NOTES ON SOME ECHINODERMS FROM SOUTHERN AFRICA

BY

AILSA M. CLARK

Pp. 421–487 ; 3 *Plates* ; 16 *Text-figures* ; 1 *Map* ; 3 *Tables*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ZOOLOGY Vol. 26 No. 6
LONDON: 1974

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical series.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

In 1965 *a separate supplementary series of longer papers was instituted, numbered serially for each Department.*

This paper is Vol. 26, *No.* 6, *of the Zoological series. The abbreviated titles of periodicals cited follow those of the World List of Scientific Periodicals.*

World List abbreviation :
Bull. Br. Mus. nat. Hist. (Zool.)

TRUSTEES OF
THE BRITISH MUSEUM (NATURAL HISTORY)

Issued 7 June, 1974 *Price* £3.40

NOTES ON SOME ECHINODERMS FROM SOUTHERN AFRICA

By AILSA M. CLARK

SYNOPSIS

The main part of this paper deals with noteworthy species of echinoderms (excepting holothurians) from around the mainland of southern Africa south of the Tropic of Capricorn, with appendices on a few species from off-lying localities including the Vema Seamount, Walter's Shoal, a peak of the South-West Indian Ocean Ridge and Madagascar. Most of the specimens came from the Ecological Survey of the University of Cape Town but some were collected in conjunction with the International Indian Ocean Year, notably by the 'Anton Bruun'; a few from the British Museum collections are also dealt with. Three new species of ophiuroids are described and the ranges of four other ophiuroids and two unstalked crinoids are extended to southern Africa. A lectotype is selected for *Astropecten granulatus natalensis* John and taxonomic changes are made to several nominal species of other Asterozoa, including transfers to different genera, alterations in rank and synonymies (see p. 483).

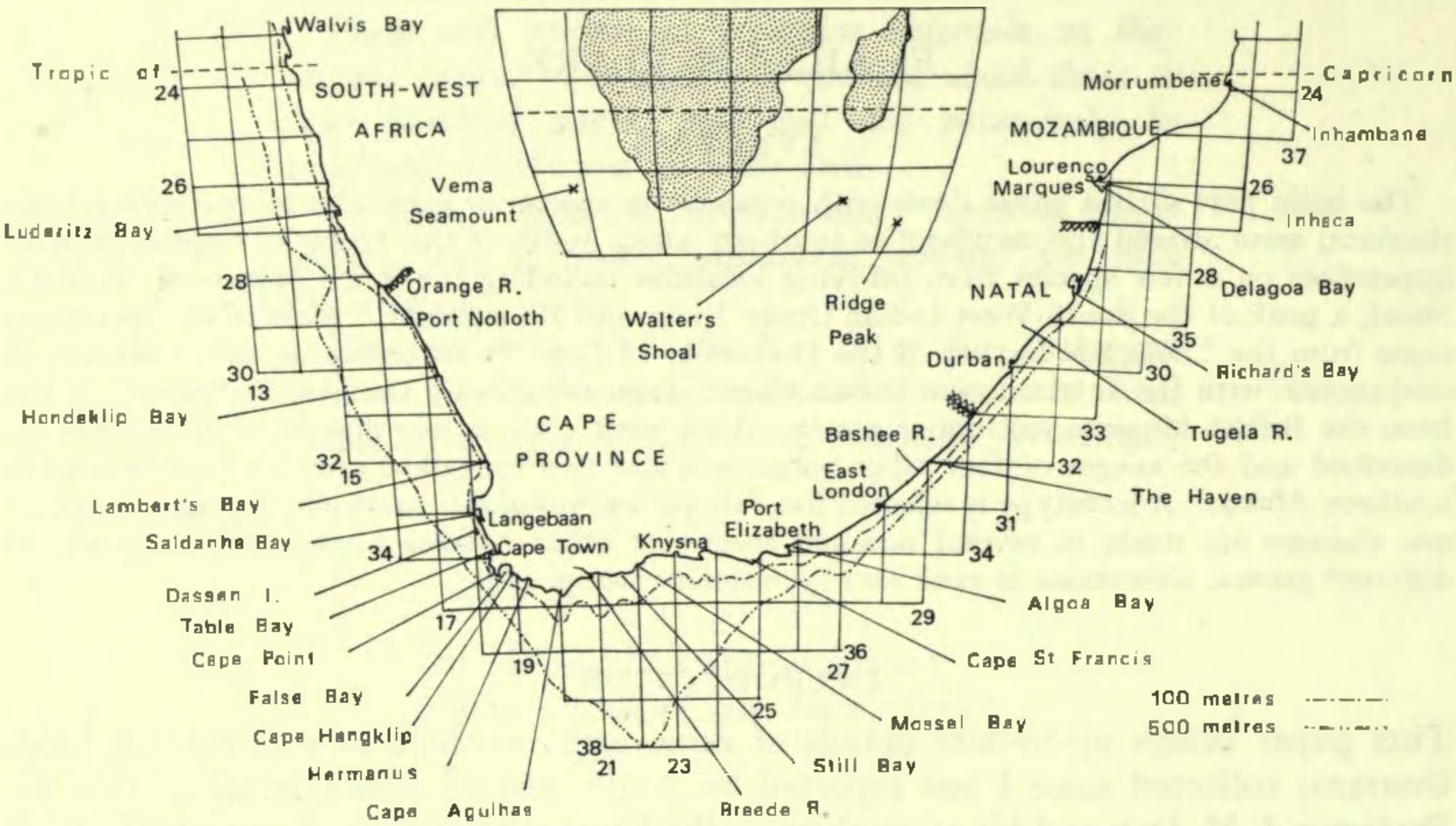
INTRODUCTION

THIS paper brings up-to-date details of noteworthy echinoderms (excepting holothurians) collected since I last reported on South African echinoderms in 1952 by Professor J. H. Day and his co-workers at the University of Cape Town during their long-term Ecological Survey of South African and adjacent waters. Following the exhaustive studies of H. L. Clark (1923) and Mortensen (1933) it is not surprising that only three undescribed species – all ophiuroids – were found. Tantalizingly, no further material came to light of some of the little-known species such as the crinoids *Decametra durbanensis* A. M. Clark and *Monachocrinus perrieri* (Koehler and Vaney), the asteroids *Tethyaster pacei* (Mortensen) (originally *Anthosticte pacei*), *Ceramaster trispinosus* H. L. Clark, *Anseropoda novemradiata* (Bell) and *Mithrodia gigas* Mortensen, or the ophiuroids *Amphiura acutisquama* A. M. Clark, *A. linearis* Mortensen, *Ophiogymna capensis* (Lütken) and *Ophioderma wahlbergi* Müller and Troschel.

The main part of the text deals with specimens from around the mainland of southern Africa south of the Tropic of Capricorn (c. $23\frac{1}{2}^{\circ}$ S), which just extends to include Inhambane in Mozambique on the east coast but not quite to Walvis Bay in South-West Africa on the west. There are six species new to the area, the crinoid *Oligometra serripinna* (P. H. Carpenter) and the ophiuroids *Anamphiura valida* H. L. Clark and *Amphiophiura trifolium* Hertz extending to Natal from Mauritius, the Amirante Islands, the Zanzibar area and Mombasa respectively, while the crinoid *Tropiometra magnifica* A. H. Clark with the ophiuroids *Ophiocirce inutilis* Koehler and *Ophiopallas paradoxa* are extended to southern Mozambique from localities further north in East Africa.

Since this paper went to press I have received from M. Jangoux a copy of his important paper 'Les Astéries de l'Ile d'Inhaca (Mozambique) (Echinodermata, Asteroidea). 1. Les espèces récoltées et leur répartition géographique.' *Ann. Mus. R. Afr. Cent.*, ser. 8°, Zool. No. 208: 1–50, 13 figs., 7 pls.

In addition, a few specimens from the off-lying Vema Seamount, Walter's Shoal, Madagascar and the South-west Indian Ocean Ridge are dealt with in appendices.



Map Southern Africa with inset of larger area including Madagascar, showing the three offshore localities dealt with in Appendices I, II and IV. The even numbers represent latitude S and the odd ones longitude E.

Class *CRINOIDEA*

Family **COLOBOMETRIDAE**

Oligometra serripinna occidentalis A. H. Clark

Oligometra serripinna var. *occidentalis* A. H. Clark, 1911 : 33–34 ; 1947 : 239–240, pl. 26, fig. 136, pl. 28, figs. 150–151, pl. 30, fig. 163.

Material. AFR 1028J, 28°28′S : 32°25′E (off N. Natal), 27 metres ; 3 specimens.

NAD 2W, 30°47·1′S : 30°29·1′E (S of Durban), 44 metres ; 1 specimen.

Description. The largest specimen from sample AFR 1028 has the centrodorsal discoidal with the perfectly flat dorsal pole 2·3 mm in diameter. The cirri are arranged in a single crowded and in some parts staggered ring around the edge. The longest are c. 10 mm long with 22 segments, all shorter than broad.

The division series are narrow, rounded laterally, and the adjacent ones are well separated from one another. The proximal arm syzygies are regularly placed at brachials 3+4, 9+10 and 14+15. The breadth at the first syzygy is 1·1 mm and the length from the proximal edge of the IBr_1 to 9+10 is 5·5–6·0 mm.

The proximal pinnules are markedly prismatic but not the distal ones. The latter have about 21 segments, most of which are half again to twice as long as broad

and they measure 5·5–6·0 mm in length. P_2 is much stouter than either P_1 or P_3 and only tapers beyond the proximal half. The last three or four segments are small.

The arms are patterned with dark stripes, especially at some of the joints. These are maroon in spirit but in life the colour was banded yellow and brown.

Some numerical details of this and two other specimens from Natal are given in Table 1 together with those for two specimens from Cargados Carajos, north of Mauritius, seen earlier in the British Museum collections by A. H. Clark. The large

TABLE 1

Numerical data from three specimens of *Oligometra serripinna occidentalis* from Natal and two from Cargados Carajos, in that order

Arms Length	Breadth at 3+4	Cirri No.	Cirri Segs.	P_1 Segs.	P_1 L.	P_2 Segs.	P_2 L.	P_3 Segs.	P_3 L.
c. 50	1·1	XX	16–22	14	4·0	16, 17	5·5	14	4·0
50	1·0	XIX	17–21	15	4·2	16, 17	6·0	13	3·5
33	0·9	XVII	17–19	12	3·5	14	5·0	12	3·5
c. 80	1·4	XIX	22–29	14	5·0	16	7·0	14	5·0
c. 55	1·1	XVII	19–21	14	4·0	17	6·0	14	4·0

number of cirrus segments in the fourth specimen in the table is noteworthy but smaller specimens from that locality agree in the counts with those from Natal. The relative proportions of the proximal pinnules appear to be fairly consistent but their shape is rather variable. In the smaller specimen from Cargados Carajos included in the table the segments are shorter and much more ornate than usual in this subspecies with flaring distal processes. However, another from the same locality is indistinguishable from those from Natal in having the early pinnules very flat and the last seven or eight segments slightly flared at the sharp outer edge distally, each following segment being narrower so that the profile of the tapering part of the pinnule is serrated without being markedly spinose.

The largest specimen from Cargados Carajos has the dorsal ridges of the middle cirrus segments rising at each end to a slight peak and a similar modification is shown in the smallest Natal specimen tabulated. In the other material examined the ridges appear fairly level, in side view resembling a single small acute tubercle arising at about the middle of the length of the segment or slightly towards the distal end.

REMARKS. It is possible that *Decametra durbanensis*, which I described in 1951 on the basis of a single specimen also from Natal (29°30·8′S : 31°23′E) in 68 metres may prove to be synonymous with *Oligometra serripinna occidentalis*. The holotype is relatively large with an arm length of 90 mm and breadth at 3+4 2·0 mm. The cirri are very stout and the dorsal surfaces of the proximal segments are studded with small tubercles, so that they appear very different to the smooth segments of the present material. The centrodorsal is similarly discoidal with marginal cirri, numbering as many as XXVII and with up to 32 segments. However, the segments of the proximal pinnules are no more numerous than those of *O. serripinna occidentalis*, though the proportions of the first three pinnules are similar.

In his key to the genera of Colobometridae (1947 : 9) A. H. Clark distinguished *Decametra* from *Oligometra* in the following terms :

'k^1 The proximal cirrus segments bear dorsally a transverse ridge which distally becomes a pair of tubercles or small spines, or rarely a single median spine ; P_a is absent ; P_2 is rounded or rounded prismatic with the distal ends of the segments uniformly spinous or smooth . . . . . *Decametra*

k^2 Cirrus segments all with a transverse ridge dorsally except for the penultimate which bears the opposing spine ; P_a present (or rarely absent on some arms) ; P_2 more or less strongly prismatic with the distal portion of the prismatic ridges on each segment produced into more or less broad finlike processes, or with the distal ends of the prismatic ridges bearing tufts or spines . . *Oligometra*'

In the holotype of *Decametra durbanensis* P_a is absent on all but two of the arms. In all four specimens of *Oligometra serripinna occidentalis* from Natal P_a is present throughout and the same is true (with the exception of single arms of two specimens) in eight out of the nine from Cargados Carajos. However, in the ninth and largest with the arm breadth 1·4 mm P_a is absent on all the arms and P_b is also missing on two arms one of which even lacks P_c as well. A. H. Clark also noted that the two small specimens from John Murray Expedition st. 45 (South Arabian coast) lack P_a ; one of them has the arms only 25 mm long. *Oligometra serripinna macrobrachius* from the East Indies regularly lacks P_a. In the Red Sea *Decametra chadwicki* may have more arms with P_a than without, as I noted in 1967. Clearly this character alone is unreliable as a generic distinction.

With regard to the dorsal armament of the cirrus segments, A. H. Clark included in *Decametra* several species, notably the type species *D. modica*, in which the transverse dorsal ridge of the middle segments never resolves itself into a pair of tubercles on the distal segments. Unfortunately no examples of these species larger than 50 mm arm length have yet been described and it is possible that this character only manifests itself with increasing size.

As for the development of processes or spines on the segments of P_2, judging from the descriptions of various specimens of *Oligometra serripinna* in A. H. Clark's monograph, it is very variable and in the subspecies *occidentalis* it is usually very slight.

Oligometra serripinna is the type species of *Oligometra*. If further studies of these three characters substantiate their unreliability as being of generic weight, then *Decametra* A. H. Clark, 1911 will be better referred to the synonymy of *Oligometra*, established three years earlier.

RANGE. These records extend the range of *Oligometra serripinna* south-west from Mauritius into South African waters.

Family **TROPIOMETRIDAE**

Tropiometra magnifica A. H. Clark

Tropiometra magnifica A. H. Clark, 1937 : 90–91, pl. 1, fig. 1 ; 1947 : 266–268, pl. 33, figs. 170–173 ; A. M. Clark, 1972 : 131–132.

MATERIAL. PED 5W, 24°46'S : 35°18'E (S of Inhambane, Mozambique), 110 metres ; 2 broken specimens.

An error in my paper of 1972 concerning this species (p. 131, bottom line) needs to be corrected. The cirrus length should be 'up to 80 mm' (not 4·0–4·5 mm).

RANGE. This record provides an extension of range southwards from Kenya and the Gulf of Aden.

Family **THALASSOMETRIDAE**

Crotalometra magnicirra (Bell)

Antedon magnicirra Bell, 1905c : 141, pl. 4.
Crotalometra magnicirra : Gislén, 1938 : 17–18 ; A. H. Clark, 1950 : 97–100.

MATERIAL. This species is only represented in the present collections by a sample of 5 specimens from the South-West Indian Ocean Ridge (see Appendix, p. 482); as it has never been properly described, details are given here of a syntype, B.M. registered number 1904.6.28.16–19 (part), 'Pieter Faure' no. 12885–6, East London, Buffalo River bearing N 15 miles distant, 567 metres.

DESCRIPTION. The arm length is c. 110 mm ; the breadth at 3+4 is 1·7 mm and the length from the proximal edge of the IBr_1 to the syzygy at 3+4, including a IIBr series of four ossicles, is 11 mm.

The centrodorsal is rounded hemispherical ; 6·5 mm in basal diameter and 4·0 mm across the convex dorsal pole. The cirrus sockets are in ten very definite columns, two in each interradius, with a narrow bare wedge-shaped concave radial area separating the pairs of columns from each other. There are three sockets in each column, though the apicalmost one may be obsolete and the peripheral one may bear only an immature cirrus. The number of mature cirri is therefore best estimated at c. XXV. Of the few remaining mature peripheral cirri, most have c. 63 segments and measure c. 55 mm in length, which is approximately half the arm length. The ninth or tenth is the transition segment and is the longest, measuring c. 2·0 mm by 1·0 mm median breadth. The proximal segments are hardly at all constricted in the middle or flared distally. Beyond the tenth, the segments become relatively shorter so that the seventeenth is as long as broad and the more distal ones are broader than long. The shorter segments are all evenly flared towards their distal ends on the dorsal side and end abruptly, so that the profile of the cirrus is very serrated.

The division series have lateral flanges with straight edges so that adjacent ones are in close apposition. The synarthrial tubercles are very low and rounded, hardly evident at all. There were probably 20 arms (two IIBr series are broken). All the IIBr series are 4 (3+4). The first brachial syzygy is at 3+4, the second at 17+18 or beyond. The distal intersyzygial interval is from four to eight muscular joints.

P_D on $IIBr_2$ has 22–27 segments and is c. 12 mm long. P_1 has c. 19 segments and is c. 9 mm long. P_2 with c. 12 segments is 5 mm long and P_3 is similar to P_2. The distal pinnules have c. 14 segments and measure c. 6·5 mm. The proximal

pinnules are markedly prismatic at the base, with a high dorsal crest which becomes displaced after the first two or three segments towards the inner angle. The segments are short but flared distally and distinctly spinose. The gonads are not at all enlarged. The distal pinnules are markedly prismatic, the segments not more than twice as long as wide and with the side and covering plates distinct.

VARIATIONS. The 15 other syntypes of *Crotalometra magnicirra* are variable with regard to certain characters. The centrodorsal is usually flattened hemispherical but may resemble a truncated high cone with the apex more or less convex, or a complete low cone about two-thirds as high as broad basally. The number of cirri varies according to the size of the centrodorsal. There may be some columns with four sockets but then the apicalmost is usually obsolete or the peripheral cirrus is immature. The maximum number of cirri found is XXXIII but commonly there are c. XXV.

One specimen has only ten arms, the longest remaining being 75 mm long, having lost c. 15 mm. The breadth at 3+4 is 1·9 mm and the length from IBr_1 to 3+4 is only 5·0–5·5 mm, no IIBr series intervening. Most of the other specimens have 20 arms or at least 15. Only one has a IIBr series of only two ossicles, all the rest are of four. The arm breadth at 3+4 is usually 1·8–2·0 mm and the length to this syzygy including a IIBr4 series is 11–12 mm.

The longest cirrus found measures c. 60 mm and the greatest number of segments is 64. The few specimens with both a complete arm and a complete mature cirrus show a ratio of just over 2 : 1.

In the ten-armed specimen P_2 (equivalent to P_1 in the other specimens since no P_D occurs) has 12 segments and measures c. 5 mm; P_3 with 11 or 12 segments is 4·5 mm and P_4 with 11 is 4·0 mm.

Two specimens from the same sample as the one described have a syzygy at brachials 1+2 on some or all arms following a IIBr series, as noted by Gislén (1938). One of them has only eight arms based on IIBr series remaining attached and six of these have a syzygy at 1+2. In the second specimen all 14 arms of this kind remaining also show such an initial syzygy. Both specimens are rather slender and it may be significant that none of the stouter individuals share this distinction.

Several of the syntypes have an abrupt change to a paler colour at the first brachial syzygy or sometimes at IIBr3+4, as if they have regenerated from that point, indicating damage so drastic that survival and recovery is surprising when feeding powers must have been badly impaired for a prolonged period.

Although the majority have the division series and brachials quite smooth, in one specimen there are distinct thorns along the edges of the joints.

REMARKS. This species is sympatric with *Glyptometra sclateri* (Bell), with which it has a number of characters in common. *Glyptometra* belongs to the family Charitometridae and *Crotalometra* to the Thalassometridae but both of these fall within the superfamily Tropiometrida. The two species both have conspicuous side and covering plates along the ambulacra, prismatic distal as well as proximal pinnules, usually more than 10 arms with the IIBr series of four ossicles, well-plated discs and laterally flared division series and proximal brachials. Apart from the

very different cirri, the long ones of *Crotalometra* having a distinct transition segment, the present material suggests that *Crotalometra magnicirra* can be distinguished from *G. sclateri* by the normal occurrence of the first brachial syzygy at brachials 3+4 (though 1+2 may occur) and by the smaller pinnules, the genital ones of *Crotalometra* having only a vestige of the lateral expansion so distinct in *Glyptometra*. Also the centrodorsal seems to be relatively higher in most specimens of *C. magnicirra*, the height usually about two-thirds the basal diameter, while the shape may be quite conical in some specimens.

Family **CHARITOMETRIDAE**

Glyptometra sclateri (Bell)

Antedon sclateri Bell, 1905c : 140, pl. 3.
Pachylometra sclateri (pt.) : H. L. Clark, 1923 : 234 [armless adult only ; non *P. sclateri* (?) : Gislén, 1938 : 18–20, which represents *Gislenometra perplexa* A. H. Clark, 1947, like H. L. Clark's small specimens.]
Glyptometra sclateri : A. H. Clark, 1950 : 268–270.

MATERIAL. Again this species is only represented in the present collections by material from the South-West Indian Ocean Ridge (see Appendix, p. 482) but since it has never been fully described details are given here of a syntype, British Museum registered number 1904.7.3.6–10 (part), 'Pieter Faure' no. 12711, East London bearing NW ½ N distant 18 miles, 457–549 metres.

DESCRIPTION. The arms are all broken but were probably at least 80 mm long ; the breadth at 3+4 is 2·0 mm and the length from the proximal edge of the IBr_1 to the syzygy at 3+4, including a IIBr series of four ossicles, is 9·0 mm.

The centrodorsal is flattened hemispherical, the rugose dorsal pole 3·5 mm in diameter, the peripheral diameter 6·0 mm and the height 2·3 mm. Some of the cirrus sockets seem to be arranged in columns but others are crowded out of alignment.

The cirri number c. XXXV and have up to 18 segments, their length being at the most 22 mm. The longest segments are the sixth to the eighth, the sixth on one cirrus measuring 1·8 mm in median length and 1·1 mm median breadth. The following segments are relatively shorter, except for the penultimate, which is abruptly narrower than the antepenultimate ; its opposing spine is terminal and directed distally, as is usual in the family Charitometridae. The antepenultimate and preceding short segments are all slightly flared at their distal ends, the more proximal ones especially on the ventral side, the distal ones on the dorsal side.

The division series have lateral flanges with straight sides so that the adjacent ones are closely apposed. The synarthrial tubercles are low and barely appreciable.

There are 21 arms. All the IIBr series are 4 (3+4) and the only IIIBr series is 2 (1+2). The proximal syzygies are rather irregular in position ; on 12 arms the first is at 1+2 with the following joint a muscular one, on eight arms there are syzygies at both 1+2 and 3+4, while the last arm has a syzygy at 2+3. The brachials of the outer half of the arm are triangular, approximately as long as wide. The intersyzygial interval is usually five, sometimes six, muscular articulations.

P_D on $IIBr_2$ has 28–30 segments and is c. 10 mm long. It is curled inwards over the disc and has short, squarish segments. P_1 has c. 27 segments and is 9·5–10·0 mm long, rather similar to P_D. P_2 has 19 or 20 segments and length c. 8 mm. It is deeper than P_D and P_1 at the base but tapers more. The segments after the first six or seven are longer than broad but none are as much as twice as long as broad. P_3 is the first genital pinnule ; it has c. 15 segments and is 5·5–6·0 mm long. The first three segments taper like those of P_2 but the fourth expands markedly and the fifth and sixth are conspicuously wide, the seventh tapers abruptly and the following segments are much longer, the distal ones twice as long as broad. P_4 and the other genital pinnules have a similar expansion of a few of the proximal segments after an initial tapering.

The disc is densely studded with small granuliform plates.

VARIATIONS. Of the 13 other specimens in the British Museum collection – 12 syntypes and one from among the syntypes of *Crotalometra magnicirra* – the arm number is as follows : 10, 11, 11, 13, 14, 15, 17, 17, 17, 18, 19, 20 and 20. In the ten-armed specimen, the arms are 90 mm long. The smallest specimen is an eleven-armed one with an arm length of c. 80 mm and breadth at 3 + 4 of 1·8 mm. Most of the specimens have all the IIBr series of four ossicles but one has two out of seven IIBr series of two ossicles and another has one out of ten similarly abbreviated. The synarthrial tubercles may be much more prominent than in the specimen described.

The occurrence of proximal arm syzygies is very variable ; a few specimens have the first syzygy at 3 + 4 on some arms arising from IIBr series, rather than the usual 1 + 2, as well as on the arms arising from IBr series. One specimen with 19 arms is unusual in having six with 2 + 3, though nine others have 1 + 2, three have both 1 + 2 and 3 + 4 and one (the only arm arising from a IBr series) has 3 + 4 alone. Another specimen with 20 arms has none with 2 + 3, but 16 with 1 + 2, three with 1 + 2 and 3 + 4 and one with 3 + 4 alone.

The centrodorsal varies in shape from thick discoidal to flattened hemispherical but is never as conical as in some specimens of *Crotalometra magnicirra* ; the dorsal pole ranges from as little as 2·0 mm in diameter to as much as 5·0 mm. There are usually ten cirri around the dorsal pole and in some specimens, particularly the smaller ones, the other cirri may be arranged in quite regular columns in line with the adapical ones. However, in larger individuals there are usually more than ten peripheral cirri and the sockets become crowded irregularly in the interradii, though sometimes they leave bare a space in each radius, which may be wedge-shaped and concave as in *C. magnicirra*. One specimen with a particularly regular columnar arrangement of the cirrus sockets and well-marked radial spaces has all its cirri broken off short and can only be distinguished from *C. magnicirra* by the irregularity of the proximal arm syzygies and the larger pinnules with some expanded segments on the genital ones.

The proximal pinnules vary to some extent. One has P_D with 23 segments, P_1 with 19, P_2 with 16 and P_3 with 13 ; while another has P_2 on an arm arising from a IBr series with 22 segments and length 9·5 mm. The ten-armed specimen has P_1 with 22 segments but only 6·5 mm long.

Class *STELLEROIDEA*
Subclass *ASTEROIDEA*
Family **LUIDIIDAE**
Luidia sp. cf. ***L. avicularia*** Fisher

See : Fisher, 1919 : 172–175, pl. 43, fig. 1, pl. 44, fig. 2, pl. 46, fig. 2.

MATERIAL. SCD 74R, 32°33′S : 28°38′E (off Bashee River mouth, N of East London), 55 metres ; 1 specimen.

Unfortunately this nine-armed *Luidia* has had all its arms broken (or bitten) off short and regeneration is only partial. The large bivalved pedicellaria on the oral face of each jaw plate and the similar but sometimes smaller one on the proximal abradial ends of most adambulacral plates, distinguish it from the similarly nine-armed *L. maculata* Müller & Troschel, which has been recorded from Natal by Mortensen, 1933, the latter having three-bladed pedicellariae on the multiple rather than single actinal plates. The present specimen also differs in having an enlarged spinelet or spine on most of the lateral abactinal paxillae, as in *L. avicularia*, known from the Philippines and Banda Sea, which also agrees in the form of the pedicellariae. Further specimens are needed to settle the specific identification.

Family **ASTROPECTINIDAE**
Astropecten granulatus natalensis John
Pl. 1, fig. 1

Astropecten granulatus : H. L. Clark, 1923 : 250–251.
Astropecten granulatus natalensis John, 1948 : 5, pl. 1, figs. 1, 2.

MATERIAL. SCD 74Q, 32°33′S : 28°38′E (off Bashee River), 55 metres ; 1 specimen.
NAD 8R, 29°53·6′S : 31°04·6′E (off Durban), 38 metres ; 3 specimens.
NAD 12D, 29° 46′S : 31°17′E, 110–130 metres ; 1 specimen.
NAD 26B, 29°53·5′S : 31°06·1′E, 71 metres ; 2 specimens.
NAD 52A, 29°29′S : 31°45′E, 86 metres ; 5 specimens ['Anton Bruun' st. 391C].

DESCRIPTION. The specimen from East London is much larger than the others so far recorded from South Africa, in which R was less than 40 mm ; it has R 72–74 mm ; r is 16 mm and br (at the fourth superomarginals) also 16 mm ; the paxillar breadth in the same position is 11 mm.

There are 34 superomarginals in a complete series, all lacking spines. The inferomarginal plates each bear two large almost equal spines at the upper end, aligned slightly obliquely, with a third fairly large spine proximal to them usually present as well as a smaller fourth spine below but distal ; on the ventral face are several more spaced spines along the distal side, each longer than the plate, giving a fairly shaggy appearance.

The paxillae are arranged in transverse rows each side of the mid-radius, though a few are slightly irregular ; 23 or 24 paxillae correspond to the first ten superomarginals. The larger proximal paxillae have c. 10 central spinelets and 15–20 peripheral ones but some are larger still.

TABLE 2

Numerical data from six specimens of *Astropecten granulatus natalensis* from near Durban

R	r	Br at SM_4	Paxillar Br	No. of superomarginals
43	11·0	9·5	5·5	21
38	11·0	9·5	6·5	19
35	9·5	8·5	5·5	18
30	7·5	7·0	4·0	18
27	8·0	6·0	4·0	16 (17)
20	5·5	5·0	2·5	16

There are only two actinal plates in each series. The first ten inferomarginals correspond to 16 adambulacral plates.

AFFINITIES. The six specimens from the vicinity of Durban included in Table 2 are the least badly damaged ones. They also have only two actinal plates in each series, like John's material In this they differ from the holotype of *Astropecten anacanthus* H. L. Clark, 1926, also taken in the vicinity of Durban, which has three actinal plates. H. L. Clark otherwise distinguished *A. anacanthus* as having relatively narrower paxillar areas (and consequently more conspicuous superomarginals) and 'totally different' ventral spinulation. The holotype of *A. anacanthus* has R/r 44/11 mm, br is given as 12 mm with paxillar br at the same level 8 mm. Judging from H. L. Clark's rather poor photograph (1926, pl. 1, fig. 1), his br measurement must have been taken proximal to the first superomarginal, i.e. between two adjacent interradial edges. Since the arms flare out at the base, I think that a better estimate of their breadth in *Astropecten* species is given by measuring at the level of the fourth superomarginals, or the fifth as Döderlein does. In the specimen with R 43 mm in Table 2, br between two interradii is 12·5 mm and the paxillar breadth here is 8 mm. The superomarginals appear more conspicuous than those of the holotype of *A. anacanthus*, not less. Nor can I detect any significant difference in the armament of the inferomarginals, which John pointed out is very variable. All the specimens of *A. granulatus natalensis* have at least some of the proximal paxillae with the peripheral spinelets distinctly higher than the central ones, which H. L. Clark did not observe in *A. anacanthus*. Possibly this, together with the difference in the number of actinal plates, may provide a valid distinction ; also the relative number of marginal plates in each series may be significant. There are 27 in the holotype of *A. anacanthus* at R 44 mm, compared with only 21 in the first specimen of *natalensis* in Table 2.

The relative number of superomarginals was also used by John to distinguish between *Astropecten granulatus* from Australia and *natalensis* from South Africa ;

the large specimen from East London reinforces this, having 34 superomarginals at R c. 74 mm, compared with 40 in an Australian specimen with R 77 mm. The smaller specimens also support this difference. The East London specimen is also notable for having two almost equal large inferomarginal spines on the proximal plates. John has already noted that smaller specimens from Natal have a second inferomarginal spine distinctly larger than in Australian specimens of *A. granulatus*.

LECTOTYPE DESIGNATION. John did not designate a holotype for the subspecies *natalensis* and it is clearly undesirable that the aberrant specimen (no. 29) with a large spine on each of the first superomarginals, of which he illustrated the upper side (1948, pl. 1, fig. 1) be treated as lectotype, while the other specimen he depicted (his pl. 1, fig. 2) is much smaller (R 22 mm) and shown in ventral view. I therefore designate the specimen with R/r 37/11 mm, reg. no. 1904.4.20.120–122 (part), ref. no. 10723 as lectotype. Some numerical data from it are included in John's tables and a photograph of it is now given (Pl. 1, fig. 1).

Astropecten polyacanthus phragmorus Fisher

Pl. 1, fig. 2 ; Pl. 2, fig. 1

Astropecten acanthifer phragmorus Fisher, 1913 : 604.
Astropecten phragmorus : Döderlein, 1917 : 178 ; Fisher, 1919 : 65–67, pl. 11, fig. 5, pl. 14, fig. 1 ; Mortensen, 1940 : 61 ; Clark & Rowe, 1971 : 44.
Astropecten polyacanthus : H. L. Clark, 1923 : 249.

MATERIAL. PED 12A, 24°46'S : 34°50'E (Mozambique, between Delagoa Bay and Inhambane), 22 metres ; 3 specimens ['Anton Bruun' st. 372C].

TAXONOMIC RANK. As noted in 1971, Mortensen (1940) has queried the specific validity of *Astropecten phragmorus*, having found many specimens intermediate between it and *A. polyacanthus* in the Persian Gulf, an experience which I have shared in dealing with material from that area. Apart from the three specimens from southern Mozambique, there is an older one in the British Museum collections, ref. no. 49 (details unknown) sent by the Cape of Good Hope Government. (This is not to be confused with the specimen of the same number illustrated as *Astropecten granulatus natalensis* by John.) All four have the complete series of superomarginal spines characteristic of *A. phragmorus*, most of the spines less conspicuous in size than the comparable ones of *A. polyacanthus*, in which the second plate (sometimes also the third) is reduced and spineless, exaggerating the prominence of the pair of spines on the first superomarginals of each series in each interradius (Pl. 2, fig. 2). H. L. Clark (1923) also noticed that the specimen from Natal which he referred to *A. polyacanthus* had smaller superomarginal spines than usual and, although he did not say that the spine series was complete, he did suggest that South African specimens might be subspecifically distinct from *A. polyacanthus*. I agree with this ranking and accordingly now reduce *A. phragmorus* to the status of a subspecies of *A. polyacanthus*.

It may be noted here that in some specimens of *Astropecten polyacanthus phragmorus* the superomarginal plates are less high than is usual in *A. polyacanthus*

polyacanthus, as shown by a comparison of figs. 1 and 2 in Plate 2. However, the apparent discrepancy in the number of plates is an illusion caused by the different magnifications ; in fact, the two specimens photographed have a comparable number of marginal plates relative to R.

RANGE. The range of *Astropecten polyacanthus phragmorus* is therefore extended to south-east Africa ; it is otherwise known from the Philippines (the type-locality) and the Persian Gulf.

Dipsacaster sladeni capensis A. M. Clark

Leptoptychaster kerguelensis : Bell, 1905a : 242–243. [Non *L. kerguelensis* Smith, 1879.]
Dipsacaster sladeni : H. L. Clark, 1923 : 246–247 ; Mortensen, 1933a : 237.
Dipsacaster sladeni capensis A. M. Clark, 1952 : 204, pl. 17.

MATERIAL. SCD 203C, 34°51'S : 23°41'E (SE of Knysna), 184 metres ; 1 specimen.

R/r is 87/33 mm = 2·6/1 and there are 35 superomarginals in each series, agreeing with the relative number found in previous South African specimens and significantly higher than in *D. sladeni* Alcock from the Bay of Bengal.

Psilaster acuminatus Sladen

Psilaster acuminatus Sladen, 1889 : 225–228, pl. 40, figs. 1, 2, pl. 42, figs. 7, 8 ; H. L. Clark, 1923 : 248–249 ; Mortensen, 1933a : 236–237.

MATERIAL. AFR 777B, 29°18'S : 15°35'E (SW from Port Nolloth), 384 metres ; 1 specimen.
TRA 73F, 32°06'S : 16°37'E (W from Lambert's Bay), c. 310 metres ; 1 specimen.
TRA 129J, 32°26'S : 16°38'E, 480 metres ; 1 specimen.
AFR 831A, 35°15·3'S : 18°39·3'E (S from False Bay), 547 metres ; 1 specimen.

REMARKS. The northernmost specimen (AFR 777) shows some minor differences from the others. Its madreporite is larger, diameter 1·1 mm, its centre nearer the interradial edge, 3·0 mm, R/r being 30/8·5 mm in comparison with specimen TRA 73, in which the same measurements are 0·75 mm, 3·4 mm and 29/8·5 mm. Its armament of furrow and marginal spines and granules is consistently more attenuated and it even has a slightly elongated granule at the distal edge of some superomarginals about one-third the height from the upper end of the plate, forming an incipient superomarginal spine. Its adambulacral plates have more pronouncedly angular furrow margins. As preserved, it has no anal cone, unlike the other specimens.

In comparison with *Bathybiaster vexillifer*, this species has relatively fewer superomarginals and these do have a small horizontal face rather than being restricted to the lateral face of the arms. . *B. vexillifer* (at least the holotype of *Phoxaster pumilus* (Sladen), which is believed to be synonymous) has 40 marginals at R c. 40 mm, in comparison with 30 at R 30 mm in one of the present specimens of *Psilaster acuminatus*.

Family **GONIASTERIDAE**

Ceramaster patagonicus euryplax H. L. Clark

Ceramaster patagonicus var. *euryplax* H. L. Clark, 1923 : 262–264, pl. 14, figs. 1, 2 ; 1926 : 11 ; A. M. Clark, 1952 : 204–205.
Ceramaster chondriscus H. L. Clark, 1923 : 258–260, pl. 14, figs. 5, 6 ; Mortensen, 1933a : 242–243.

MATERIAL. AFR 729C, 31°22·8′S : 16°20·2′E (W from Hondeklip Bay), 365 metres ; 3 specimens.

TRA 7C, 48 miles W by S of Cape Town, c. 34°S : 17°E, 402 metres ; 1 specimen.

REMARKS. R/r is 35/21 mm = 1·67/1, 50/30 mm = 1·67/1, 51/29 mm = 1·76/1 and 60/32 mm = 1·88/1. The number of superomarginals in each series is respectively 12, 15 (or 16), 14 and 19. The smallest specimen has most of the upper surface of all the superomarginals bare but the larger ones have only small bare patches on the distal plates.

The superomarginals are squarish in shape, the paxillar spinelets are angular and the distal subambulacral spines are hardly at all enlarged, so these specimens run down to *Ceramaster chondriscus* in H. L. Clark's key (1923). Mortensen and I have already pointed out the lack of distinction between *C. chondriscus* and *C. patagonicus euryplax* and I believe that they are synonymous. In fact, the former has page priority in H. L. Clark, 1923 but, since I regard the difference between South African and Patagonian specimens as less than a specific one, it seems better to retain the existing trinomial than to introduce the combination *C. patagonicus chondriscus*. Since there is a geographical distinction, the rank is that of a subspecies rather than a variety.

Family **OREASTERIDAE**

Genus ***ASTERODISCIDES*** nom. nov.

Asterodiscus Gray, 1847 : 75 [Non *Asterodiscus* Ehrenberg, 1839, Protozoa.] Type-species : *Asterodiscus elegans* Gray, 1847.

I am obliged to Dr D. L. Pawson and Miss M. Downey for notification of the homonymy of this generic name.

Asterodiscides elegans Gray

Asterodiscus elegans Gray, 1847 : 75 ; Macnae & Kalk, 1969 : 129 ; Clark & Rowe, 1971 : 34, 40.

MATERIAL. NAD 20M, 29°58′S : 31°02′E (off Durban), 49 metres ; 1 specimen.

RANGE. This record provides a small extension of range from Inhaca.

Family **OPHIDIASTERIDAE**

Hacelia capensis Mortensen

Hacelia superba var. *capensis* Mortensen, 1925 : 152.

MATERIAL. NAD 91F, 29°11'S : 32°02'E (SE of Richard's Bay, Natal), 70 metres ; 1 specimen ['Anton Bruun' st. 357B].

DESCRIPTION. Unfortunately this specimen (only the second to be taken) is small with R/r only 15/3 mm = 5/1 ; br basally is 3 mm and at half R also 3 mm since the arms only taper in their distal half.

There are nine complete longitudinal series of plates on each arm (not counting the adambulacrals), one dorso-lateral series each side of the carinal row, two marginals and one actinal each side, with eight series of papulae between them. The granulation is slightly coarser on the middles of the plates. There is also a partial second series of actinal plates proximally, above the main series, consisting of two rounded plates on the disc and very base of the arm and about six other very narrow plates corresponding in position and very close to the inferomarginals. There are 16 (or 17) superomarginals in each series, the last seven to ten with a large bare central area, as also on most of the carinal plates except for the first two to four. The terminal plates are very large and convex. The papulae are relatively few, only one or two in each area, those below the inferomarginals single. The subambulacral spines are up to twice as long as broad ; the two furrow spines of each plate are slightly spaced from those of adjacent plates ; there are no granules on the furrow faces of the plates. Pedicellariae are numerous, tong-shaped, their valves very compressed beyond the base and not at all expanded sideways terminally. Their sockets have prominent flanged edges. There is usually a pedicellaria in each papular area above about five consecutive superomarginals at about one-third the arm length and several others in other papular areas on the upper side but not below.

NOMENCLATURE. *Hacelia superba* H. L. Clark, 1921 from off Barbados in the West Indies was referred by A. H. Clark (1948) to the synonymy of *H. floridae* (Perrier, 1881), which species Downey (1971) has referred back to *Tamaria* without reference to *H. superba* in her synonymy. The holotype of *H. superba* was the largest specimen, R 75–78 mm, and had actinal papular areas below the inferomarginal plates with up to eight papulae in each ; accordingly it could not be referred to *Tamaria* in which the absence of proper actinal papular areas is diagnostic. In *H. floridae* (and *H. superba* if distinct) the arms taper evenly from the base in contrast to this South African specimen and also differ in having pedicellariae on the under side, not above, and small terminal plates. Also only the holotype of *H. superba* had any distal marginal plates medially bare ; judging from the descriptions of Verrill (1915, as *Ophidiaster alexandri*) and Downey all small specimens are fully granulated.

In spite of its small size, I am sure that this South African specimen is not conspecific with the West Indian species, whether or not that is a *Hacelia*. Also it looks more like an *Ophidiaster* superficially, with which the eight series of papulae agree but of course the fact that there are not ten series, as in *Hacelia*, could well be due to the small size. Mortensen did not even give the size of his specimen – the holotype – and only distinguishes it from *H. superba* by the more numerous centrally bare plates including dorso-lateral as well as carinal plates. Pending discovery of larger South African specimens, it seems best to retain the combination of *capensis* with *Hacelia*.

Family **ASTERINIDAE**

Asterina gracilispina H. L. Clark

Asterina gracilispina H. L. Clark, 1923 : 286–287, pl. 16, figs. 3, 4 ; Mortensen, 1933a : 255–256.

MATERIAL. FAL 720D, 34°07′S : 18°45′E (False Bay), 20–26 metres ; 1 specimen.
CP 710A, no data ; 1 specimen.
AG 2E, Cape Agulhas (nearly 35°S : 20°E) ; 1 specimen.
MB 13C, 34°04′17″S : 22°13′53″E (Mossel Bay) ; 1 specimen.
SCD 155U, 34°03′S : 25°59′E (Algoa Bay), 85 metres ; 1 specimen.
SCD 177K, 34°20′S : 23°31′E (SE of Knysna), 56 metres ; 1 specimen.

Unfortunately most of these specimens are in poor condition ; the two from Mossel Bay and Cape Agulhas are the best. They have R/r respectively 6/4·5 mm = 1·3/1 and 12/9 mm = 1·3/1. The holotype was dried and this probably accounts for the choice of specific name which conflicts with Mortensen's comment that his wet specimen has the abactinal spinelets blunt, not 'short, sharp' as in the type. The present wet specimens agree in general with Mortensen's but their abactinal spinelets extend all over the plates, not leaving a bare central patch and average about 12 per plate in the smaller and c. 15 in the larger. Other spine counts include : actinal spines 3–5 (in a straight row) and 2 or 3 ; subambulacral spines 3 and 3 to 2 ; furrow spines 4 to 3 and 4 or 5 ; suboral spines 2 and 3 sometimes 4 ; oral furrow spines 6 and 9. The madreporite is only visible in the larger one. This is also true of the specimen from south of Algoa Bay, where R/r is 10/7·5 mm = 1·3/1 and the actinal spines number 3–5 on each plate.

CP 710A is rather flattened, the arms distinctly petaloid ; R/r is 18/12 mm = 1·5. It retains some purple colour on the upper side except peripherally and small patches near the centre which are buff-yellowish ; there are 2–4 actinal spines, usually 3 ; 4 furrow spines ; 2 or sometimes 3 subambulacral and 3 suboral.

Asterina burtoni Gray

Asterina burtonii Gray, 1840 : 289 ; H. L. Clark, 1923 : 283 ; Smith, 1927 : 641–645.
Asterina burtoni : A. M. Clark & Rowe, 1971 : 68–70, pl. 9, figs. 4, 5.

MATERIAL. PEA 2P, Maxixe, Mozambique (c. 25°S : 32°E), LW ; 7 specimens.
JAN 26G, Jangamo reef, Mozambique (c. 24°S : 35°E) ; 1 specimen.
MOR 6F, Morrumbene, Mozambique (c. 23°S : 35°E) ; 1 specimen.

One of the first sample has six arms and three madreporites ; the rest have five and one, as usual in East African specimens.

The specimen from Jangamo reef has unusually long arms, R/r 25/9 mm = 2·8/1. From above it closely resembles the larger of the two specimens from Zanzibar which I called *Paranepanthia* sp. in 1971 ; that has R/r 30/11 mm = 2·7/1. Both have a distinct boundary between the mid-radial and lateral 'fields' of abactinal plates, though in the Jangamo specimen the innermost plates of the lateral series are not noticeably larger than the second row of plates, unlike the Zanzibar specimen. However, from the under-side there is a marked difference from *Paranepanthia* in the

armament of the actinal plates, which consists in JAN 26 of fans of three to five spines, similar to the subambulacral spines, as usual in *Asterina burtoni*, but of clusters of 7–12 on most plates of the Zanzibar specimen.

Patiriella dyscrita (H. L. Clark) new comb.

Asterina dyscrita H. L. Clark, 1923 : 284–285, pl. 16, figs. 5, 6.
Asterina (*Patiriella*) *exigua* (part) : Mortensen, 1933a : 252–255.

MATERIAL. BRE 78F, c. 33°S : 19°E (Breede River estuary) ; 3 specimens.
E 3B, c. 33°S : 25°E (Port Elizabeth), below LWS ; 1 specimen.

NOMENCLATURE. Dartnall (1971) has reviewed *Patiriella exigua* and recognizes two species from South African waters, one (the true *P. exigua*) with downwardly directed gonopores and the other with upwardly directed ones. As quoted in Dartnall's paper, I think that the latter is conspecific with H. L. Clark's *Asterina dyscrita*. Since Dartnall has split off a tropical Indo-West Pacific species that also has dorsal gonopores as *Patiriella pseudoexigua*, clearly he does not consider the different alignment of these pores warrants a generic distinction. As *A. dyscrita* is otherwise so similar morphologically to *P. exigua*, I propose to refer it to *Patiriella*. Preserved colourless specimens where the position of the genital openings is often difficult to detect are all likely to be referred to *P. exigua*, though in life the greenish-blue of its lower side will distinguish that species from *P. dyscrita*.

Family **SOLASTERIDAE**

Lophaster quadrispinus H. L. Clark

Lophaster quadrispinus H. L. Clark, 1923 : 295–297, pl. 18, figs. 1, 2 ; 1926 : 21 ; Mortensen, 1933 : 272.

MATERIAL. AFR 730A, 31°29′S : 16°03′E (W of Lambert's Bay), 459 metres ; 1 specimen.
TRA 8A, 42 miles W by N of Cape Town (c. 33°S : 17°E) ; 1 specimen.
WCD 214A, 34°29′S : 18°16′E (W of Cape Point), 400 metres ; 1 specimen.

Whereas H. L. Clark gives the number of furrow spines on each plate in the proximal half of the arm of the holotype (R 70 mm) as four and Mortensen (size not given) as five to six, no. AFR 730A with R 60 mm has only three furrow spines on most plates, only a few proximal ones with four and at least one with only two. The same is true of the dry specimen, TRA 8A, R again c. 60 mm, in which only about two proximal plates of each series have four spines, the rest three.

Family **ECHINASTERIDAE**

Henricia reticulata (H. L. Clark) new comb.

Echinaster reticulatus H. L. Clark, 1923 : 290–292, pl. 15, figs. 1, 2 ; Mortensen, 1933a : 264–265.

NOMENCLATURE. Fisher (1940 : 272) has pointed out Mortensen's inconsistency in referring *Henricia ornata* (Perrier) back to *Echinaster* on the grounds that it has no actinal papulae but leaving *E. reticulatus*, with such papulae, still in *Echinaster*.

Unfortunately, however, Fisher's own attempt to distinguish between *Echinaster* and *Henricia* on the supposed longitudinal webbing of the innermost subambulacral spines in *Echinaster* is not reliable. Although some specimens of the type-species, *E. sepositus* (Lamarck) [perhaps properly called *E. sentus* (Retzius)], are preserved with the skin-covering appearing markedly thickened and giving some effect of longitudinal webbing, the usual condition is for the spine sheaths to be independent, with a distinct crease between adjacent plates.

In the armament of the abactinal plates, *H. ornata* does span both genera, specimens with coarser, spaced spinelets resembling *Echinaster*, whereas others in which there are linear or even doubled series of spinelets along the reticulations of the skeleton agree with *Henricia*. This is a notoriously difficult family to classify.

Family **ASTERIIDAE**

Marthasterias glacialis forma ***africana*** (Müller & Troschel)

Asteracanthion africanus Müller & Troschel, 1842 : 15.
Asterias africana : Döderlein, 1910 : 252.
Marthasterias africana : H. L. Clark, 1923 : 306.
Marthasterias glacialis var. *africana* : Mortensen, 1933a : 273–274, pl. 16, fig. 1.

MATERIAL. FBY 133J, False Bay, no details ; 1 specimen.

R/r is c. 110/c. 20 mm = 5·5/1, maximum br c. 30 mm but possibly less in life since the arms have flattened in preservation somewhat. Even allowing for this, the arms are unusually short and fat. It is also unusual in having about ten proximal actinal plates each with a spine, simulating a third inferomarginal spine as they are in series. The pedicellaria wreaths on the outer inferomarginal spines wrap well round and appear to be more or less fused to some of the inner spines as well. However, some northern specimens of *M. glacialis* also show this. There are not very many dorso-lateral spines but the carinal plates have up to four spines on a single plate. The more lateral parts of the dorso-lateral areas are fairly bare but not so obviously so as in the forma *rarispina*. The largest straight pedicellariae have broad rounded tips, sometimes with digits, unlike Fisher's description for northern *M. glacialis* (1928) as 'slender lanceolate to ovate'.

Perissasterias polyacantha H. L. Clark

Perissasterias polyacantha H. L. Clark, 1923 : 307–309, pl. 18, fig. 3 ; 1926 : 29–30, pl. 6 ; Mortensen, 1933a : 278.

MATERIAL. AFR 736N, 30°42·4′S : 15°59·2′E (SW of Hondeklip Bay), 201 metres ; 1 specimen.

This specimen is dried ; it has R only c. 100 mm, whereas H. L. Clark's material had R 260 to over 300 mm. This probably accounts for it having only three adambulacral spines, when he described five to seven. The carinal spines are tapering

and bluntly pointed, unlike *Perissasterias obtusispina* H. L. Clark, 1926, the only specimen of which (R c. 160 mm) has low capitate spines. The latter has four adambulacral spines on most plates and I think will prove to be conspecific with *P. polyacantha* when more material is available ; the shapes of abactinal spines are often very variable in this family.

Subclass *OPHIUROIDEA*

Family **GORGONOCEPHALIDAE**

Astrocladus euryale (Retzius)

Pl. 3, figs 1 and 2

Asterias euryale Retzius, 1783 : 243.
Euryale verrucosum Lamarck, 1816 : 537.
Gorgonocephalus verrucosus : Lyman, 1882 : 262–263 ; Bell, 1905b : 260.
Astrocladus verrucosus : Döderlein, 1910 : 256.
Astrocladus euryale : Döderlein, 1911 : 28, 40, 106 ; H. L. Clark, 1923 : 319 ; Mortensen, 1933a : 293–296, figs. 21, 22, pl. 18, fig. 7.

MATERIAL. AFR 842C, 34°34′S : 19°18′E (W of Cape Agulhas), 31 metres ; 1 specimen.

SCD 32U, 33°38·6′S : 26°54·7′E (W of Port Elizabeth), 55 metres ; 1 large and 2 small specimens.

SCD 42K, 32°15·2′S : 28°57·7′E (off Bashee River), 47 metres ; 1 small specimen.
SCD 57W, 33°37′S : 26°56·6′E (W of Port Elizabeth), 46 metres ; 5 specimens.
SCD 91C, 33°03′S : 27°55′E (S of East London), 27 metres ; 4 specimens.
SCD 155P, 34°03′S : 25°59′E (S of Port Elizabeth), 85 metres ; 2 specimens.
SCD 355A, 34°03·3′S : 25°43·5′E, 38 metres ; 1 specimen.

VARIATIONS. In his key to the family Gorgonocephalidae, Döderlein (1911 : 28) used the presence or absence of tentacle scales (or arm spines) before the first fork in the arms as one of the main dichotomies, *Astrocladus* being included among the genera in which these are absent (at least in adult specimens). However, of the specimens now referred to *Astrocladus euryale*, only the one from west of Cape Agulhas (AFR 842C) does not have spines before the first fork. It has disc diameter (d.d.) 60 mm. All the others come from east of Cape Agulhas and have spines developed before the first fork to some degree. Apart from this, I cannot discern any significant difference between them to warrant a specific, let alone a generic distinction. Of the 'Challenger' specimens from False Bay, the largest (d.d. 75 mm) has two very short spines adjacent to several pores before the first fork, including those of the third arm segment, just projecting from the granulation, though consecutive segments all have spines only after the first fork. A smaller specimen from the same station (d.d. 40–44 mm) has short spines, at first two then three, starting at the second segment but another with d.d. 47 mm shows no spines at all before the first fork. The largest of sample SCD 91C (d.d. 45 mm), as well as the smaller ones, has three spines at the second tentacle pores increasing to four, though the largest from SCD 57W of similar size (d.d. 40–45 mm) only has two very short spines on

these early segments. Clearly there is much more variation in the degree of reduction of these spines with growth than has hitherto been allowed for. Mortensen (1933) thought them suppressed from about d.d. 20 mm, while H. L. Clark (1923) gave the critical size as 15 mm. The holotype of Mortensen's *Astroconus capensis* has d.d. 30 mm and superficially resembles *Astrocladus euryale* in the tubercles on the radial ribs. It has two arm spines by the second and following pores before the first arm fork, which presumably prompted its inclusion in *Astroconus* rather than *Astrocladus*. It also lacks the belts of hook-bearing platelets which Mortensen discovered on the distal arm segments of *Astrocladus euryale*. These platelets are found at least in the largest specimen from SCD 91C (d.d. 45 mm) (and from the third fork onwards, not just distally) but, as noted above, this specimen also has arm spines before the first fork.

It seems to me that a reappraisal of the taxonomic characters in use for the family Gorgonocephalidae in the light of ontogenetic changes and variation is badly needed. It is possible that some use can be made of the average number of segments between successive forks on the arms but this distinction may also prove to be untenable. It may be noted that most of the specimens now referred to *Astrocladus euryale* have only six to eight, sometimes nine, segments between most of the forks on the main branches, whereas the holotype of *Astroconus capensis* has 12–13 on the main branches and seven or eight only on the side branches. The type-locality of Mortensen's species was off Natal (c. 30°S : 31½°E). Most of the specimens he referred to *Astrocladus euryale* were from False Bay and Walker Bay (west of Cape Agulhas) and were large with d.d. 50–60 mm but he also referred specimens from East London (size not given) to the same species.

Family **OPHIACANTHIDAE**

Ophiomitrella corynephora H. L. Clark

Ophiomitrella corynephora H. L. Clark, 1923 : 322–324, fig. 2, pl. 19, figs. 5, 6 ; Mortensen, 1933a : 331–333, figs. 48, 49.

MATERIAL. AFR 743F, 30°S : 15°E (W of Hondeklip Bay), 102 metres ; 4 specimens.

WCD 25U, 33°06·5′S : 17°55·5′E (near Saldanha Bay), 79 metres ; 17 specimens.
WCD 219C, 34°42·8′S : 18°08·8′E (SW of Cape Point), 360 metres ; 6 specimens.
SCD 4A, 34°30′S : 24°40′E (SW of Cape St Francis), 102 metres ; 2 specimens.
SCD 177C, 34°20′S : 23°31′E (SE of Knysna), 56 metres ; 7 specimens.
SCD 249E, 34°48′S : 23°39′E (SE of Knysna), 146 metres ; 4 specimens.
SCD 320F, 34°15′S : 25°50·5′E (S of Port Elizabeth), 108 metres ; 1 specimen.

Contrary to H. L. Clark's figure, not all specimens of *Ophiomitrella corynephora* have the radial shields completely separated. In several smaller ones the radial shields of some pairs at least are just contiguous, for instance in one from SCD 4A with d.d. 3·5 mm, which also has relatively large radial shields, 0·75 mm long or nearly half the disc radius.

One of the seven from SCD 177C has unusually short disc stumps and arm spines. Unfortunately the ventral side is concealed since it is wrapped around a gorgonian.

Ophiacantha sp. juv., aff. *O. striolata* Mortensen

MATERIAL. WCD 140K, 34°16′S : 18°15′E (SW of Table Bay), 158 metres ; 1 specimen.

AFFINITIES. The d.d. is only 1·1 mm. The mouth plates are immature with the first ventral arm plate and second oral tentacle superficial. The distal oral papilla is present but the second one is not yet developed, leaving a diastema between the distal papilla and the first one, which is close alongside the apical papilla (or outermost tooth). The disc is armed with relatively long trifid stumps. The radial shields are not visible. The oral papillae are markedly rugose and many of the arm spines have lateral thorns for about the basal one-third or half of their length. The lateral plates are very moniliform (constricted proximally and flared distally) and their texture is striated like that of the small ventral arm plates. It is this last character particularly which suggests affinity with *Ophiacantha striolata*. Neither Koehler (1923) nor Cherbonnier (1962) mentioned striations on the arm plates of *Ophiacantha angolensis*, while a specimen of *Ophiacantha baccata* of similar small size already has oral papillae like those of the adult, even to the third one being distinctly coarser than the second. However, it does have relatively large trifid stumps on the disc and the proximal arm spines are similarly thorny in their basal halves. In *O. baccata* the arm plates are not striated.

If this specimen can be referred to *Ophiacantha striolata*, then it extends the range of the species westwards, other records being from the Durban area (Mortensen) and a new one from off East London (SCD 297F, 33°09′S : 28°02′E, 84 metres).

Amphilimna cribriformis sp. nov.

Fig. 1

MATERIAL. NAD 33B, 29°38′S : 31°36′E (NE of Durban), 200 metres ; 1 specimen ['Anton Bruun' st. 390G].

NAD 35W, 29°35′S : 31°38′E, 150 metres ; 1 specimen [St. 390L].

NAD 40V, 29°34′S : 31°39′E, 118 metres, 17 specimens including the holotype. [St. 390P.]

NAD 43G, 29°34′S : 31°39′E, 115 metres ; 2 specimens [St. 390N].

NAD 52E and 55C, 29°29′S : 31°45′E, 86 metres ; 22 specimens [St. 391C & B].

PED 19J, 25°07′S : 34°34′E (between Delagoa Bay and Inhambane, Mozambique), 112 metres, 4 specimens [St. 372L].

DESCRIPTION. The holotype has the disc somewhat distorted in preservation, having d.d. 5·5–6·5 mm. It is similar to that of *Amphilimna olivacea*, having fine indistinct scaling with scattered slender tapering spinelets, in this specimen up to c. 0·5 mm long. The radial shields are narrow, length : breadth c. 0·8 : 0·15 mm, contiguous for most of their length but separated by a (possibly unnatural) notch distally. The upper end of the genital plate just distal to each shield is armed with a pair of tapering spines stouter than the disc spines.

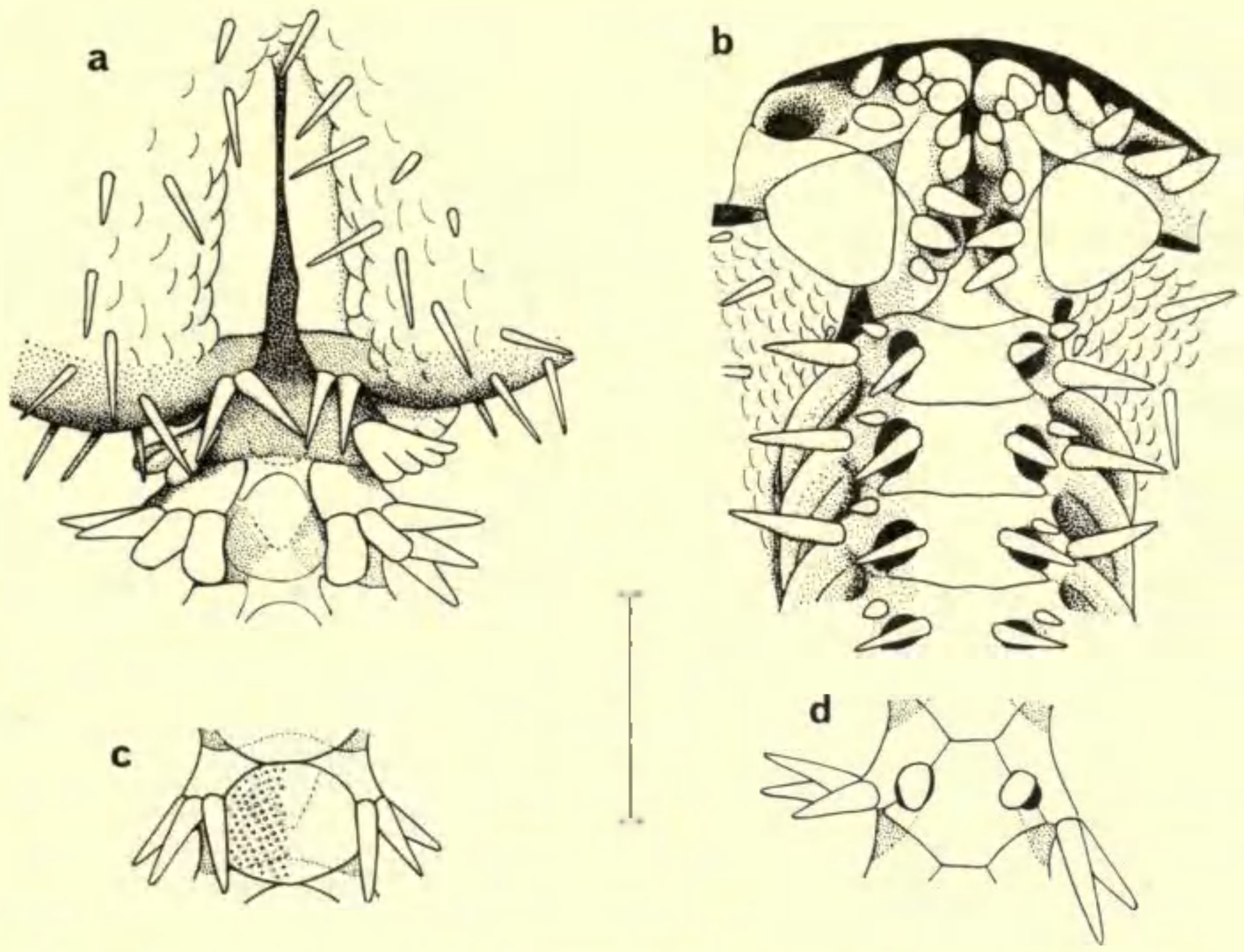


FIG. 1. *Amphilimna cribriformis* sp. nov. Holotype. NAD 40V. a. Dorsal view of part of disc (apparently incompletely regenerated) and two arm segments which would normally be overlain by the disc, showing transitionally modified upper arm spines and rudimentary, non-contiguous dorsal arm plates. b. Two jaws and the first few arm segments, the distal oral papillae omitted from the series on the extreme left, the indistinct sutures between the ventral and lateral arm plates proximal to the tentacle pores not drawn in. c and d. Dorsal and ventral views of the twelfth free arm segment, the perforations in the dorsal arm plate only drawn on half the plate ; the lines of dashes indicate the underlying vertebrae seen by transparency. The scale measures 1 mm.

The oral shields are rounded triangular, broadest distally and about as long as broad, the adorals widely separated from each other by the width of the rounded proximal angles. The oral plates are long. On each jaw there are two to four asymmetrically placed apical papillae superficial to the outermost broad, rounded tooth and flanked on each side by an almost superficial, elongated oral tentacle scale filling in the diastema between the apical group of papillae and the three spiniform distal papillae each side, the two outer of which arise from the edge of the adoral shield.

The disc appears to have shrunk back from the bases of the arms slightly since the dorsal arm plates of the first few free segments are rudimentary and their upper arm spines are very flat and abbreviated, though not fused together like those of the basal segments adjoining the genital slits. The succeeding dorsal arm plates become broader than long, approximately ovate, but still thin and semi-transparent, having a sieve-like appearance (hence the specific name) owing to the single layer of perforations. The underlying parts of the lateral arm plates and vertebrae can accordingly be discerned, at least when wet.

The first ventral arm plate is fairly large, its superficial part appearing triangular and swollen ; the distal edge is convex. The second plate has the distal edge almost straight and is relatively broad between the tentacle pores but the following

plates soon become narrow in the proximal part, flare out abruptly distal to the pores and rejoin the lateral plate each side, while the distal edge sweeps back each side for more than a third of its extent.

On the first seven segments all the spines but the lowest of each series are modified into a wing-like flange, as also in *Amphilimna olivacea*. Beyond the disc the arm spines are still flattened but separate, tapering to sharp tips ; they number up to six and none exceed the segment in length. Owing to the flattening, their internal cavities are small.

The first eight to ten segments have two tentacle scales to each pore, a short proximal one on the lateral arm plate, at first almost in series with the lowest spine and itself resembling a short stumpy spine, while the second scale is based on the ventral arm plate about half-way along the side of the pore and is at first long and spiniform but soon becomes reduced and lost altogether by about the tenth (rarely the twelfth) segment ; simultaneously the proximal scale becomes flattened and shifts to the edge of the pore, adopting the more usual lid-like form.

AFFINITIES. In comparison with *Amphilimna olivacea* from both sides of the tropical Atlantic and adjacent coasts, recently redescribed and figured by Cherbonnier (1962), Thomas (1967), Madsen (1971) and Thomas & Schoener (1972), this new species from the Indian Ocean side of southern Africa differs in the following ways : the presence of usually two well-developed spines at the upper end of each genital plate rather than one ; the triangular shape of the oral shields with a flattened distal side rather than the rhombic shape so constantly found in *A. olivacea*, with the adorals widely separated rather than contiguous (or nearly so) interradially ; the more asymmetrical apical oral papillae, usually numbering three or four, sometimes two, rather than usually only two ; the greater breadth of the dorsal arm plates and their delicacy ; and the lesser elongation of the arm spines, not exceeding the segment length.

I agree with Thomas (1967) that the genus *Amphilimna* does not belong in the family Amphiuridae. He has ranged it instead in the Ophiacanthidae, which is rather a heterogeneous assemblage and badly in need of revision. Some of its members show considerable affinity with the Chilophiurida, including the Ophiocomidae and Ophionereidae.

Family **AMPHIURIDAE**

Amphiura albella Mortensen

Amphiura albella Mortensen, 1933a : 359–361, fig. 67.

MATERIAL. ABD 12H, 30°09'S : 31°37'E (E of Durban), 930 metres ; 1 specimen ['Anton Bruun' st. 389E].

This specimen has d.d. 6·0 mm, compared with 5 mm in the holotype. It differs in having the radial shields relatively larger, their length almost equal to half the disc radius, length : breadth c. 1·4 : 0·5 mm = 2·8 : 1. One radius is abnormal with a single very broad radial shield. There are five arm spines proximally, compared with four in the type. There are two tentacle scales only on the proximal parts of the arms, the remaining pores having only the one on the lateral arm plate.

Amphiura candida Ljungman

Fig. 2

Amphiura candida Ljungman, 1867 : 318–319 ; Mortensen, 1933a : 361. [Non *A. candida* : Marktanner-Turneretscher, 1887, nec Koehler, 1904a.]
Amphiura kalki Balinsky, 1957 : 3–5, fig. 1, pl. 1, figs. 1, 2 ; A. M. Clark *in* Clark & Rowe, 1971 : 80, 97.

MATERIAL. MOR 50C, c. 23½°S : 35½°E (Morrumbene estuary, Mozambique), 3–5 metres ; 9 specimens.
MOR 131Y, same locality, 2 metres ; 2 specimens.

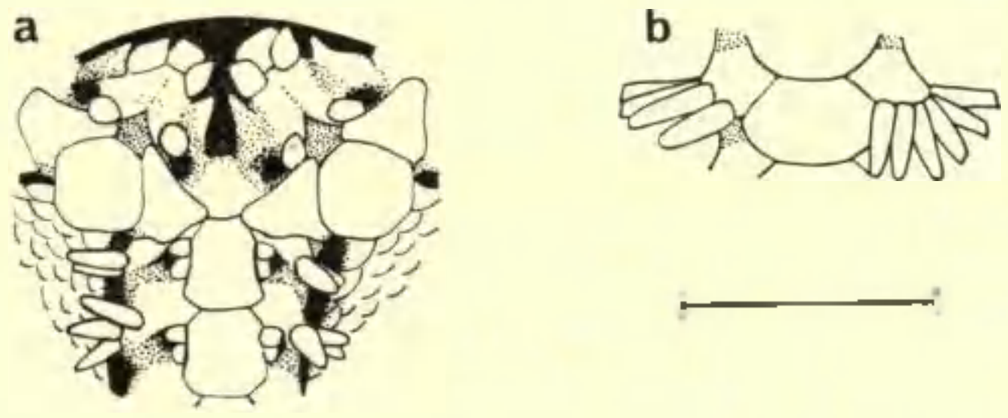


FIG. 2. *Amphiura candida* Ljungman. MOR 50C. D.d. 5·0–5·5 mm. a. Two jaws and the first two arm segments ; most jaws have more or less offset apical papillae, not fully infradental, as in the one on the left ; the distal oral papillae are all foreshortened. b. Dorsal view of twentieth free arm segment showing the truncated, slightly hooked, middle arm spines. The scale measures 1 mm.

NOMENCLATURE. Mortensen's unilateral declaration of the name *Amphiura candida* as a 'species delenda' has no validity without supporting action by the International Commission on Zoological Nomenclature, under the code of which the designation of a Japanese specimen as neotype by Koehler (1904) is also invalid. Since the type locality is Mozambique – for long a neglected collecting area – and not South Africa, the absence of the species among the South African collections studied by Mortensen is not surprising. It is unfortunate that Balinsky accepted at face value Mortensen's rejection of the name *A. candida* and so introduced the new name *Amphiura kalki*, which is surely synonymous. He himself 'had no criterion for distinguishing it from *A. candida*'.

The Morrumbene specimens agree with Ljungman's description as far as that goes, except that the distal oral papilla is not really squamiform, being quite thick, though short and slightly broadened with a rounded end. It arises from the distal end of the oral plate just adjacent to the edge of the adoral shield. Unfortunately Ljungman omitted to mention the arm spines, which have the distinctively large number of up to eight.

Amphiura capensis Ljungman

Amphiura capensis Ljungman, 1867 : 320 ; Lyman, 1882 : 129, pl. 18, figs. 14–16 ; Koehler, 1908 : 634 ; Döderlein, 1910 : 253–254, pl. 5, fig. 2 ; H. L. Clark, 1923 : 327 ; Mortensen, 1933a : 348–350.

? *Amphiura angularis*: H. L. Clark, 1923 : 327–328; Mortensen, 1933a : 354. [Non *A. angularis* Lyman, 1879.]
Amphiura adjecta Mortensen, 1933a : 355–357, fig. 62.
Amphiura compressa Mortensen, 1933a : 357–358, figs. 63, 64.

MATERIAL. LU 53Y, Luderitz Bay (c. 26½°S : 15°E), shore; 2 specimens.
SWD 86G, 27°30′S : 15°25′E (S of Luderitz Bay), 35 metres; 7 specimens.
HB 5D, Hondeklip Bay (c. 30°S : 17°E); 3 specimens.
PP 4S, Paternoster (c. 32°S : 17°E), shore; 1 specimen.
SB 176D, 178X, 187A, 188F, 205P, Saldanha Bay (c. 33°S : 18°E), 13–15 metres; 16 specimens.
LB 116, 524Q, 555B, Langebaan Lagoon (c. 33°S : 18°E); 7 specimens.
TRA 76N, 32°41′S : 18°03′E (N of Saldanha Bay), 27 metres; 1 specimen.
TRA 132I, 34°19′S : 18°30′E (False Bay); 3 specimens.
FAL 19D, 453H, 457D, 467K, 493M, 505D, 578T, False Bay, 29–80 metres; 19 specimens.
TRA 102S, near Mossel Bay (34°S : 22°E); 1 specimen.
KKN 42Z, Buffalo Bay, near Knysna (34°S : 23°E), intertidal; 1 specimen.
SCD 155C, 34°03′S : 25°59′E (Algoa Bay), 85 metres; 3 specimens.
SCD 294H, 33°04′S : 27°57′E (near East London), 84 metres; 6 specimens.
SCD 323C, 34°15′S : 25°50·5′E (S of Algoa Bay), 108 metres; 1 specimen.
SCD 365E, 33°50·7′S : 25°47·5′E (Algoa Bay), 36 metres; 1 specimen.

VARIATION. Like H. L. Clark I cannot distinguish specifically between specimens from deeper water down to c. 180 metres (as at 'Challenger' st. 141) and those taken by shore collecting. The only possibly significant difference found in a detailed examination of 24 specimens was in the length of the radial shields in relation to the disc radius, the ratio being 1 : 3·5 and 1 : 3·2 in two out of the three 'Challenger' specimens compared with a range of 1 : 2·2–2·8 in 21 of the Ecological Survey specimens from depths down to only 84 metres. However, the third 'Challenger' specimen (d.d. 5·8 mm) has the ratio 1 : 2·7.

I counted up to only seven arm spines in the 'Challenger' specimens and I suspect that the presence of eight in Lyman's figure was an artist's mistake. The maximum number of spines basally tends to increase with size from five at d.d. <4·5 mm to seven at >8 mm, though there is some individual variation. The upper spines at least are distinctly flattened, usually broadest at about the middle of their length but slightly tapering in smaller specimens, as in the holotype of *Amphiura adjecta* with d.d. 4 mm, or conversely spatulate with the tip more or less truncated or even expanded like an axe-head, as in the large holotype of *A. compressa* (d.d. 11 mm). The length of the longest spines is 1·0–1·4 (normally 1·1 or 1·2) times the segment length, compared with 1·5 times as long in the spines of the holotype and paratype of *A. angularis* Lyman from south of the Antarctic Convergence, which also number up to only five, even though d.d. is as much as 9·2 and 7·5 mm, and are tapering, though the middle ones are blunted at the tip.

Although H. L. Clark and Mortensen have both referred some South African specimens to *Amphiura angularis*, the latter realized in 1936 that these were distinguished from the type material by having the disc scaled ventrally rather than

abruptly naked below with only a few scattered scales. In fact, I find that nearly all the South African specimens which I am attributing to *A. capensis* have the scaling deficient in a small area immediately distal to the oral shields, as Mortensen shows in his figure of *A. adjecta*. Only three specimens show perfectly continuous scaling ; conversely six specimens have larger bare areas ventrally, one of them (from south of Luderitz Bay – the northernmost locality) has an abrupt edge to the scaling below the ambitus, though another from the same station has more extensive ventral scaling.

Another variable feature is the occurrence of a distinct primary rosette on the disc, which occurs in only about half the specimens ; anyway the rosette decreases in relative size with growth. It is possible that the variable occurrence of the rosette as well as the differences in the ventral scaling can be attributed to the viviparous habit, which may render the disc more than usually liable to deformity, rupture or loss and regeneration.

The shape of the distal oral papilla is always somewhat elongated but varies from blunted conical to flattened ; only occasionally is it more acute.

Growth changes include modifications in the shape of the ventral arm plates. These usually have a straight distal edge but it is convex in the smallest specimens, as in the type of *Amphiura adjecta*, while three specimens (two of them relatively large) have the edge slightly concave, as in the type of *A. compressa*.

The adoral shields are contiguous interradially in the smallest specimen studied (d.d. 2·5 mm), again as in the holotype of *Amphiura adjecta*, and almost so in several of the other smaller specimens, but distinctly separate in the majority.

The least number of scales on a line between the radial shields interradially increases from four to seven at d.d. <4 mm to c. 20 at 10·8 mm, with usually 9–13 at d.d. 5–7 mm. Again there is some individual variation.

There is a tendency for reduction in the relative length of the radial shields with growth, as usual in amphiurids, but only to the extent of changing the mean from 1 : 2·6 to 1 : 2·5 when the larger Survey specimens (d.d. 5 mm or more) are treated separately from the smaller ones. The length : breadth ratio of the radial shields changes from a mean of 2·35 : 1 in 12 specimens with d.d. <5 mm to 2·60 : 1 in a similar number of larger specimens.

Considering all these variable characters, I find myself quite unable to distinguish the four species recognized by Mortensen and consequently am referring both *Amphiura adjecta* and *A. compressa* to the synonymy of *A. capensis*, simultaneously restricting *A. angularis* to antarctic specimens.

Amphiura grandisquama natalensis Mortensen

Fig. 3

Amphiura grandisquama var. *natalensis* Mortensen, 1933a : 353–354, fig. 60.

MATERIAL. ABD 1G, 29°21′S : 31°58′E (NE of Durban), 370 metres ; 5 specimens. ['Anton Bruun' st. 358C.]

These specimens are all very small, d.d. <3·5 mm, and are notable for the extreme length of the lowest arm spine, sometimes equalling the length of three segments. The single, relatively large, tentacle scale appears rounded in contrast to the rather pointed scales illustrated by Mortensen (1933b) in a specimen from St Helena. The oral plates are distinctly flattened so that the proximal end of the first oral tentacle scale is on the same level as the infradental papilla and the second tentacle is almost superficial, approaching the structure of *Amphilepis* except that the teeth are broad.

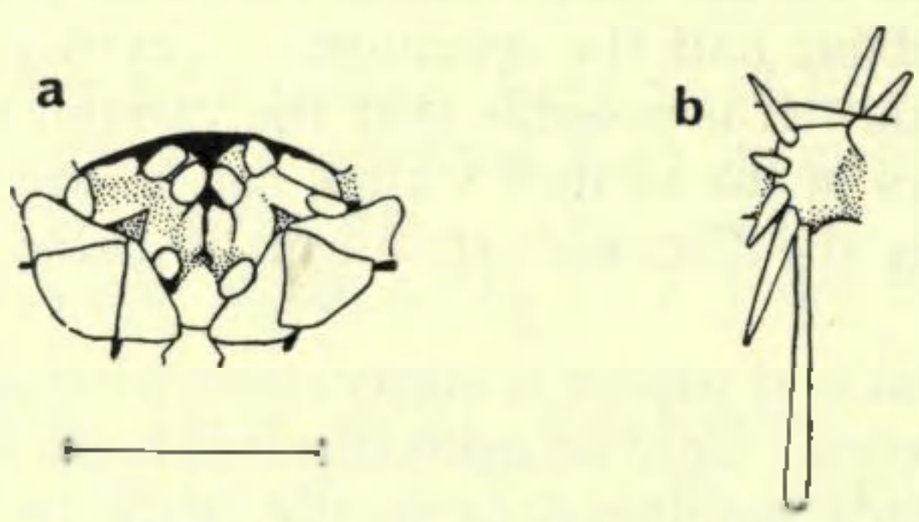


FIG. 3. *Amphiura grandisquama natalensis* Mortensen. ABD 1G. D.d. 3·25 mm. a. Two jaws. b. Side view of seventh free arm segment, the middle spines foreshortened. The scale measures 1 mm.

Amphiura simonsi A. M. Clark

Fig. 4

Amphiura simonsi A. M. Clark, 1952 : 215–217, fig. 2.

MATERIAL. FB 1056C, FAL 64T, 96Z, 188W, 206E, 210Q, 234H, 374H, 395D, 419C, 422C, 447D, 450A, 703B, 804N, False Bay, 27–75 metres ; 36 specimens but only 16 of them with discs.

SCD 94R, 34°21′S : 25°41′E (SW of Port Elizabeth), 110 metres ; 1 discless specimen.

SCD 114V, 34°29′S : 21°49·5′E (SW of Mossel Bay), 73 metres ; 1 discless specimen.

SCD 119C, 34°33′S : 21°52′E, 76 metres : 1 discless specimen.

SCD 209C, 33°58·8′S : 25°42·2′E (Algoa Bay), 27 metres ; 2 specimens with discs detached, but present.

NAD 85C, 29°10′S : 31°51′E (S of Richards Bay), 42 metres ; 1 discless specimen. ['Anton Bruun' st. 356G.]

DESCRIPTION. The holotype of this species was also from sample FB 1056 but lacked the disc. A complete specimen from this sample was only sent to me later. Its disc is partially detached and rather deformed but probably measured between 6 and 7 mm in diameter. The oral frame (from distal edge of an oral shield to the distal edge of the first ventral arm plate opposite it) measures 2·0 mm. The radial shields are relatively small, c. 0·9 mm long and 0·3–0·4 mm broad ; they are contiguous only at the distal end and diverge proximally. The rest of the upper side of the disc is covered with small, even-sized scales and the primary plates cannot be

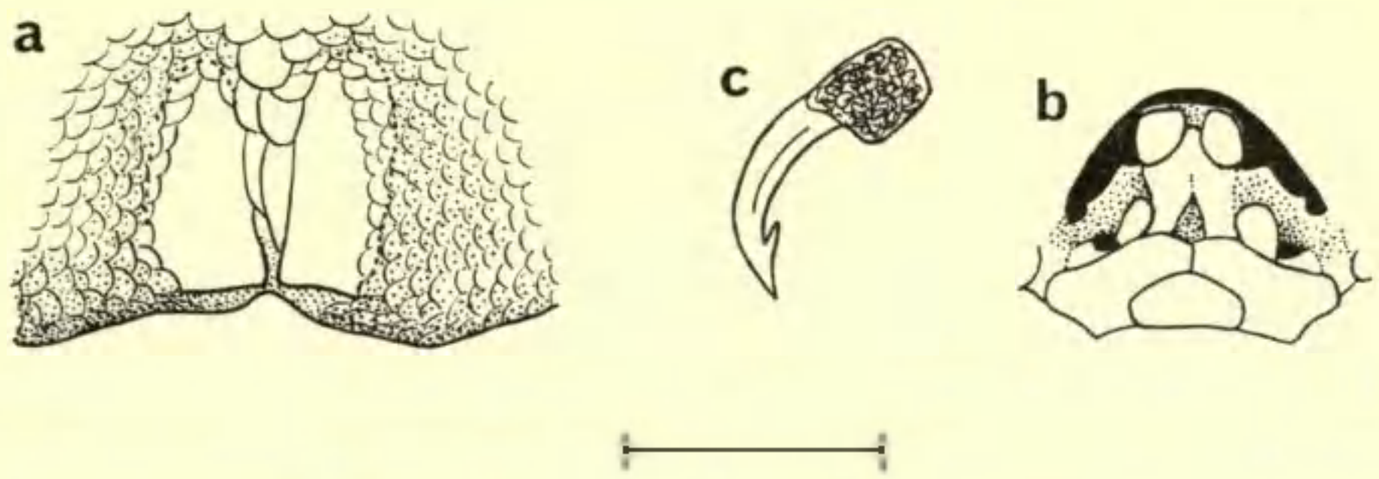


FIG. 4. *Amphiura simonsi* A. M. Clark. 'Topotype.' FB 1056C. D.d. 6 mm (oral frame diameter 2·0 mm). a. Dorsal view of part of semi-detached disc, the scaling very transparent and the abradial limits of the radial shields seen by transparency shown by dashes. b. One jaw showing the ill-defined limits of the outer of the two distal oral papillae each side. c. Fully modified middle arm spine with barb in this specimen. The scale measures 1 mm for a and b and 0·5 mm for c.

distinguished. The ventral side is abruptly more flexible and appears to be completely lacking in scales.

The outer of the two distal oral papillae is less well developed than the inner one and may be more of an extension of the rim distal to the second oral tentacle than an articulated papilla. The oral tentacle scale is small and rounded, not projecting much from the side of the oral plate, and well within the slit.

There are four arm spines proximally, the lowest one somewhat flattened and tapering to a blunt or rounded tip, half as long again as the segment ; the second spine gradually develops the conspicuous glassy hook beyond the base of the arm, its complete modification being reached by about the fortieth segment, where it shows an abrupt constriction after the opaque basal part ; the transparent hook is armed with a barb, not found in the holotype. The two upper spines are extremely flat and paddle-shaped or elliptical, widest in the middle or distally, with the tip broadly rounded. As many as twelve of the basal segments may lack the single tentacle scale, compared with only two in the holotype.

Amphiura sp. indet. A.

MATERIAL. SCD 323C, 34°15′S : 25°50½′E (S of Algoa Bay), 108 metres ; 1 small, damaged specimen.

The disc is very distorted. The radial shields seem relatively long and were probably only contiguous distally. The disc was probably bare below. There are two spiniform distal oral papillae each side of the jaw, of which the outermost and largest arises from the adoral shield, while the other is on the distal end of the oral plate, separated from the infradental papilla by a diastema revealing the oral tentacle scale in the slit. The oral formula is m,om,m + t. The oral shields are rhombic and the adorals, with the exception of one contiguous pair, are just separate inwardly. The dorsal arm plates are almost circular, though the distal edge is slightly flattened medially. There are four short, stout, blunt arm spines and one poorly calcified tentacle scale.

? Amphiura sp. indet. B

MATERIAL. NAD 40Z, 29°34'S : 31°39'E (NE of Durban), 118 metres ; 1 discless specimen ['Anton Bruun' st. 390P].

This specimen again has two distal oral papillae but rounded, not spiniform and the inner one of them arises partly from the adoral shield so that the formula is m,o$\overline{n}$,$\overline{n}$m + t. It has some resemblance to *Amphiura koreae* Duncan. The dorsal arm plates are broad, oval. There are three acute arm spines and one tentacle scale, unlike *A. koreae*, which has two.

? Amphiura sp. indet. C

MATERIAL. FAL 416G, 34°12·5'S : 18°37'E (False Bay), 48 metres ; 1 oral frame and arm bases and a detached disc, ? of the same specimen.

The disc has very long narrow radial shields equal to about half the radius and was probably bare below. The oral shields are very short and broad, the adorals relatively large and broadly contiguous. There is one short rounded distal oral papilla. The four arm spines are extremely flat. The proximal pores are scaleless but then a narrow scale develops along the edge of the ventral arm plate.

Amphipholis similis Mortensen

Fig. 5a

Amphipholis similis Mortensen, 1933a : 363–364, fig. 69.

MATERIAL. TRA 59F, off Bull Point (c. 34°S : 21°E), 70 metres ; 1 specimen.

SCD 144N, 34°46'S : 22°05'E (S of Mossel Bay), 93 metres ; 1 specimen.

NAD 46C, 29°35'S : 31°42'E (NE of Durban), 138 metres ; 1 specimen ['Anton Bruun' st. 390S].

This species is liable to confusion with small specimens of *Amphioplus* (*Lymanella*) *integer* with the fourth oral papilla undeveloped or more or less completely concealed behind the enlarged third one. However, the *Amphipholis* can be distinguished by the third papilla being much more than twice as broad as the second, markedly broader than in *A. integer*. Also the tentacle scales are not so much enlarged in *Amphipholis similis* and the arm spines are all shorter than the segment and taper more.

All three specimens are small with d.d. not more than 3 mm, the size of the holotype, but the one from Natal has four arm spines proximally, whereas the holotype had only three as also in *Amphioplus* (*Lymanella*) *integer* at all sizes.

Amphipholis strata Mortensen

Fig. 5b–d

Amphipholis strata Mortensen, 1933a : 361–363, fig. 68, pl. 19, fig. 20.

MATERIAL. FAL 216W, 467L, 493M, False Bay (c. 34°S : 18½°E), 29–42 metres ; 5 specimens.

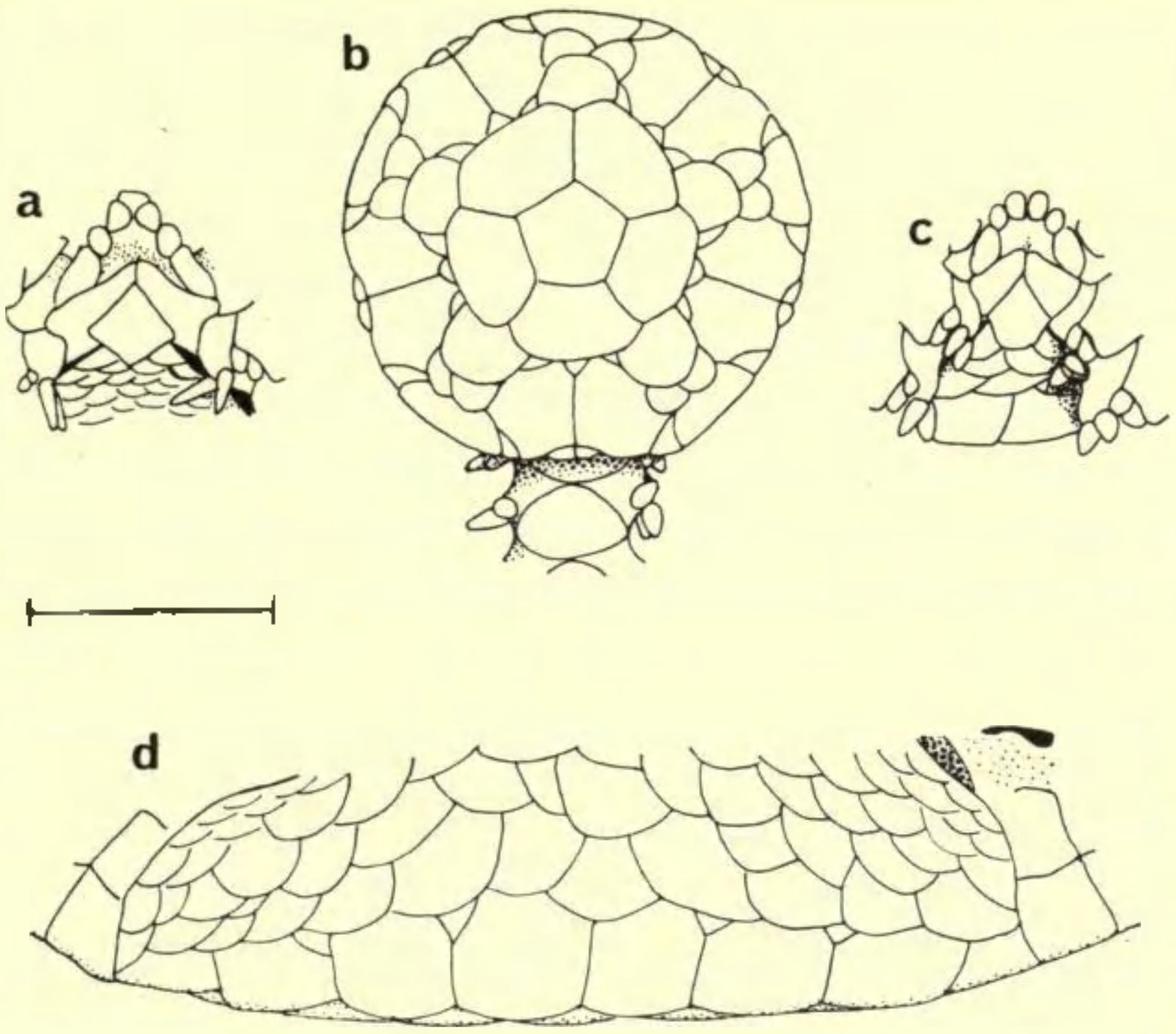


FIG. 5. a. *Amphipholis similis* Mortensen. NAD 46C. D.d. 3 mm. One jaw. b–d. *Amphipholis strata* Mortensen, b and c. FAL 467L. D.d. 1·9 mm. b. Dorsal view of whole disc and one arm base. c. One jaw and the adjacent interradius. d. FAL 493M. D.d. 7·0 mm. Ventral view of disc edge between two radii from which the entire arms have been lost. The scale measures 1 mm.

TRA 132G, 34°19·6′S : 18°30·5′E (False Bay), depth? ; 4 specimens.
MB 74J, 77G, 34°09′S : 22°07′E (Mossel Bay), 12–24 metres ; 2 specimens.
SCD 155D, 34°03′S : 25°59′E (Algoa Bay), 85 metres ; 1 specimen.

DESCRIPTION. All but one of the False Bay specimens are fairly large with d.d. >6 mm. Only interstitial scales occur between the plates of the rosette. At d.d. c. 6 mm there are usually only four scales in a line between the radial shields across each interradius, but six in the largest specimen (d.d. 8·5 mm).

A modification not noticed by Mortensen is the presence of a row of enlarged squarish disc scales just below the ambitus across each interradius, numbering eight, sometimes nine, in each area between the genital plates at d.d. c. 7 mm (fig. 5d). These are less noticeable in the largest specimens.

The oral frame is rather like that of *Amphioplus* (*Lymanella*) *integer* except for the absence of a fourth oral papilla and a more squared-off sculptured appearance of the three papillae with the third one particularly broad, as usual in *Amphipholis*.

The relatively long blunt-tipped arm spines are also reminiscent of *Amphioplus integer*.

The small specimen (fig. 5b, c) has d.d. only 1·9 mm ; its two intact arms measure 5·0 and 6·1 mm. It has a huge rosette on the disc without even interstitial scales between the plates and with only one row of very small scales between each primary radial and the relatively short broad radial shields. Interradially there are only two scales spanning the space between the radial shields distal to the primary interradial.

The row of square scales below the ambitus is even larger than in the adult specimens, occupying half the length of each ventral interradial area. The main difference from the larger specimens is in the extremely short arm spines, only about half as long as the segment.

At the same station in False Bay several young specimens of *Amphioplus* (*Lymanella*) *integer* of similar size were also collected. These differ conspicuously in having more numerous disc scales, the plates of the rosette already almost completely separated, while the uppermost scales of the ventral side of the disc are unmodified and the arm spines just exceed the segment in length. At d.d. 2 mm the fourth oral papilla is not yet developed in the young *A. integer*.

Amphioplus (Lymanella) furcatus Mortensen

? Ophiophragmus gibbosus Ljungman, 1867 : 316.
Amphiura incana : Bell, 1905b : 258. [Non *A. incana* Lyman, 1879.]
? Amphioplus gibbosus : Koehler, 1927 : 21–23, pl. 4, figs. 5, 6.
Amphioplus furcatus Mortensen, 1933a : 370–372, fig. 75.

MATERIAL. NAD 83F, 29°10′S : 31°40′E (E of Tugela River mouth, N Natal), 33 metres ; 1 complete and 2 discless specimens ['Anton Bruun' st. 356C].
[Also 4 syntypes, Tugela River mouth, B.M. no. 1904.6.8.1–3.]

NOMENCLATURE. After studying numerous specimens from the Persian Gulf, Mortensen (1940, Danish Scientific Investigations in Iran, part 2 : 95–97) concluded that his *Amphioplus furcatus* is synonymous with *A. hastatus* from Mozambique and other tropical Indo-West Pacific localities. Although unfortunately most of the few specimens of *A. hastatus* in the British Museum collections are relatively small, d.d. <4 mm, I am not convinced that Mortensen was correct in this case. The four syntypes of *A. furcatus* and one Survey specimen which are complete with the disc all have relatively finer scaling and the radial shields relatively smaller, narrower and more tapering proximally than in the specimens of *A. hastatus* studied and the syntype figured by Koehler (1927, pl. 3, fig. 2). Also, contrary to Mortensen's description, two of his four syntypes do have the rosette just distinct though the plates are relatively small and widely separated, even in the smaller of the two with d.d. c. 3·3 mm, whereas in specimens of *A. hastatus* with the original disc the rosette is very conspicuous, its plates separated by only one line of scales. The two smaller specimens of *A. furcatus* have about 11 scales across each interradius along the shortest line between two neighbouring radial shields but those with d.d. 4 mm or more have about 13 such scales. These figures compare with minima of five scales in an Arabian specimen of *A. hastatus* with d.d. 3·25 mm (Clark & Rowe, 1971, fig. 24a) and seven scales in the figured syntype with d.d. 4 mm. Such discrepancies seem to me too large to overlook.

Yet another question of synonymy concerns the identity of the holotype and only known specimen of *Ophiophragmus gibbosus* Ljungman, 1867, type locality Port Natal, d.d. only 2·33 mm (2·5 mm according to Koehler). In the contiguous radial shields, four oral papillae, three arm spines and two tentacle scales, Ljungman's description of this species agrees both with *Amphioplus furcatus* and with *A. integer*

Ljungman, type locality also Port Natal. The presence of a rosette may be matched by both species at this small size, though it may be less conspicuous in *A. furcatus*. However, the description of the margin of the disc in *O. gibbosus* as having a row of rounded or tubercular papillae (as characteristic of the genus *Ophiophragmus*) fits with neither. It seems though that Ljungman made a mistake in so describing the margin of the disc since Koehler (1927) re-examined the holotype and could not find any marginal papillae or tubercles, the only modification being that the marginal scales were slightly elevated and projecting. This observation prompted him to remove the species to *Amphioplus*. The projection of the marginal scales could resemble the condition found in *A. furcatus*, where all five specimens with discs have the free edges of the uppermost row of ventral scales extended into spinose, sometimes bifid, projections. Thanks to the kindness of Dr P. A. Andersson I have been able to borrow the holotype of *A. gibbosus* from the Riksmuseum, Stockholm, but unfortunately it is now in an even worse condition than when Koehler saw it, badly decalcified with many of the superficial plates completely eaten away. At the same time I borrowed the holotype of *A. integer*, also collected at Port Natal by Wahlberg, which is in good condition. This fact in itself implies affinity of *A. gibbosus* with *A. furcatus*, even the recently collected Survey specimens of which are not strongly calcified, their arm plates being semitransparent, showing the underlying vertebrae beneath, in contrast to *A. integer*. Conversely, however, the arm spines of *A. gibbosus* were described as disproportionately stout by Koehler, agreeing with *A. integer*, not with the relatively slender tapering spines of *A. furcatus*. In view of this contradiction, coupled with the hopeless condition of the holotype, I think that it is best to reject the name *Ophiophragmus gibbosus*.

TABLE 3

Numerical data from the four syntypes (1, 2, 4 and 5) of *Amphioplus furcatus* with discs and one specimen from NAD 83 (3)

	1	2	3	4	5
Disc diameter (d.d.)	5·2	5·0	4·0	3·7	3·3
Radial shield length	1·0	0·9	0·8	0·7	0·75
Disc radius : radial shield length	2·5 : 1	2·75	2·4	2·7	2·2
Radial shield length : breadth	2·4 : 1	2·6	2·5	2·3	2·3
Minimum no. interradial scales	13	13	13	11	11
Arm segment length : spine length	1·0 : 1	1·1	1·0	1·0	1·3

The number of interradial scales is from a linear series across the interradius between neighbouring radial shields. The spine lengths were taken from the middle arm spine of about the third free segment. [The small discrepancies in the ratios of disc radius to radial shield length compared with the figures above them are due to using the radial disc radius, which may be slightly less than half the diameter and to approximations in the conversion from micrometer scale units to the nearest tenth of a millimetre.]

Amphioplus (Lymanella) integer (Ljungman)

Fig. 6

Amphipholis integra Ljungman, 1867 : 313.
? *Ophiophragmus gibbosus* Ljungman, 1867 : 316.

Amphiura integra : Koehler, 1904a : 65–66, figs. 16, 17.
Amphioplus integer : H. L. Clark, 1923 : 330–331 ; Mortensen, 1933a : 368–370, figs. 73, 74.
? *Amphioplus gibbosus* : Koehler, 1927 : 21–23, pl. 4, figs. 5, 6.
Amphioplus (Lymanella) integer : A. M. Clark, 1970 : 52.

MATERIAL. LAM 29H, 32°05'S : 18°17'E (Lambert's Bay), 20 metres ; 1 specimen.

SBS 33K, Lambert's Bay, 10 metres ; 1 specimen.

FAL 108E, 467L, 486E, 745P, False Bay (c. 34°S : 18½°E), 7–62 metres ; 21 specimens.

F 169, False Bay ; 1 specimen.

HM 8E, Hermanus (34°S : 19°E) ; 1 specimen.

CI 4D, Cape Infanta (34°S : 20°E) ; 1 specimen.

KKN 41Q, Buffalo Bay, near Knysna (34°S : 23°E), intertidal ; 1 specimen.

SCD 329A, 34°04'S : 23°23'E (E of Knysna), 22 metres ; 5 specimens.

SCD 260B, 33°48'S : 25°47'E (Algoa Bay), 26 metres ; 3 specimens.

LLL 8Y, East London (33°S : 27°E) ; 1 specimen.

MOR 39C, 41X, 44A, 49M, 50C, 51V, 70V, 77M, 107U, 115S, 117F, 127E, 128S, 164N, 168Q, 171E, Morrumbene estuary, Mozambique (23°S : 35°E) ; c. 55 specimens including some discless and others juvenile.

VARIATION AND SYNONYMY. There is considerable variation in the form of the disc, at least partly correlated with regeneration following its loss, the most obvious consequence of which is absence of the rosette. When regeneration is incomplete the radial shields are abnormally short. The scales may make a fairly smooth covering or they may be somewhat thickened and if the disc is flattened in preservation then the marginal scales at the junction between the dorsal and ventral ones tend to project, though they do not have the spinose prolongations found in *Amphioplus furcatus*. Koehler (1904) described the marginal scales of the small holotype of *Ophiophragmus gibbosus* Ljungman (from Port Natal like that of *A. integer*) as erect. As detailed under the heading of *A. furcatus*, it is debatable whether *O. gibbosus* is conspecific with that species or with *A. integer*. The holotype is now unrecognizable.

In 1971 (Clark & Rowe : 102–103), on the basis of some of the specimens from Morrumbene, I treated *Amphioplus integer* as a species with relatively narrow radial shields, thinking that Koehler's diagrammatic figure of the holotype (1904, fig. 16) showed them as shorter than reality, especially as Mortensen's specimen (also from Durban) has relatively longer shields, length : breadth c. 2·4 : 1. However, since the Cape Province specimens collected by the Ecological Survey now examined show some divergence in comparison with the Morrumbene specimens and both lots show considerable variation in shield shape and arm spine length, I borrowed the holotype of *A. integer* from the Riksmuseum, Stockholm, thanks to Dr P. A. Andersson. Its locality falls between the two groups of specimens geographically. The length : breadth ratio of its shields is only c. 1·9 : 1, Koehler's figure being actually fairly accurate in this respect, and since the rosette is present there is clearly no regeneration in process. This ratio falls within the range of 1·6–2·5 : 1 (mean 2·2 : 1) found in 18 specimens from around Cape Province, compared with a range of 2·3–3·7 : 1 (mean 2·8) for 15 specimens from Morrumbene.

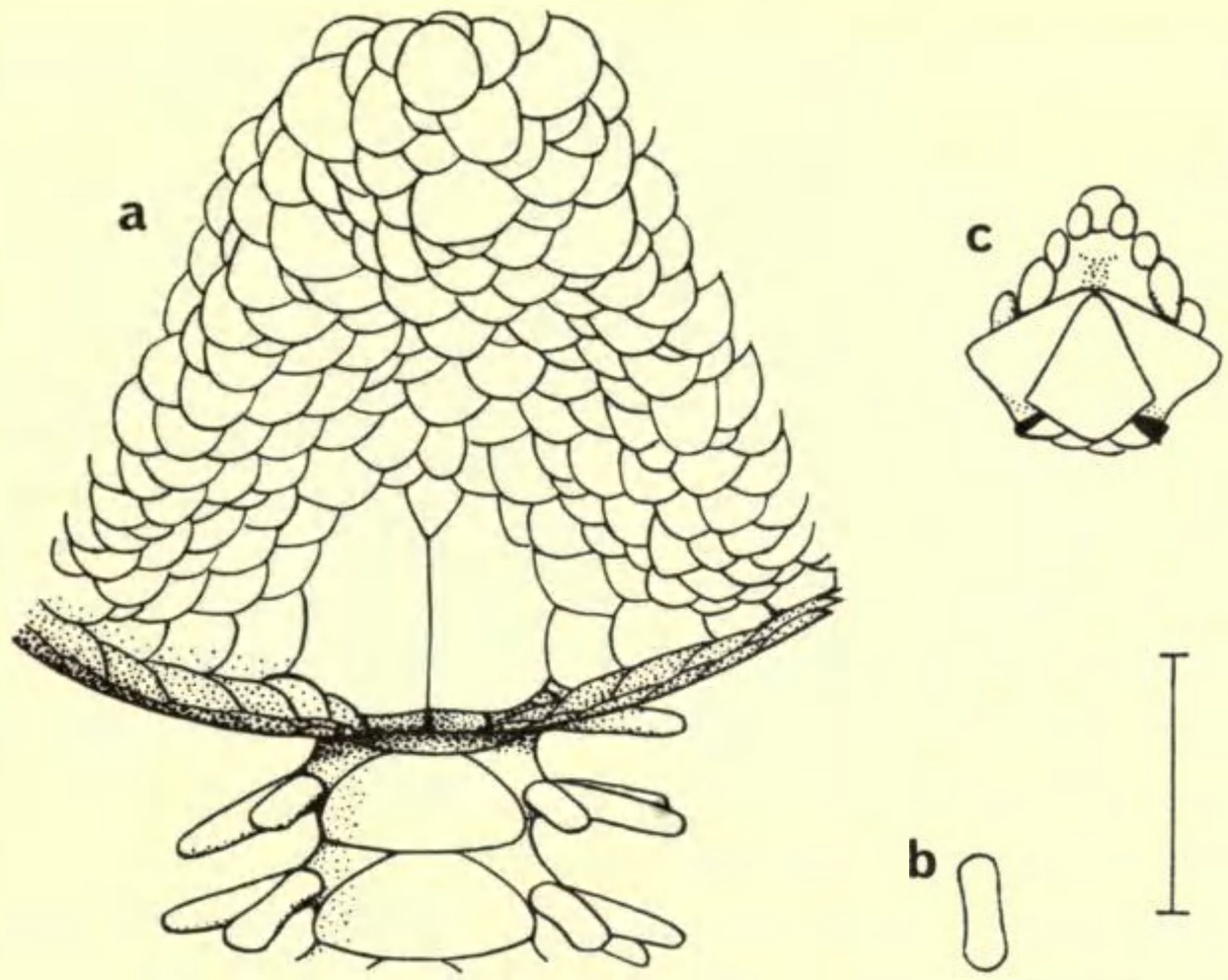


FIG. 6. *Amphioplus* (*Lymanella*) *integer* (Ljungman). Holotype. Port Natal. Stockholm Museum no. 771. D.d. 5 mm. a. Dorsal view of part of disc and one arm base. b. Uppermost arm spine viewed perpendicularly. c. One jaw. The scale measures 1 mm.

As for relative arm spine length, the maximum length of the middle spine compared with the length of the corresponding segment is 1·5 : 1 in the holotype, 1·4–1·8 (mean 1·6) : 1 in the Cape specimens and 1·0–1·25 (mean 1·1) : 1 in the Morrumbene specimens. The specimens from the False Bay area seem to have relatively the longest spines.

Possibly the strictly South African specimens with their broader radial shields and longer spines merit a subspecific distinction from those taken at Morrumbene. Unfortunately Balinsky (1957) does not comment on either of these characters in his specimens from Inhaca, midway between Durban and Morrumbene.

It should be noted that Koehler's 1904 figure of the holotype of *Amphioplus integer* exaggerates the shape and length of the uppermost arm spines, which in fact barely exceed the segment in length (Fig. 6b) and are flattened and only slightly expanded at the tip, appearing somewhat truncated when foreshortened but rounded when viewed from above. None of the other specimens I have studied have the uppermost spine modified to this extent.

Amphioplus (Unioplus) falcatus Mortensen

Fig. 7

Amphioplus falcatus Mortensen, 1933a : 365–367, figs. 70, 71, pl. 19, figs. 18, 19.
Unioplus falcatus : Fell, 1962 : 16.
Amphioplus (*Unioplus*) *falcatus* : A. M. Clark, 1970 : 44, 49.

MATERIAL. ABD 15E, 29°42′S : 31°38′E (NE of Durban), 350 metres ; 1 discless specimen ['Anton Bruun' st. 390E].

NAD 31V, 29°37·5S : 31°33′E, 175–200 metres ; 1 specimen lacking arms [St. 390H].

NAD 35V (part), 29°35′S : 31°38′E, 150 metres ; 9 discless specimens and 4 discs [St. 390L].

NAD 46C, 29°35′S : 31°42′E, 138 metres ; 2 discless specimens [St. 390S].

Judging from this series of specimens, the normal oral formula in this species is clearly m,om,m + t, the tentacle scale rarely being quite in series with the oral papillae. Only on very occasional jaws is a fourth oral papilla present.

The great length of the radial shields, more than half the disc radius, and their sickle-shaped (falcate) form, with a distinct kink at about a quarter of the way from the distal end, is very conspicuous and in addition many of the scales have an orange patch, giving a peculiar spotty appearance. On one disc particularly the pigmented areas are also slightly elevated and the profile is correspondingly uneven. The arm plates and spines are also partially orange coloured.

The largest specimen has d.d. 10 mm.

This species is sympatric with *Amphioplus pectinatus* but the single elongated tentacle scale and the fewer oral papillae immediately distinguish it even if the disc with its unusual radial shields is lacking.

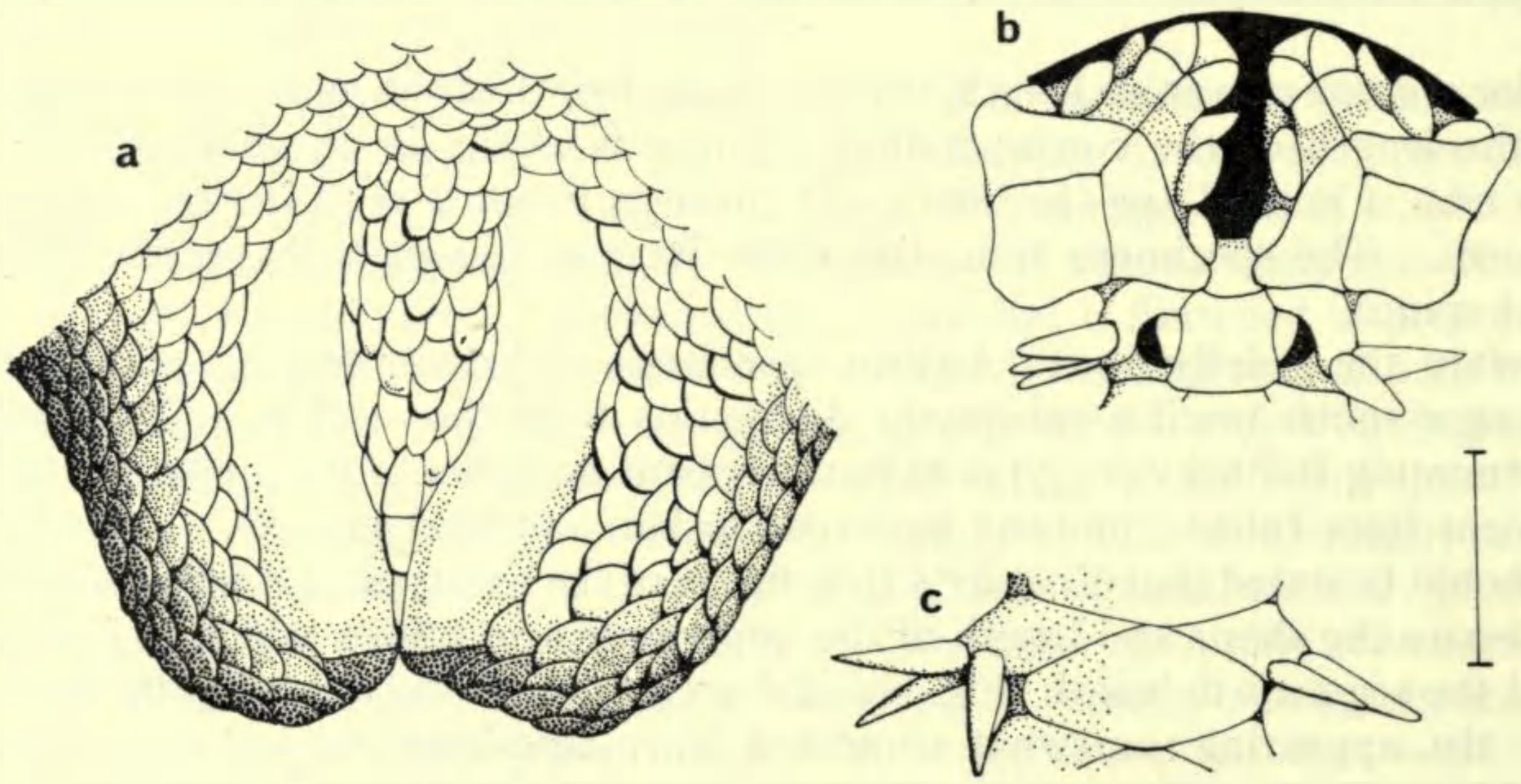


FIG. 7. *Amphioplus* (*Unioplus*) *falcatus* Mortensen. NAD 35V. a. Dorsal view of part of detached disc, d.d. 10 mm. b. Two jaws and the first arm segment. c. Dorsal view of twentieth free arm segment. The scale measures 1 mm.

Amphioplus (Amphioplus) pectinatus Mortensen

Fig. 8

Amphioplus pectinatus Mortensen, 1933a, : 367–368, fig. 72.

MATERIAL. NAD 31W, 29°37·5′S : 31°33′E (NE of Durban), 175–200 metres ; 5 discless specimens and 1 disc, form A ['Anton Bruun' st. 390H].

NAD 35V (part), 29°35′S : 31°38′E, 150 metres ; 6 discless specimens, form A [St. 390L].

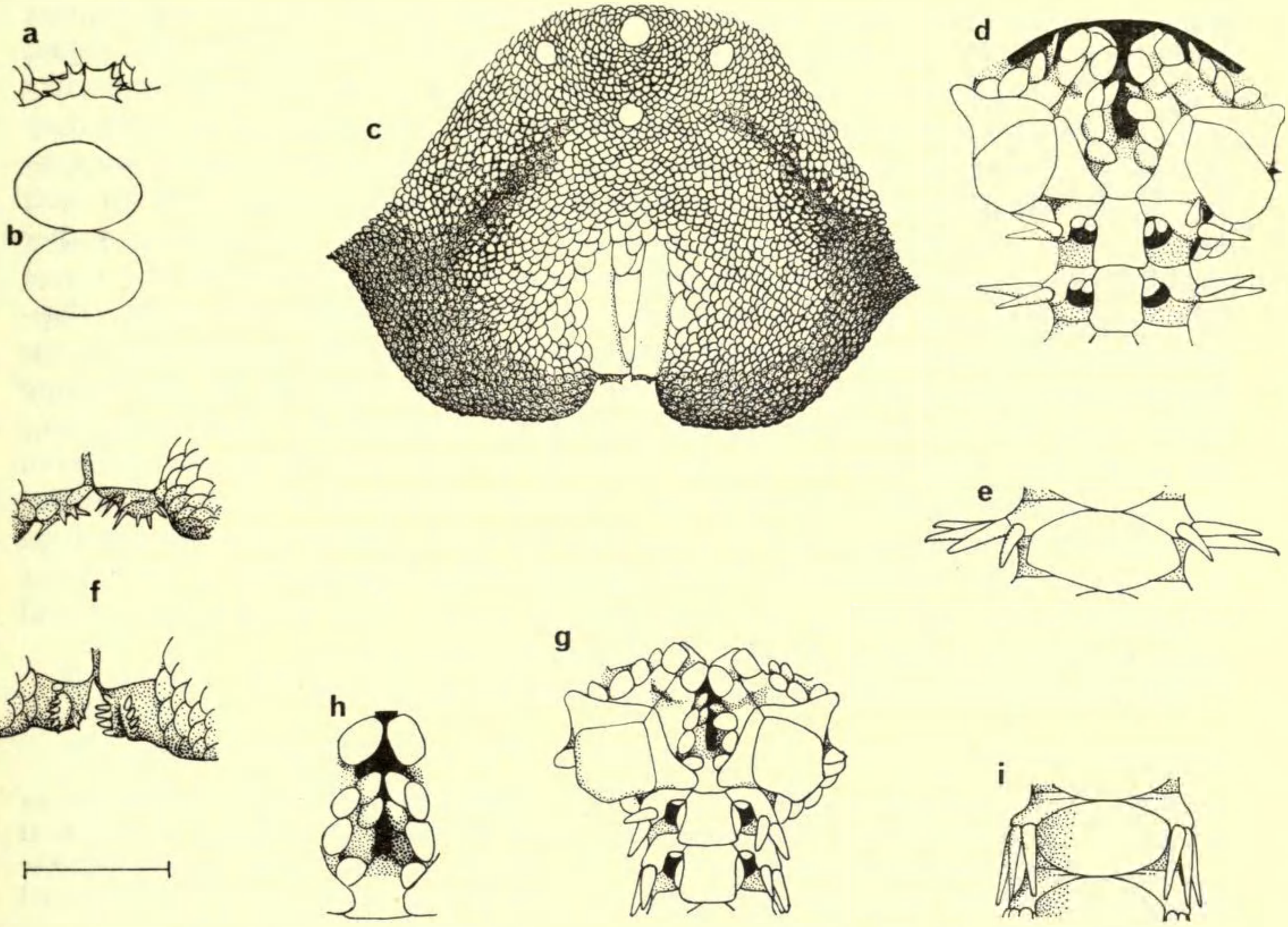


FIG. 8. *Amphioplus* (*Amphioplus*) *pectinatus* Mortensen. a and b. Holotype. Copenhagen Museum ; from sketches by Dr Madsen. a. Oblique view of disc radially showing 'combs' distal to the radial shields. b. Eighth and ninth dorsal arm plates. c–e. NAD 31V. Form A. c. Dorsal view of part of detached disc, d.d. c. 8 mm. d. Two jaws and first two arm segments. e. Dorsal view of fifteenth free arm segment. f–i. NAD 61R. Form B. f. Oblique radial views of two different detached discs. g. Two jaws and first two arm segments with h. Enlargement of oral slit between two jaws. i. Dorsal view of fifteenth free arm segment. The scale measures 1 mm for c–g and i and 0·5 mm for h.

NAD 46D, 29°35′S : 31°42′E, 138 metres ; 1 discless specimen, form A [St. 390S].

NAD 52C, 29°29′S : 31°45′E, 86 metres ; 3 discless specimens and 1 disc, form B [St. 391C].

NAD 55D, 29°29′S : 31°45′E, 86 metres ; 2 discless specimens and 3 discs, form B [St. 391B].

NAD 61R, 29°26′S : 31°46′E, 77 metres : 3 discless specimens and 4 discs, form B [St. 391F].

VARIATION. As indicated above, two forms, A and B, are now attributed to *Amphioplus pectinatus* from the Survey collections, the first from samples NAD 31W, 35V and 46D and the second from 52C, 55D and 61R. I am by no means sure that

these are conspecific but, as none of the discs found are attached to oral frames, there is an element of doubt that they do correspond. In addition, the intact holotype of *A. pectinatus* with d.d. only 5 mm appears to have tentacle scales like form A but dorsal arm plates and discs as in form B. I am indebted to Dr Madsen of the Copenhagen Museum for comments on and sketches of Mortensen's two type specimens. He notes that Mortensen's fig. 72 is reasonably accurate except with regard to the projections distal to the radial shields in fig. 72b, which appear rather as in the detail in fig. 72c. Also Madsen's drawing of the eighth and ninth dorsal arm plates of the holotype shows them as more convex distally, being more nearly elliptical than triangular in shape, though in fact in the paratype (d.d. 4 mm) their shape is more triangular, agreeing with fig. 72b. The paratype also has the disc scaling fairly coarse and its rosette of primary plates is distinguishable. Both types have the second from outermost oral papilla distinctly enlarged and the smaller specimen has the distalmost papilla reduced in size. The oral tentacle scale (or second papilla) is superficial in the paratype and in series with the other papillae but in the holotype it is slightly inset. Incidentally, the longitude of the type locality is the subject of a printer's error and should have been 31°19'E, not 49', from which station several other amphiurids including *Amphiolus falcatus* were also taken.

The differences between the two present forms are as follows :

A	B
1. First oral tentacle scale single (Fig. 8d)	1. Usually two oral tentacle scales adjacent on the side of the oral plate, the proximal one sometimes almost superficial, the distal one tending to be hidden behind the second oral papilla (Fig. 8g)
2. Dorsal arm plates with a more or less distinct median distal angle (Fig. 8e)	2. Dorsal arm plates almost elliptical in shape, the distal side convex but flattened medially (Fig. 8i)
3. Arm spines five on a few proximal segments (six in one specimen, d.d. 7 mm)	3. Arm spines four on proximal segments, rarely five at d.d. 8 mm
4. Some tentacle pores with only one scale rather than two ; the scale on the ventral arm plate short (Fig. 8d)	4. All tentacle pores with two scales, the one on the ventral arm plate long and narrow (Fig. 8g)

The eight discs of form B agree fairly well with that of the holotype of *Amphioplus pectinatus*. The scaling is somewhat finer but this is probably accountable to the fact that they are larger with diameter up to 8 mm. None of them show a primary rosette so it is possible that all may be regenerated rather than original discs, the species is clearly vulnerable to shedding of the disc. Distal to the radial shields on the outer end of the genital plate they all have the spinose projections which prompted the specific name ; these may be arranged irregularly but in one or two cases seem to be in paired vertically aligned combs (Fig. 8f, lower).

The single disc found in the samples of form A contrasts in having extremely small but very thick and projecting scales recalling those of the holotype and only known specimen of *Amphiura acutisquama* A. M. Clark, 1952, from the west coast of South Africa. However, the present disc is also unusual in having the six plates of

the primary rosette showing as conspicuously larger than the central scales. In addition it has spinose projections distal to each radial shield, though these are not so well developed as in the discs from the samples of form B. The ratio of radial disc radius to radial shield length is 2·7 : 1, though if the ratio is calculated from half the disc diameter its value comes to 3·2 : 1 since the radial radius is markedly less than the interradial one owing to bulging of the disc. Length : breadth of the radial shields is between 4·0 and 4·5 : 1. These compare with ratios of radial radius : shield length of 2·0–2·5 : 1, the shields being relatively larger, on the discs of form B, with shield length : breadth 5–6 : 1. In spite of these differences, the coincidence of the development of the spinose processes on the genital plates indicates a close relationship. Also, in the type material of *Amphioplus pectinatus* the radius : shield length is about 3 : 1 and the scales are thick, though coarse.

Amphioplus sp. indet. A (aff. ***A. falcatus***)

Fig. 9

MATERIAL. TRA 104L, 34°31′S : 19°21′E (near Hermanus), 22 metres ; 1 discless specimen.

MB 36B, 34°08′52″S : 22°09′19″E (Mossel Bay), 11·5 metres ; 1 discless specimen.

MB 37B, 34°09′18″S : 22°10′02″E, 31 metres ; arms.

MB 71F, 34°08′46″S : 22°07′20″E, 12 metres, 1 discless specimen.

MB 75F, 34°08′40″S : 22°07′26″E, 15·5 metres ; 1 discless specimen.

LIZ 13P, 33°58·2′S : 25°38·8′E (Port Elizabeth), 7–8 metres ; 2 discless specimens.

NAD 63Q, 29°21·6′S : 31°35·7′E (NE of Durban), 57 metres ; 1 discless specimen ['Anton Bruun' st. 391J].

DESCRIPTION. All these incomplete specimens appear to belong to an undescribed species. Without knowledge of the disc it seems unwise to give them a specific name.

The torn edges of some of the discs still attached to the oral shields indicate that scaling was present ventrally, though probably tenuous.

The largest specimen, from LIZ 13P, had d.d. c. 10 mm, judging from the extent of the missing dorsal arm plates basally. The oral frame measures 2·6 mm from the distal edge of one oral shield to the distal edge of the first ventral arm plate opposite. The oral shields are elongate hexagonal, broadest in the middle with the proximal and distal lobes broadly truncated. The adoral shields have a distal lobe between the oral shield and the adjacent lateral arm plate but are very short interradially and widely separated. The oral plates are sunken distally but sharply elevated proximally, increasing the vertical height of the jaw. Of the four oral papillae, the infradental is squarish but rounded at the corners. The second and third papillae both arise from the side of the oral plate and are finger-like in shape, about three times as long as broad. The short rounded fourth papilla arises from a proximal extension of the first ventral arm plate, not from the adoral. The oral tentacle scale is inset in the oral slit and is also finger-like but smaller than the second oral papilla which may hide it. The oral formula is m,mm, ,m + t.

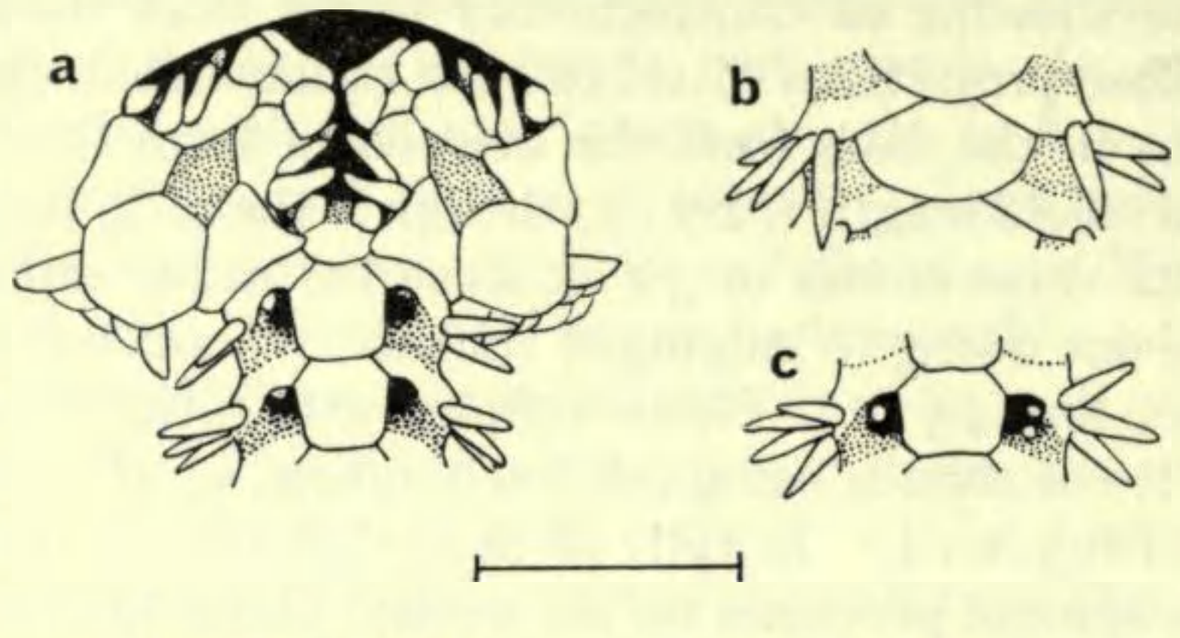


FIG. 9. *Amphiopus* sp. A (aff. *A. falcatus*). LIZ 13P. D.d. c. 10 mm. a. Two jaws and the first two arm segments. b and c. Dorsal and ventral views of fifteenth arm segment. The scale measures 1 mm.

The arms increase in width from a minimum of 0·75 mm proximally to 1·0 mm at about the sixtieth segment, by which they are all broken; they were probably relatively long. The dorsal arm plates are approximately elliptical, though slightly broader towards the proximal end; most of them are just contiguous or very slightly overlapping. The ventral arm plates are at first squarish, the proximal lobe being broadly truncated and the sides only slightly tapering; they soon become almost hexagonal with the proximal lobe more prolonged and the distal tapering more markedly. The distal edge of the first two or three plates is slightly convex but it soon becomes straight and then develops a small notch in the middle. There are four arm spines on the entire length of arm remaining, all somewhat flattened but the uppermost one more so; all taper more abruptly near the tip. The proximal spines are all slightly longer than the corresponding segment and those on the broader part of the arm are half again as long as the segment. There are no proper tentacle scales but in the skin covering many of the pores there are single or sometimes double calcareous accretions, well isolated from the ventral and lateral arm plates, which may be homologous with tentacle scales.

The second specimen from sample LIZ 13P is much smaller. Its oral shields are much shorter, broader than long, though the adorals are again widely separated. The arm plates are relatively narrower, as would be expected, the ventral arm plates longer than broad. The tentacle pores appear quite naked.

The other oral frames also show some variation in the shape of the oral shields, which may be circular, octagonal or pentagonal. There may be a small gap in the row of oral papillae between the first and second ones and in one specimen the two elongated middle papillae are flattened and slightly fluted. Distal portions of arms are unusual in that, although the arms taper, the segments remain broad and short instead of attenuating and the arm becomes very compact. The number of spines drops to three and the lowest one becomes relatively longer than the other two, up to twice as long as the segment. Some of the longer arm spines may have a very small terminal hook or a few divergent thorns.

The spiniform middle oral papillae, the broadly separated adoral shields, the

reduction of the tentacle scales and the distally compact arms easily mark off this species from the other South African amphiurids.

? Amphioplus sp. indet. B

MATERIAL. PED 5S, 24°46'S : 35°18'E (S of Inhambane, Mozambique), 110 metres ; 1 specimen ['Anton Bruun' st. 371F].

D.d. is only 3·3 mm in this specimen and only part of one arm remains attached to the disc. In many ways it agrees superficially with *Amphipholis similis*, as figured by Mortensen, but the third oral papilla is only about twice as broad as long and is also very thick, while in some series there appears to be a fourth papilla behind the third one, as in young *Amphioplus* (*Lymanella*) *integer*. The shapes of the oral shields and arm plates agree with *A. similis* as well as with *A. integer* but the disc scaling is very thick, much more so than in the present material of either of the species named. There is no distinct rosette but this could be due to regeneration of the disc. Also the radial shields are all less contiguous than in the two species named, four pairs being separated for at least their proximal thirds and the fifth only touching at their distal ends. On the first two free arm segments there are four arm spines, then three. The two fairly large tentacle scales agree with those of *A. similis* but those of *A. integer* are even larger and usually somewhat angular.

If the oral papillae are only transitionally three, this with the broadness of the third and distalmost and the straightness of the papilla series suggests affinity with *Amphioplus* (*Lymanella*). However, the more or less separated radial shields and the somewhat smaller tentacle scales and fourth arm spine disagree with this.

Apart from South African species, this specimen also has some resemblance to *Amphioplus platyacanthus* Murakami, 1943, from the Caroline Islands, but that has the fourth oral papilla fully exposed at d.d. 3 mm. *Amphioplus* (*Amphichilus*) *ochroleuca* (Brock, 1888) also has thick disc scales and only three oral papillae fully developed but the third of these is no larger than the second and there is no sign of a fourth papilla underlying it, even at a larger size.

Amphiodia sp. aff. *A. microplax* Burfield

? *Amphiodia* sp. Balinsky, 1958 : 10.

MATERIAL. NAD 67H, 29°21·6'S : 31°35·7'E (NE of Durban), 57 metres ; 1 discless specimen ['Anton Bruun' st. 391H].

NAD 78G, 29°19·1'S : 31°26·8'E, 38 metres ; 1 discless specimen [St. 392J].

NAD 85C, 29°10'S : 31°51'E, 42 metres ; 3 discless specimens [St. 356G].

These incomplete specimens have the oral shields relatively long and only a single tentacle scale. This accords with *Amphiodia* (*Amphispina*) *microplax* Burfield, known from the Red Sea and Persian Gulf, which also frequently loses its disc so that the presence of the modified marginal disc scales prolonged into spinose processes, characteristic of the subgenus *Amphispina*, cannot be ascertained. The other *Amphiodia* known from the western Indian Ocean – *A. dividua* Mortensen – has two tentacle scales, apart from being fissiparous and six-armed.

*Ophionephthys lowelli** sp. nov.

Fig. 10

MATERIAL. SCD 74S, 32°33′S : 28°38′E (NE of East London), 55 metres ; 2 specimens with discs, 2 loose discs and 21 discless specimens.

SCD 82P, 33°03′S : 27°54′E (East London), 51 metres ; 1 specimen.

DESCRIPTION. The holotype has the disc partly detached from the oral frame and rather shrunken. Judging from the extent of the incomplete proximal dorsal arm plates, its d.d. was c. 7·5 mm ; the diameter of the oral frame is 2·3 mm. The arms are all broken off short ; judging from the remaining material they were extremely long, well over ten times the d.d.

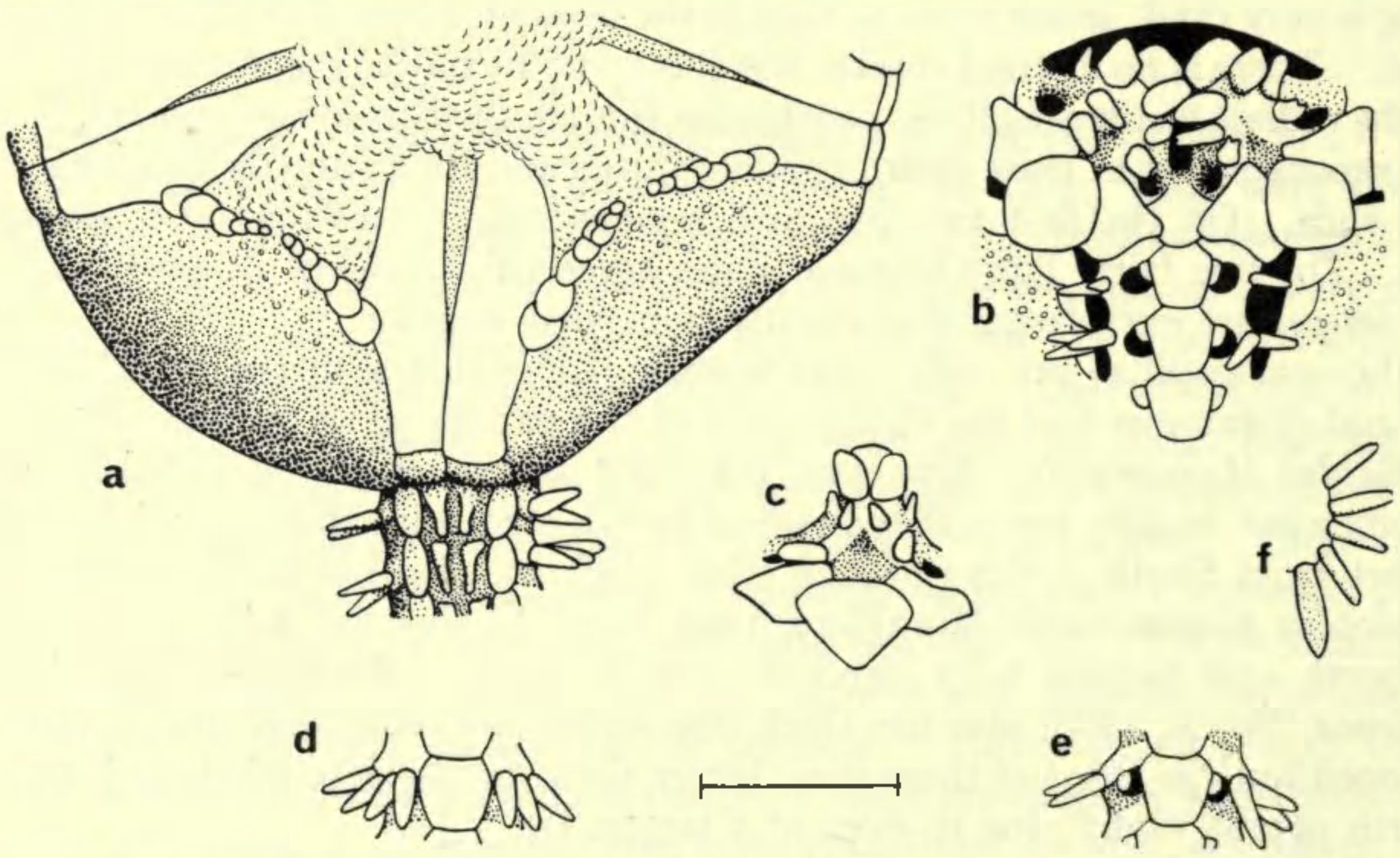


FIG. 10. *Ophionephthys lowelli* sp. nov. a, b. Holotype. SCD 74S. a. Dorsal view of part of disc (somewhat reconstructed) and base of one arm from which the disc has shrunk back revealing segments with the dorsal arm plates divided by erosion of the median part. b. Two jaws and the first two arm segments. c–f. Paratype. c. Jaw with oral shield truncated proximally. d–f. Dorsal, ventral and side views of twentieth arm segment. The scale measures 1 mm.

The upper side of the disc was probably covered with continuous extremely fine scaling, except towards the periphery where it turns brown when partially dried. However, there is a conspicuous row of enlarged scales extending interradially from the abradial edge of each radial shield at about half-way along its length. These belts do not appear to meet interradially but the shrinkage of the discs renders this uncertain. The radial shields have length : breadth 1·9 : 0·5 mm = nearly 4 : 1 and

* Named after Lowell P. Thomas, whose fine work on the amphiurids of Florida (1962) includes a redescription of the type-species of *Ophionephthys*, *O. limicola* Lütken.

are contiguous in the distal half though narrowly separated proximally, at least in the preserved condition. The scaling at their proximal ends is a little more substantial than elsewhere. The ventral skin of the disc bears only scattered rudimentary scales and is more or less transparent.

The oral shields are as long as broad ; the proximal lobe is almost semicircular but for a slight medial flattening and the distal lobe is distinctly angular. The adoral shields are widely separated interradially but have a broad distal lobe between the oral shield and the first lateral arm plate on each side. The oral plates are fairly long and sunken, without a proximal peak and the broad infradental papillae, as preserved, project almost vertically from their apical ends. There are two spiniform oral papillae on each side of the jaw, even the distal one distinctly separated from the adoral shield ; their tips are rugose and they also tend to project vertically. There is a small spiniform oral tentacle scale inset in the slit close to the teeth. The oral formula is m,mm,o + t.

The dorsal arm plates are bucket-shaped, tapering distally and relatively narrow, as long as broad or longer. The ventral arm plates are similar in shape, broadly overlapping, the distal edge convex. The lateral arm plates bear four spines, the lowest one about equal in length to the segment, the rest slightly shorter. There is one fairly long tentacle scale on each pore, equal in length to about half the length of the ventral arm plate.

VARIATIONS. The other oral frames show considerable variation in the shape of the oral shields, which may be rhombic but more often have the proximal lobe very reduced and flattened, with the adoral shields more widely separated than in the holotype. There are usually five arm spines on the proximal segments, of which the lowest slightly exceeds the segment length beyond the base of the arm and all are somewhat flattened and blunt-tipped ; under a high magnification they appear very finely ridged.

Although there is some variation in the size of the oral papillae, their number seems fairly constant ; only in one specimen do most of the jaws lack the second papilla. None were seen to have a fourth papilla on the adoral shield.

AFFINITIES. The combination of normally two oral papillae on each side of each oral plate with an oral tentacle scale in addition and the presence of belts of enlarged scales contrasting with extremely reduced scaling elsewhere on the disc indicate that this species is congeneric with *Ophionephthys limicola* Lütken, the type and only species of that genus since I reviewed it in 1970. The only discrepancy from my diagnosis of the genus is the minor one of the somewhat more extensive, though still very reduced, disc scaling. *O. limicola* is known from the West Indies. Geographically much closer and morphologically nearly as similar is the species from Madagascar recently described by Cherbonnier (1972) as *Amphioplus polymorphus*, which likewise has belts of enlarged disc scales extending interradially from the radial shields. Cherbonnier made no comparison of *A. polymorphus* with *O. limicola*, only with those species which Fell had referred to *Ophionephthys* in 1962 and I had transferred to *Amphioplus*, presumably because *A. polymorphus* seems consistently to have a fourth oral papilla present on the adoral shield, although its jaws are otherwise rather

variable. Cherbonnier compared it also with the West Indian *Amphioplus coniortodes* H. L. Clark, 1918, which, incidentally, is sympatric with *O. limicola*. It is noteworthy that the two West Indian species both have almost keyhole-shaped oral shields proximal to which the adorals meet broadly, whereas both *Ophionephthys lowelli* and *A. polymorphus* have the proximal lobe of the oral shields more or less reduced and the adorals widely separated. The relationships of all four will bear future study.

Apart from the difference in the oral and adoral shields, *Ophionephthys lowelli* differs from *O. limicola* in the spiniform shape of the second and third oral papillae, the more elongate dorsal arm plates and the blunter arm spines, though the more extensive disc scaling of the holotype may be subject to variation, as in *Amphioplus polymorphus*, which likewise has the papillae on the side of the oral plates elongated and the arm spines blunted. Clearly *Ophionephthys lowelli* occupies an intermediate position.

Amphilepis scutata Mortensen

Amphilepis scutata Mortensen, 1933a : 372–373, fig. 76.

MATERIAL. NAD 31X, 29°37·5′S : 31°33′E (NE of Durban), 175–200 metres ; 1 specimen ['Anton Bruun' st. 390H].

D.d. is only 3·3 mm compared with 5 mm in the holotype. The radial shields are relatively smaller, more widely separated interradially and more tapering proximally than shown in Mortensen's figure, so that the widest part is near the distal end, not in the middle. Even the first two ventral arm plates are not contiguous at this size.

Family **OPHIACTIDAE**

Ophiactis plana Lyman

Ophiactis plana Lyman, 1869 : 330–331 : H. L. Clark, 1923 : 333 : Mortensen, 1933a : 345–346, fig. 57 ; H. L. Clark, 1939 : 76–77.
? *Ophiactis lymani* Ljungman, 1871 : 629 ; Mortensen, 1933b : 442–449, figs. 15a–d, 16d, e ; Balinsky, 1957 : 14.
? *Ophiactis parva* Mortensen, 1926 : 123–124, fig. 12 ; Balinsky, 1957 : 15.
Ophiactis flexuosa (part) Lyman, 1882 : 116 ('Challenger' st. 142).

MATERIAL. SST 12L, M, 35°22′S : 22°31′E (SSW of Knysna), 200 metres ; 3 specimens.
SCD 155K, 34°03′S : 25°59′E (Algoa Bay), 85 metres ; 1 specimen.
SCD 177D, 34°20′S : 23°31′E (SE of Knysna), 110 metres ; 1 specimen.
SCD 203G, 34°51′S : 23°41′E, 184 metres ; 1 specimen.
SCD 249E, 34°48′S : 23°39′E, 146 metres ; 2 specimens.
NAD 15N, 30°47′S : 30°27·5′E (S of Durban), 36 metres ; 1 specimen.
NAD 27F, 29°53·5′S : 31°57·7′E (E of Durban), 71 metres ; 3 specimens.
NAD 81R, 29°11·5′S : 31°37′E (NE of Durban), 18 metres ; 2 specimens ['Anton Bruun' st. 356B].
DBN 238K, Durban Harbour entrance, LWST ; 2 specimens.

Most of these specimens are very small, d.d. <3 mm. The only one larger than this lacks spinelets on the disc but these are present in small numbers in one or two of the other specimens and show a small hyaline terminal point, much as in Mortensen's figure (1933b) from the specimens from St Helena which he refers to *Ophiactis lymani*. In addition the South African specimens resemble the West Indian holotype of *O. lymani* in having slightly concave distal edges to the ventral arm plates, unlike Mortensen's specimens. Lyman described the distal edges of these plates in *O. plana* as simply 'curved', presumably convex since he did not qualify it with 're-entering'.

In his St Helena paper Mortensen (1933b) made no reference to *Ophiactis plana*.

Both Mortensen (1933a) and Madsen (1971) have commented on the close similarity between the West African *Ophiactis luetkeni* Marktanner-Turneretscher and the South African *O. carnea* Ljungman, both with five arms and more or less ovate dorsal arm plates. However, the parallel resemblance between the geographically corresponding *O. lymani* and *O. plana*, both with six arms and fan-shaped dorsal arm plates, escaped them. The naming of South African specimens as *Ophiactis plana* follows from Lyman's comment (1882) that some collected on the Agulhas Bank by the 'Challenger' were 'scarcely to be distinguished' from *O. plana* though, for some reason, he referred them provisionally to *O. flexuosa*, simultaneously described from north of New Zealand. Mortensen accepted H. L. Clark's usage of the name *O. plana* for South African material as he assumed that Clark would have compared them with Lyman's type material, also in the Harvard Museum, from the West Indies.

Surprisingly, Lyman (1869) made no mention of the arm number, when describing the type material of *Ophiactis plana*, or again in his 'Challenger' report where he gave a synopsis of the species of *Ophiactis*. Only his comment about the six-armed South African specimens resembling *O. plana* implies that this number was also found in the type material. H. L. Clark also gave little weight to the number of arms as a specific character in the genus *Ophiactis* and in 1915 made no comment when he illustrated as *O. plana* a six-armed specimen from off Georgia. Mortensen (1933a) assumed that this was one of the type specimens but they were from the Florida Strait area.

Mortensen (1940) contested H. L. Clark's provisional reference of *Ophiactis parva* from the Suez Canal to the synonymy of *O. plana* in 1939 but the diminutive type material shows little in the way of definitive characters to justify distinguishing it specifically in my opinion.

REGENERATION. The specimen forming sample SST 12M is extraordinary in that it has five arms altogether with one old arm and four regenerating.

Family **OPHIOTRICHIDAE**

Ophiothrix (Acanthophiothrix) proteus Koehler

Fig. 11a, b

Ophiothrix comata: Koehler, 1898 : 105, pl. 2, figs. 11–14. [Non *O. comata* Müller & Troschel, 1842.]

Ophiothrix proteus Koehler, 1905 : 100–101 ; 1922 : 260–261, pl. 36, figs. 3, 4, pl. 101, fig. 3.
Placophiothrix proteus : H. L. Clark, 1939 : 86 ; Balinsky, 1957 : 21.
Ophiothrix (*Acanthophiothrix*) *proteus* : A. M. Clark, 1967 : 643, 648.

MATERIAL. NAD 2S, 30°47·1′S : 30°29·1′E (S of Durban), 44 metres ; 1 specimen.
NAD 52B and 55B, 29°29′S : 31°45′E (near Tugela River mouth), 86 metres ; 3 specimens ['Anton Bruun' st. 391B, C].
NAD 58A, 29°26′S : 31°46′E, 77 metres ; 3 specimens [St. 391F].
NAD 63Q, 29°21·6′S : 31°35·7′E, 57 metres ; 5 specimens [St. 391J].
PED 19H, 25°07′S : 34°34′E (between Delagoa Bay and Inhambane, Mozambique), 112 metres ; 1 specimen [St. 372L].

AFFINITIES. Although similar to *Ophiothrix aristulata* in the bare radial shields, long tapering arm spines, slender disc spines and light mid-line to the arms dorsally, these specimens have the pair of dark lines on the arms much better defined, the light mid-line between them being raised on a sharp continuous crest while the plates are broadly truncated at the distal end. In fact the largest specimens seen, d.d. 15–17 mm, have the dorsal arm plates broader than long, length : breadth 1 : c. 1·7, contrary to my diagnosis of the subgenus *Acanthophiothrix*. Nevertheless, their truncated shape allies the species with the other members of the subgenus, few of which reach such a relatively large size.
[See also the discussion under the heading of *Ophiothrix aristulata*.]

Ophiothrix (Ophiothrix) aristulata Lyman

Fig. 11c, d

Ophiothrix aristulata Lyman, 1879 : 50–51, pl. 15, figs. 421–424 ; 1882 : 223–224, pl. 21, figs. 9–12 ; Koehler, 1904b : 151 ; (?) 1922 : 205–208, pl. 35, figs. 1–3, pl. 97, fig. 1 ; A. M. Clark, 1967 : 640.
Placophiothrix aristulata : H. L. Clark, 1939 : 85.

MATERIAL. WCD 218Z, 34°43·3′S : 18°12·5′E (SW of Cape Point), depth ? ; 2 specimens.
AFR 761D, 30°13′S : 15°17·6′E (W of Hondeklip Bay), 260 metres ; 5 specimens [including three in the British Museum collections, no. 1949.9.27.119].

AFFINITIES. In splitting off *Acanthophiothrix* from *Placophiothrix* in 1967, I referred *Ophiothrix aristulata* back to *Ophiothrix* sensu stricto. However, an attempt to key it out from *O.* (*Acanthophiothrix*) *proteus*, collected off Natal and Mozambique revealed its intermediate position, emphasizing the infra-generic rank of *Acanthophiothrix*.

The dorsal armament of the disc, consisting exclusively of more or less rugose spines in the holotype (d.d. 14 mm) and other similarly large specimens, seemed at first sight to provide a reliable distinction of *Ophiothrix aristulata* from *O.* (*Acanthophiothrix*) *proteus* in which trifid stumps normally predominate over fine spinelets and often exist alone. However, the armament of a small paratype of *O. aristulata* from the Agulhas Bank with d.d. 7 mm also has peripheral trifid stumps while conversely several large specimens of *O.* (*Acanthophiothrix*) *proteus* taken off Natal

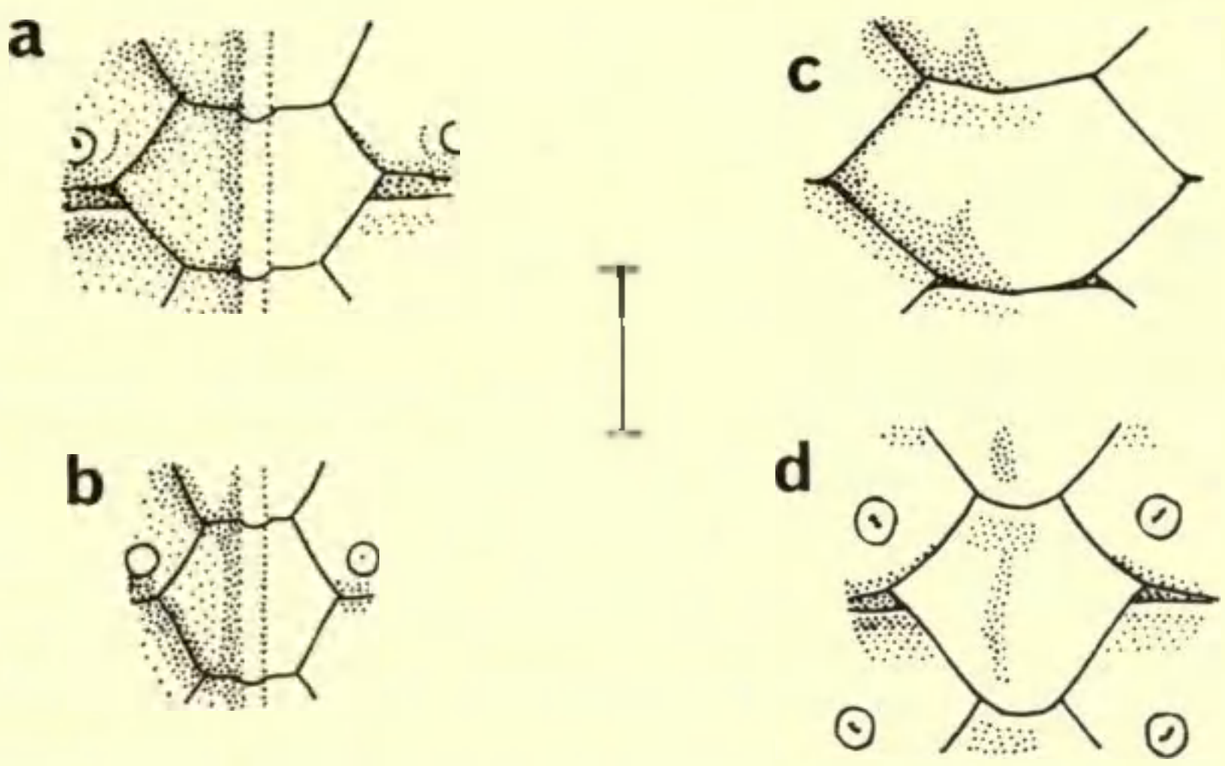


FIG. 11. Dorsal views of proximal arm segments. a and b. *Ophiothrix* (*Acanthophiothrix*) *proteus* Koehler. a. NAD 63Q. D.d. c. 16 mm. b. John Murray Expedition st. MB IIC, Arabian coast, d.d. 9 mm. c and d. *Ophiothrix* (*Ophiothrix*) *aristulata* Lyman. c. AFR 761G. D.d. 16 mm. d. 'Challenger', Agulhas Bank, d.d. c. 10 mm. The scale measures 1 mm.

by the Ecological Survey (d.d. c. 15 mm) all have numerous well-developed spinelets or spines on the centre of the disc, though intermingled with trifid stumps, which again predominate peripherally. Koehler (1922) has also commented on the variation in disc armament of *O. aristulata*, though I think it possible that not all his specimens were conspecific.

The shape of the arm spines appeared also distinct when comparing the John Murray Expedition specimens, which H. L. Clark (1939) referred to these two species, since those he named *Placophiothrix aristulata* have the longer spines on the proximal half of the arms at most four times the segment length with relatively coarse thorns numbering c. 14 each side, whereas those of *proteus* have spines up to six times the segment length with more than 20 fine serrations each side. However, the holotype of *Ophiothrix aristulata* itself has the spines up to 4·6 times the segment length (according to Lyman) and the number of thorns or serrations may also exceed 20.

Two of the specimens from AFR 761 with d.d. c. 16 mm have unusually broad dorsal arm plates, breadth : length nearly 2 : 1, on the more proximal segments and they are contiguous for more than a third of their breadth.

I do not agree with Lyman's statement that the dorsal arm plates have a median ridge giving a carinate appearance. In all the specimens I have studied each plate has a rounded median distal convexity but proximally is flatter medially, in marked contrast to the continuous sharp keel on the arms of *Ophiothrix* (*Acanthophiothrix*) *proteus*. More material from South Africa is needed to show if this character is consistent.

Ophiothrix aristulata has an unusually wide geographical range, being also reported from the Philippines to south-east Australia.

Ophiothrix fragilis (Abildgaard *in* O. F. Müller)

Asterias fragilis Abildgaard *in* O. F. Müller, 1789 : 28, pl. 98.

Ophiothrix fragilis : J. Müller & Troschel, 1842 : 110 ; H. L. Clark, 1923 : 337 ; Mortensen, 1933a : 338 ; Madsen, 1971 : 213–214, fig. 36c.
Ophiothrix triglochis Müller & Troschel, 1842 : 114 ; Koehler, 1904a : 81–84, figs. 41–45 ; 1908 : 635 ; H. L. Clark, 1923 : 337–339.
Ophiothrix fragilis var. *pentaphyllum* : Koehler, 1908 : 635.
Ophiothrix aristulata : Döderlein, 1910 : 254, pl. 5, figs. 4, 5. [Non *O. aristulata* Lyman, 1879.]

MATERIAL. Forma *Pentaphylla* : Latitude/longitude squares 26/15, 32/17, 32/18, 33/17, 34/18, 34/21, 33/25, 34/25, 33/27, 32/28, 29/31 ; shore–148 metres.
Forma *triglochis* : 33/17, 33/18, 34/18, 34/21, 33/26, 34/21, 34/22, 34/23, 33/25, 34/25, 33/26, 33/27, 32/28, 30/30, 29/31, 28/32 ; 7–183 metres.

SYNONYMY. The type material of *Ophiothrix triglochis* from Port Natal had the disc armed only with short bifid or, probably more often, trifid stumps, also covering the radial shields, though more sparsely. However, many superficially similar South African specimens actually have the stumps 'multifid', averaging about five points ; alternatively the stumps may be more or less elongated. H. L. Clark (1923) comments 'in typical *triglochis* there are no disc spinelets among the stumps and the radial shields are more or less covered by the latter'. The dorsal arm plates usually have the distal edge simply convex or with a rounded angle, though sometimes with a median distal bump. Such stump-covered South African specimens therefore approximate either to Koehler's form b of *Ophiothrix fragilis* variety *echinata* (1924) armed with trifid or quadrifid stumps only, or to his variety *lusitanica*, with quadri- or quinti-fid stumps. These two northern varieties or forms are both common on the Mediterranean coasts of France, Spain and Portugal, though *lusitanica* also occurs in the Atlantic, as its name suggests. In British waters the common form of *Ophiothrix fragilis* is *pentaphylla* Pennant, also found in France, with spines as well as stumps on the disc, the radial shields normally relatively large and bare and the dorsal arm plates rhombic with a well-marked distal angle and their surface carinate. However, throughout the European range of *O. fragilis* may be found specimens intermediate in some or all of these characters, for instance with bare radial shields but an armament solely of stumps on the scales or conversely with more or less numerous stumps on the shields but disc spinelets present on the scales. The form and number of the arm spines and the relative arm length also vary.

H. L. Clark (1923) named as *Ophiothrix triglochis* some specimens from False Bay with spinelets among the disc stumps, in one even replacing the stumps and contrasting with bare radial shields. These clearly approximate to some British specimens of *O. fragilis*. Both H. L. Clark and earlier (1908) Koehler identified some specimens of *Ophiothrix* from Saldanha Bay with coarse-spined discs and bare radial shields as *O. fragilis*, Koehler referring them to the variety *pentaphyllum*. However, among the similarly spinose specimens taken by the Ecological Survey are some with the disc spines very stout, mounted on low but distinct tubercles on the scales, as Koehler (1924) described for the Mediterranean *O. quinquemaculata* (Delle Chiaje) in his key to the European species of *Ophiothrix*. Recently, however, Guille (1964) has shown that *O. fragilis* may also encompass *O. quinquemaculata*.

In view of the immense variability of *Ophiothrix fragilis* in the north-east Atlantic, it seems pointless to distinguish *O. triglochis* specifically in the south-east Atlantic.

Although the geographical ranges of the two almost coincide in South Africa it may be useful to retain the name *triglochis* for specimens without disc spines.

Ophiothela nuda (H. L. Clark) new comb.

Ophiopsammium nudum H. L. Clark, 1923 : 341–342.
Ophioteresis beauforti Engel, 1949 : 140–143, figs. 1, 2.
Ophiothela beauforti : Balinsky, 1957 : 22–24, pl. 4, fig. 16 ; A. M. Clark & Rowe, 1971 : 117.

MATERIAL. NAD 2T, 30°47·1′S : 30°29·1′E (S of Durban), 44 metres ; 2 specimens.

NAD 15R, 30°47′S : 30°27·5′E, 36 metres ; 4 specimens.

NAD 63Q, 29°21·6′S : 31°35·7′E (near Tugela River mouth), 57 metres : 1 specimen ['Anton Bruun' st. 391J].

PED 10W, 24°46′S : 34°50′E (S of Inhambane, Mozambique), 22 metres ; 8 specimens [St. 372C].

PED 17H, 24°53′S : 34°56′E, 55 metres ; 14 specimens [St. 372G].

MOR 45S, Morrumbene estuary, N of Inhambane (23°S : 35°E) ; 1 specimen.

VARIATION. Two of the four specimens from sample NAD 15 have some coarse, spaced granules towards the periphery of the disc dorsally and on the arms ; the other two are naked except for some peripheral and ventral disc spines. Of PED 10, seven specimens have a continuous coat of coarse granules, one of them with an additional cluster of rough spines in the middle of the disc, but the eighth specimen is almost completely bare on both disc and arms. About half of the 14 specimens of PED 17 have a few median disc spinelets but only one has granules on the arms, mainly sited over the vertebrae. MOR 45 has the disc mainly bare above but many coarse granules near the periphery, which graduate into rugose spines. The arms are covered with a continuous coat of coarse granules for the proximal half but become naked distally.

NOMENCLATURE. The type locality of *Ophiopsammium nudum* is near the Tongaat River mouth, Natal, while that of *Ophioteresis beauforti* is further north in Mozambique. The holotype of *O. nudum* has some inconspicuous disc and arm granules dorsally, despite its specific name. In view of the notes above and previous comments by Balinsky and by me on the variability of *O. beauforti*, clearly this nominal species and *O. nudum* cannot be specifically distinguished. The type-species of *Ophiopsammium*, *O. semperi* Lyman, has a continuous coat of extremely fine granules all over and I am convinced that *O. nudum* is much more closely related to *Ophiothela mirabilis* (Verrill), the type-species, and other members of the genus *Ophiothela* with their relatively coarse granulation, varying in both density and size.

A young specimen from NAD 15 with d.d. only 2 mm shows that this species, like several other ophiotrichids, goes through an *Ophiopteron*-stage with the arm spines webbed.

Ophiothela danae Verrill

Ophiothela danae Verrill, 1869 : 391 ; Koehler, 1922 : 297–298, pl. 59, figs. 1–3, pl. 103, fig. 1 ; Mortensen, 1933a : 342 ; A. M. Clark *in* Clark & Rowe, 1971 : 116, pl. 14, fig. 5.
? *Ophiothela dividua* von Martens, 1879 : 127–130, figs. 1–4 ; Balinsky, 1957 : 22.

MATERIAL. NAD 15Q, 30°47′S : 30°27·5′E (S of Durban), 36 metres ; 2 specimens.
JAN 27, Jangamo Reef, Mozambique (c. 24°S : 35°E) ; 5 specimens.

SYNONYMY. In 1933 Mortensen could only put forward the colour pattern of the type material of *Ophiothela dividua*, usually with two dark blue bands across each pair of radial shields, to try and distinguish between it and the similarly fissiparous *O. danae*. In 1971 I noted that the two will probably prove to be synonymous. Unfortunately only three of the present seven specimens have any colour left. One from Jangamo Reef has traces of blue bands across the arms, each about one segment wide and separated by three to five pale segments. Of the two specimens from Natal, one has some large dull red patches, not bands, and the other has fine linear blue-black markings running parallel to the edges of the radial shields (i.e. more longitudinal than transverse) and defining the distal edges of the dorsal arm plates. Koehler (1922, pl. 59, fig. 3) shows a specimen of *O. danae* with slightly coarser dark lines across the arms and irregularly on the disc with one pair of radial shields marked with a transverse band near their distal ends but the others mostly with longitudinal bands on or near the shields. Koehler gives the general colour as pinkish grey 'with dark blue striae on the dorsal surface of the disc and on the arms'. Clearly there is considerable variation in the precise pattern.

Nor is there a reliable zoogeographical distinction. Von Martens said that the type material of *Ophiothela dividua* came allegedly (angeblich) from Algoa Bay, on the south coast of South Africa. However, since the specimens were evidently epizoic on the tropical Indo-Pacific gorgonian *Melitaea ochracea*, of which Natal would be expected to be the southern limit, I suspect that they may have been rather from Delagoa Bay at the southern end of Mozambique. Balinsky has recorded a single specimen from Inhaca, Delagoa Bay, as *O. dividua* since its colour pattern matched that of the types. Mortensen's specimens of *O. danae* were from the vicinity of Durban like the southernmost of the Survey's specimens.

Family **OPHIOCOMIDAE**

Ophiopsila seminuda A. M. Clark

Fig. 12

Ophiopsila seminuda A. M. Clark, 1952 : 218–219, fig. 3.

MATERIAL. FAL 428C and 434B, 34°15·2′S : 18°33·2′E (False Bay), 22 metres ; 11 specimens.
FAL 467P, 34°07′S : 18°42′E, depth ? ; 1 specimen.
SST 22Z, 35°06′S : 22°15′E (S of Mossel Bay), 120 metres : 1 specimen.
LIZ 19U, 33°58·5′S : 25°42′E (Port Elizabeth), 27 metres ; 1 specimen.
SCD 272B, 34°23′S : 25°54′E (S of Port Elizabeth), 181 metres ; 1 specimen.

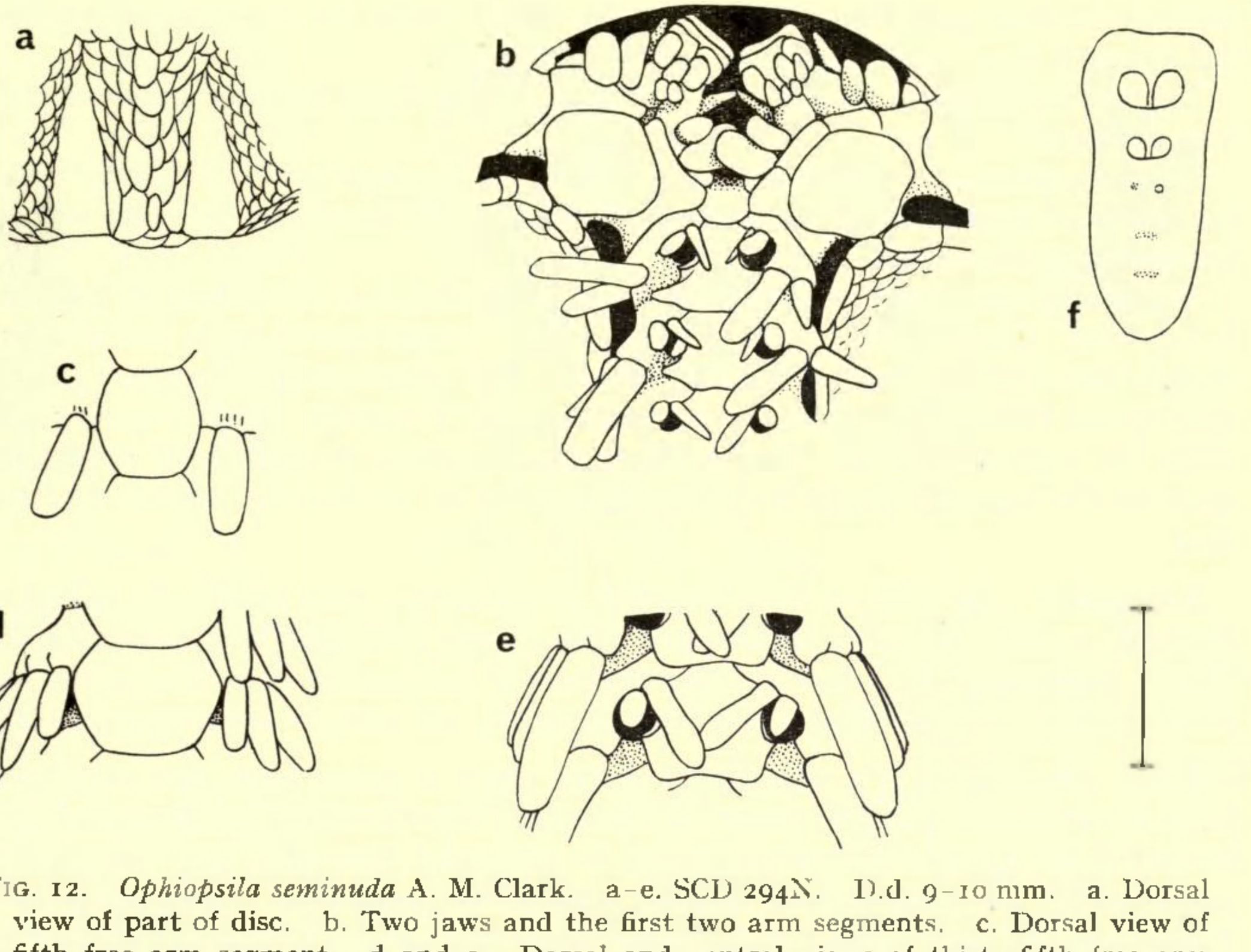


FIG. 12. *Ophiopsila seminuda* A. M. Clark. a–e. SCD 294N. D.d. 9–10 mm. a. Dorsal view of part of disc. b. Two jaws and the first two arm segments. c. Dorsal view of fifth free arm segment. d and e. Dorsal and ventral views of thirty-fifth free arm segment. f. FAL 434B. Isolated dental plate. The scale measures 1 mm for a–e and 0·3 mm for f.

SCD 294N, 33°04′S : 27°57′E (near East London), 84 metres ; 1 specimen.
SCD 326D, 34°27′S : 25°57′E, 172 metres ; 1 specimen.

VARIATION. Although the holotype of *Ophiopsila seminuda* gave the appearance of lacking disc scales ventrally, most of the better-preserved specimens since collected have the under-side of the disc opaque with very fine scales embedded in the rather pustular skin ; only near the genital slits is the scaling barely distinguishable.

In most specimens the radial shields taper proximally, or at least the disc scaling encroaches more on to their surface than in the holotype. They are usually well separated but in the smallest specimen, SST 22, d.d. only 1·8 mm, they approximate distally.

The armament of the jaws also varies, with additional papillae developing in larger specimens. At d.d. 8–10 mm there are usually four to seven tooth papillae at the apex of each jaw superficial to the lowest tooth. The holotype at d.d. 4 mm has only three papillae, the median third one smaller than the other two, which make an almost symmetrical pair on most jaws. The smallest specimen now present, d.d. <2 mm, lacks even the third papilla and looks very amphiurid-like. In addition to the two flat, rounded, distal oral papillae each side observed in the holotype,

most of the larger specimens show a much smaller papilla (or scale) distally between the enlarged outer papilla and the ventral arm plate.

The oral shields have a more or less well-developed distal lobe and may even be as long as broad.

The dorsal arm plates broaden somewhat on the stoutest part of the arms beyond the disc and become as broad as long, or broader by about the thirtieth segment, transverse oval in shape.

The arm spines number up to 10 in a specimen with d.d. 8 mm and up to nine at d.d. 7 mm. One with d.d. only 5·5 mm also has nine spines on a few segments, though the smaller holotype has only seven. The spines are all spatulate in shape with broad round tips. The lowest and longest is usually about one-and-a-half times the segment length. The length of the long inner tentacle scale ranges from equal to the segment length in smaller specimens up to twice as long in the largest ones.

AFFINITIES. In spite of the discovery of specimens with more arm spines and ventrally scaled discs, this species still differs from *Ophiopsila aranea* (known from Europe to tropical West Africa) in the fineness of this scaling as well as in the fewer tooth papillae at a comparable size, though clearly the two are fairly closely related.

JAWS. A drawing of a dissociated dental plate is given here since no illustrations of the dental and oral plates of *Ophiopsila* were included by Murakami in his survey of the ophiuroids (1963), though he described those of a new species of the genus which he subsequently named *Ophiopsila squamifera*. Judging from his description, the dental plates of *O. seminuda* are very similar to those of his Japanese species and similar to those of *Ophiocoma* and *Ophiomastix* which he illustrated, though rather smoother.

Ophiopsila bispinosa sp. nov.

Fig. 13

MATERIAL. NAD 35X, 29°35′S : 31°38′E (near Tugela River mouth), 150 metres ; 1 broken specimen ['Anton Bruun' st. 390L].

NAD 46C, 29°35′S : 31°42′E, 138 metres ; 1 specimen, the holotype [St. 390S].

NAD 52D, 29°29′S : 31°45′E, 86 metres ; 1 specimen [St. 391C].

NAD 58A, 29°26′S : 31°46′E, 77 metres ; 1 specimen [St. 391F].

DESCRIPTION. The holotype is the least poorly preserved of all the specimens but even it has the disc broken, probably regenerated. The original d.d. was probably c. 9 mm. The arms are broken. The oral frame (from the distal edge of one oral shield to the distal edge of the first ventral arm plate opposite) measures 3·3 mm in diameter. [This compares with an oral frame diameter of 3·5 mm in the specimen of *Ophiopsila seminuda* with d.d. c. 8 mm.] The disc is very poorly calcified, mainly bare or with scales so minute and thin as to be transparent except around the radial shields. The shields have length : distal breadth 1·5 : 0·33 mm.

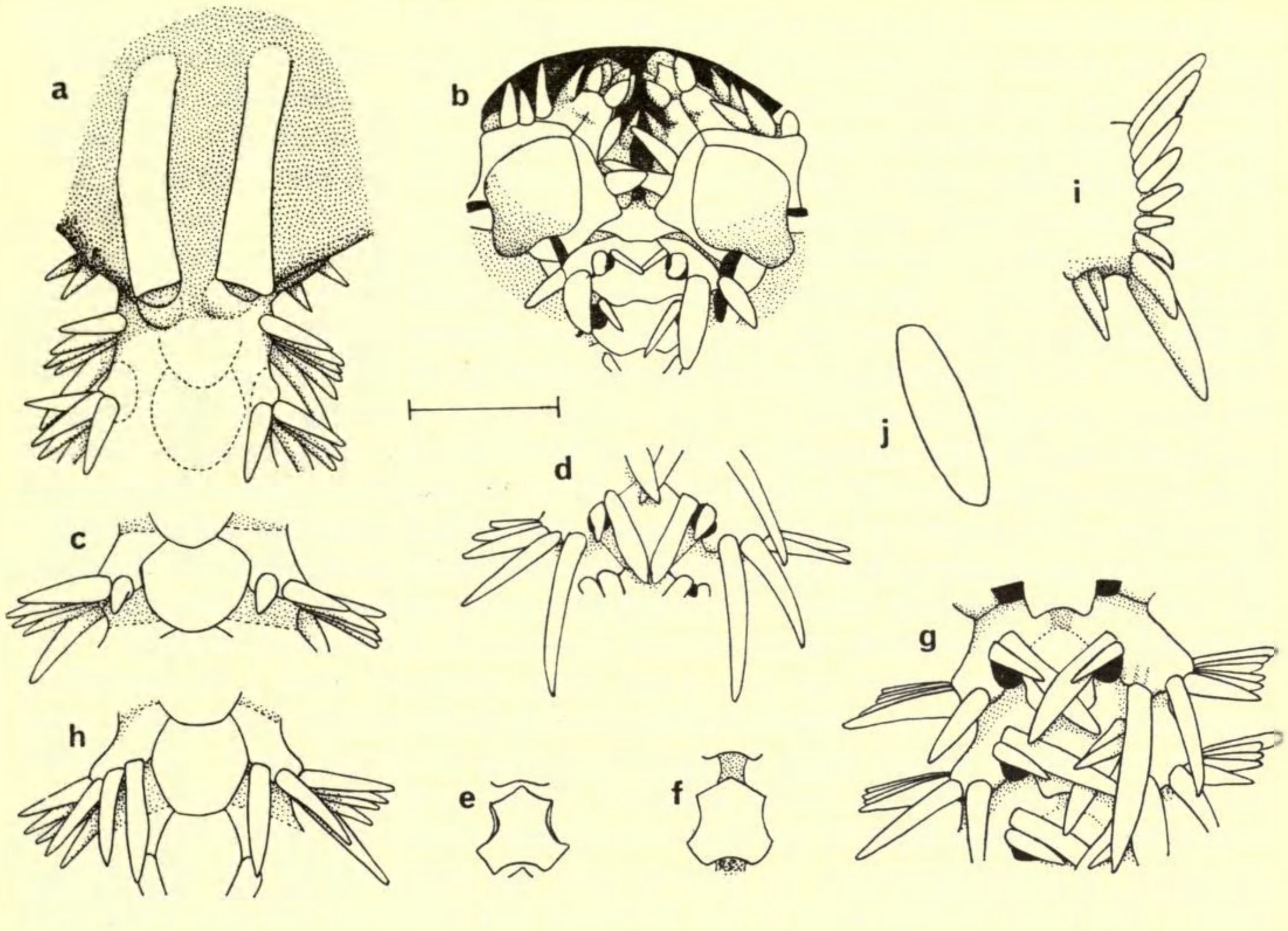


FIG. 13. *Ophiopsila bispinosa* sp. nov. a–f. Holotype. Oral frame diameter 3·3 mm. NAD 46C. a. Dorsal view of part of disc and the base of one arm. b. Two jaws and the first two arm segments. c and d. Dorsal and ventral views of the twelfth free arm segment. e and f. Sixth and twenty-fifth ventral arm plates. g–j. Paratype. NAD 35X. Oral frame diameter 3·5 mm. g–i. Dorsal, ventral and side views of arm at about the twentieth free segment. j. A particularly broad lowermost spine. The scale measures 1 mm.

The oral shields are longer than broad, spearhead-shaped with the proximal angle rounded and the distal lobe narrower. The adorals are contiguous or closely approximating interradially and have a distal lobe between the oral shield and the first lateral arm plate each side. The tooth papillae at the apex number only three to five, two of them forming a symmetrical amphiurid-like, though pointed, pair on four out of the five jaws. The distal oral papillae number two in five positions and three in the other five ; all of them are conspicuously spiniform, broad medially, slightly flattened and tapering to a more or less blunted point. The innermost one arises partly or completely from the oral plate but leaves a diastema between it and the tooth papillae, revealing the long spiniform oral tentacle scale within the slit. In addition, on the outer corner of the adorals is a small rounded supernumerary papilla, inset slightly into the oral slit and partly abutting on the first ventral arm plate.

The basal dorsal arm plates are very ill-defined but may be regenerating; they are about as broad as long but by the twelfth free segment have become slightly broader than long and deep fan-shaped with the two proximal sides almost straight; they are widest proximal to the middle of their length and have a slight angle in the middle of the distal curve. They are contiguous for less than half their breadth.

The proximal ventral arm plates are broader than long since each has a prolonged lateral angle distal to the tentacle pore, though this is progressively reduced beyond the basal segments. The middle of the distal edge is distinctly concave. By the middle of the arm the ventral arm plates have become longer than broad and consecutive ones are spaced from each other, exposing a membranous space between the lateral arm plates medially.

The lateral arm plates bear eight spines for about the first 12 free segments, then nine for two or three segments, then ten for about two segments before dropping to nine again. The upper and middle spines are markedly flattened in approximately the vertical plane, presenting their maximum area when looking along the length of the arm, when standing erect. However, the more ventral ones are obliquely flattened and the lowermost, when pointed downwards, is flattened laterally. The lowest is the longest spine, up to 1·3 mm long, compared with a corresponding segment length of 0·7 mm. The second from lowest is also relatively long, then come four or five smaller spines, while the uppermost ones are longer again. The spines are hollow centrally but the cavity is narrow, owing to the considerable flattening.

The inner tentacle scale is sword-like and may exceed 0·8 mm in length. As preserved, it normally crosses its partner over the distal end of the ventral arm plate. The outer tentacle scale is also flattened and spiniform but only about half as long.

PARATYPES. The larger of the three paratypes (sample NAD 35) (fig. 13g–j) has only a remnant of the disc attached to the oral frame, which measures 3·5 mm in diameter. The distal oral papillae usually number three each side and all are pointed and slightly flattened; the outer one (or two) may be slightly broadened medially but markedly tapering in the distal third. The arm spines appear less markedly flattened than in the holotype, very slender and tapering; the uppermost are almost as markedly elongated as the lowermost.

The two other paratypes both have the oral frame 2·2 mm in diameter and are remarkable in having six arms; because of this the jaws are unusually narrow with only two to four tooth papillae and the oral shields are even longer than in the holotype. One has some quite large but extremely thin disc scales dorsally. Their arm spines number up to eight.

AFFINITIES. *Ophiopsila bispinosa* resembles *O. seminuda* in the relatively small number of tooth papillae but carries the reduction of the disc scaling even further. It is most easily distinguished by the spiniform distal oral papillae and the more pointed arm spines, also the spiniform second tentacle scale. There may also be a geographical distinction, the new species being found so far only in Natal whereas *O. seminuda* has not been recorded from north-east of East London. The other neighbouring species is *Ophiopsila paucispina* Koehler, from northern Mozambique,

which differs not only in the few arm spines (only four at d.d. 11 mm – actually five according to Koehler in 1930) but also in the oral shields being broader than long, the tooth papillae forming a cluster of four rows and the distal oral papillae being rounded. Morphologically, the closest species of *Ophiopsila* is probably *O. timida* Koehler (1930) from the East Indies. This also appears to have tenuous disc scaling, spiniform distal oral papillae (but only two in each series), the outer tentacle scale also spiniform and a similar number of arm spines, eight at d.d. 5 mm. However, in *O. timida* the spines are cylindrical with rugose blunt tips, the oral shields are as much as two-and-a-half times as long as broad and there is a large cluster of tooth papillae with usually four superficial ones, even at a smaller size.

Remarkably reminiscent of *Ophiopsila bispinosa*, at least in the shape of the arm spines and the bar-like separated radial shields, is *Amphiura linearis* Mortensen, also from Natal, which is unusual for an *Amphiura* just because of the separated shields. The types were in poor condition, even the larger with d.d. only 3·5 mm. However, the disc is evidently covered with fine scales and the distal oral papillae and the tentacle scales, though pointed, are single.

Family **OPHIURIDAE**

Ophiura trimeni Bell

Ophiura trimeni Bell, 1905b : 257, pl. 1, figs. 3, 4 ; H. L. Clark, 1923 : 360–361 ; Mortensen, 1933a : 384–385, fig. 84.

Gymnophiura novembris Hertz, 1927 : 72–73, pl. 6, figs. 9, 10 ; Mortensen, 1933a : 393–394, fig. 89.

MATERIAL. AFR 830A, 35°11′S : 18°42′E (S of False Bay), 315 metres ; 1 poor specimen.

WCD 76D, 34°17′S : 17°53′E (W of Cape Point), 320 metres ; 5 specimens.

WCD 105C, 33°07′S : 17°33′E (W of Saldanha Bay), 183 metres ; 8 poorly preserved specimens.

TRA 51A, West of Dassen Island (33°S : 17°E), 356 metres ; 1 specimen.

TRA 73G, 32°06′S : 16°37′E (W of Lambert's Bay), 310 metres ; 4½ poor specimens.

LBT 27L, 68C and 72F, off Lambert's Bay (32°S : 16–17°E), 280–400 metres ; 1 poor specimen and 7 small ones.

SYNONYMY. The type and only recorded locality of *Gymnophiura novembris* is 35°09′S : 18°32′E, on the Agulhas Bank very close to sample AFR 830A, in 564 metres. The largest syntype has d.d. only 5 mm. Mortensen figured one of the syntypes, showing the same unusual membranous areas bordering the first two dorsal arm plates laterally that occur in specimens which have arm combs present and thus run down to *Ophiura trimeni*. He pointed out the great similarity between the two. In fact, the arm combs were overlooked by Bell in the type of *O. trimeni* and they are certainly difficult to see or absent in smaller specimens, observation not being helped by the poor condition shown by most preserved individuals of this species. H. L. Clark identified as *O. trimeni* specimens from both south-east and north-west

of the type locality of *G. novembris*. Clearly the two nominal species are sympatric and I cannot see any way in which *G. novembris* can be distinguished. It is accordingly now referred to the synonymy of *O. trimeni*.

Amphiophiura trifolium Hertz

Amphiophiura trifolium Hertz, 1927 : 78–79, fig. 3, pl. 6, figs. 14, 15 ; H. L. Clark, 1939 : 108–109.

MATERIAL. ABD 7C, 24°12′S : 36°01′E (SE of Inhambane, Mozambique), 1140 metres ; 4 specimens ['Anton Bruun' st. 369J].

ABD 10B, 27°09′S : 34°09′E (E of Natal–Mozambique border), 1335 metres ; 3 specimens [St. 374D].

RANGE. These two records extend the known range of the species southwards from off Mombasa and Somalia in East Africa ; it has also been recorded from the Maldive area. The minimum depth known is also extended to 1140 metres, other depths ranging from 1289 to 2727 metres.

Ophiomisidium pulchellum (Wyville Thomson)

Ophiomusium pulchellum Wyville Thomson, 1877 : 67–69, figs. 18, 19 ; Lyman, 1882 : 96–98, pl. 3, figs. 1–3.
Ophiomisidium pulchellum Koehler, 1914 : 37 ; H. L. Clark, 1923 : 356–357.

MATERIAL. SST 12J, 35°22′S : 22°31′E (S of Mossel Bay), 200 metres ; 6 specimens.

The size ranges from 2·5 mm to 4·1 mm d.d. The smallest specimen has only three pairs of tentacle pores and only the largest has appreciable knobs in the middle of each primary disc plate. The holotype has d.d. 4·5 mm and is the largest recorded.

Family **OPHIOLEUCIDAE**

Ophiocirce inutilis Koehler

Fig. 14

Ophiocirce inutilis Koehler, 1904b ; 13–14, pl. 3, figs. 4, 5 ; 1922 : 436 ; H. L. Clark, 1939 : 131–132.

MATERIAL. PED 2J, 24°46′S : 35°20′E (S of Inhambane, Mozambique) ; 132 metres ; 5 specimens ['Anton Bruun' st. 371E].

RANGE. This record provides an extension of range southwards from the Zanzibar area.

The specimens agree with Koehler's description except that the better preserved ones have only a small indentation in the disc opposite each arm.

Since Koehler's figures are very diagrammatic, fresh drawings are given here.

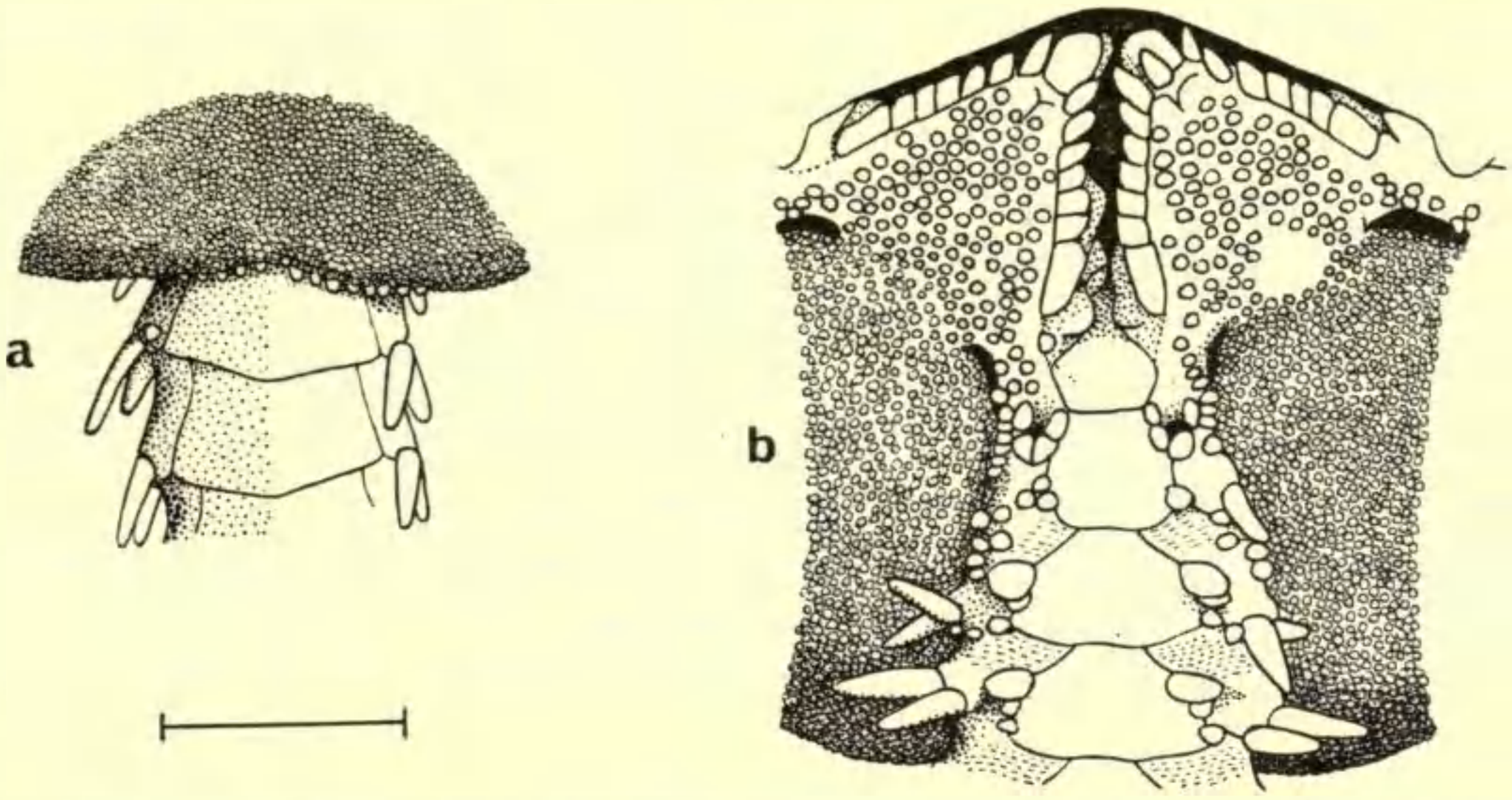


FIG. 14. *Ophiocirce inutilis* Koehler. PED 2J. D.d. 6·2 mm. a. Dorsal view of part of disc and the base of one arm. b. Two jaws and the base of one arm with adjacent interradii ; the fingerprint-like texture of the lateral arm plates indicated by dashes. The scale measures 1 mm.

Ophiopallas paradoxa Koehler

Fig. 15

Ophiopallas paradoxa Koehler, 1904b : 12–13, pl. 3, figs. 1–3 ; 1922 : 436–437, pl. 79, figs. 1, 2.
Ophiopallas paradoxa altera Hertz, 1927 : 110, pl. 9, fig. 5.

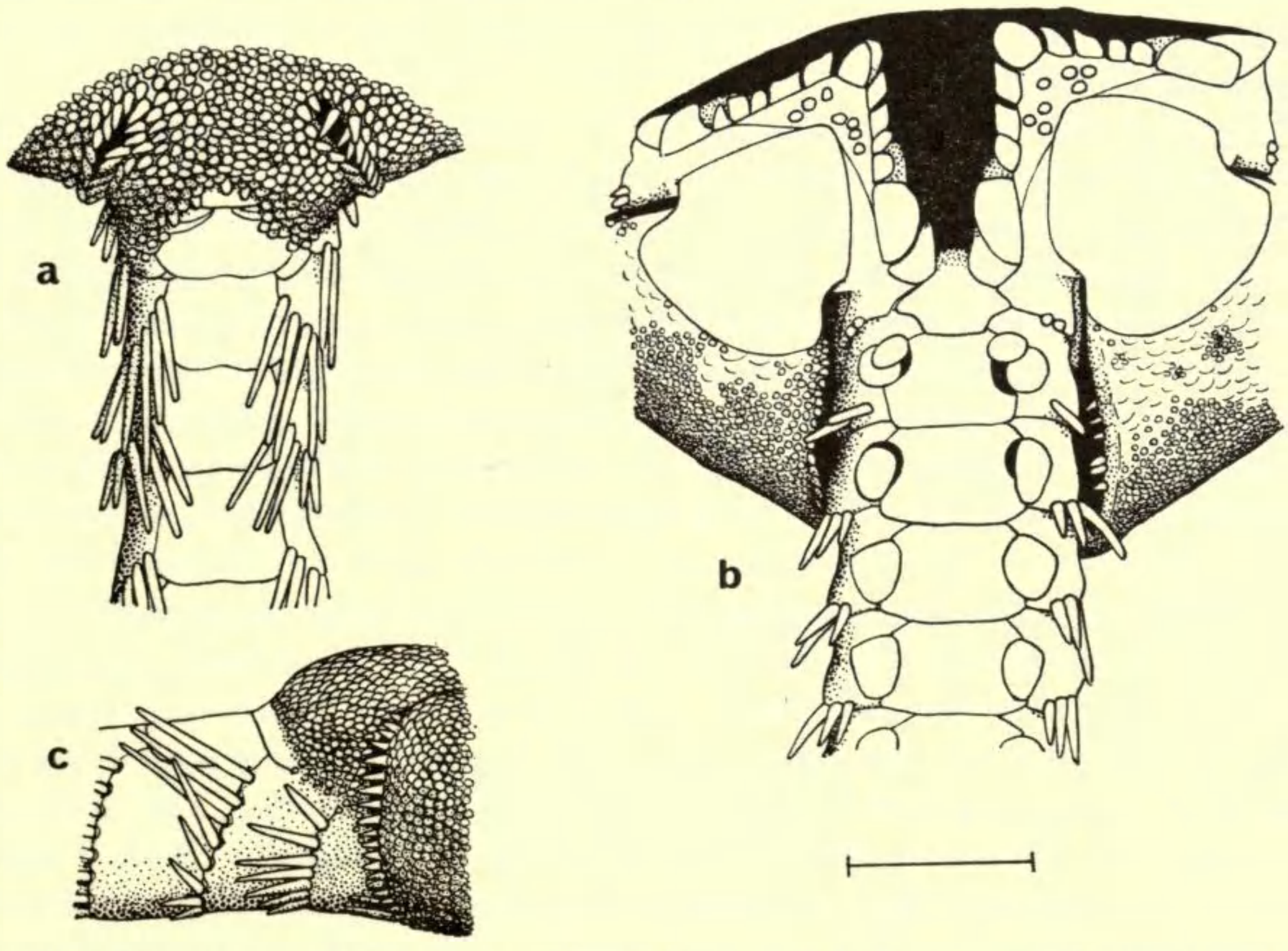


FIG. 15. *Ophiopallas paradoxa* Koehler. 'Albatross' st. 5541, Philippine Is., 400 m. U.S.N.M. no. 41347. D.d. 6 mm. a. Dorsal view of part of disc and the base of one arm. b. Two jaws and the base of an arm with adjacent interradii (some of the granules probably rubbed off). c. Side view of base of an arm. The scale measures 1 mm.

MATERIAL. ABD 8R, 24°40'S : 35°28'E (S of Inhambane, Mozambique), 347 metres ; 1 specimen ['Anton Bruun' st. 370G].

RANGE. This record provides an extension of the range to Mozambique. Unfortunately the specimen is not in good condition and does not help to settle whether Hertz' subspecies *altera* from off Dar-es-Salaam is valid or distinguished only by immature characters. Her type has d.d. only 4 mm whereas in the holotype of *Ophiopallas paradoxa* it is 8 mm. This may well account for the smaller number of oral papillae and the relatively narrower dorsal arm plates.

The figure given here is of a specimen from the Philippines, named by Koehler, which is in better condition than the present one.

INCERTAE SEDIS

Anamphiura valida H. L. Clark

Fig. 16

Anamphiura valida H. L. Clark, 1939 : 70–72, figs. 26A, 27.

MATERIAL. ABD 15D, 29°42'S : 31°38'E (near Tugela River mouth), 350 metres ; 2 specimens ['Anton Bruun' st. 390E].

DESCRIPTION. This peculiar species is known only from H. L. Clark's description of the holotype, d.d. 5 mm, and I think a supplementary account of the present material is worth while.

The larger of the two specimens has d.d. 3·6 mm and arm length c. 9 mm. The primary rosette is perfectly regular, as in the three paratypes. The radial shields are slightly convex, joined for just over half their lengths but cut away in the distal third with a slight concave adradial edge to make a notch above the base of the arm in which the very narrow swollen first dorsal arm plate appears below. At least one pair of radial shields is distinctly asymmetrical with one shield larger than the other. The distal ends of the genital plates projecting beyond the radial shields each bear two conical spinelets, much shorter than the scattered disc spinelets and resembling an ophiurid arm comb. H. L. Clark's figure shows only one such spinelet on each plate in the holotype. The jaw structure is variable with two to four small tapering apical papillae, not one jaw showing the symmetrical pair of infradental papillae characteristic of the family Amphiuridae, to which H. L. Clark referred *Anamphiura*. The abradial flanges of the oral plates each side are more nearly superficial than in most amphiurids with the free proximal end of the oral tentacle scale level with the apical papilla on one jaw and only slightly inset on the others. The distal papillae number only two, the outer one wider, and are quite separate. H. L. Clark found three in the holotype and his figure shows them incorrectly as a single tri-lobed unit ; though clustered together they are not fused. The teeth are rounded or slightly squared off but relatively narrower than is usual in amphiurids. The ventral arm plates are quite unlike the usual amphiurid shape, having a prolonged lateral angle each side distal to the tentacle pore meeting the lateral plate so as to encircle the

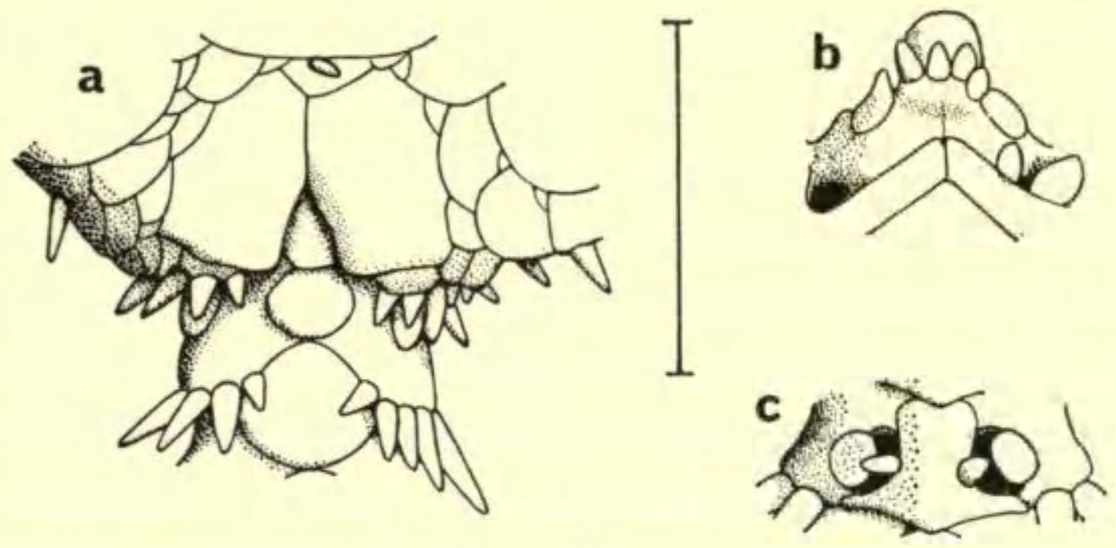


FIG. 16. *Anamphiura valida* H. L. Clark. ABD 15D. D.d. 3·6 mm. a. Dorsal view of part of disc and the base of one arm. b. One jaw, the distal oral papillae missing on the left side. c. Ventral view of third arm segment. The scale measures 1 mm.

pore. The alignment of the two tentacle scales found on the first five or six segments is also unlike that of any amphiurid, the smaller scale arising on the edge of the ventral arm plate from about midway along its length, *not* at the proximal end, while the larger rounded scale is hinged almost opposite to it on the lateral plate. The three upper spines of the five on the first and second arm segments are markedly flattened and expanded ; those of the first segment at least make a continuous flange on the adradial side of the genital slit. The entire surface has a distinctly granular texture.

AFFINITIES. The relatively huge primary rosette, presence of arm combs of a kind, apical jaw structure and form of the ventral arm plates and tentacle pores, all seem to me very unamphiurid-like but show affinities in some ways with the Ophiuridae, in others with the Ophiactidae. However, the notch between the distal ends of the radial shields, the spines on the genital plates distal to the radial shields, the flattened arm spines opposite the genital slits, the irregular papillae at the apex of the jaw, the shape of the ventral arm plates with latero-distal angles meeting the lateral plates distal to the pore and the position of the tentacle scale on the ventral plate (relatively short through the scale is) all agree with the anomalous genus *Amphilimna*, recently referred from the Amphiuridae to the Ophiacanthidae by Thomas (1967). Hopefully, the main 'Anton Bruun' collections include further material of this sample for anatomical study to help decide the best systematic position for this genus.

RANGE. This record extends the known range of the species south from the Zanzibar area.

Class *ECHINOIDEA*

Family **ECHINIDAE**

Dermechinus horridus (A. Agassiz)

Echinus horridus A. Agassiz, 1879 : 203 ; Döderlein, 1906 : 220, pl. 28, figs. 1, 2, pl. 35, figs. 2, 3, pl. 47, figs. 10, 11.

Dermechinus horridus : Mortensen, 1943 : 112–117, figs. 46–49, 50a, pl. 19, figs. 6–10, pl. 20, figs. 1–3, pl. 56, figs. 22, 23, 29–31.

MATERIAL. WCD 219F, 34°42·8′S : 18°08·8′E (SW of Cape Point), depth ? ; 1 specimen.

This individual is unusual in having the peristome larger than the apical system by 4·5/4·0 mm. However, it has horizontal diameter only 15 mm, whereas Mortensen's smallest specimen measured has h.d. 39 mm. The test is coloured vermilion and white, the very edges of the apical system opposite the interambulacrals are densely red and also the median parts of the interambulacrals but the ambulacrals and adjacent parts of the interambulacrals are white. All the spines are vermilion. The pores and tube feet are very small. Pedicellariae appear rare but possibly many have been lost. A globiferous one has two teeth each side and a tridentate has spoon-shaped valves but constricted necks.

Family **BRISSIDAE**

Spatagobrissus mirabilis H. L. Clark

Spatagobrissus mirabilis H. L. Clark, 1923 : 402–404, pl. 23 ; Mortensen, 1951 : 492–494, figs. 258–260, pl. 28, figs. 10–12, pl. 60, fig. 8.

MATERIAL. FB 1067, 34°09·5′S : 18°24·25′E (False Bay), 26·5 metres ; 1 specimen.

Length : breadth is 28/23 mm = 1·22 : 1. Height 15 mm.

The peripetalous fasciole is almost oval but well separated from the posterior end by 6–7 mm. It is more like the holotype than the specimen figured by Mortensen, which was rounder. The genital pores are undeveloped, as in the specimen of similar size in the British Museum collection. The test is broken in the subanal area.

The holotype has test length 112 mm and length : breadth 1.18 : 1.

APPENDICES

[Specimens from outside southern Africa]

I. VEMA SEA-MOUNT (see Berrisford, 1969)

This is in approximately 32°S : 8°E, c. 450 miles W of Lambert's Bay ; 54–61 metres.

Comanthus wahlbergi (J. Müller)
VEM 3F, 6A, 10A and 19W ; 19 specimens.

Ophionereis porrecta Lyman
VEM 15V ; 1 specimen. The middle arm spines are unusually enlarged at about a third of the length from the disc.

Ophionereis sp. indet.
VEM 15T ; 1 specimen, small and in poor condition. This might be *O. dubia* but the probability of both species having reached the sea-mount from Africa is small.

Ophiarachnella capensis Bell
VEM 3E, 15U ; 3 specimens. These have d.d. 19, 17 and 4 mm whereas in the largest mainland specimen recorded (H. L. Clark, 1923) it is 15 mm and the largest Survey specimen has d.d. 13 mm. The two largest Vema specimens have up to seven arm spines, equal in length to about half the segment length, except the longer

lowest one ; the middle ones are less conical than in mainland specimens. Also the supplementary oral shields are relatively larger, one or two of them almost equal in area to the main shield, the two together forming a continuous oval in the largest specimen, which also shows a pair of pores between the first and second ventral arm plates not seen in the 17 mm specimen. I think that these small differences are accountable to the greater size ; certainly the trend towards relatively larger supplementary oral shields is shown in mainland specimens with d.d. c. 13 mm.

II. Walter's Shoal

This is in approximately 33°S : 44°E, S of Madagascar and c. 1000 miles E of East London ; 38–46 metres.

Comanthus wahlbergi tenuibrachia A. M. Clark
WSS 1U ; 7 specimens. ['Anton Bruun' st. 381A–C. See A. M. Clark, 1972 : 78–81.]

Ophiocoma sp. aff. *O. pica* Müller & Troschel
WSS 1V ; 1 specimen.

III. Madagascar

Amphioplus (*Lymanella*) *hastatus* (Ljungman)
MDD 1B, 23°19'S : 43°36'E (near Tulear), 82 metres ; 1 complete and 2 discless specimens ['Anton Bruun' st. 363W].

Amphioplus sp. C
MDD 2C, 23°20'S : 43°36'E (near Tulear), depth ? ; 1 complete specimen, 1 with disc detached and 1 with disc missing.

D.d. of the intact specimen is 5·0 mm. It is covered with fine smooth scales except that the uppermost ventral scales have their edges prolonged into spinose projections, as in *Amphioplus* (*Lymanella*) *furcatus* and *Amphiodia* (*Amphispina*) *microplax*. In addition, there is a triple spinose projection distal to each radial shield as in *Amphioplus pectinatus*, to which it has a considerable resemblance. The radial shields are narrow, c. 1·0 mm long and are contiguous for about the distal third, separated proximally by a wedge of scales. The primary plates are just distinguishable, though widely spaced among the disc scales.

The oral shields are elongated rhombic, widest in the middle, with the proximal and distal lobes both broadly rounded. The adoral shields meet interradially. The oral plates are rather short. The four rounded oral papillae are distinctly arranged in a straight line, as in the subgenus *Lymanella*, rather than the concave row of most species of *Amphioplus* sensu stricto. There is a very small gap between the infradental and second papillae, through which the small oral tentacle scale can be seen. Also the third and fourth oral papillae tend to gape around the second oral tentacle. The fourth papilla is based at least partly on the first ventral arm plate. The oral formula is $m,m\overline{n,n}\ \overline{n,n}+t$.

The dorsal arm plates are fan-shaped, broadest distally, the rounded distal edge sometimes with a slight median angle ; they are mostly not quite contiguous. The proximal ventral arm plates are almost square but the shape becomes more pentagonal

with the proximal lobe prolonged. The sides are almost parallel, slightly excavated for the pores and the distal edge is straight or slightly concave. The proximal lateral arm plates carry four slender pointed spines, giving way distally to three. There are two relatively small tentacle scales, the inner one extending less than half the length of the side edge of the ventral arm plate.

The detached disc is similar to that of the intact specimen, with the radial shields distally contiguous and spinose processes present along the disc margin and outside the radial shields. The oral frames show minor differences in the shapes of the oral shields but again the alignment of the oral papillae in a straight line is noticeable. The combination of these two characters probably justifies the distinction of a new species. Since it is likely that there is more abundant and better preserved material with the balance of the 'Anton Bruun' collections, I do not think it desirable to name it in the present context.

IV. South-West Indian Ocean Submarine Ridge

A single dredging station on about the highest point of the ridge at 36°48'S : 52°08'E (about mid-way between Port Elizabeth and Amsterdam Island, or north of the Crozet Islands), 400 metres.

Crotalometra magnicirra (Bell)	5 specimens
Glyptometra sclateri (Bell)	4 specimens
Juvenile indeterminable Antedonidae	3 specimens
Democrinus chuni (Döderlein)	1 specimen
Porphyrocrinus polyarthra A. M. Clark. [See A. M. Clark, 1973.]	2 specimens
Odinia clarki Koehler	5 broken specimens

Otherwise known from the Maldive area.

Ophiomyxa vivipara capensis Mortensen	4 specimens
Ophiomitrella corynephora H. L. Clark	3 specimens
Ophiomitrella sp.	1 specimen

Like the three *O. corynephora*, this was clinging to a gorgonian. It differs from them in the much shorter disc armament, the stumps barely longer than broad. The arm spines do not exceed the segment in length, as in *O. hamata*, from which it differs in the spines not being distinctly rugose and again probably in the shorter disc spines. Unfortunately the size is small, d.d. only 4·5 mm.

Juvenile indeterminable Ophiacanthidae	3 specimens
Ophiomusium sp.	5 specimens

All these specific identifications provide extensions of range to this remote part of the southern Indian Ocean, except for the stalked crinoid *Porphyrocrinus polyarthra* of which this is the first record.

The fact that five of the six other species are common to South Africa, having spanned the enormous gulf between, is of particular interest, though of course larval transport from South Africa must be facilitated by the eastwards flowing current.

SUMMARY OF TAXONOMIC CHANGES

New Species

Amphilimna cribriformis (Ophiuroidea) Family Ophiacanthidae
Ophionephthys lowelli (Ophiuroidea) Family Amphiuridae
Ophiopsila bispinosa (Ophiuroidea) Family Ophiocomidae

Other taxonomic changes

Astropecten phragmorus Fisher – reduced to a subspecies of *A. polyacanthus* Müller & Troschel.
Ceramaster chondriscus H. L. Clark, 1923 – referred to synonymy of *C. patagonicus euryplax* H. L. Clark, 1923.
Hacelia superba var. *capensis* Mortensen – raised to specific rank.
Asterina dyscrita H. L. Clark – referred to *Patiriella*.
Echinaster reticulatus H. L. Clark – referred to *Henricia*.
Perissasterias obtusispina H. L. Clark, 1926 – probably a synonym of *P. polyacantha* H. L. Clark, 1923.
Amphiura adjecta and *A. compressa* Mortensen, 1933 – referred to synonymy of *A. capensis* Ljungman, 1867.
Amphiura kalki Balinsky, 1957 – referred to synonymy of *A. candida* Ljungman, 1867.
Amphioplus (*Lymanella*) *furcatus* Mortensen – restored from the synonymy of *A. hastatus*.
Ophiothrix triglochis Müller & Troschel – reduced to a form of *O. fragilis* (Abildgaard).
Ophiopsammium nudum H. L. Clark, 1923 – referred to *Ophiothela* and with synonym *Ophiothela* (formerly *Ophioteresis*) *beauforti* (Engel, 1949).
Gymnophiura novembris Hertz, 1927 – referred to synonymy of *Ophiura trimeni* Bell, 1905.

REFERENCES

Agassiz, A. 1879. Preliminary report on the Echini of the exploring expedition of H.M.S. 'Challenger'. *Proc. Am. Acad. Arts Sci.* **14** : 190–262.
Balinsky, J. B. 1957. The Ophiuroidea of Inhaca Island. *Ann. Natal Mus.* **14** : 1–33, 7 figs., 4 pls.
—— 1969. See : Macnae & Kalk.
Bell, F. J. 1904. The Echinoderma found off the coast of South Africa. 1. Echinoidea. *Marine Invest. S. Afr.* **3** : 167–175.
—— 1905a. The Echinoderma found off the coast of South Africa. 2. Asteroidea. *Marine Invest. S. Afr.* **3** : 241–253.
—— 1905b. The Echinoderma found off the coast of South Africa. 3. Ophiuroidea. *Marine Invest. S. Afr.* **3** : 255–260, pl. 1.
—— 1905c. The Echinoderma found off the coast of South Africa. 4. Crinoidea. *Marine Invest. S. Afr.* **4** : 139–142, pls. 2–4.

BELL, F. J. 1909. Report on the Echinoderms (other than Holothurians) collected by Mr J. S. Gardiner in the western parts of the Indian Ocean. *Trans. Linn. Soc. Lond.* (Zool.) **13** (1) : 17–23, pl. 3.

BERRISFORD, C. D. 1969. Biology and zoogeography of the Vema Seamount : a report on the first biological collection made on the summit. *Trans. R. Soc. S. Afr.* **38** : 387–398, 1 fig.

CHERBONNIER, G. 1962. Ophiures. *Rés. scient. Expéd. océanogr. Belge Eaux Côt. Afr. Atlant. Sud* **3** (8) : 1–24, 7 pls.

—— 1972. *Amphioplus polymorphus* n. sp., nouvelle espèce d'Ophiure (Echinoderme) des côtes malgache. *Bull. Mus. Hist. nat., Paris* (Zool.) **24** : 285–290, 1 fig.

CLARK, A. H. 1911. The recent crinoids of the coasts of Africa. *Proc. U.S. natn. Mus.* **40** (1808) : 1–51.

—— 1937. Crinoidea. *Scient. Rep. John Murray Exped.* **4** : 88–108, 1 pl.

—— 1947. A monograph of the existing crinoids. 1. The Comatulids. 4b. Superfamily Mariametrida (concluded – the family Colobometridae) and Superfamily Tropiometrida (except the families Thalassometridae and Charitometridae). *Bull. U.S. natn. Mus.* **82** : vii + 473. 43 pls.

—— 1948. Two new starfishes and a new brittle-star from Florida and Alabama. *Proc. biol. Soc. Wash.* **61** : 55–64, pl. 2.

—— 1950. A monograph of the existing crinoids. 1. 4c. Superfamily Tropiometrida (families Thalassometridae and Charitometridae). *Bull. U.S. natn. Mus.* **82** : vii + 383, 32 pls.

—— 1952. A new species of the crinoid genus *Cyclometra* from South Africa. *Trans. R. Soc. S. Afr.* **33** : 189–192, 1 fig., pls. 15, 16.

CLARK, A. M. 1951. On some echinoderms in the British Museum (Natural History). *Ann. Mag. nat. Hist.* (12) **4** : 1256–1268, 4 figs., pl. 22.

—— 1952. Some echinoderms from South Africa. *Trans. R. Soc. S. Afr.* **33** : 193–221, 3 figs., pl. 17.

—— 1967. Notes on the family Ophiotrichidae (Ophiuroidea). *Ann. Mag. nat. Hist.* (13) **9** : 637–655, 1 fig., 2 pls.

—— 1970. Notes on the family Amphiuridae (Ophiuroidea). *Bull. Br. Mus. nat. Hist.* (Zool.) **19** : 1–81, 11 figs.

—— 1972. Some crinoids from the Indian Ocean. *Bull. Br. Mus. nat. Hist.* (Zool.) **24** : 73–156, 17 figs.

—— 1973. Some new taxa of recent stalked Crinoidea. *Bull. Br. Mus. nat. Hist.* (Zool.) **25** : 265–288, 6 figs., 2 pls.

CLARK, A. M. & ROWE, F. W. E. 1971. *Monograph of Shallow-water Indo-West Pacific Echinoderms*. London : vii + 238, 100 figs., 31 pls.

CLARK, H. L. 1921. The echinoderm fauna of Torres Strait : its composition and its origin. *Pap. Dep. mar. Biol. Carnegie Instn Wash.* **10** : vii + 223, 38 pls.

—— 1923. The echinoderm fauna of South Africa. *Ann. S. Afr. Mus.* **13** : 221–435, 4 figs., pls. 8–13.

—— 1924. Echinoderms from the South African Fisheries and Marine Biological Survey. 1. Sea-urchins (Echinoidea). *Rep. Fish. mar. biol. Surv. Un. S. Afr.* No. 4 : Spec. Rep. No. 1 : 1–33, 4 pls.

—— 1926. Echinoderms from the South African Fisheries and Marine Biological Survey. 2. Sea-stars (Asteroidea). *Rep. Fish. mar. biol. Surv. Un. S. Afr.* No. 4 : Spec. Rep. No. 7 : 1–34, 7 pls.

—— 1939. Ophiuroidea. *Scient. Rep. John Murray Exped.* **4** : 29–136, 62 figs.

DARTNALL, A. J. 1971. Australian sea-stars of the genus *Patiriella* (Asteroidea, Asterinidae). *Proc. Linn. Soc. N.S.W.* **96** : 39–49, 1 fig., 2 pls.

DAY, J. H., FIELD, J. G. & PENRITH, M. J. 1970. The benthic fauna and fishes of False Bay, South Africa. *Trans. R. Soc. S. Afr.* **39** : 1–108.

DÖDERLEIN, L. 1906. Die Echinoiden der deutschen Tiefsee-Expedition. *Wiss. Ergebn. dt. Tiefsee-Exped. 'Valdivia'*, **5** : 61–290, pls. 9–50.

DÖDERLEIN, L. 1910. Asteroidea, Ophiuroidea, Echinoidea. *In* Schultze, L. Forschungsreise im westlichen und zentralen Südafrika. 4 (1). *Denkschr. med-naturw. Ges. Jena*, **16** : 245–258, 2 pls.

—— 1911. Über japanische und andere Euryalae. *Abh. bayer. Akad. Wiss.* **2.** Suppl. 5 : 1–123, 52 figs., 9 pls.

—— 1917. Die Asteriden der Siboga-Expedition. 1. Die Gattung *Astropecten*. *Siboga Exped.* **46a** : 1–190, 20 figs., 17 pls.

DOWNEY, M. E. 1971. Two new species of the genus *Tamaria* (Echinodermata : Asteroidea) from the tropical western Atlantic. *Proc. biol. Soc. Wash.* **84** : 43–50, 3 figs.

ENGEL, H. 1949. *Ophioteresis beauforti* nov. spec. *Bijdr. Dierk.* **28** : 140–143, 2 figs.

FELL, H. B. 1962. A revision of the major genera of amphiurid Ophiuroidea. *Trans. R. Soc. N.Z.* (Zool.) **2** : 1–26, 1 pl.

FISHER, W. K. 1913. Four new genera and fifty-eight new species of starfishes from the Philippine Islands, Celebes and the Moluccas. *Proc. U.S. natn. Mus.* **43** : 599–648.

—— 1919. Starfishes of the Philippine Seas and adjacent waters. *Bull. U.S. natn. Mus.* **100** (3) : 1–546, 156 pls.

—— 1928. Asteroidea of the North Pacific and adjacent waters. 2. Forcipulata (part). *Bull. U.S. natn. Mus.* **76** : 1–245, 81 pls.

—— 1940. Asteroidea. *Discovery Rep.* **20** : 69–306, 23 pls.

GISLÉN, T. 1938. Crinoids of South Africa. *K. svenska VetenskAkad. Handl.* (3) **17** (2) : 1–22, 26 figs., 2 pls.

GRAY, J. E. 1840. A synopsis of the genera and species of the class Hypostoma (*Asterias*, Linn.). *Ann. Mag. nat. Hist.* **6** : 175–184 ; 275–290.

—— 1847. Descriptions of some new genera and species of Asteriadae. *Proc. zool. Soc. Lond.* **1847** : 72–83.

GUILLE, A. 1964. Contribution à l'étude de la systématique et de l'écologie d'*Ophiothrix quinquemaculata* d. Ch. *Vie Milieu*, **15** : 243–308, 13 figs., 6 pls.

HERTZ, M. 1927. Die Ophiuroiden der deutschen Tiefsee-Expedition. *Wiss. Ergebn. dt. Tiefsee-Exped. 'Valdivia'*, **22** (3) : 59–122, 7 figs., pls. 6–9.

JOHN, D. D. 1948. Notes on asteroids in the British Museum (Natural History). 1. The species of *Astropecten*. *Novit. zool.* **42** (3) : 485–508, 4 pls.

KOEHLER, R. 1898. Echinodermes recueillis par l'Investigator dans l'Océan Indien. 2. Les Ophiures littorales. *Bull. scient. Fr. Belg.* **31** : 54–124, pls. 2–4.

—— 1904a. Ophiures nouvelles ou peu connues. *Mém. Soc. zool. Fr.* **17** : 54–119, 98 figs.

—— 1904b. Ophiures de l'Expedition du Siboga. 1. Ophiures de mer profonde. *Siboga Exped.* **45a** : 1–167, 36 pls.

—— 1905. Ophiures de l'Expedition du Siboga. 2. Ophiures littorales. *Siboga Exped.* **45b** : 1–142, 18 pls.

—— 1907. Revision de la collection des Ophiures du Muséum d'Histoire naturelle de Paris. *Bull. scient. Fr. Belg.* **41** : 279–351, 5 pls.

—— 1908. Astéries, Ophiures et Echinides de l'Expédition antarctique nationale Ecossaise. *Trans. R. Soc. Edinb.* **46** (3) 22 : 529–649, 16 pls.

—— 1914. A contribution to the study of Ophiurans of the United States National Museum. *Bull. U.S. natn. Mus.* **84** : 1–173, 18 pls.

—— 1922. Ophiurans of the Philippine seas. *Bull. U.S. natn. Mus.* **100** (5) : x + 486, 103 pls.

—— 1924. *Les Echinodermes des Mers d'Europe*, 1. Paris : xiii + 360, 9 pls.

—— 1927. Révision de quelques ophiures de Ljungman appartenant au Musée d'Histoire Naturelle de Stockholm. *Ark. Zool.* **19A** (2) : 1–29, 4 pls.

LAMARCK, J. B. P. A. de. 1816. *Histoire naturelle des Animaux sans Vertèbres*. Ed. 1. Paris **2** : 522–568 ; **3** : 1–59 ; 60–76.

LJUNGMAN, A. 1867. Ophiuroidea viventia huc usque cognita enumerat. *Ofvers. K. Vetensk-Akad. Förh. Stockh.* **23** : 303–336.

—— 1871. Förteckning öfver uti Vestindien af Dr. A. Goës samt under Korvetten Josefinas Expedition : Atlantiska Oceanen samlade Ophiurider. *Ofvers. K. VetenskAkad. Förh. Stockh.* **28** : 615–658.

LYMAN, T. 1869. Preliminary report on the Ophiuridae and Astrophytidae dredged in deep water between Cuba and the Florida Reef by L. F. de Pourtales. *Bull. Mus. comp. Zool. Harv.* **1** : 309–354.

—— 1878. Ophiuridae and Astrophytidae of the 'Challenger' Expedition. 1. *Bull. Mus. comp. Zool. Harv.* **5** : 65–168, 10 pls.

—— 1879. Ophiuridae and Astrophytidae of the 'Challenger' Expedition. 2. *Bull. Mus. comp. Zool. Harv.* **6** : 17–83, 8 pls.

—— 1882. Ophiuroidea. *Rep. scient. Results Voy. Challenger*, Zool. **5** : 1–386, 46 pls.

MACNAE, W. & KALK, M. 1962. The fauna and flora of sand flats at Inhaca Island, Moçambique. *J. Anim. Ecol.* **31** : 93–128, 5 figs.

—— 1969. *A Natural History of Inhaca Island, Moçambique.* Revised ed. Johannesburg : iii + 163, figs., 11 pls. [Echinoderms by Balinsky, B. I. pp. 96–107.]

MADSEN, F. J. 1971. West African ophiuroids. *Atlantide Rep.* No. 11 : 151–243, 49 figs.

MARKTANNER-TURNERETSCHER, G. 1887. Beschreibung neuer Ophiuriden und Bemerkungen zu bekannten. *Annln naturh. Mus. Wien*, **2** : 291–316, pls. 12, 13.

MARTENS, E. VON. 1879. Vorzeigung eines eigenthümlichen sechsarmigen Schlangensterns, *Ophiothela dividua*, sp. n. *Sber. Ges. naturf. Freunde Berlin*, **1879** : 127–130.

MORTENSEN, T. 1925. On some echinoderms from South Africa. *Ann. Mag. nat. Hist.* (9) **16** : 146–154, 5 figs., 1 pl.

—— 1926. Cambridge Expedition to the Suez Canal, 1924. 6. Report on the Echinoderms. *Trans. zool. Soc. Lond.* **22** : 117–131, figs. 11–13.

—— 1933a. Echinoderms of South Africa (Asteroidea and Ophiuroidea). *Vidensk. Meddr dansk naturh. Foren.* **93** : 215–400, 91 figs., 12 pls.

—— 1933b. The echinoderms of St Helena (other than crinoids). *Vidensk. Meddr dansk naturh. Foren.* **93** : 401–472, 29 figs., 3 pls.

—— 1940. Echinoderms from the Iranian Gulf. *Dan. scient. Invest. Iran.* Part 2 : 55–112, 24 figs., 2 pls.

—— 1943. *A Monograph of the Echinoidea.* III. 3. Camarodonta II. Copenhagen : 1–446, 215 figs., 66 pls.

—— 1951. *A Monograph of the Echinoidea.* V. 2. Spatangoida II. Copenhagen : 1–593, 286 figs., 64 pls.

MÜLLER, J. & TROSCHEL, F. H. 1842. *System der Asteriden.* Braunschweig : xx + 134, 12 pls.

MÜLLER, O. F. [with ABILDGAARD, P. C.]. 1789. *Zoologica Danica.* Ed. 3. Hauniae. **3** : iv + 71, pls. 81–120.

MURAKAMI, S. 1963. The dental and oral plates of Ophiuroidea. *Trans. R. Soc. N.Z.* (Zool.) **4** : 1–48, 1 fig., 7 pls.

PERRIER, E. 1881. Description sommaire des espèces nouvelles d'Astéries. *Bull. Mus. comp. Zool. Harv.* **9** : 1–31.

RETZIUS, A. J. 1783. Anmaerkningar vid Asteriae Genus. *K. svenska VetenskAkad. Handl.* **4** : 234–244.

SIMPSON, J. C. & BROWN, R. N. R. 1910. Asteroidea of Portuguese East Africa collected by Jas. C. Simpson. *Proc. R. Phys. Soc. Edinb.* **18** : 45–60.

SLADEN, W. P. 1889. Asteroidea. *Rep. scient. Results Voy. Challenger*, Zool. **30** : 1–935, 118 pls.

SMITH, G. A. 1927. On *Asterina burtoni* Gray. *Ann. Mag. nat. Hist.* (9) **19** : 641–645.

THOMAS, L. P. 1962. The shallow water amphiurid brittle stars (Echinodermata, Ophiuroidea) of Florida. *Bull. mar. Sci.* **12** : 623–694, 23 figs.

—— 1967. The systematic position of *Amphilimna* (Echinodermata : Ophiuroidea). *Proc. biol. Soc. Wash.* **80** : 123–130, 9 figs.

THOMAS, L. P. & SCHOENER, A. 1972. Growth changes in *Amphilimna olivacea* (Lyman) and the systematic status of *Amphitarsus spinifer* Schoener. *Breviora* No. 387 : 1–9, 2 figs.

THOMSON, C. WYVILLE. 1877. *The Voyage of the 'Challenger'. The Atlantic.* London. **1** : 1–424, 106 figs., pls. 1–14 ; **2** : 1–396, 62 figs., pls. 15–42.

VERRILL, A. E. 1869. On some new and imperfectly known echinoderms and corals. *Proc. Boston Soc. nat. Hist.* **12** : 381–396.

—— 1915. Report on the starfishes of the West Indies, Florida and Brazil. *Bull. Labs nat. Hist. St. Univ. Ia*, **7** (1) : 1–232, 29 pls.

MISS A. M. CLARK
Department of Zoology
BRITISH MUSEUM (NATURAL HISTORY)
CROMWELL ROAD
LONDON, SW7 5BD

PLATE 1

FIG. 1. *Astropecten granulatus natalensis* John. Lectotype. B.M. reg. no. 1904.4.20.120.
FIG. 2. *A. polyacanthus phragmorus* Fisher. 1904.4.26.9. R 70 mm. [The locality of both specimens is assumed to be Natal.]

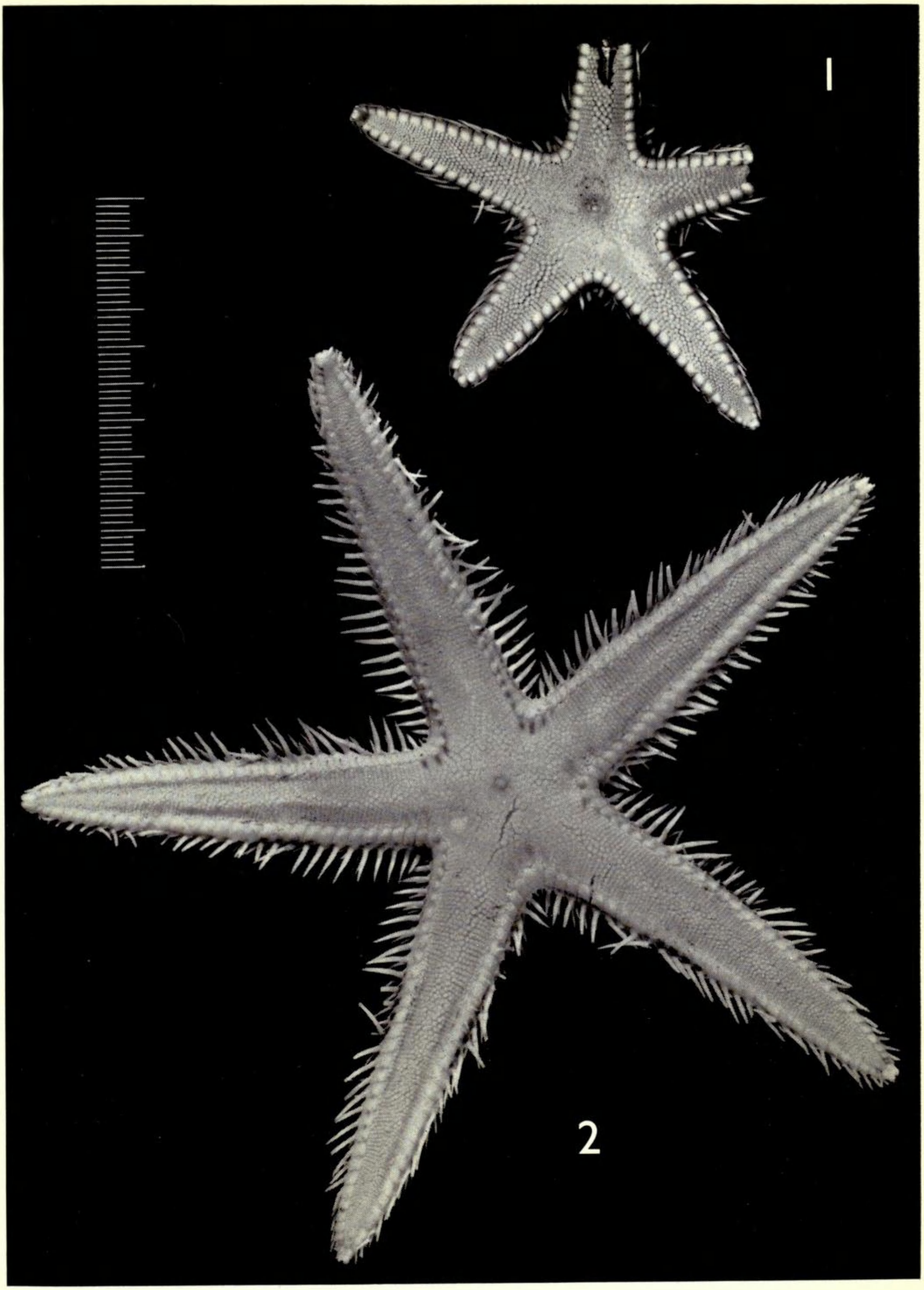
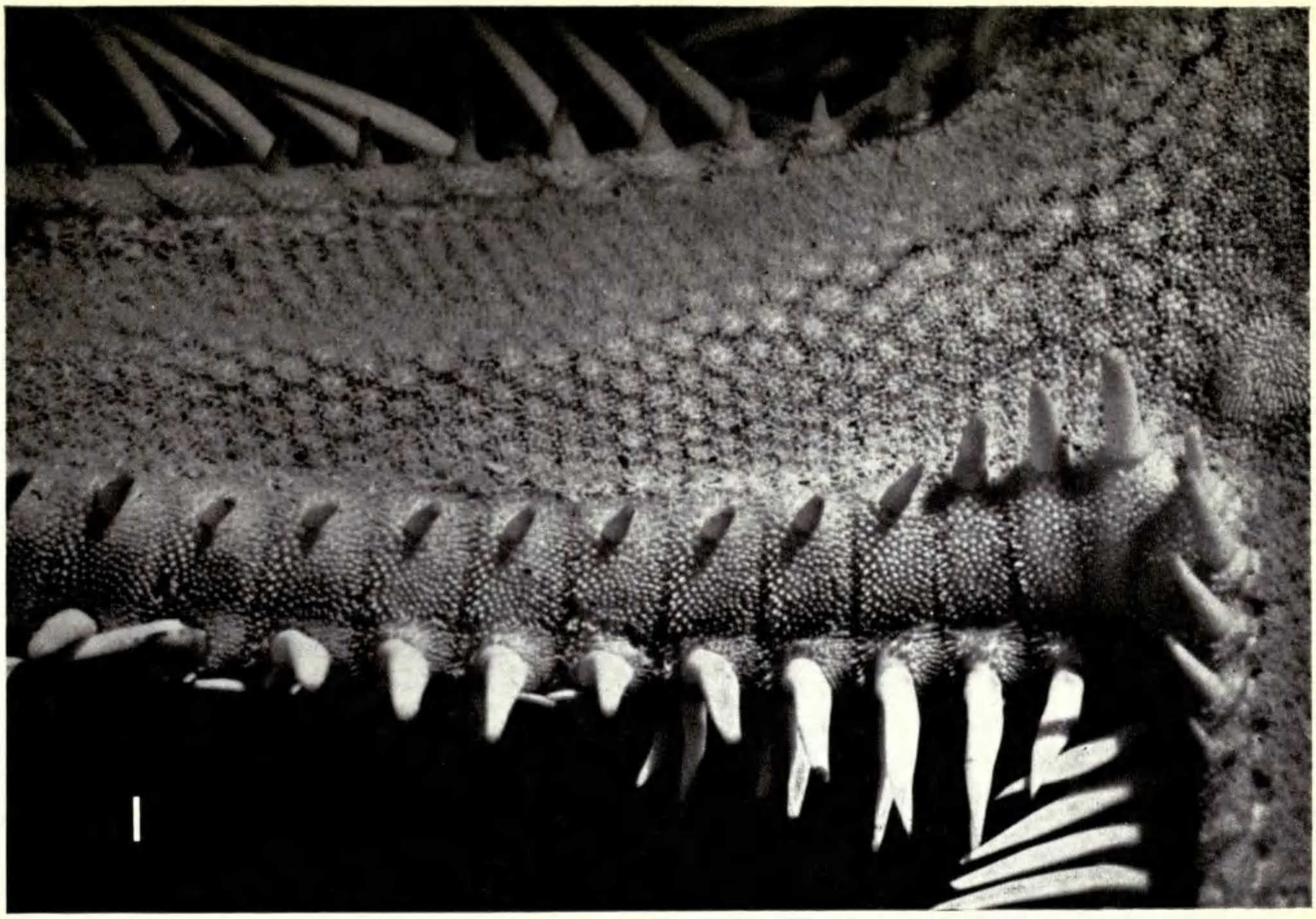

2

PLATE 2

FIG. 1. *Astropecten polyacanthus phragmorus* Fisher. 1904.4.26.9. Enlargement (×5) of proximal part of arm viewed obliquely, showing continuous series of superomarginal spines.

FIG. 2. *A. polyacanthus polyacanthus* Müller & Troschel. B.M. reg. no. 1972.8.22.32, Assab, Eritrea. R 105 mm. Similar view (×2) showing the proximal gap in the spine series. (This specimen has an unusually large number of supernumerary superomarginal spines.) [Photographed by Patricia Cunningham, the remainder by Mr P. A. Richens of the British Museum Photographic Studio.]


1

2

PLATE 3

FIGS. 1 and 2. *Astrocladus euryale* (Retzius). SCD 155P. Ventral and dorsal views.