 mm. long, agree with Richardson's figure of *P. emeryana* and the type of *P. coxii*, Ramsay. They vary somewhat in colour-marking and in the development of the candal filaments. The greater number are without any cross-bands on the body, which may be due to their preservation in formalin. In the smallest specimen the caudal is slightly emarginate with the outer angles pointed, but in older ones the outer rays become produced as filaments which are two thirds as long as the head in the largest examples. None have palatine teeth, and the median spines of the first dorsal are longest in all.

Locs.—Off Bustard Head Lighthouse, Queensland. 11-21 fathoms: 8th July, 1910.

Five miles South-west of Boomerang Hill, Frazer Island, 14-16 fathoms; 29th June, 1910.

Twenty two miles North-west of Double Island Point, Queensland, 29 fathoms: 29th June, 1910.

Mouth of Wide Bay, Queensland.

PARAPERCIS (NEOPERCIS) ALLPORTI, *Günther*.

Percis allporti, Günther, Ann. Mag. Nat. Hist. (4), xvii., 1876, p. 394. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, v., 1881, p. 564. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), p. 115, and 1890 (1891), p. 33. *Id.*, Günther, "Challenger" Rept., Zool., i., 1880, p. 28.

Neopercis allporti, Waite, Mem. N.S. Wales Nat. Club, No. 2, 1904, p. 50.

Parapercis ocularis, Waite, Mem. Austr. Mus., iv., pt. i., 1899, p. 109, pl. xxiv., and Rec. Austr. Mus., v., 1904, p. 237.

Though several striking differences occur in the descriptions of *P. allporti* and *P. ocularis*, the large series of specimens in the "Endeavour" collection convinces me that the two species are identical. A large example, 325 mm. long, only differs from Günther's description in having eighteen instead of sixteen anal rays; twenty others also have eighteen, so that Günther's "16" may be a typographical error. The size of the eye is subject to remarkable variation in different individuals, being from 2.7 to almost 4 in the head; the larger eye is usually characteristic of the younger fish, but its size differs greatly in half-grown specimens of the same length. This variation is also present in the "Thetis" examples of *P. ocularis*.

Well preserved specimens sometimes have ten dark bands across the back, of which the first is on the nape, and the last at the base of the caudal. Besides these, there are very faint indications of narrow bars between the others. None of the specimens have palatine teeth, and the last spine of the first dorsal is not shorter than the middle ones.

Locs.—This fish is not uncommon in deeper water on the bank to the eastward of Tasmania. A large series of specimens is preserved from the following localities:—

Between Port Stephens and Newcastle, New South Wales, 22-60 fathoms.

South from Gabo Island, Victoria, 200 fathoms; August, 1913.

East of Flinder's Island, Bass Strait, 30 fathoms.

Oyster Bay, Tasmania, 40-60 fathoms.

South of Cape Wiles, South Australia, 75 fathoms; August, 1909.

Great Australian Bight, west of the meridian of Eucla 70-120 fathoms.

PARAPERCIS (NEOPERCIS) RAMSAYI, *Steindachner*.

Parapercis ramsayi, Steindachner, Sitzb. Akad. Wiss. Wien, lxxxviii. i., 1884, p. 1072.

Percis novæ-cambriæ, Ogilby, Proc. Linn. Soc. N.S. Wales, x., 1885, p. 228.

Parapercis novæ-cambriæ, Waite, Mem. Austr. Mus., iv., pt. i., 1899, p. 111, pl. xxv.

Neopercis novæ-cambriæ, Waite, Rec. Austr. Mus., v., 1904, p. 237.

Suspecting the identity of *P. novæ-cambriæ* and *P. ramsayi*, I forwarded a specimen of the former to Dr. Steindachner for comparison with his type, and he informs me that the two are identical.

Locs.—This fish was not secured by the "Endeavour," the three specimens available to me being taken in Port Jackson. Steindachner's type came from St. Vincent Gulf, South Australia.

FAMILY OPHIDIIDÆ.

Genus GENYPTERUS, *Philippi*.

GENYPTERUS BLACODES, *Bloch & Schneider*.

Ophidium blacodes, Bloch & Schneider, Syst. Ichth., 1801, p. 484.

Genypterus blacodes, Günther, Brit. Mus. Cat. Fish., iv., 1862, p. 379 (part). *Id.*, Regan, Ann. Mag. Nat. Hist. (7), xi., 1903, p. 600. *Id.*, Stead, Proc. Linn. Soc. N.S. Wales, xxxi., 1906, p. 174, and Add. Fish. Faun. N.S. Wales (Dept. Fish. N.S. Wales), p. 25, and Ed. Fish. N.S. Wales, 1908, p. 117, pl. lxxxi. *Id.*, Waite, Rec. Canth. Mus., i., pt. 2, 1911, p. 248.

Genypterus tigerinus, Klunzinger, Arch. Naturg., xxxviii. i., 1872, p. 39; and Sitzb. Akad. Wiss. Wien, lxxx. i., 1879, p. 405.

Genypterus australis, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 164. *Id.*, McCoy, Prodr. Zool. Vict., Dec. iii., 1879, pl. xxvii., fig. 1. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p. 117. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883), pp. 89, 127.

Four young examples, 325-420 mm. long, differ from *G. microstomus*, Regan, in having smaller eyes, which are about as wide as the interorbital space, and in colour-marking. The whole fish is much darker, owing to the brown markings being broader than the interspaces between them, and the dorsal and anal fins have only narrow white margins. They are well represented by McCoy's figure, quoted above.

A very large specimen, 1125 mm. long, differs from the smaller ones in its proportions, the tail being a little shorter, instead of somewhat longer than the head and body. The eye is proportionately smaller, and the interorbital space is much wider; they vary in the five specimens as follows:—Eye 6.9-9.6 in the head, bony interorbital width 7.5-8.6 in the same.

Locs.—East Coast of Flinders Island, Bass Strait—small specimens.

Between Gabo Island and Cape Everard, Victoria, 150-250 fathoms—large specimen.

Genypterus microstomus, *Regan.*

(Plate xiv., fig. 2.)

Genypterus microstomus, Regan, Ann. Mag. Nat. Hist. (7), xi., 1903, p. 599.

In eight specimens, 275-405 mm. long, the eye is 5.4-6.8 in the length of the head; the bony interorbital width is 9.1-10.9 in the same, and not more than two-thirds as wide as the eye. The colour-marking consists of more or less distinct brown, wavy bands, which are about as broad as the interspaces between them; a very prominent black band is present on the posterior portions of the dorsal and anal fins, which also have broad white margins.

The lighter colour-marking, broad white margins of the dorsal and anal fins, the larger eye, and the narrower interorbital space distinguish this species from *G. blacodes*. Regan noted that the maxillary did not reach beyond the hinder margin of the eye as in all the other species of *Genypterus*, but this is not a reliable character. In five of my eight it is as he decribes it, in one the maxillary reaches a little beyond, and in two well beyond the eye; on the other hand, in one of my specimens of *G. blacodes* it ends below the hinder ocular margin.

Locs.—Great Australian Bight, Long. 127-128°E., 160-200 fathoms; May & June, 1913.

Great Australian Bight, Long. 129°E., 350-450 fathoms; 14th May, 1913.

Family LOPHIIDÆ.

Genus Chirolophius, *Regan*.

Chirolophius? laticeps, *Ogilby*.

(Plate xxxii.: Fig. 15.)

Chirolophius laticeps, Ogilby, New Fish. Q'ld. Coast, 1911, p. 136.

D. v. 8; A. 6; P. 23; V. i. 5; C. 6. Head, measured from the middle of the upper jaw to the anterior edge of the gill-opening, 1.93 in the length to the hypural; its width 1.71 in the same, and much greater than its length. Width of the mouth 1.3 in the head or 2.52 in the length. Snout 3.34 in the head. Interorbital 1.53, eye-opening 3 in the snout. Greatest depth just behind the ventrals 4.65, length of pectoral 4.8, caudal 4.25 and first dorsal spine 4.38 in the length.

Body covered with soft loose skin, all the upper parts with minute pores set in dark-edged ocelli, the larger of which bear blackish skinny appendages. A lateral line, consisting of a series of pores, extends from the back of the head, in a curve above the gill-opening, to the side of the tail where it is lost; a branch extends over the back at the base of the third dorsal spine, and another runs downward onto the sides of the head and branches out over the opercles. The sides of the head and tail bear numerous rather long branched tentacles. Upper margin of the orbit with two blunt spines, the posterior of which is the largest: directly behind the eye is a third, followed by another smaller one placed a little nearer the median line of the head. A large tubercle on either side of the temporal region above the point of suspension of the operculum. Humeral spine trifid, with a short supplementary basal spine. A minute spine is present on each side of the premaxillary symphysis, and there are two larger, diverging ones exterior to the nasal papilla. The hinder margin of the preopercular bears a small spine, and two others occur on its lower margin just behind the maxillary. The outer anterior angle of the operculum ends in an acute spine, which is followed by one or two small teeth, and a second spine projects a little further back on the upper surface. Most of the spines of the head are normally covered by the skin and are difficult to see.

The gill-openings are very wide, and commence just above and in front of the anterior borders of the pectorals. They extend under and behind those fins, and their skinny margins terminate in broad free flaps on the sides. The opercles have no real free borders as in other species of *Chirolophius*.

Fig. 15. *Chirolophius laticeps*, Ogilby.

The maxillary reaches back to behind the level of the second dorsal spine, but not to the orbital margin. The nostrils open in two fleshy papillæ, on short stalks, near the margin of the upper lip: they are separated by a space which is greater than that between the orbits. There is a single row of minute teeth projecting forward on the front of the premaxillaries; these are followed by much larger ones which are in two rows in front and one on the sides, those of the second row being much the largest. The mandibular teeth are similar to, but larger than the inner premaxillary ones; they are triserial anteriorly, becoming uniserial behind, and the longest, which are in the third row, are about two-thirds as long as the eye-opening. There is a single fixed tooth on each side of the vomer, which is widely separated from its fellow. Each palatine bone has two distinct teeth anteriorly and three or four smaller ones farther back.

First dorsal spine longest, very slender, and placed close behind the tip of the snout; it terminates in a short flap, and extends backwards almost to the base of the third spine. Second spine midway between the first and the level of the front margin of the eye; it is enveloped in skin, and has some short tentacles projecting from the sides. Third and fourth spines extremely slender and hair-like, and without dermal appendages, the base alone being enveloped in skin; the third is a little before the highest point of the back, and the fourth is between the ends of the humeral spines. A low, skinny tentacle, which is rather nearer the fourth spine than the first ray, apparently represents the fifth spine, but I find no trace of a sixth. Soft dorsal originating between the posterior flaps of the gill-openings; all the rays are simple except the last which is divided from the base into two, and the fourth is the longest. The anal commences below the fifth dorsal ray, and the fourth ray, which is the longest, is about equal to that of the dorsal; most of the rays are bifurcate, and the last is also divided to the base. Caudal rounded with all the rays branched. Pectorals quadrangular: the rays are simple with their tips free, and the last seven or eight are thickened at their tips and normally bend forwards on the lower surface of the fin. Ventrals inserted below the hinder margin of the eye; the spine is small and hidden in the skin, and the first two rays are thickened and divided, the others simple.

Colour.—Upper surface pale lilaceous brown, the dermal filaments and tentacles darker. Lower surface white. Tongue white with blackish, anastomosing lines anteriorly.

Described from a single specimen, 184 mm. long from the upper lip to the middle caudal rays. It is undoubtedly the type of Ogilby's *Chirolophius laticeps* which was "described on

board the Endeavour . . . . . and subsequently forwarded to the Australian Museum" without any label accompanying it. Ogilby gave the length as 196 mm., but this measurement includes the lower jaw when the mouth is wide open. His description is unintelligible in parts and misleading in others, errors which are doubtless the result of its absurdly hurried preparation and publication.

There is considerable doubt as to whether this species is correctly placed in *Chirolophius*. Though the gill-opening extends forward to above the base of the pectoral, it does not leave a free border to the opercular membrane as in other species of the genus. The pectorals, also, have twenty-three rays instead of thirteen to eighteen. It may be either a *Lophius*, Linnæus or *Lophiomus*, Gill, but its position must remain unsettled until another specimen can be secured of which the vertebræ can be counted.

Loc.—Thirty-six miles N. 12°E. of Cape Moreton, Queensland, in 73 fathoms; 3rd September, 1910.

Family OGCOCEPHALIDÆ.

Genus Halieutæa, *Cuvier & Valenciennes.*

Halieutæa brevicauda, *Ogilby.*

(Plate xxxiii.)

Halieutæa brevicauda, Ogilby, New Fish. Q'ld. Coast, 1911, p. 138.

D. 4; A. 4; P. 14; V. 5; C. 9. Length of disk, from the end of the snout to the level of its junction with the pectoral fins, 1.4 in the total length (from the snout to the hypural); its breadth is greater than its length, and 1.23 in the total length. Tail, from the vent to the hypural, 3.11 in the total length; its greatest breadth is 2.08 in its own length. Length of head, from the snout to the gill opening, 1.61 in the total length. Interorbital space a little less than the length of the eye, which is 6.5 in the head. Width of mouth, including the tips of the maxillary bones, 1.73 in the head. Depth of the body, at the ventrals, 3.25 in the head, and equal to twice the diameter of the eye. Depth of caudal peduncle half the length of the eye. Longest pectoral ray 2.47, fifth ventral ray 3.71, and caudal fin 2.26 in the head. Second dorsal ray 3, and second anal ray 1.90 in the longest pectoral ray.

Upper surface of the cephalic disk closely covered with small spines which are of unequal size; the larger ones have about four ridges radiating from their bases. Three strong, curved

spines on the snout form a triangular cavity in which the rostral tentacle is situated. There is another similar one between these and the supraorbital series on each side. Five more are arranged round the upper and posterior margins of each orbit, and a strong one is placed exterior to the nostrils on either side. There are seventeen series of marginal spines between the snout and either pectoral fin, which are usually provided with four radiating points. A second series of enlarged, single-pointed spines projects upwards on the upper surface near the margin. A space exterior to each eye, which is defined in front and on its outer side by four strong spines, is almost naked, while the interorbital space and an area surrounding the gill-openings are nearly spineless. Tail covered with spines similar to those of the body, and its lateral margins armed with three or four-pronged spines. Most of the marginal spines of the disk and tail bear clusters of simple, dermal filaments, which are most developed posteriorly. A few spines on the back also have similar filaments.

The greater part of the lower surface appears smooth to the naked eye, though microscopic granules can be detected between the ventral fins and beneath the branchial regions. A row of small spines, armed with several points, forms a submarginal series round the greater part of the disk and on the sides of the tail. Between this series and the marginal spines is a groove which is bridged at intervals by thick fleshy tubercles meeting across it; a row of smaller tubercles in its centre line appear to represent a mucous system.

Rostral tentacle trilobed, the lateral lobes with a fringe of minute filaments. Interorbital space concave. Anterior nostril opening in a short tube, and close to the posterior which is subcircular; they are placed in the anterior half of the snout. Lips margined above and below with thick fleshy tubercles covering minute bony granules. Jaws with bands of minute, villiform teeth, vomer and palatines toothless; pharangeal and hyoid bones closely covered with minute teeth. Gills two and a half; pseudobranchiæ developed. Gill-rakers short and thick.

Dorsal originating in advance of the level of the hinder angle of the wrists; its rays are simple, the second the longest, and the last is not connected with the tail by membrane. Anal commencing in advance of the tip of the adpressed dorsal; and not nearly reaching backwards to the base of the caudal; it is similar in form to the dorsal, but the rays are longer, and the last is connected by membrane with the tail. Anterior three or four pectoral rays subequal in length, the others decreasing rapidly; they are simple and their tips are free and a little

thickened. Ventrals inserted nearer the vent than the tip of the lower jaw; the rays are simple and increase a little in length backwards. Caudal slightly rounded, the two outer rays simple, the others bifurcate.

Colour.—Upper surface lavender, the tail and edges of the disk shading to gray. Pectoral with a broad violet band crossing the distal half, and there is a similar submarginal band on the dorsal fin.

Described from a single example, 106 mm. long, which is the type of Ogilby's description. This latter is very brief and not quite accurate, his proportional measurements in particular being very confusing.

H. brevicauda differs from *H. stellata*, Vahl [1], *H. coccinea*, Alcock [2], *H. nigra*, Alcock [3], *H. hancocki*, Regan [4], and *H. indica*, Annandale & Jenkins [5], in having the lower surface practically smooth instead of being distinctly granular or spiny. It is very closely allied to, and possibly identical with *H. fumosa*, Alcock [6], which is the only other species of the genus. From this it appears to differ only in having the cephalic disk not quite so wide, and in having the upper surface covered with distinct spines instead of mere spicules. It also lacks the numerous, fine, jet-black filaments on the disk described by Alcock. All these characters are probably subject to variation, but it is convenient to regard the two as distinct species until specimens of each can be compared.

Loc.—Thirty six miles N. 12°E of Cape Moreton, Queensland, 73 fathoms; 3rd September, 1910.

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1 Jordan & Sindo—Proc. U.S. Nat. Mus., xxiv., 1902, p. 380.

2 Alcock—Ann. Mag. Nat. Hist. (6), iv., 1889, p. 382, and Illustr. Zool. Investig., Fishes, 1898, pl. xix., fig. 1.

3 Alcock—*Loc. cit.*, viii., 1891, p. 24, and *Loc. cit.*, pl. xix., fig. 2.

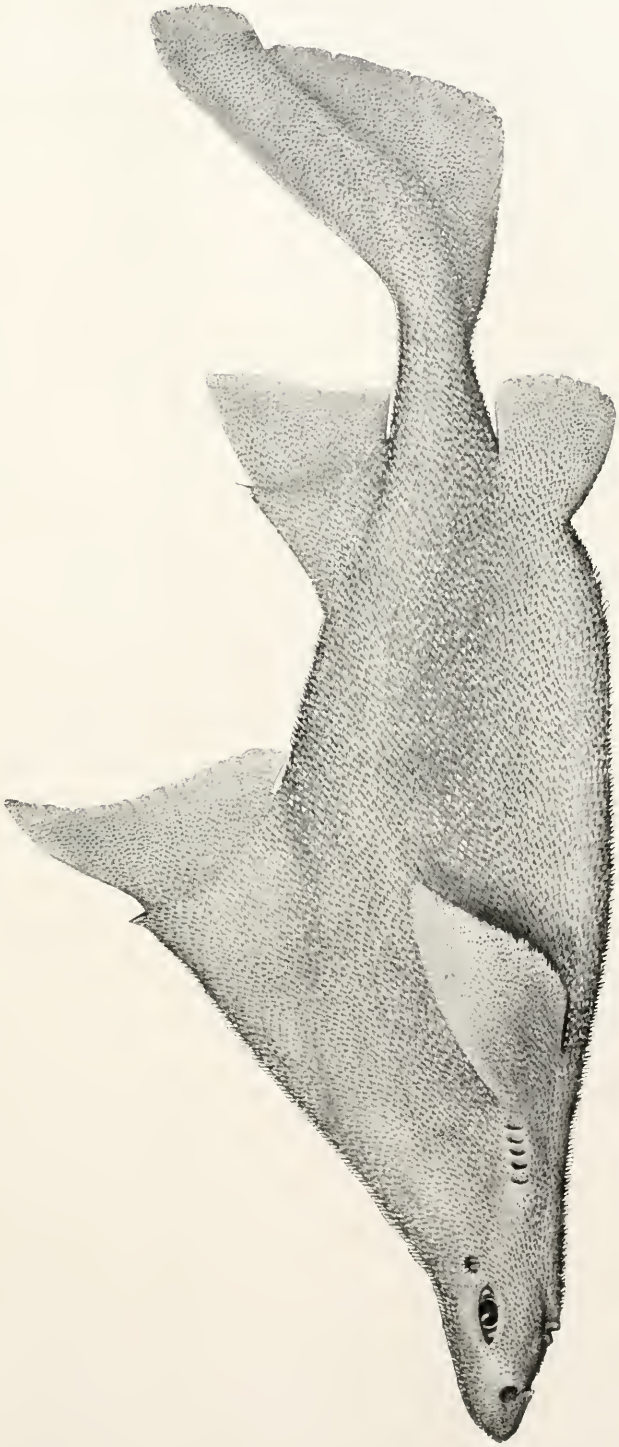
4 Regan—Trans. Linn. Soc. (2), xii., 1908, p. 251, pl. xxxi., fig. 6.

5 Annandale & Jenkins—Mem. Ind. Mus., iii., 1910, p. 19, pl. ii., fig. 1.

6 Alcock—Journ. Asiat. Soc. Bengal, lxiii., 1894, p. 119, and Illustr. Zool. Investig., Fishes, 1895, pl. xiv., fig. 2.

EXPLANATION OF PLATE XIII.

Oxynotus bruniensis, Ogilby.



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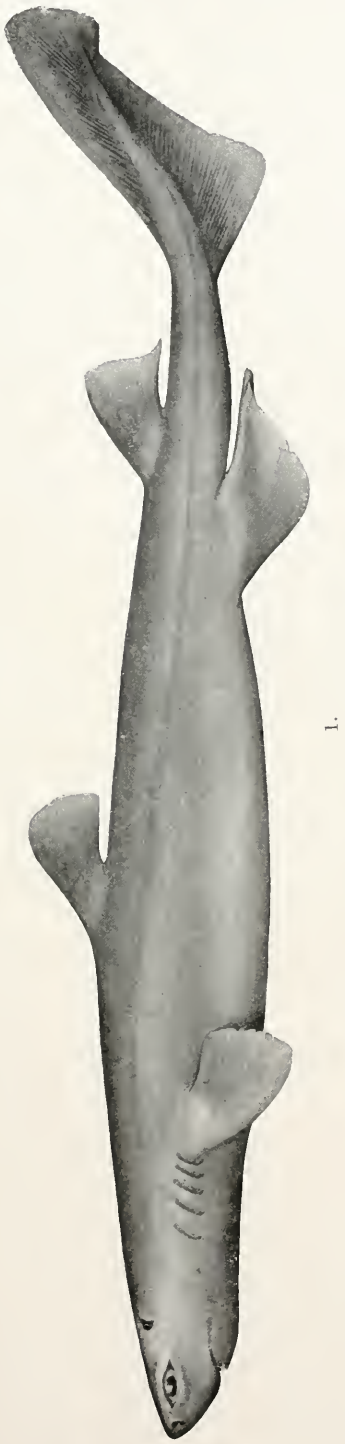
EXPLANATION OF PLATE XIV.

Fig. 1. *Scymnorhinus licha*, Bonnaterre.

Fig. 2. *Genypterus microstomus*, Regan.



1.

2i

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EXPLANATION OF PLATE XV.

Squatina tergocellata, sp. nov. Type.

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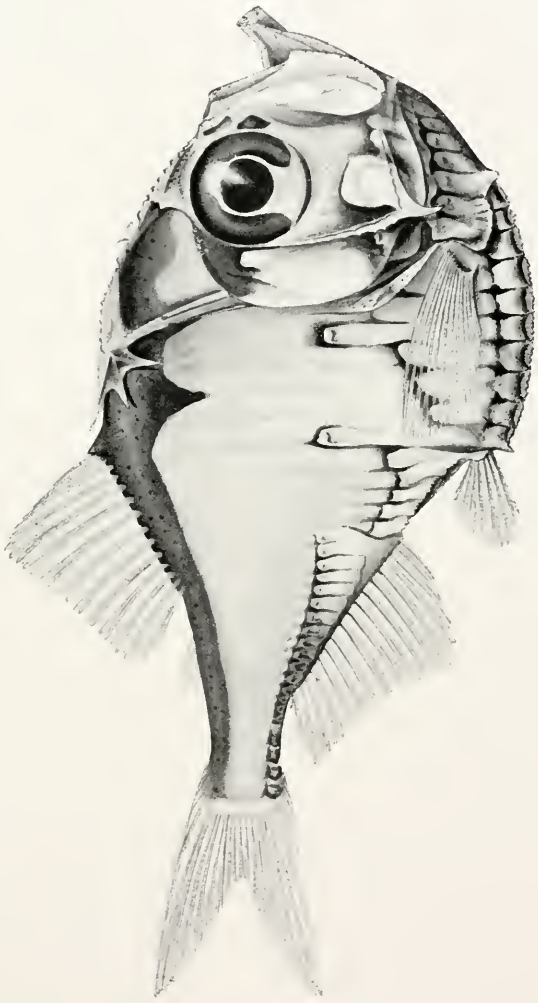
EXPLANATION OF PLATE XVI.

Polyipnus tridentifer, sp. nov. Type.



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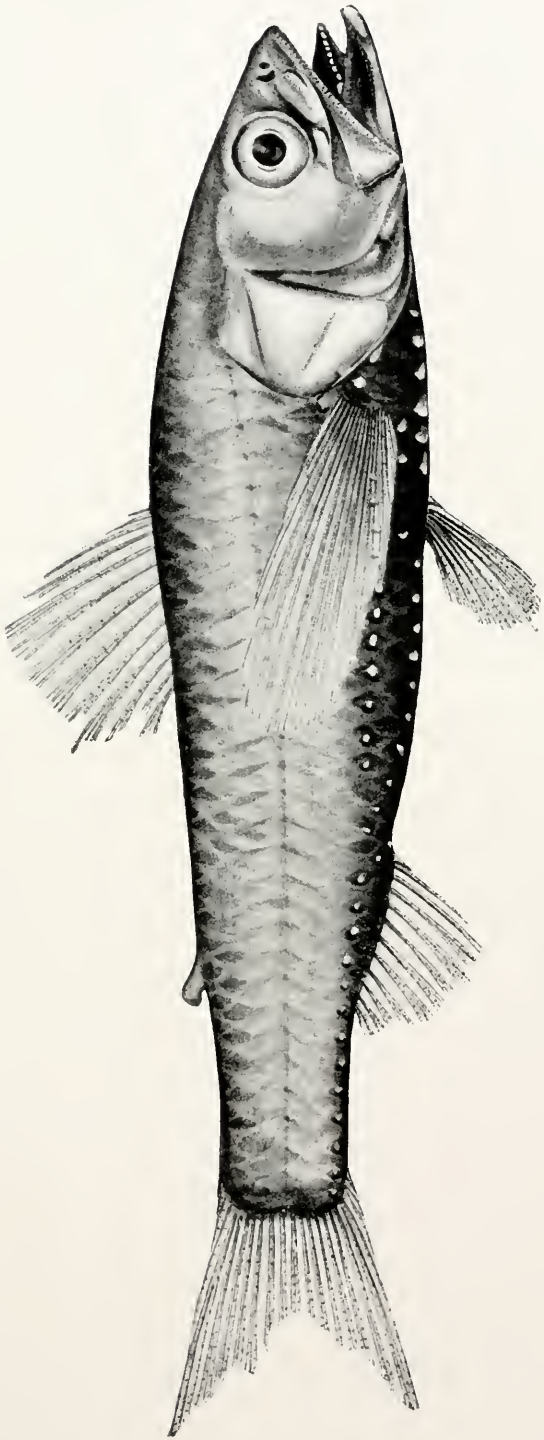
EXPLANATION OF PLATE XVII.

Neoscopelus macrolepidotus, Johnson.



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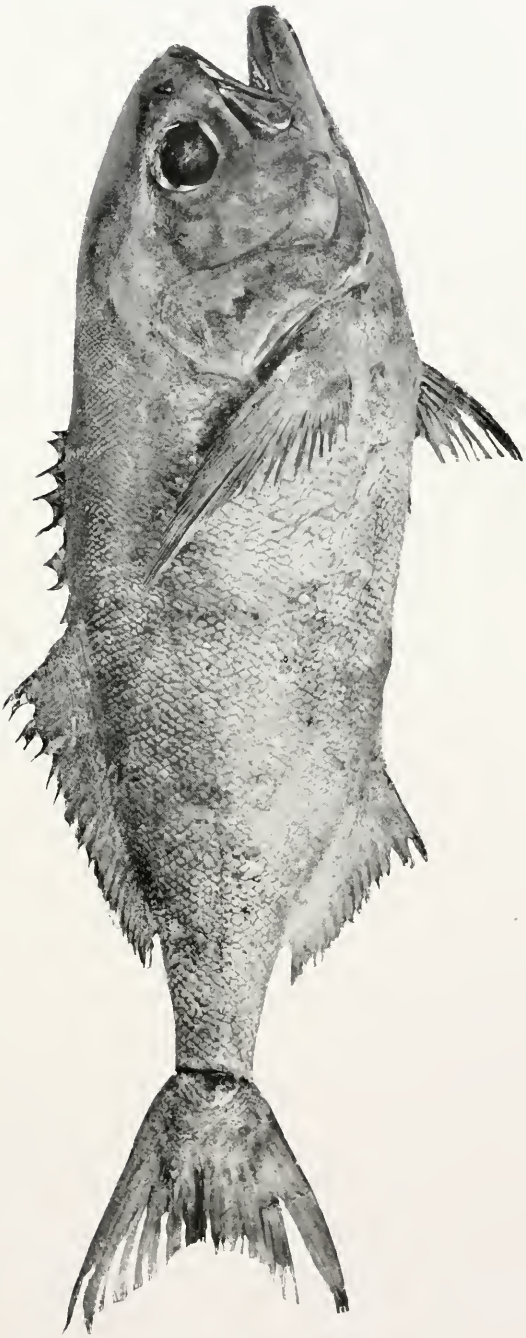
EXPLANATION OF PLATE XVIII.

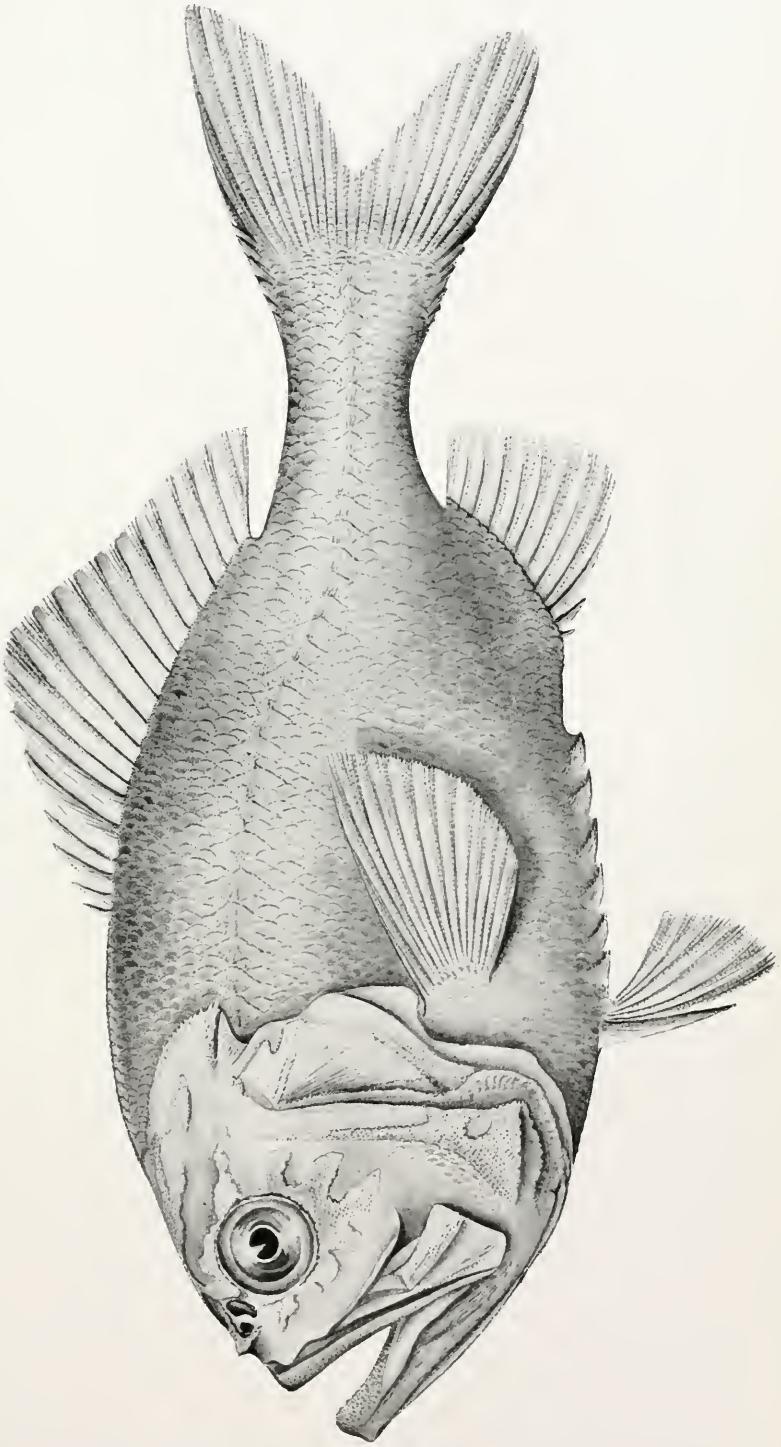
Hyperoglyphe johnstonii, Morton.



A. R. McCulloch, photo., Austr. Mus.

EXPLANATION OF PLATE XIX.

Hoplostethus gigas, sp. nov. Type.



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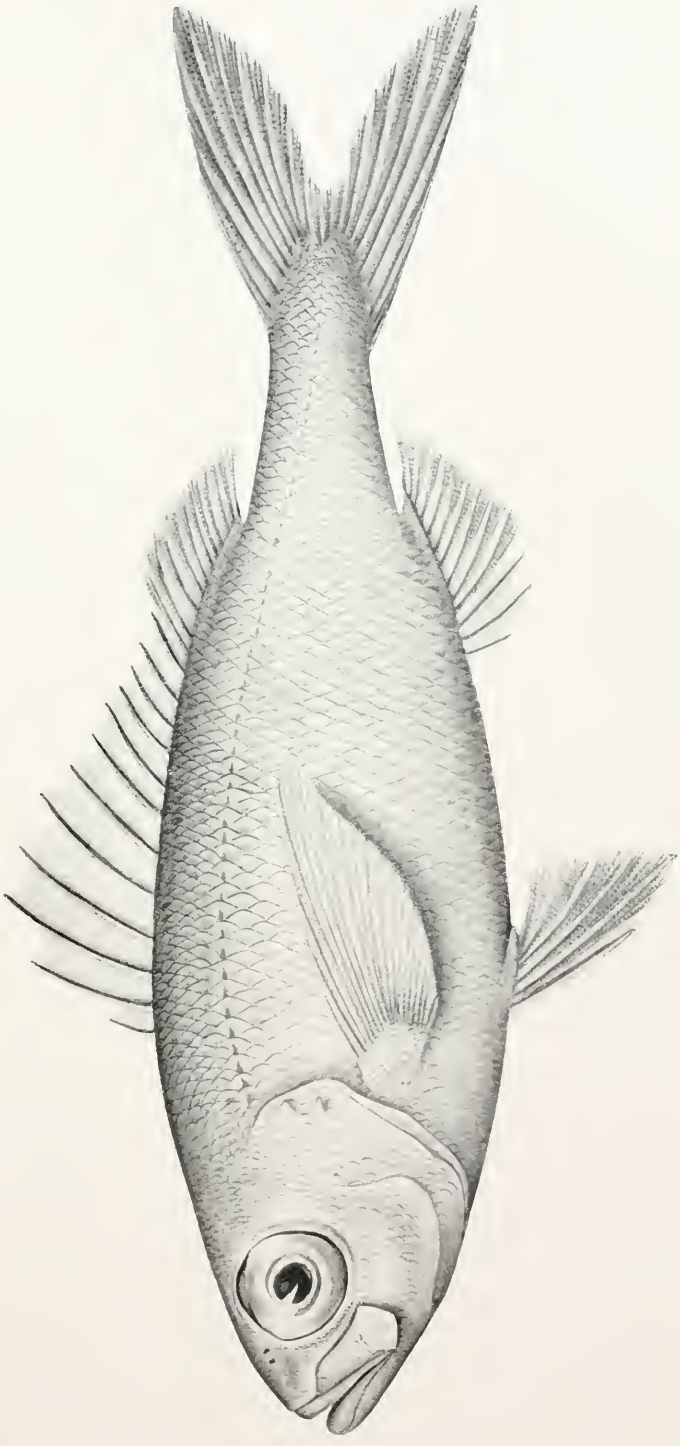
EXPLANATION OF PLATE XX.

Plagiogeneion macrolepis, sp. nov. Type.



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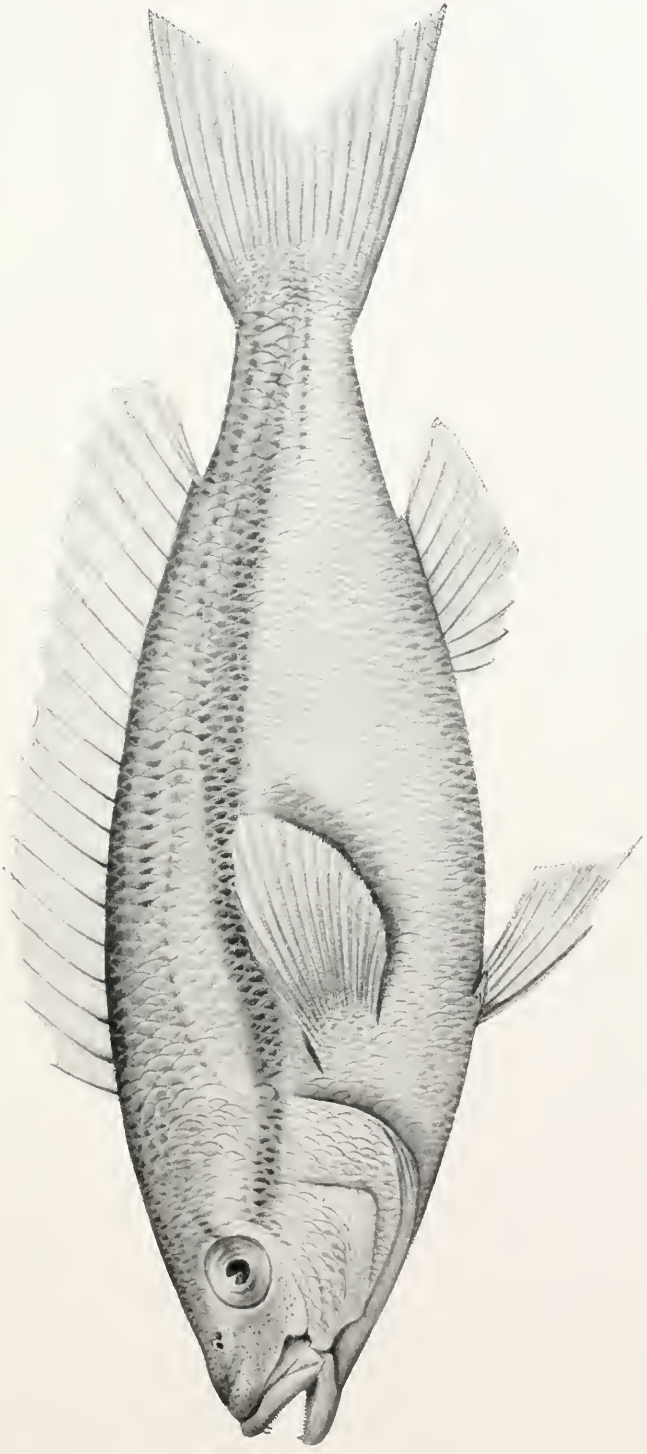
EXPLANATION OF PLATE XXI.

Pentapus vitta, Quoy & Gaimard.



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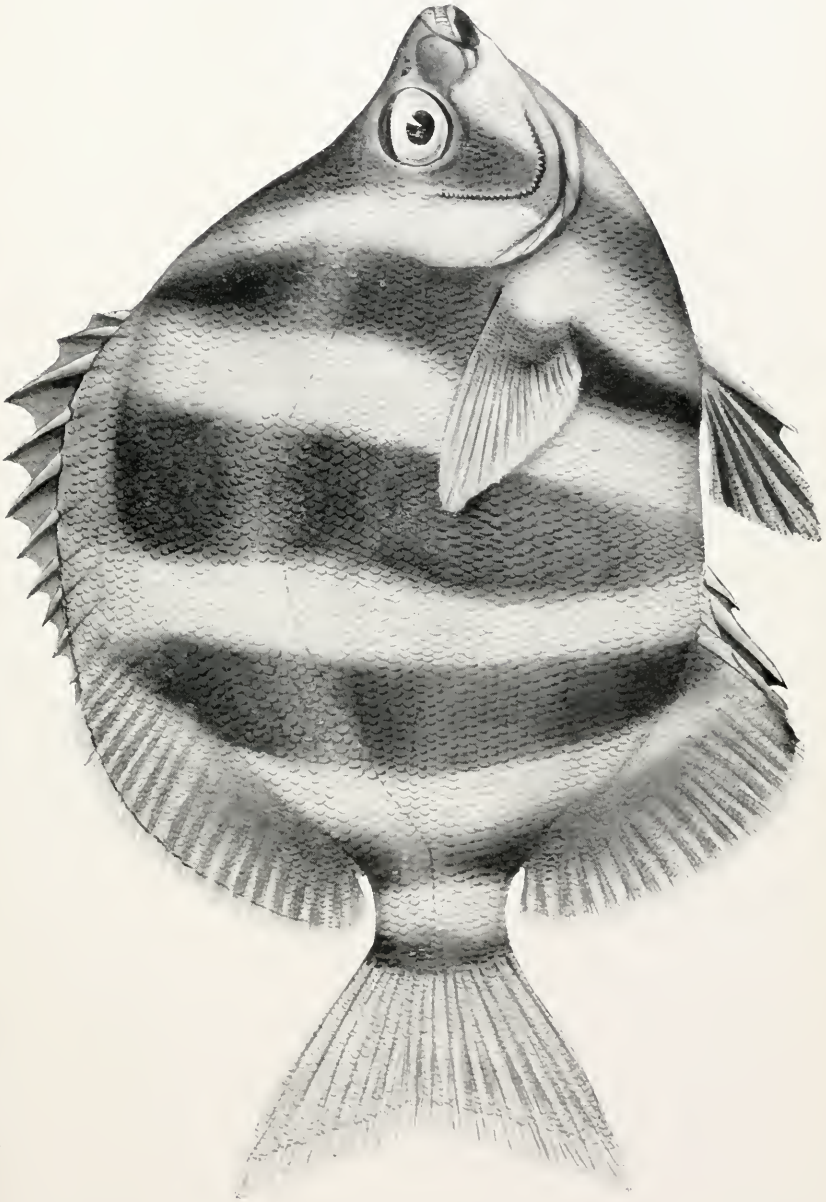
EXPLANATION OF PLATE XXII

Vinculum sexfasciatum, Richardson.



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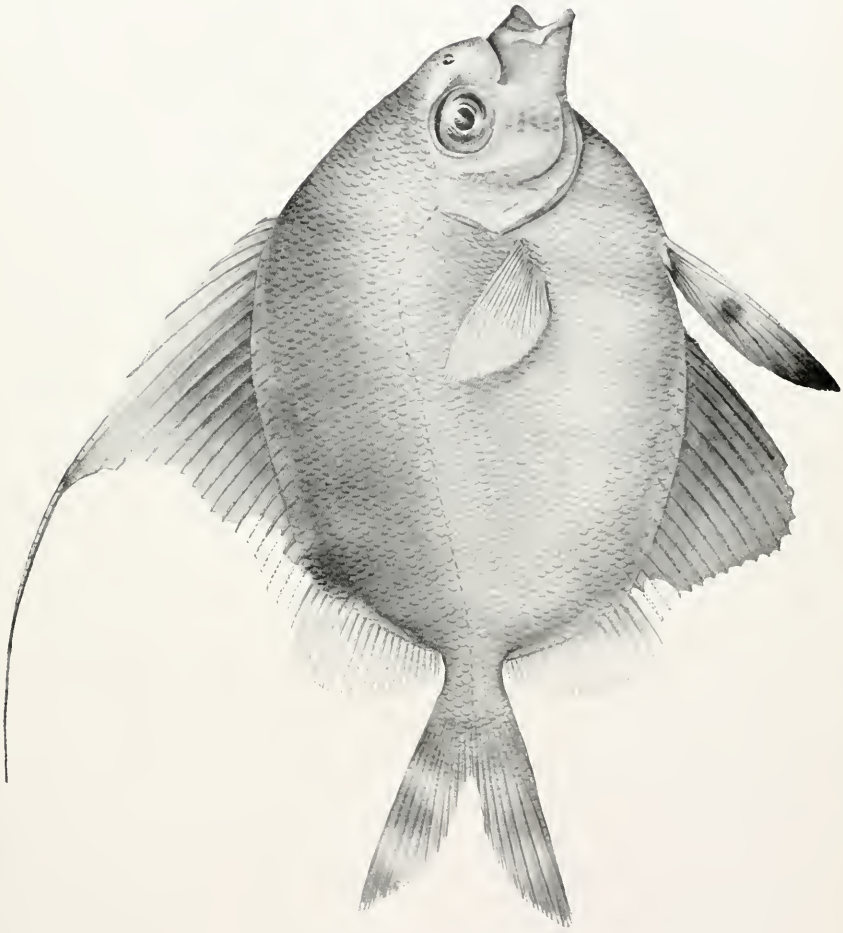
EXPLANATION OF PLATE XXIII.

Velifer multiradiatus, Regan.



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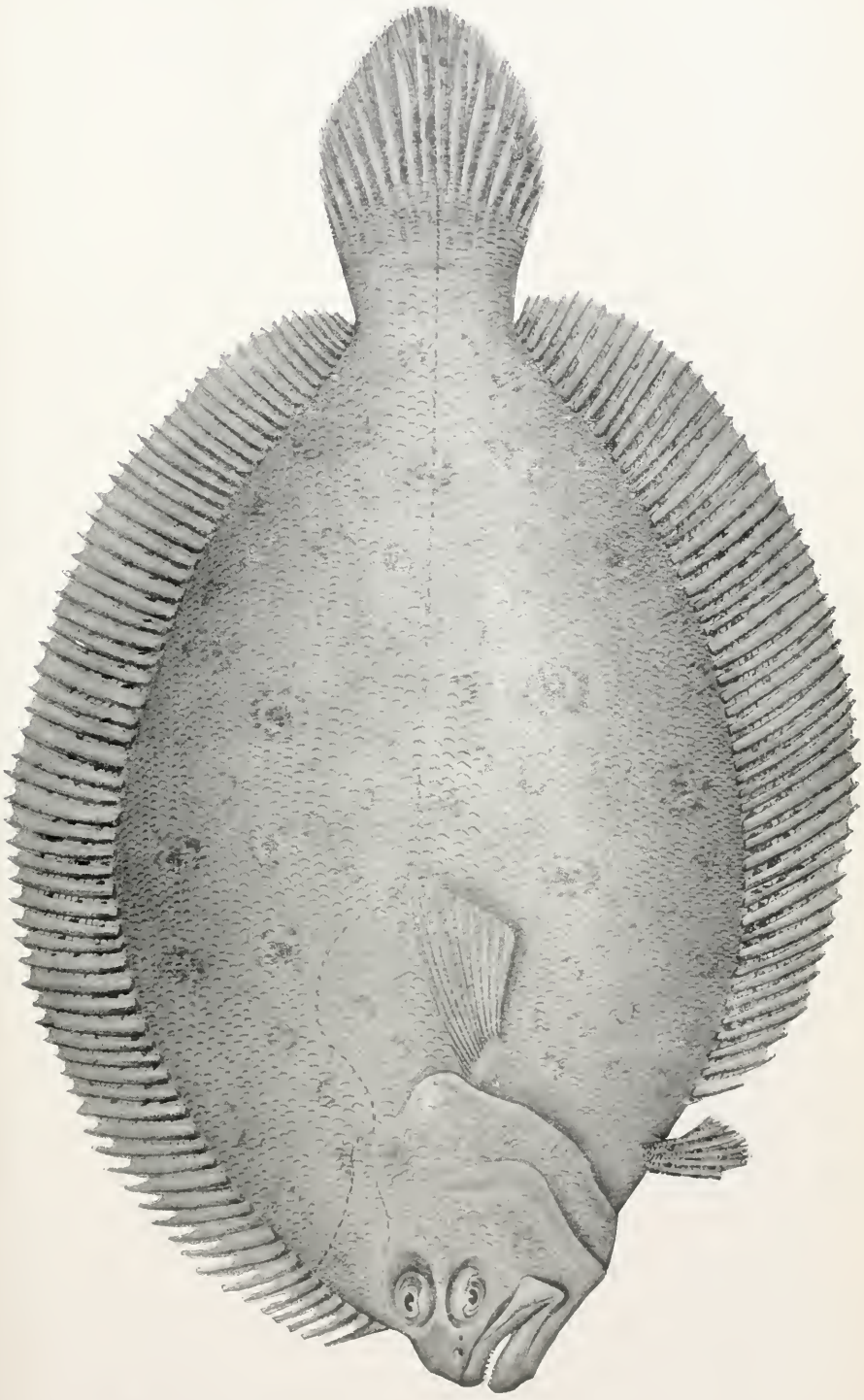
EXPLANATION OF PLATE XXIV.

Pseudorhombus multimaculatus, Günther.



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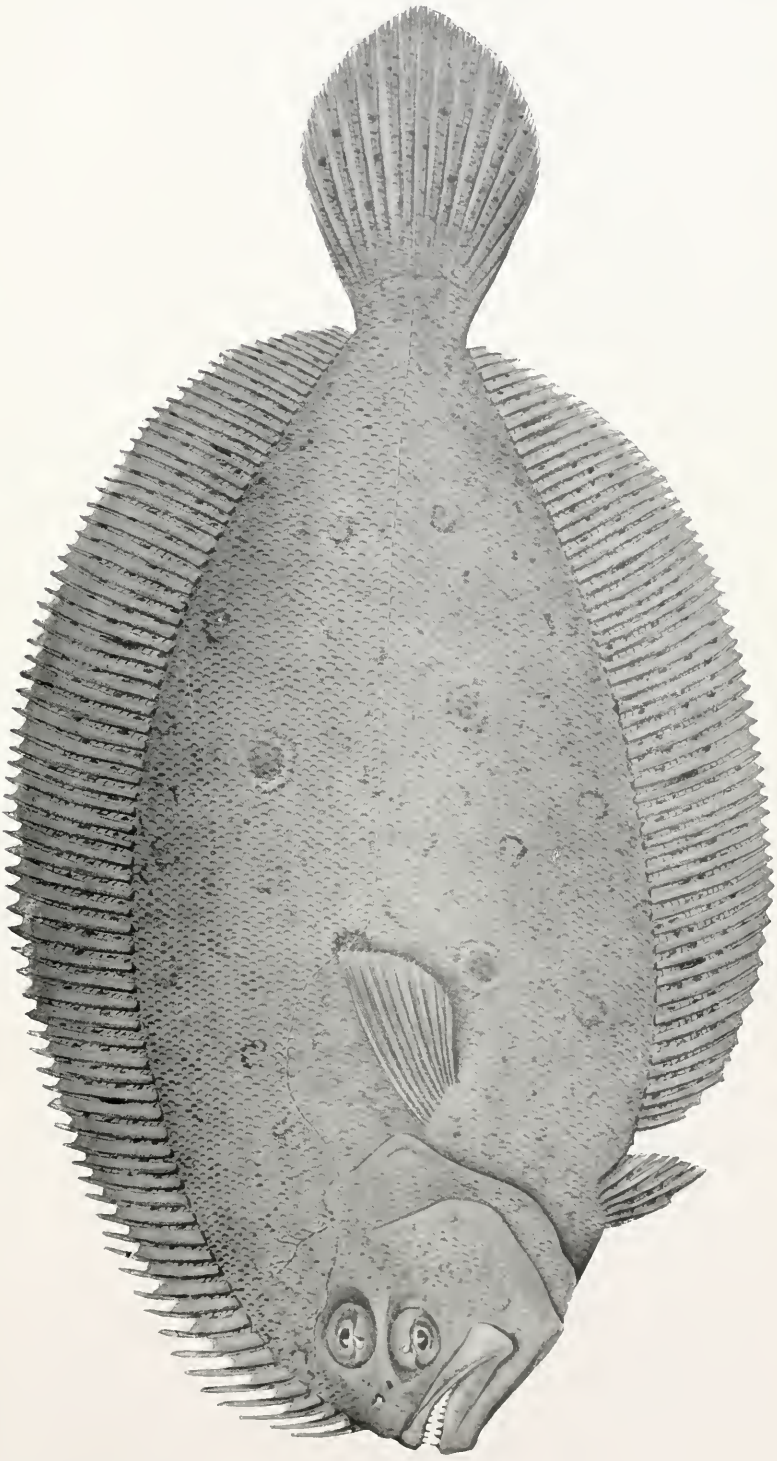
EXPLANATION OF PLATE XXV.

Pseudorhombus spinosus, sp. nov. Type.



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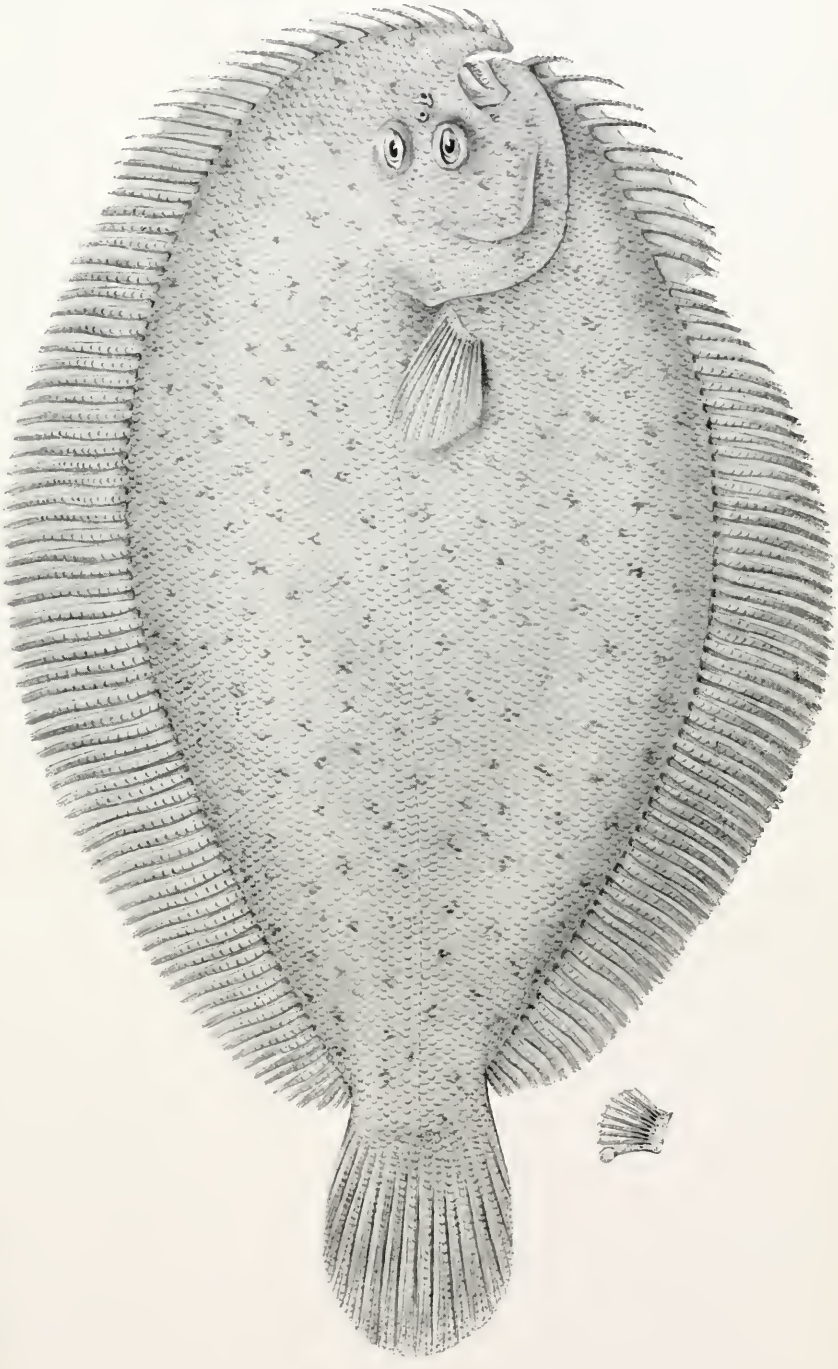
EXPLANATION OF PLATE XXVI.

Ammotretis tudori, sp. nov. Type.



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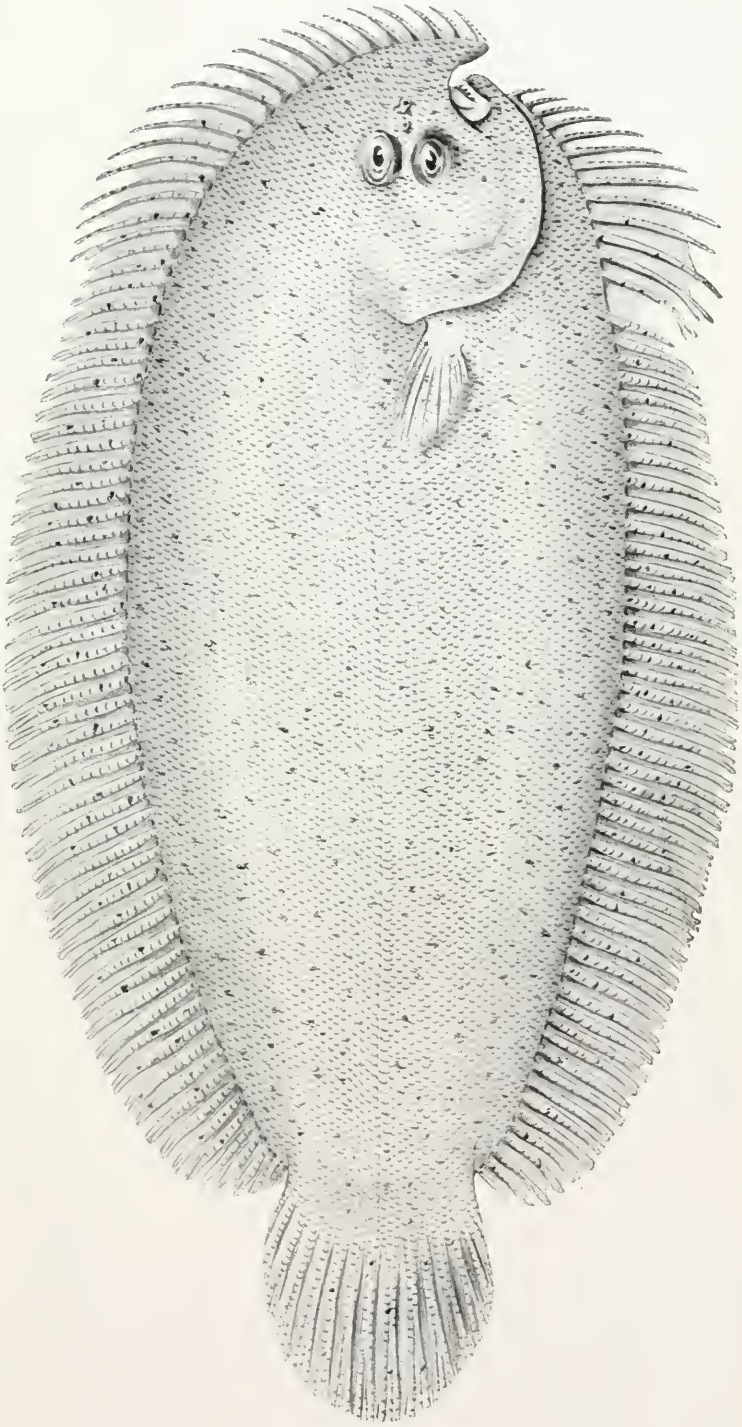
EXPLANATION OF PLATE XXVII.

Ammotretis elongatus, sp. nov. Type.



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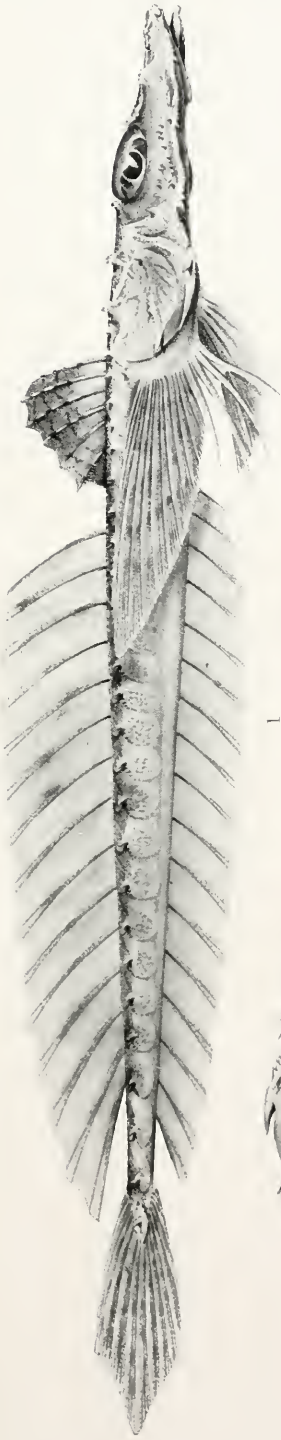
EXPLANATION OF PLATE XXVIII.

Fig. 1-1a. *Hoplichthys ogilbyi*, sp. nov. Type.
Fig. 2-2a. *Elates thompsoni*, Jordan & Seale.



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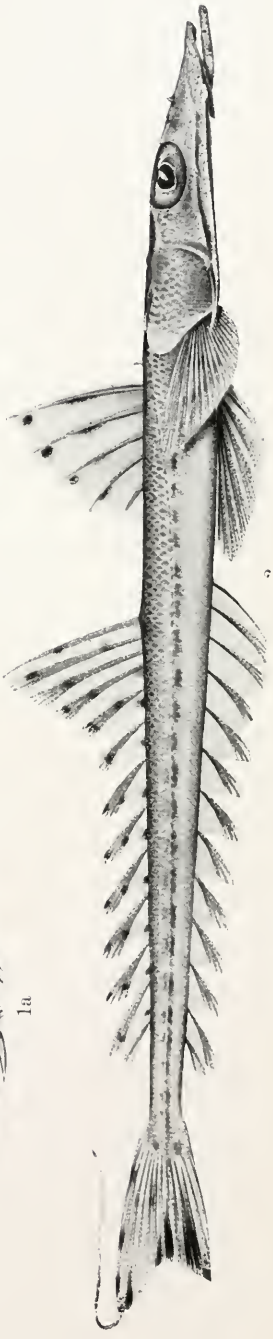

2

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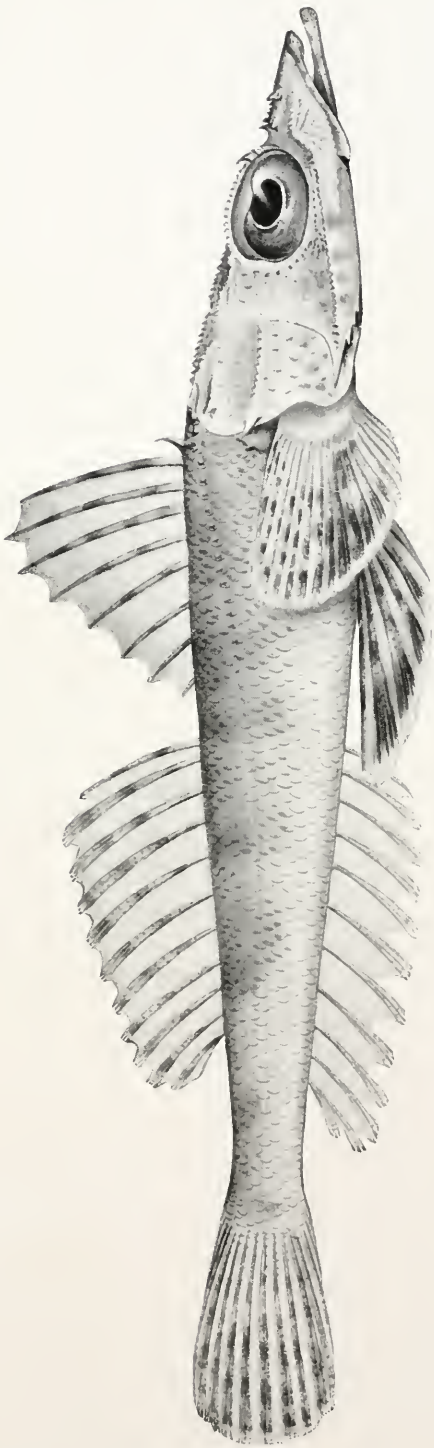
EXPLANATION OF PLATE XXIX.

Insidiator tuberculatus, Cuvier & Valenciennes.



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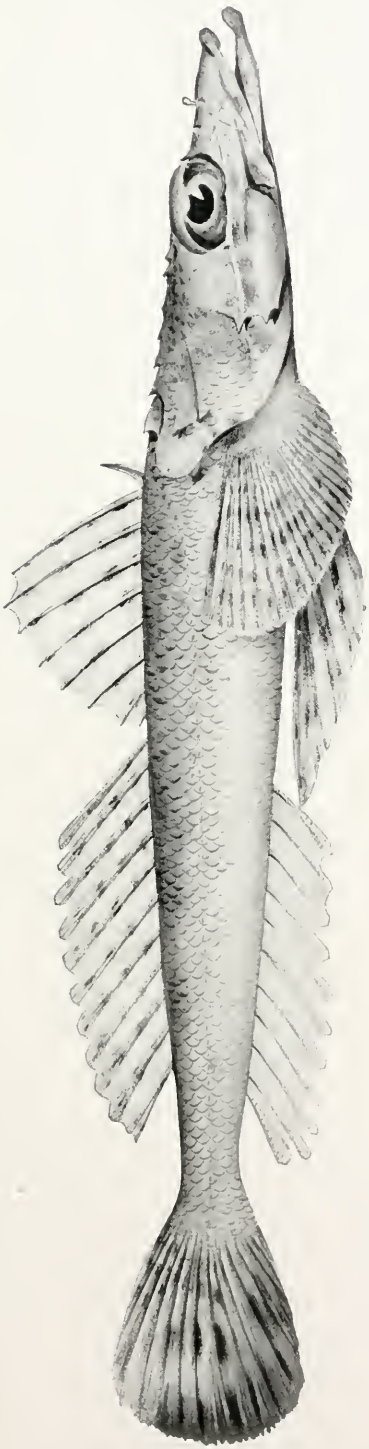
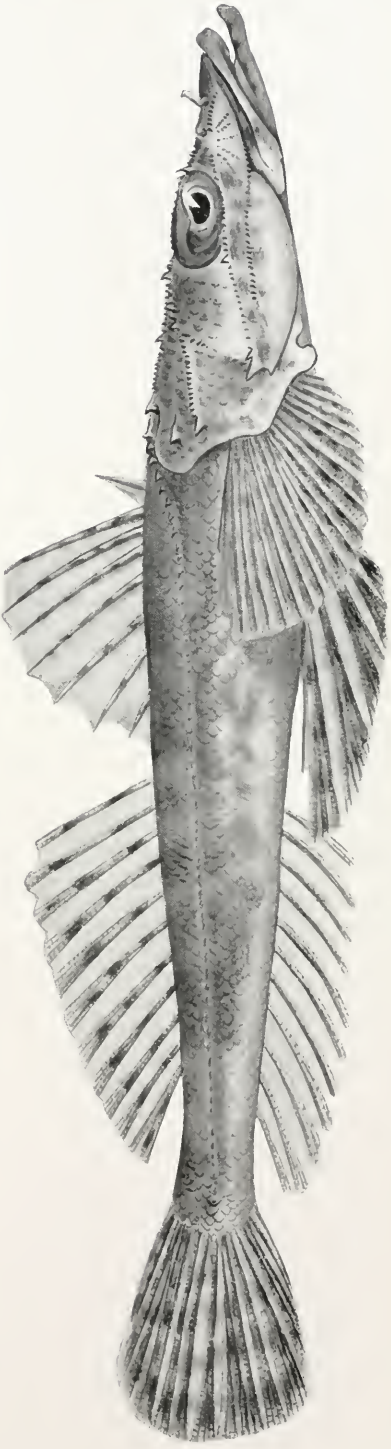
EXPLANATION OF PLATE XXX.

Fig. 1. *Insidiator harrisii*, sp. nov. Type.
Fig. 2. ,, *jugosus*, sp. nov. Type.



1



2

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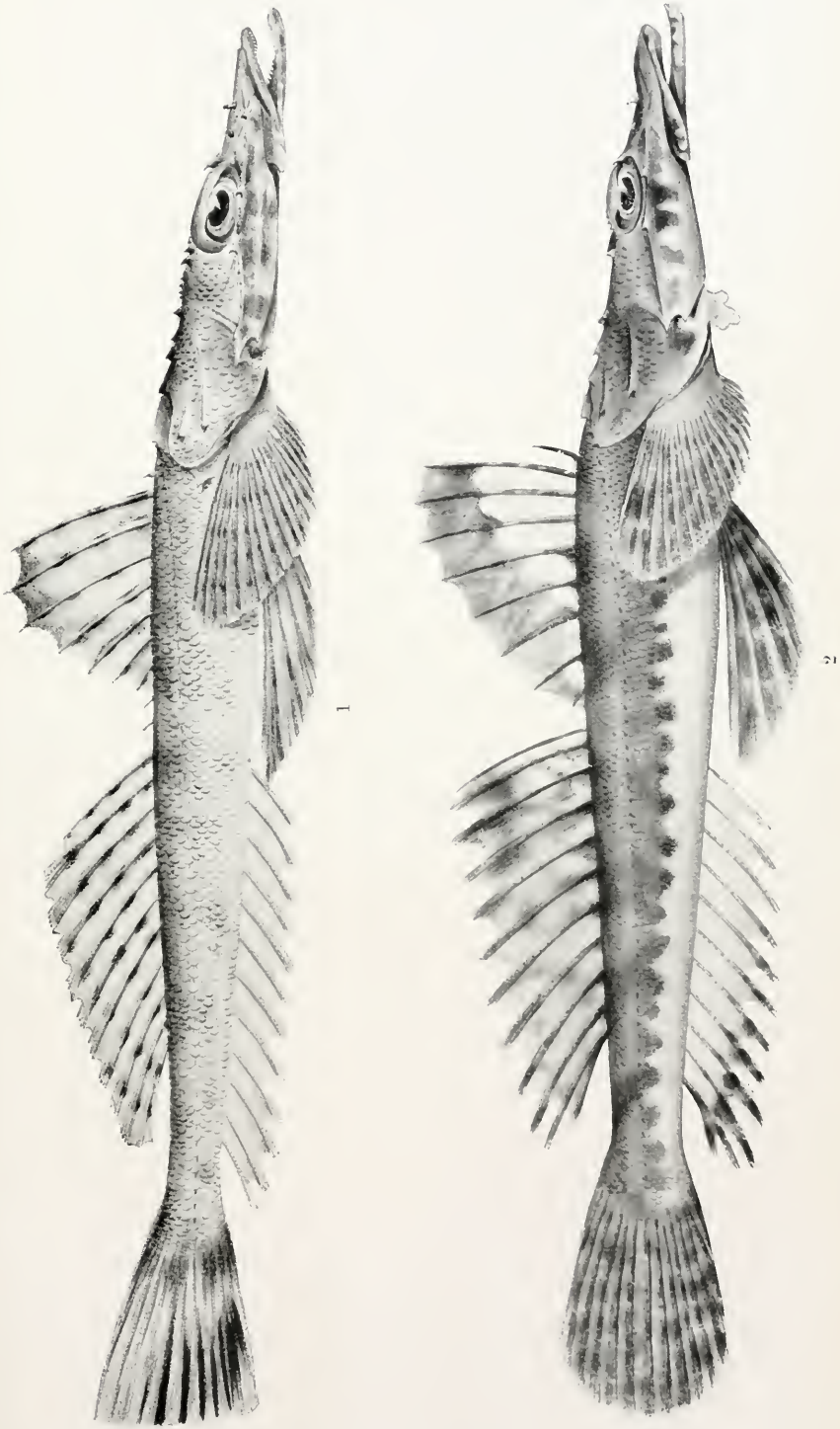
EXPLANATION OF PLATE XXXI.

Fig. 1. *Insidiator diversidens*, sp. nov. Type.
Fig. 2. ,, *parilis*, sp. nov. Type.



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EXPLANATION OF PLATE XXXII.

Chirolophius laticeps, Ogilby.

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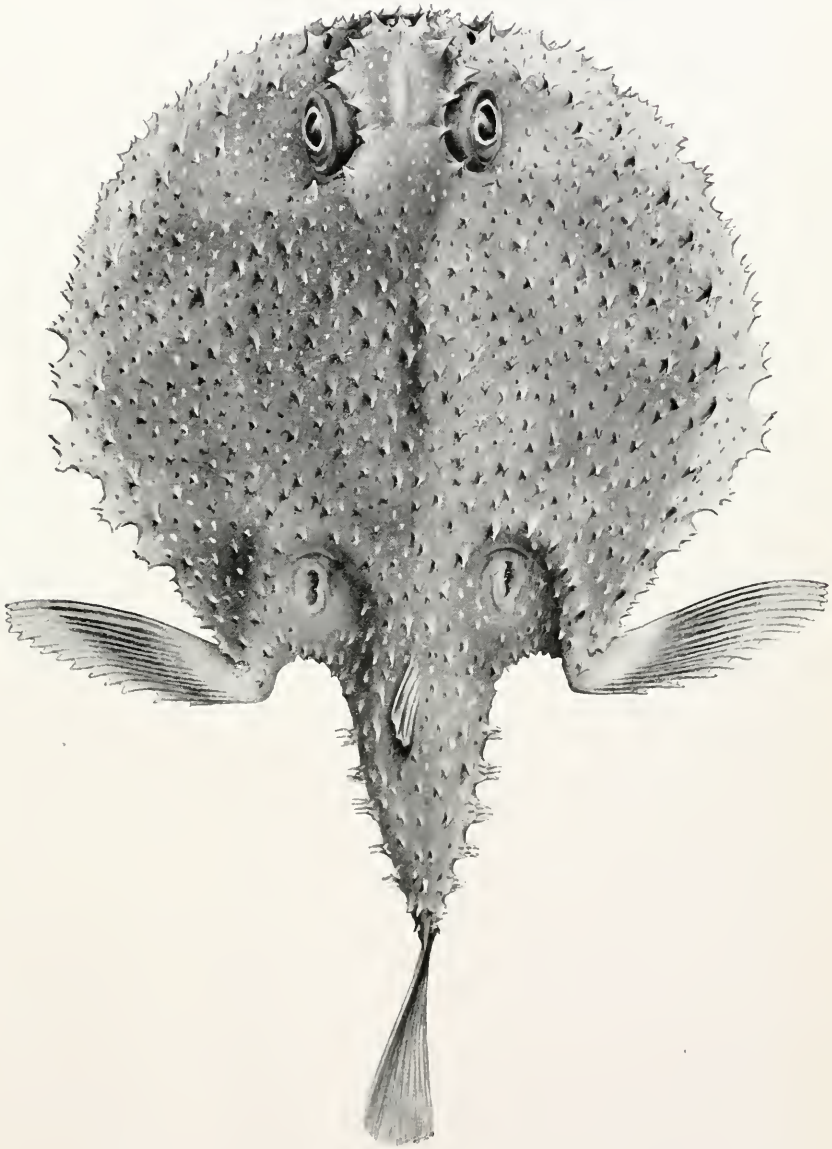
EXPLANATION OF PLATE XXXIII.

Halieutæa brevicauda, Ogilby.



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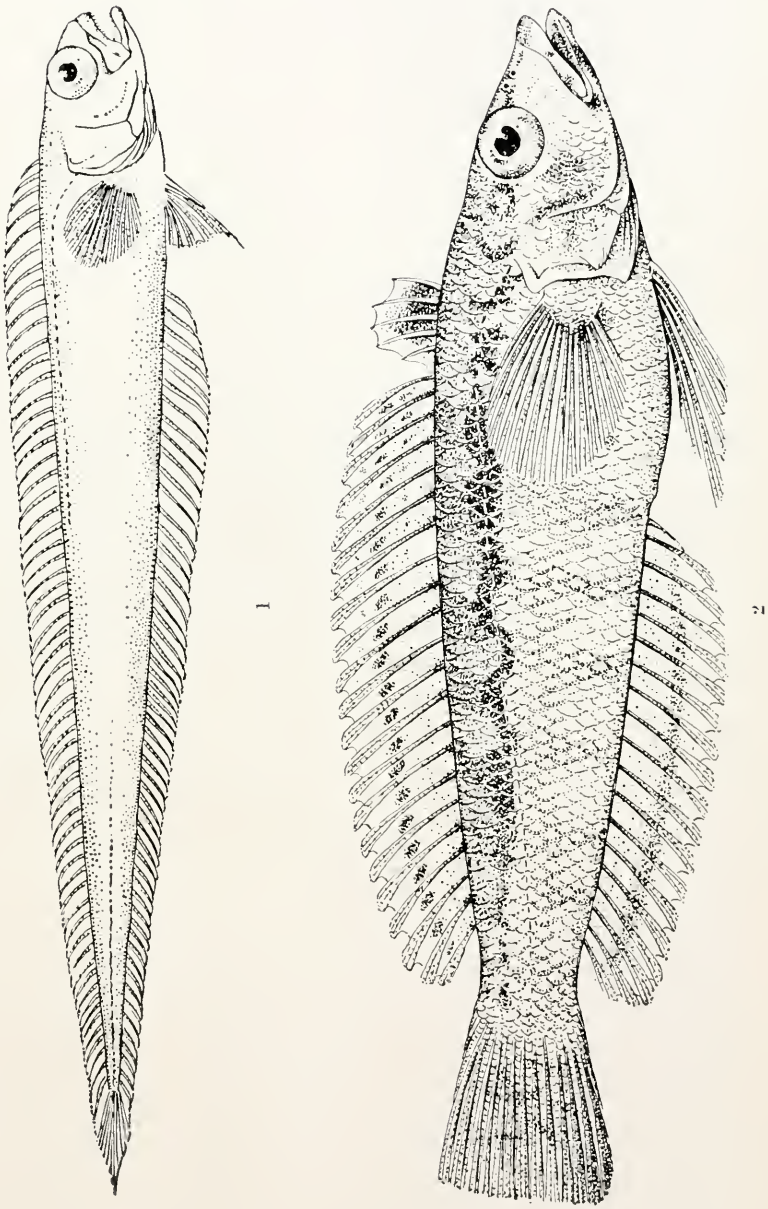
EXPLANATION OF PLATE XXXIV.

Fig. 1. *Cepola australis*, Ogilby.

Fig. 2. *Parapercis haackei*, Steindachner.



P. Clarke and A. R. McCulloch, del.. Austr. Mus.

IV.—Report on the Hydroida collected in the Great Australian Bight and other Localities. Part II.

BY

W. M. BALE, F.R.M.S.,

Late Senior Inspector of Excise, Victoria.

(Plates xxxv.—xxxviii.)

IV.—REPORT ON THE HYDROIDA, II.

I.—Introduction.

This Second Report is mainly devoted to the description of a few new species which only came under notice after the former Report was in the hands of the printer. Again the Plumularians predominate, and are of interest as including types of *Aglaophenia* and *Halicornaria* not previously known from Australian localities.

A number of other species, already known, also occur in the collection, a complete enumeration of which is deferred to a Third Report, in which it is proposed to summarize the results obtained up to the present.

II.—Descriptions of the Genera and Species.

Family LAFOËIDÆ.

Genus Cryptolaria, *Busk*.

Cryptolaria angulata, *sp. nov.*

(Plate xxxv., fig. 1.)

Hydrophyton about three inches in height, branched and rebranched in one plane; branches irregular, neither opposite nor alternate, slender, fascicle-tubes not numerous.

Hydrothecæ alternate, long, lower half erect, finally enclosed, upper half sharply curved at right angles and the free part then projecting outward and very slightly upward, its diameter somewhat greater than that of the proximal part; a boss-like projection from the hydrocaulus into the hydrotheca just below the bend; border circular, smooth, often with several renewals, very slightly everted.

Gonosome.—

This species is particularly characterized by the sharply geniculate outward bend, with the noticeable crease in the angle, also by the distinct boss projecting into the hydrothecal cavity, opposite the crease. Immediately after the bend the axis of the hydrotheca is at a right angle with that of the lower portion, but

it usually bends a little upward again, so that the distal half is not horizontal but slightly ascending; there are, however, here and there exceptions, where the direction may vary. The free portion is of nearly equal diameter throughout. The rim may have a number of renewals close together, or they may be more distant, commencing in some of the hydrothecæ nearly as far back as the middle of the free portion.

The structure of the stem is not so dense as to preclude the course of the hydrothecæ being easily traced through the enveloping tubes, except in the thickest portions of the hydrocaulus.

Loc.—Great Australian Bight, 100 fathoms.

Family SERTULARIIDÆ.

Genus Hypopyxis, *Allman*.

Hypopyxis distans, *sp. nov.*

(Plate xxxv., figs. 2-5.)

Stems monosiphonic, thick, seven or eight inches or more in height, giving off a number of irregular branches on one or both sides, which are separated from the long slender cladophores by very long oblique joints; nodes on both stem and branches at distant and irregular intervals.

Hydrothecæ arranged alike on stem and branches, in rather distant pairs, opposite and in contact in front, very widely separated behind, large, erect, adnate nearly their whole length, somewhat contracted towards the aperture, which is vertical; margin thin, membranous, with two very slight angular lateral lobes; operculum abcauline; a pouch-like appendage in front and at the side, near the base. "Stalk-marks" conspicuous.

Gonothecæ very large, elongate-ovate, smooth, summit narrowing in to the small circular elevated border; a number of irregular processes projecting into the interior for some distance below the rim.

Colour.—Brown.

This hydroid exhibits a close affinity with the *H. labrosa* of the "Challenger" Report, and may possibly have to be united to it when more is known of the relations of the two forms, in which case the name *distans* may stand as a variety-name, indicating the most patent distinction between them. The interspaces between consecutive pairs of hydrothecæ on the

pinnæ generally equal from half to three-fourths the length of a hydrotheca, and those on the stem are still further separated, while in Allman's figure they are mostly close together. The hydrothecæ according to Allman are more tumid below than in our specimens, and the hydrocaulus is much more contracted between the pairs. The chitinous prolongations downward of the hydrotheca-walls ("stalk-marks" of Levinsen), which are very pronounced in the present form, are not indicated in Allman's figure.

In regard to the form of the aperture my specimens differ very materially from Allman's account. *H. labrosa* is described as having a thin membranous inoperculate lip, trumpet-shaped, circular, and at right angles to the terminal part of the hydrotheca (in other words at an angle of 45° to the axis of the hydrocaulus), and liable to be readily detached at a suture in the neck of the hydrotheca, which runs parallel with the border. In *H. distans* the aperture is nearly vertical, indeed in so far as it diverges from the vertical it does so in the opposite direction to Allman's figure, that is to say the upper side of the hydrotheca projects outward even further than the lower, so that the border slopes downward and slightly inward. The lip is thin, but not circular nor trumpet-shaped, and it does not appear at all liable to detachment. It may be noted however that the delicacy of its perisarc is such that it shrivels up when placed in a dense medium, so that it is scarcely possible to find a perfect example in a balsam-mounted specimen unless special precautions are taken. There is no definite line of demarcation between the lip and the rest of the hydrotheca, the perisarc simply thins away to the margin. The aperture is widest from side to side; in the ordinary aspect of the polypidom the two slight lateral angles are scarcely noticeable, but in side view they are more distinct. There is an abcauline opercular flap, which is most commonly seen in a vertical position, just within the aperture, but is also frequently found in the position in which Allman represents the suture. I have not found such a suture in any instance, and I think it possible that Allman may have misinterpreted the operculum, which, seen edge-wise, often appears as a sharply-defined line.

The whole border structure is practically the same as in *Sertularia tuba*, to which species the present form shows a singularly close resemblance in the form and arrangement of the hydrothecæ, as well as in the ramification, though differing in its much larger proportions throughout, as well as in the presence of the pouch-like appendages of the hydrothecæ, which Allman considers undoubtedly sarcothecæ. I have not been able to satisfy myself as to the true character of these structures, and I find great difficulty in the way of accepting Allman's view. In

the first place it is a peculiar circumstance, not noticed by Allman, that they are *inside* the hydrothecæ. Then they are appendages of the hydrotheca itself, having no apparent connection with the hydrocaulus, as sarcothecæ have, and I have been unable to detect any aperture except the distal one, so that even assuming that the stem of a sarcostyle entered the hydrotheca through the same orifice as the hydranth, (a most improbable theory), it would still have no means of entering the cavity of the supposed sarcotheca Every sarcotheca, like every hydrotheca, must have at least two orifices, one for the protrusion of the contained zooid, the other for connection with the hydrocaulus, and the fact of the latter being absent in this instance seems to negative the theory of the sarcothecal function of these receptacles. They are exactly like flat pockets attached to the hydrotheca, and they lie so close to it, and enclose such an extremely narrow space that it is difficult to imagine that a sarcostyle could occupy a cavity so contracted.

The habit is similar to that of the "Challenger" form, but the stem seems rather more slender and the pinnæ shorter and less regular. Sometimes for a certain distance they may be regularly arranged, in which case they are alternate, with two pairs of hydrothecæ between every two, but for the most part they are more irregular, and often several follow in succession on the same side. The longest specimen which I measured was about seven inches in length, bare for about four inches up, and the remainder with a regular series of branches all on one side. But the cladophores remaining showed that the lower branches had been biserial.

The branches may be without nodes, or may have one or two short internodes at the ends, each supporting a pair or two pairs of hydrothecæ. There does not seem to be any tendency to the production of secondary branches, as none were found in the colonies examined.

The gonangia are unusually large (about 2·8 mm. long and 1·18 mm. in diameter), and the circlet of minute denticles which are found in the neck of many species is here represented by much larger irregular processes.

Loc. —Great Australian Bight, Long. 126° 45¼′ E, 190-320 fathoms: Long 130° 40′ E, 160 fathoms.

Family PLUMULARIIDÆ.

Genus Nemertesia, *Lamouroux*.

(*Antennularia*, Lamarck.)

Nemertesia ciliata, *sp. nov.*

(Plate xxxvi., fig. 1.)

Hydrophyton about a foot in height, in one plane, stem and main branches polysiphonic, beset with very numerous small monosiphonic branchlets, which are biserial, varying from opposite to alternate, and are divided into distinct internodes, each of which, except the proximal one, bears several whorls of hydrocladia. Hydrocladia mostly in whorls of three or four, alternating in position with those above and below, divided into hydrothecate long internodes and intermediate short ones bearing sarcothecæ only.

Hydrothecæ very small, cup-shaped, adnate up to the margin, which is smooth.

Sarcothecæ large, wine-glass-shaped, bithalamic, canaliculate, moveable; one in front of each hydrotheca, two laterals above it, one on each intermediate internode, and two in the axil of each hydrocladium.

Gonothecæ borne on the bases of the hydrocladia, campanulate, very thin and delicate.

Colour.—Light brown.

A very pretty species, the best specimen of which has a stem over ten inches in height, with several large branches and numerous smaller ones, all given off nearly in one plane, and at about 45°. The branches extend downwards to within about an inch of the base of the stem, and the ultimate branchlets, which are monosiphonic, are closely set, not being more than three to six millimetres apart. They are indifferently opposite or alternate, and are closely fringed throughout by the delicate hydrocladia, which are like fine cilia, averaging only from two to three millimetres in length. The internodes of the branchlets vary much in length, supporting from one up to six or eight whorls of hydrocladia. On some branchlets each whorl consists of three hydrocladia, on others four, and the same branchlet may have them in fours up to a certain point and in threes beyond it. Besides this, other irregularities occur; thus in many cases, especially on the proximal parts of the branchlets, the hydrocladia which should constitute a whorl are set at unequal heights.

Loc.—Oyster Bay, Tasmania, 60 fathoms.

Genus PLUMULARIA, *Lamarck* (in part).

PLUMULARIA ZYGOCLADIA, *sp. nov.*

(Plate xxxvi., fig. 2.)

Hydrophyton about one and a half inches in height, very slender, rarely branched, monosiphonic, divided into long internodes, each of which bears a hydrotheca and a pair of hydroeladia at the lower extremity. Hydrocladia opposite, internodes long, each (except the proximal one) bearing a hydrotheca; nodes very oblique. Isolated secondary hydroeladia occasionally present.

Hydrotheeæ borne at the lower ends of the internodes, at an angle of about 40°; campanulate, border circular, entire, back free.

Sarcotheeæ bithalamie, canaliculate, short, stout, rigid, widest in the middle of the terminal loculus; one at each side of the hydrotheca, one in front, one on the upper part of the hydrotheeal internode, one on the proximal internode of each hydrocladium, and several in line on the front of each stem-internode.

Gonothecæ:—female, pear-shaped, slightly flattened above, operculate, with a sub-globular segment between the pedicle and the capsule itself, a sarcotheca on each side near the base: (male, smaller, ovate, not flattened above, with a single sarcotheca only ?)

Colour.—Whitish.

This very delicate little species is almost a replica of the slenderest forms of *P. campanula*, except in the ramification, the hydroeladia being paired and opposite instead of alternate. *P. campanula* varies greatly in regard to the length of the hydrothecal internodes, and the consequent distance apart of the hydrotheeæ; whether the present form is similarly variable remains to be ascertained, but the few specimens found all have long slender internodes. As in the allied forms there is a tendency for the hydrothecal internodes to be divided by a more or less distinct joint above the hydrotheca, so as to form intermediate internodes. While the hydrocladia are in very regular opposite pairs, the secondary hydrocladia which are sometimes produced are given off singly and irregularly. I found a true branch only in one case, which took the place of a hydrocladium.

Not only are the mesial sarcothecæ rigidly fixed, as in most of our *Plumulariæ*, but the supracalycine pair also are too stout at the point of origin to admit of their free movement. Their

diameter at the end is less than at the middle, so that they contrast strongly with those of the " wine-glass " type. As in all the allied forms the supracalycine sarcothecæ spring from a pair of lateral enlargements of the hydrocaulus, these enlargements however are so slight that they do not appear in a side view, consequently the so-called " pedunculate " appearance of the sarcothecæ is not apparent.

I have not seen the male gonangia, but have little doubt they will be found to agree in form with those of the closely-allied *P. campanula*.

The specimens were found mixed with the root-fibres of a larger Plumularian (*Aglaopheuia armata*).

Loc.—Thirty eight-miles north-east of North Reef Lighthouse, Capricorn Group, off Port Curtis, Queensland, 74 fathoms.

PLUMULARIA SULCATA, *Lamarck*.

(Plate xxxv., figs. 6-7.)

Plumularia sulcata, Lamarck, Anim. s. Vert., 1816, p. 128; Bale, Cat. Austr. Hyd. Zooph., 1884, p. 145; Billard, Ann. Sci. Nat., 9 sér., v, 1907, p. 321; Ritchie, Mem, Austr. Mus., iv, 1911, p. 852, pl. lxxxiv, fig. 3, pl. lxxxix. fig. 5; *Id.*, Proc. Roy. Soc. Edin., xix, 1913, p. 6.

Plumularia aglaophenoides, Bale, Cat. Austr. Hydr. Zooph., 1884, p. 126, pl. x, fig. 6.

Hydrophyton reaching eighteen inches or more in height, polysiphonic, with numerous ascending branches, stem and branches thick, flexuous, giving rise to two series of monosiphonic pinnately-disposed alternate branchlets, one from each flexure; branchlets continued uninterruptedly from some of the fascicle-tubes of the stem or branch, their proximal portion separated from the rest by two distinct oblique joints, less distinctly jointed for the rest of their length, bearing hydrothecæ as well as hydrocladia. Hydrocladia alternate, close, one on each internode of the branchlets, both series borne towards the front and supporting a hydrotheca on each internode; nodes oblique, sometimes very strongly marked at or near the ends of the hydrocladia, but mostly obsolete. No septal ridges in the internode.

Hydrothecæ large, close, campanulate, set at an angle of about 45°, border circular, entire except at the back, which has a broad sinuation.

Sarcothecæ bithalamic, canalieulate; one, seoop-shaped, stout and rigid, in front of the hydrotheca, to which it is almost appressed; two, large, wine-glass-shaped, at the sides, on rather high peduneles; two, very small, under the back of the hydrotheca and two larger ones just above, one or two on the proximal internode of each hydroeladium, and generally a double series running down the proximal part of each branchlet (below the double joints); only the laterals freely moveable.

Gonothecæ large, urceolate, slightly narrowed upward and again expanding to the summit, margin circular, oblique, not contracted nor thickened; a stout transverse ridge inside the front a little below the margin; a large operculum the full width of the gonotheca, slightly convex in the middle, situated inside the margin and resting on the internal ridge in front; several large sarcothecæ (often five or six) surrounding the base.

Colour.—Blackish in some colonies, very pale-brownish in others.

This remarkable species, which was first made known by me under the name of *P. aglaophenoides*, has been identified by Billard with *P. sulcata*, one of the species named, but not adequately described, by Lamarck. My original specimen was a fragment only, but the species has been further described by Billard, and also by Ritchie, who obtained specimens from the "Thetis" collection. Some finer specimens than have hitherto been observed are among the material dredged by the "Endeavour," and some of them include the gônangia, not heretofore described.

The largest specimen is about eighteen inches high and three to five wide, with eight or nine main branches and many smaller ones. The stem is over one-third of an inch in diameter at the base, and is bare only for the lowest two or three inches. The stem and branches are regularly flexuous, the pinnately-disposed branchlets* springing from the flexures alternately on each side.

The ramification is different from that of any other species which I have examined, and I have not succeeded in tracing clearly the origin of the branchlets. They are not given off, as in most species, laterally from a distinct primary stem, but their proximal portion is continued without interruption into the fasciele of tubes which make up the stem or branch, and may be traced for some distance down till they are lost to sight among

*I prefer the term "branchlets" to "primary hydrocladia" for convenience, and also because in bearing hydrothecæ as well as hydrocladia they merely agree with the branches and stems of many species of *Plumularia*, which nevertheless could not with propriety be classed as "hydrocladia."

the many other tubes constituting the fascicle. The curve which they make in emerging from the branch is continued down into the latter, and constitutes the flexure: below this they curve in the opposite direction, accommodating themselves to the outward flexure of the next branchlet below.

Examining the top portion of an unbroken branch we find it to consist of the two branchlets last produced, each composed of two outward-curved tubes, one of which has more or less distinct internodes, while the other is unjointed. The latter does not accompany the first beyond the point at which it becomes ultimately united with other tubes to form the polysiphonic branch. Accordingly below the second branchlet the stem consists of four tubes, two of which afterwards become entirely immersed in the fascicle, while two are continued outwards as monosiphonic branchlets. I have also found the third branchlet accompanied by its supplementary tube, and the stem below it therefore consisting of six tubes, but I have not been able to follow the structure further. The component tubes of the stem are not easily teased apart without breaking the thinner ones, even after boiling in liquor potassæ; besides this treatment shrivels and distorts them badly. I was able however to ascertain that branching occurs among them. Some bear rows of sarcothecæ on the front, others are without them.

The two oblique joints near the base of the branchlet include between them a short internode bearing a small hydrotheca or sometimes a hydrocladium, as pointed out by Ritchie. Below this, where they curve into the stem, they may be divided into several short internodes, or the nodes may be wanting here but yet distinct lower down, where the tubes form part of the fascicle. The double row of sarcothecæ is also continued for some distance down into the stem. Successive branchlets on the same side may be, in different specimens, from three to six millimetres apart.

The anterior sarcothecæ are very thick at the base and quite rigid, and those above the hydrothecæ, though much narrower at the point of origin, are pretty firmly attached. The laterals however are freely moveable. Ritchie says that the two above the hydrotheca are often replaced by a single one.

The gonangia, like the rest of the polypidom, are of firm robust texture. It is an unusual feature that they are entirely without any thickening of the margin, which is quite thin and even, and neither everted nor contracted, while the operculum instead of being, as usual, on the summit, is wholly within the capsule, and some distance below the margin. The ridge which is situated inside the front is evidently a support on which the

edge of the operculum rests, and above which it seems to be hinged. The large sarcotheeæ surround the base of the gonotheca like a ealyx; in most cases I found five or six, but in others there were not so many.

My first specimen was extremely dark in colour, almost black indeed, as are some of those in the present eolleetion. But there are several eolonies of very pale colour, which present a striking contrast to the others; they are also rather more lax in growth, with the branehlets further apart. After careful examination, however, I can find no suffieient ground of separation. The colour of the black form is due less to the perisare than to the remains of the soft parts, which are so opaque as to render it impossible in most cases to see the details of the polypidom. In the pale variety the remaining soft tissues are quite light in eolour, and there was no difficulty in the examination. When studying the original speeimen I did not find more than two hydrotheeæ fairly elear, the figure however was eorrect exeept in the position of the sareothecæ behind the hydrotheea, whieh were facing outwards; their more usual position seems to be faeing upward.

Loc.—Bass Strait, 40 fathoms (type form); fifty miles south of Cape Wiles, South Australia, 75 fathoms (both forms).

Genus Aglaophenia, *Lamouroux* (in part.)

Aglaophenia armata, *sp. nov.*

(Plate xxxviii., figs. 3-4.)

Hydrophyton nearly a foot in height, polysiphonic, branched freely and irregularly, mostly in the upper portion, branehes springing from the front of the primary tube, between the bases of the hydrocladia, internodes supporting eaeh a hydroeladium but the nodes often indistinct. Hydroeladia alternate, close, divergent at about 45° or 50°, nearly in one plane, nodes transverse or slightly obliqne.

Hydrothecæ borne nearly on the front of the hydroeladia, elosely set at a wide angle, long, tubular; a strong intratheeal ridge a little above the base, originating at the baek angles of the lateral sareotheeæ, and extending fully half through the eell, and directed somewhat downward; border with a rather large straight pointed median anterior tooth, and three teeth on each side, baek very deeply excavated. Two septal ridges in the internode, one under the front of the hydrotheca and one under the lateral sareothecæ, very often a third between them.

Mesial sarcotheca tubular, about as long as the hydrotheca, straight or slightly curved, free for one-fourth or one-third of its length and often diverging somewhat from the hydrotheca, the circular terminal aperture often united to the inferior one. Lateral sarcothecæ tubular, nearly erect, closely adnate to the hydrotheca throughout and reaching more than three-fourths the height of the latter, apertures as in the mesial. Cauline sarcothecæ, two in front close to the base of each hydrocladium (the upper larger), and one at the back. A crateriform elevation with a circular aperture on each hydrocladium-process.

Gonangial branch replacing a hydrocladium—female, commencing with about eight to ten internodes bearing modified hydrothecæ, often deformed and united by perisarcal growths; corbula closed, consisting of about fourteen or fifteen pairs of alternate leaflets, each bearing on the distal side at the base a projecting sarcotheca and above it a minute irregular hydrotheca (?) with two or three sarcothecæ above; distal edges of the leaflets higher up continued into extremely large foliaceous expansions which project outwards on all sides, dividing into several very large lobes, all profusely fringed with sarcothecæ: male, commencing with about four hydrothecæ, not much modified, corbula differing from the female in the much smaller foliaceous appendages. Small apertures at the bases of the leaflets covered by the rudimentary hydrothecæ.

Colour.—Light brown.

This is a handsome plumose species, with closely-set hydrocladia, which are about one-third of an inch in length. Its branches are directed forward from the stem, springing from the front, and not taking the place of a hydrocladium. The long tubular hydrothecæ are very distinct from those of any other species known to me, and the peculiar position of the intrathecal ridge is a character shared only by *A. megalocarpa*. There is some variation in the angle at which the hydrothecæ are borne, especially marked in those on the proximal portion of the gonocladium, which are much less erect than the others. The marginal teeth are distinct; typically the first on each side is triangular and acute, while the second is more broadly rounded, but exceptions are common. The mesial sarcotheca may be quite straight, or a little incurved towards the hydrotheca, or with the free portion somewhat directed away from it.

The gonangial structures are very remarkable. The male and female colonies differ not only in the corbula itself, but in the arrangement of the proximal internodes of the gonocladium, those of the male bearing only four or five hydrothecæ, which are normal or nearly so, while in the female there are eight or ten, many of which are, in the specimens examined, more or less

deformed and distorted, and partly overgrown by perisarcal tubes such as form the fasciculate structure of the hydrocaulus. The hydrothecæ of the corbula are extremely rudimentary structures. They are borne on the distal edges of the leaflets, just above their origin; there is first a projecting sarcotheca, above it the hydrotheca, and one or two smaller sarcothecæ higher up. The hydrotheca itself is very irregular in form, and very small; it often has a distinct single lobe on the outer margin, but the inner side seems to be adherent to the leaflet. It has no lateral sarcothecæ. The hydrotheca, with the inferior sarcotheca, forms a very slight projection corresponding to the more prominent lateral spur which in some species bears a hydrotheca, and in others sarcothecæ only, and it similarly covers an opening between the bases of the leaflets, which, however, is here very small, and which I have only been able to distinguish in the male corbula. The structure is very difficult to make out, and it is only after considerable hesitation, and still with some doubt, that I have come to the conclusion that these small indefinite receptacles are really hydrothecæ.

The characteristic foliaceous appendages of the corbula are of the same class as those which occur in *A. tasmanica* and allied forms, but they are here even more developed, standing out from the sides of the corbula as much as above it, and surrounding it with a complete cheval-de-frise except immediately behind the rachis. There are two main lobes rising from the edge of each leaflet, the lower and smaller one curling back towards the rachis, while the larger spreads laterally and above the corbula, dividing into three or four large angular secondary lobes of thick perisarc, with all the margins bordered with sarcothecæ. The diameter of a female corbula seen from above, and measured across these appendages, will average at least three times the diameter of the closed receptacle alone. Female corbulæ may average about 8 or 9 mm. in length, male about 5 or 6 mm.

The species seems rather prone to irregularity of growth. I have seen two or three instances of isolated secondary hydrocladia, each of which grew out of a hydrotheca, and stood out at right angles to the primary hydrocladium. In another case a ramule commenced as an ordinary hydrocladium, the first five internodes bearing hydrothecæ, it then assumed the character of a branch, producing first an ordinary hydrocladium, then a gonocladium with a corbula, on the same side, then several short alternate hydrocladia, after which it passed uninterruptedly into a corbula.

Loc.—Thirteen miles north east of North Reef, 70-74 fathoms; thirty-eight miles north east of North Reef Lighthouse, Capricorn Group, off Port Curtis, Queensland, 74 fathoms.

AGLAOPHENIA CALYCIFERA, *sp. nov.*

(Plate xxxvii., figs. 3-4.)

Hydrophyton about six inches in height, polysiphonic, rather slender, a few branches in one plane at an angle of about 45°, springing from the primary tube and replacing a hydrocladium; nodes oblique, faint. Hydrocladia alternate, divergent at about 40°, both series borne on the front, nodes transverse.

Hydrothecæ almost parallel with the hydrocladium, a narrow intrathecal ridge near the base, at right angles to the internode, with a fold from it crossing the cell and curved backwards; border with a sharp median anterior tooth and about three shallow crenations on each side, back entire, adnate. Two septal ridges in the internode, one opposite the intrathecal ridge, the other at the base of the lateral sarcothecæ.

Mesial sarcotheca about two-thirds the length of the hydrotheca, arched throughout, much widened towards the aperture which is oblique, and the full width of the sarcotheca. Lateral sarcothecæ large, adnate up to the hydrotheca-margin, wider towards the aperture. Cauline sarcothecæ like the laterals, two at the base of each hydrocladium in front.

Gonangial branch replacing a hydrocladium, commencing with several elongated internodes bearing hydrothecæ; corbula—female, composed of about ten or twelve pairs of ribs, narrow at the base but widening immediately into broad leaflets, which unite to form the closed corbula; a short spur projecting forward from the distal side of each leaflet close to the base, supporting a modified hydrotheca with its lateral sarcothecæ, one or two sarcothecæ above and below, distal edges of the leaflets giving rise to large free-edged wings directed outward and rising above the corbula, their edges armed with close series of cup-like sarcothecæ; one or two free leaflets usually at the distal or both ends of the corbula; male—with seven or eight pairs of leaflets, the lateral wings smaller and generally developed only on the distal portion of the corbula.

Colour.—Light brown.

One of the most noticeable features of this species is found in the cup-like character of the sarcothecæ, which all agree in becoming wider to the aperture, which extends right across. The form of the apertures, however, clearly indicates in most cases, especially in the mesial sarcothecæ, that they are the result of two wide orifices—terminal and inferior—cutting into each other. The narrow intrathecal ridge and the base of the lateral sarcothecæ are nearer together than in most species, consequently the same condition prevails in the septal ridges which accompany

them. The hydrothecæ on the proximal internodes of the gonocladium (which numbered in the specimens examined from six to eleven) are little if at all modified, but the internodes supporting them are much elongated, their proximal ends extending some distance beyond the hydrothecæ. In these long internodes the septal ridges were wanting. The crenation of the hydrotheca-margin varies, being sometimes scarcely indicated.

In the corbula the ribs widen out into broad leaflets close above their point of origin, so that they do not leave the large intermediate openings such as we find in *A. billardi* and many other species; the openings, where they exist at all, being very small. Sometimes a few small openings are found higher up, where the edges of the leaflets fail to meet. The superior crests or secondary leaflets of the female corbula are sometimes almost as large as those of *A. billardi*, those of the male are usually smaller and strongly curved forward, not so erect as those of the female. The latter average about 6-8 mm. in length, the male about 5 mm. The lateral spurs scarcely project outward, they usually terminate with a small semi-globular sarcotheca, immediately below the hydrotheca, and bear a larger one below, set further back. The corbula is especially characterized by the closely-ranked rows of cup-like sarcothecæ.

Loc.—Great Australian Bight, Long 130° 40′ E, 160 fathoms; Long. 126° 45¼′ E, 190-320 fathoms.

Aglaophenia tenuissima, *sp. nov.*

(Plate xxxvii., figs. 1-2.)

Hydrophyton reaching about fifteen inches in height, polysiphonic but extremely slender, flexuous, giving off from the flexures small and delicate monosiphonic alternate branches which bear only sarcothecæ on the proximal portions; nodes indistinct, hydrocladia alternate, short, one on an internode.

Hydrothecæ nearly cylindrical, almost parallel with the internode, an oblique rudimentary intrathecal ridge on the adcauline side near the base; aperture oblique, border with a triangular pointed median anterior tooth, and four teeth, similar but shorter, on each side, back entire, adnate. Two septal ridges in the internode, one opposite the intrathecal ridge, the other opposite the base of the lateral sarcothecæ, a third often between them.

Mesial sarcotheca less than half the length of the hydrotheca, adnate, projecting free portion very short, widely canaliculate. Lateral sarcothecæ small, adnate up to the hydrotheca-margin and scarcely projecting beyond it, canaliculate. Cauline sar-

cothecæ similar to the laterals, but larger, one in front in the axil of each hydrocladium and one lower down, one at the back of each axil.

Gonangial branch replacing a hydrocladium, commencing with three or four internodes supporting slightly modified hydrothecæ; corbula (female?) composed of about fifteen pairs of ribs, narrow at the base, but widening above into broad leaflets which unite to form the closed corbula; a lateral spur projecting forward and outward from the distal side of each leaflet close to the base, supporting a modified hydrotheca with its lateral sarcothecæ, and then continued into a leaf-like process, sometimes very large, armed with few sarcothecæ; distal edges of the corbula-leaflets giving rise to large leaf-like free-edged wings directed outward and rising above the corbula, their edges armed with sparsely-disposed sarcothecæ; one or two free leaflets often at the distal or both ends of the corbula.

Colour.—Very pale brownish.

Old specimens of this species, a foot or more in height, may have a thickness of one and a half centimetres close to the base, but the topmost two or three inches, which alone retain the hydrocladia, are extremely slender. The stem is formed primarily by the proximal portions of a succession of alternate branches. The primary shoot, after giving off a lateral branch, continues on its course for perhaps an inch or two, bearing hydrocladia, and then terminates; the lateral branch then becomes the axial one, growing for some distance (an inch or so) without hydrocladia, but with a long series of sarcothecæ; it then in turn gives off a lateral branch on the opposite side to that on which it commenced, after which it produces hydrocladia, while the new lateral branch takes up the role of continuing the axial column. It appears to be the rule that a branch does not produce hydrocladia till after it has given origin to the next branch, the stem therefore, being made up of a succession of these sarcothecate portions of the branches, does not bear hydrocladia, but there are exceptions. A lateral offshoot is much slenderer at its origin than the branch from which it springs, but it grows thicker upwards till at the next furcation it is as thick as its predecessor, and gives origin in turn to another slender one, which recapitulates the process.

The fasciculation commences at the bifurcations, at each of which originates a supplementary unjointed tube which also bifurcates, sending a branch up each of the jointed tubes, and thus originating the fasciculate structure. In each instance where I was able to trace the first appearance of the supplementary tubes they originated in the same manner. After a branch has been produced and has grown for some distance a small

orifice is formed in front of the axil, on the apophysis of the new branch. Through this proceeds an offshoot from the cœnosarc which takes its course through the axil to the back, where it bifurcates and grows up the branches as described, establishing communication with them at intervals by the formation of small foramina as is usual in compound stems. As the supplementary tubes accompany *both* jointed tubes it would seem that the branch as well as the stem should become fascicled, but so far as I observed the supplementary tube only proceeds for a very short distance up the base of the hydrocladiate branch, which remains monosiphonic for the rest of its length, while on the other branch, the proximal part of which is destined to form part of the stem, the fasciculation is continued upward. It is interesting to compare the fasciculation of this species with that of *Halicornaria vegæ* and *H. tubulifera*, in which supplementary tubes originate at the axils and grow *down* the stem.

The regularity of the hydrotheca-margin is noticeable. All the teeth are alike except that the anterior one is somewhat larger. Of the two cauline sarcothecæ in front of each internode, the lower is further from the hydrocladium than the other, and both are about in the middle line, so that they form a straight series down the front. The proximal part of a branch may bear as many as fifty sarcothecæ in line, possibly more.

The corbulæ are commonly borne in rows of four or five. The large secondary leaflets differ strikingly in the sparseness of their sarcothecæ from those of *A. calycifera*. The lateral spurs support their hydrothecæ quite outside the corbula-wall, and are then continued into a large spatulate process which however may bear only two sarcothecæ, with a blunt point between them; towards the end of the corbula they may become much larger, with more sarcothecæ.

Loc.—Great Australian Bight, Long. 126° 45¼′ E, 190-320 fathoms; Long. 130° 40′ E, 160 fathoms.

Aglaophenia carinifera, *sp. nov.*

(Plate xxxviii., figs. 1-2.)

Hydrophyton reaching about a foot in height, polysiphonic (unbranched ?); stems divided by oblique joints into internodes, each supporting a hydrocladium. Hydrocladia long (about an inch), alternate, both series springing from the front, nodes oblique.

Hydrothecæ set at an angle of about 40°, deep, a rudimentary ridge on the adcauline side near the base, continued into a slight intrathecal fold nearly or quite crossing the basal part of

the cell; border with a median anterior tooth and two on each side, the first triangular, short and wide, the second still shallower, often nearly obsolete, back excavated, adnate; front of the hydrotheca with an external longitudinal ridge terminating in an elevated pointed crest over the anterior marginal tooth. Two septal ridges in the internode, one opposite the hydrothecal fold, the other at the base of the lateral sarcothecæ, sometimes a third between them.

Mesial sarcotheca about three-fourths the length of the hydrotheca, adnate most of its length, the free distal portion usually directed more outward, terminal and inferior apertures completely confluent. Lateral sarcothecæ divergent, adnate up to the hydrotheca-margin, free terminal portion short, conical, directed outward, terminal and inferior apertures confluent. Cauline sarcothecæ stout, widely open above, two at the base of each hydrocladium in front.

Gonosome ?

Colour.—Brown.

This species, so far as the form of the hydrotheca is concerned, somewhat resembles *A. carinata*, Bale, which Billard identifies with *A. brachiata* (Lamarck), but the habit is very different, the polypidom being usually unbranched. In one or two instances new shoots were given off at right angles from the bare denuded portions of old stems; these however appeared to be entirely new colonies, the hydrorhizal filaments by which they were attached running round and along the supporting stem in every direction.

Other characters by which the species may be distinguished from *A. carinata* are—the larger size of the hydrotheca (·48 mm. as against ·32 mm. in length), the smaller and shallower lateral teeth, and the general absence of the third tooth on each side, which in *A. carinata* is usually well marked, and the different configuration of the apocauline side of the hydrotheca, with the mesial sarcotheca. The last feature is characteristic; in *A. carinifera* the free part of the sarcotheca is rather abruptly bent outward, giving the sarcotheca, with the hydrotheca, a "broken-backed" aspect, while in *A. carinata* the sarcotheca has a uniform convex curve throughout, the free portion being directed inward rather than outward. The apertures of the sarcothecæ are more widely canaliculate in *A. carinifera*, and the laterals are directed more outward.

The structure of the hydrocaulus is very different in the two species. In *A. carinata* the supplementary tubes which grows up in contact with the primary tube are rather slender, and the

little circular foramina—channels of communication between the different tubes—are excessively numerous, often indeed for considerable distances almost touching each other. The supplementary tubes of *A. carinifera* on the contrary are much stouter, but fewer, and the foramina few and distant.

When the second pair of lateral teeth is feebly developed the hydrotheca-margin may become indistinguishable from that of *A. billardi* or *A. tasmanica*, except of course in the presence of the conspicuous crest formed by the median ridge.

Loc. :—Great Australian Bight, 130-190 fathoms, 80-120 fathoms, 100 fathoms; Long. 126° 45¼′ E, 190-320 fathoms.

Genus Halicornaria, *Busk.*

Halicornaria urceolifera *(Lamarck.)*

(Plate xxxvii., figs. 5-6.)

Plumularia urceolifera, Lamarck, Anim. sans Vert., ii., 1816, p. 125.

Aglaophenia urceolifera, Kirchenpauer, Abh. Nat. Ver. Hamburg, v., 1872, p. 29.

Halicornaria urceolifera, Billard, Ann. Sci. Nat. Zool., (9), v., 1907, p. 324, fig. 1; Bale, Report on the Hydroida, "Endeavour" Results, ii., 1914, p. 51, pl. v., fig. 4, pl. vii., fig. 5 (var. *scandens*.)

Hydrocaulus monosiphonic, unbranched or with few small branches, reaching a foot in height; hydrocladia alternate, two, or rarely one, on an internode, at an angle of about 45°, and both series directed towards the front; nodes transverse or slightly oblique.

Hydrothecæ cup-shaped, deep, set at an angle of about 40°, without intrathecal ridge; border with a small anterior tooth which, along with the part of the hydrotheca-wall immediately below it, is abruptly bent inward, the first tooth on each side erect, a large triangular tooth or lobe near the middle on each side, widely everted, and another lobe smaller and more rounded, adjoining each lateral sarcotheca; back entire, adnate; the hydropore with a few minute denticles on the margin. No septal ridges in the internode.

Mesial sarcotheca about two-thirds the length of the hydrotheca, projecting free portion short, with two small sub-tubular apertures besides the inferior one. Lateral sarcothecæ large,

adnate, saccate, with one or two tubular apertures, one directed downwards at right angles with the hydrotheca, the other, when present, directed upwards and forwards, but often merged completely in the wide lateral aperture. Cauline sarcothecæ similar to the laterals but with more apertures, two on the rachis at the base of each hydrocladium, and a third at the back of each axil.

Gonothecæ about three times the length of the hydrothecæ, campanulate, truncate.

Colour.—Brown, stems very dark.

Among the Hydroids described in the first part of this Report were some small specimens of *Halicornaria*, found overrunning the stems of large *Aglaophenia*, and which, while differing slightly from Billard's account of *H. urceolifera*, seemed sufficiently close to that description to admit of their being referred to the species. Later on other specimens were obtained, which correspond pretty closely with Lamarck's type, and I consequently distinguished the first form as var. *scandens*. It differs from the type principally in its smaller size—about four to five inches—and in the mesial sarcotheca, which has nearly always a single terminal aperture instead of two.

The present form is represented by a small number of shoots about a foot in height, or slightly more than Lamarck's specimen, and which all spring from the hydrorhiza in a cluster, thus not sharing in the parasitic or climbing habit of the smaller variety. Some are unbranched, but one or two have a small branch near the summit. Most of the stem-internodes which I examined bore two hydrocladia, those bearing a single one being rare. Some specimens of var. *scandens*, with thick stems, agree in this particular; in others, where the stems are more slender, the shorter internodes preponderated. The large specimens are darker in colour, especially the stems, which are nearly black, as described by Lamarck.

The minute structure is very similar to that of var. *scandens*, the most conspicuous difference being in the mesial sarcothecæ, which have two small sub-tubular terminal orifices placed side by side, and distinct from the wide inferior opening. Another distinction is that in the type form the first pair of lateral teeth of the hydrotheca-border are considerably shorter than those of var. *scandens*, while an inward bulging of the front of the hydrotheca, under the mesial sarcotheca, is more apparent. The back lateral lobes of the border scarcely rise beyond the lateral sarcothecæ, and are therefore still more inconspicuous than in the small variety; in both forms however, this lobe is feebly developed and apt to be obsolete.

In all these points the specimens coincide with Billard's figures. The absence from those figures of the median lateral lobes of the hydrotheca-margin is immaterial, as Billard mentions that the specimens were not in a condition to enable him to make out clearly the exact form of that part.

The little circular orifices, of which both mesial and lateral sarcothecæ possess two, are still more profusely developed in those of the hydrocaulus, the two in front usually having from three to five, while the one behind the axil commonly has six or seven.

The lateral sarcothecæ are very large, and in side view they mostly overlap the base of the next hydrotheca, often even to a greater extent than shown in the figure.

Loc.—Great Australian Bight, 80-120 fathoms.

Halicornaria vegæ, *Jäderholm.*

(Plate xxxvi., figs. 4-5.)

Halicornaria Vegæ, Jäderholm, Aussereuropäische Hydroiden im Schwedischen Reichsmuseum, 1903, p. 301, pl. 15, fig. 1-4.

Hydrophyton about eight inches in height, stem slightly geniculate, fascicled below, dividing into three at each geniculation; side branches three or four inches long, divergent on alternate sides, monosiphonic, bearing only sarcothecæ on the proximal portions, nodes oblique. Hydrocladia short, alternate, one on an internode.

Hydrothecæ very large and stout, almost parallel with the internode, campanulate in front view and narrow except towards the aperture, where they are expanded; in side view much stouter, and narrowed towards the aperture; smooth, with no intrathecal ridge nor fold; a small process projecting from the lower edge of the hydropore, with two or three minute denticles; border circular, with a distinct anterior tooth, otherwise entire, smooth or faintly undulated, back free; a slight longitudinal fold running up the front. No septal ridges.

Mesial sarcotheca tubular, small, projecting at a wider angle than the hydrotheca, to the basal part of which it is adnate; free portion short, contracted, with terminal and inferior apertures, which are generally distinct though closely approximate. Lateral sarcothecæ small, ovate, closely adnate, apertures as in the mesial. Cauline sarcothecæ similar to the laterals, two at the base of each hydrocladium in front and one behind the axil.

Gonosome ?

Colour.—Very light brownish, the polypidom very thin and flaccid.

A little uncertainty exists as to the identity of this Hydroid with Jäderholm's species, which seems to be of more robust habit, with the branches characteristically recurved. The difference however is not greater than may possibly be accounted for by the ages of the respective forms, and in view of the very close similarity of their minute structure I have not felt justified in separating them. Jäderholm's specimens were from Japanese waters.

In most of its characteristics the species differs widely from the previously known Australian species, the ramification especially being quite distinct (though similar to that of *H. tubulifera*, also described in the present Report). There is in reality no true *stem*, as distinguished from the branches, but instead we find a succession of branches, each springing from the proximal part of the preceding one alternately on opposite sides, and the series of the proximal segments of these branches forms practically a stem, which moreover becomes fascicled in the manner to be described. If we take any given segment of the upper part of the axial tube we find that at a certain point (a geniculation) it gives origin to a lateral branch. This branch immediately divides, one division continuing upward and outward, the other curving round the axial tube (to which it remains adherent) to the opposite side, where it again subdivides, one division forming another lateral branch, while the other is continued in the form of a supplementary tube, which grows *downward* in contact with the axial one, thus contributing to the formation of the fascicled stem. From every geniculation, therefore, ascend three free tubes, which in relation to each other, may be described as primary, secondary, and tertiary. They are all alike, having a considerable proximal portion provided with sarcothecæ only, but one of them (the secondary one) soon branches, repeating the scheme of ramification above described, so that the secondary tube of one axial segment becomes the primary one of the next above. This occurring on alternate sides causes the stem to have a somewhat zig-zag course, the geniculations being about a quarter to a half inch apart, and the branches are free from hydrocladia for a greater distance than this from their origin. The nodes are faint or quite indistinguishable on these portions, but more pronounced on the hydrocladiate parts.

The branches are all originally monosiphonic, and continue so with the exception of those portions which become part of the stem. The supplementary tubes which, as described above, originate at each geniculation, grow downward towards the base

of the colony, so that for each additional branching point a fresh tube is added. While the latest formed tubes do not reach so far down as the next geniculation, the older ones extend further down in proportion to their age, and probably the fasciculation of the lower part of the stem may be entirely due to them.

Few of the hydrocladia reach more than about one-fifth inch in length, or support more than seven or eight hydrothecæ. The latter are unusually large (about ·60 mm. in length), and appear noticeably different in form according to the aspect in which they are viewed. In the absence of any denticulation of the border, other than the anterior tooth, they present a character more commonly found in the genus *Cladocarpus*. The denticles on the margin of the hydropore are generally situated on a small prominent flap of perisarc.

In an exact front view two faint lines are seen running nearly parallel along the front of the hydrotheca and diverging in outward curves towards the border, where they become nearly or quite invisible. These apparently indicate the edges of a longitudinal depression, but they are extremely slight, so that if the cell lies a little obliquely the nearer one is not apparent, while the other becomes conspicuous throughout. The part of the hydrotheca-wall on which the anterior tooth is situated is distinctly bent inward, the longitudinal furrow becoming at that part wider and deeper, but without any defined boundary.

The gonangia, which Jäderholm has shown as of a deep cylindrical form, not narrowed at the top, are not present in our specimens.

Loc.—Great Australian Bight, 80-120 fathoms.

Halicornaria tubulifera, *sp. nov.*

(Plate xxxvi., fig. 3.)

Hydrophyton very small, stem slightly fascicled in parts, dividing into sets of three branches at intervals; side branches divergent on alternate sides, monosiphonic, bearing only sarcothecæ on the proximal portions, nodes oblique, often indistinct. Hydrocladia short, alternate, one on an internode.

Hydrothecæ tubular, very long and slender, lying along the hydrocladium for about three-fourths of their length, then curving upwards and becoming erect; free portion expanding towards the aperture; no intrathecal ridge nor fold; a long narrow process projecting from the lower edge of the hydropore, with two or three minute denticles at the end; border nearly horizontal, with a rather large median anterior tooth, incurved, and three slight points (or four shallow emarginations) on each side (sometimes obsolete), back entire, free. No septal ridges.

Mesial sarcotheca very small, adnate to the base of the hydrotheca, free projecting portion very short, with terminal and inferior apertures which are generally distinct though closely approximate. Lateral sarcothecæ very small, ovate, closely adnate, apertures as in the mesial. Cauline sarcothecæ similar to the laterals, but larger, two at the base of each hydrocladium in front and one behind the axil.

Gonothecæ borne at the bases of the hydrocladia small, ovate, slightly flattened on the summit.

Colour.—Whitish.

This species is very closely allied to *H. vegæ*, notwithstanding the marked dissimilarity in the hydrothecæ of the two species. The peculiar system of ramification agrees closely with that of *H. vegæ*, and the description need not be repeated. But whether the species ever attains a size approaching that of *H. vegæ*, or develops a distinct fascicled stem, is not apparent. I saw only a few fragments, not exceeding an inch and a half in height, and branching about twice, and the supplementary tubes which originate from the branching points had in scarcely any cases reached the next branch below.

The long slender hydrothecæ are of graceful form and delicate texture, the free distal portion being so collapsible that few of them have, in the mounted specimens, retained their original form. The denticulation of the border varies greatly, being sometimes almost wanting. In lateral view there appears at first sight to be a distinct intrathecal ridge; closer scrutiny however shows that this is a narrow process, triangular in front view, which projects freely into the cavity of the hydrotheca from the margin of the hydropore, and corresponds with the small perisarcal flaps found in a similar position in *H. vegæ*.

The specimens were found mixed with a cluster of shoots of *Aglaophenia tenuissima*, but were detached; it is uncertain, therefore, whether the association was accidental or whether the colony had established itself on the *Aglaophenia* in the fashion of so many other species of the genus.

A very closely allied species is *H. expansa*, Jäderholm (Aussereuropäische Hydroiden im Schwedischen Reichsmuseum), which however seems to be a far larger and more robust form, while the hydrothecæ have the adnate portion not nearly so elongated and the distal portion much less strongly curved away from the hydrocladium than in the present species. It is found in the Japanese region.

Loc.—Great Australian Bight, Long. 130° 40′ E, 160 fathoms.

EXPLANATION OF PLATE XXXV.

Fig. 1. *Cryptolaria angulata*, sp. nov.
Shown without the supplementary tubes which ultimately surround it.

Fig. 2 *Hypopyxis distans*, sp. nov.
Part of a pinna, with the opercula in various positions.

Fig. 3. *Hypopyxis distans*, sp. nov.
Part of main stem. Opercula absent.

Fig. 4. *Hypopyxis distans*, sp. nov. Back view.

Fig 5. *Hypopyxis distans*, sp. nov. Gonotheca.

Fig. 6. *Plumularia sulcata*, Lamarck. Gonotheca.

Fig. 7. *Plumularia sulcata*, Lamarck. Gonotheca.
Figs. 1-7 x 40.

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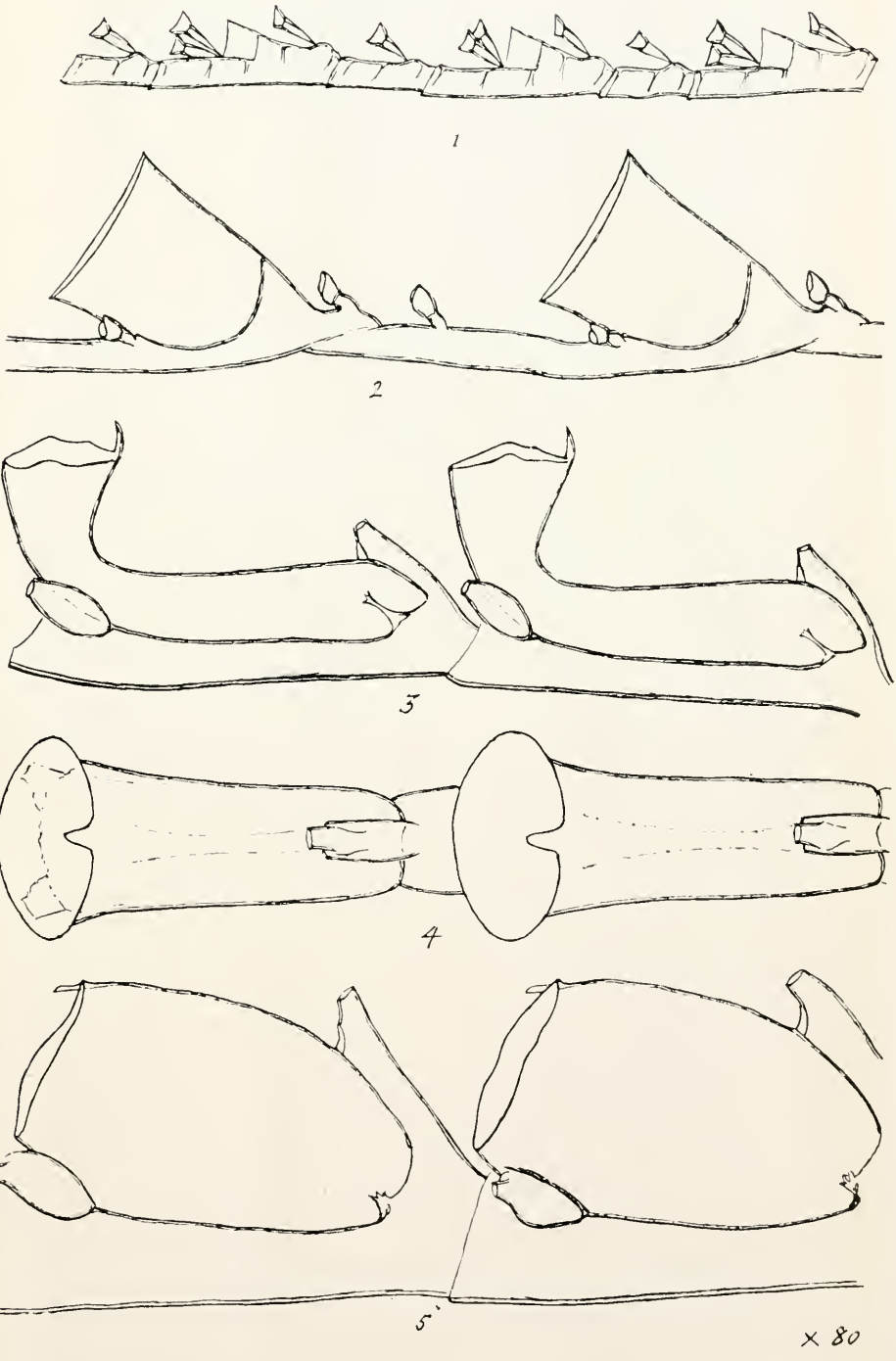
EXPLANATION OF PLATE XXXVI.

Fig. 1. *Nemertesia ciliata*, sp. nov.
Fig. 2. *Plumularia zygocladia*, sp. nov.
Fig. 3. *Halicornaria tubulifera*, sp. nov.
Fig. 4. *Halicornaria vegæ*, Jäderholm.
Fig. 5. *Halicornaria vegæ*, Jäderholm.

Figs. 1-5 x 80.



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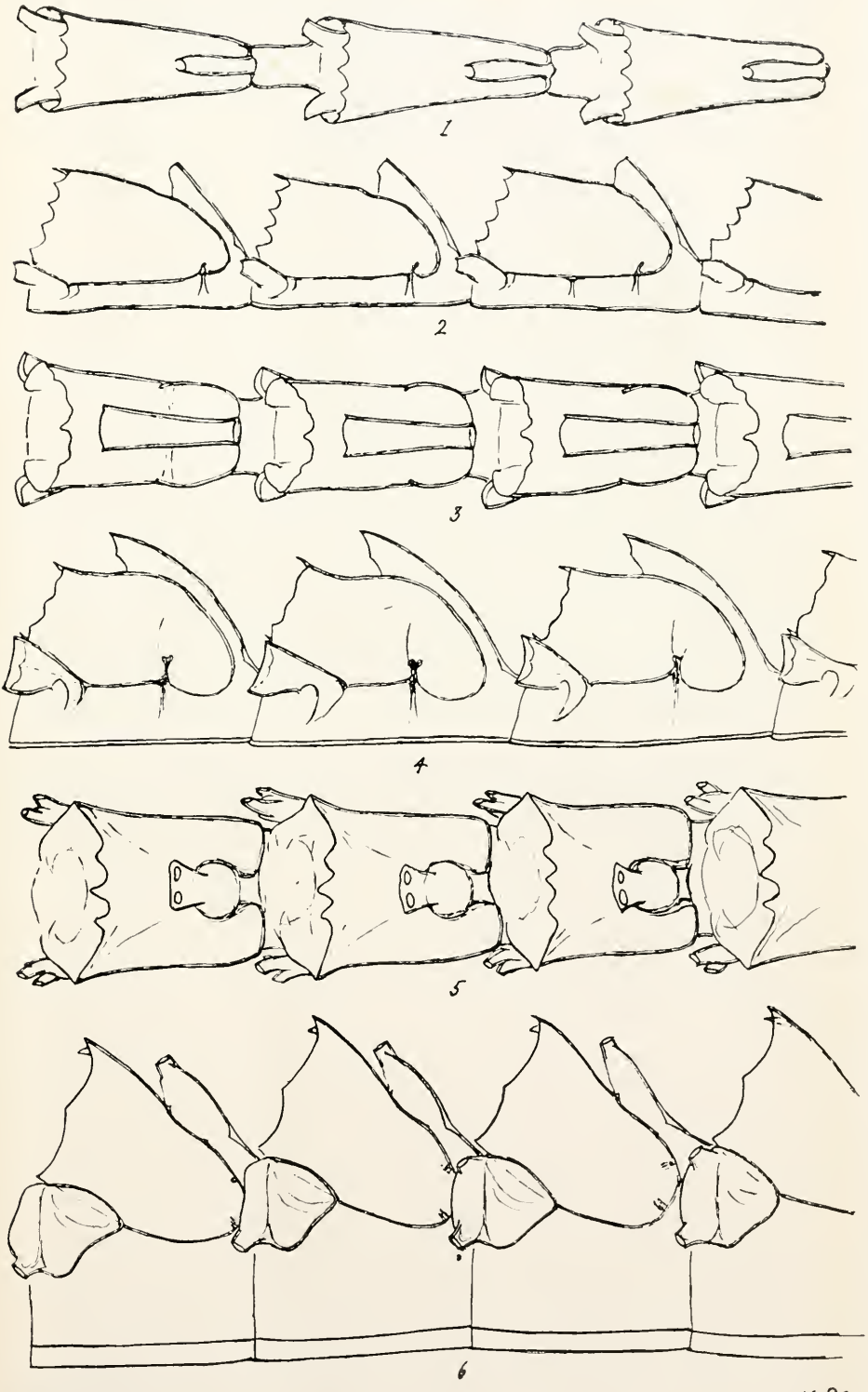
EXPLANATION OF PLATE XXXVII.

Fig. 1. *Aglaophenia tenuissima*, sp. nov.
Fig. 2. *Aglaophenia tenuissima*, sp. nov.
Fig. 3. *Aglaophenia calycifera*, sp. nov.
Fig. 4. *Aglaophenia calycifera*, sp. nov.
Fig. 5. *Halicornaria urceolifera* (Lamarck).
Fig. 6. *Halicornaria urceolifera* (Lamarck).

Figs. 1-6 x 80.



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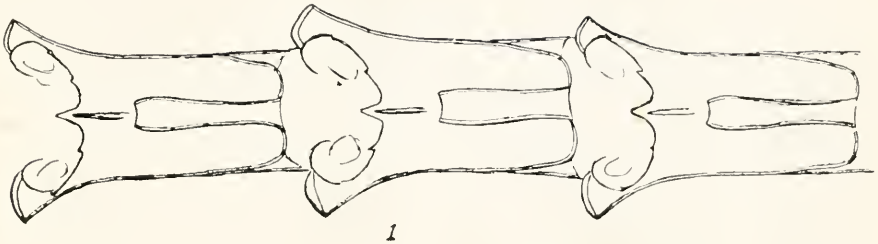
EXPLANATION OF PLATE XXXVIII.

Fig. 1. *Aglaophenia carinifera*, sp. nov.
Fig. 2. *Aglaophenia carinifera*, sp. nov.
Fig. 3. *Aglaophenia armata*, sp. nov.
Fig. 4. *Aglaophenia armata*, sp. nov.
Figs. 1-4 x 80.



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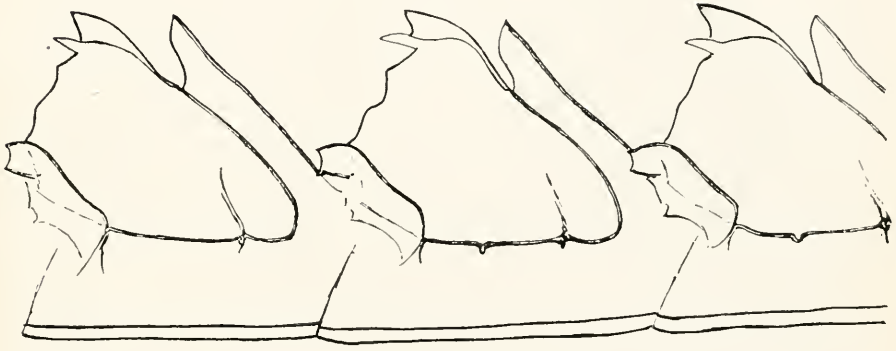

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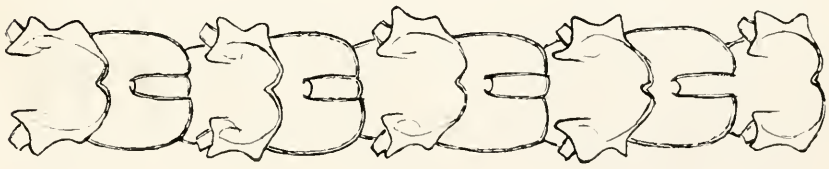

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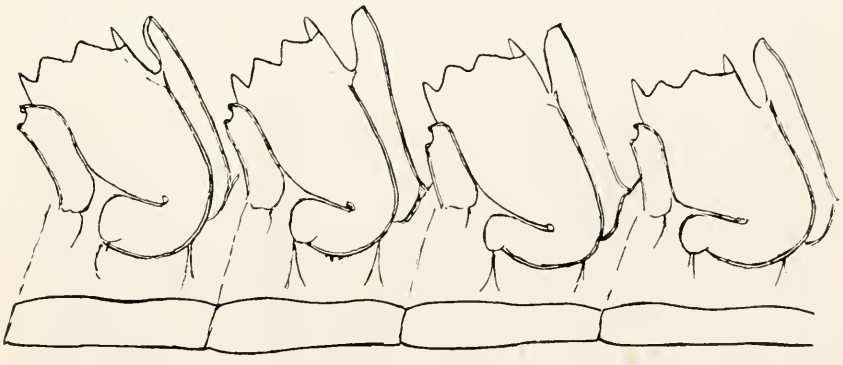

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