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# Field guide to the brittle and basket stars (Echinodermata: Ophiuroidea) of South Africa

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**Cover illustration:** dorsal view of *Ophiarachna affinis* Lütken, 1869 from the shallow-waters of KwaZulu-Natal (photo by Yves Barette).

**Inner page photograph: top:** upon re-surfacing, one is reminded of the recreational value of the scenery and its biodiversity; **bottom left:** a colony of mushroom soft-coral (*Sarcophyton* sp.), with a small giant clam (*Tridacna* sp.) in the middle of the picture and with, a.o., colonial tunicates (*Didemnum molle* Herdmann, 1866) at the top of the picture; **bottom right:** close encounters of a fish kind: big-eye stumpnoses (*Rhabdosargus thorpei* Smith, 1979) swarm around; not known if this species feeds on ophiuroids.

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# Field guide to the brittle and basket stars (Echinodermata: Ophiuroidea) of South Africa



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## **Abstract**

Brittle and basket stars (ophiuroids) are one of five extant classes of the phylum Echinodermata and have a fossil record dating back almost 500 million years to the Early Ordovician. Today, they remain diverse and widespread, with over 260 described genera and 2,077 extant species globally (Stöhr *et al.* 2018), more than any other class of echinoderm. Ophiuroid species are found across all marine habitats from the intertidal shore to the abyss. In southern Africa, the ophiuroid fauna has been studied extensively by a number of authors and is relatively well-known. The last published review of the southern African Ophiuroidea however was by Clark & Courtman-Stock in 1976. It included 101 species reported from within the boundaries of South Africa. In the 40 years since that publication the number of species has risen to 136. This identification guide includes a taxonomic key to all 136 species, and gives key references, distribution maps, diagnoses, scaled photographs (where possible), and a synthesis of known ecological and depth information for each. The guide is designed to be comprehensive, well illustrated and easy to use for both naturalists and professional biologists. Taxonomic terms, morphological characteristics and technical expressions are defined and described in detail, with illustrations to clarify some aspects of the terminology. A checklist of all species in the region is also included, and indicates which species are endemic (33), for which we report significant range extensions (23), which have been recorded as new to the South African fauna (28) since the previous monograph of Clark & Courtman-Stock (1976) and which have undergone taxonomic revisions since that time (28).

## **Keywords**

Taxonomy, biodiversity, new records, Indian Ocean

## Preface

The Republic of South Africa is widely recognized as being highly bio-diverse. With a coastline of some 3,650 km and an Exclusive Economic Zone of just over 1 million km<sup>2</sup>, South Africa is bordered by the Southern Atlantic and Indian Oceans and dominated by the cold Benguela Current along the Atlantic coast to the west and the warm Agulhas Current along the Indian Ocean coast to the east. This offers marine life diverse habitats in which to flourish: cold and warm water, strongly wave exposed and sheltered coastlines, areas of low (nutrient poor) and high (upwelling) productivity with known biodiversity hotspots both in the water and on adjacent surrounding coastal plains.

Despite its status as a developing nation, South Africa has a relatively strong history of marine taxonomic research maintaining well-curated museum collections totaling over 291,000 records (Griffiths *et al.* 2010). The coastline is divided into five regions nine marine bioregions, with 33% of the biota listed as endemic species. Marine speciation in general, gets progressively richer to the (more tropical) east, whereas some taxa attain maximum species richness in the temperate southwest, with range-restricted species strongly concentrated on the boundaries or “ecoregions” where the Atlantic and Indian Oceans meet, especially around Cape Point.

The volume here reports on the diversity of the most species rich group of echinoderms, the ophiuroids. At the level of major phyla, Echinodermata surprisingly have some of the lowest levels of endemism on the current record (3.6%), so what did they find in the current studies? Importantly, what opportunities do ophiuroids offer man in further understanding the productivity and sustainability of our oceans, especially at this time when man-made pressures, like the impacts from direct exploitation, the introduction of non-native marine species, climate change, habitat modification, pollution, and habitat alternation, harmful invasive species are rapidly changing our marine systems? Questions of food security, livelihoods, economic and socio-cultural benefits that productive and sustainable marine systems offer are critical to South Africa’s development, and also central to the strategic objective of the United Nations Food and Agriculture Organization. FAO invests to ensure that fisheries and aquaculture ensure food security of the world’s peoples, with all its implications for resource conservation, livelihoods and maintaining sustainability and ecosystem services.

So why examine and gain further understanding of ophiuroid biodiversity? Why bother? What we have found is that we need to develop better tools and indicators of human pressures, to describe a consolidated view of impacts of human pressures on the health of benthic and pelagic communities. We also have to continue to look for potential species to support the livelihoods of a growing world population. Are there eco-tourism opportunities, potential pre-cursors for the development of new medicines, or other opportunities (e.g., supply the aquarium industry) that such taxonomic enquiry can offer? Might ophiuroids be a good taxon group to help train our future marine scientists? What insights or opportunities can and will they offer?

The South African marine biota supports a wide range of fisheries and ecotourism and recreation based on South Africa's marine environment that has developed significantly along with its growing population. FAO has a relatively long history when it comes to the taxonomy of edible taxa (<http://www.fao.org/fishery/fishfinder/en>), mainly to improve the capacity of countries to identify and record artisanal and commercially exploited fish species, for improving the definition of country fish records. FAO also supports countries in gaining a greater understanding of the scope and importance of their biodiversity, not just of target species in fisheries but also for 'associated' and 'dependent' species. The work reported here aims to drive better understanding, communication and action to manage and conserve our marine environment.

Luckily a new generation of taxonomists<sup>1</sup> is being supported by the South African National Biodiversity Institute (SANBI) and the South African Biosystematics Initiative (SABI) that are increasing the availability of funding for such work, and encouraging young researchers to enter this field. For, a.o., ophiuroids, these budding taxonomists also can count on the support of the Belgian Development Cooperation and this through the Belgian Global Taxonomy Initiative ([www.taxonomy.be](http://www.taxonomy.be)), through for instance its flagship capacity building product: *Abc Taxa* ([www.abctaxa.be](http://www.abctaxa.be)). Such enquiry will no doubt lead to greater care, and resilience of our oceans.

Kim Friedman<sup>2</sup>  
December 2017

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<sup>1</sup>) The primary marine invertebrate collections in the region are housed at the Iziko South African Museum in Cape Town and comprise some 129,000 records, offering significant coverage of all major marine taxonomic groups.

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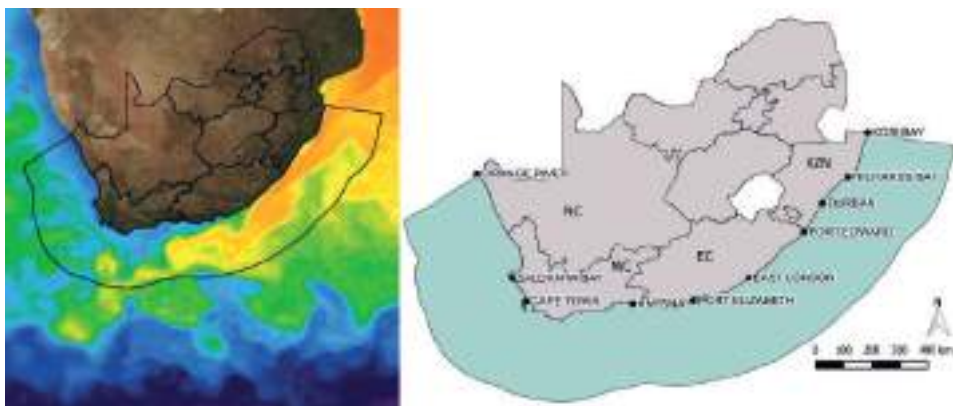
## 1. Introduction

Brittle and basket stars in southern Africa have been relatively well-documented (Clark 1923; Mortensen 1925; Mortensen 1933a; Clark A.M. 1952; Balinsky, 1957; Clark 1974; Clark & Courtman-Stock 1976; Clark 1977; Olbers & Samyn 2012; Olbers *et al.* 2014; Olbers *et al.* 2015; Olbers 2016). Unfortunately, until now, Clark & Courtman-Stock's monograph of 1976 was the last comprehensive guide to the ophiuroids of southern Africa. It is not confined to South Africa, making a clear assessment of the South African fauna challenging and the available identification keys also lack images of many species and are riddled with jargon that is too technical for most users. Furthermore, since the publication of Clark & Courtman-Stock (1976), an extensive number of samples have been collected and have accumulated unidentified in museum collections. These unidentified collections have been tackled in this work and form the principal basis for this guide.

The primary aim of this guide is to provide a well-illustrated and easy to use field guide with a taxonomic key to the ophiuroids of South Africa.

The geographic coverage (Fig. 1) of this guide is limited to the South African coast and its Exclusive Economic Zone (EEZ), for which maps are provided for each species. Global distribution as well as known depth range information for all species are also given.

The bulk of the book is an easy-to-use guide to the identification of South African ophiuroids. This guide targets the general public, biologists and naturalists and is designed to be comprehensive for scientists to obtain accurate and useful information, while easy enough for a naturalist to understand. For this reason, technical terms have been kept to a minimum, although taxonomic terms are essential, therefore all morphological characters referred to have been explained



**Fig. 1.** Exclusive Economic Zone (EEZ) of mainland South Africa showing provincial boundaries overlaid on a MODIS satellite sea surface temperature image (June 2002–June 2019; daily average) illustrating the warm Agulhas current flowing down the east coast and the colder Benguela Current on the west coast of southern Africa (right), with major coastal towns being indicated (left); NC: Northern Cape; WC: Western Cape; EC: Eastern Cape; KZN: KwaZulu-Natal.

and illustrated. The formal taxonomy of the species, which makes up the bulk of the guide, includes descriptions of families, genera and species. Information for each species includes taxonomic synonymies, diagnostic features, distribution (including maps), depth range, known habitat and any additional remarks that are considered noteworthy. Each species is represented by at least one photograph or illustration.

In addition to the taxonomy, the procedures of collecting, transporting and storing brittle and basket stars are also outlined and supported by illustrations.

The majority of new records and data were sourced from previously unidentified specimens deposited in the Iziko South African Museum collection, while additional records were obtained from photographic evidence sourced from the South African National Biodiversity Institute (SANBI) iSpot programme, and the University of Cape Town Animal Demographic Unit EchinoMAP programme.

Taxa are arranged according to their currently known classification, as given by Stöhr *et al.* (2018). Orders are as defined by O'Hara *et al.* (2018). Species are presented under the binomen considered valid by Stöhr *et al.* (2018).

### 1.1. Abbreviations used in the text

- A.L. = Arm length.
- AM = Australian Museum, Sydney, Australia.
- BMNH = British Museum (Natural History), London, United Kingdom (now NHMUK).
- CSIRO = Commonwealth Scientific and Industrial Research Organisation, Australia.
- DEFF = Department of Environment, Fisheries and Forestry, South Africa.
- DEA = Department of Environmental Affairs, South Africa.
- D.D. = Disc diameter.
- D.D./A.L. = Disc diameter to arm length ratio.
- EC = Eastern Cape province, South Africa.
- EKZNW = Ezemvelo KZN Wildlife, South Africa.
- GMNH = Muséum d'Histoire naturelle, Genève, Switzerland (See MHNG)
- KZN = KwaZulu-Natal province, South Africa.
- MCZ = Museum of Comparative Zoology, Harvard University, Massachusetts, United States of America.
- MHNG = Muséum d'Histoire naturelle (Natural History Museum), Genève, Switzerland (See GMNH).
- MNHN = Muséum national d'Histoire naturelle, Paris, France.
- Naturalis = Naturalis Biodiversity Centre, Leiden, The Netherlands (incorporating ZMA and RMNH).
- NC = Northern Cape province, South Africa.
- NHMUK = Natural History Museum, London, United Kingdom (see BMNH).
- RBINS = Royal Belgian Institute of Natural Sciences, Brussels, Belgium.
- RMCA = Royal Museum for Central Africa, Tervuren, Belgium.
- RMNH = Rijksmuseum van Natuurlijke Historie (National Museum of Natural History), Leiden, The Netherlands (see Naturalis).

- SAMC = Iziko South African Museum, Cape Town, South Africa.  
 SANBI = South African National Biodiversity Institute.  
 SEM = Scanning Electron Microscope.  
 SMNH = Swedish Museum of Natural History, Stockholm, Sweden.  
 UCT = University of Cape Town, South Africa.  
 USNM = Smithsonian Institution, National Museum of Natural History, Washington, D.C., United States of America.  
 WC = Western Cape province, South Africa.  
 ZMA = Zoölogisch Museum Amsterdam (Zoological Museum Amsterdam), The Netherlands (see Naturalis).  
 ZMB = Museum für Naturkunde (Museum of Natural History of Berlin), Berlin, Germany.  
 ZMUC = Natural History Museum of Denmark, Copenhagen, Denmark.  
 ZSM = Zoologische Staatssammlung München (Zoological State Collection Munich), Munich, Germany.

## 1.2. Echinoderms

Echinodermata (from the ancient Greek, ἔχινος, *ekhinos* - meaning spine or hedgehog and δέρμα, *derma* - meaning skin) is largely a marine phylum, belonging to the Deuterostomia branch of the Animal Kingdom. Echinoderms are the only pentamerous or five-rayed organisms. Although they are radially symmetrical, their larvae are bilateral, later developing into radially symmetrical adults. Other unique characters of the echinoderms include their water vascular system: a complex system of channels and reservoirs that form a hydraulic skeleton, their almost hollow interior, dermal endoskeleton and haemal system (Hyman 1955; Hickman 1998).

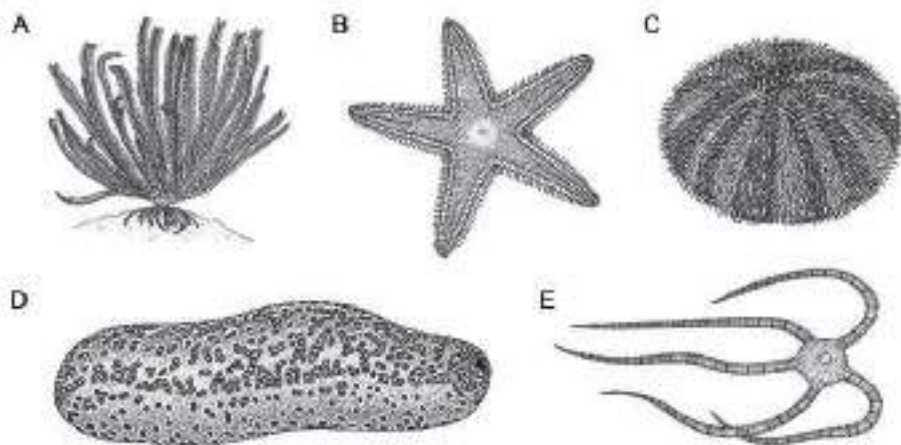
Some 6,950 extant and 13,000 fossil species of echinoderms are known (Pawson 2007). There are five accepted echinoderm extant classes, with the morphology of each class being quite different (Fig 2). The feather stars or sea lilies (Class Crinoidea: Greek *krinoeidēs*, lily-like) which are either free-living or sessile, have a central body with five or more long, feather-like arms and are the only echinoderm class where the mouth is directed upwards in adults. The sea stars or starfish (Class Asteroidea: Gr. *asteroeidēs*, star-like) have five or more hollow arms radiating from the centre of the body. They are flattened, with a distinctly differentiated dorsal and ventral surface. The sea urchins, heart urchins and sand dollars (Class Echinoidea: Gr. *ekhinος*, spine) have no arms but a single calcareous test which is armed with spines. The sea cucumbers (Class Holothuroidea: Gr. *holothurum*, Gr. *holos*, whole + *thureos*, oblong shield) do not possess arms or spines, and have a more-or-less cylindrical body that lies on its side with the mouth, which is encircled by feeding tentacles, at one end and the anus at the other. The serpent stars, basket stars and brittle (Class Ophiuroidea: Gr. *ophis*, snake + *ura*, tail) have a small disc and long mobile arms; gaining their name from the serpentine-like movements of their arms which have the tendency to break off or autotomise.

**Table 1.** Number of echinoderm species recorded globally, for southern Africa and for South Africa. Global data from Horton *et al.* (2018) and Pawson (2007) [Crinoidea]; southern African data from Clark & Courtman-Stock (1976) and Thandar (2015); South African data from Griffiths *et al.* (2010); Filander & Griffiths (2014), Olbers (2016), Ahmed Thandar and Erich Koch, pers. comm.

Class	Number of species		
	Global	Southern Africa	South Africa
Crinoidea	~650	17	19
Astroidea	1,879	99	116
Echinoidea	1,012	59	71
Holothuroidea	1,711	163	143
Ophiuroidea	2,076	124	136
<b>Total</b>	<b>~7,328</b>	<b>462</b>	<b>485</b>

Ophiuroidea are all benthic, but can be found on all types of bottom substrata, at all depths, and in all oceans and seas. They inhabit both open and secluded habitats and can range in size from large to very small, sometimes making them difficult to collect in comparison to other echinoderm classes, such as the more conspicuous Asteroidea and Echinoidea. Together with their negative response to light (Cowles 1910) and their high level of stereotropism (Hyman 1955), they are found in most habitats, concealing themselves by day under stones, rocks, boulders, in sediment or among seaweeds (Hyman 1955).

The number of species recorded globally, for southern Africa and for South Africa are listed in Table 1. Until recently, published data on echinoderms have been for the southern African region (i.e., south of the Tropic of Capricorn), which included parts of Mozambique, Namibia and South Africa and not within the political boundaries of South Africa *per se*.



**Fig. 2.** Representatives of the five echinoderm classes. **A.** Crinoidea. **B.** Asteroidea. **C.** Echinoidea. **D.** Holothuroidea. **E.** Ophiuroidea. Adapted from Rowe & Gates (1995).

### 1.3. Ecological and economic importance of the brittle and basket stars

Although brittle and basket stars have little economic value, the function of brittle and basket stars in a broad ecological context is poorly understood, but does offer some value in marine conservation management planning by acting as indicators of impact or as surrogates for seafloor communities.

The Ophiuroidea have a variety of ecological roles with one of their main roles being that of biodegradation or the process of breaking down and decomposition of dead plants and/or animals. Other roles include being scavengers or detritivores, whereby they feed on decaying material (Aronson 1989, 1992) but are also suspension feeders (Roushdy & Hansen 1961) in which they feed upon diatoms, phytoplankton, plant material and other particles in the water column (Eichelbaum 1910; Wintzell 1918). Eichelbaum (1910) found that the stomach contents of several European brittle and basket stars included detritus, diatoms, foraminiferans, dinoflagellates, tintinnoids, polychaete worms, small crustaceans, young echinoderms, bivalves and other molluscs. Later Wintzell (1918) reported that some species feed primarily on kelp fronds but also the other fauna which inhabits the same fronds, such as hydroids and other small invertebrates.

Brittle and basket stars are also prey items for various fish and invertebrates. Fish species known to prey on brittle and basket stars in European waters include the common dragonet (*Callionymus lyra* Linnaeus, 1758), the ballan wrasse (*Labrus bergylta* Ascanius, 1767) and the cuckoo wrasse (*Labrus mixtus* Linnaeus, 1758), whereas common invertebrates include the velvet crab (*Necora puber* (Linnaeus, 1767)), brown crab (*Cancer pagurus* Linnaeus, 1758), spiny starfish (*Marthasterias glacialis* (Linnaeus, 1758)), common starfish (*Asterias rubens* Linnaeus, 1758), seven-armed sea star (*Luidia ciliaris* (Philippi, 1837)) and five-armed sea star (*Luidia sarsii* Düben & Koren in Düben, 1844) (Aronson 1989; Brun 1972 and Fenchel 1965).

Brittle star beds, which are well-documented in European waters, can harbour up to thousands of individuals per m<sup>2</sup>, living epifaunally on bedrock, boulders, gravel or sedimentary substrata. These beds create shelter for other species, such as the bivalve *Abra alba* (W. Wood, 1802) (Warner 1971; Davoult & Gounin 1995; Hughes 1998).

There is evidence to suggest that the massive aggregations of suspension-feeding brittle and basket stars can influence the water quality in coastal environments and possibly assist in counteracting potentially harmful effects of eutrophication caused by anthropogenic activities (Hughes 1998).

Brittle and basket stars are also host to several ectoparasites, the best documented group of these being the copepods (Boxshall 1988; Stöhr & Hansson 2010; Boxshall 2001).

Stöhr *et al.* (2012) stated that given brittle and basket stars occur in all marine habitats, have a range of trophic and life history strategies and have a high abundance and diversity, they make prime candidates for scientific studies. For

continental Australasia, the brittle and basket stars have been used extensively (O'Hara 2007; O'Hara 2008a; O'Hara 2008b) in macro-ecological and biogeographic studies. In addition, Stöhr *et al.* (2012) suggested that brittle and basket stars have the potential to act as indicators of palaeoceanographic events because their skeletons are taxonomically identifiable in sediment cores.

#### **1.4. History of taxonomic research on brittle and basket stars in South Africa**

The current state of knowledge for brittle and basket stars in South Africa is a result of numerous contributions from authors since the late 1700s. The first record of an ophiuroid from South Africa was that by Retzius (1783) who reported *Asterias euryale* Retzius, 1783 (= *Astrocladus euryale*) from the Cape of Good Hope, followed by Müller & Troschel (1842) who reported two species and then Ljungman (1867) who added five additional species to the South African fauna.

The *Challenger* expedition between 1873 and 1876, sampled seven stations within South African waters (excluding the Prince Edward and Marion Islands) and as a result 21 new ophiuroid records were reported by Lyman (1878; 1882). Later, Bell (1888; 1905) described six additional new records of Ophiuroidea to South Africa in two subsequent papers. In 1910, Döderlein wrote the first consolidated account of South African echinoderms, reporting on 29 ophiuroids. More than a decade later, Clark (1923) reported a total of 57 ophiuroid species as being known for South Africa, including six new species which were largely derived from the *Pieter Faure* expedition. Mortensen (1925) added two more species to the fauna from a collection sent to him from the Durban Museum (*Astroschema capensis* Mortensen, 1925 (= *Astromorpha capensis*) and *Ophiactis savignyi* (Müller & Troschel 1842), the former being new to science. Hertz (1927a, b) added four new species to the South African fauna, but two of these were soon synonymized by Mortensen (1933a) in his significant contribution to the Ophiuroidea and Asteroidea of South Africa. Mortensen (1933a) recorded 36 new ophiuroid species from material collected mostly off the *Pickle* and the *John. C. Meikle*, bringing the total number of ophiuroids known for South Africa to 82 species. Mortensen (1936) reported on collections from the *Discovery* expedition (1901-1904) to Antarctica and added two new species from South Africa. Clark (1952) described an additional three species collected during the University of Cape Town (UCT) Ecological Surveys and from the *Africana*. Later, Clark (1974) summarized records from 22 years of collections undertaken during the UCT Ecological Surveys and the *Anton Bruun* expedition that had accumulated since the Clark (1952) report by describing three new species and adding four new records to South Africa.

Clark & Courtman-Stock (1976) reported on 115 species of Ophiuroidea for southern Africa, but only 101 of these species were recorded within the political borders of South Africa. Shortly afterwards, Clark (1977) reported on a number of deep-water species collected by the *Meiring Naude*, which added ten new ophiuroid species to the South African fauna. Madsen (1977) reported *Ophiernus quadrispinus* Koehler (1907) from off Cape Point, a new record for South Africa.

Following this, no taxonomic work was undertaken for 35 years until recently when Olbers & Samyn (2012) reported four new ophiocomid species as new records for South Africa. Later that year, Milne (2012) reported *Ophiactis picteti* (de Loriol 1893), *Macrophiothrix demessa* (Lyman 1862) and *M. propinqua* (Lyman 1862) as occurring at Sodwana Bay. These two reports raised the total number of ophiuroids reported in the published literature for South Africa to 119. In 2015, Olbers *et al.* published a consolidated report on all new species to South Africa, raising the total number to 137. Examined material of *Ophiactis flexuosa* Lyman 1879 from South Africa and consideration of H.L. Clark's (1923) synonymy of *O. flexuosa* with *O. plana* Lyman, 1869, Olbers (2016) revised the list and excluded *O. flexuosa*, amended the number of known brittle and basket stars for South Africa to 136.





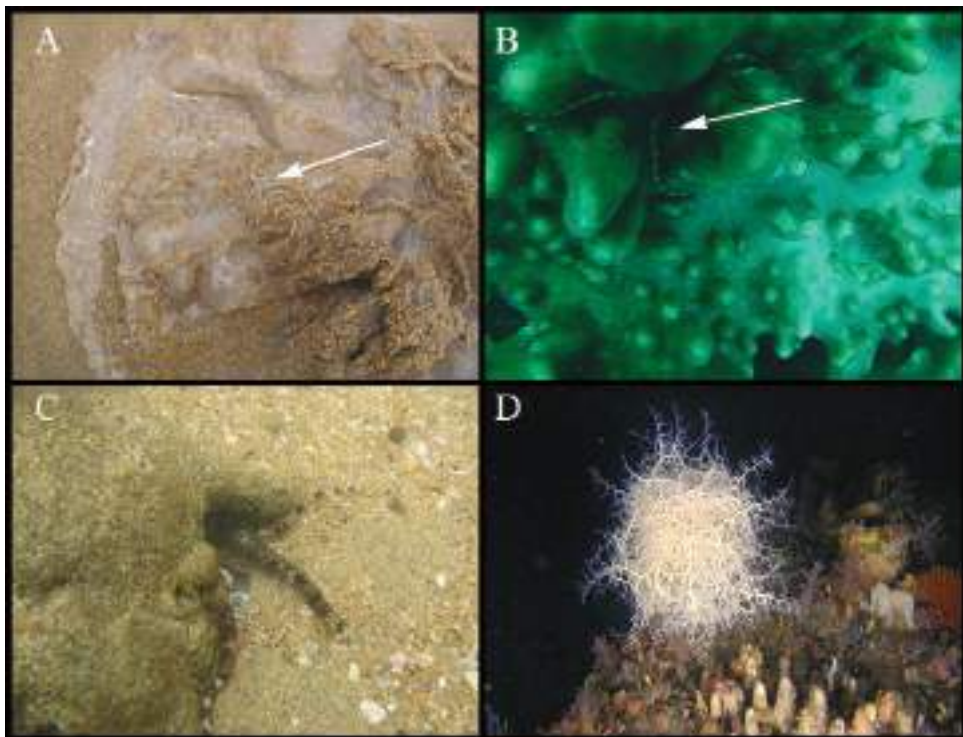
## 2. Taxonomic study of Ophiuroidea

### 2.1. Collecting

Collecting brittle and basket stars can be challenging, as they often 'fall to pieces' when handled. With careful handling and gentle manipulation, they generally can be collected by hand without damaging them. Lifting specimens with a scraper or knife or by lifting them by the disc can assist in handling.

They occur in a wide variety of habitat types, under rocks, inside crevices and crannies (Fig. 3), within sediment, on open reef (Hyman 1955), and amongst algae and other organisms, such as jellyfish, soft corals and sponges. In some cases, brittle and basket stars may be cryptic and nocturnal, but are relatively easy to find and collect by hand by breaking rocks and by lifting boulders or rocks.

When collecting, these shelters should be carefully returned to their original position to avoid crushing other organisms and to minimize any damage or disturbance to their habitat. The marine environment is under immense pressure so it is important, when collecting, to only take what you need, do not waste samples and take proper care of your samples to maximise the data obtained.



**Fig. 3.** Ophiuroidea are found in many habitat types and together with other organisms. **A.** On jellyfish. **B.** On soft coral. **C.** In crevices, under rocks and boulders. **D.** On open reef.

In the field, buckets, plastic resealable bags, collecting mesh bags and plastic bottles are good temporary storage items. When collecting, plastic bags are effective in that they form a protective water-balloon around the specimens. Mesh bags can also be used, but basket stars become tangled in the mesh and may prove difficult to remove from the bag. It is preferable to keep specimens separated from each other to avoid antagonistic effects.

If specimens need to be studied alive in the laboratory, it is preferable they are returned alive once the study is complete. However if the specimens have been kept in a laboratory together with alien species, or the laboratory has had a recent disease outbreak, it is better to destroy the specimens or have them lodged in a museum for taxonomic studies. Specimens should not be returned to sites other than the one from which they were collected, as this can spread diseases, result in disruption of genetic structure of populations or spread species to sites in which they would not naturally occur.

When specimens are collected for purposes where they are required to be killed or specimens which die during a study, it is important to deposit representative samples in a natural history museum, where they will be preserved and used for future reference.

## 2.2. Photography

Photographs of specimens in their environment are incredibly valuable and hold an immense amount of information, but the cryptic nature of these animals is such



**Fig. 4.** Photographing the specimens alive or soon after being collected to capture the natural colour, together with labels and scale bars.

that photography is not always possible. Where specimens are required to be preserved, they should be photographed soon after collection (Fig. 4) before they lose their natural colouration. When photographing, a scale bar should be placed adjacent to the specimen. Photographs taken with the specimen placed beneath some water, may enhance the quality of the image. To avoid reflections on the surface of the water, place light source at a 45 degree angle.

Photographs of this nature can add immense value to online platforms such as iSpot (<https://www.ispotnature.org/communities/southern-africa>) and EchinoMAP (<http://vmus.adu.org.za/>), which hold distribution records and assist in species distributions.

### **2.3. Relaxation, fixation and preservation**

Relaxing specimens can be somewhat time-consuming, but is worth the effort as this greatly enhances the scientific value of the specimens. It is essential to anaesthetise or relax the specimens before fixation. Often they contort, crunch up or release their arms when chemicals are added to the water while they are un-anaesthetised. To relax them, several methods exist, but adding Magnesium Chloride ( $MgCl_2$ ) or Magnesium sulphate ( $MgSO_4$ ; 4% being the desired concentration) to a basin of sea water allows the specimens to expire. If the concentration of  $MgCl_2$  is too high, they will crunch their arms, but this can be counteracted by diluting the solution with more sea water and by placing pressure on the arms until the specimens relax. As the specimen begins to expire and relax more, slowly add more  $MgCl_2$  to the solution until the specimens perish; ii) use a fresh and sea water solution, in the same manner as above iii) place specimens in the refrigerator overnight. All three processes can take a relatively long time, i.e., a few hours.

Relaxation is complete once the tube feet or arms no longer react to nudging or prodding. At this point, they need to be preserved in either 70-99% ethanol ( $C_2H_6O$ ) or in 4% formaldehyde ( $CH_2O$ ) solution. Ethanol (EtOH) is the preferred chemical because formaldehyde is acidic, hazardous to human health and damages the integrity of DNA, obstructing future molecular studies. After fixation, the fixative needs to be replaced with the preservation fluid, i.e., 70-80% ethanol. One can also opt to dry the specimens, a procedure that is less costly and saves precious museum shelf space. The disadvantage of dry preservation is the internal anatomy becomes largely unaccessible and the molecular integrity is reduced for study. Furthermore, if preserved dry, fixation in formaldehyde is preferred. Dry specimens are prone to insect infestations while collections in warm and humid climates are prone to mould, both of which, can destroy a specimen.

### **2.4. Molecular studies**

For molecular studies, the specimens are required to be subsampled, which is recommended practice for all collection trips. This should take place after relaxation but before fixation and preservation. Depending on the size of the specimen, a small piece of the arm is cut off with sterilised scissors or scalpel and

placed in 99% ethanol. These are stored separately from the specimen in vials or Polymerase Chain Reaction (PCR) vials for further processing. It is imperative that subsamples can be tracked back to the original specimen, see labelling below.

## 2.5. Labelling and record keeping

Data should be logged from the moment a collection trip begins until the specimens are preserved for long term storage in a museum. Every specimen should be accompanied with a label detailing collection information. Specimen labels (Fig. 5) should contain at least the following information: genus and species (if known), unique number, expedition name, locality, GPS coordinates, depth, habitat, collection date, collector name, collection method and if identified, who by. Special alcohol and water-proof paper must be used (i.e., Xerox NeverTear paper), while the label must be written using a soft lead pencil or in indelible Indian ink or printed with ink that will not dissolve in alcohol.

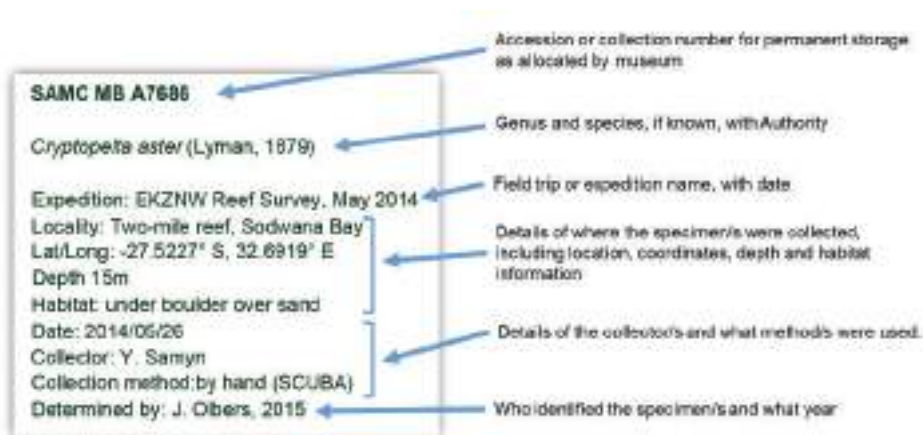


Fig. 5. Example of label with essential information.

## 2.6. Transportation

If the specimens are being transported locally, then storing them in ethanol in plastic resealable bags in a bucket is acceptable. Labels with data are required for each specimen or lot of specimens, even during transportation or temporary storage.

If specimens are to be couriered or posted, then specimens will require correct packaging procedures (Fig. 6), relevant permits (transportation, import, export) and will be required to meet shipping standards and codes, as per shipping regulations and the courier company.

The International Air Transport Association (IATA) has shipping standards which specimens are required to be packaged in accordance with. Natural history



**Fig. 6.** Packing specimens for transportation requires correct procedures. **A.** Each specimen / lot to be packaged separately in a bag of the correct size, this can be made with plastic and a heat sealer. **B.** Seal three sides of the bag for the specimens. **C.** Insert specimens, ethanol (not more than 30 ml in inner package) and label. **D.** Seal bag and check for leaks. **E.** Make and seal specimen in a triple bag, placing some absorbent material in the third bag. **F.** Wrap in bubble wrap. **G.** Place in box with packaging material. **H.** Place additional packaging material around specimen. **I.** Seal the box and attach necessary documentation or permits.

specimens are considered to be in the IATA category of ‘dangerous goods’ when in ethanol. Specimens will require an IATA SP A180 shipping declaration to accompany the package. An example of a shipping declaration, to be placed on the outside of the package, is given on page 22.

## 2.7. Storage

Once the specimens reach their destination for identification and/or permanent storage, it is imperative that specimens are not muddled up and the labels with data are kept meticulously together with the samples and/or specimens

Museums and institutions around the world have different storage techniques and facilities. Brittle and basket stars can be stored wet or dry. If wet, they should be

Cape Town, 18 December 2018

**SHIPPING DOCUMENTATION/CUSTOMS DECLARATION**  
**“scientific research specimens, not restricted, special provision**  
**A180 applies”**

**Full description of goods:** Ophiuroidea specimens preserved in a minimal quantity of 70 % ethanol. These biological samples are non-toxic, non-pathogenic and are derived from non-CITES listed species. They are on loan from the Iziko South African Museum in Cape Town to the Royal Belgian Institute of Natural Sciences in Brussels (Belgium).

The scientific research specimens are not restricted and have been packed according to IATA SP A180 (triple heat-sealed packing, no more than 30 mL of free ethanol in inner package, outer packing not exceeding 1 L, absorbent material included)”. Class 3/UN1170/PG III.

**Declared value: ZAR 100**

Iziko South African Museum  
Collections Manager  
25 Queen Victoria Street  
Cape Town  
8001  
South Africa  
Email address:  
Tel: +2721 481 3800

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**Important**

**Postal inspectors:** This package contains dead, preserved material for scientific research without commercial value. If this shipment is inspected, it is absolutely imperative that the packages are sealed tightly again. If not, the material will dry rapidly and become useless for scientific research. We thank you very much for taking good care of this important resource.

**Très important**

**Précautions à Prendre à l'inspection postale:** Ce colis contient du matériel biologique fixé dans un produit de conservation et est destiné à des études scientifiques. S'il est ouvert pour une inspection il est très important que les sacs en plastiques doivent de nouveau être soigneusement scellés. Si non, le matériel biologique desséchera rapidement et deviendra alors inutile pour étude. Nous vous en remercions beaucoup.

Convention on International Trade in Endangered Species of Wild Fauna and Flora: *Include Institutional CITES Number*

**HS-Code: 9705.00** (Collections of zoological/botanical/ mineralogical/archaeological/paleontological interest)

preserved in 70-96% ethanol, which covers the specimen, in well-sealed jars, after which the ethanol regularly needs to be topped up, if evaporation occurs. If the climate is not excessively humid then specimens can be dried for storage, which is often the case when large specimens are being stored. Drying brittle and basket stars can compromise the integrity of the DNA and the morphology of many internal features, conversely, examination of skeletal features is often enhanced.

## **2.8. Permits and legislation**

South Africa is a signatory to the Nagoya Protocol on Access and Benefit Sharing and collecting any marine plant or animal can be undertaken with two types of permits. A recreational permit allows for collection for food, bait and/or for use in home aquaria, this is for personal use only. The second permit is for scientific research which needs to be applied for from the Department of Environment, Forestry and Fisheries. In some cases, permission from the marine protected area management authority is also required.

All collecting requires a permit, regardless of whether the specimen will be released alive after the study or not. The National Environmental Management Act (107 of 1998) creates the framework for environmental law in South Africa together with its associated regulations and Specific Environmental Management Acts. For all marine species, including brittle and basket stars, the following legislation applies:

- National Environmental Management: Biodiversity Act 10 of 2004;
- National Environmental Management: Protected Areas Act 57 of 2003;
- National Environmental Management: Integrated Coastal Management Act 24 of 2008; and the
- Marine Living Resources Act 18 of 1998.

Permits for scientific research are applied for to the Department of Environment, Forestry and Fisheries, at the following email address: [researchpermits@daff.gov.za](mailto:researchpermits@daff.gov.za).

For further queries:

Dr. Kim Prochazka  
Director: Resources Research  
Tel: +27 (0)21 402-3546  
Email: [kimpro@environment.gov.za](mailto:kimpro@environment.gov.za)

Ms Melleney Cope  
Personal Assistant to Dr. Kim Prochazka  
E-mail: [melleneyC@daff.gov.za](mailto:melleneyC@daff.gov.za)

## 2.9. Morphology, biology and taxonomic terminology of brittle and basket stars

There are 33 families arranged into six orders as per O'Hara *et al.* (2018): Euryalida, Ophiurida, Ophiuroleucida, Ophiacanthida, Ophioleucida and Amphilepidida. All six orders and 26 families are represented in the South African Ophiuroidea fauna.

The Ophiuroidea are most similar in body shape to the Asteroidea and can be differentiated from them by a number of features, but most importantly because the arms of an asteroid are usually confluent with one another and the body cavity between the arm and disc is open. To identify Ophiuroidea, knowledge of the terminology used to describe their anatomy is necessary. A glossary of terms used can be found at the end of this guide.

The morphology of the ophiuroid is illustrated in Fig. 7 with additional figures below. It is important to understand the location of features when referring to the body plan of an ophiuroid. Proximal is closest to the centre of the disc and distal is furthest from the centre or the disc.

The water vascular, nervous and haemal systems are similar to those of asteroids. Each arm contains a small coelom, a radial nerve, and a radial canal of the water vascular system. In contrast to other echinoderms, the ambulacral grooves are enclosed and covered by plates. A pair of tube feet are present on each arm joint on the ventral surface, which in many cases are protected by one or more modified spines or tentacle scales.

Five pairs of invaginations called bursae open toward the ventral surface through genital slits at the bases of the arms. They can be variable in size and shape but they generally extend from the disc margin to the oral shields, supported either side by a genital plate. These plates may be distinct, but the shield adjacent to the arm base is usually indistinct. The genital slit edges may be smooth, have scallops, or bear genital papillae. Externally, these slits may be long and narrow, short and wide, or be divided into pairs. Water circulates in and out of the bursae for exchange of gases. Gonads occur on the coelomic walls of each bursa and



**Fig. 7.** General morphology of an ophiuroid, also indicating position of distal and proximal in relation to disc.



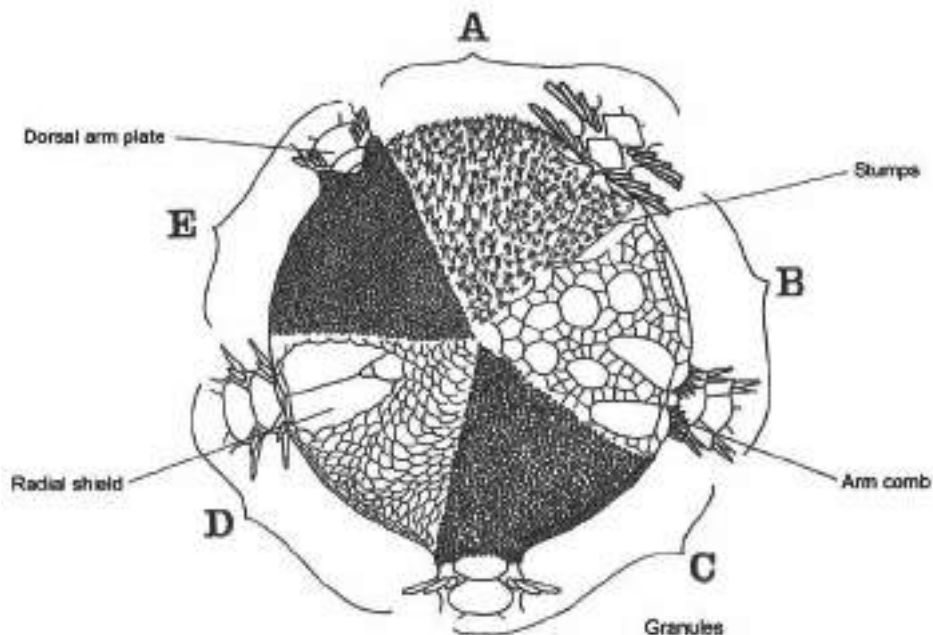
discharge their ripe sex cells, passing through the genital slits into the water for fertilization.

In most cases, the organs are confined to the disc, with the stomach being sac-like. There is no anus, thus any indigestible material is expelled through the mouth. The disc can be round or pentagonal, flat or puffy, excavated or indented radially or interradially. The disc is covered in plates and may be covered with thickened skin, scales, spines, granules, stumps, or a combination of these.

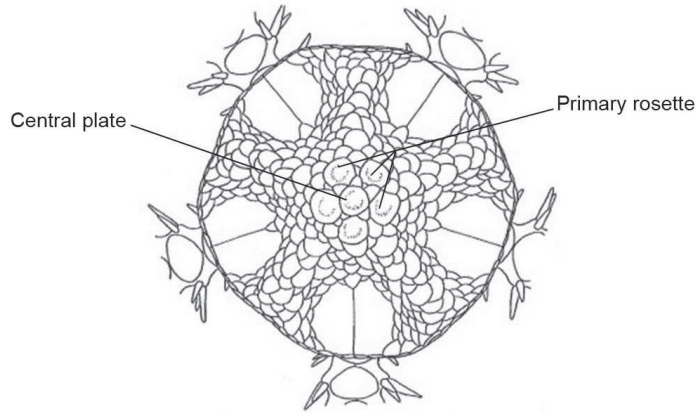
The main taxonomic characters on the dorsal disc are the radial shields (Fig. 8) and the primary scales or primary rosettes, including the central scale, which may or may not be distinct (Fig. 9). The armament of the dorsal disc is also of prime importance and may include granules, spines or tubercles. Figure 8 shows some of the dorsal characters and a composite of the dorsal disc armament of some common families.

The ventral surface of the disc (Fig. 10) holds more taxonomically informative characters. Adjacent to the jaws, the main characters visible are the genital slits, with some taxa also bearing genital papillae.

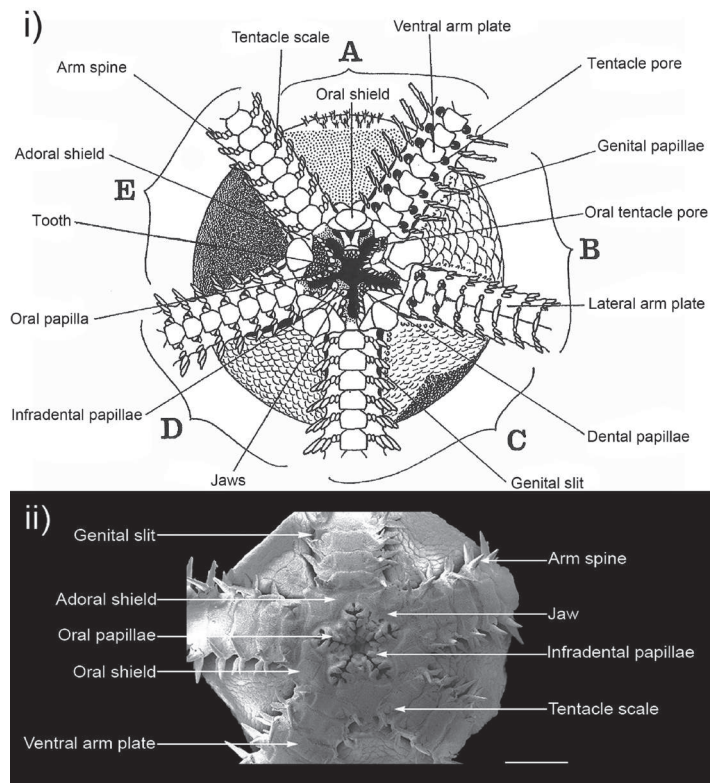
On the arms, the dorsal, ventral and lateral arm plates are taxonomically significant. The arm plates are taxon-indicative in width: length ratio and the curvature of the plates distally and/or proximally. Lateral arm plates support the arm spines, in



**Fig. 8.** Composite diagram showing characters of the dorsal surface of the disc in the following families. **A.** Ophiotrichidae. **B.** Ophiuridae. **C.** Ophiocomidae. **D.** Amphiuroidae. **E.** Ophiodermatidae. From Clark & Rowe (1971).



**Fig. 9.** Plates forming part of the primary rosette including the central plate. Adapted From Clark & Rowe (1971).

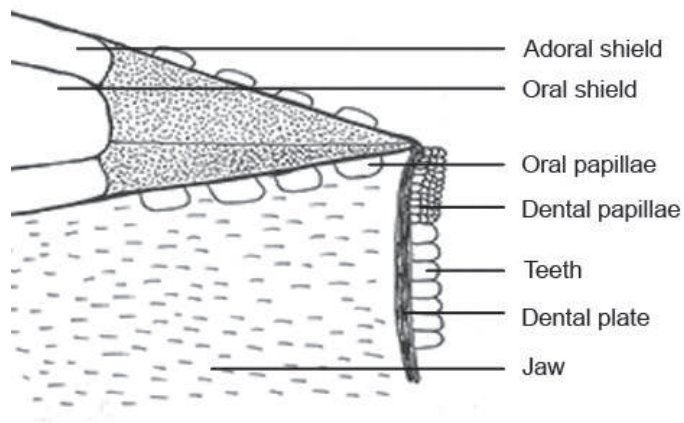


**Fig. 10.** Composite diagram (i) showing characters of the ventral surface of the disc in the following families. **A.** Ophiotrichidae. **B.** Ophiuridae. **C.** Ophiocomidae. **D.** Amphiridae. **E.** Ophiodermatidae. From Clark & Rowe (1971). Ventral disc of an amphirid (ii). Scale bar: 1 mm. Photo: Didier VandenSpiegel.

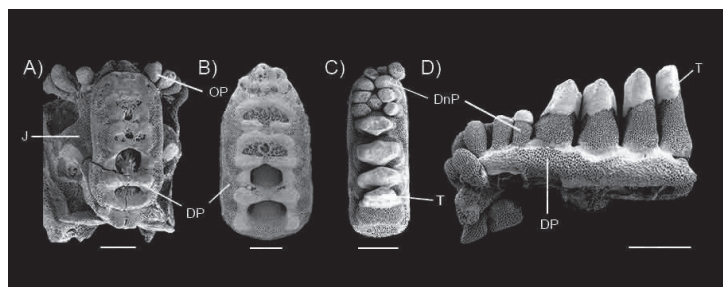
which some species, the number and sequence have been used as important features (Devaney 1970).

The ventral interradiar areas may also be covered in a combination of granules, spines, tubercles and scales. Figure 10 shows the main ventral characters and a composite of typical ventral disc armament for some common families.

In this guide, the primary characters by which most families are distinguished from each other are with the jaws. Jaw features include the oral papillae, dental papillae, oral tentacle pores, oral tentacle scales, teeth, oral shields, dental plates at the tip of the jaws, and adoral shields, which flank the oral shields on either side. Figure 11, a side view of the jaw, shows the placement of the dental plate, teeth and dental papillae, while Figure 12 shows the placement of teeth, dental papillae



**Fig. 11.** Side view of the jaw, indicating placement of the dental plate, dental papillae, teeth, oral shield, adoral shields and oral papillae.



**Fig. 12.** Placement of dental plate, dental papillae, oral papillae and teeth. **A.** Dental plate attached to jaw (*Breviturma brevipes*). **B.** Dental plate with no teeth or dental papillae attached, showing structures to which teeth and papillae would attach (*O. scolopendrina*). **C.** Dental plate with teeth and dental papillae attached (*Ophiocoma erinaceus*). **D.** Side view of dental plate with teeth and dental papillae attached (*Ophiocoma erinaceus*). Abbreviations: J = jaw; OP = oral papillae; DP = dental papillae; DnP = dental papillae; T = teeth. Scale bar: 0.5 mm. Photos: Didier VandenSpiegel.

and oral papillae on the jaw. The madreporite, a modified oral shield, is located in the vicinity of the mouth. In combination with the jaws, the arrangement, number, shape and size of various other external characters determine genera and species. The dental plate requires dissection to view and is used as a taxonomic character for some species.

There are usually five arms, but sometimes more, and these can be long and slender, short and stout and may be smooth or spiny. While the majority of species have simple arms, basket stars have branching arms, producing a network of tree-like branches. To the eye, the ophiuroid arms appear to be segmented, but these correspond to internal articulated ossicles or vertebrae (Fig. 13) which are connected by soft tissue. They are usually covered dorsally, ventrally and laterally by arm plates (Fig. 14).

In some families or genera, there are supplementary plates or shields adjacent to the dorsal arm plates, ventral arm plates or the oral shields (Fig. 15).

The distal, lateral and/or proximal shape of the arm plate edges are of significance in taxonomy. The plate edges may be concave (curving in), convex (curving out) or straight (Fig. 16).

Most often the lateral arm plates bear arm spines, varying in number, forming a vertical series. The arm spines may be positioned at right angles, or they can be appressed to the arm. The arm spines (Fig. 17) can vary in length and shape and may be tapering, pointed, blunt, clavate or hooked. In addition, the spines can be smooth, serrated, or bear hooks to varying degree.

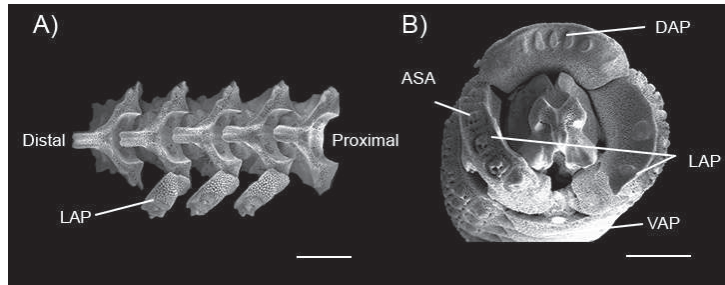
In some cases (except in the girdle hooks of Gorgonacephalidae) arm spines transform into hooks in various forms and number. The terminal or primary tooth is on the distal end of the hook, while the secondary, additional teeth and the lamina of the structure are proximal to the base of the hook or spine (Fig. 18).

Radial shields (dorsal side of the disc) and oral shields (ventral side of the disc) are described in length and width (Fig. 19) and in some cases in colouration and armament (e.g., granules, spines). The distinction between width and length is important for both these skeletal structures.

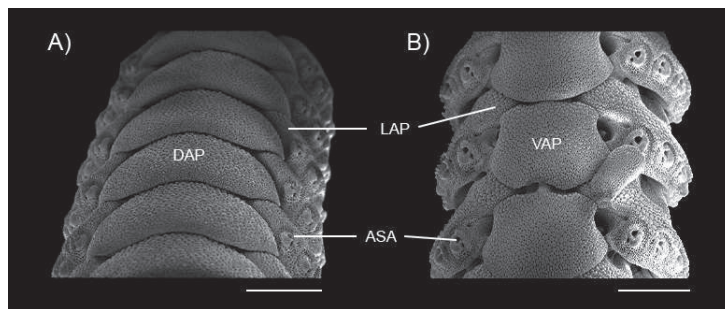
The terminology used for describing the shape and form of various plates, shields and papillae is illustrated in Figure 20.

Various terms used to describe disc armament, arm spines and protrusions are illustrated in Figure 21.

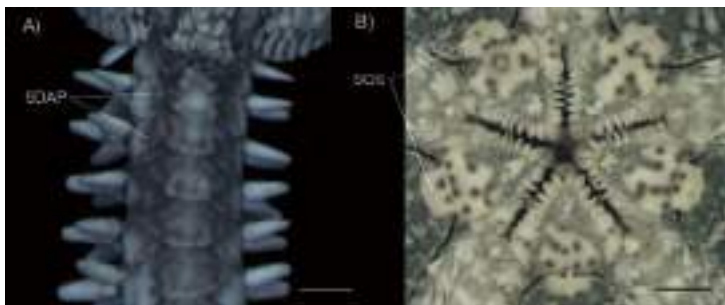
As explained above, the combination of jaw characters are important in distinguishing between many Ophiuroidea families. Table 2 illustrates the position and arrangement of the oral papillae, dental papillae, oral tentacle pores, oral tentacle scales, teeth, oral shields and adoral shields in 26 Ophiuroidea families where the differences are most obvious.



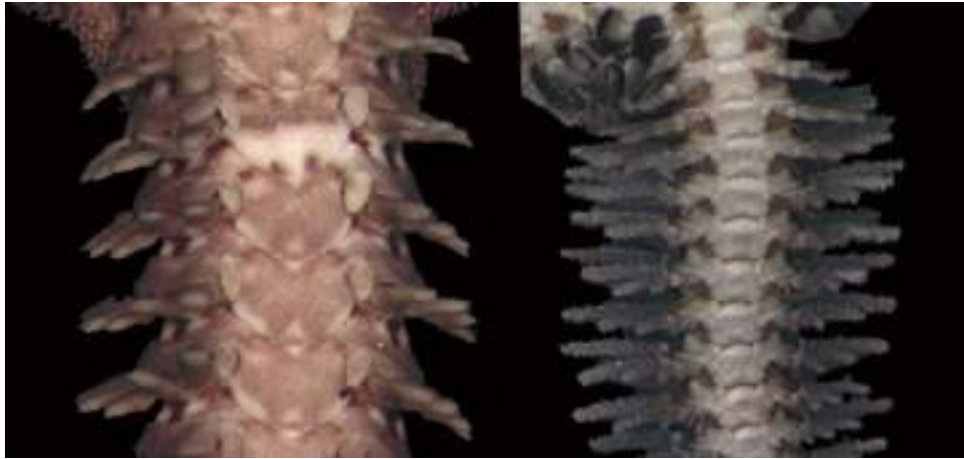
**Fig. 13.** Arm vertebrae of Ophiuroidea. **A.** Series of vertebrae, dorsal view, three lateral arm plates attached (Ophiotrichidae). **B.** Section of arm with arm plates attached around vertebra (*Ophiarachnella* sp.). Abbreviations: ASA = Arm spine articulation; DAP = dorsal arm plate; LAP = lateral arm plate; VAP = ventral arm plate. Scale bars: 1 mm. Photos: Didier VandenSpiegel.



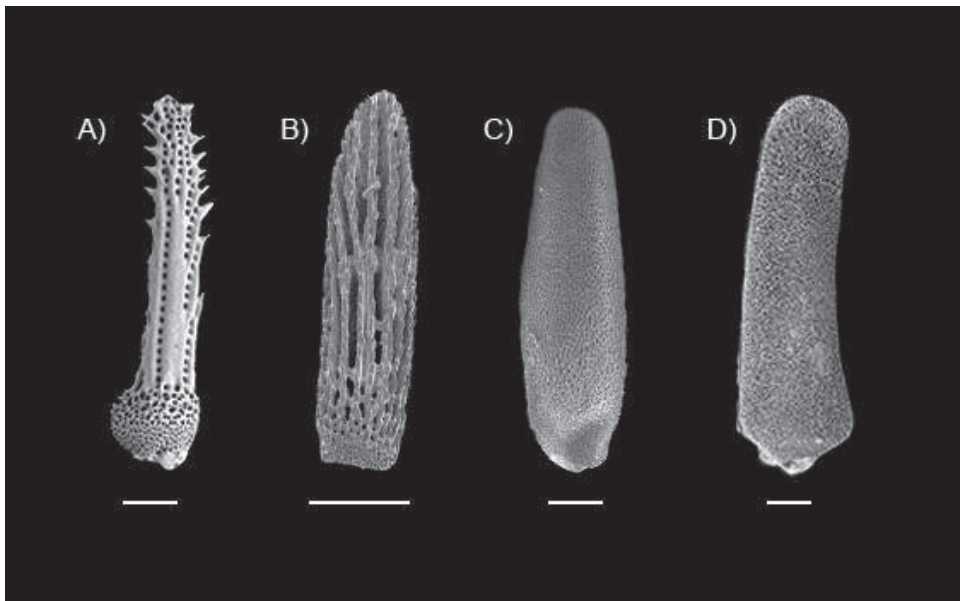
**Fig. 14.** View of dorsal and ventral arm of *Ophirachnella* sp. **A.** Dorsal and lateral arm plates. **B.** Ventral and lateral arm plates. Abbreviations: ASA = Arm spine articulation; DAP = Dorsal arm plates; VAP = Ventral arm plates; LAP = Lateral arm plates. Scale bars: 1 mm. Photos: Didier VandenSpiegel.



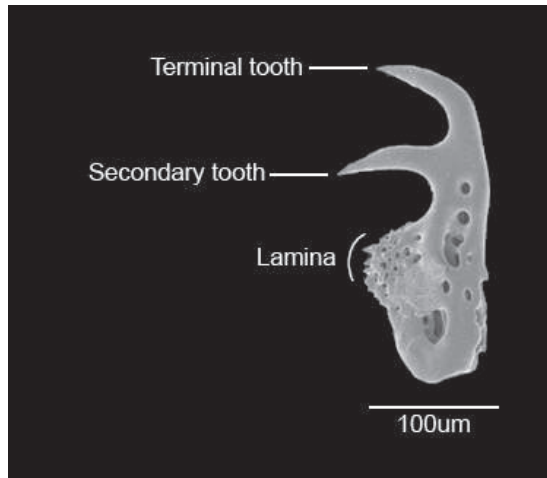
**Fig. 15.** Placement of supplementary plates and shields. **A.** Supplementary dorsal arm plates (*Ophionereis porrecta*) on dorsal arm. **B.** Supplementary oral shields (*Ophiarachnella gorgonia*) adjacent to oral shields. Abbreviations: SDAP = Supplementary dorsal arm plates; SOS = Supplementary oral shields. Scale bars: A = 1 mm; B = 2 mm. Photos: Didier VandenSpiegel.



**Fig. 16.** Section of ventral arms showing arm plate edges which are distally convex (left) and distally concave (right). Photos: Didier VandenSpiegel.



**Fig. 17.** Arm spines illustrating the different forms and shape. Tapering (A, B and C), pointed (A and B), blunt (C, D), cigar (D), smooth (C, D) and serrated (A). **A.** *Macrophiothrix* sp. **B.** *Ophioconis cupida*. **C.** *Ophiocoma* sp. **D.** *Ophionereis* sp. Scale bar: A, C, D = 200  $\mu$ m; B = 50  $\mu$ m. Photos: Didier VandenSpiegel.



**Fig. 18.** Hooked arm spine showing placement of terminal tooth, secondary tooth and lamina. Photo from Okanishi *et al.* (2013).



**Fig. 19.** A pair of radial shields (left) and two jaws with their oral shields (right) illustrating their width and length.

**Table 2.** Representative jaws and key features of South African Ophiuroidea families. Papillae and teeth are colour coded: Yellow: infradental papillae, blue: apical papillae, green: oral papillae, purple: dental papillae, orange: teeth, pink: oral tentacle scales. Illustrations adapted from Mortensen (1933a), Clark & Rowe (1971), Clark & Courtman-Stock (1976) and O'Hara *et al.* (2018).




















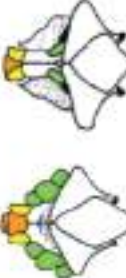


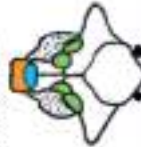

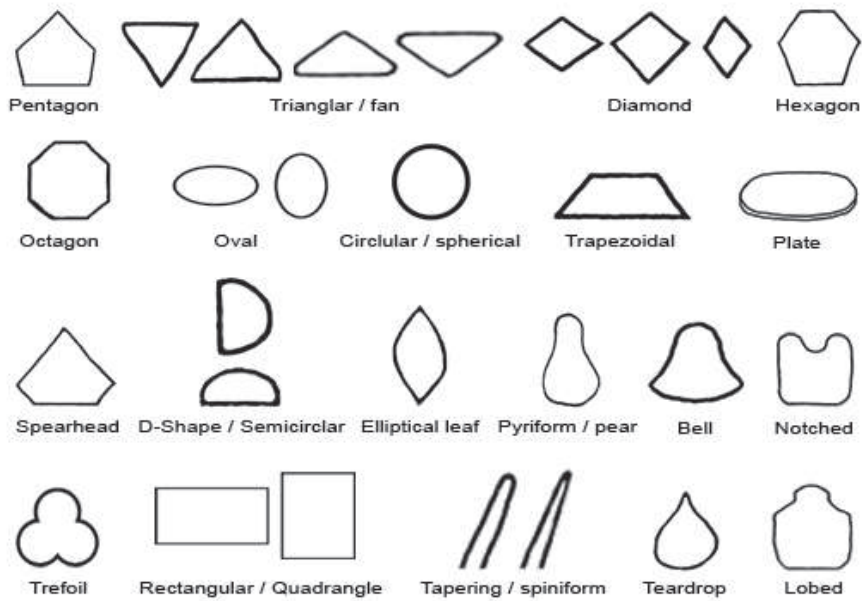
<p><b>Asteronychiidae</b> Multiple columns of spiniform oral papillae.</p> 	<p><b>Euryaliidae</b> Single column of teeth and sometimes some papillae either side which may or may not be considered as true oral papillae.</p> 	<p><b>Gorgonocephalidae</b> Multiple, more or less spiniform, oral papillae in irregular columns.</p> 	<p><b>Ophiomussaidae</b> Oral papillae almost appear fused, structure of each papilla still visible.</p> 
<p><b>Aetrophauridae</b> Single apical papillae with numerous oral papillae either side.</p> 	<p><b>Ophiuridae</b> Numerous oral and apical papillae, oral tentacle scales both sides of second oral tentacle pore, often within series.</p> 	<p><b>Ophiopygidae</b> Oral papillae close together or may appear fused, lowermost tooth distinct or apical papillae present.</p> 	<p><b>Ophiostolebidae</b> Both teeth and oral papillae serrated, may be broad or narrow and appear similar. Oral papillae either side of jaws, teeth apical.</p> 
<p><b>Ophiotomidae</b> Clusters of short oral papillae, sometimes papilliform.</p> 	<p><b>Ophiacanthidae</b> Single pointed apical papilla flanked by three or more oral papillae, often with distalmost papillae being enlarged. Teeth below apical papillae. No clusters.</p> 	<p><b>Ophiodermatidae and Ophiopozidae</b> Teeth not particularly broad, oral papillae in a vertical series along sides of the jaw and, if present, in series with oral tentacle scale towards the distal end.</p> 	<p><b>Ophiomyzidae</b> Both teeth and oral papillae serrated, may be broad or narrow and appear similar. Oral papillae either side of jaws, teeth apical.</p> 

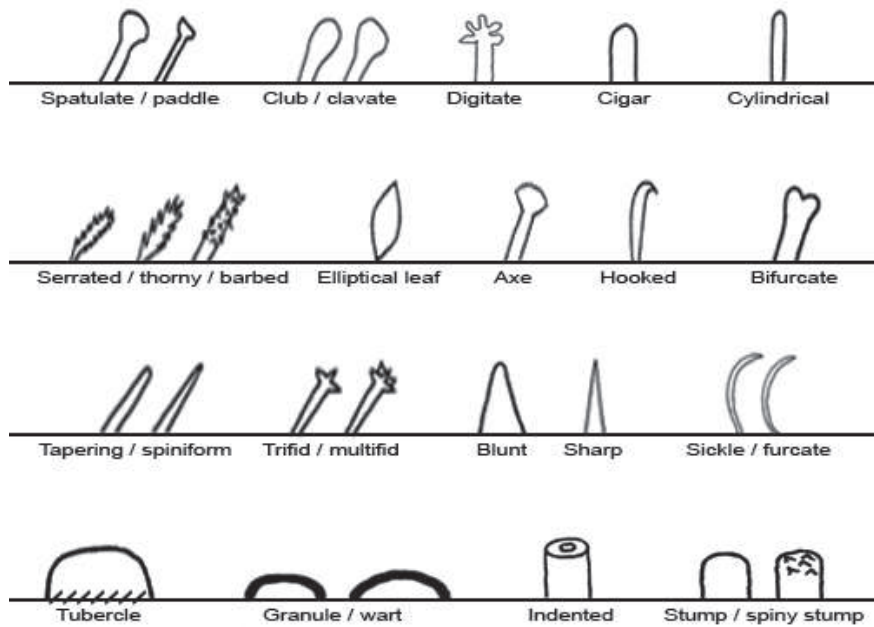


Table 2 (continued).

<p><b>Ophiocomidae</b></p> <p>Teeth broad and square (not illustrated here) with a number of dental papillae and oral papillae present.</p> 	<p><b>Ophiemidae &amp; Ophiocuridae</b></p> <p>Oral papillae may be pointed or opercular. Teeth present, tapering to blunt point.</p> 	<p><b>Ophioplepididae</b></p> <p>Rounded oral papillae with distalmost being broadest and in series with single tentacle scale.</p> 	<p><b>Hemiseuonyalidae</b></p> <p>Oral papillae, distalmost being broadest, remaining papillae elliptical leaf-shaped, apical papillae bluntly pointed. Teeth four, rounded (not illustrated here).</p> 
<p><b>Amphilemidae</b></p> <p>Apical oral papillae asymmetrical, distalmost oral papillae on edge of adoral shield. Teeth single, broad.</p> 	<p><b>Ophiomereididae</b></p> <p>Broad quadrangular teeth blunt angled apices. The four or more oral papillae may be in series or overlap the tentacle scale of second oral pore.</p> 	<p><b>Ophiopalidae</b></p> <p>Oral papillae separated from apical tooth by diastema.</p> 	<p><b>Amphiruridae</b></p> <p>Two infradental papillae spaced apart and symmetrical, teeth may be broad or tapering and flanked by one, two or three oral papillae either side.</p> 
<p><b>Amphilepididae</b></p> <p>Two infradental papillae spaced apart, oral papillae, distalmost elongated and much longer than proximal-most. Teeth triangular and long.</p> 	<p><b>Ophiothamidae</b></p> <p>Numerous oral papillae, distalmost broad and opercular, single large apical papillae.</p> 	<p><b>Ophiacridae</b></p> <p>Single, apical, broad and blunt papillae and broad, rounded or rectangular teeth with a diastema between these and the one or two oral papillae.</p> 	<p><b>Ophiotrichidae</b></p> <p>Cluster of dental papillae superficial to the broad rectangular teeth (not illustrated here) and no oral papillae present.</p> 



**Fig. 20.** Terms describing various shapes of plates, shields and papillae.



**Fig. 21.** Terms describing various disc armament, arm spines and protrusions.

### 3. Key to South African Ophiuroidea

This dichotomous key requires a basic knowledge of ophiuroid taxonomy, which can be gained using the instructions above. Each pair of statements or 'couplet' provides alternate descriptions of some characteristic of the specimen being identified. Choose the statement that closest describes the character of the specimen in question and this leads you to another numbered couplet, where another choice is made, until eventually an identification is arrived at. Reference figures are provided for each species in the main guide and once you have arrived at an identification using the key you should check that the specimen corresponds to the diagnosis and figure of that species in the main guide. It should be noted that this key cannot reliably be used for species found outside South Africa.

A full checklist of all species occurring in South Africa is available at the end of the guide.

1. Disc and arms covered in thick skin .....2  
 – Disc and arms covered in thin skin .....21
2. Arms always simple .....3  
 – Arms branched .....9
3. Skin concealing radial shields .....16  
 – Skin covered but radial shields distinct .....4
4. Radial shields narrow or bar-like .....5  
 – Radial shields broad, may be tapering .....*Asteromorpha capensis* (Fig. 27)
5. Disc and radial shields naked .....*Asteronyx loveni* (Fig. 23)  
 – Disc and radial shields with armament .....6
6. Disc or radial shields armed with low tubercles / granules / warts .....7  
 – Disc or radial shields armed with stumps .....8
7. Disc and arms covered in coarse and fine granules intermixed .....  
 .....*Astrothorax papillatus* (Fig. 45)  
 – Disc and arms covered in low minute granules ...*Asteroschema salix* (Fig. 25)
8. One pair of stumps per arm segment .....*Astroceras spinigerum* (Fig. 31)  
 – More than two stumps per arm segment ...*Asterostegus tuberculatus* (Fig. 29)
9. Madreporites five, deep in interradius ...*Astroglymma cf. sculptum* (Fig. 43)  
 – Madreporites less than five, indistinct ..... 10
10. Oral papillae in distal notches ..... 11  
 – Oral papillae absent in distal notches ..... 13
11. Dorsal arms armed with tubercles .....12  
 – Dorsal arms smooth, with flat platelets .....*Astrocladus africanus* (Fig. 35)

12.	Arm armament fine and smooth .....	<b><i>Astrodendrum capensis</i></b> (Fig. 41)	
–	Arm armament distinct, variable in size surrounded by dark rings .....	<b><i>Astrocladus euryale</i></b> (Fig. 37)	
13.	Arm spines begin after at least second fork .....		14
–	Arm spines begin before first fork .....		15
14.	Belt of hooks complete from fifth fork .....	<b><i>Astrocladus hirtus</i></b> (Fig. 39)	
–	Belt of hooks complete from third fork .....	<b><i>Astroboa nuda</i></b> (Fig. 33)	
15.	Papillae on genital slits in series with papillae of oral area; no gap in tubercles between radial shields and disc ...	<b><i>Gorgonocephalus chilensis</i></b> (Fig. 47)	
–	Papillae on genital slits randomly spaced / placed, distinct gaps in tubercles between radial shields and disc ...	<b><i>Gorgonocephalus pustulatum</i></b> (Fig. 49)	
16.	Oral papillae broad, serrated, flattened .....		17
–	Oral papillae spiniform .....		19
17.	Arm spines slender and serrated .....		18
–	Arm spines long, with lowermost club- or cigar-shaped .....		20
18.	Two arm spines on segments 3–4 .....	<b><i>Ophiomyxa australis</i></b> (Fig. 141)	
–	One arm spine on segments 3–4 ...	<b><i>Ophiomyxa vivipara capensis</i></b> (Fig. 147)	
19.	Second oral tentacle pore outside oral slit .....	<b><i>Ophioscolex inermis</i></b> (Fig. 91)	
–	Second oral tentacle pore inside oral slit .....	<b><i>Ophiolycus dentatus</i></b> (Fig. 89)	
20.	Dorsal arm plates fragmented .....	<b><i>Ophiomyxa tenuispina</i></b> (Fig. 145)	
–	Dorsal arm plates not fragmented .....	<b><i>Ophiomyxa bengalensis</i></b> (Fig. 143)	
21.	Single, pointed apical papilla .....		22
–	No apical papilla, or if present then not pointed .....		37
22.	Radial shields not naked, or only partly naked .....		23
–	Radial shields naked .....		29
23.	Jaws granulated .....	<b><i>Ophiolimna perfida</i></b> (Fig. 109)	
–	Jaws not granulated .....		24
24.	Two tentacle scales distally .....		25
–	One tentacle scale distally .....		26
25.	Disc covered in dense spines only .....	<b><i>Ophiotreta matura</i></b> (Fig. 99)	
–	Disc covered in granules, sometimes with interspersed spines .....	<b><i>Ophiotreta durbanensis</i></b> (Fig. 97)	
26.	Arms moniliform .....	<b><i>Ophiacantha baccata</i></b> (Fig. 101)	
–	Arms not moniliform .....		27

27.	Ventral arm plates fan-shaped .....	28
–	Ventral arm plates pentagonal, distal edge straight .....	
	..... <b>Ophiacantha nerthepsila</b> (Fig. 103)	
28.	Ventral and lateral arm plates with concentric striations .....	
	..... <b>Ophiacantha scutigera</b> (Fig. 105)	
–	All arm plates with concentric striations .....	
	..... <b>Ophiacantha striolata</b> (Fig. 107)	
29.	Dorsal arm plates contiguous on the proximal arm .....	
	..... <b>'Ophiophthalmus' relictus</b> (Fig. 115)	
–	Dorsal arm plates not contiguous proximally .....	30
30.	Ventral interradiar areas with no armament .....	33
–	Ventral interradiar areas with armament (granules, stumps and/or spines)...	31
31.	Oral shields triangular or heart-shaped .....	32
–	Oral shields diamond-shaped, wider than long .....	
	..... <b>Ophiothamnus remotus</b> (Fig. 247)	
32.	Arm spines exceeding segment length, jaws sunken .....	
	..... <b>Ophiomitrella corynephora</b> (Fig. 111)	
–	Arm spines not exceeding segment length, jaws flat .....	
	..... <b>Ophiomitrella hamata</b> (Fig. 113)	
33.	Arm spines four, smooth .....	34
–	Arm spines seven, thorny, lowermost shortest .....	36
34.	Six arms .....	<b>Ophioplinthaca sexradia</b> (Fig. 121)
–	Five arms .....	35
35.	Oral shields spearhead-shaped, with distinct lobe, much wider than long; tentacle scales 5–6, spinose; dorsal arm plates triangular, as long as wide, not contiguous .....	<b>Ophiotoma cf. gracilis</b> (Fig. 95)
–	Oral shields D-shaped with slight lobe; tentacle scales needle-like or round, small if not absent; dorsal arm plates triangular to bell-shaped, twice as wide as long .....	<b>Ophiotoma cf. alberti</b> (Fig. 93)
36.	Disc margin may have scattered spines; radial shields only just contiguous distally if at all; tentacle scales large, flat, pointed .....	
	..... <b>Ophioplinthaca papillosa</b> (Fig. 117)	
–	Disc margin spines absent; radial shields not contiguous; tentacle scales large, thick and pointed .....	<b>Ophioplinthaca rudis</b> (Fig. 119)
37.	Pair of symmetrical papillae at apex of each jaw .....	40
–	Multiple or single apical papillae, rarely two, but if so papillae asymmetrical ...	38
38.	Oral papillae fused, forming a serrated flange .....	
	..... <b>Ophiodaphne scripta</b> (Fig. 241)	
–	Oral papillae not fused .....	39

39. Apical papillae symmetrical, offset laterally ... ***Amphilepis scutata*** (Fig. 245)  
 – Apical papillae may be present, if a pair then asymmetrical .....61
40. Basal arm spines form a flange .....41  
 – Basal arm spines do not form a flange .....42
41. All segments which border genital slits have fused arm spines (except lowest arm spine) forming curved flange on each side of arm .....  
 ..... ***Amphylimna cribriformis*** (Fig. 187)  
 – On first segment, two lowest arm spines each side of arm unmodified, but upper spines flattened and fused, forming curved flange which borders genital slits ..... ***Amphylimna valida*** (Fig. 189)
42. Four oral papillae .....43  
 – One to three oral papillae .....46
43. Four oral papillae with a gap between infradental papillae and second oral papillae revealing second oral tentacle scale, which is in series .....  
 ..... ***Amphioplus (Amphioplus) pectinatus*** (Fig. 203)  
 – Four oral papillae in series, third papilla enlarged and no distinct oral tentacle scale .....44
44. Disc margin with no armament ... ***Amphioplus (Lymanella) integer*** (Fig. 209)  
 – Disc margin vertical with small spines or projections .....45
45. Thirteen disc scales between radial shields .....  
 ..... ***Amphioplus (Lymanella) furcatus*** (Fig. 207)  
 – 9–11 disc scales between radial shields .....  
 ..... ***Amphioplus (Lymanella) depressus*** (Fig. 205)
46. Three oral papillae with a single oral tentacle scale in series, second oral papilla on lower level than other two, third papilla large and broad .....  
 ..... ***Amphioplus (Unioplus) falcatus*** (Fig. 211)  
 – Three oral papillae, outermost very broad and opercular .....47
47. Radial shields narrow, bar-like .....48  
 – Radial shields broad, D-shaped; may be missing dorsal disc 'lid' .....49
48. Three arm spines ..... ***Amphipholis similis*** (Fig. 213)  
 – Four arm spines ..... ***Amphipholis squamata*** (Fig. 215)
49. Ventral disc partially skin covered, with incomplete scaling .....50  
 – Ventral disc fully scaled .....51
50. Six or more arm spines proximally, middle spine with glassy hook; distal oral papillae broad and semicircular ... ***Amphiura (Amphiura) uncinata*** (Fig. 239)  
 – Four or five arm spines proximally, none hooked; distal oral papillae elliptical leaf-like ..... ***Amphiura (Amphiura) albella*** (Fig. 221)

51. Two tentacle scales .....	52
– Tentacle scale single or absent .....	55
52. Tentacles scales moderate to large in size .....	53
Tentacle scales small in size or absent .....	54
53. Tentacle scales very large, ventral arm plates broad pentagonal .....	
..... <b>Amphipholis strata</b> (Fig. 217)	
– Tentacle scales moderate, ventral arm plates truncated pentagonal .....	
..... <b>Amphiura (Amphiura) acutisquama</b> (Fig. 219)	
54. Disc scales coarse and thick; arm spines blunt and flattened .....	
..... <b>Amphiura (Amphiura) incana</b> (Fig. 231)	
– Disc scales moderately coarse; arm spines pointed, some with terminal hook .....	
..... <b>Amphiura (Amphiura) otteri</b> (Fig. 235)	
55. One distal oral papilla, tentacle scales absent or rudimentary .....	
..... <b>Amphiura (Amphiura) atlantica</b> (Fig. 225)	
– One distal oral papilla, single tentacle scale .....	56
56. Tentacle scale oval .....	57
– Tentacle scale pointed, spiniform .....	58
57. Radial shields tapering proximally, may be only just separated distally .....	
..... <b>Amphiura (Amphiura) grandisquama natalensis</b> (Fig. 229)	
– Radial shields contiguous for at least half-length .....	
..... <b>Ophionephtys lowelli</b> (Fig. 243)	
58. At least one arm spine flattened .....	59
– Arm spines stout, blunt, tapering ...	<b>Amphiura (Amphiura) angularis</b> (Fig. 223)
59. Arm spines flattened, second lowest spine conspicuously curved; no more than five arm spines .....	<b>Amphiura (Amphiura) simonsi</b> (Fig. 237)
– Arm spines flattened, more than five arm spines .....	60
60. Radial shields long, narrow, well-separated and almost parallel, more than one-third disc radius, six arm spines ...	<b>Amphiura (Amphiura) linearis</b> (Fig. 233)
– Radial shields longer than wide, diverging and tapering distally, contiguous at distal ends, less than half disc radius; seven arm spines .....	<b>Amphiura (Amphiura) capensis</b> (Fig. 227)
61. Teeth broad and square-tipped, single apical papilla or reduced tooth ...	62
– Teeth broad and square-tipped, rounded or conical, one or many papillae ...	68
62. Disc scaling overlapping and armament absent.....	
..... <b>Histampica duplicata</b> (Fig. 249)	
– Disc with coarse scaling and armament present .....	63

63. One distal oral papilla .....64  
 – Two or three distal oral papillae .....65
64. Oral shields almost circular, as long as wide; fissiparous (usually six arms)  
 .....***Ophiactis plana*** (Fig. 259)  
 – Oral shields diamond-shaped, five arms, not fissiparous, radial shields  
 contiguous distally, ventral arm plates fan-shaped .....  
 .....***Ophiactis carnea*** (Fig. 253)
65. Up to four arm spines .....66  
 – More than four arm spines, usually six .....67
66. Dorsal arm plates diamond-shaped, twice as wide as long, not contiguous  
 distally; not fissiparous .....***Ophiactis abyssicola*** (Fig. 251)  
 – Dorsal arm plates narrow fan-shaped, broadly in contact, longer than wide;  
 fissiparous .....***Ophiactis nidarosiensis*** (Fig. 255)
67. Dorsal arm plates oval, becoming elliptical, rounded distally with median lobe  
 emphasized by two dark spots after first two to three segments; fissiparous,  
 up to seven arms but usually hexamerous .....***Ophiactis savignyi*** (Fig. 261)  
 – Dorsal arm plates oval, becoming elliptical, arms marbled with dark spots;  
 not fissiparous, five long arms .....***Ophiactis* cf. *picteti*** (Fig. 257)
68. No oral papillae, each jaw with cluster of apical dental papillae .....69  
 – Oral papillae present on sides of jaws, apically either a cluster of dental  
 papillae or one or a few larger oral papillae .....84
69. Disc and arms covered in skin, sometimes with granules .....70  
 – Disc scales and arm plates distinct, unless covered in armament such as  
 spines or stumps .....73
70. Arms mostly flexible horizontally; dorsal and ventral arm plates present  
 beneath skin, but dorsal arm plates may be fragmented; longest arm  
 spines easily exceeding segment length .....71  
 – Arms flexible dorso-ventrally; dorsal and ventral arm plates rudimentary/  
 absent; arm spines short, barely exceeding single segment length .....72
71. Dorsal arm plates mostly entire; seven arm spines .....  
 .....***Ophiogymna fulgens*** (Fig. 275)  
 – Dorsal arm plates fragmented; eight arm spines .....  
 .....***Ophiogymna capensis*** (Fig. 273)
72. Fissiparous, usually six arms; armament on disc margin usually more  
 granuliform than spinose .....***Ophiothela danae*** (Fig. 277)  
 – Not fissiparous, usually five arms; disc armament usually includes marginal  
 spines .....***Ophiothela venusta*** (Fig. 279)



73. Radial shields naked, very large, taking up most of dorsal side; narrow interradi al areas and centre of disc scales covered in granules .....  
 .....**Ophiocnemis marmorata** (Fig. 271)  
 – Radial shields may or may not be covered in armament, but usually smaller in area than remainder of disc, which may be covered in spines or stumps ...74
74. Dorsal arm plates wide and broadly contiguous, arms long, 8–20 times D.D .....75  
 – Dorsal arm plates less than twice as long as wide, narrowly in contact, arm length moderate, 4–8 times D.D .....76
75. Radial shields densely covered in stumps or spines .....77  
 – Radial shields naked, or mostly so .....78
76. Disc covered in stumps; colour grey and dark blue or purple, both dorsally and ventrally; dorsal arms with a longitudinal light stripe bordered by two dark blue lines, ventral arms with similar stripe but less conspicuous, radial shields variegated with blue .....**Macrophiothrix hirsuta cheneyi** (Fig. 265)  
 – Only disc margin with stumps; colour pink, purple with patterns on disc, arms banded every three to four segments; radial shields reddish, sometimes with blue patches, distal edge outlined with white, no longitudinal line down arms, arm spines with long thorn near tip ...**Macrophiothrix propinqua** (Fig. 269)
77. Ventral armament not reaching proximal edges of genital slits; dorsal side of disc greyish with more or less conspicuous dark pink spots, ventrally lighter and less spots. Arms banded purple, pink or red with white dorsally and lighter ventrally, with two to three arm segments between bands; may have white longitudinal band from c. half way down arms .....**Macrophiothrix demessa** (Fig. 263)  
 – Ventral armament reaching edges of genital slits; disc dorsally and ventrally blue or purple with blue or purple spots and blotches, radial shields spotted, ventrally similar but lighter, arms banded with white, or spotted with purple .....**Macrophiothrix longipeda** (Fig. 267)
78. Arms marked with one or more longitudinal lines running down arms .....79  
 – Arms patterned, but not with longitudinal lines .....81
79. Arms with either faint white longitudinal line, or light line with two darker lines either side .....80  
 – Arms with single thin dark longitudinal line along length of arm both dorsally and ventrally, dorsal arm plates with some lateral whitish patches .....**Ophiiothrix (Acanthophiothrix) purpurea** (Fig. 283)
80. Dorsal arm plates hexagonal or fan-shaped, wider than long; colour brownish green with yellow or white line bordered by two dark lines of dark purple or green, longitudinal white stripe along entire length of arm with two darker lines either side .....**Ophiiothrix (Acanthophiothrix) proteus** (Fig. 281)

- Dorsal arm plates fan, rhomboidal or diamond-shaped, distal side strongly convex, equally wide as long or slightly wider; colour grey, red, pink, arms similar, light white longitudinal line, sometimes bordered by pink or red striped .....**Ophiothrix (Ophiothrix) aristulata** (Fig. 285)
- 81. Dorsal arm plates armed with single short rugose stump between successive dorsal arm plates .....**Ophiothrix (Ophiothrix) echinotecta** (Fig. 287)
  - No stump between successive dorsal arm plates .....82
- 82. Disc and radial shields patterned with dark purple lines and pinkish patches with adradial edges of radial shields accentuated with dark lines, arms not banded .....**Ophiothrix (Ophiothrix) foveolata** (Fig. 289)
  - No linear patterns on disc or radial shields, arms banded and often with dots associated with dorsal arm plates .....83
- 83. Spines and stumps intermixed on disc .....**Ophiothrix fragilis** (Fig. 291)
  - Spines and stumps not intermixed on disc .....  
.....**Ophiothrix fragilis** var. **triglochis** (Fig. 293)
- 84. Both oral and dental papillae present .....85
  - Only oral papillae present, usually only single apical papilla below teeth, but sometimes two or three .....97
- 85. Two tentacle scales, beyond basal arm tentacle scale/s elongated or sword-like, aligned obliquely across ventral arm plate, forming a cross with corresponding tentacle scale .....86
  - One or two tentacle scales, both oval .....87
- 86. Only inner tentacle scale spiniform, distal oral papillae small, papilliform with rounded tips .....**Ophiopsila seminuda** (Fig. 201)
  - Both tentacle scales spiniform, distal oral papillae also spiniform .....  
.....**Ophiopsila bispinosa** (Fig. 199)
- 87. Five arms, not fissiparous .....88
  - Six arms, fissiparous .....**Ophiocomella sexradia** (Fig. 169)
- 88. Disc covered at least dorsally with dense granules .....89
  - Disc smooth or with granules and spines, upper arm spines club / clavate in shape .....96
- 89. One tentacle scale .....**Ophiocomella valenciae** (Fig. 171)
  - Two tentacle scales .....90
- 90. On one to three consecutive segments at about one–third of length of arm, uppermost arm spine enlarged or clavate ...**Breviturma pusilla** (Fig. 163)
  - Uppermost arm spines one–third of the length along arm, not enlarged ...91

91. Disc dark with radiating golden lines<sup>1</sup> ..... ***Breviturma pica*** (Fig. 161)  
 – Disc light and mottled, uniformly dark, or with spots or speckles .....92
92. Disc light with patterns / mottles of greens, whites, yellows, similar number of arm spines on each arm segment ..... ***Breviturma brevipes*** (Fig. 155)  
 – Disc brown/dark in colour .....93
93. Disc with speckles/spots .....94  
 – Disc uniformly dark above and below, tube feet red, white when preserved ...  
 ..... ***Ophiocoma erinaceus*** (Fig. 165)
94. Arm spine annulation very faint, if at all ..... ***Breviturma dentata*** (Fig. 157)  
 – Arm spine annulation strong / broken if present .....95
95. Colour greyish brown dorsally and ventrally, either with fine black reticulating lines, white-ringed black spots, or speckled with light spots; two or three tentacle scales along arms ..... ***Breviturma doederleini*** (Fig. 159)  
 – Colour broken or uniform brown; two oval tentacle scales .....  
 ..... ***Ophiocoma scolopendrina*** (Fig. 167)
96. Arm spines 3–4, spines annulated; disc uniformly dark .....  
 ..... ***Ophiomastix koehleri*** (Fig. 173)  
 – Arm spines 2–4, dark longitudinal lines on spines, disc light brown with radiating lines ..... ***Ophiomastix venosa*** (Fig. 175)
97. Arms inserted below disc, arm spines rarely much shorter than segment, projecting sideways from arm, pair of supplementary dorsal arm plates present .....98  
 – Arms fused to disc edge, arm spines usually shorter than segment and usually appressed to arm, but may be long and outstanding, supplementary dorsal arm plates only present if arm spines short and appressed to arms ..... 101
98. Genital papillae absent .....99  
 – Genital papillae present ..... 100
99. Colour pattern reticulated with a well-marked 'V' or 'Y' opposite base of each arm; supplementary dorsal arm plates triangular, length of dorsal arm plate becoming smaller distally ..... ***Ophionereis dubia dubia*** (Fig. 193)  
 – Disc white with large reddish-brown dense spot or star in middle of disc; supplementary dorsal arm plates large ... ***Ophionereis vivipara*** (Fig. 197)
100. Supplementary dorsal arm plates small and only well-developed on proximal part of arms; disc scales coarse, subequal ... ***Ophionereis australis*** (Fig. 191)  
 – Supplementary dorsal arm plates well-developed for most of arm, interradial disc scales distinctly smaller than radial and marginal plates ...  
 ..... ***Ophionereis porrecta*** (Fig. 195)

<sup>1</sup> Some species of *Breviturma* have a different night and day colouration (Hendler 1984)

101. Disc densely granulated, including jaws and sometimes including oral shields and adoral shields .....	102
– Disc scales naked and most often distinct .....	113
102. Oral shields mostly covered in granules .....	103
– Oral shields naked .....	106
103. One tentacle scale .....	104
– Two or three tentacle scales .....	105
104. Teeth wide with hyaline edges; disc concealed by granules, no granules on basal arm segments .....	<b><i>Ophioconis cupida</i></b> (Fig. 149)
– Teeth pointed, no hyaline edges; disc concealed by granules, granules extending onto basal arm segments .....	<b><i>Cryptopelta aster</i></b> (Fig. 123)
105. Disc covered in granulation and spinelets; arm spines all shorter than one segment length; tentacle scales two proximally, one along most of arm .....	<b><i>Ophiochaeta hirsuta</i></b> (Fig. 135)
– Disc covered in granulation; arm spines less than half segment length; tentacle scales three basally, two distally.....	<b><i>Ophiodyscrita acosmeta</i></b> (Fig. 125)
106. Genital slits single (two in each interradius) .....	107
– Genital slits two (four in each interradius) .....	<b><i>Ophioderma wahlbergii</i></b> (Fig. 133)
107. Radial shields naked .....	108
– Radial shields covered in armament .....	111
108. Oral shields and supplementary oral shields naked; radial shields moderate to small .....	109
– Oral shields and supplementary oral shields concealed by granules, easily rubbed off; radial shields very large .....	<b><i>Ophiochasma nitida</i></b> (Fig. 131)
109. Arm spines same length as segment except lowermost, which is twice as long as segment; colour bright red .....	<b><i>Ophiarachna septemspinosa</i></b> (Fig. 153)
– Arm spines short, no longer than half segment length, colour combination of browns, greens and / or whites .....	110
110. Arm spines conical, with lowermost shorter than half segment length, colour irregular patterns of browns, sometimes with irregular dark spot or blotch in middle of disc .....	<b><i>Ophiarachnella capensis</i></b> (Fig. 127)
– Arm spines tapering, all half segment length; colour greens, greys and whites ...	<b><i>Ophiarachnella gorgonia</i></b> (Fig. 129)
111. Arm spines long and flaring, all exceeding segment length .....	<b><i>Ophiarachna affinis</i></b> (Fig. 151)
– Arm spine length never exceeding segment length .....	112

112. Marginal plates enlarged, few but large, supplementary oral shields covered in granules ..... ***Ophiopeza fallax fallax*** (Fig. 137)
- Marginal plates enlarged, many but small, supplementary oral shields not covered by granules ..... ***Ophiopeza spinosa*** (Fig. 139)
113. Oral slits generally tightly closed, oral papillae not in continuous series with oral tentacle scales, no true tentacle scales, disc scales thick ..... 114
- Oral slits may be closed, oral papillae in continuous series with oral tentacle scales, disc scaling usually distinct, but not necessarily thick ..... 118
114. Disc scales smooth or tumid, low granules, oral papillae not fused ..... 115
- Disc scales smooth, oral papillae fused ..... 116
115. Dorsal interradial area covered by a single scale, many scales of various sizes on remainder of dorsal disc, low and tumid tubercles present on disc ...  
..... ***Ophiomusa lymani*** (Fig. 51)
- Dorsal interradial area with many scales, disc scales naked ..... 117
116. Dorsal interradial area covered by a single scale, but remainder of disc with many scales of various sizes, three arm spines, one separated from other two ..... ***Anophiura simplex*** (Fig. 75)
- Dorsal interradial margin covered by a single scale with remainder of dorsal disc scales few and of similar size; three arm spines, equally spaced  
..... ***Aspidophiura corone*** (Fig. 77)
117. Disc scales surrounded by smaller scales both dorsally and ventrally, colour pink to brown, irregularly marbled with grey, white or silver patches .....  
..... ***Ophiolepis cincta cincta*** (Fig. 183)
- Disc scales naked, imbricating, colour dark green or grey with irregular patterns and patches on dorsal disc conforming to interradial areas .....  
..... ***Ophioplocus imbricatus*** (Fig. 185)
118. Disc extending into flat pentagon, lateral arm plates extremely modified, interradial edges straight, fringed by modified arm plates, free arm segments very reduced ..... ***Astrophiura permira*** (Fig. 53)
- Disc not extending beyond normal limits, no modification to lateral arm plates or arm spines, free arm segments not reduced ..... 119
119. Disc scaled, granules at least on disc margin or on jaws ..... 120
- Disc scaled, granules absent ..... 122
120. Oral shields huge, reaching into ventral interradial area, disc with granules and jaws with scattered granules ..... ***Ophiopallas paradoxa*** (Fig. 181)
- Oral shields not extending into interradial area, disc margin with scattered granules, usually extending onto radial shields, no granules on jaws ..... 121

121. Arm spines three, longest spine as long as ventral arm plate, but others shorter than segment; bristles present on lateral arm plates ..... ***Ophiernus vallincola*** (Fig. 179)
- Arm spines four, shorter than segment, decreasing distally; no bristles on lateral arm plates ..... ***Ophiernus quadrispinus*** (Fig. 177)
122. Single tentacle scale, tentacle pores stopping abruptly after first 2–5 arm segments; oral papillae two, fused each side of triangular apical papillae ..... ***Ophiomisidium pulchellum*** (Fig. 55)
- One or more tentacle scales on basal pores, but often only one along arms; oral papillae three or more, not fused ..... 123
123. Oral shield distal lobe not well-developed or enlarged; three (*Ophiura kinbergi* only) or five or more tentacle scales on second oral pore ..... 128
- Oral shield distal lobe well-developed; one to three tentacle scales on second oral pore if present ..... 124
124. Arm spines short, none more than one-third segment length ..... 125
- Arm spines with at least one exceeding segment length ..... 126
125. Dorsal arm plates fan-shaped with rounded distal edge, contiguous, up to six arm spines, subequal, short and blunt ... ***Amphiophiura sculptilis*** (Fig. 71)
- Dorsal arm plates bell-shaped, twice as long as wide proximally, first 4–5 plates contiguous, arm spines no more than three, one spine (usually uppermost) becoming hooked ..... ***Amphiophiura trifolium*** (Fig. 73)
126. Three arm spines, uppermost spine exceeding segment length ..... 127
- Three arm spines, uppermost two spines exceeding segment length ..... ***Ophiocten affinis simulans*** (Fig. 57)
127. Uppermost spine usually thicker than other two spines ..... ***Ophiocten hastatum*** (Fig. 61)
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128. Radial shields contiguous, double arm combs ..... ***Dictenophiura anoidea*** (Fig. 69)
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129. Uppermost arm spines much longer and stouter than others, exceeding segment length, dorsal arm plates oval and small ... ***Ophiura trimeni*** (Fig. 67)
- Arm spines similar, longest spines not longer than segment ..... 130
130. Three arm spines, middle spine becoming upturned hook on distal segments; genital papillae squat and broad ..... 131
- Three arm spines, all similar, genital papillae small and tapering ..... 134

131. Disc scales large, few interstitial scales .....132  
 – Disc scales medium or small, many interstitial scales .....133
132. Arm combs separated radially by more than half width of first free arm segment, disc scales not convex and dorsal arm plates almost flat in profile and contiguous.....***Ophiuroglypha costata*** (Fig. 79)  
 – Arm combs approximating mid–radially, larger disc and dorsal arm plates not contiguous, swollen and convex in side view .....  
 .....***Ophiuroglypha tumida*** (Fig. 81)
133. Arm combs present but not distinct, widely separated, papillae stout and short, disc scales small, many and irregular, supplementary ventral arm plate present on basal segments .....  
 .....***Ophiuroglypha irrorata irrorata*** (Fig. 83)  
 – Arm combs not widely separated, distinct, papillae large, square; disc scales thick, medium-sized, irregular .....***Ophiuroglypha schmidtotti*** (Fig. 85)
134. Deep hollows between basal ventral arm plates ...***Ophiura kinbergi*** (Fig. 63)  
 – No hollows between basal ventral arm plates .....135
135. Radial shields almost half disc radius, not widely separated, small spines on disc, small in size .....***Ophiura ljunmani*** (Fig. 65)  
 – Radial shields small, oval, partly covered by disc scales, widely separated, no discspines, large in size .....‘***Ophiura flagellata*** (Fig. 87)





## 4. Taxonomic account

Phylum ECHINODERMATA Bruguière, 1791 (ex Klein, 1734)

Class OPHIUROIDEA Gray, 1840

### 4.1. Order EURYALIDA Lamarck, 1816

#### 4.1.1. Family ASTERONYCHIDAE Ljungman, 1867

Genus *Asteronyx* Müller & Troschel, 1842

**Diagnosis** – Adapted from Müller & Troschel (1842) and McKnight (2000). Arms simple, covered in naked skin. Dorsal disc covered with naked skin, arm spines more than three, usually modified as simple hooklets. Oral papillae spiniform.

*Asteronyx loveni* Müller & Troschel, 1842

*Asteronyx loveni* Müller & Troschel, 1842: 119-120, pl. 10, figs 3-5; Bell 1892: 136-137; Koehler 1907: 348; Clark 1913: 219; Clark 1915a: 180; Clark 1923: 314-315; Döderlein 1927: 59, 97, pl. 7, figs 7, 8; Mortensen 1927: 158-160; Mortensen 1933a: 300-301; Clark A.M. 1952: 199, 212; Clark & Courtman-Stock 1976: 100, 108, 129; Baker 1980: 12, 16-18, figs 2, 3 (upper); Paterson 1985: 13-15, fig. 9a-d; Alva & Vadon 1989: 828-831, fig. 1a, b; Liao & Clark 1995: 165-166, fig. 71; McKnight 2000: 8, 13-15, pl. 1; Laguarda-Figueras *et al.* 2009: 46, fig. 5.

*Ophiuropsis lymani* Studer 1885: 55-46, pl. 5, fig. 12a-d; Clark 1913: 213; Clark 1915a: 180; Clark 1923: 315, pl. 5, fig. 12a-d; Döderlein 1930: 389, pl. 2, figs 11, 11a.

*Asteronyx locardi* Koehler 1895: 470-471, fig. 10; Koehler 1907: 348.

*Asteronyx Cooperi* Bell 1909: 22.

*Asteronyx dispar* Lütken & Mortensen 1899: 185, pl. 21, figs 1, 2, pl. 22, figs 10-12; Koehler 1907:348; Clark 1913: 218-219; Clark 1915a: 180.

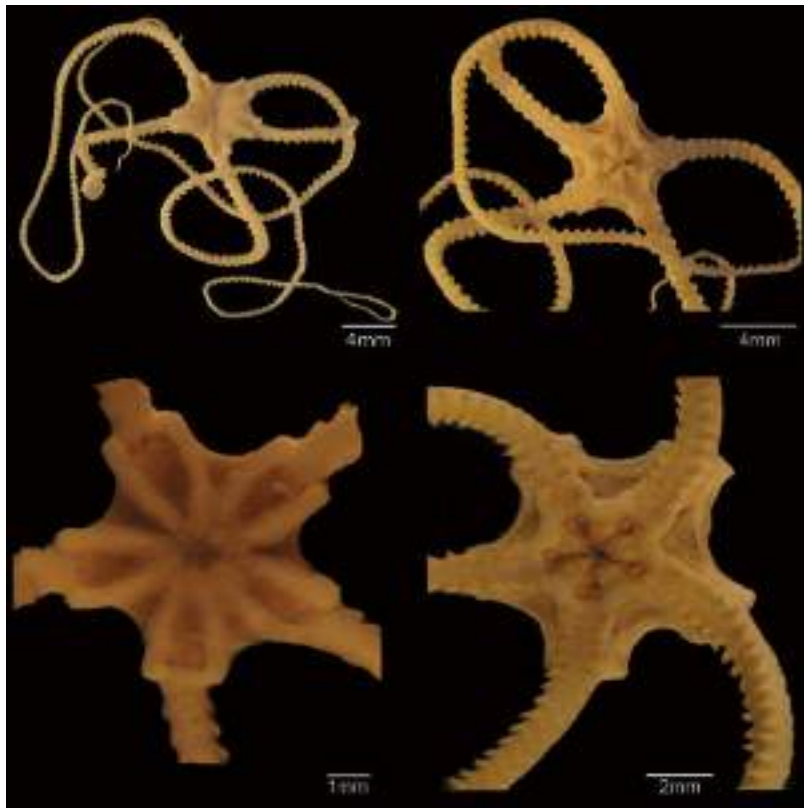
*Ophiuraster patersoni* Litvinova 1998: 441-444, fig. 3.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 20 mm. Disc inflated, pentagonal in shape, rounded margin. Disc and arms covered with naked skin. Radial shields narrow, smooth, almost meeting at centre of disc. Ventral disc sometimes with irregular plates. Oral shields seldom distinct, small or lacking in larger specimens, proximal margin bluntly pointed while distal margin rounded. Oral papillae on lateral side and apex of jaw, irregular, numerous, blunt. Teeth pointed, sometimes in single or multiple vertical series. Arms flexible dorso-ventrally, unequal in length, c. 10 times D.D. No dorsal arm plates, vertebrae distinct. Ventral arm plates small, square to rectangular with rounded corners, but obscured by skin. Lateral arm plates large. Arm spines 3-9, hook-shaped, lowest arm spine largest, long, club-shaped, thorny. Genital slits short, c. single segment length, lying well within ventral interradial area. No tentacle scales on first pair of pores. Madreporite distinct. Colour in life red.

**Distribution and habitat** – Almost cosmopolitan, Indian Ocean, discontinuous in Pacific and Atlantic Oceans (Rowe & Gates 1995; McKnight 2000), South Africa: Orange River (NC) to Cape Town (WC); depth range: 62-4721 m. Habitat: mud and sand, associated with gorgonians and pennatulids.



**Fig. 22.** Distribution of *Asteronyx loveni* in South Africa.



**Fig. 23.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), ventral disc (bottom right) views of *Asteronyx loveni* (SAMC A22013).

**Remarks** – Known to cling to pennatulids and gorgonians (Mortensen 1927; Hyman 1955). Clark (1923) reported that the only difference between the southern African form and the northern form are that the oral papillae are shorter, flatter and more regularly arranged in the southern African form. Genetic data indicates that this is a species complex and there could be more than one species of *Asteronyx* from South Africa. *Asteronyx luzonicus* has been recorded from southern Mozambique (Baker *et al.* 2018).

Syntypes are in the Swedish Museum of Natural History, SMNH Type-3288 (Finnmark); SMNH Type-3732 (Kattegat); SMNH Type-3287 (Kattegat; south west Sweden as 'Bohuslän, Norway as far as Hammerfäst') (Stöhr 2007c), Bay of Biscay (Clark & Courtman-Stock 1976).

#### 4.1.2. Family EURYALIDAE Gray, 1840

##### Genus *Asteroschema* Oersted & Lütken, 1856

**Diagnosis** – Adapted from Oersted & Lütken (1856); McKnight (2000) and Okanishi *et al.* (2011a). Disc covered in skin with embedded platelets or ossicles, being either granule-shaped and slightly in contact or cone-shaped and completely in contact. Radial shields covered by tubercles or naked distally. Arms simple with ability to coil. Ventral arm plate on middle to distal part of arms absent. Lateral arm plates large, contiguous ventrally. Longest arm spines twice as long as corresponding arm segment. Gonads extend into arms.

##### *Asteroschema salix* Lyman, 1879

*Asteroschema salix* Lyman, 1879: 66-67, pl. 17, figs 466-469; Baker 1980: 23-24; McKnight 2000: 21, 22. pl. 6, fig. 7; Olbers *et al.* 2015: 85, pl.1A, B.

**Diagnosis** – Adapted from Lyman (1879), McKnight (2000) and Olbers *et al.* (2015). D.D. up to 10 mm. Disc round, indented interradially, lateral interradiation surface almost vertical, body surface covered with skin covered platelets with rounded granules. Radial shields elongated, narrow, raised, covered in plates, converging and almost meeting at centre of disc. Oral shields absent, adoral shields indistinct. Jaws covered by minute granules. Teeth seven, broad, triangular, lowermost appearing to be paired. Genital slits short, wide. Arms five, slender, flexible dorso-ventrally, narrow, higher than wide. No arm spines from first pair of tentacle pores to segment 15, then two arm spines, one slightly smaller. Arm spines short, innermost longest and cigar-shaped, finely serrated. Colour in life pink.

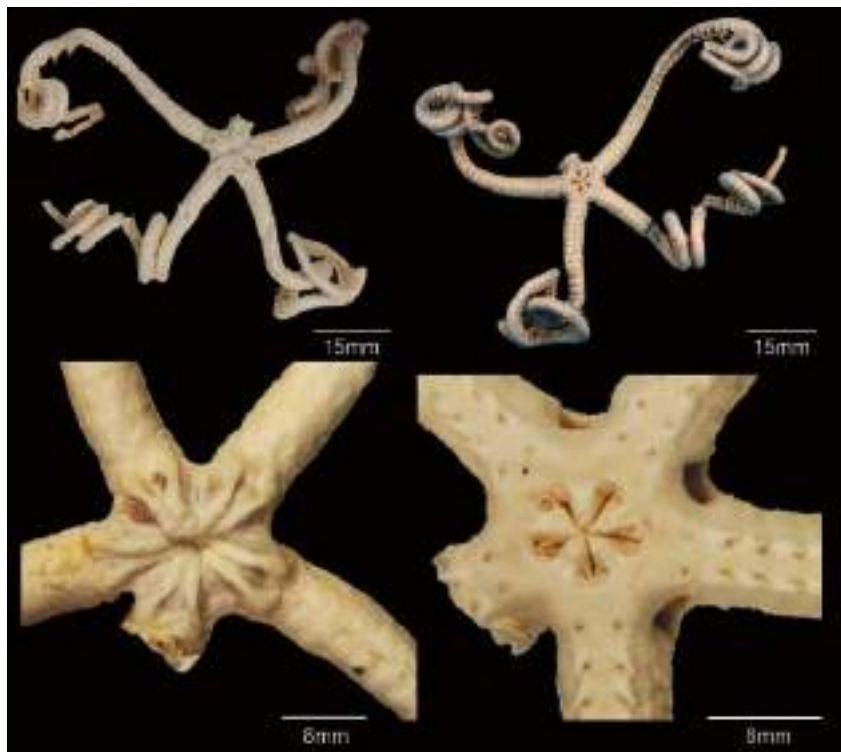
**Distribution and habitat** – New Zealand (McKnight 2000), South Africa: off Glenmore (KZN); depth range 341-1800 m. Habitat: no habitat details recorded.

**Remarks** – Recorded as new record to South Africa by Olbers *et al.* (2015). Single specimen recorded off KZN south coast, previously only known from New Zealand

and thus a noteworthy range extension into the Indian Ocean. According to Baker (1980), type locality is West of Raoul Island, Kermadecs, depth 1152 m. Holotype is in the Natural History Museum, London (NHMUK 82.12.23.271B) but was not located.



**Fig. 24.** Distribution of *Asteroschema salix* in South Africa.



**Fig. 25.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), ventral disc (bottom right) views of *Asteroschema salix* (SAMC A28143).

## Genus *Asteromorpha* Lütken, 1869

**Diagnosis** – Adapted from Lütken (1869) and Okanishi *et al.* (2013). Disc with skin covered ossicles, either plate-shaped (in full contact) or granule-shaped (partly in contact). Radial shields may have large domed tubercles. Teeth triangular or square. Oral papillae domed, granule-shaped. Vertebrae with oral bridge. Lamina of distal arm spines smooth. Tentacle pores with two arm spines from fourth (rarely fifth) arm segment.

### *Asteromorpha capensis* (Mortensen, 1925)

*Astroschema capensis* Mortensen, 1925: 152-155, pl. 8, figs 4-5, text-fig. 5; Mortensen 1933a: 221, 227.

*Astroschema capensis*: Clark & Courtman-Stock 1976: 100, 108, 130; Sink *et al.* 2006: 469-470.

*Astroschema capense*: Okanishi & Fujita 2009: 116, 119, 123, 125; Okanishi & Fujita 2011: 149 (*lapsus calami*).

*Asteromorpha capensis* Okanishi *et al.* 2013: 462-467, figs 2-5; Olbers *et al.* 2014: 14, pl. 1F; Baker *et al.* 2018: 4-5.

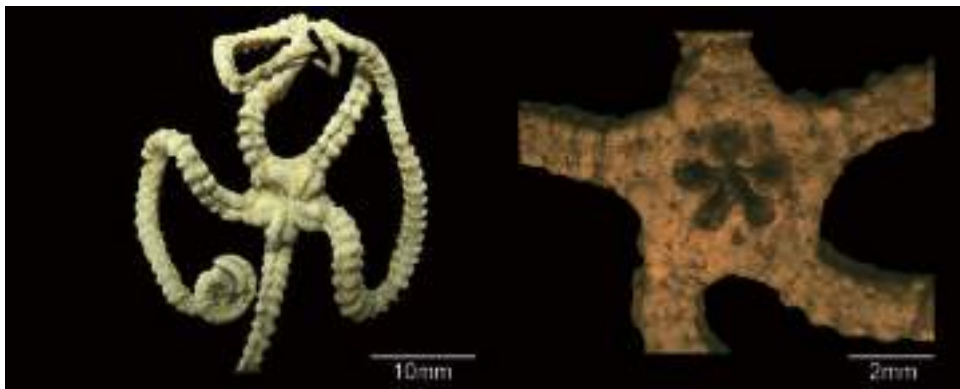
**Diagnosis** – Adapted from Okanishi *et al.* (2013). D.D. up to 8 mm; dorsal disc with skin covered ossicles, plate-shaped, polygonal, tessellated. Lateral interradiial surface almost vertical. Radial shields tumid, with skin covered ossicles, almost meeting at centre of disc. Arms five, simple, flexible dorso-ventrally, no regular transverse rows of skin covered ossicles on dorsal and lateral surface, furrow to at least mid-arm. First to third tentacle pores lack arm spines, fourth pair with one spine, from fifth pair, two spines. Oral papillae 6-7, domed. Teeth 4-6, broad, triangular. Oral shields and adoral shields indistinct. Genital slits broad. Colour in life reddish purple with creamy white spots on dorsal disc, white bands on dorsal and lateral surface of the arms, or body light brown dorsally and white ventrally.

**Distribution and habitat** – Mozambique, Madagascar, Somalia (Okanishi *et al.* 2013), South Africa: Umvoti River (KZN) to Sodwana Bay (KZN); depth range: 64-500 m. Habitat: rock, epizoic on gorgonians and other anthozoans. Sodwana Bay specimens associated with the gorgonian *Nicella dichotoma* (Sink *et al.* 2006).



Fig. 26. Distribution of *Asteromorpha capensis* in South Africa.

**Remarks** – The holotype of *Astroschema capensis* has an oral bridge on the ventral side of the vertebrae on the distal portion of the arms, as well as two arm spines from the fifth arm segment. These morphological features confirm an affiliation with the Euryalinae (Mortensen 1933e; Okanishi & Fujita 2011; Okanishi *et al.* 2013). In addition, the disc and arms are covered mostly by skin covered ossicles, with the distal arm spines having a smooth basal lamina. These features required this species to be transferred to the genus *Asteromorpha* of the family Euryalidae (Okanishi *et al.* 2013). The holotype (examined), is in the Durban Natural Science Museum, as *Astroschema capensis* (DNSM ECH1). It is from 18-20 miles off Umvoti River Mouth, South Africa, depth 64-73 m.



**Fig. 27.** Dorsal (left) and ventral (right) views of *Asteromorpha capensis* (DNSM ECH1).

### Genus *Asterostegus* Mortensen, 1933

**Diagnosis** – Adapted from Mortensen (1933a) and Okanishi & Fujita (2014). Arms simple, flexible dorso-ventrally, covered in tubercles dorsally. Radial shields covered in tubercles. Teeth present, triangular. Oral papillae domed, minute. Ventral interradial area with plates on distal side of adoral shields. Arm spines present from fourth arm segment. Vertebrae with oral bridge. Lamina of distal arm spines smooth.

### *Asterostegus tuberculatus* Mortensen, 1933

*Asterostegus tuberculatus* Mortensen, 1933a: 298-300, figs 24-26; Clark & Courtman-Stock 1976: 100, 108, 128, figs 87, 96; Okanishi & Fujita 2013: 568, 572, 575, fig. 1; Okanishi & Fujita 2014: 1, 3-4, 12-17, figs 7-10.

**Diagnosis** – Adapted from Mortensen (1933a) and Okanishi & Fujita (2014). D.D. up to 23 mm. Disc round, slightly notched interradially, covered in skin with stumps that are granule-shaped in centre and club-shaped on disc margin. Radial shields narrow, covered in skin and stumps. Arms five, simple, flexible dorso-ventrally.

Dorsal arm plates indistinct, proximal lateral arm plates narrow with 2-3 club-shaped stumps. Ventral arm plates more distinct, 4-5 ossicles on each segment, decreasing in size distally, absent at arm tips. Proximal lateral arm plates with 2-3 stumps. Arm spines two from fourth pore, ovoid and small proximally, club-shaped at mid-arm and hook-shaped with smooth lamina on distal side. Oral shields small, not distinct, adoral shields large, hexagonal. 5-8 interradial plates forming two rows between disc margin and adoral shields. Jaws short, single vertical series of well-spaced spearhead-shaped teeth. Oral papillae 6-7, dome-shaped. Lateral interradial surface almost vertical. Madreporite one. Colour in life unknown.

**Distribution and habitat** – Reunion (Okanishi & Fujita 2014), South Africa: Durban (KZN); depth range: 382-500 m. Habitat: no notes recorded.

**Remarks** – No specimen was found or examined in the South African collections. According to Mortensen (1933a) and Clark & Courtman-Stock (1976) only a single specimen is known from the region (Natural History Museum of Denmark, holotype ZMUC OPH-307); off Durban, 382 m. Okanishi & Fujita (2014) later redescribed *A. tuberculatus* based on a specimen found off the west coast of Reunion at 500 m, in the Swedish Museum of Natural History (SMNH-123461). *Asterostegus* is similar to *Astroceras* but with a stronger and more robust skeleton.



Fig. 28. Distribution of *Asterostegus tuberculatus* in South Africa.



Fig. 29. Dorsal (left) and ventral (right) views of *Asterostegus tuberculatus* (ZMUC OPH-307).

Genus ***Astroceras*** Lyman, 1879

**Diagnosis** – Adapted from Lyman (1879), Clark & Courtman-Stock (1976) and McKnight (2000). Body covered in smooth skin. Disc naked or with spines or tubercles. Arms simple, flexible dorso-ventrally, scattered tubercles or spines on dorsal lateral ridge of arms. Radial shields narrow, tall, almost meeting in centre of disc, containing spines, tubercles or naked. Genital slits two, gonads ribbon-like extend into base of each arm. No true oral papillae but a clump of tubercles on lateral sides of jaws giving appearance of oral papillae. Teeth broad, triangular.

***Astroceras spinigerum*** Mortensen, 1933

*Astroceras spinigerum* Mortensen, 1933a: 296-297, fig. 23, pl. 28 figs 8, 9; Clark & Courtman-Stock 1976: 100, 111, 128-129, fig. 94.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 13 mm. Radial shields narrow, rib-like with 3-5 thick, cylindrical, smooth spines, outermost largest, tips rugose. Disc margin with scattered stumps, remainder of disc naked. Oral papillae small, warty. Infradental oral papillae slightly larger and elongated than oral papillae. Teeth five, conical, elliptical leaf-shaped. Adoral shields short, square. Oral shields rudimentary or absent. Arms simple, moderate in length, flexible dorso-ventrally, spines from radial shields continue down arms becoming smaller distally, one pair per segment. Dorsal arm plates indistinct. Ventral arm plates small, not contiguous. Lateral arm plates meeting on ventral side between ventral arm plates. Arm spines two from second pair of pores, short, cylindrical with thorny tip, hooked distally. Colour in life uniform greyish-brown.

**Distribution and habitat** – Mozambique (Clark & Courtman-Stock 1976), South Africa: Durban (KZN) to Leven Point (KZN); depth range: 112-411 m. Habitat: associated with sand, mud and sponges.

**Remarks** – No South African specimens were available for examination but Mozambican specimens were examined. Holotype is in the Natural History



**Fig. 30.** Distribution of *Astroceras spinigerum* in South Africa.



Museum of Denmark (ZMUC OPH-281), type locality off Durban, depth 411 m. The genetic data presented in Okanishi & Fujita (2013) suggest that *A. spinigerum* belongs in the genus *Asterostegus*.



**Fig. 31.** Dorsal (left) and ventral (right) views of *Astroceras spinigerum* (SAMC A23233).

#### 4.1.3. Family GORGONOCEPHALIDAE Ljungman, 1867

##### Genus *Astroboa* Döderlein, 1911

**Diagnosis** – Adapted from Döderlein (1911) and McKnight (2000). Radial shields elongated, converging towards centre, may be covered with small tubercles. Interradial areas usually have small tubercles, not uniformly placed. Arms branched, flexible dorso-ventrally. Belts of hooks (girdle belts) present as patches on lateral sides of arm then becoming continuous after fifth fork, girdle hooklets with curved terminal tooth and secondary tooth. No arm spines before the fourth fork, initially two then increasing up to five, with glassy tips, distally becoming flattened multi-tooth hooklets. Madreporite one.

##### *Astroboa nuda* (Lyman, 1874)

*Astrophyton nudum* Lyman, 1874: 251-252, pl. 6, figs 4-5.

*Astrophyton elegans* Koehler, 1905b: 123-125, pl. 13, fig. 2, pl. 18, fig. 1.

*Astroboa nuda*: Döderlein 1911: 86-88; Mortensen 1940: 67; Tsurumal & Marder 1966: 9-17, figs 1-4; Clark & Courtman-Stock 1976: 100, 108, 130-131; Cherbonnier & Guille 1978: 17-18, pl. 1, figs 3-4; Baker 1980: 60, fig. 22; Guille & Vadon 1985: 62; Marsh 1986: 70; Olbers *et al.* 2015: 85, 88.

*Astroboa nigra* Döderlein, 1911: 83-86, pl. 9. Figs 9, 9a.

*Astroboa nuda* var. *elegans*: Döderlein 1927: 45.

*Astroboa nuda* var. *nigra*: Döderlein 1927: 44; Balinsky 1957: 2-3.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Baker (1980). D.D. up to 92 mm. Disc depressed interradially and centrally, interradiial and radial areas naked towards centre of disc, but with increasing presence of tiny tubercles towards disc margin. Radial shields narrow, paved densely with low granules giving smooth appearance, raised at disc margin, slightly broader on distal side, terminating in oval slightly concave plate, converging to centre of disc. Ventral interradiial areas densely covered with tiny tubercles. Oral papillae short, narrow, no continuous fringe in distal notches. Teeth 3-5, thicker than oral papillae but elongated. Arms higher than wide basally, branched, first fork close to disc base, 4-8 segments between forks with up to 28 forks along arm, flexible dorso-ventrally. Arms covered in small, smooth, polygonal plates. Bands of hooks (girdle belts) present on arms from after second fork, but continuous before third branch, girdle hooklets with secondary tooth. Arm spines absent before fifteenth fork on main arm stem, but may occur from fourth fork on secondary stems, spines 3-4 with distal spines becoming hooks with two hooklets. Genital slits small, wide. Genital papillae present on inner edge. Madreporite one. Colour in life black, white or yellow.

**Distribution and habitat** – Western Indian Ocean, Red Sea, East Indies, Persian Gulf, China and south Japan, Philippines, Australia (Balinsky 1957; Kalk 1958; Macnae & Kalk 1958; Tsumamal & Marder 1966; Clark & Rowe 1971; Clark & Courtman-Stock 1976; Cherbonnier & Guille 1978; Rowe & Gates 1995; Richmond 2002), South Africa: Sodwana Bay (KZN) (Sink *et al.* 2006); depth range: intertidal -120 m. Habitat: found on coral reefs, both within deep crevices and on open reef.

**Remarks** – Reported as new record for South Africa by Olbers *et al.* (2015). Previously known from Mozambique and hence not surprisingly recorded in South Africa. According to Rowe & Gates (1995), type locality is Philippines, with the holotype being in the Museum of Comparative Zoology (MCZ OPH-2911).

Two specimens were found at Sodwana Bay by Olbers *et al.* (2015) which only reported up to 20 forks, as opposed to 28 as reported by Baker (1980).

A notable difference between *Astroboa* and *Astrocladus* is that the arm spines in *Astroboa* are found after the fourth fork, while in *Astrocladus*, they occur from either first or second forks, however, this difference is not obvious in young specimens (Baker 1980).



**Fig. 32.** Distribution of *Astroboa nuda* in South Africa.



**Fig. 33.** Dorsal (left) and ventral (right) views of *Astroboa nuda* (SAMC A081578). Arrow indicates the distal notch.

### Genus *Astrocladus* Verrill, 1899

**Diagnosis** – Adapted from Verrill (1899a) and McKnight (2000). Disc armed with flat or conical tubercles, no belts of marginal platelets. Oral papillae present in distal notches (except in *A. hirtus*). Arms branched, belts of hooks (girdle belts) present, flexible dorso-ventrally. Often more arm segments before the first fork than between first and second forks, no more than 11 segments between successive forks distally. Arm spines small, begin after segments bearing second or third pores.

### *Astrocladus africanus* Mortensen, 1933

*Astrocladus africanus* Mortensen, 1933a: 291-293, fig. 20, pl. 17, figs 1, 2; Clark & Courtman-Stock 1976: 108, 131, fig. 92.

**Diagnosis** – Adapted from Mortensen (1933a). D.D. = 58 mm, dorsal disc with moderately sized conical tubercles, denser on radial shields and centre of disc, interradial areas with fewer tubercles. Radial shields converge towards centre of disc. Ventral interradial areas with few scattered tubercles, mouth frame and ventral arms covered with small irregular plates. Jaws thick, elevated. Oral papillae clustered on apex of jaw and fringe mouth slits including in distal notches. Arms flexible dorso-ventrally, first arm forks lie at disc edge, distance between successive forks short, 7-8 segments between forks, arms with more than eight forks. Dorsal arms with dense, uniform mosaic of small, smooth, almost flat plates, no larger tubercles, distinct sunken dorsal midline, spaces between segments somewhat sunken, with irregular larger oval plates found in sunken rings. Belts of hooks (girdle belts) present. Arm spines at first branch, sometimes at second and third pores, two, short, slightly curved and ending in a single thorn. Spines become hook-shaped distally, with 2-4 teeth or hooklets, serrated on convex edge. Genital

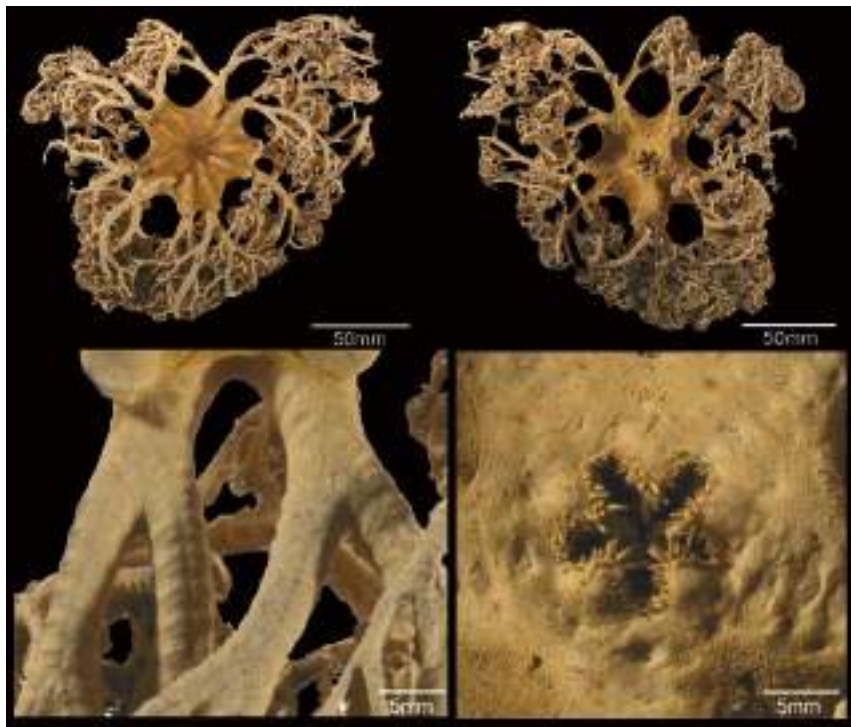
slits short. Genital papillae absent. Madreporite close to edge of mouth frame, scarcely protruding into interradius. Colour in life unknown.

**Distribution and habitat** – South Africa; depth range: unknown. Habitat: unknown.

**Remarks** – Considered endemic, only a single specimen is known, which was found during a South African Fisheries Survey (Mortensen, 1933b) but for which more detailed locality data are not available. Holotype in the Natural History Museum of Denmark (ZMUC OPH-74), type locality 'South Africa'.



**Fig. 34.** Distribution of *Astrocladus africanus* in South Africa.



**Fig. 35.** Dorsal whole (top left), ventral whole (top right), proximal dorsal arms (bottom left), jaws (bottom right) views of *Astrocladus africanus* (ZMUC OPH-74).

## ***Astrocladus euryale* (Retzius, 1783)**

*Asterias euryale* Retzius, 1783: 243-244.

*Astrocladus euryale*: Döderlein 1911: 6, 75; Clark 1923: 319; Mortensen 1933a: 293-296, figs 21, 22, pl. 18, fig. 7; Clark A.M. 1952: 199; Day *et al.* 1952: 412; Day *et al.* 1970: 80; Clark 1974: 440-441, pl. 3, figs 1, 2; Clark & Courtman-Stock 1976: 100, 108, 131, figs 89, 90, 91; Branch *et al.* 2010: 230, fig. 103.1.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 75 mm, disc smooth. Radial shields armed with moderate to large round tubercles, converging towards centre of disc. Dorsal arms coated with similar tubercles, continued down arm, tubercles absent distally, belts of hooks (girdle belts) present proximally. Arms branched, flexible dorso-ventrally, first fork beyond base, 6-9 segments between forks. Lateral arm plates short, barely reaching edge of the arm, ventral arm plates not well-developed. Ventral disc smooth, naked skin including jaws, oral and adoral shields indistinct. Oral papillae spiniform, fringe oral area including distal notches. Arm spines at first fork, sometimes before. Arm spines conical, becoming hook-shaped distally. Genital slits small, no genital papillae. Colour in life white and / or grey with black surrounding tubercles on disc and arms, arms and radial shields dark brown to black with white tubercles, interradial areas white.

**Distribution and habitat** – South Africa: Cape Town (WC) to Amatikulu (KZN); depth range: 11-555 m. Habitat: rock, sand, shell, mud and sponge.

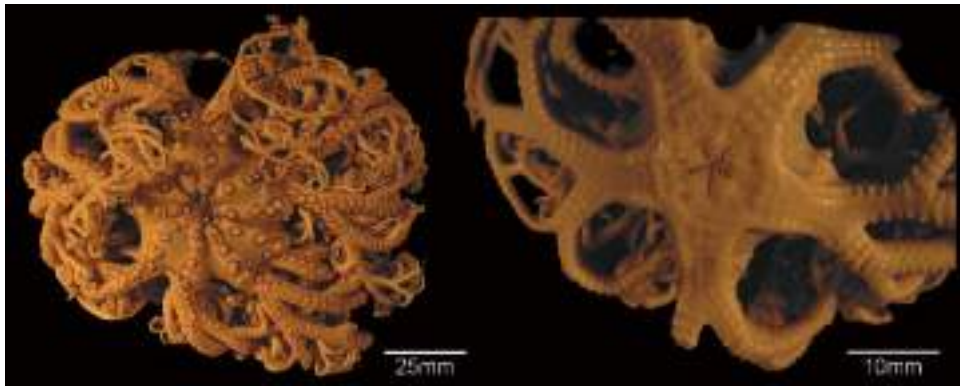
**Remarks** – The most common basket star in South Africa and frequently seen and photographed by divers. When live, the arms and radial shields are dark brown to black with white tubercles and white interradial areas. The colouration is distinctive and easily identified positively by divers. When preserved, colouration often duller, but the darker areas are accentuated in comparison to the white / lighter areas.

*Astrocladus euryale* is endemic to South Africa. There have been three reports of distribution outside South Africa, namely Providence Island, Northern Madagascar (Bell 1905), Jobi, New Guinea and the Moluccas (Stiasny & Groenewegen 1929), but Mortensen (1933a) dispelled these records based on corrected identification of Bell's specimens and this was confirmed by Dr Stiasny saying that the specimen labels were unreliable.



**Fig. 36.** Distribution of *Astrocladus euryale* in South Africa.

The location of the type specimen is unknown, type locality, 'Cape of Good Hope', depth unknown.



**Fig. 37.** Dorsal (left) and ventral (right) views of *Astrocladus euryale* (SAMC A084243).

### ***Astrocladus hirtus* Mortensen, 1933**

*Astrocladus hirtus* Mortensen, 1933a: 288-290, fig. 17, pl. 19, figs 1-3; Clark & Courtman-Stock 1976: 101, 132.

*Astrocladus hirtus* var. *reticulatus* Mortensen 1933a: 290-291, pl. 18, figs 5, 6.

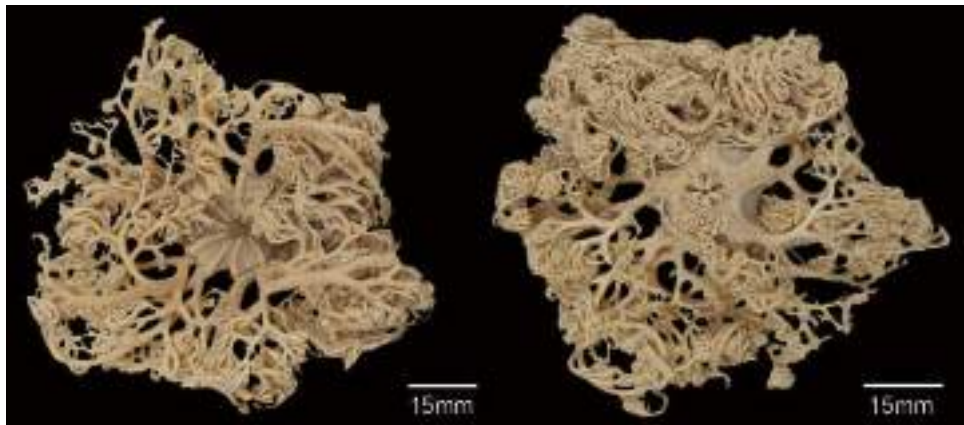
**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 25 mm, disc pentagonal. Radial shields elevated, narrow, almost reaching centre of disc, not parallel, covered by small conical tubercles terminating in one or two very small thorns. Dorsal interradial areas and between radial shields coated in granules with some conical tubercles, tubercles becoming slightly larger on distal ends of radial shields. Ventral disc covered in small granules, few scattered conical granules in interradial areas. Oral papillae forming dense cluster at apex of jaws, no oral papillae in distal notches, lowermost papillae with sharp pointed tips, remaining papillae blunt or round. Arms five, branched, flexible dorso-ventrally, smooth, first fork within disc, 3-6 segments between forks, up to 12 forks. Arm spines 2-3 basally then 4-5 distally, short, with one or several hyaline thorns; arm spines begin at the second fork, but more developed from third fork. Ventral groove along most of the length of the arms. Dorsal sides of arms covered by granules, belts of hooks evident both dorsally and laterally, belts becoming complete after fifth fork, belts indistinct on most specimens. Genital slits small and restricted to edge of disc, adjacent to first fork, no genital papillae, but spines present on radial side of each genital slit. Single madreporite at edge of interradius close to jaws. Colour in life brown to yellow, lighter ventrally.

**Distribution and habitat** – South Africa: Aliwal Shoal (KZN) to Sodwana Bay (KZN); depth range: 12-111 m. Habitat: seen at night, attached to firm substrates; often in crevices (Yves Samyn, pers. comm.) and / or under large coral boulders.

**Remarks** – Endemic to South Africa, in northern KZN waters. This study increased the known depth range from 24 to 111 m. A syntype is housed at the Natural History Museum of Denmark (ZMUC OPH-125). The type locality is uncertain, but is possibly the Natal coast or Mozambique (Clark & Courtman-Stock 1976). A paratype (examined), from the Tugela Banks (SAMC A22382) is in the Iziko South African Museum.



**Fig. 38.** Distribution of *Astrocladus hirtus* in South Africa.



**Fig. 39.** Dorsal (left) and ventral (right) views of *Astrocladus hirtus* (RMCA MT2186).

## Genus *Astrodendrum* Döderlein, 1911

**Diagnosis** – Adapted from McKnight (2000) and Döderlein (1911). Teeth, oral papillae and dental papillae similar, spiniform. Genital slits small, often pore-like and close to disc margin. Arms flexible dorso-ventrally, basal vertebrae not very small, belts of hooks present, hooklets in patches on dorsal side at base of arms.

### *Astrodendrum capensis* (Mortensen, 1933)

*Astroconus capensis* Mortensen, 1933a: 285-288, fig. 18a-d, pl. 18, figs 3, 4; Clark & Courtman-Stock 1976: 100, 132; Alva & Vadon 1989: 829-830, 831, fig. 1c, d.  
*Astrodendrum capensis*: Baker 1980: 58.

**Diagnosis** – Adapted from Mortensen (1933a) and Baker (1980). D.D. up to 90 mm. Disc and arms covered in fine granules. Disc with few intermixed conical and warty tubercles towards disc margin and radial shields, denser in centre of disc. Radial shields narrow, slightly broader on distal side, converging towards centre. Mouth frame covered in dense mosaic of small, flat, polygonal plates, arms similar. Oral papillae long, spiniform and stout on apex, forming continuous fringe including in distal notches. Arms branched, flexible dorso-ventrally. First fork beyond base, 8-9 segments between first and second forks, up to 20 segments distally. Belts of hooks begin on third to fourth fork. Arm spines short, begin on second pair of oral pores. Genital slits small, pore-like and close to disc margin. Genital papillae present.

**Distribution and habitat** – Namibia, South Africa: Orange River (NC) to Leven Point (KZN); depth range: 161-420 m. Habitat: found in sandstone, rubble, broken shell, coarse sand and attached to gorgonians.

**Remarks** – Distribution range here extended north-east from Durban (KZN) to Leven Point (KZN) and west from Durban to the Orange River (NC).

Baker (1980) placed *Astroconus capensis* Mortensen, 1933 in the genus *Astrodendrum* Döderlein 1911 after re-examination of the holotype in the Natural History Museum of Denmark (ZMUC OPH-80), because of the presence of girdle



**Fig. 40.** Distribution of *Astrodendrum capensis* in South Africa.



hooklets in patches on the dorsal side at the base of the arms, which is a character unknown in *Astroconus*, but present in all *Astrodendrum* species. Type locality is off Durban, depth 420 m.



**Fig. 41.** Dorsal (left) and ventral (right) views of *Astrodendrum capensis* (SAMC A088481).

### Genus *Astroglymma* Döderlein, 1927

**Diagnosis** – Adapted from Döderlein (1927). Disc tubercles fine, all similar in size. Arms branched, flexible dorso-ventrally, c. 16 forks. Arm spines 2-3, minute. Madreporites five, equal in size.

#### *Astroglymma* cf. *sculptum* (Döderlein, 1896)

*Astrophyton sculptum* Döderlein, 1896: 299, pl. 18, fig. 29a, b; Baker 1980: 66, 74, figs 19, 28, 31.

*Gorgonocephalus robillardi* de Loriol, 1899: 31-34, pl. 3, fig. 3.

*Astroductylus robillardi*: Döderlein 1911: 96-98.

*Astroglymma sculptum*: Döderlein 1927: 47-50, pl. 1, figs 3, 4; pl. 5, fig. 13; Koehler 1930: 15, pl. 2, figs 10-12; Guille & Vadon 1985: 62; Liao & Clark 1995: 170, fig.

74; Okanishi *et al.* 2011b: 380-381, fig. 7; Olbers *et al.* 2015: 88-89, pl. 1C, D.

*Astroglymma robillardi*: Mortensen 1933e: 34, pl. 3, figs 1, 2; pl. 4, fig. 1.

*Astroglymma sculptum*: Rowe & Gates 1995: 365 (*lapsus calami*).

**Diagnosis** – Adapted from Baker (1980). D.D. up to 50 mm. Disc deeply excavated interradially. Radial shields long, slender, widely separated distally, almost touching proximally, almost reaching centre of disc. Disc and radial shields covered in minute conical tubercles, ventral interradial area may bear long spinelets. Oral shields smooth, adoral shields not distinct, deep pits bordering jaws. Oral papillae unequal, small, mostly spiniform. Teeth small, spatulate. Arms branched, flexible dorso-ventrally, first fork just beyond disc, forking at least 20 times along arm. Dorsal arms covered in low polygonal plates. Belts of hooks (girdle belts) narrow, present from arm bases, girdle hooklets with secondary

tooth. Arm spines present from sixth fork as two stumps, becoming three with one or two terminal points, distally becoming hooklets with terminal tooth and smaller secondary tooth. Ventral arms covered with smaller flat polygonal plates, ventral arms have ladder-like pits on first 2-3 forks. Genital slits short, D-shaped. Genital papillae blunt-tipped on outer edge. Five madreporites present in angle of ventral interradial area.

**Distribution and habitat** – Mauritius, India, China Sea, Malaysian Archipelago, Australia (Baker 1980; Imaoka *et al.* 1991; Rowe & Gates 1995), South Africa: off Durban (KZN); depth range: 68-70 m. Habitat: no notes recorded.

**Remarks** – Reported as new to South Africa by Olbers *et al.* (2015), found off Durban in KZN. Another specimen from off Durban in the Smithsonian Institution, National Museum of Natural History (USNM) was reported by Baker *et al.* (2018).



**Fig. 42.** Distribution of *Astroglymma cf. sculptum* in South Africa.



**Fig. 43.** Dorsal (left) and ventral (right) views of *Astroglymma cf. sculptum* (USNM 1072476).

Genus *Astrothorax* Döderlein, 1911

**Diagnosis** – Adapted from Döderlein (1911) and McKnight (2000). Arms simple, flexible dorso-ventrally, disc covered in tubercles, arm spines 5-10, hooklets with single secondary tooth.

*Astrothorax papillatus* H.L. Clark, 1923

*Astrothamnus papillatus* Clark, 1923: 316-318, pl. 20, figs 5, 6.

*Astrothorax waitei* (Benham, 1909): Baker 1980: 30-32, figs. 8, 31 (in part).

*Astrothorax papillata*: Mortensen 1933a: 279-280, fig. 15; Clark A.M. 1952: 199; Clark & Courtman-Stock 1976: 100, 108, 132.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 20 mm. Disc tumid dorsally, flat ventrally, with interradial areas slightly excavate. Radial shields form distinct ridges, upper surface with coarse and fine tubercles intermixed, tubercles wider than high, rounded or truncated, smooth or have fine glassy, prickly protrusions. Ventral disc tubercles abruptly finer, conceal oral shields. Disc margin paved with low smooth tubercles. Arms five, long, simple, flexible dorso-ventrally, dorsally rounded, alternating bands of fine and coarse tubercles, fine tubercles bear numerous hooks and hooklets, while coarser tubercles more or less smooth. Arm spines begin at second tentacle pore, two, short, thorny, increasing in number up to ten. Arm spine shape changes from thorny-tipped stumps proximally to F-shaped hooks distally. Distal arm spines have large terminal tooth with smaller secondary tooth. Jaws covered by uniform fine tubercles, coarsest interradially. Teeth, tooth-papillae and oral papillae similar, spiniform, teeth larger, oral papillae small. Genital slits small, no genital papillae.

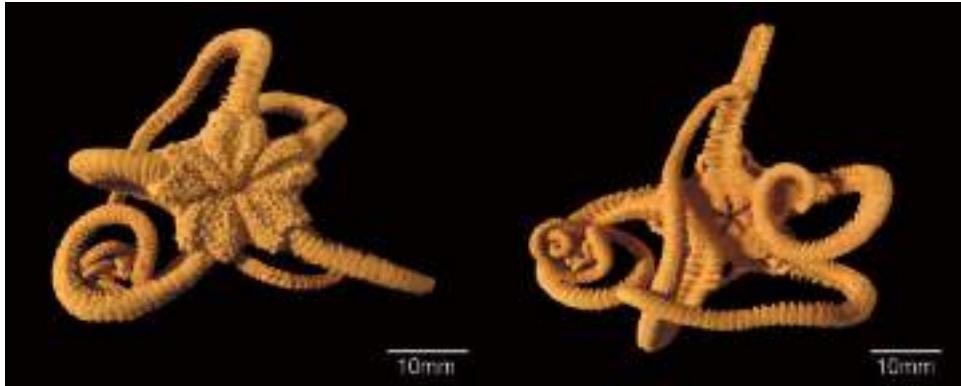
**Distribution and habitat** – South Africa: Cape Point (WC) to Durban (KZN); depth range: 43-650 m. Habitat: mud, sand and attached to coral or coralline algae.

**Remarks** – Holotype, as *Astrothorax papillatus* (SAMC A6443), type locality off Cape Hangklip, depth 110 m. Genetic data (O'Hara *et al.* 2017; unpublished) indicates that the South African records are distinct from those of *A. waitei*



**Fig. 44.** Distribution of *Astrothorax papillatus* in South Africa.

Bentham, 1909 from Australian/New Zealand, and here *A. papillatus* is recognised as distinct.



**Fig. 45.** Dorsal (left) and ventral (right) views of *Astrothorax papillatus* (SAMC A7519).

### Genus *Gorgonocephalus* Leach, 1815

**Diagnosis** – Adapted from Leach (1815) and McKnight (2000). Disc and arms covered with small spiny or thorny tubercles, disc margin contains plates. Radial shields narrow, elongated. Arms five, flexible dorso-ventrally, first fork near disc, dorsally with annulated bands of hooks (girdle belts) well-developed distally. Arm spines present before first fork. Madreporite usually one.

### *Gorgonocephalus chilensis* (Philippi, 1858)

*Astrophyton chilense* Philippi, 1858: 268.

*Astrophyton pourtalesii* Lyman, 1875: 28-29, pl. 4, figs 41-43.

*Gorgonocephalus chilensis*: Lyman, 1882: 261; Koehler 1908b: 142; Clark 1915a: 185; Clark 1923: 318, Döderlein 1927: 30-31; Zirpolo 1932: 1-16, figs 1, 2; Mortensen 1936: 240-241; Fell 1958: 20; Seno & Irimura 1968: 148-149; Monteiro & Tommasi 1983: 33-54; McKnight 2000: 45-46, fig. 20, pl. 19.

*Gorgonocephalus pourtalesii*: Lyman 1882: 261-262, pl. 45.

*Gorgonocephalus chilensis* var. *novaezelandiae* Mortensen, 1924: 93, 109-110, pl. 4, fig. 1.

**Diagnosis** – Adapted from Lyman (1882) and McKnight (2000). D.D. up to 64 mm. Disc slightly inflated, interradial areas slightly indented. Radial shields conspicuous, narrow, extend more or less to centre of disc, tapering at distal ends, densely covered in conical tubercles, mostly higher than wide, remainder of disc covered in skin with numerous scattered tubercles, sometimes smaller in size. Disc margin with few larger tubercles, forming continuous series with those of radial shields. Ventral interradial areas covered in skin with small, scattered, low tubercles, few scattered tubercles towards oral area. Oral shields triangular, covered in smooth

skin, sometimes with few scattered tubercles, adoral shields square. Oral papillae and teeth spiniform, fringe oral frame, but absent in distal notches. Arms branched, flexible dorso-ventrally, forks c. ten times, rounded dorsally with small round or dome-shaped tubercles, proximal segments with naked plates. First fork at base of disc, approximately six segments between forks. Arm spines lacking on first arm segment, increasing to two on segment two and three, increasing again to four or five then decreasing to two or three from about fifth fork, spines shorter than the arm width, slightly flattened, pointed becoming multi-toothed hooks. Ventral arm surface flat, relatively smooth near base, becoming scattered with small tubercles. Genital slits short, wide. Papillae on edge of slits present, in series with disc papillae, large, usually higher than wide. Madreporite one, at edge of oral frame. Colour uniform creamy white, disc pale brown, arms, radial shields and tubercles cream (Baker 1980; McKnight 2000).

**Distribution and habitat** – New Zealand, Ross Sea, Falklands, Chile (Philippi 1858; Mortensen 1924; Mortensen 1936; Seno & Irimura 1968; McKnight 2000), South Africa: Cape Town (WC) to Port Edward (KZN); depth range: 22-900 m. Habitat: mud, fine sand.

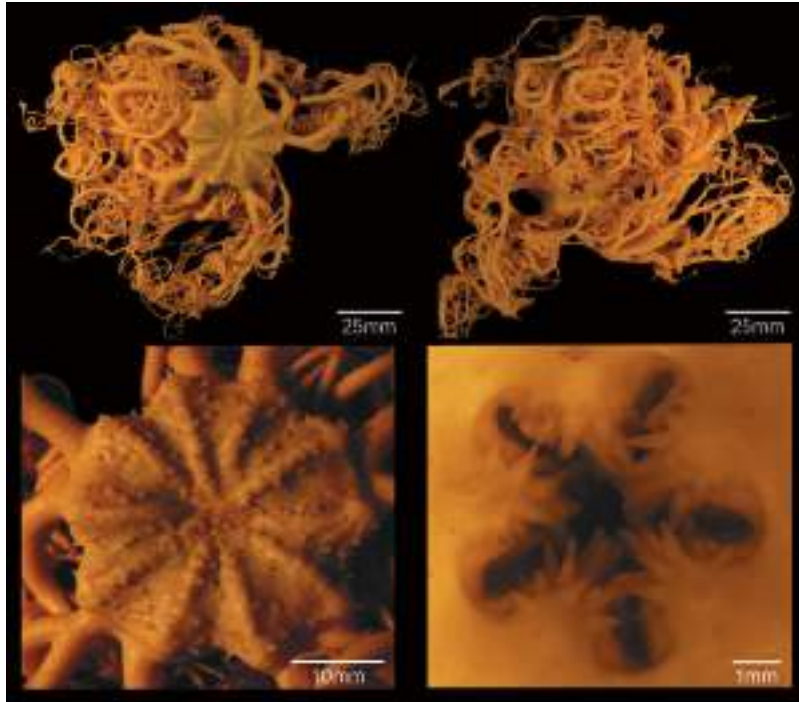
**Remarks** – Distribution here extended into southern KZN from Cape Town (WC).

Clark (1923), Seno & Irimura (1968) and Mortensen (1936) reported that a number of specimens had younger individuals attached to them. Clark reported they were adults and were viviparous, while Mortensen (1933a, 1936) disputed this and suggested that the presence of smaller individuals on, or attached, to larger individuals has nothing to do with viviparity or brood protection, but was rather a function of the smaller individual using the larger animal in a similar way to gorgonians.

The type material is in the Museum of Comparative Zoology (syntype: MCZ OPH-2954), type locality off Cape Raso, Argentina, depth 100 m. Genetic data is required to determine whether one or more species is included within this taxa. It is unusual for the same species to be recorded all the way from Antarctica to subtropical latitudes.



**Fig. 46.** Distribution of *Gorgonocephalus chilensis* in South Africa.



**Fig. 47.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), jaws (bottom right) views of *Gorgonocephalus chilensis* (SAMC A084240).

### ***Gorgonocephalus pustulatum* (Clark, 1916)**

*Astrodendrum pustulatum* Clark, 1916: 84-85, pl. 34, figs 1, 2; Döderlein 1927: 32-33, pl. 1, figs 5, 6; Clark 1946: 181.

*Gorgonocephalus moluccanus* Döderlein, 1927: 26-27, pl. 2, fig. 2.

*Gorgonocephalus pectinatus* Mortensen, 1933a: 281-285, figs 16, 17, pl. 18, figs 1, 2; Clark & Courtman-Stock 1976: 133, 100, 108, figs 86, 88.

*Gorgonocephalus pustulatum*: Baker 1980: 54-56, fig. 20; Rowe & Gates 1995: 368; McKnight 2000: 49-51, pl. 21.

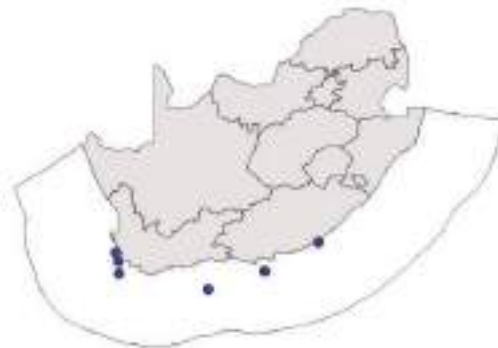
**Diagnosis** – Adapted from Mortensen (1933a), Baker (1980) and McKnight (2000). D.D. up to 54 mm. Dorsal disc covering variable, some specimens naked interradially, while others with numerous tubercles, conical or almost spine-like, interradiial areas excavate, disc margin of mostly thin, naked plates, sometimes with tubercles. Radial shields prominent, narrow, uniform in width, converge towards centre, tubercles irregular. Ventral surface flat, naked. Jaws with small low tubercles, with remaining area naked covered in skin. Oral papillae slender, spiniform, teeth stouter, with slightly flattened tips, papillae forming continuous fringe, but not within distal notches. Arms branched, flexible dorso-ventrally, with at least eight forks, first fork just beyond disc, approximately 8-11 segments

between forks, then between 10-33 segments between forks distally. Dorsal arms round, smooth and covered with fairly large irregular plates sometimes with tubercles. Ventral arms flat, smooth, with few, low scattered tubercles. Belts of hooks continuous from near the arm base, slightly raised above arm surface, hooklets with small secondary tooth. Arm spines begin on second arm segment, with segments 4-6 with two spines, and then 3-4 spines continuing down arm, only one spine distally. Spines short, cylindrical, blunt multi-pointed tips becoming multi-toothed hooks distally. Genital slits large, conspicuous, papillae slightly larger than disc tubercles, randomly spaced. Colour from deep pinkish-brown (Clark & Courtman-Stock 1976) to dull brown, with the radial shields and ventral surface lighter or red (McKnight 2000).

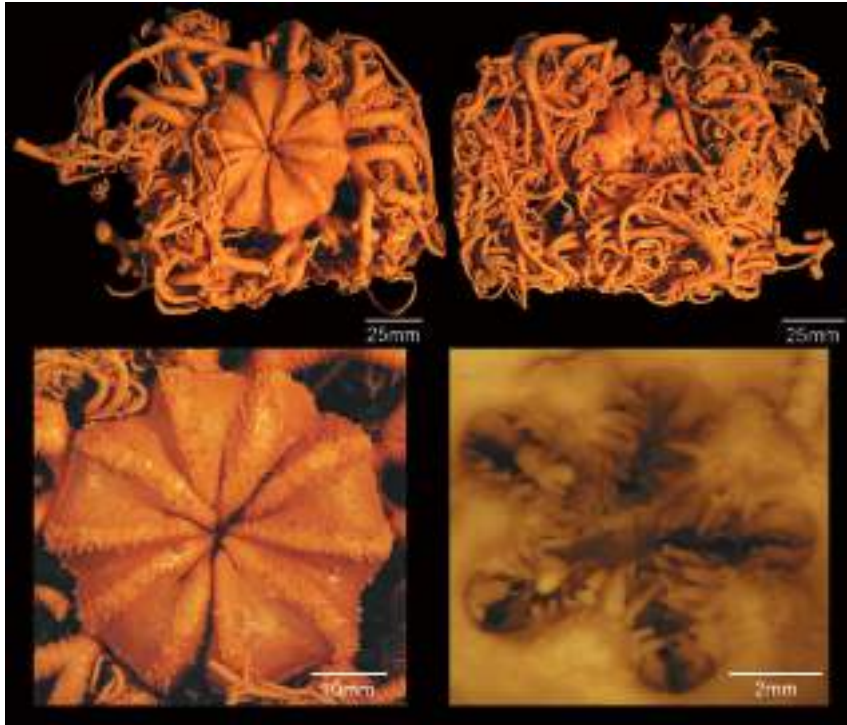
**Distribution and habitat** – Western Indian Ocean, Indonesia, Australia, New Zealand, West Pacific (Baker 1980; Rowe & Gates 1995), South Africa: Cape Town (WC) to Folokwe (EC); depth range: 78-860 m. Habitat: fine sand, rock, rough substrata and one specimen attached to an anemone.

**Remarks** – The type material is in the Museum of Comparative Zoology (holotype: MCZ OPH-3952), type locality east of Flinders Island, Australia, depth 183-549 m.

The differences between *Gorgonocephalus chilensis* and *G. pustulatum* are not obvious. Baker (1980) stated that tubercle density on the disc cannot be used as the single character to differentiate between gorgonocephalid species. Since then, authors have put forward a variety of characters to differentiate between the two species, however, it seems that there still is no easy-to-use character to differentiate between them. Okanishi (2012) proposed that *G. pustulatum* had tubercles only on the radial shields, while *G. chilensis* also had tubercles scattered on the dorsal disc. In *G. pustulatum*, the dorsal interradial areas were relatively narrow with clusters of small granule-shaped epidermal ossicles. The interradial areas in *G. chilensis* are relatively wide, while the hooklets on the arms are discontinuous from the base of the arms.



**Fig. 48.** Distribution of *Gorgonocephalus pustulatum* in South Africa.



**Fig. 49.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), jaws (bottom right) views of *Gorgonocephalus pustulatum* (SAMC A084227).

## 4.2. Order OPHIURIDA Müller & Troschel, 1840

### 4.2.1. Family OPHIOMUSAIDAE O'Hara *et al.*, 2018

#### Genus *Ophiomusa* Hertz, 1927

**Diagnosis** – Adapted from Lyman (1869). Disc covered by large, naked scales. Radial shields relatively large. Oral papillae fused, apical papillae present, teeth present. Ventral arm plates restricted to the proximal 1-2 arm segments. Dorsal arm plates very small, not contiguous. Ventral arm plates present basally only. Lateral arm plates meeting above and below. Tentacle pores absent beyond basal arm segments. Arm spines small.

#### *Ophiomusa lymani* (Wyville Thomson, 1873)

*Ophiomusium lymani* Wyville Thomson, 1873: 174-175, fig. 33; Koehler 1904a: 58; Clark 1911: 107-108; Clark 1913: 213-214; Matsumoto 1917: 289; Koehler 1922b: 411, pl. 86, figs 5, 7-9; Clark 1923: 364; Mortensen 1927: 253-254, fig. 138; Mortensen 1933a: 394; Clark & Courtman-Stock 1976: 107, 125, 191,



fig. 211; Baker 1979: 30; Paterson 1985: 147-148, fig. 58a, b; Alva & Vadon 1989: 828; Imaoka *et al.* 1990: 95; Garcia-Diez *et al.* 2005: 49; Laguarda-Figueras *et al.* 2009: 100, fig. 32.

*Ophiomusa lymani*: Hertz 1927a: 103-105; Clark H.L. 1939: 128.

**Diagnosis** – Adapted from Mortensen (1927). D.D. up to 48 mm. Disc round, covered dorsally and ventrally with scales of various sizes, some tumid, others flat but with tubercles, cluster of flat scales in centre of disc, primary rosette sometimes distinct. Radial shields with embedded tubercles, triangular, longer than wide, *c.* half disc radius. Oral shields triangular, longer than wide, proximal lobe sharp, distal edge straight, bordered distally by pentagonal plate covering most of interradiar area. Adoral shields broad and large, contiguous. Oral papillae 5-6 but almost appear fused, structure of each papilla still visible. Oral tentacle pore bordered by first arm plate. Genital slits half-way to disc margin, thin and narrow, genital plates present. Dorsal arm plates diamond or triangular, distal edge convex, widely separated, longer than wide, becoming smaller and entirely absent for much of the arm. Ventral arm plates only present on first three segments, pentagonal. Lateral arm plates meet dorsally and ventrally, very large. Arms slender but stiff. Arm spines up to 13, very small, conical. Tentacle scales one, oval, large, present on first two arm segments only.

**Distribution and habitat** – Arabian Sea, Indonesia, Australia, New Zealand, Chile, Gulf of Mexico, Caribbean and Atlantic Ocean (Baker 1979; Rowe & Gates 1995), South Africa: off Orange River (NC) to St Lucia (KZN); depth range: 130-4829 m. Habitat: mud and sand.

**Remarks** – The DNA-based revision of O'Hara *et al.* (2018) indicates that the type species of *Ophiomusium* is distinct from all other species previously placed in this genus. These species have been placed in the genus *Ophiomusa* pending a full revision. The type species of *Ophiomusa* is *O. lymani*.

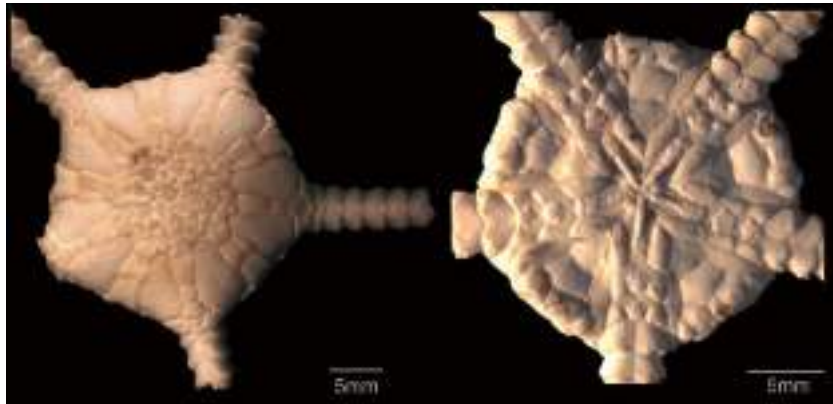
At first glance, this species is superficially similar to *Ophiomusidium* (Astrophiriidae), but they differ in a number of characters. The basal lateral arm plates are much expanded on *Ophiomusidium* and the ventral disc area much reduced. The ventral arm plates are typically absent on *Ophiomusa* after two segments near the arm base.



**Fig. 50.** Distribution of *Ophiomusa lymani* in South Africa.

The distribution range is here extended westwards from off Saldanha Bay (WC) to off the Orange River (NC) and eastwards from off Cape Agulhas (WC) to St Lucia (KZN).

According to Rowe & Gates (1995), the syntypes are most probably housed in the Natural History Museum, London, however these were not located. The type locality is off the coast of Ireland, depth unknown (Rowe & Gates 1995).



**Fig. 51.** Dorsal (left) and ventral (right) views of *Ophiomusa lymani* (SAMC A22044).

#### 4.2.2. Family ASTROPHIURIDAE Sladen, 1879

##### Genus *Astrophiura* Sladen, 1879

**Diagnosis** – Adapted from Sladen (1879), Matsumoto (1917) and Fujita & Hendler (2001). Dorsal disc covered with scales, while modified lateral arm plates appear to form remainder of disc or umbrella, fringed with modified spines along whole disc margin. Radial shields half true disc radius. Oral papillae up to seven. Teeth and dental papillae absent. Dorsal and ventral arm plates rudimentary external to umbrella, but well-developed within. Arms short. Tentacle scales only present within umbrella, tentacle pores very large within umbrella.

##### *Astrophiura permira* Sladen, 1878

*Astrophiura permira* Sladen, 1878: 456-457; Sladen 1879: 401-415, pl. 20; Hertz 1927a: 83-85, pl. 7, figs 4, 5; Mortensen 1933a: 394-396, figs 90, 91; Clark & Courtman-Stock 1976: 125, 107, 188, fig. 207; Clark 1977: 143-144.

*Astrophiura cavellae* Koehler, 1915:1-15, figs 1-6; Clark 1923: 354-356.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 10 mm, disc pentagonal, concave below, central plate with protrusion, disc scales distinct.

Disc expanded from modified lateral arm plates, creating an umbrella effect on disc. Single triangular interradial segment with five segments either side, longer than wide, with undulating distal edges meeting arms at right angles. Spines modified to form fringe on expanded disc margin. Undulating edges and modified spines make disc appear to have a double fringe. Oral shields not always distinct, small, triangular. Adoral shields large, more distinct than oral shields, contiguous. Oral papillae four, apical papillae two on apex. Dorsal arm plates not contiguous, triangular, convex distally, distal plates very far apart, separated by large lateral arm plates. First ventral arm plate bell-shaped, other non-free plates square, slightly longer than wide, all plates constricted by large tentacle pores, plates becoming reduced distally by large lateral arm plates. Arm spines short, blunt. No genital slits, genital organs present, sometimes visible through ventral disc. Tentacle scales two, round.

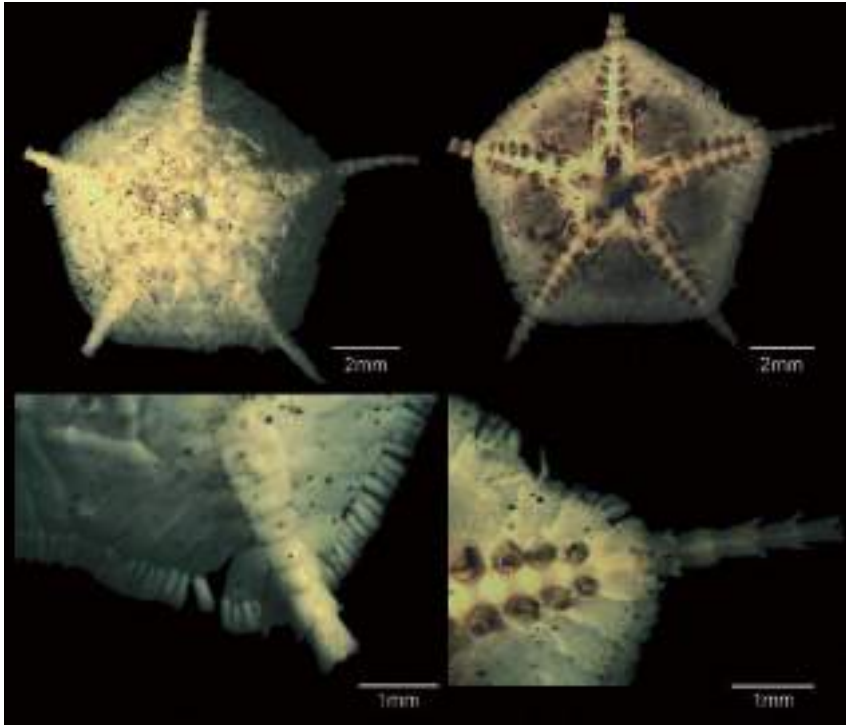
**Distribution and habitat** – Indo-West Pacific, Madagascar (Sladen 1878), Australia (Rowe & Gates 1995), South Africa: Cape Town (WC) to Black Rock (KZN); depth range: 164-1300 m. Habitat: sand, stones, rock and coral (Clark & Courtman-Stock 1976).

**Remarks** – Sladen (1878) briefly described the characters of this species, completing his description in a separate publication in 1879, in which he argues that this species forms a link between the Ophiuroidea and Asteroidea.

Type material is in the Museum of Natural History of Berlin (syntype of *Astrophiura cavellae*: ZMB Ech 7079), type locality being Madagascar.



**Fig. 52.** Distribution of *Astrophiura permira* in South Africa.



**Fig. 53.** Dorsal whole (top left), ventral whole (top right), dorsal basal arms (bottom left), ventral arms (bottom right) views of *Astrophiura permira* (SAMC A6460).

### Genus *Ophiomisdium* Koehler, 1914

**Diagnosis** – Adapted from Wyville Thomson (1878) and Borges & de Siqueira Campos (2011). Adults small, D.D. up to 5 mm, disc covered dorsally with medium-sized plates in addition to a primary rosette. Number of tentacle pores varies, but usually more than two. Dorsal and ventral proximal arm plates wider than distal plates, first three ventral arm plates well-developed. Ventral interradial areas reduced or absent. Genital slits reduced or absent.

#### *Ophiomisdium pulchellum* (Wyville Thomson, 1878)

*Ophiomusium pulchellum* Wyville Thomson, 1878: 65-67, figs 18, 19; Lyman 1882: 96-98, pl. 3, figs 1-3.

*Ophiomisdium pulchellum* Koehler 1914a: 37; Clark 1915a: 308; Clark & Courtman-Stock 1976: 190-191, 125, 107, fig. 211; Clark 1923: 356-357; Hertz 1927a: 82; Clark 1974: 476; Paterson 1985: 141, fig. 53; Borges & de Siqueira Campos 2011: 222-224, figs 6-10; Hernández-Herrejón *et al.* 2008: 102-104, fig. 4a, b; Laguarda-Figueras *et al.* 2009: 84, fig. 24.

**Diagnosis** – Adapted from Lyman (1882) and Clark & Courtman-Stock (1976). D.D. up to 5 mm, D.D./A.L. = c.1/1-2, disc round, slightly inflated. Primary rosette distinct, plates large, thick, taking up most of dorsal disc. Radial shields oval, not contiguous distally, separated by two plates or scales, distalmost plate triangular. Two plates in dorsal interradial areas, distal plate on disc margin with small, semi-circular, knob-like tubercle extending beyond disc margin. Ventral interradial area covered in elongated trapezoid plate, from edge of oral shield to disc margin. Oral shields diamond-shaped with rounded distal edge, equally long as wide. Adoral shields larger, contiguous. Oral papillae two, fused each side of triangular apical papillae. Genital slits with very small opening between genital plate and first lateral arm plate. Genital plates may touch each other near oral shield. Arms short, only consisting of c.15 segments. First dorsal arm plates twice as wide as long, with proximal side touching a triangular plate which separates radial shields, distal margin of remaining dorsal arm plates rounded, plates decreasing in size distally. First four ventral arm plates bell-shaped, not contiguous, decreasing in size distally, becoming triangular. Lateral arm plates well-developed, joined both dorsally and ventrally. First lateral arm plate with 2-4 enlarged, flattened arm spines, remaining arm segments with three short, blunt spines, rapidly decreasing in size down arm. Five pairs of tentacle pores with a single, large tentacle scale, being lost abruptly after first 2-5 segments.

**Distribution and habitat** – Canary Islands, Atlantic Ocean (Lyman 1882; Clark & Courtman-Stock 1976; Borges & de Siqueira Campos 2011), South Africa: Cape Town (WC) to Amanzimtoti (KZN); depth range: 70-3065 m. Habitat: sand and stones.

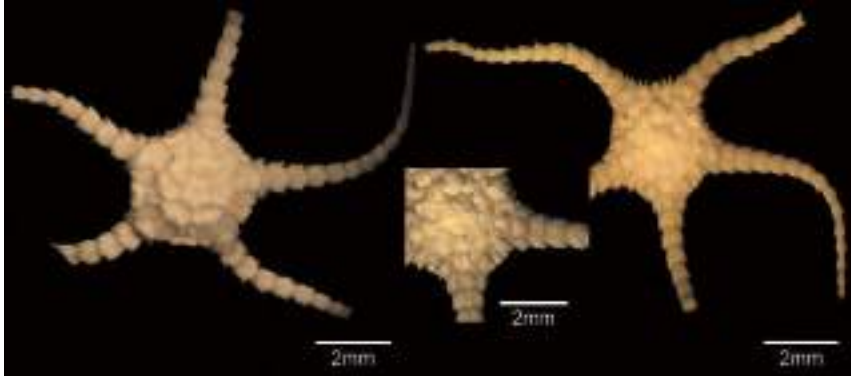
**Remarks** – The distribution range within South Africa here extended to KZN. The diagnostic features between *Ophiomusa* Hertz, 1926 (Ophiomusidae) and *Ophiomysidium* Koehler, 1914 (Astrophriuridae) result in these genera often being confused. In *Ophiomysidium*, the tentacle pore associated with the first ventral arm plate is outside the oral slit, while in *Ophiomusium*, it is inside the oral slit and is seldom seen. The basal lateral arm plates are swollen in *Ophiomysidium* and often reach the disc margin. In addition, in *Ophiomusa*, there are only two (or less) pairs of tentacle pores. In the past, *Ophiomysidium pulchellum* (Wyville



**Fig. 54.** Distribution of *Ophiomysidium pulchellum* in South Africa.

Thomson, 1878) was included in *Ophiomusium* until Koehler (1914) created the genus *Ophiomisidium*.

Type whereabouts are unknown. Type locality south-west of the Canary Islands, depth 3063 m (Clark & Courtman-Stock 1976).



**Fig. 55.** Dorsal (left) and ventral (right) views of *Ophiomisidium pulchellum* (SAMC A084246). Inset shows ventral interradiar areas.

#### 4.2.3. Family OPHIURIDAE Müller & Troschel, 1840

##### Genus *Ophiocten* Lütken, 1855

**Diagnosis** – Adapted from Lütken (1855) and Lyman (1882). Disc round, with radial indentations, disc covered in plates and distinct primary rosette. Radial shields may or may not be separated by overlapping plates, ventral interradiar areas covered in overlapping plates. Papillae on genital slits may form arm combs over base of arm. Distalmost oral papillae wider than 2-3 proximal lateral papillae, teeth present. Lateral arm plates meeting ventrally, but not dorsally. Tentacle scales present, usually each oral tentacle pore with more than one papilla.

##### *Ophiocten affinis simulans* (Mortensen, 1936)

*Ophiocten amitinum* var. *simulans* Mortensen, 1936: 337, fig. 48b; Day *et al.* 1970: 81.

*Ophiocten amitinum* var. *microplax* Mortensen, 1933a: 391-393, fig. 88b.

*Ophiura* (*Ophiura*) *affinis simulans*: Clark & Courtman-Stock 1976: 192-193, 125, 107.

*Ophiura affinis simulans*: Guille 1982: 79, fig. 7e, f.

**Diagnosis** – Adapted from Mortensen (1936) and Clark & Courtman-Stock (1976). D.D. up to 2 mm. Disc flattened, large symmetrical circular plates, including rosette, all encircled by smaller plates. Radial shields approximating

distally, separated by plates. Edge of disc slightly indented radially, arm combs distinct, some additional papillae also present in indentation. Oral shields longer than wide, sometimes twice as long as wide, distal lobe only slightly tapering to broadly rounded tip, surface textured with folds. Adoral shields contiguous and narrow. Oral papillae three each side of apical papillae, distalmost broad. Oral tentacle pore slightly set back, with one scale either side of pore. Dorsal arm plates carinate, trapezoidal, proximal plates broadly contiguous. Ventral arm plates semi-circular, small, not contiguous, separated by lateral arm plates. Arm spines three, slender and pointed, uppermost two spines only slightly exceeding segment length, if at all, not thicker than adjacent spine. Tentacle scales two on first two pairs of tentacle pores, then one, broad and rounded, not longer than wide, tentacle pores and scales distinct for most of arm.

**Distribution and habitat** – South Africa: Lambert’s Bay (WC) to Port Elizabeth (EC); depth range: 55-273 m. Habitat: coarse to fine sand, shell and rock.

**Remarks** – Endemic to South Africa. Clark & Courtman-Stock (1976) suggested that the differences between South African *Ophiura* and *Ophiocten* species are very slight, while the difference between *affinis* and *simulans* were that *affinis* had slightly smaller arm spines on the proximal arm segments and with the upper arm comb papillae were less tapered than in *simulans*. Clark & Courtman-Stock (1976) placed *affinis simulans* in *Ophiura* but O’Hara *et al.* (2017) found that *affinis* was closer to *Ophiocten*.

The relationship between *Ophiura* and *Ophiocten* has been debated by various authors (Mortensen 1927; Mortensen 1936, Clark & Courtman-Stock 1976; Paterson *et al.* 1982 and Martynov 2010). In 1936, Mortensen erected *Ophiocten amitinum* var. *simulans* for the South African variety of *Ophiura affinis*. Later, *Ophiura affinis* Lütken, 1855 was placed into the genus *Ophiocten* Lütken, 1855 by Sumida *et al.* (1998). A distribution record for South Africa of *Ophiura affinis* exists in the Natural History Museum of Denmark, but it is unlikely this was identified correctly and it is most probably *Ophiocten affinis simulans* (Mortensen, 1936). Until examination of this specimen takes place, this distribution record is not



**Fig. 56.** Distribution of *Ophiocten affinis simulans* in South Africa.

recognised in this account. Further investigation of the validity of the South African *O. amitinum* and *O. affinis simulans* specimens is recommended.

The type material is in the Museum of Comparative Zoology (paratype: MCZ OPH-5912), type locality Port Elizabeth, South Africa. Syntypes of *Ophiocten amitinum* var. *microplax* are in the Natural History Museum of Denmark (ZMUC OPH-200) with the type locality as Roman Rock, False Bay, depth 35 m. The two specimens accessioned in the Iziko South African Museum were registered as 'cotypes' (examined).



**Fig. 57.** Dorsal (left) and ventral (right) views of *Ophiocten affinis simulans* (SAMC A088402).

### ***Ophiocten amitinum* Lyman, 1878**

*Ophiocten amitinum* Lyman, 1878: 100-101, pl. 5, figs 129-130. Lyman 1882: 79-80, pl. 9, figs 7-9; Studer 1882: 16, pl. 2, fig. 8a-f; Murray 1896: 359, 369, 416, 436; Ludwig 1899, 4; Koehler 1907: 288; Clark 1915a: 328; Clark 1923: 363-364, Mortensen 1933a: 390-391, fig. 88a; Madsen 1967: 138; Clark & Courtman-Stock 1976: 192; Dahm 1999: 429; Gutt *et al.* 1999: 160; De Castro Manso 2010: 192-193, fig. 8a.

*Ophiura amitina*: Guille 1982: 78-79, figs 6a-c, 7c, d.

**Diagnosis** – Adapted from Lyman (1878) and Clark & Courtman-Stock (1976). D.D. up to 10 mm. Disc round, flattened, primary rosette plates encircled by smaller overlapping plates. Radial shields approximating on distal side, narrowly separated by plates. Edge of disc indented, arm combs distinct, with some additional papillae also present in indentation. Ventral interradiation areas with overlapping plates. Oral shields longer than wide, distal lobe tapering to rounded tip (trefoil-shaped). Adoral shields contiguous and narrow. Oral papillae 3-4 each side of apical papillae, elliptical leaf-shaped, distalmost broadest. Teeth 3-4, similar in shape to apical papillae. First oral tentacle pore large, with 2-4 tentacles scales. Genital slits elongated, papillae present. Dorsal arm plates wider than long proximally and



equally wide as long distally, broadly contiguous. Ventral arm plates semi-circular, not contiguous, separated by large lateral arm plates. Arm spines three, slender and pointed, uppermost spine only slightly exceeding segment length, if at all, not thicker than adjacent spine. Tentacle scales one, broad and rounded with a slight tip.

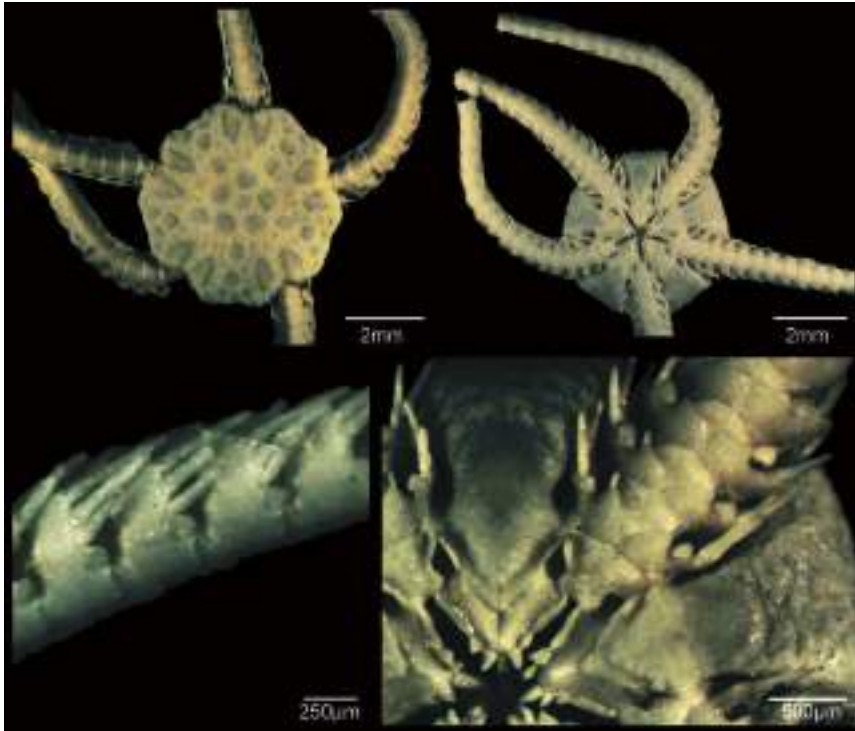
**Distribution and habitat** – Patagonia, Southern Ocean (Lyman 1878; Murray 1896; Clark 1915a), South Africa: Lambert's Bay (WC) to East London (EC); depth range: 110-3566 m. Habitat: sand, mud, stones or gravel.

**Remarks** – The specimens collected at stations FAL185P and TRA74L (University of Cape Town Ecological Survey) were originally identified as *O. affinis simulans* (unknown determinant) but were changed to *O. amitinum* in 1973 by A.M. Clark. Clark & Courtman-Stock (1976) recorded only slight differences between *O. amitinum* and *O. affinis simulans*, such as the radial shields, arm comb papillae, cross section of the arms, uppermost arm spine and tentacle scales. The major differences in all the above characters were not consistent in all the *O. amitinum* specimens examined in the Iziko South African Museum collection. The easiest character to differentiate between species is the tentacle scale arrangement. Clark & Courtman-Stock (1976) recorded that the tentacle scales in *O. amitinum* were longer than wide and tapered to a point, while those in *O. affinis simulans* were evenly rounded. This was observed in all the *O. amitinum* specimens examined. The number of tentacle scales on the first tentacle pore was also inconsistent.

The type material is in the Museum of Comparative Zoology (syntype: MCZ OPH-761), type locality Kerguelen Islands, depth unknown.



**Fig. 58.** Distribution of *Ophiocten amitinum* in South Africa.



**Fig. 59.** Dorsal disc (top left), ventral disc (top right), arm spines (bottom left), basal arms (bottom centre), ventral interradiation areas (bottom right) views of *Ophiocten amitinum* (SAMC A084234).

### ***Ophiocten hastatum* Lyman, 1878**

*Ophiocten hastatum* Lyman, 1878: 103, pl. 5, figs 133-134; Lyman 1882: 82-83, pl. 9, figs 10-11.

*Ophiocten longispinum* Koehler, 1896a: 204-205b; Koehler 1896b: 243.

*Ophiocten pacificum* Lütken & Mortensen, 1899: 131-132, pl. 3, figs 5-7; Clark 1923: 364.

*Ophiocten latens* Koehler, 1906: 13, pl. 1, figs 9, 10; Mortensen 1927: 246; Mortensen 1933a: 392-393; Clark & Courtman-Stock 1976: 189, 107, 125, figs 215, 219.

*Ophiocten australis* Baker, 1979: 26-28, fig. 3a-c.

*Ophiura hastata*: Guille 1982: 80, figs 6d, e, 7a, b.

**Diagnosis** – Adapted from Lyman (1878) and Clark & Courtman-Stock (1976). D.D. up to 14 mm. Disc round, flat dorsally and rounded ventrally. Disc plates medium in size, primary rosette present, not distinct in all specimens, interspersed with smaller overlapping plates. Radial shields triangular in shape with rounded angles, length less than half disc radius, not contiguous, separated by fine overlapping

scales. Arm combs or papillae may be present, but easily lost. Ventral interradial areas covered in fine overlapping scales. Oral shields large, as long as wide but usually much wider, five-sided, distal edge rounded, proximal edge pointed. Adoral shields narrow and contiguous. Oral papillae 3-5 either side of pointed apical papillae, square. Teeth four, similar in shape to apical papillae. Genital slits long, reaching to almost dorsal side. Arms carinate dorsally, dorsal arm plates flat pentagonal, wider than long, distally equally long as wide, broadly contiguous. Ventral arm plates semi-circular, not contiguous, separated by large lateral arm plates. Arm spines three, uppermost much longer than segment and adjacent spines, sometimes thicker than other spines, remaining spines thin, pointed and about one segment length. Oral tentacle pore adjacent to adoral shield with 4-5 rounded scales, remaining pores with single tiny tentacle scale.

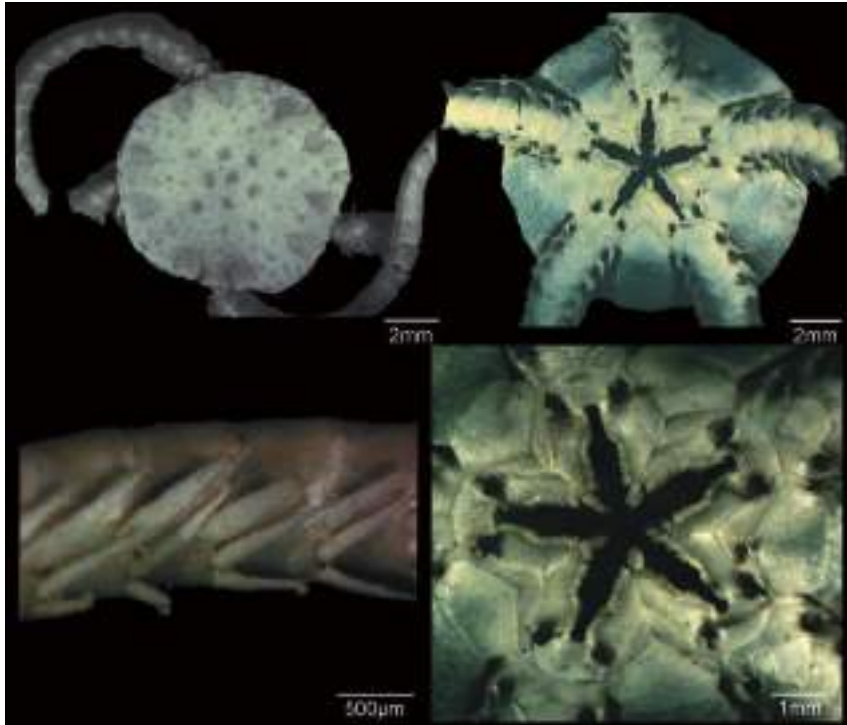
**Distribution and habitat** – Atlantic Ocean, Bay of Biscay, Spain, southern Australia, New Zealand, Kerguelen Islands, Pacific Ocean (Mortensen 1927; Clark & Courtman-Stock 1976), South Africa: Saldanha Bay (WC) to Gansbaai (WC); depth range: 910-4060 m. Habitat: *Globigerina* ooze (Lyman 1882); green and grey mud.

**Remarks** – Specimens examined were missing their arm combs, but Clark & Courtman-Stock (1976) (as *O. latens*) noted that these were easily lost.

The type material is in the Museum of Comparative Zoology (syntypes: MCZ OPH-1019, MCZ OPH-765, MCZ OPH-767), type locality is west of Marion Island, depth 2514 m.



**Fig. 60.** Distribution of *Ophiocten hastatum* in South Africa.



**Fig. 61.** Dorsal disc (top left), ventral disc (top right), arm spines (bottom left), jaws (bottom right) views of *Ophiocten hastatum* (SAMC A7475).

### Genus *Ophiura* Lamarck, 1801

**Diagnosis** – Adapted from Matsumoto (1917) and Clark & Courtman-Stock (1976). Disc flat, covered with scales, usually small, sometimes armed with scattered spines, primary rosette usually distinct. Radial shields mostly not contiguous. Genital papillae well-developed, arm combs usually present. Second oral tentacle pore usually outside the oral slits, sometimes opening into oral slit on adradial side with numerous scales and may form a continuous series with oral papillae. Arms flat or cylindrical, tapering, not stout. Dorsal arm plates usually well-developed, usually broadly contiguous. Ventral arm plates small, usually separated from one another by large lateral arm plates bearing 3-7 arm spines, tapering but blunt or needle-like, appressed or flaring. Proximal tentacle pores large, with numerous scales. Tentacle scales one, two or many, becoming very small distally.

### *Ophiura kinbergi* Ljungman, 1867

*Ophiura kinbergi* Ljungman, 1866: 166; Lyman 1882: 38-39, pl. 4, fig. 7; Koehler 1905a: 22-24; Koehler 1907: 294; Clark 1911, 37, fig. 9; Matsumoto 1917: 271-272, fig. 73; Rowe & Gates 1995: 437-438; Clark & Rowe 1971: 128, fig. 46b,

pl. 22, figs 5, 6. Ludwig 1901: 925; Price 1981: 7; Vine 1986: 195; Imaoka *et al.* 1991: 96, fig. 54; Liao & Clark 1995: 303-304, fig. 173.

*Ophioglypha kinbergi* Ljungman 1867: 166.

*Ophioglypha sinensis* Lyman, 1871: 12-14, pl. 1, figs 1, 2; Lyman 1878, 99; Döderlein 1896, 283-284, pl. 15, figs 3, 3a; Koehler 1898b: 60, pl. 2, fig. 6, pl. 4, fig. 39.

*Ophioglypha ferruginea* Lyman, 1878: 68, pl. 3, fig. 76.

*Ophiura (Ophiura) kinbergi*: Clark & Courtman-Stock 1976: 194, 127, 107, fig. 222.

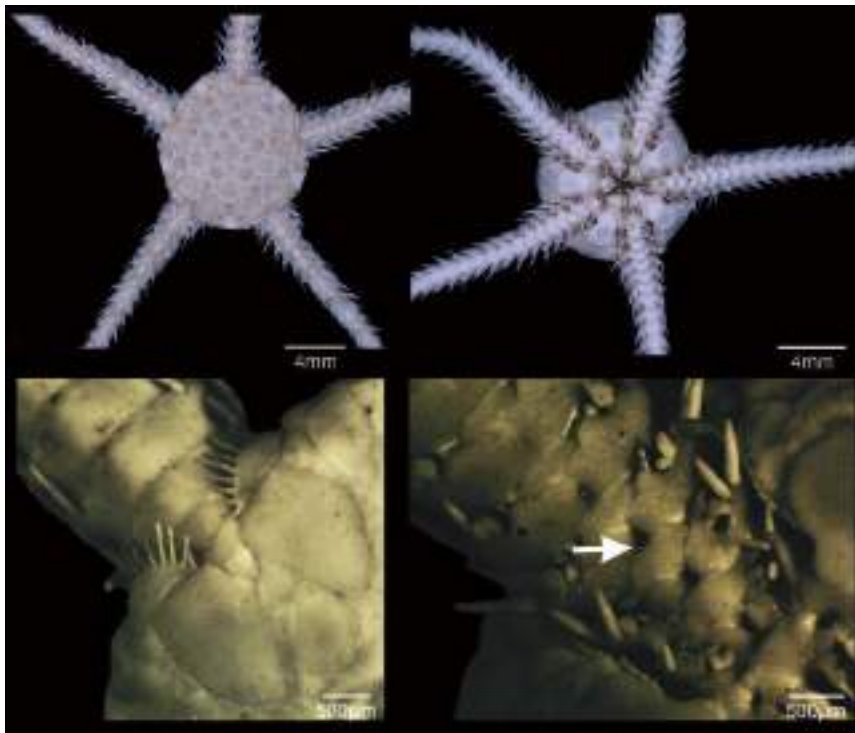
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 9.5 mm. Disc round, disc plates thick, primary rosette distinct and surrounded by slightly smaller plates. Radial shields oval, tapering slightly on distal side, longer than wide, c. one-third to half disc radius, approximating distally but not contiguous, separated by scales. Arm combs present, distinct with long, sharp, tapering papillae. Ventral interradiar area covered in overlapping plates. Oral shields large, pentagonal, constricted in vicinity of genital slits. Adoral shields narrow, contiguous. Oral papillae three, either side of apical papillae, pointed. Teeth five, same shape as apical papillae. Genital slits long, single and armed with small, conical, blunt genital papillae. Dorsal arm plates trapezoid, wider than long proximally, becoming longer than wide, contiguous. Ventral arm plates small, oval, wider than long, pointed on proximal side, separated by large lateral arm plates which meet ventrally and form cavity or hollow on first 3-5 segments. Arm spines three, one segment length, tapering. Oral tentacle pores with c. three rounded tentacle scales. Tentacle scales 2-3 on first few segments, then single rounded large scale for length of arm. Colour in life uniformly grey (Rowe & Gates 1995).

**Distribution and habitat** – Red Sea, Gulf of Thailand, Andaman Sea, Japan, Australia, Indo-Pacific southwards towards and including Bass Strait, south east Arabia, Persian Gulf, West India, Pakistan, Ceylon, Bay of Bengal, East Indies, Philippines, China, South Pacific Islands and Hawaii (Lyman 1878; Matsumoto 1917; Clark & Rowe 1971; Tortonese 1977; Rowe & Gates 1995; Putschakarn & Sonchaeng 2004), South Africa: Amatikulu (KZN) to Sodwana Bay (KZN); depth range: 0-500 m. Habitat: sand and sea grass beds.

**Remarks** – Distribution of this species here extended from Amatikulu to Sodwana Bay. Several species have been synonymised under *Ophiura kinbergi*, however, genetic data indicates the presence of several species. Tropical Australian specimens differ genetically from those from Southern Australia (Sydney is the type locality of *O. kinbergi*) and could be called *O. indica* (Brock, 1888) (type locality Indonesia) or *Ophiura sinsensis* (type locality Hong Kong) depending on how these clades are found to be distributed. The relationships of the specimens from the south-western Indian Ocean are unknown, and in the interim we retain the name *O. kinbergi*. The type specimens of *O. kinbergi* are SMNH type-1416, *O. sinensis* are holotype: MCZ OPH-623, paratypes: MCZ OPH-4114, MCZ OPH-975, and the types of *Ophiura indica* are presumably in the Zoological Museum Göttingen.



**Fig. 62.** Distribution of *Ophiura kinbergi* in South Africa.



**Fig. 63.** Dorsal whole (top left), ventral whole (top right), arm combs (bottom left), cavity on ventral arms (bottom right) views of *Ophiura kinbergi* (RMCA MT1566). Arrow indicating cavity between lateral arm plates.

### ***Ophiura ljungmani*** (Lyman, 1878)

*Ophioglypha lepida* Lyman, 1878: 70-71, pl. 3, figs 71-73, Lyman 1882: 43-44, pl. 4, figs 1-3; Koehler 1907: 294; Koehler 1914a: 20.

*Ophioglypha ljungmani* Lyman 1878: 71-72, pl. 3, fig. 77; Lyman 1882: 44-45, pl. 4, figs 8-10; Koehler 1907: 294.

*Ophioglypha thouletii* Koehler, 1895: 456-458, fig. 4; Koehler 1896a: 241; Koehler 1909b: 158-159, pl. 6, fig. 6; pl. 26, figs 1, 2.

*Ophiura ljungmani*: Ludwig, 1901: 925; Clark 1915a: 321; Mortensen 1927: 240-242, fig. 130; Clark 1954: 377; Alva & Vadon 1989: 828; Hernández-Herrejón *et al.* 2008: 101-102, fig. 3e-f; Laguarda-Figueras *et al.* 2009: 74-75, fig. 19.

*Ophiura lepida* Ludwig 1901: 925.

*Ophioglypha ljungmanni*: Koehler 1906: 6; Koehler 1909: 152.

*Ophiura (Ophiura) ljungmani*: Paterson 1985:118-120, fig. 44; Alva & Vadon 1989: 828-829, 841-831, fig. 8a, b.

**Diagnosis** – Adapted from Lyman (1882) and Mortensen (1927). D.D. up to 13 mm, disc round. Central disc plate and primary rosette distinct in some specimens, remainder of disc covered in plates and small spines (easily rubbed off), plates larger towards disc margin. Radial shields pyriform or teardrop-shaped, half disc radius in length, separated by plates, may or may not be contiguous distally. Arm combs present at arm bases, comb papillae longest in middle of comb. Ventral interradiar area covered in overlapping plates, but most of area taken up by large, triangular oral shield. Adoral shields narrow, contiguous. Oral papillae 3-4 either side of blunt apical papillae. Teeth 3-4, uppermost two square, others same shape as apical papillae. Genital slits long, single and armed with many small genital papillae. Dorsal arm plates rhombic, convex distally, contiguous proximally, almost as wide as long, becoming longer than wide and not contiguous on distal arm. Ventral arm plates fan-shaped, distal edge convex, not contiguous, becoming semi-circular, separated by large lateral arm plates. Arm spines three, small, tapering, high on lateral arm plate, upper arm spines as long as segment length, lower spines no longer than half segment length, arm spines begin on second or third segment and similar in size to tentacle scales. Oral tentacle pores with many scales, up to 10 on first and second oral pore. Tentacle scales on remainder of arm vary from 1-3.

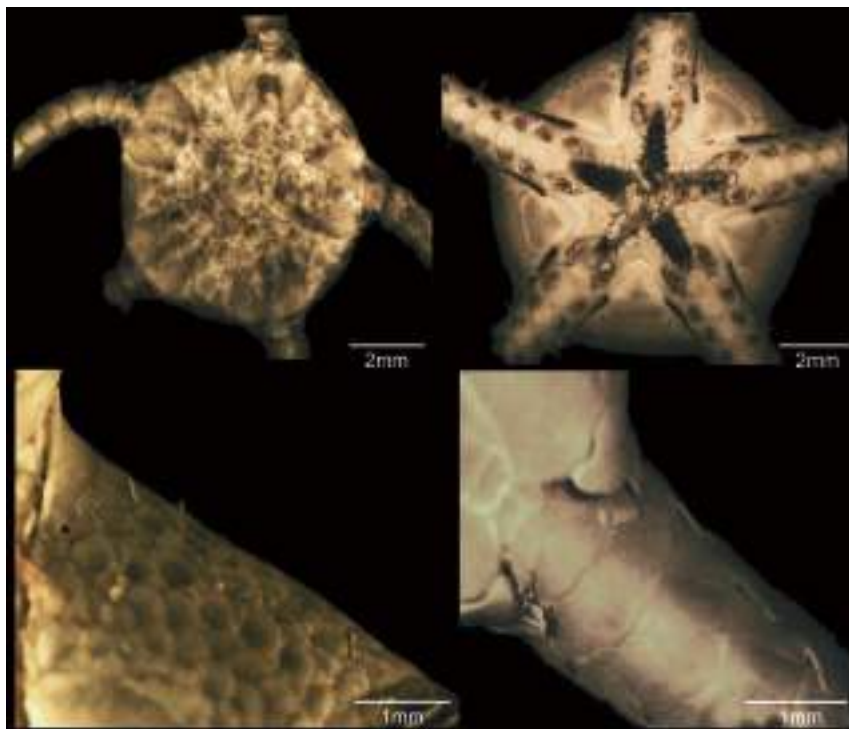
**Distribution and habitat** – Brazil, Mexico, Tobago, Bay of Biscay, Azores, Florida north to Labrador Basin, south east Iceland to North Africa (Clark 1915a; Mortensen 1927; Paterson 1985; Laguarda-Figueras *et al.* 2009), South Africa: off Orange River (NC) to off Cape Town (WC); depth range: 528-3906 m. Off South Africa the species is only known from 2688-3906 m. Habitat: mud.

**Remarks** – Disc spines were only seen on a single examined specimen, many specimens damaged. Paterson (1985) also recorded that disc spines had been rubbed off in many specimens he examined. Radial shields usually not contiguous, this variation also noted by Lyman (1882).

Paterson (1985) stated that *Ophiura ljungmani* had been recorded in 'Southern Africa' but the source of this record could not be traced. In addition, Paterson (1985) also stated the type specimens of *Ophioglypha lepida* were in the Natural History Museum in London, however, these types could not be traced in the online catalogue. Type locality off Bermuda, depth 2469 m.



**Fig. 64.** Distribution of *Ophiura ljungmani* in South Africa.



**Fig. 65.** Dorsal disc (top left), ventral disc (top right), ventral disc spines (bottom left), dorsal arm bases (bottom right) views of *Ophiura ljungmani* (SAMC A23344).



### *Ophiura trimeni* Bell, 1905

*Ophiura trimeni* Bell, 1905: 257-258, pl. 1, figs 3, 4; Clark 1923: 360-361; Mortensen 1933a: 384-385, fig. 84; Clark 1974: 475-476.

*Ophiura (Ophiura) trimeni*: Clark & Courtman-Stock, 1976: 194-195, figs 224, 127, 107; Alva & Vadon 1989: 841-842, figs c, d.

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

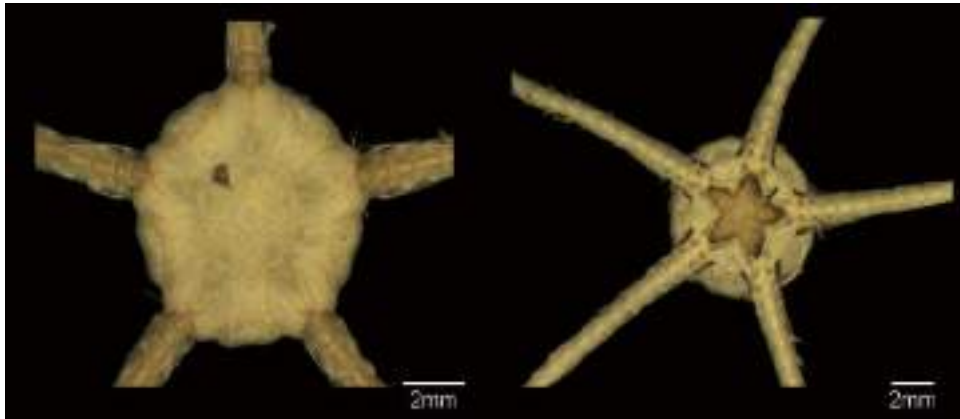
**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 9 mm. Disc plates present, sometimes armed with small spines, primary rosette and central plates distinct in some specimens. Radial shields half disc radius, twice as long as wide, approximating distally, but not contiguous. Arm combs present, not always distinct and rubbed off easily, papillae short and stout. Ventral interradiar area covered in small, overlapping plates. Oral shields large, pentagonal, constricted in vicinity of genital slits and strongly pointed on both sides, distal edge truncated. Adoral shields narrow, contiguous. Oral papillae three, distalmost broadest, apical papillae pointed. Teeth 3-5, same shape as apical papillae. Genital slits long, single and armed with small, rounded genital papillae. First 2-4 dorsal arm plates elongated, contiguous, wider than long, flat on distal side, becoming oval and small, distal side convex, becoming longer than wide, not contiguous, straight proximal edge. Ventral arm plates fan-shaped, as wide as long for first 2-3 segments, contiguous, becoming small and wider than long and semi-circular with median tip on distal edge. Lateral arm plates large, separating both dorsal and ventral arm plates distally, notch on distal sides adjacent to tentacle pores. Arm spines three, proximally spines twice segment length, one segment length distally. Spines irregular, in some specimens uppermost longest or thicker, remaining spines three, equal in size. Oral tentacle pores with up to ten rounded scales. Tentacle scales up to seven from segments 1-3, then on free segments decreasing from 3-1 distally, elongated but blunt.

**Distribution and habitat** – South Africa: off Platbaai (NC) to Sodwana Bay (KZN); depth range: 165-1647 m. Habitat: sand, mud, rough bottom and sponge.



**Fig. 66.** Distribution of *Ophiura trimeni* in South Africa.

**Remarks** – This species, closely related to the Indo-Pacific *Ophiura ooplax* H.L. Clark, 1911, is endemic to South Africa, with the distribution range extended to Sodwana Bay (Kendyl le Roux, pers. comm.). Arm combs not distinct and can be easily missed (Mortensen 1933a) or completely absent (Clark 1923). The Iziko South African Museum material includes a ‘cotype’ (SAMC A7471), type locality is west of Cape Town, depth 285-420 m.



**Fig. 67.** Dorsal (left) and ventral (right) views of *Ophiura trimeni* (SAMC A084237).

### Genus *Dictenophiura* H.L. Clark, 1923

**Diagnosis** – Adapted from Clark (1923) and McKnight (2003). Primary dorsal disc plates enlarged. Radial shields contiguous. First dorsal arm plate with longitudinal furrow. Double arm combs.

### *Dictenophiura anoidea* H.L. Clark, 1923

*Dictenophiura anoidea* Clark, 1923: 361-363, pl. 19, figs 1, 2; Mortensen 1933a: 388-390, figs 86, 87a; Clark & Courtman-Stock 1976: 188, 125, 107, fig. 220; Morgans 1959: 303; Day *et al.* 1970: 80.

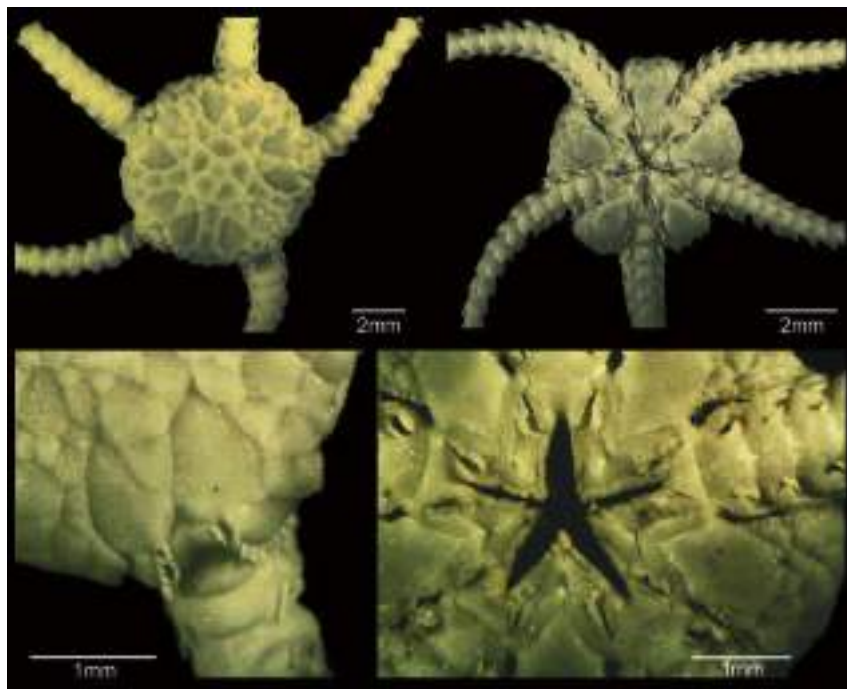
**Diagnosis** – Adapted from Clark (1923) and Clark & Courtman-Stock (1976). D.D. up to 10 mm, disc round, thick with vertical edge, disc plates thick, primary rosette distinct in most specimens, surrounded by slightly smaller plates. Radial shields oval or pyriform, longer than wide, c. half disc radius, approximating distally, contiguous. Arms inserted below disc. Arm combs present, double set, primary arm comb extending from genital slit, secondary comb opposing primary comb. Ventral interradiar area covered in thick, overlapping plates. Oral shields large, pentagonal, slightly constricted by genital slits. Adoral shields contiguous. Oral papillae three, distalmost broadest, apical papillae pointed. Teeth same shape as apical papillae. Genital slits long, single, armed with small, rounded, blunt genital

papillae. Dorsal arm plates fan-shaped, wider than long, contiguous proximally, becoming non-contiguous and as long as wide distally. Lateral arm plates large, separating both dorsal and ventral arm plates distally. Ventral arm plates fan-shaped, only contiguous on first 3-5 segments, becoming small distally. Arm spines three, short, thick, half segment length, tapering, blunt. Oral tentacle pores with up to seven rounded scales. Tentacle scales round, up to three basally, becoming one on remainder of arm.

**Distribution and habitat** – South Africa: Lambert’s Bay (WC) to Amanzimtoti (KZN); depth range: 0-250 m. Habitat: sand, shell, rock and mud.



**Fig. 68.** Distribution of *Dictenophiura anoidea* in South Africa.



**Fig. 69.** Dorsal (top left), ventral (top right), dorsal arm bases (bottom left), jaws (bottom right) views of *Dictenophiura anoidea* (SAMC A084244).

**Remarks** – Endemic to South Africa. Although Madsen (1970) demoted *Dictenophiura anoidea* to *Ophiura (Dictenophiura) anoidea*, Clark & Courtman-Stock (1976) ignored this, even though they referred to Madsen's suggestion. This species is morphologically more similar to *D. skoogi* (Koehler, 1923) from West Africa and *D. carnea* (Lütken, 1856) from the north-east Atlantic, than *Dictenophiura* species from Australia.

Clark (1923) stated that the holotype was at the Iziko South African Museum (SAMC A6438; False Bay, depth 40 m), but this specimen was not located. Three paratypes were examined, namely SAMC A7473 (Great Fish Point, depth 90 m), SAMC A7474 (Cove Rock, depth 79m) and SAMC A7505 (False Bay, depth 40 m).

#### 4.2.4. Family OPHIOPYRGIDAE Perrier, 1893

##### Genus *Amphiophiura* Matsumoto, 1915

**Diagnosis** – Adapted from Matsumoto (1915) and Mortensen (1927). Disc thickly scaled and plated, primary rosette distinct. Radial shields stout. Oral shields oval, pyriform or trefoil. Arms moderately long, tapering gradually to blunt tips, distinctly keeled. Dorsal and ventral arm plates fairly well-developed, broadly in contact in at least proximal segments, arm spines tapering but blunt, few to numerous. Second oral tentacle pore open or entirely outside oral slits, tentacle pores large. Tentacle scales numerous.

##### *Amphiophiura sculptilis* (Lyman, 1878)

*Ophioglypha sculptilis* Lyman, 1878: 84-85, pl. 4, figs 115, 116; Lyman 1882: 37; Koehler 1914a: 24.

*Ophioglypha variabilis* Lyman, 1878: 85-86, pl. 4, figs 113, 114; Lyman 1882: 37.

*Ophiura sculptilis*: Ludwig 1901: 925; Clark 1911: 77.

*Ophioglypha remota* Koehler, 1904a: 54, pl. 9, figs 1-3.

*Amphiophiura sculptilis*: Koehler 1922b: 364; Clark 1915a: 313; Matsumoto 1915: 77; Hertz 1927a: 74; Clark H.L. 1939: 108; Madsen 1951: 114; Litvinova 1971: 299, pl. 3, figs 2, 4, 5; Vadon & Guille 1984: 588, 592-593, pl. 5, 1-4; Guille & Vadon 1986: 169; Manso 2010: 196; Olbers *et al.* 2015: 91.

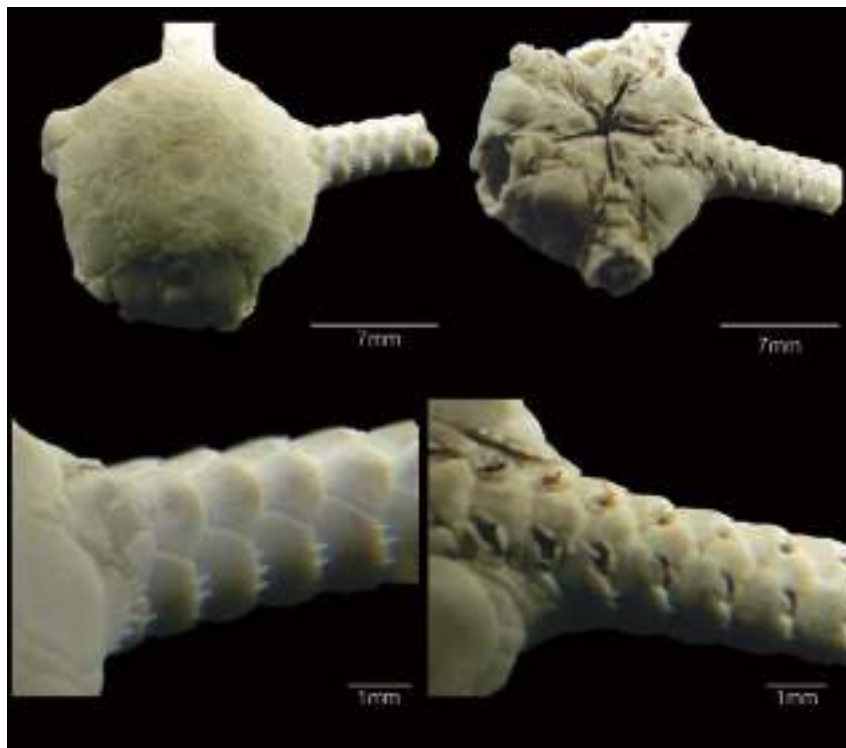
**Diagnosis** – Adapted from Lyman (1878), Vadon & Guille (1984) and Olbers *et al.* (2015). D.D. up to 15 mm. Dorsal disc thick, plates flat, large round central plate, five distinct primary plates separated by small irregular scales. Radial shields distinct, D-shaped or broad triangular, contiguous distally, tapering proximally with wedge of scales between them, large scale present marginally on dorsal interradial area. Ventral interradial areas scaled, but dominated by large oral shield. Oral shield pentagonal, distal edge rounded, slightly longer than wide, covering most of the ventral disc surface. Adoral shields relatively broad, contiguous. Oral papillae five, broad, closely set, apical papillae blunt. Genital slits moderately long, genital papillae present, squarish becoming spiniform, forming arm combs dorsally. Dorsal arm plates fan or diamond-shaped, rounded distal edge, contiguous. Lateral arm

plates broad, meeting ventrally. Ventral arm plates squat, bell-shaped, constricted by large tentacle pores, distal edge longer than proximal edge, wider than long, distal edge straight, becoming rounded, not contiguous. Arm spines up to six, blunt. Tentacle pores large, tentacle scales up to five within disc, two on remaining arm.

**Distribution and habitat** – Antarctic Ocean, Reunion, Zanzibar, Oman, Bay of Bengal, Indonesia, Japan, South America, Brazil (Koehler 1914a; Koehler 1922b;



**Fig. 70.** Distribution of *Amphiophiura sculptilis* in South Africa.



**Fig. 71.** Dorsal disc (top left), ventral disc (top right), dorsal basal arms (bottom left), ventral basal arms (bottom right) views of *Amphiophiura sculptilis* (USNM E42847).

Vadon & Guille 1984), South Africa: off Durban (KZN) (Guille & Vadon 1986); depth range: 1000-4320 m. Habitat: grey sand and mud, *Globigerina* ooze.

**Remarks** – Reported as a new record for South Africa in Olbers *et al.* (2015) from a single record, collected during the French expedition Safari I with the research vessel *Marion-Dufresne*. The syntypes are in the Museum of Comparative Zoology (MCZ OPH-731 and MCZ OPH-715), type locality off Yokohama, Japan, depth 3429 m.

### ***Amphiophiura trifolium* Hertz, 1927**

*Amphiophiura trifolium* Hertz, 1927a: 78-79, pl. 6, figs 14, 15; Clark H.L. 1939: 108-109; Clark 1974: 476; Clark & Courtman-Stock 1976: 187, 107, 125.

**Diagnosis** – Adapted from Hertz (1927) and Clark & Courtman-Stock (1976). D.D. up to 12 mm. Dorsal disc fairly thick, plates thick, moderately distinct, primary and central plates better defined. Radial shields usually distinct, rounded triangular, contiguous distally, length less than half disc radius. Arm combs present, primary set coarse papillae becoming broader ventrally, secondary set with blunt, finer papillae. Ventral interradiation areas minimal, scaled, but dominated by the large oral shields, which are trefoil in shape with distalmost side being rounded, broad and proximal side protruding from constriction at about one-third of length. Adoral shields narrow, contiguous proximally. Oral plates slightly sunken. Single apical papillae with 5-6 oral papillae either side, not well defined, some broad. Teeth 2-3, tapering. Dorsal arm plates oval or bell-shaped, twice as long as wide proximally, first 4-5 contiguous, then separated. Lateral arm plates broad and large. Ventral arm plates squat bell-shaped, wider and round on distal side, not contiguous. Arm spines 2-3, small, short, no more than one-third segment length, on the distal arm one spine (usually uppermost) becoming hooked. Genital slits long, genital papillae present only on distalmost side, forming arm combs on dorsal side. Tentacle pores large, tentacle scales 2-3.

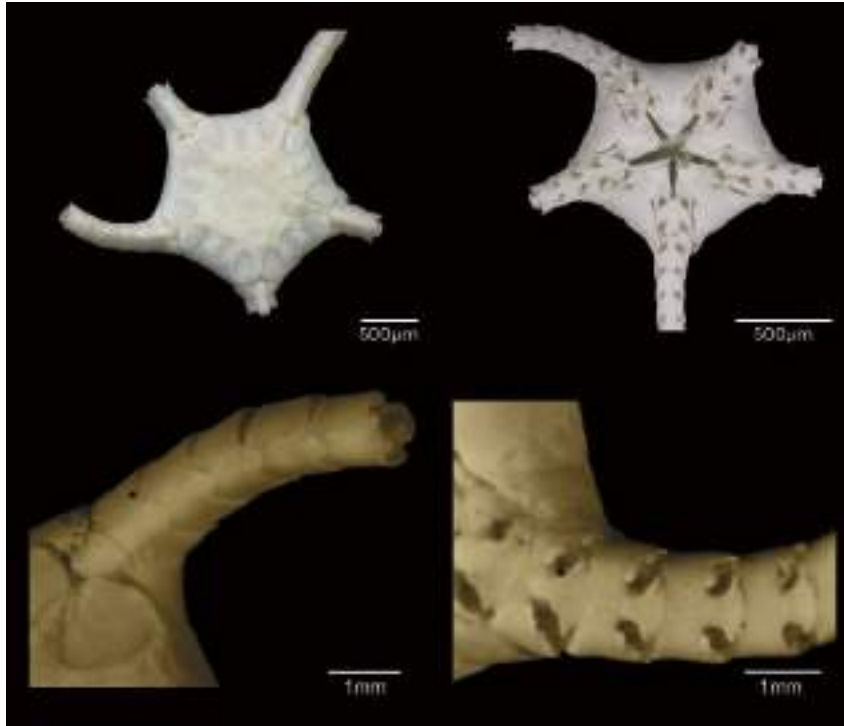
**Distribution and habitat** – Mozambique, Zanzibar, Kenya, Somalia, Maldives (Stöhr 2007b), South Africa: Margate (KZN) to off Kosi Bay (KZN); depth range: 850-2727 m. Habitat: hard sand, rock and *Globigerina* ooze.



**Fig. 72.** Distribution of *Amphiophiura trifolium* in South Africa.

**Remarks** – Specimens examined were all damaged and missing arms. The number of tentacle scales could therefore not be determined.

Type material is in the Museum of Natural History of Berlin (syntype: ZMB Ech 6983), type locality off Somalia, depth 1289-1633 m.



**Fig. 73.** Dorsal disc (top left), ventral disc (top right), dorsal basal arms (bottom left), ventral basal arms (bottom right) views of *Amphiophiura trifolium* (SAMC A23217).

### Genus *Anophiura* H.L. Clark, 1939

**Diagnosis** – Adapted from Clark (1939). Disc flat and thin, interradial disc scales large, five marginal plates in each interradial. Arms slender. Dorsal and ventral arm plates small. Arm combs may or may not be present. Oral shields, adoral shields and oral plates large, covering most of interradial area. Oral papillae low, wide, quadrilateral. Genital slits two per interradius. Tentacle pores only three pairs on each arm, first pair with two low, wide tentacle scales, other two pairs with single, circular tentacle scale.

## ***Anophiura simplex*** H.L. Clark, 1939

*Anophiura simplex* Clark H.L., 1939: 119, figs 55, 56; Clark 1977: 135, 143.

**Diagnosis** – Adapted from Clark (1939). D.D. up to 7 mm, D.D./A.L. = 1/2. Disc round, covered in plates both dorsally and ventrally, primary rosette distinct. Dorsal interradiar marginal area covered by single plate. Radial shields naked, large, broad triangular, one-third disc radius, as wide as long, contiguous but separated proximally by elongated scale. No arm combs. Oral papillae appear fused, with lowermost tooth distinct. Oral tentacle pores on outside of oral slit, with numerous scales surrounding pore. Oral shields naked, large, pentagonal, as wide as long, or slightly wider. Adoral shields large, contiguous. Genital slits long, thin, no genital papillae. Dorsal arm plates triangular, with slightly convex distal edge, small, as long as wide basally, becoming wider than long distally, not contiguous on entire arm. Ventral arm plates small, twice as wide as long, elliptical, distal edge convex, not contiguous for entire arm. Lateral arm plates make up most of arm segments, meeting dorsally and ventrally. Arm spines three, very short, tapering, uppermost longest, first two separated from third spine. Tentacle pores not present on entire arm. Tentacle scales two or three basally, becoming single, circular.

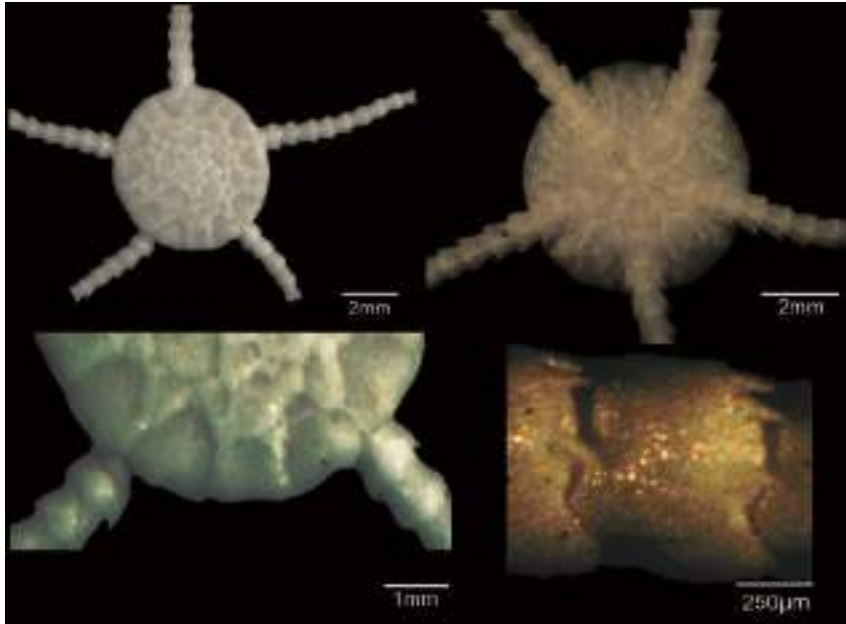
**Distribution and habitat** – South Arabia (Clark H.L. 1939), South Africa: off Kosi Bay (KZN); depth range: 720-1046 m. Habitat: no information available.

**Remarks** – Only one specimen was available for examination in the Iziko South African Museum collection. This species has three arm spines, in which two are separated from the third, similar to the spine arrangement in *Ophiura* (*Ophiuroglypha*) *irrorata irrorata*. The type material is in the Natural History Museum, London (NHMUK 1948.5.26.363) and the type locality is south Arabian coast, depth 1046 m.



**Fig. 74.** Distribution of *Anophiura simplex* in South Africa.





**Fig. 75.** Dorsal disc (top left), ventral disc (top right), radial shields (bottom left), arm spines (bottom right) views of *Anophiura simplex* (SAMC A22954).

### Genus *Aspidophiura* Matsumoto, 1915

**Diagnosis** – Adapted from Matsumoto (1915). Disc elevated above arms, flat, covered with naked plates. Ventral interradiial areas dominated by single plate. Arm combs present. Oral shields large. Oral papillae joined, second oral tentacle pores outside oral slits, with numerous scales. Genital slits two per interradius. Arms relatively short. Dorsal arm plates small or absent. Ventral arm plates small, triangular. Tentacle pores present only on first few basal segments. Arm spines three, short, conical. Tentacle scales present or absent.

### *Aspidophiura corone* Hertz, 1927

*Aspidophiura corone* Hertz, 1927a: 79-80, pl. 7, figs 1, 2; Clark 1977: 135, 143.

**Diagnosis** – Adapted from Hertz (1927) and Clark (1977). D.D. up to 5 mm. Disc round with slight indentations at arm bases, covered in plates dorsally and ventrally, primary rosette distinct with large central plate. Dorsal interradiial marginal area covered by large single scale. Radial shields naked, large, broad triangular, almost half disc radius, longer than wide, inner margins straight, not contiguous. Arm combs present. Oral papillae appear fused, lowermost tooth distinct. Oral tentacle pores lie outside of oral slit with numerous scales surrounding pore. Oral shields naked, large, spearhead-shaped with proximal tip triangular, sharp, lateral sides slightly restricted and distal edge with wide distal lobe. Adoral shields large,

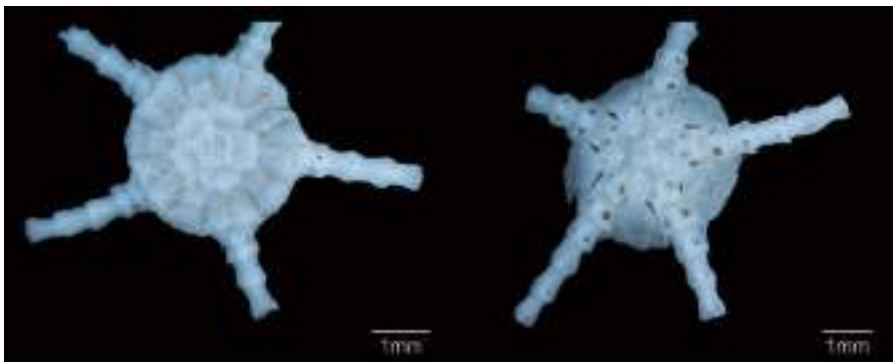
contiguous. Genital slits long, slightly restricted on lateral sides of oral shield. Dorsal arm plates triangular, very small, widely separated. Ventral arm plates small, fan-shaped, wider than long, distal edge convex, not contiguous for entire arm. Lateral arm plates make up most of arm segments, meeting dorsally and ventrally. Arm spines three, short, tapering. Tentacle pores large. Tentacle scales two basally, becoming single.

**Distribution and habitat** – Somalia and East Africa, South Africa: Cape Vidal (KZN) to Kosi Bay (KZN); depth range: 740-977 m. Habitat: no information available.

**Remarks** – No new specimens have been found in South Africa since those identified by Clark (1977). The holotype (ZMB Ech 6984) is in the Museum of Natural History of Berlin, type locality is off Somalia, East Africa, depth unknown.



**Fig. 76.** Distribution of *Aspidophiura corone* in South Africa.



**Fig. 77.** Dorsal (left) and ventral (right) views of *Aspidophiura corone* (SAMC A22955).

## Genus *Ophiuroglypha* Hertz, 1927

**Diagnosis** – Adapted from McKnight (2003). Usually recognised as having three small arm spines, middle spine becoming an upturned hooklet on distal arm segments (Hertz 1927a).

### *Ophiuroglypha costata* (Lyman, 1878)

*Ophioglypha costata* Lyman, 1878: 76-77, pl. 4, figs 92-94; Lyman 1882: 50, pl. 5, figs 1-3.

*Ophiozona capensis* Bell, 1905: 256-257, pl.1, figs 1, 2.

*Ophiura costata*: Clark 1923: 357-358; Clark A.M. 1952: 201; Ludwig 1901: 925.

*Ophiuroglypha capensis*: Hertz 1927a: 90-91, pl. 7, fig. 10.

*Ophiura (Ophiuroglypha) costata*: Mortensen 1933a: 385-386, fig. 85a, d.

*Ophiura (Ophiuroglypha) costata costata*: Clark & Courtman-Stock 1976: 195-196, 127, 107, figs 209, 216; Alva & Vadon 1989: 828-829, 843, fig. 8e, f.

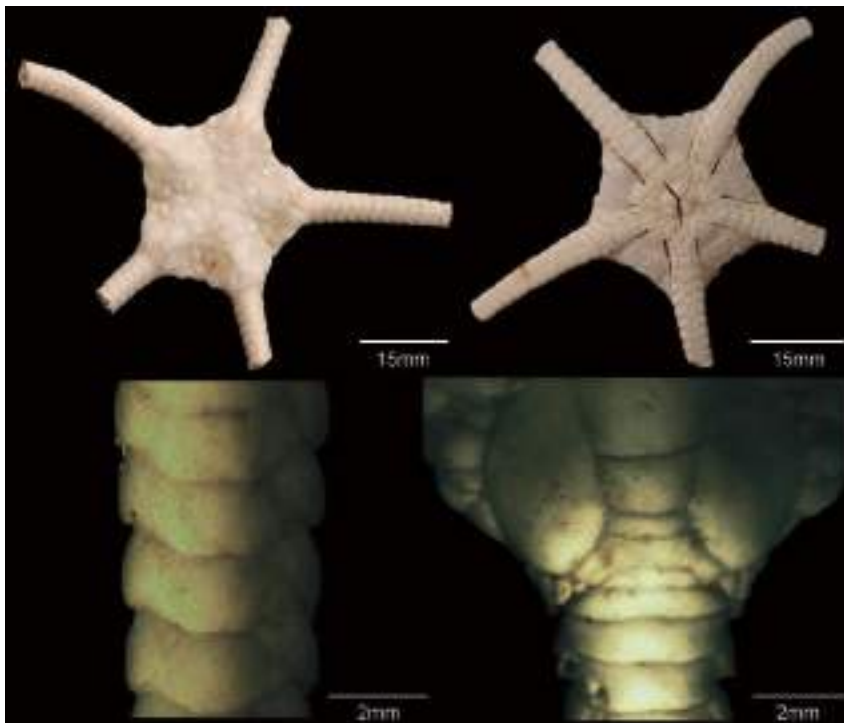
**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 23 mm, D.D./A.L. = 1/4. Disc pentagonal, disc plates flat, irregular, primary rosette distinct in most specimens. Few scattered disc spines dorsally and ventrally. Radial shields longer than wide, oval, separated by large plates. Arm combs present, not distinct, widely separated, papillae stout, thick and short, restricted to bases of radial shields. Ventral interradial area covered in thick, large plates. Oral shields fairly large, triangular, with rounded distal edge. Adoral shields contiguous. Oral papillae irregular, 3-5 either side of pointed apical papillae. Teeth three, broad triangular, oral slits narrow, base of jaws sunken. Genital slits long, single and armed with squat, broadly attached genital papillae. Dorsal arm plates not carinate, elongated trapezoidal, contiguous, wider than long, becoming fan-shaped with rounded point on distal side, contiguous for c. half arm then separated by lateral arm plates. Ventral arm plates pentagonal, contiguous for one or two segments, becoming diamond-shaped, wider than long. Lateral arm plates large, separating both dorsal and ventral arm plates distally, arm spines low on plate. Arm spines three, very short. Second oral tentacle pores not in series with oral papillae, with up to 12 scales, then decreasing towards free segments, small and indistinct from arm spines. Tentacle scales from segments 1-3, up to seven scales, then decreasing to one distally on free segments, elongated but blunt, adradial tentacle scale not enlarged.

**Distribution and habitat** – South Africa: off Orange River (NC) to Cape St Francis (EC); depth range: 43-1647 m. Habitat: sand, mud, shells, stones, gravel and rock.

**Remarks** – Endemic to South Africa. The type material is in the Museum of Comparative Zoology (syntype: MCZ OPH-577), type locality Agulhas Bank, depth 275m. O'Hara *et al.* (2017) recognised *Ophiuroglypha* as a separate genus, as genetic data indicates that these species are in a separate family than the true *Ophiura* species.



**Fig. 78.** Distribution of *Ophiuroglypha costata* in South Africa.



**Fig. 79.** Dorsal disc (top left), ventral disc (top right), dorsal arm plates (bottom left), arm base (bottom right) views of *Ophiuroglypha costata* (SAMC A23265).

## ***Ophiuroglypha tumida* Mortensen, 1933**

*Ophiura* (*Ophiuroglypha*) *tumida* Mortensen, 1933a: 387-388, fig. 85b, c, pl. 19, figs 22-23.

*Ophiura* (*Ophiuroglypha*) *costata tumida*: Clark & Courtman-Stock 1976: 196, figs 223, 225, 127, 107; Alva & Vadon 1989: 843.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 13 mm, disc round, tumid, plates medium-sized, thick, irregular, primary rosette distinct. Radial shields slightly longer than wide, oval, separated interradially by single disc scale, just shorter than half disc radius. Ventral interradial area covered in four thick disc plates adjacent to two large genital plates, one wider than long on disc margin, two plates touching oral shield and smaller scale in between, often triangular in shape. Oral shields fairly large, pentagonal, rounded but flat distal edge. Adoral shields contiguous. Oral papillae irregular, 3-5 either side of pointed apical papillae, distalmost being broadest. Genital slits long, single and armed with squat, rectangular, broadly-attached genital papillae. Dorsal arm plates fan-shaped, not contiguous. Ventral arm plates bell-shaped, becoming triangular, distal edge straight, but rounded distally. Lateral arm plates large, separating both dorsal and ventral arm plates. Arm spines three, short, uppermost slightly longer. Oral tentacle pores not in series with oral papillae, with up to nine scales, then decreasing towards free segments from 3-1 tentacle scales and then one on remainder of arm, small and indistinct.

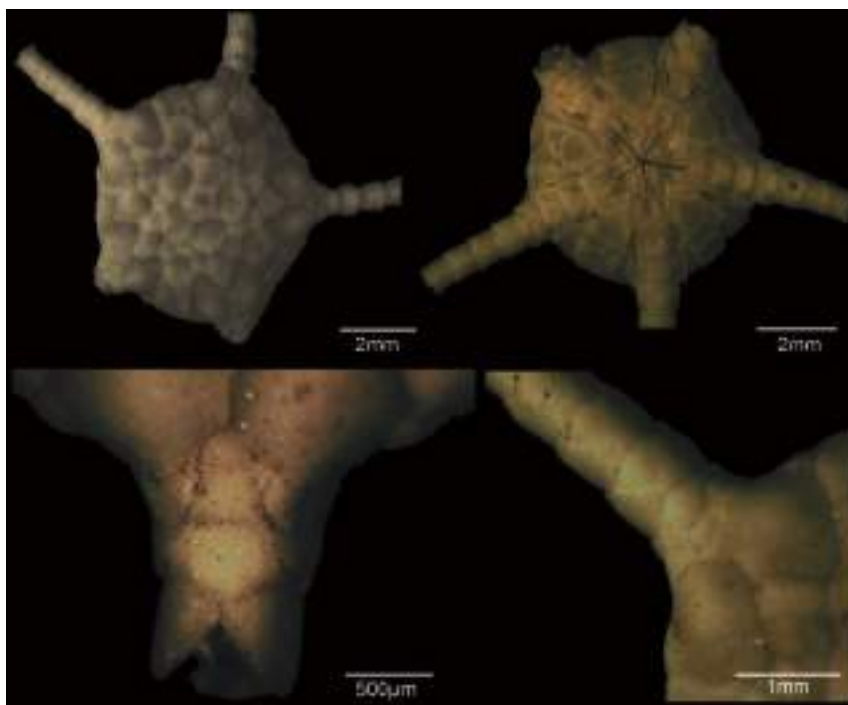
**Distribution and habitat** – Namibia, South Africa: Durban (KZN); depth range: 122-820 m. Habitat: no information available.

**Remarks** – Only recorded by the *Pickle* (1929) and *Valdivia* (1985). In this study, three specimens from the *Pickle* expedition were examined from the Iziko South African Museum (including two paratypes; SAMC A22369). All were in a poor condition and a count of tentacle scales could not be carried out with certainty. Type locality is off Durban, depth 232 m.



**Fig. 80.** Distribution of *Ophiuroglypha tumida* in South Africa.

It is uncertain whether this species is related to *O. costata*, it shows similarities to *O. scomba* as described by Paterson (1985) (O'Hara, pers. obs.), and as such warrants full species recognition.



**Fig. 81.** Dorsal disc (top left), ventral disc (top right), dorsal arm base (bottom left), radial shields (bottom right) views of *Ophiuroglypha tumida* (SAMC A22370).

### ***Ophiuroglypha irrorata irrorata* (Lyman, 1878)**

*Ophioglypha irrorata* Lyman, 1878: 73-74, pl. 4, figs 106-108; Lyman 1882: 47-48, pl. 5, figs 7-9; Koehler 1914a: 18-20, pl. 1, figs 3, 4.

*Ophioglypha orbiculata* Lyman, 1878: 74-75, pl. 4, figs 103-105.

*Ophioglypha grandis* Verrill, 1894: 293-295.

*Ophioglypha involuta* Koehler, 1897: 295-297, pl. 6, figs 16-18; Koehler 1899: 15-16, pl. 8, figs 61-63.

*Ophioglypha tumulosa* Lütken & Mortensen, 1899: 120-122, pl. 1, figs 9-13.

*Ophiura irrorata*: Ludwig 1901: 925; Clark 1911: 62-64; Clark 1915a: 320; Matsumoto 1917: 277-278; Koehler 1922b: 380; Clark 1923: 358-359; Mortensen 1927: 235; Clark H.L. 1939: 109; Madsen 1955: 11; Madsen 1956: 26; Madsen 1967: 130; Martynov & Litvinova 2008: 79-80, pl. 1c.

*Homalophiura irrorata*: Koehler 1922a: 55-57, pl. 86, figs 15, 16.

*Ophiuroglypha irrotata*: Hertz 1927a: 86-87 (*lapsus calami*).

*Ophiura (Ophiuroglypha) irrorata*: Mortensen 1933a: 388; Clark & Courtman-Stock 1976: 107, 127, 197, fig. 217.

*Ophiura (Ophiuroglypha) irrorata irrorata*: Mortensen 1933c: 86-87; Paterson 1985: 123-124, figs 46, 47.

**Diagnosis** – Adapted from Lyman (1882), Clark & Courtman-Stock (1976) and Paterson (1985). D.D. up to 30 mm. Disc pentagonal, disc plates small and irregular, primary rosette distinct. Radial shields round to oval, separated by plates. Arm combs present, widely separated, papillae stout and short. Ventral interradial area covered in thick, medium-sized, overlapping plates. Oral shields pentagonal, flat distal edge, fairly large. Adoral shields contiguous. Oral papillae irregular, mostly pointed, 6-8 either side of pointed apical papillae, in series with first set of oral tentacle scales. Teeth 3-4, similar in shape to apical papillae. Genital slits long, single and armed with squat, broadly attached genital papillae. Dorsal arm plates trapezoid, contiguous for most of arm, becoming fan-shaped with round distal edge. Ventral arm plates bell-shaped proximally, becoming diamond-shaped, wider than long with rounded distal edge. Supplementary ventral arm plate adjacent to lateral arm plates present on basal segments. Lateral arm plates large, with three arm spines, very small, upper spine well-separated from other two spines. Oral tentacle pores, with up to 15 scales, then decreasing towards free segments to about 3-4 scales and further down the arm to one, small and not distinct from arm spines. Tentacle scales from segments 1-3 up to seven, then decreasing on free segments from 3-1 distally, barely distinct from segment 10-12, adradial tentacle scale slightly enlarged which may appear similar to a supplementary ventral arm plate.

**Distribution and habitat** – Currently considered almost cosmopolitan, but absent in Arctic seas (Clark H.L. 1939; Paterson 1985; Martynov & Litvinova 2008), South Africa: off Saldanha Bay (WC) to off Quoin Point (WC), depth range: 403-7340 m (Martynov & Litvinova 2008). This species is likely to contain numerous morphologically similar species across its wide range (O'Hara unpublished data). However, the species living at lower bathyal depths off South Africa is likely to be the true *O. irrorata* as the type locality occurs in this region. Habitat: *Globigerina* and grey ooze.



**Fig. 82.** Distribution of *Ophiuroglypha irrorata irrorata* in South Africa.

**Remarks** – *Anophiura simplex* (Ophiolepididae) has a similar arm spine arrangement with two arm spines widely separated from the third spine. The type material is in the Museum of Comparative Zoology (syntype: MCZ OPH-615), type locality south of Cape Agulhas, depth 3475 m.



**Fig. 83.** Dorsal disc (top left), ventral disc (top right), dorsal arm and radial shields (bottom left), arm spines (bottom right) views of *Ophiuroglypha irrorata irrorata* (SAMC A23341).

### ***Ophiuroglypha schmidtotti* (Hertz, 1927)**

*Ophiuroglypha schmidt-otti* Hertz, 1927a: 91-93, fig. 5, pl. 7, figs 11, 12.

*Homalophiura schmidtotti*: Clark 1977: 136, 144-145.

*Ophiura (Ophiuroglypha) schmidtotti* Paterson 1985: 136, 151.

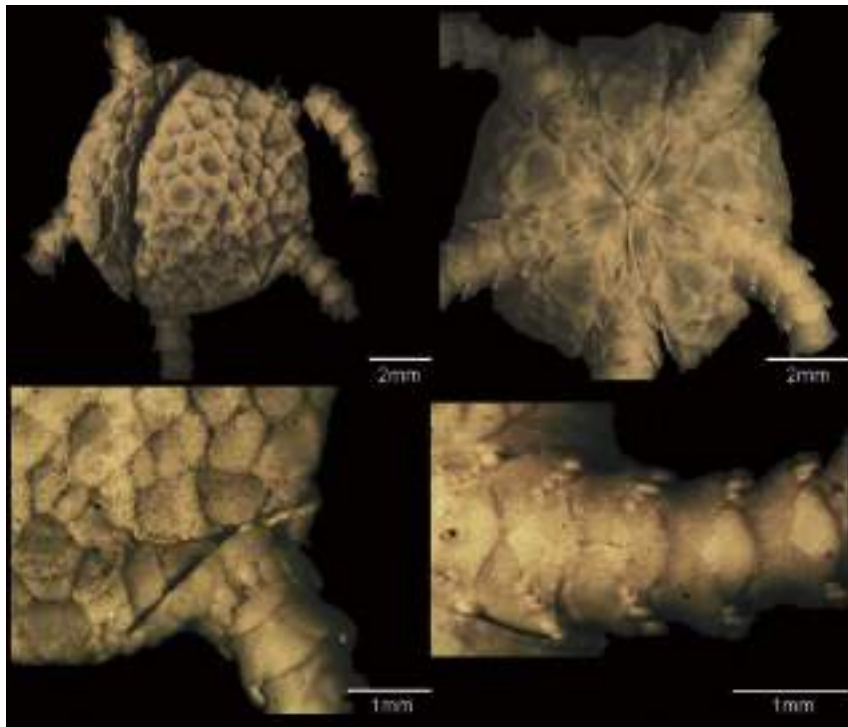
**Diagnosis** – Adapted from Clark (1977) and Paterson (1985). D.D. up to 9 mm, D.D./A.L. = 1/2.5. Disc round, disc plates thick, medium-sized, irregular, primary rosette distinct and large central disc scale. Radial shields triangular or oval, only just touching distally unless separated by row of plates, longer than wide, c. one-quarter to one-third disc radius in length. Arm combs distinct, papillae large, square. Oral shields rounded pentagonal, slightly convex on distal edge, slightly wider than long, fairly large. Adoral shields relatively large, contiguous. Oral papillae 3-6 either



side of apical papillae, all broad. Genital plates distinct, single, slits long, armed with short, squat, broad genital papillae. Dorsal arm plates triangular, contiguous for first 2-3 segments, wider than long basally. Ventral arm plates bell-shaped, then becoming wider than long and fan-shaped, only first two plates contiguous, remaining plates not contiguous. Lateral arm plates large, separating both dorsal and ventral arm plates. Arms relatively short. Arm spines three, short, blunt, equal



**Fig. 84.** Distribution of *Ophiuroglypha schmidtotti* in South Africa.



**Fig. 85.** Dorsal disc (top left), ventral disc (top right), arm combs (bottom left), ventral arms (bottom right) views of *Ophiuroglypha schmidtotti* (SAMC A22811).

in length, not tapering, one hooked and turned upwards. Oral tentacle pores in series with oral papillae, with up to ten scales, then decreasing to single, small tentacle scale distally.

**Distribution and habitat** – East Africa and Indonesia (Hertz 1927a), South Africa: St Lucia (KZN); depth range: 693-1644 m. Habitat: no details available.

**Remarks** – A single specimen was examined, on which all arms were broken and tentacle scale count could not be undertaken. The type material is in the Museum of Natural History of Berlin (ZMB Ech 7009, ZMB Ech 7010, ZMB Ech 7011 and ZMB Ech 7012, type locality is Sumatra and East Africa, depth 1143 m (Hertz 1927a)).

### '*Ophiura*' *flagellata* (Lyman, 1878)

*Ophioglypha flagellata* Lyman, 1878: 69, pl. 2, figs 49-51; Lyman 1882: 42, pl. 4, figs 16-18; Koehler 1899: 18-19; Koehler 1904a: 56; Koehler 1907: 294.

*Gymnophiura coeruleascens* Lütken & Mortensen, 1899: 114-116: pl. 7, figs 4-6.

*Ophiura flagellata*: Clark 1911: 60-62, fig. 15; Matsumoto 1917: 273-274; Koehler 1922b: 375-377, pl. 85, figs 1, 6, 7, pl. 86, figs 1-4, 10; Clark 1923: 359-360; Mortensen 1933a: 383-384; Murakami 1942: 28; Baker 1979, 22, fig. 1a, c, e; Imaoka *et al.* 1990: 97, fig. 55.

*Ophiura* (*Ophiura*) *flagellata*: Clark & Courtman-Stock 1976: 193-194, figs 221, 127, 107; Alva & Vadon 1989: 828-829, 841.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 29 mm, disc pentagonal. Central disc plate covered in skin, not distinct in adults, surrounded by overlapping medium-sized plates. Radial shields small, oval in shape, partly covered by disc plates, widely separated. Arm combs present at base of arms. Ventral interradiation area covered in overlapping plates, but most of area taken up by large pentagonal oral shield with pointed proximal edge, equally long as wide, elongated in larger specimens. Adoral shields contiguous. Oral papillae five either side of rounded apical papillae, all squarish slightly tapering, distalmost smaller but not broader. Oral papillae in series with oral tentacle scales. Genital slits long, single and armed with many sharp genital papillae. First dorsal arm plates triangular, wider than long, with convex distal edge, remaining plates hexagonal, wider than long, contiguous for length of arm. Ventral arm plates rhombic proximally, wider than long, becoming diamond-shaped, but still wider than long, contiguous until fourth or fifth segment then separated by lateral arm plates, ventral arm plates becoming reduced distally. Oral tentacle pores within oral slit, with up to ten oral tentacle scales. Arm spines three, uppermost longest, about one to one-and-a-half times segment length, tapering but not sharp. Tentacle scales, many (up to eight in examined specimens) in proximal parts of arm, decreasing to one distally.

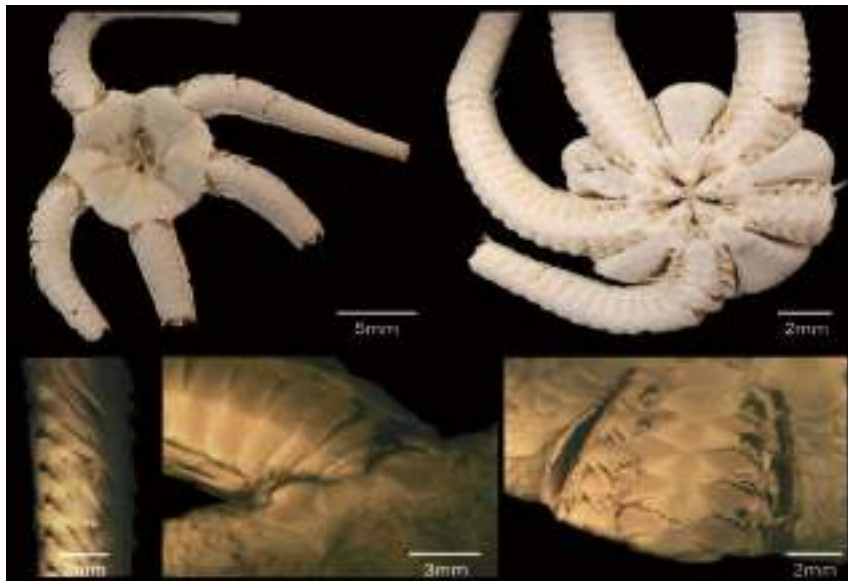
**Distribution and habitat** – Bering Sea, Andaman Islands, Indonesia, Japan, Australia, Tasman Sea, western Mexico, eastern Atlantic (Baker 1979; Rowe &

Gates 1995), South Africa: off Saldanha Bay (WC) to North of Richards Bay (KZN); depth range: 96-2330 m (Baker 1979). Habitat: mud.

**Remarks** – The DNA analysis of O'Hara *et al.* (2017) indicates that this species belongs to the family Ophiopyrgidae and thus requires a new genus name. Syntypes in the Natural History Museum in London (NHMUK 1882.12.23.444), type locality Japan (Rowe & Gates 1995), depth unknown.



**Fig. 86.** Distribution of '*Ophiura*' *flagellata* in South Africa.



**Fig. 87.** Dorsal whole (top left), ventral disc (top right), arm spines (bottom left), basal dorsal arms (bottom centre), basal arms and genital slits (bottom right) views of '*Ophiura*' *flagellata* (SAMC A7470).

**4.3. Order OPHIOSCOLECIDA O’Hara, Hugall, Thuy, Stöhr & Martynov, 2017**  
**4.3.1. Family OPHIOSCOLECIDAE Lütken, 1869**

Genus *Ophiolycus* Mortensen, 1933

**Diagnosis** – Adapted from Mortensen (1933a) and Martynov (2010). Disc covered in skin. Radial shields moderately developed, elongated, genital slits long; genital plates bordering about two-thirds of slits. Oral papillae spiniform, similar in shape to the cluster of teeth. Oral tentacle scales almost in series with oral papillae. Oral shield oval to rhomboidal, indistinct distal lobe. Adoral shields bilobed distally, very narrow proximally. Dorsal arm plates moderately developed, sometimes fragmented. Ventral arm plate well defined. Arm spines relatively long, flattened, distally transformed into hooks. Tentacle scale absent or small.

*Ophiolycus dentatus* (Lyman, 1878)

*Ophioscolex dentatus* Lyman, 1878: 157, pl. 7, figs 184-186; Lyman 1882: 233, pl. 24, figs 4-6; Bell 1905: 259; Clark 1923: 314; Clark A.M. 1952: 199.

*Ophioscolex (Ophiolycus) dentatus*: Mortensen 1933a: 309-312, figs 32-34; Clark & Courtman-Stock 1976: 101, 111, 135, fig. 104; Alva & Vadon 1989: 832-833.

*Ophioscolex dentatus* var. *spiniger* Mortensen, 1933a: 312-313, fig. 35.

*Ophiolycus dentatus*: Martynov 2010: 104, fig. 71a-h, fig. 72.

**Diagnosis** – Adapted from Lyman (1878), Lyman (1882); Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 23 mm, disc covered in thick skin dorsally and ventrally, small spines on dorsal disc. Radial shields narrow, just shorter than width of arm base. Oral shields oval, with broad distal lobe. Adoral shields contiguous, moderately narrow, with two spines, one in sequence with oral papillae. Oral papillae spiniform, long. Teeth similar in shape, but smaller and clustered at apex of jaw. Genital slits long, narrow. Genital plates present but not along entire length of slit. Arms five, simple, length moderate. Dorsal arm plates fragmented especially basally, but varied along length of arm, with no apparent pattern. Ventral arm plates distinct, equally as wide as long basally and contiguous, becoming longer than wide and not contiguous. Arm spines three, lowermost cigar-shaped, broad and flattened, approximately one segment length, remaining spines spiniform, uppermost being slightly longer than segment length, spines becoming hook-shaped distally. Tentacle pores large. Tentacle scales one, spiniform, small.

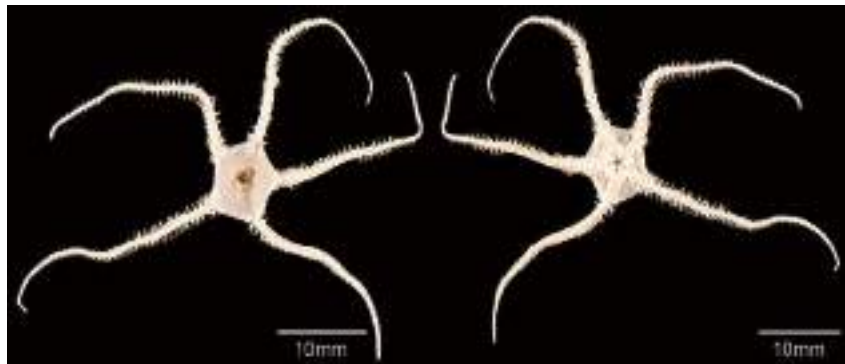
**Distribution and habitat** – Namibia, South Africa: off Groen River (NC) to Sodwana Bay (KZN); depth range: 129-450 m. Habitat: rock, black speckled sand, shell and mud.

**Remarks** – Specimens examined from Iziko South African Museum were all labelled as *Ophioscolex dentatus* var. *spiniger* Mortensen, 1933. See remarks

on *Ophiolycus* under *Ophioscolex inermis*. The syntype is in the Natural History Museum of Denmark (ZMUC OPH-284), type locality Agulhas Banks, depth 275 m.



**Fig. 88.** Distribution of *Ophiolycus dentatus* in South Africa.



**Fig. 89.** Dorsal (left) and ventral (right) views of *Ophiolycus dentatus* (ZMUC OPH-284).

### Genus *Ophioscolex* Müller & Troschel, 1842

**Diagnosis** – Adapted from Müller & Troschel (1842) and Martynov (2010). Disc covered in thick skin, small plates visible when dried, radial shields small, triangular, hardly conspicuous, genital slits long, conspicuous, genital plates border only distalmost part of slit. Oral papillae spiniform, teeth similar in shape, clustering. Oral shields vary in shape, with or without distinct distal lobe, adoral shields similar in size, slightly widened distally. Dorsal arm plates conspicuous in *O. inermis* only, ventral arm plates well-defined. Arm spines relatively long, conical, with or without hooks, tentacle scales absent or small, oval or spiniform.

***Ophioscolex inermis* Mortensen, 1933**

*Ophioscolex inermis* Mortensen, 1933a: 313-315, fig. 36; Martynov 2010: 108, 111.

*Ophioscolex (Ophioscolex) inermis*: Clark & Courtman-Stock 1976: 136, 101, 111, fig. 103.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 8 mm. Dorsal disc covering unknown. Oral shields small, rounded semi-circular inner edge, straight or slightly concave outer edge. Adoral shields large, contiguous radially. Oral papillae spiniform, slender, small, apex of jaw with cluster of papillae which are slightly longer. Oral tentacle pore not within mouth slit. Dorsal arm plates thin, transparent, broadly contiguous, distally convex, some appear to be split transversely into two parts. Ventral arm plates slightly longer than wide, distal edge flat or slightly concave. Arm spines three, long, slender, glassy, lowermost club-shaped. Tentacle scales absent.



**Fig. 90.** Distribution of *Ophioscolex inermis* in South Africa.



**Fig. 91.** Dorsal (left) and ventral (right) views of *Ophioscolex inermis* (ZMUC OPH-126).

**Distribution and habitat** – South Africa: Durban (KZN) to off Tugela River mouth (KZN); depth range: 366-412 m. Habitat: sandy mud.

**Remarks** – No specimen was examined during this study, but known to be endemic to South Africa. According to Mortensen (1933a) and Clark & Courtman-Stock (1976) there is only one collected specimen of this species. However, a second specimen was located in the Smithsonian Institution (USNM E42564, off Durban, 366 m), but no photos were available to examine the dorsal disc (Dave Pawson, pers. comm.). The holotype is in the Natural History Museum of Denmark (ZMUC OPH-126), type locality off Durban, depth 412 m.

#### **4.4. Order OPHIACANTHIDA O’Hara, Hugall, Thuy, Stöhr & Martynov, 2017**

##### **4.4.1. Family OPHIOTOMIDAE O’Hara *et al.*, 2018**

Genus *Ophiotoma* Lyman, 1883

**Diagnosis** – Adapted from Martynov (2010) and Lyman (1883). Disc with numerous small plates or disc scales and sometimes spinelets of various lengths. Radial shields elongated, distinct. Oral papillae short, conical. Oral tentacle scales in continuous series with oral papillae. Teeth broad, conical to rectangular. Oral shields broadly spearhead-shaped, with a short distal lobe. Adoral shields with distal wings, proximally tapered. Dorsal and ventral arm plates well-developed. Arm spines relatively long, rounded, smooth, not hooked. Tentacle pores relatively large. Tentacle scales small, rudimentary or absent.

*Ophiotoma* cf. *alberti* (Koehler, 1896)

*Ophiotrema alberti* Koehler, 1896a: 251; Koehler 1906: 6; Koehler 1907: 324; Koehler 1908a: 612; Koehler 1909: 196-198; Matsumoto 1915: 62; Koehler 1922b: 90; Mortensen 1927: 183; Gage *et al.* 1983: 288; Paterson 1985: 57-58, fig. 3; Smirnov *et al.* 2014: 197.

*Ophiotoma alberti*: Madsen 1951: 113; O’Hara & Stöhr 2006: 75; Martynov 2010: 18, 92, 97-103, 126, 131, figs 66A-E, 67A, 68, 6C, H, 13C, E, F, 18L, 28B; Olbers *et al.* 2015: 104, pl. 6C, D.

**Diagnosis** – Adapted from Paterson (1985) and Martynov (2010). D.D. up to 17 mm. Disc with small disc scales, scattered spinelets also extending onto ventral interradial areas. Radial shields naked, sometimes visible, rounded pear-shaped. Oral papillae 4-5, in continuous series with two scales at oral tentacle pores. Oral shields large, wider than long, nearly D-shaped, with rounded proximal edge and slight distal lobe. Adoral shields wing-like, proximal edge indented opposite second oral tentacle pore. Dorsal arm plates triangular to bell-shaped, twice as wide as long, nearly contiguous. Ventral arm plates rectangular, with obtuse proximal angle and slight indent on distal edge, nearly contiguous on proximal arm. Arm spines four, glassy, smooth, slightly flattened, rounded tip, uppermost longest, up to two

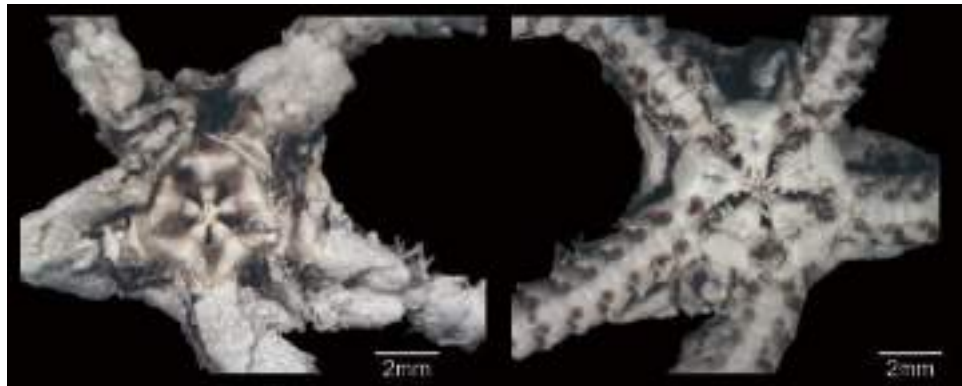
segments in length. Tentacle pores large. Tentacle scales needle-like or round, variable, small if not absent, 0-5 in number.

**Distribution and habitat** – North Eastern Atlantic (Paterson 1985), South Africa: off Cape Town (WC); depth range: 1862-4354 m. Habitat: no information available.

**Remarks** – Olbers *et al.* (2015) recorded this species as a new record for South Africa.



**Fig. 92.** Distribution of *Ophiotoma cf. alberti* in South Africa.



**Fig. 93.** Dorsal (left) and ventral (right) views of *Ophiotoma cf. alberti* (SAMC A22112).

### ***Ophiotoma cf. gracilis* (Koehler, 1914)**

*Ophiotrema gracilis* Koehler, 1914a: 112-114, pl. 12, figs 1, 2; Paterson 1985: 54, 58, fig. 23; Borrero-Perez *et al.* 2008: 181, fig. 71.

*Ophiotoma gracilis*: Martynov 2010: 98, 103, 141; Olbers *et al.* 2015: 104-105, pl. 6E, F.



**Diagnosis** – Adapted from Paterson (1985) and Martynov (2010). D.D. up to 11 mm. Disc with small disc scales, scattered spinelets also extending onto ventral interradiial areas, but not up to oral shields. Radial shields naked, elongated triangular, rounded distal margin, separated but diverging. Oral papillae five, conical, in a continuous series with two scales at oral tentacle pores, which are more elongated, almost spiniform. Oral shields large, much wider than long, spearhead-shaped, with distinct distal lobe. Adoral shields elongated, contiguous. Genital slits narrow. Dorsal arm plates triangular, distal edge convex, almost as long as wide, not contiguous. Ventral arm plates pentagonal, proximal edge concave and obtuse, lateral edges excavated by tentacle pores, much longer than wide, not contiguous. Arms relatively slender. Arm spines four, fine, smooth, pointed, uppermost longest, up to one-and-a-half segments in length. Tentacle pores large. Tentacle scales subequal, 5-6, spinose.

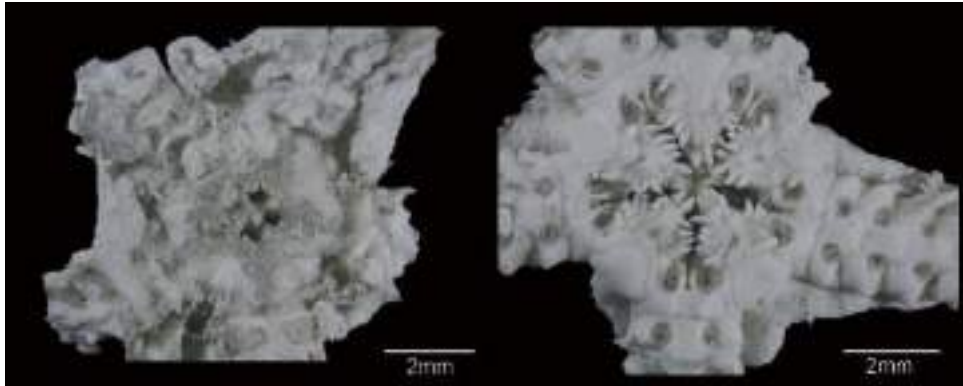
**Distribution and habitat** – Lesser Antilles and Columbia (Borrero-Pérez *et al.* 2008), South Africa: off Cape Town (WC); depth range: 490-2948 m. Habitat: no information available.

**Remarks** – Olbers *et al.* (2015) recorded this species as a new record for South Africa. In addition, they noted a number of differences which occur between *Ophiotoma alberti* and *O. gracilis*. In *O. gracilis* the arms are more slender, arm spines finer, dorsal arm plates narrower, smaller and more widely separated, ventral arm plates longer, the oral tentacle pore scales are different in size and shape to the oral papillae and the oral shields are spearhead-shaped. The tentacle scales in *O. alberti* are small, while in *O. gracilis* they are spinose and more distinct.

According to Borrero-Perez *et al.* (2008) the type locality of *O. gracilis* is Lesser Antilles and the type is in the Smithsonian Institution (USNM 32301), depth 1256 m (Koehler 1914a).



**Fig. 94.** Distribution of *Ophiotoma* cf. *gracilis* in South Africa.



**Fig. 95.** Dorsal (left) and ventral (right) views of *Ophiotoma* cf. *gracilis* (SAMC A22103).

### Genus *Ophiotreta* Verrill, 1899

**Diagnosis** – Adapted from Verrill (1899b). Jaw elongated with 5 or more oral papillae that can extend around the oral tentacle pore. Adoral shields may or may not be contiguous. Ventral arm plates as wide as long, proximal edge obtuse, distal edge convex, not contiguous distally. Arm spines cylindrical, but tapering slightly, flattened, slender, serrated or nearly smooth, do not approximate towards dorsal midline. Disc with spines or granules. Tentacle scales large, 1-2.

### *Ophiotreta durbanensis* (Mortensen, 1933)

*Ophiacantha* (*Ophiotreta*) *durbanensis* Mortensen, 1933a: 324-325, fig. 44, pl. 19. figs 13-15.

*Ophiacantha durbanensis*: Clark & Courtman-Stock 1976: 105, 121, 171, fig. 176.

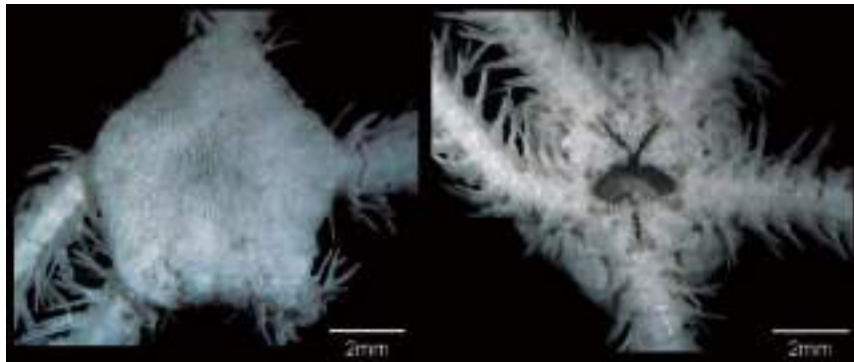
**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 7 mm, A.L. = 40 mm, D.D./A.L. = 1/6. Disc not constricted interradially. Disc covered with fine granules scattered, sometimes with few spines interspersed, extending to ventral interradiial areas, leaving areas closest to genital slits naked. Radial shields small, oval, partly naked, widely separated. Oral shields spearhead-shaped, longer than wide, distal sides slightly sunken. Adoral shields approximating or just contiguous. Oral papillae 5-6, oral tentacle scale also present at distal end of series. Genital slits narrow. Dorsal arm plates fan-shaped or triangular, distal edge slightly convex, just contiguous. Ventral arm plates broad fan-shaped, slightly wider than long, distal edge convex, contiguous, at least basally. Arm spines up to five, tapering, smooth or finely serrated, two segments in length, middle spines may be truncated. Tentacle pores small. Tentacle scales two, becoming one on distal arms, small, papilliform. Colour faint mottling of white and brown which disappears on distal arms.

**Distribution and habitat** – South Africa: Durban (KZN) to Sodwana Bay (KZN); depth range: 400-550 m. Habitat: no information available.

**Remarks** – Endemic to South Africa. The syntype is in the Natural History Museum of Denmark (ZMUC OPH-116) and the type locality is Durban, depth 411 m.



**Fig. 96.** Distribution of *Ophiotreta durbanensis* in South Africa.



**Fig. 97.** Dorsal (left) and ventral (right) views of *Ophiotreta durbanensis* (SAMC A22797).

### ***Ophiotreta matura*** (Koehler, 1904)

*Ophiacantha matura* Koehler, 1904a: 112-113, pl. 23, figs 2-4.

*Ophiotreta matura*: Koehler 1922b: 76-81, pl. 12, figs 1-6, pl. 13, figs 1-5, pl. 14, figs 1-5, pl. 15, figs 1-3, pl. 95, fig. 2; Koehler 1930: 66; Clark H.L. 1939: 53-54; Clark 1977: 135, 141; Clark & Courtman-Stock 1976: 121 (footnote); O'Hara & Stöhr 2006: 59-60, figs 4h-l, 17r.

*Ophioprium kapalae* Baker, 1979: 38-39, fig. 6g-m.

*Ophiotreta kapalae*: Paterson 1985: 56.

**Diagnosis** – Adapted from O’Hara & Stöhr (2006). D.D. up to 8 mm, D.D./A.L. = 1/4. Disc not constricted interradially. Disc covered in dense spines obscuring underlying plates, disc spines long, thorny, several with multiple thorns at tips, extending to ventral interradiial areas, leaving areas closest to genital slits naked. Radial shields covered in disc armament. Oral shields diamond-shaped, wider than long, distal edge convex. Adoral shields short, thick, contiguous. Oral papillae up to seven, with one or two oral tentacle scales at distal end of series, all spiniform. Genital slits wide. Dorsal arm plates triangular, distal edge convex, not contiguous, basal plates with tiny spines. Ventral arm plates fan-shaped, equally wide as long, distal edge strongly convex, not contiguous. Arm spines up to eight, finely serrated, tapering, uppermost longest, up to five segments long, lowest spine hooked on distal segments, spines meeting at dorsal midline. Tentacle scales two on basal pores, large, wide and rounded, becoming tapered sharp and thorny tipped, may be longer than ventral arm plate. Colour slightly green when dry (O’Hara & Stöhr 2006).

**Distribution and habitat** – Gulf of Aden, Indonesia, Philippines, eastern Australia, New Caledonia (O’Hara & Stöhr, 2006), South Africa: North of Richards Bay (KZN) to Sodwana Bay (KZN); depth range: 239-1270 m. Habitat: no information available.



**Fig. 98.** Distribution of *Ophiotreta matura* in South Africa.



**Fig. 99.** Dorsal (left) and ventral (right) views of *Ophiotreta matura* (SAMC A22919).

**Remarks** – Clark & Courtman-Stock (1976) only mention *Ophiotreta matura* in a footnote, noting that *O. matura* differs from *O. durbanensis* by the dense covering of elongated spinelets on disc and single, very large tentacle scale. Clark (1977) recorded this species as a new record for southern Africa. The type material is in the Zoological Museum Amsterdam (now Naturalis) (syntype: ZMA.ECH.O.2349) and the type locality is Maluku, Indonesia, depth 397 m.

#### **4.4.2. Family OPHIACANTHIDAE Ljungman, 1867 as restricted by O'Hara *et al.* (2018).**

**Diagnosis** – Adapted from Mortensen (1927), Clark & Courtman-Stock (1976), Paterson (1985), O'Hara & Stöhr (2006) and Martynov (2010). Disc covered to a varying degree by spines, stumps or granules, which may or may not conceal the plates. Single unpaired infradental apical papilla with three or more smaller oral papillae on either side in a continuous series, mostly pointed, papilliform or sometimes spine-like. Within this series, papillae may arise from the jaws. Teeth sometimes present. Arms flexible horizontally or dorsoventrally, sometimes with vertebrae being restricted, giving a moniliform appearance. Arm spines usually long and serrated to varying degrees. Tentacle pores usually small. Tentacle scales usually single. Most species found in deep-water, often clinging to corals, sponges or gorgonians.

##### **Genus *Ophiacantha* Müller & Troschel, 1842**

**Diagnosis** – Adapted from Mortensen (1927), Clark & Courtman-Stock (1976) and Devaney (1978). Disc not restricted interradially, covered by spines, stumps, granules or a combination of these, which may or may not conceal the plates. Radial shields inconspicuous, separated, bar-like, but only distal ends visible. Oral shields broad-rhombic, adoral shields relatively large and usually broadly contiguous, single unpaired apical papilla with three or more smaller oral papillae either side in a continuous series, mostly pointed, papilliform, and sometimes spine-like, often distalmost papillae enlarged. Teeth in single series, pointed. Dorsal arm plates small, fan-shaped or triangular with distal side convex, plate becoming rhombic distally. Ventral arm plates pentagonal or bell-shaped with distal side convex, not usually contiguous. Arm spines erect, often long, sometimes rugose, tapering, pointed. Tentacle pores small. Tentacle scales usually single, papilliform.

##### ***Ophiacantha baccata* Mortensen, 1933**

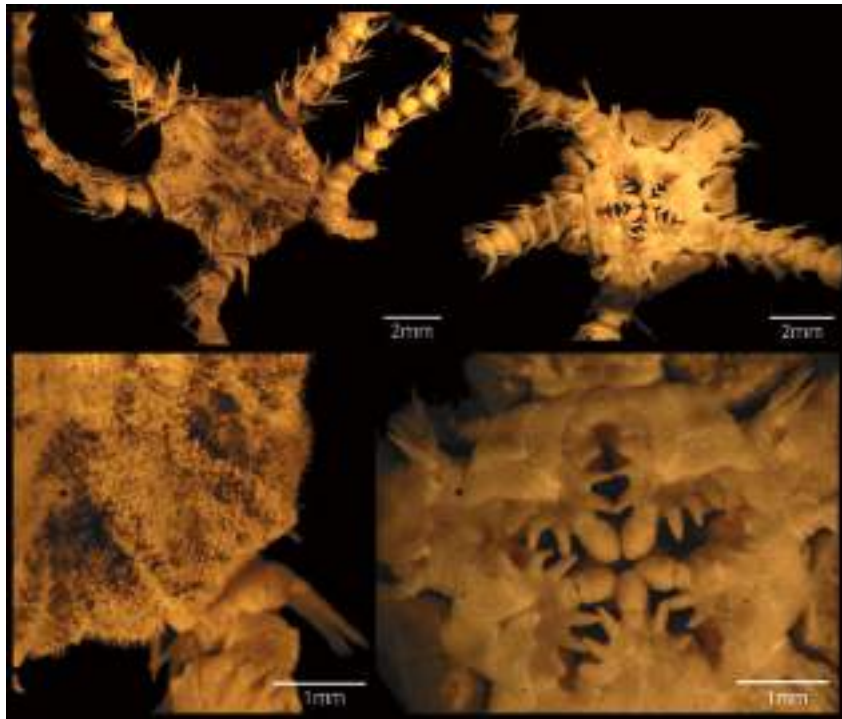
*Ophiacantha baccata* Mortensen, 1933a: 319-322, figs 40, 41, pl. 19; Clark & Courtman-Stock 1976: 104, 121, 167, figs 170, 181; Clark 1977: 135.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 6.5 mm, D.D./A.L. = c.1/6. Disc armed above and below with small trifid and multifid thorny stumps. Radial shields indistinct with distal ends naked. Oral shields diamond-shaped, with point on proximal side, sunken in the middle. Adoral

shields with narrow distal lobe, broadly contiguous. Oral papillae three each side of broad apical papilla, outermost broadest. Arms moniliform. Dorsal arm plates diamond-shaped, equally wide as long, widely separated by lateral arm plates. Ventral arm plates pentagonal, all plates smooth. Arm spines up to seven, slender, rugose, long, up to three times segment length. Tentacle scale small, single, elongated and rugose. Colour in life light straw, numerous dark spots scattered on disc, dark spots often have single, darker stump, arms lightly banded.



**Fig. 100.** Distribution of *Ophiacantha baccata* in South Africa.



**Fig. 101.** Dorsal whole (top left), ventral whole (top right), dorsal disc and arm bases (bottom left), jaws (bottom right) views of *Ophiacantha baccata* (SAMC A084245).

**Distribution and habitat** – Mozambique (Mortensen 1933a; Clark & Courtman-Stock 1976), South Africa: Cape Town (WC) to Kosi Bay (KZN); depth range: 9-900 m. Habitat: sand, shells and stones.

**Remarks** – Mortensen's Pacific Expedition collection of 1933 is lodged at the Natural History Museum of Denmark, which includes syntypes ZMUC OPH-75 and ZMUC OPH-359, while in the Iziko South African Museum, additional syntypes are housed (labelled as 'cotypes') (SAMC A22372), which were examined during this study. The type locality is Durban, depth 400-450 m.

### ***Ophiacantha nerthepsila* H.L. Clark, 1923**

*Ophiacantha nerthepsila* Clark, 1923: 319-322, fig. 1, pl. 19, figs 3, 4; Mortensen 1933a: 316-317, fig. 37; Day *et al.* 1970: 80; Clark & Courtman-Stock 1976: 104, 121, 168, fig. 173.

*Ophiacantha barracoutae* Koehler, 1923: 3-5, figs 1-3.

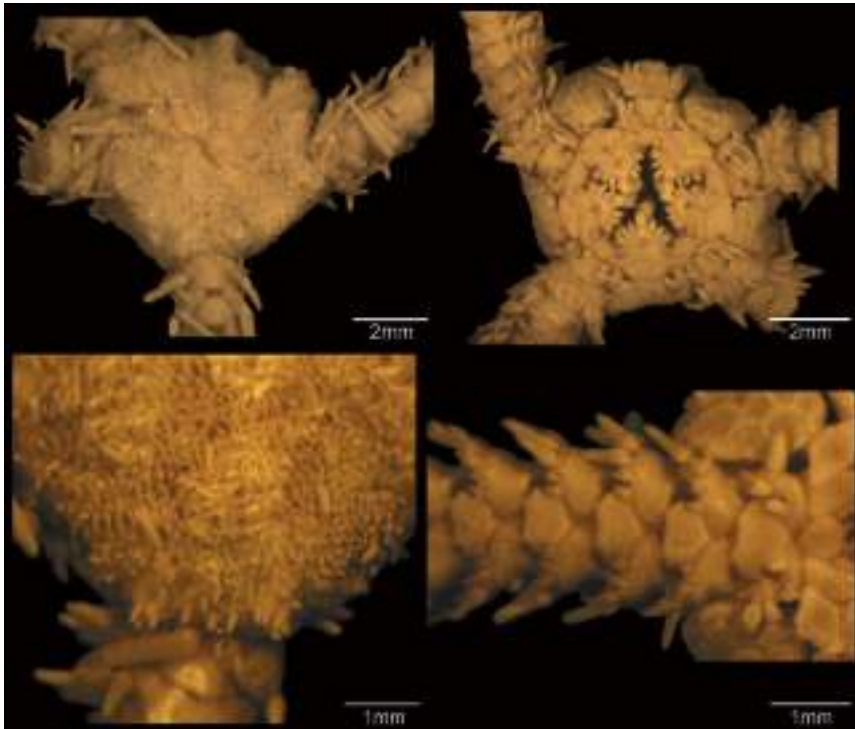
**Diagnosis** – Adapted from Mortensen (1933a). D.D. up to 7 mm, D.D./A.L. = c.1/3-4. Disc round, disc armed above with granules and scattered spinelets, sometimes extending onto ventral interradial areas. Radial shields widely separated, c. as wide as arm, mostly covered in granules and spines, with only small triangular portion of each exposed. Disc margin vertical. Oral shields broad diamond-shaped, sunken. Adoral shields with no distal lobe, contiguous. Oral papillae three each side of broad apical papilla, outermost broadest. Teeth becoming square deep in mouth. Dorsal arm plates fan-shaped or triangular, distal edge convex, may be bell-shaped if successive arm plates are sinuous, narrowly contiguous, if at all. Ventral arm plates pentagonal, distal side straight. Arm spines up to seven, uppermost longest, at most three times segment length, usually twice segment length. Tentacle scale small, single, spiniform but blunt. Colour pale brown, lighter below, dorsal interradial area with faint white patches surrounded by darker brown, arms banded.

**Distribution and habitat** – South Africa: Elands Bay (WC) to Mfafazana (KZN); depth range: 22-900 m. Habitat: rock, sand and mud.



**Fig. 102.** Distribution of *Ophiacantha nerthepsila* in South Africa.

**Remarks** – Endemic to South Africa. Distribution here extended both east and west within South Africa. The Iziko South African Museum has a type specimen, SAMC A6437 (examined), accessioned as the paratype, but according to Clark (1923) (original description) this accession number is the holotype. Additional types available include: paratypes: SAMC A7478 (examined) and ZMUC OPH-221. The type locality is Riet Point, Eastern Cape, depth 42 m.



**Fig. 103.** Dorsal disc (top left), ventral disc (top right), dorsal disc and arm bases (bottom left), ventral arms (bottom right) views of *Ophiacantha nerthepsila* (SAMC A084235).

### ***Ophiacantha scutigera* Mortensen, 1933**

*Ophiacantha scutigera* Mortensen, 1933a: 317-319, figs 38, 39, pl. 19, figs 6, 7;  
Clark & Courtman-Stock 1976: 104, 121, 168, figs 174, 179.

**Diagnosis** – Adapted from Mortensen (1933a). D.D. up to 6 mm, D.D./A.L. = 1/6. Disc covered with tubercles or low, blunt stumps with some scattered slender spinelets, becoming longer towards centre of disc. Radial shields short and small, tapering proximally, separated by less than arm width. Disc margin vertical, disc plates distinct, some tubercles present. Ventral interradial areas with medium to coarse scaling, with one or two scattered tubercles. Oral shields rhombic or



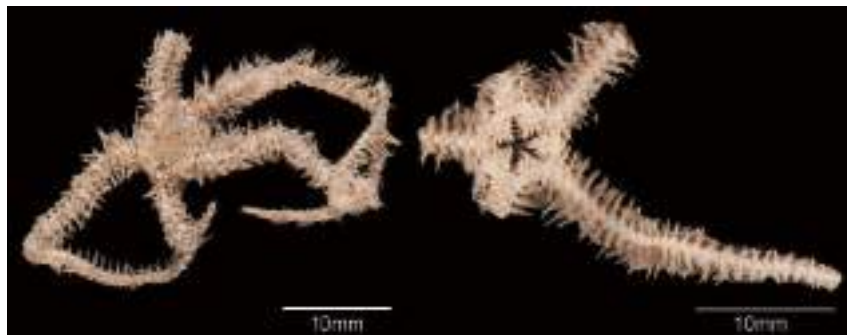
oval, with proximal point. Oral papillae three, sometimes four, may be concaved, outermost papilla sometimes slightly enlarged, broader infradental papilla. Teeth present, c. 5-6, similar in shape to apical papilla. Adoral shields contiguous. Dorsal arm plates triangular, twice as wide as long, with distal side convex, not contiguous, separated by lateral arm plate. Ventral arm plates fan-shaped, not contiguous, separated by lateral arm plates. Lateral and ventral arms plates with transverse concentric striations. Arm spines up to ten proximally, upper spines long and smooth, lower spines slightly serrated, spiniform, c. four times segment length on basal segments then two times on remaining arm. Uppermost arm spines on both sides of the arm almost meet at dorsal midline. Arms not moniliform. Tentacle scale single, rounded, fairly large. Colour light grey or brown with small dark spots around radial shields with dark patches on distal edges and dark spots along dorsal midline of arms.

**Distribution and habitat** – South Africa: Amanzimtoti (KZN) to Leven Point (KZN); depth range: 164-450 m. Habitat: no information available.

**Remarks** – Endemic to South Africa. Distribution here extended north and south within KwaZulu-Natal. The type material in the Iziko South African Museum was labelled as ‘cotype’ (SAMC A22368). Additional syntypes were located in the Natural History Museum of Denmark (ZMUC OPH-358 and ZMUC OPH-263). The type locality is off Durban, depth 219 m.



**Fig. 104.** Distribution of *Ophiacantha scutigera* in South Africa.



**Fig. 105.** Dorsal (left) and ventral (right) views of *Ophiacantha scutigera* (ZMUC OPH-263).

### ***Ophiacantha striolata* Mortensen, 1933**

*Ophiacantha striolata* Mortensen, 1933a: 322-324, figs 42, 43; Clark 1974: 442; Clark & Courtman-Stock 1976: 105, 121, 168-169, figs 169, 175, 180; Clark 1977: 135.

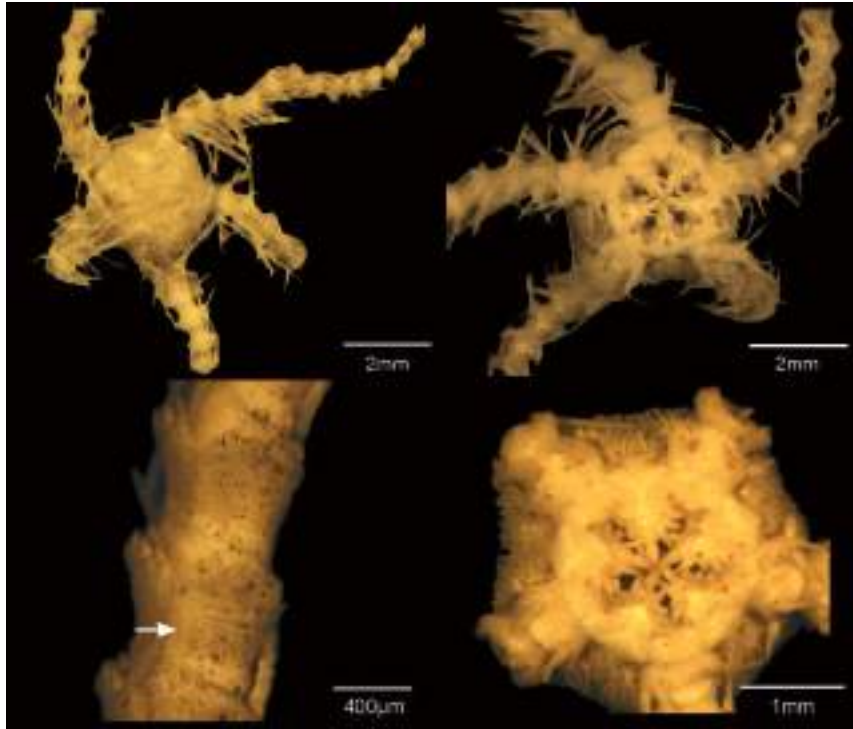
**Diagnosis** – Adapted from Mortensen (1933a). D.D. up to 3 mm, D.D./A.L. = 1/4. Disc covered with small, thorny, trifold stumps. Radial shields mostly covered in same armament, with only distal ends visible. Ventral interradiial areas covered in same stumps, except in areas closest to oral shields. Oral shields almost triangular, with slight distal lobe. Adoral shields fairly narrow, contiguous, with narrow distal lobe. Oral papillae three, all similar and narrow, conspicuously smaller than apical papilla. Dorsal arm plates small, triangular, distal side convex, not contiguous. Ventral arm plates fan-shaped, not contiguous, separated by lateral arm plates, first ventral arm plate narrow, longer than wide and distal edge strongly convex. All arm plates having transverse concentric striations. Arm spines up to eight, deeply serrated, slender, longest being twice segment length, distally spines nearly smooth except for lowermost, which have fine serrations. Arms not moniliform. Tentacle scale single, pointed, with furrow on upper side.

**Distribution and habitat** – South Africa: Cape Town (WC) to Sodwana Bay (KZN); depth range: 84-650 m. Habitat: fine khaki sand and gravel.

**Remarks** – Endemic to South Africa. A syntype is in the Natural History Museum of Denmark (ZMUC OPH-271), depth unknown.



**Fig. 106.** Distribution of *Ophiacantha striolata* in South Africa.



**Fig. 107.** Dorsal whole (top left; SAMC A084241), ventral whole (top right; SAMC A084241), concentric striations, as indicated by the arrow on arm plates (bottom left; SAMC A084241), jaws (bottom right; SAMC A088364) views of *Ophiacantha striolata*.

### Genus *Ophiolimna* Verrill, 1899

**Diagnosis** – Adapted from Verrill (1899b). Disc plates and radial shields concealed by granules and spines. Jaws more or less granulated. Arm spines seven or eight, nearly smooth, placed obliquely on distal portion of lateral arm plates, not strongly divaricate or spreading.

### *Ophiolimna perfida* (Koehler, 1904)

*Ophiacantha perfida* Koehler 1904a: 118-120, pl. 23, figs 5, 6; Clark 1915a: 204.  
*Ophiolimna perfida*: Koehler, 1922b: 64-66, pl. 9, figs 7-9, pl. 92, fig. 6; Clark 1977: 139-140.  
*Ophiacantha lambda* Clark, 1911: 231-232, fig. 108; Clark 1915a: 199.

**Diagnosis** – Adapted from Clark (1911) and Clark (1977). D.D. up to 12 mm, D.D./A.L. = 1/6. Disc covered with small, elongated granules. Radial shields mostly covered in same armament, with distal ends bare and visible. Ventral interradial areas covered in same granules up to oral shields, less dense than dorsal side,

jaws also covered in coarse granules. Oral shields almost oval, wider than long. Adoral shields covered in granules, contiguous. Oral papillae four, distalmost much broader. Apical papilla blunt, similar in size to first three oral papillae. Teeth round, larger than infradental. Genital slits small. Dorsal arm plates fan-shaped, convex distally, not contiguous. Ventral arm plates fan-shaped to pentagonal, with distal edge convex, not contiguous, wider than long. Arm spines up to five, slender, tapering, smooth, uppermost spine longest, three times segment length. Tentacle scale single, oval, fairly large.

**Distribution and habitat** – Southern Japan to Indonesia (Clark 1977), South Africa: Sodwana Bay (KZN); depth range: 411-1280 m. Habitat: fine sand and mud.

**Remarks** – Only a single damaged specimen was available for examination in the Iziko South African Museum collection. Most of the type material of *O. perfida* is in the Naturalis Biodiversity Centre (ZMA) in Leiden, with syntypes also in the Museum of Comparative Zoology (OPH-1986) and the Monaco Oceanographic Museum.



**Fig. 108.** Distribution of *Ophiolimna perfida* in South Africa.



**Fig. 109.** Dorsal disc (left), ventral disc (right) and jaws (inset) views of *Ophiolimna perfida* (SAMC A22936).

## Genus *Ophiomitrella* Verrill, 1899

**Diagnosis** – Adapted from Verrill (1899b) and Clark & Courtman-Stock (1976). Disc not constricted interradially, disc armament covered in large, thick plates and bearing stumps or granules of varying densities. Radial shields broad, rounded, may be widely separated or partially contiguous. Oral shields usually wider than long. Adoral shields relatively large, wide and contiguous. Oral papillae three, papilliform either side of apical papilla. Dorsal arm plates small rhombic or fan-shaped, not contiguous. Ventral arm plates fan- or bell-shaped, not contiguous. Arm spines long and slender. Tentacle pores small. Tentacle scales small, single.

### *Ophiomitrella corynephora* H.L. Clark, 1923

*Ophiomitrella corynephora* Clark, 1923: 322-324, fig. 2, pl. 19, figs 5, 6; Mortensen 1933a: 331-333, figs 48, 49; Clark A.M. 1952: 199, 212; Clark 1974: 441; Clark & Courtman-Stock 1976: 105, 121, 169, figs 172, 177; Alva & Vadon 1989: 829.

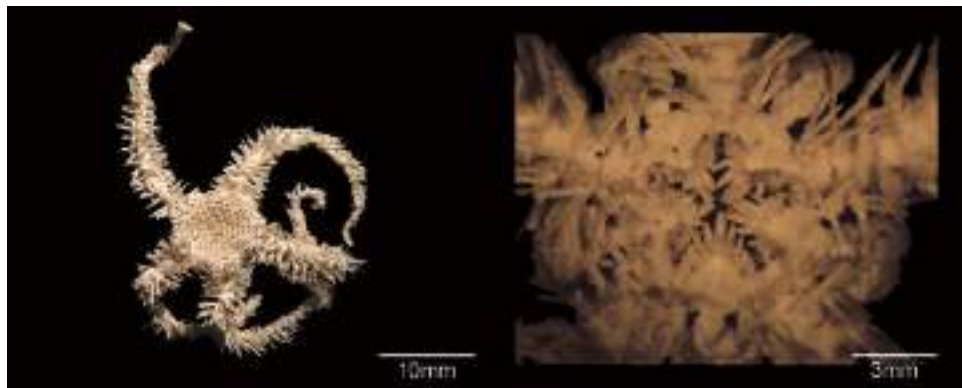
**Diagnosis** – Adapted from Clark (1923). D.D. up to 10 mm, D.D./A.L. = 1/3-4. Disc round, covered with overlapping plates bearing cylindrical granules with rounded tips. Some plates with multiple granules, others bare. Radial shields about one-third to half disc radius, naked or covered in similar granules to dorsal disc, rounded triangular, as wide as long, separated from each other by a series of plates. Ventral interradiial areas covered in same granules as dorsal disc, but scattered and less dense. Oral shields diamond-shaped, wider than long, two proximal sides slightly concave, distal sides convex. Adoral shields large, contiguous. Jaws sunken. Oral papillae three, large, tapering, thick. Teeth four, squarish to pointed. A calcified elevation distal to outermost oral papillae arising from edge of first ventral arm plate adjoining oral tentacle pore. Genital slits long and narrow. Dorsal arm plates rhombic, not contiguous. Ventral arm plates rhombic with very rounded, obtuse distal edge, almost half moon-shaped, basal ventral arm plates with rounded distal edge. Arm spines up to seven, smooth or very finely serrated, uppermost long, pointed, exceeding one segment length, lowermost two spines short and blunt. Tentacle scale single, moderately large, narrow, long and tapering, but blunt. Colour in life white to red and pink.

**Distribution and habitat** – South Africa: Orange River (NC) to off Clansthal (KZN); depth range: 42-900 m. Habitat: rock, sand, mud, stones and on alcyonarians.

**Remarks** – Endemic to South Africa. Clark (1923) states that SAMC A6441 (examined) is the holotype, but the specimen label reads that it is a paratype. The holotype was not found. Distribution within South Africa here extended north to Clansthal in KZN and west from Port Elizabeth to Orange River in the Northern Cape. The type locality is Vasco da Gama Peak, Cape, depth 42 m.



**Fig. 110.** Distribution of *Ophiomitrella corynephora* in South Africa.



**Fig. 111.** Dorsal (left) and ventral (right) views of *Ophiomitrella corynephora* (SAMC A23252).

### ***Ophiomitrella hamata* Mortensen, 1933**

*Ophiomitrella hamata* Mortensen, 1933a: 333-335, figs 50, 51, pl. 19, fig. 12;  
Clark & Courtman-Stock 1976: 105, 121, 169, figs 168, 178; Olbers *et al.* 2014:  
16, pl. 3C.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 4 mm, D.D./A.L. = 1/3. Disc round, covered with plates bearing short rugose-tipped stumps, some plates with multiple stumps, while others have one. Radial shields no more than one-third disc radius, converging, contiguous distally only, oval in shape, longer than wide. Ventral interradial areas covered in same stumps. Oral shields diamond-shaped, wider than long, with two proximal sides slightly concave. Adoral shields large, contiguous. Jaws not sunken. Oral papillae three, large, similar in size and shape. Teeth four. Genital slits long and narrow. Dorsal arm plates rhombic, not contiguous. Ventral arm plates rhombic with very rounded obtuse distal edge, becoming almost flat in mid-arm, first ventral arm

plates fan-shaped with rounded distal edge, first two ventral arm plates narrowly contiguous. Arm spines up to five, serrated, longest not exceeding segment length. Tentacle scales single, small, pointed.

**Distribution and habitat** – South Africa: Waterfall Bluff (EC) to Durban (KZN); depth range: 63-900 m. Habitat: on gorgonians, including *Thouarella* species.

**Remarks** – Endemic to South Africa. The distribution is here extended to the Eastern Cape. Type material was located in Iziko South African Museum (syntype: SAMC A22380), type locality is off Durban, KZN, depth 412 m.



Fig. 112. Distribution of *Ophiomitrella hamata* in South Africa.



Fig. 113. Dorsal (left) and ventral (right) views of *Ophiomitrella hamata* (DNSM ECH26).

## Genus '*Ophiophthalmus*'<sup>2</sup> Matsumoto, 1917

**Diagnosis** – Adapted from Matsumoto (1917), Koehler (1922) and Paterson (1985). Disc covered with irregular plates, may be armed with coarse granules. Radial shields naked, round or oval. Oral papillae 3-6. Teeth present in single series. Dorsal arm plates contiguous only in basal segments. Arm spines numerous, long, conical, finely serrated, do not approximate dorsally. Tentacle scale single, large, flat, elliptical leaf-shaped.

To distinguish *Ophiophthalmus* from *Ophiomitrella*, Matsumoto (1917) suggested that in *Ophiophthalmus*, the basal dorsal arm plates are contiguous and there is an absence of a fan arrangement of arm spines on the basal arm segments. Subsequently, Koehler (1922) also distinguished that the disc plates were imbricating and radial shields were naked and round. However, Paterson (1985) suggested that these characters are not reliable or consistent across all species within the genera and that a comprehensive revision of both *Ophiophthalmus* and *Ophiomitrella* is required.

### '*Ophiophthalmus*' *relictus* (Koehler 1904)

*Ophiacantha relictus* Koehler, 1904a: 106-107, pl. 17, figs 4-6.

*Ophiacantha oedidisca* Clark, 1911: 219-221, fig. 101.

*Ophiophthalmus relictus*: Koehler 1922b: 124-127, pl. 9, figs 1-4, pl. 95, fig. 3; Clark A.H. 1939: 54-55; Clark 1977: 130, 140; Baker 1979: 39; Rowe & Gates 1995: 375; O'Hara & Stöhr 2006: 134.

**Diagnosis** – Adapted from Koehler (1904), Clark (1911) and Koehler (1922). D.D. up to 12 mm, D.D./A.L. = 1/5. Disc round, tumid or swollen, covered in closely-packed minute granules, but not touching each other, granules may have thorns. Radial shields well-separated, naked, oval, longer than wide. Ventral interradial areas covered in same granules, but not as dense. Oral shields diamond-shaped, wider than long, with two proximal sides slightly concave. Adoral shields narrow, long, straight, contiguous. Oral papillae 3-4, long, flat, pointed. Genital slits long. Dorsal arm plates triangular, may be contiguous basally, wider than long, distal margin of basal plates may have granules like those on disc. First ventral arm plates small, wider than long, but narrow distally, plates becoming squarish, their outlines becoming indistinct, not contiguous. Lateral arm plates fairly small, not meeting dorsally or ventrally. Arms flexible dorsoventrally. Arm spines up to six, usually five, thorny, stout, short, upper two longest, longer than one segment in length, lowest arm spine with rough tips, arm spines do not reach to mid-dorsal arm. Tentacle scale single, small, pointed.

**Distribution and habitat** – Western Indian Ocean, Gulf of Aden, Japan, Indonesia, and northern Tasman Sea (Baker 1979; Rowe & Gates 1995), South Africa: Richards Bay (KZN) to Black Rock (KZN); depth range: 100-2194 m. Habitat: mud, fine grey sand, foraminifera, small stones, epizoic.

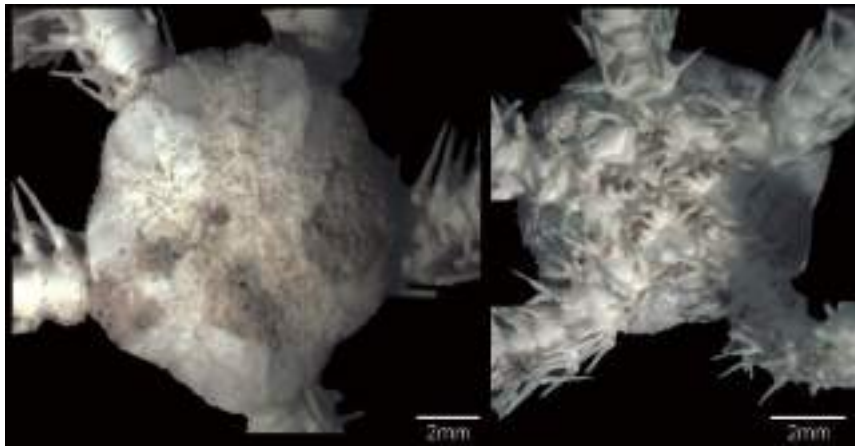
<sup>2</sup> Paterson (1985) correctly stated that *Ophiophthalmus* is a junior homonym of a reptilian genus described by Fitzinger (1843). A replacement name is required.



**Remarks** – Type material is in the Naturalis (ZMA.ECH.O.2351- ZMA.ECH.O.2359) and the type locality is Indonesia; depth unknown.



**Fig. 114.** Distribution of 'Ophiophthalmus' *relictus* in South Africa.



**Fig. 115.** Dorsal (left) and ventral (right) views of 'Ophiophthalmus' *relictus* (SAMC A22929).

### Genus *Ophioplinthaca* Verrill, 1899

**Diagnosis** – Adapted from Verrill (1899a). Interradial areas deeply constricted, centre of disc deeply concave, disc plates large, no armament on ventral interradian areas. Disc marginal and submarginal plates large and specialised. Radial shields large, naked. Oral shields contiguous with first lateral arm plates. Arm spines long, thorny, not approximating dorsally. First tentacle pore large, with one or two tentacle scales.

***Ophioplinthaca papillosa* H.L. Clark, 1939**

*Ophioplinthaca papillosa* Clark H.L., 1939: 49-51, figs 10, 11; Clark 1977: 135, 140-141.

**Diagnosis** – Adapted from Clark (1939). D.D. up to 10 mm, A.L. 50-60 mm, D.D./A.L. = 1/5. Disc tumid, but deeply concave in centre and constricted in interradial areas. Disc covered with irregular plates. Centre of disc with distinct thorny stumps terminating in 2-6 sharp teeth. Margin and interradial areas may have scattered stumps including inside creases. Radial shields large, narrow, naked, length just more than half disc radius. Ventral interradial areas small and covered in disc plates with no stumps. Genital slits wide and moderately long, but do not reach disc margin. Oral shields diamond-shaped, wider than long. Adoral shields fairly wide, contiguous. Oral papillae 3-4, subequal, narrow, long, pointed. Arms five. Dorsal arm plates broadly bell-shaped, distal margin convex, not contiguous. Ventral arm plates small, wider than long, proximal margin almost straight, proximal edge slightly concave, not contiguous. Lateral arm plates large, meeting dorsally and ventrally. Arm spines up to seven, not approximating dorsally, uppermost two longest, usually equal to three segments, but in one specimen (SAMC A22918) uppermost spine on second segment six times segment length, lowermost spine shortest and also exceeds one segment length, tapering, finely serrated. Tentacle scale single, moderately large, flat, pointed.

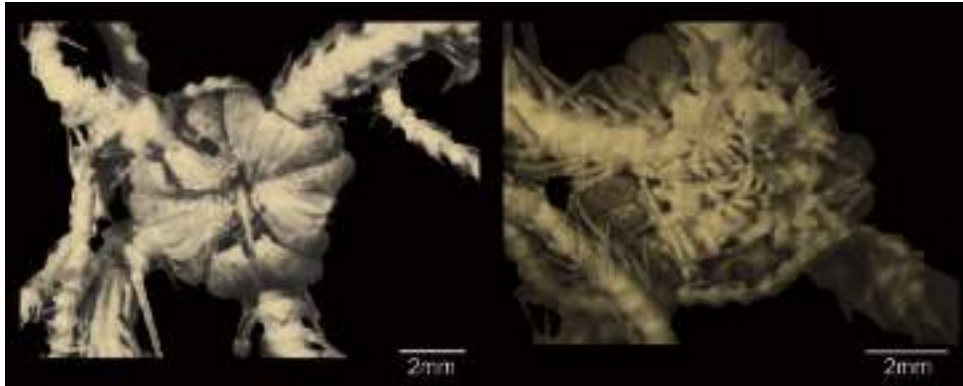
**Distribution and habitat** – Gulf of Aden and Maldives area (Clark H.L. 1939), South Africa: off Richards Bay (KZN); depth range: 1000-1200 m. Habitat: most *Ophioplinthaca* species are epizoic on corals.

**Remarks** – A single damaged specimen from North of Nhlabane (KZN) from 1000-1200 m was available for examination.

The type material is in Natural History Museum (BMNH 1948.5.26.36-8) with a paratype also in the Museum of Comparative Zoology (MCZ OPH-6009), type locality Maldives, depth 914-1646 m.



**Fig. 116.** Distribution of *Ophioplinthaca papillosa* in South Africa.



**Fig. 117.** Dorsal (left) and ventral (right) views of *Ophioplinthaca papillosa* (SAMC A22918).

### ***Ophioplinthaca rudis* (Koehler, 1897)**

*Ophiomitra rudis* Koehler, 1897: 358-360; Koehler 1899: 65; pl. 7, figs 58, 59.

*Ophioplinthaca rudis*: Koehler 1904a: 132; Clark 1915a: 211; Koehler 1922b: 142-147, pl. 24, figs 1-6, pl. 96, fig. 1; Clark H.L. 1939: 46-47; Clark 1977: 135, 141; Imaoka *et al.* 1990: 17, 79; Rowe & Gates 1995: 375; O'Hara & Stöhr 2006: 85-86, fig. 9A-C.

*Ophiomitra cardiomorpha* Clark, 1911: 179-180, fig. 81.

**Diagnosis** – Adapted from Koehler (1922) and Clark (1977). D.D. up to 16 mm. A.L. 90 mm, D.D./A.L. = 1/5-6. Disc tumid, but not deeply concave in centre, interradiial areas constricted. Disc covered with irregular plates and spines. Disc centre with distinct long spines, disc margin spines conical, present adjacent to radial shields but absent or sparse elsewhere. Radial shields large, triangular, twice as long as wide, slightly more than half disc radius, separated for entire length, but approximating distally. Ventral interradiial areas heart-shaped, covered in smooth plates. Oral shields diamond-shaped, as long as wide or slightly wider, with distal lobe. Adoral shields large, contiguous. Oral papillae 5-6, all pointed except proximal- and second proximal-most, which are flattened. Apical papillae larger than other oral papillae. Genital slits distinct. Dorsal arm plates fan-shaped, twice as wide as long, distal margin slightly convex or straight, contiguous basally. Ventral arm plates triangular, wider than long, distal edge straight, longer than proximal edge, lateral margins concave, diverging distally, only first two basal plates contiguous. Lateral arm plates large, meeting dorsally and ventrally relatively narrowly. Arms five, wide compared to other ophiacanthids. Arm spines up to seven, slender, long, uppermost 3-4 segments in length, sharp, lowermost being blunt, shortest and more serrated than others, spines do not approximate to dorsal midline. Tentacle scale single, moderately large, thick, sharply pointed. Colour in life red (Imaoka *et al.* 1990).

**Distribution and habitat** – Indo-West Pacific (Clark 1977; Imaoka *et al.* 1990; Rowe & Gates 1995), South Africa: Richards Bay (KZN) to Black Rock (KZN); depth range: 165-3124 m. Habitat: recorded from mud and sand, but in reality probably living on corals.

**Remarks** – Koehler (1897) included incorrect figures in the original description (plate 9; figures 75 and 76) which caused some confusion and led to Clark H.L. (1911) describing the species as new, *Ophiomitra cardiomorpha*. Later, Clark H.L. (1939) noted this error and included photographs of *Ophioplinthaca rudis*.

O'Hara & Stöhr (2006) designated a lectotype (ZSI 8581/6), type locality Bay of Bengal, depth 1450 m and noted that the “form of the long slender spines is very characteristic of this species”. A paralectotype is also present in the Natural History Museum (BMNH 98.7.11.17).



**Fig. 118.** Distribution of *Ophioplinthaca rudis* in South Africa.



**Fig. 119.** Dorsal (left) and ventral (right) views of *Ophioplinthaca rudis* (SAMC A22913).

### ***Ophioplinthaca sexradia* Mortensen, 1933**

*Ophioplinthaca sexradia* Mortensen, 1933a: 326-327, fig. 45; Clark & Courtman-Stock 1976: 105, 121, 170.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 2.5 mm. A.L. up to 12 mm. D.D./A.L. = 1/ 4-5. Disc tumid, slightly concave in centre and interradial areas constricted. Disc covered with irregular plates, granules and stumps, mainly towards centre of disc. Dorsal interradial areas almost not present due to large radial shields. Radial shields large, triangular, approximating, contiguous distally, more than half disc radius in length. Ventral interradial areas almost not-existent as deeply constricted. Oral shields rhombic with obtuse distal edge, slightly wider than long. Adoral shields large, contiguous, wider distally. Oral papillae three, distalmost broader. Genital slits short. Dorsal arm plates triangular, not contiguous, distal edge slightly convex. Ventral arm plates pentagonal, wider than long, distal edge convex. Lateral arm plates meeting dorsally and ventrally. Arms six. Arm spines up to four, thick, short, tapering, shorter than single segment. Tentacle scale small, single, pointed.

**Distribution and habitat** – South Africa: East London (EC); depth range: 44 m. Habitat: on gorgonians.

**Remarks** – Endemic to South Africa. No material is housed in the Iziko South African Museum collection. Type material in the Natural History Museum of Denmark (syntype: ZMUC OPH-278) and the type locality is near East London, depth 44 m.



**Fig. 120.** Distribution of *Ophioplinthaca sexradia* in South Africa.



**Fig. 121.** Dorsal (left) and ventral (right) views of *Ophioplinthaca sexradia* (ZMUC OPH-278).

#### 4.4.3. Family OPHIODERMATIDAE Ljungman, 1867

##### Genus *Cryptopelta* H.L. Clark, 1909

**Diagnosis** – Adapted from Clark (1909). Disc, radial shields, interradial areas, oral shields, adoral shields and arm bases usually covered in fine granules. Arm spines up to seven, short and appressed. Oral papillae numerous, distal papillae wide and blunt, proximal papillae sharp and narrow. Teeth few, narrow. Genital slits two per interradius. Tentacle scales one.

##### *Cryptopelta aster* (Lyman, 1879)

*Ophiopelta aster* Lyman, 1879: 50, pl. 14, figs 395-397, Lyman 1882: 12, pl. 21, figs 16-18.

*Cryptopelta aster* Clark 1909: 131; Clark 1923: 350-351; Mortensen 1933a: 376-379, figs 78a, 79a, 80a, d, pl. 19, fig. 21; Clark & Courtman-Stock 1976: 106, 124, 182, fig. 204.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 13 mm, D.D./A.L. = 1/3. Disc pentagonal, flat, covered dorsally and ventrally in fine granules extending onto basal arm segments. Granules covering adoral shields, jaws and oral shields, granulation on jaws slightly coarser. Oral papillae eight or nine, in series with second oral tentacle scale, proximal-most papillae narrower and more pointed, distal-most ones broad. Madreporite naked. Genital slits one, not reaching disc margin. Dorsal arm plates fan-shaped, broadest near middle, wider than long, distal edge convex. Ventral arm plates bell-shaped, distal edge convex. Arm spines up to seven, sometimes eight, less than half segment length. Tentacle scale one, oval. Colour in life cream or orange to brick-red on the disc, orange and red, mottled, arms banded.

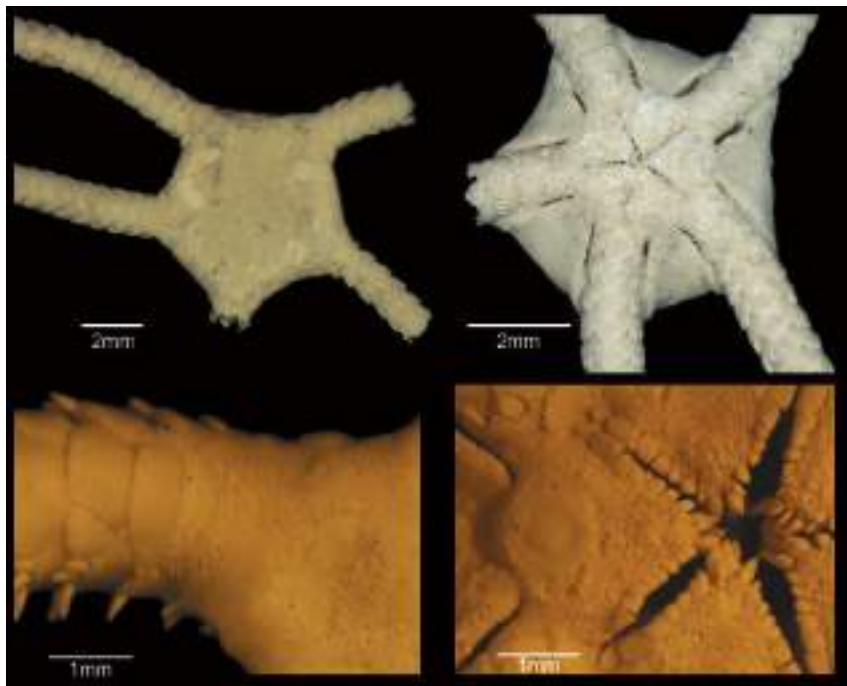
**Distribution and habitat** – South Africa: Cape Town (WC) to off Shaka's Rock (KZN); depth range: 75-421 m. Habitat: rock, shell, sand and coral.

**Remarks** – The records from Sulu Islands (Philippines) and Pternoster Islands (Indonesia) cited by Clark (1909) are unconfirmed as they are not cited anywhere else. Therefore, *Cryptopelta aster* may be endemic to South Africa.

The type material is presumably in the Natural History Museum (BMNH) and the Museum of Comparative Zoology (syntype: MCZ OPH-155), type locality is Agulhas Bank, depth 274 m.



**Fig. 122.** Distribution of *Cryptopelta aster* in South Africa.



**Fig. 123.** Dorsal whole (top left), ventral disc (top right), dorsal basal arms (bottom left), jaws (bottom right) views of *Cryptopelta aster* (SAMC A23236).

Genus *Ophiodyscrita* H.L. Clark, 1938

**Diagnosis** – Adapted from Clark (1938). Disc covered in granules extending over arms both dorsally and ventrally, as well as over the entire oral surface of disc and oral frame. Disc margin with large plates. Genital slits two per interradius. Tentacle scales two, sometimes three proximally.

*Ophiodyscrita acosmeta* H.L. Clark, 1938

*Ophiodyscrita acosmeta* Clark, 1938: 356-357; Clark 1946: 265; Clark & Rowe 1971: 88-89, 128; Rowe & Gates 1995: 399; Price & Rowe 1996: 79; Lane *et al.* 2000: 483; Marsh & Morrison 2004: 295, 298, 302, 306, 312, 337; Olbers *et al.* 2015: 107, pl. 7E, F.

*Ophiocryptus pacificus* Murakami, 1943a: 188-189, fig. 10.

*Ophiostegastus compsus* Clark, 1968: 317-321, fig. 10.

**Diagnosis** – Adapted from Clark (1938). D.D. up to 8 mm. Disc round to pentagonal, covered with small, slightly-indented granules completely covering dorsal and ventral side. Granules on oral shields, adoral shields, supplementary oral shields and dorsal, ventral and lateral arm plates. Radial shields also concealed, some granules slightly enlarged over marginal area. Oral shields ovate to spearhead-shaped, wider than long. Oral papillae 6-7, flattened. Genital slit up to two-thirds to margin of disc. Arms slightly flattened. Dorsal arm plates D-shaped, twice as wide as long, with rounded distal edge, with two more-or-less conspicuous whitish patches on distal edge of each plate, covered with granules similar to those on disc. Ventral arm plates more-or-less rhombic, becoming bell-shaped with distal edges round, not contiguous distally. Lateral arm plates slightly projecting. Arm spines up to eight, appressed, short, less than half segment length. Tentacle scales ovate, up to three basally, inner one largest, two becoming one toward distal segments of arm. Colour in life brown and grey dorsally, ventrally lighter, dorsal disc patchy light and dark, arms with dark bands of 3-5 segments.

**Distribution and habitat** – China, Japan and Australia (Clark & Rowe 1971), South Africa: Sodwana Bay (KZN); depth range: 0-23 m. Habitat: no information available.

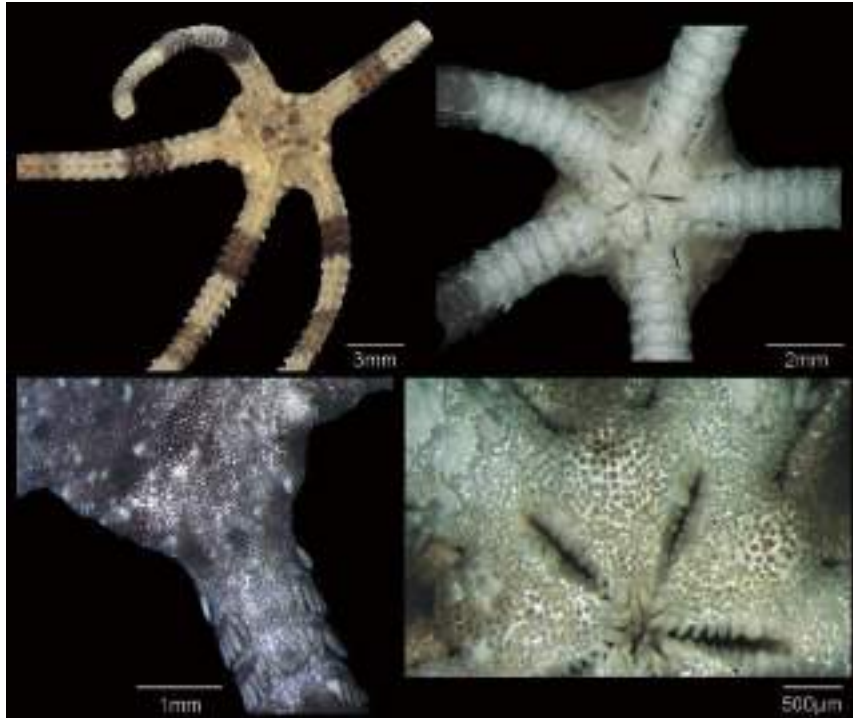


**Fig. 124.** Distribution of *Ophiodyscrita acosmeta* in South Africa.



**Remarks** – Olbers *et al.* (2015) noted this species as a new record for South Africa.

The type material is in the Museum of Comparative Zoology (holotype: MCZ OPH-5294), type locality is Broome, Australia, depth unknown.



**Fig. 125.** Dorsal whole (top left), ventral disc (top right), dorsal basal arms and disc (bottom left), jaws (bottom right) views of *Ophiodyscrita acosmeta* (RMCA MT2183).

### Genus *Ophiarachnella* Ljungman, 1872

**Diagnosis** – Adapted from Ljungman (1872) and Clark (1909). Disc granulated. Radial shields naked. Oral shields large, naked. Supplementary oral shields present, naked. Oral papillae large, numerous and close-set. Teeth in vertical series. Genital slits two per interradius. Arm spines smooth, more than five, shorter than arm segments. Tentacle scales two.

### *Ophiarachnella capensis* (Bell, 1888)

*Pectinura capensis* Bell, 1888: 282, pl. 16, figs 3, 4.

*Ophiarachnella capensis*: Clark 1923: 351; Mortensen 1933a: 380-381, fig. 82, Stephenson *et al.* 1937: 380; Stephenson *et al.* 1938: 18; Stephenson 1944: 347; Clark 1955: 24, fig. 4b; Day 1959: 544; Day 1969: 184; Day *et al.* 1970: 81; Clark & Courtman-Stock 1976: 106, 124, 182, fig. 200, 205; Olbers *et al.* 2014: 17, pl. 3D.

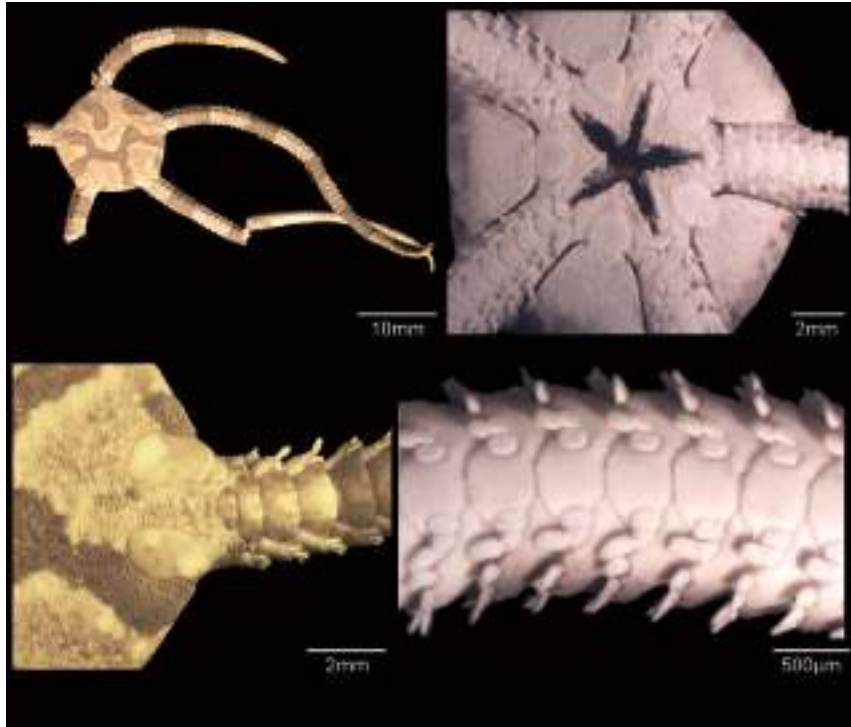
**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 19 mm, D.D./A.L. = 1/5. Disc covered both dorsally and ventrally by granules. Radial shields naked, oval or pear-shaped, longer than wide. Oral shields naked, triangular or spearhead-shaped. Supplementary oral shields naked, as wide as oral shield. Adoral shields small, with slightly less granules, not contiguous. Jaws and / or oral plates covered in granules, slightly coarser than disc granules. Oral papillae 7-8, in series with the second oral tentacle scale, proximal papillae becoming narrower and pointed. Dorsal arm plates hexagonal, broadest near their distal ends, distal edge slightly convex, broadly contiguous. Ventral arm plates square with distal edge convex, broadly contiguous. Arm spines up to seven, short and conical, lowest less than half segment length. Tentacle scales two, oval. Colour, irregular dark spot or blotch in middle of disc, arms banded with broad bands.

**Distribution and habitat** – Vema Seamount (Clark & Courtman-Stock 1976), South Africa: Langebaan (WC) to Kosi Bay (KZN); depth range: 0-92 m. Habitat: rock, sand, shell and under stones.

**Remarks** – Range here extended from Cape Town (WC) to Langebaan (WC) to the west and from Amatikulu (KZN) to Kosi Bay (KZN) to the east. The type locality is Cape of Good Hope, depth unknown. This species is closely related to the common Indo-Pacific complex *Ophiarachnella gorgonia*.



**Fig. 126.** Distribution of *Ophiarachnella capensis* in South Africa.



**Fig. 127.** Dorsal whole (top left), ventral disc (top right), dorsal disc and basal arms (bottom left), ventral arm (bottom right) views of *Ophiarachnella capensis* (SAMC A084228).

### ***Ophiarachnella gorgonia* (Müller & Troschel, 1842)**

*Ophiarachna gorgonia* Müller & Troschel, 1842: 105.

*Pectinura gorgonia*: Lütken 1869: 15; Lyman 1882: 15; Koehler 1898b: 59, pl. 2, figs 1, 2.

*Pectinura marmorata* Lyman, 1874: 222, pl. 5, figs 1-7.

*Pectinura venusta* de Loriol, 1893a: 16-19, pl. 23, fig. 3.

*Ophiarachnella gorgonia*: Clark 1909: 123-124; Matsumoto 1917: 323-324, pl. 6, fig. 7; Clark 1921: 141-142, pl. 12, fig. 5, pl. 35, figs 4, 5; Koehler 1922b: 339-340; Clark 1932: 209; Clark 1946: 260-261; Clark 1965: 66; Clark & Rowe 1971: 88, 125, fig. 42b, pl. 20, fig. 2; Cherbonnier & Guille 1978: 217-218, pl. 15, figs 5, 6; Sloan *et al.* 1979: 111; Tortonese 1980: 129; Humpreys 1981: 10; Irimura 1982: 66, 67, fig. 39, pl. 13, fig. 6; Guille & Vadon 1985: 64; Marsh *et al.* 1993: 62; Liao & Clark 1995: 281-282, fig. 156, pl. 19, figs 2, 3; Rowe & Gates 1995: 396; Putchakarn & Sonchaeng 2004: 423; Olbers *et al.* 2015: 109-110, pl. 8E, F.

*Ophiarachnella marmorata*: Clark 1915a: 305.

**Diagnosis** – Adapted from Cherbonnier & Guille (1978). D.D. up to 19 mm. Disc round, with slight indentations on both sides at base of arms, covered in rounded granules dorsally and ventrally, peripheral granules slightly elongated. Radial shields naked, ovate, longer than wide, relatively small. Granules on ventral interradial areas closely packed up to oral shields and onto jaws. Oral shields naked, pentagonal, large, supplementary oral shields distal to each oral shield, D-shaped, often equal to length of oral shield. Adoral shields small, not contiguous, triangular. Oral papillae oval and flattened, distalmost broadest. Teeth 4-5, lowermost square, others pointed. Genital slits reach disc margin, genital papillae absent, but disc granulation to slit edge. Arms triangular in cross section for more than half arm length. Arm spines up to 11, appressed to arm, tapering, approximately half segment length. Dorsal arm plates elliptical proximally, twice as wide as long, broadly in contact, becoming fan-shaped and narrowly in contact in distal parts. Distal edge on proximal-most segments sometimes scalloped. Ventral arm plates hexagonal, distal edge convex, becoming flattened distally, wider than long proximally, but longer than wide distally. Tentacle scales two for most of arm length, inner one oval and long, outer one rectangular and slightly pointed. Colour in life, disc green, brown and white with patches both dorsally and ventrally, radial shields may be mottled white, arms banded dark green and white, ventrally uniformly white, with white patches on interradial areas. Arm spines similar in coloration to arm segments.

**Distribution and habitat** – Western Indian Ocean and associated islands, Red Sea, East Indies, Sri Lanka, Bay of Bengal, Thailand, China, Japan, Philippines, Australia and South Pacific Islands (Clark & Rowe 1971; Rowe & Gates 1995), South Africa: Aliwal Shoal (KZN) to Kosi Bay (KZN); depth range: 0-50 m. Habitat: under *Porites* colonies over gravel, beneath encrusting coral colonies, rubble and among algae.

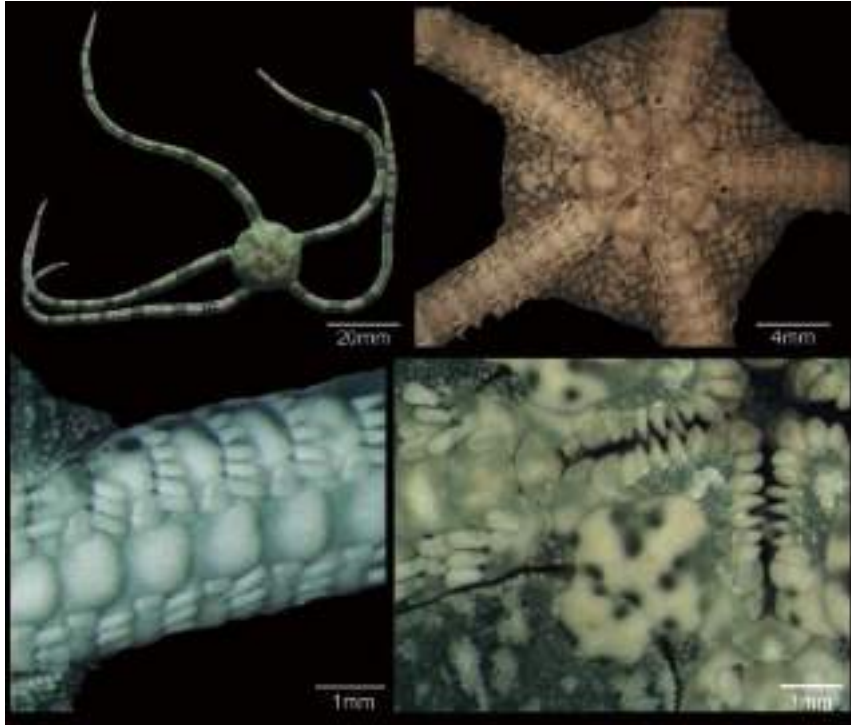
**Remarks** – Hoareau *et al.* (2013) found three clades within *O. gorgonia*, two from the Western Indian Ocean. Based on the colour morphology, it is believed that this species is from Hoareau's lineage number two (Tim O'Hara, pers. comm.). However, sequencing the South African *O. gorgonia* specimens would be required



**Fig. 128.** Distribution of *Ophiarachnella gorgonia* in South Africa.

to confirm these findings. Olbers *et al.* (2015) noted this species as a new record for South Africa.

One paratype is in the Museum of Comparative Zoology (MCZ OPH-135), type locality is Bohol, Philippines, depth 14-18 m.



**Fig. 129.** Dorsal whole (top left; SAMC A081608), ventral disc (top right; RMCA MT2144), arm spines and ventral arms (bottom left; RMCA MT2322), jaw (bottom right; RMCA MT2322) views of *Ophiarachnella gorgonia*.

### Genus *Ophiochasma* Grube, 1868

**Diagnosis** – Adapted from Grube (1868) and Clark (1909). Disc covered in granules. Radial shields naked, very large, widely separated. Oral shields distinct, no granulation. Ventral interradial areas small. Arm spines short, rarely exceeding segment length, more or less appressed to the arm. Genital slits two per interradius. Tentacle scales two, at least basally, outer scales sometimes overlapping base of lowest arm spine.

## *Ophiochasma nitida* Hertz, 1927

*Ophiochasma nitida* Hertz, 1927a: 116-117, pl. 9, figs 13, 14; Mortensen 1933a: 216; Clark & Courtman-Stock 1976: 106, 124, 183 and 260, fig. 267a, b.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 12 mm, D.D./A.L. = 1/6. Disc covered in granules, easily rubbed off. Radial shields very large, naked, oval, widely separated, but not by more than arm width. Oral papillae 7-9, in series with second oral tentacle scale, distalmost oral papillae broader. Oral shields naked, hexagonal or elliptical leaf-shaped with rounded edges, short distal lobe, longer than wide. A disc scale that appears to be a supplementary oral shield, D-shaped, may or may not be covered in granules, longer than wide. Adoral shields naked on lateral parts, but covered in granules. Genital slits single. Dorsal arm plates broad, hexagonal, surface convex. Ventral arm plates broad, octagonal, or the three distal sides forming a continuous round edge or curve. Arm spines up to ten, short, no more than half segment length, tapering, lower spines blunter than others, appressed to arms or slightly projecting. Tentacle scales two.

**Distribution and habitat** – South Africa: Agulhas Bank (WC); depth range: 86-102 m. Habitat: no information available.



Fig. 130. Distribution of *Ophiochasma nitida* in South Africa.

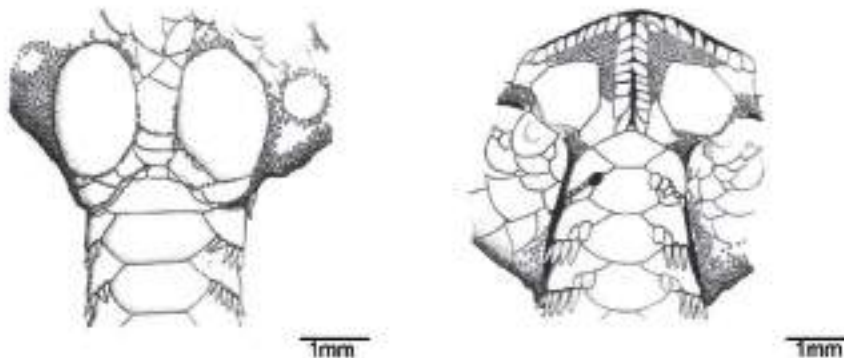


Fig. 131. Radial shields (left) and jaws and ventral arm plates (right) views of *Ophiochasma nitida* (ZMB 1623/1936 (538/1)), syntype, from Clark & Courtman-Stock (1976).

**Remarks** – Endemic to South Africa. No material was available for examination in the Iziko South African Museum collection and only three specimens are known. Type material is in the Museum of Natural History of Berlin (syntype: ZMB 1623/1936 (538/1)) and the type locality is Agulhas Banks, depth 86 m.

Genus *Ophioderma* Müller & Troschel, 1840

**Diagnosis** – Adapted from Müller & Troschel (1840) and Ziesenhenné (1955). Disc plates flat. Genital slits four per interradius. Arms more than twice length of disc.

*Ophioderma wahlbergii* Müller & Troschel, 1842

*Ophioderma wahlbergii* Müller & Troschel, 1842: 87; Clark 1923: 353; Mortensen 1933a: 382; Ziesenhenné 1955: 187, 189.

*Ophiura wahlbergii* Lyman 1865: 10; Lyman 1882: 10.

*Ophioderma wahlbergi* (*lapsus calami*): Ljungman 1867: 305; Clark & Courtman-Stock 1976: 106, 124, 183-184, 262-263, figs 206, 276c, d.

*Ophioderma leonis* Döderlein, 1910: 252-253, pl. 5, figs 1, 1a; Mortensen 1933a: 381-382; Day 1969: 184; Grindley & Kensley 1966: 12; Stöhr *et al.* 2009: 1, 18.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Mortensen (1933a). D.D. up to 38 mm, D.D./A.L. = 1/3. Disc round, densely covered in round, flattish granules both dorsally and ventrally, extending to oral plates or jaws. Radial shields either naked or partly naked, small, oval. Oral papillae 5-6, in series with oral tentacle scale, elliptical leaf-shaped, slightly pointed, distalmost broader, Teeth broad but not square. Oral shields naked, oval to spearhead-shaped with distal lobe, approximately as wide as long, or slightly wider. Supplementary oral shields absent. Adoral shields small, not contiguous. Genital slits two, short, no genital papillae. Arms usually five, up to seven. Dorsal arm plates elliptical rectangular, more than twice as long as wide, distal edges mostly straight, but may be slightly concave, may be divided in some basal plates. Ventral arm plates hexagonal, convex distally, as wide as long, contiguous. Arm spines up to seven (exceptionally eight or nine), conical, blunt, shorter than segment. Tentacle scales two, oval. Colour in life grey, brown, dark brown, may have patterns on disc, arms not banded, lighter ventrally.

**Distribution and habitat** – Namibia (Branch *et al.* 2010), South Africa: Orange River (NC) to Danger Point (WC); depth range: 0-75 m. Habitat: shell, sand and stones.

**Remarks** – Type material is in the Museum of Natural History of Berlin (syntype: ZMB Ech 838 and ZMB Ech 839) and the holotype was lodged by Müller & Troschel in the Swedish Museum of Natural History (SMNH-Type-3292). The type locality is Port Natal (Durban), depth unknown.

Numerous authors (Mortensen 1933a; Clark 1923 and Ziesenhenné 1955) report that the type locality (Port Natal) is probably incorrect and that this is probably an

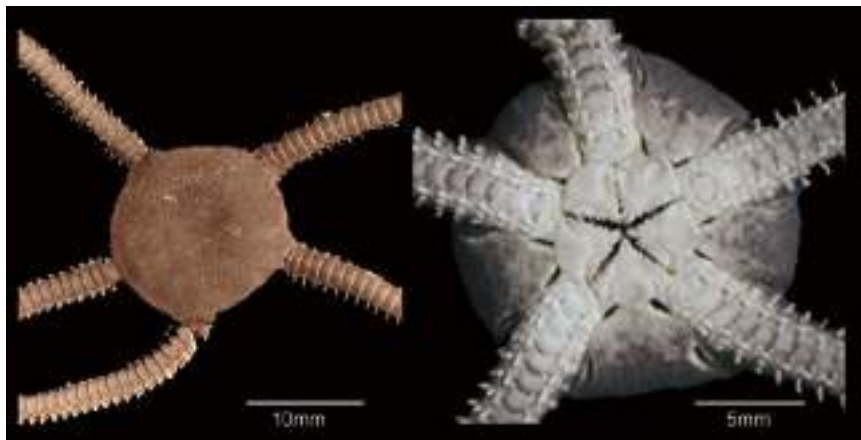
endemic SW African species. Given the specimens collected up to now, which have all been from Atlantic waters in the Western and Northern Cape, the record from KZN is considered incorrect.

Stöhr *et al.* (2009) referred to a South African ophi dermatid as *Ophioderma leonis*, however, this had been synonymised by Clark & Courtman-Stock (1976), based on the syntypes of Döderlein's *Ophioderma leonis*.

The reproduction and brooding behaviour of this species has been comprehensively studied by Landschoff (2014), Landschoff *et al.* (2015) and Landschoff & Griffiths (2015).



**Fig. 132.** Distribution of *Ophioderma wahlbergii* in South Africa.



**Fig. 133.** Dorsal (left) and ventral (right) views of *Ophioderma wahlbergii* (SAMC A084232).



#### 4.4.4. Family OPHIOPEZIDAE O'Hara *et al.*, 2018

Genus *Ophiochaeta* Lütken, 1869

**Diagnosis** – Adapted from Cherbonnier & Guille (1978) and Lyman (1882). Disc densely covered in small spines and or granules, radial shields concealed by same disc armament, no supplementary oral shields present. Oral papillae numerous, up to 14. Teeth various shapes, pointed, sharp or square. Genital slits two per interradius. Arm spines numerous, up to ten.

*Ophiochaeta hirsuta* Lütken, 1869

*Ophiochaeta hirsuta* Lütken, 1869: 38, 71; Clark 1915a: 222; Clark & Rowe 1971: 127, fig. 44a, b; Gibbs *et al.* 1976: 129; Sloan *et al.* 1979: 115; Marsh *et al.* 1993: 62; Rowe & Gates 1995: 398; Price & Rowe 1996: 78; Olbers *et al.* 2015: 105, pl. 7A, B.

*Ophiochaeta boschmai* Clark, 1964: 388-340, fig. 2.

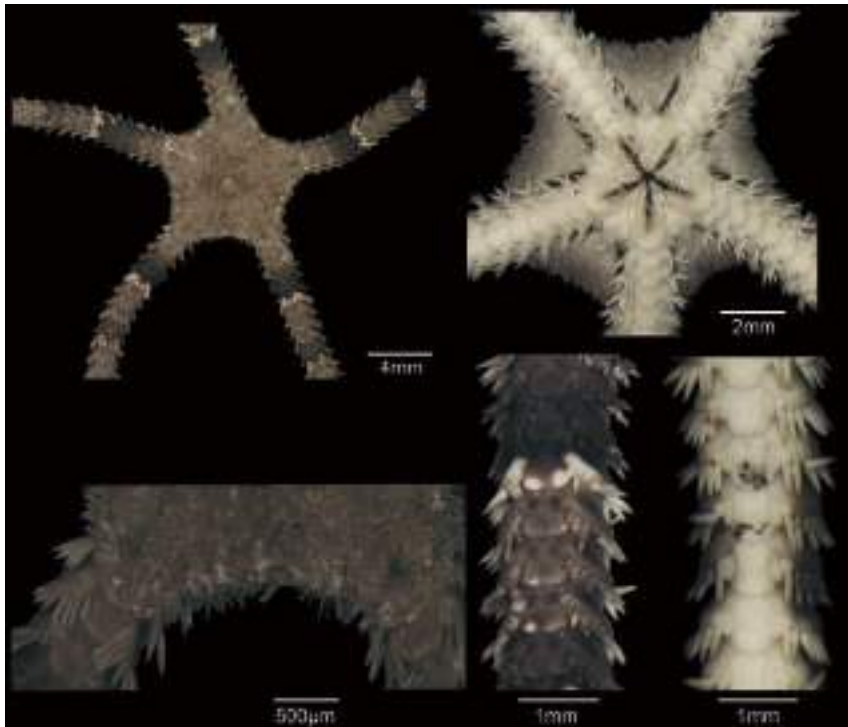
**Diagnosis** – Adapted from Clark & Rowe (1971) and Sloan *et al.* (1979). D.D. up to 7 mm. D.D./A.L. = 1/4. Disc pentagonal, completely covered in indented granules and long, thin spinelets both dorsally and ventrally, spinelets densest on ventral interradiial areas close to oral shields. Oral shields and adoral shields may have granules, but few if present. Radial shields concealed by granulation and spinelets. Marginal plates covered by rounded and enlarged granules, disc spines dense on disc margin. Oral shields triangular, slightly longer than wide; no supplementary oral shields. Adoral shields large, triangular, not contiguous. Oral papillae 5-6, pointed. Teeth three, lowermost bluntly pointed, second square and uppermost pointed. Genital slits single, up to half-way to margin, genital papillae absent. Dorsal arm plates triangular, distal edge straight, proximally narrowly contiguous, distally not contiguous. Ventral arm plates pentagonal, distal edge straight or somewhat convex. Arm spines up to 12, tapering, subequal, all shorter than one segment length. Tentacle scales oval, two proximally, but one along most of arm. Colour in life grey to brown, mottled, arms banded with dark brown, light brown and white.



**Fig. 134.** Distribution of *Ophiochaeta hirsuta* in South Africa.

**Distribution and habitat** – Western Indian Ocean, Red Sea, Indo-Malayan region, Australia, South Pacific Islands (Clark & Rowe 1971; Rowe & Gates 1995; Richmond 2002), South Africa: Sodwana Bay (KZN) to Kosi Bay (KZN); depth range: 0-26 m. Habitat: associated with *Porites* coral colonies or on sandy gravel in lagoonal sea grass beds (Sloan *et al.* 1979).

**Remarks** – Olbers *et al.* (2015) noted this species as a new record for South Africa.



**Fig. 135.** Dorsal whole (top left), ventral disc (top right), dorsal interradial area (bottom left), dorsal arms (bottom centre), ventral arms (bottom right) views of *Ophiochaeta hirsuta* (RMCA MT2290).

### Genus *Ophiopeza* Peters, 1851

**Diagnosis** – Adapted from Peters (1851), Lyman (1882) and Vail & Rowe (1989). Disc granulated, plates coarse, overlapping. Marginal plates enlarged, usually covered in granules. Radial shields obscured by granules. Jaws covered in granules. Oral shields naked, supplementary oral shields present. Genital slits two per interradius. Dorsal arm plates fan-shaped to rectangular, arm spines never exceeding single segment length, usually appressed. Tentacle scales one or two; smaller scale covering or overlapping base of lowest arm spine.

### ***Ophiopeza fallax fallax* Peters, 1851**

*Ophiopeza fallax* Peters, 1851: 465-466; Lyman 1865: 39; Ljungman 1867: 305; Lyman 1874: 221; Studer 1882: 4; Lyman 1882: 13; de Loriol 1893a: 4, pl. 23, fig. 1; Clark & Rowe 1971: 90-91, 127; Clark & Courtman-Stock 1976: 106, 124, 184; Cherbonnier & Guille 1978: 225-226, pl. 17, figs 1, 2; Sloan *et al.* 1979: 115; Tortonese 1980: 129; Vine 1986: 195; Mbongwa 2013: 16.

*Pectinura fallax*: Clark 1909: 119; Clark 1915a: 303, pl. 18, figs 9, 10; Koehler 1930: 270.

*Ophiopezella decorata* Mortensen, 1933a: 379-380, fig. 81, pl. 19, fig. 24; Balinsky 1957: 28; Kalk 1958: 238; Macnae & Kalk 1969: 106, 130.

*Ophiopeza fallax fallax*: Clark 1968: 312-313, fig. 9c; Vail & Rowe 1989: 275, fig. 4.

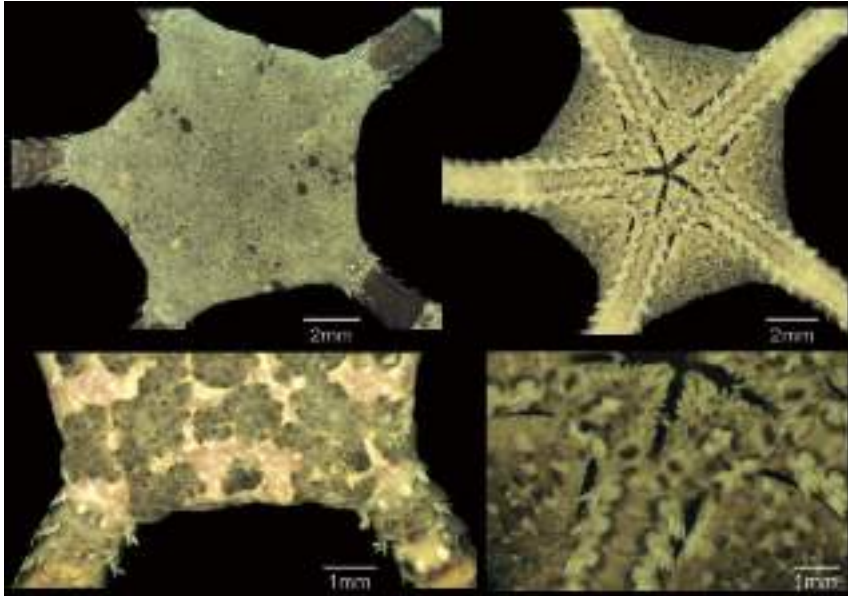
**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 15 mm; D.D/A.L. = 1/3-3.5. Disc pentagonal, covered in dense coat of granules, closely packed up to oral shields (seldom on oral shields), extending onto jaws and basal dorsal arm segments. Marginal plates few, large and puffy. Radial shields concealed by granulation. Oral shields truncated, oval, wider than long, marbled white and brown; supplementary oral shields distal to each oral shield, small, normally covered by granulation. Adoral shields present, relatively small and usually covered in granules. Oral papillae 8-9. Oral tentacle scale single. Teeth four, lowermost squarish, becoming pointed. Genital slits almost reaching disc margin, no genital papillae but disc granulation continues up to genital slits. Dorsal arm plates broadly fan-shaped, wider than long, round distal edge becoming narrowly contiguous distally. Ventral arm plates fan-shaped, but distal edge angle more obtuse than for dorsal arm plates. Arm spines up to 13, conical, short, lowest spine longest, barely as long as segment length if at all, more or less appressed to arm. Tentacle scales two basally, inner one relatively large, ovate becoming pointed at distal end of arm, almost twice as long as outer one. Colour, disc grey to brown, mottled, sometimes with patchy patterns, arms banded.

**Distribution and habitat** – Mozambique, Tanzania, Madagascar, Philippines (Clark & Rowe 1971; Cherbonnier & Guille 1978), South Africa: Aliwal Shoal (KZN) to Bhanga Nek (KZN); depth range: 0-64 m. Habitat: under boulders over sand, under stones, on reef.



**Fig. 136.** Distribution of *Ophiopeza fallax fallax* in South Africa.

**Remarks** – Distribution range in South Africa here extended from Durban (KZN) (from synonym *Ophiopezella decorata*) south to Aliwal Shoal (KZN). Syntype in the Museum of Natural History of Berlin (ZMB Ech 973). The type locality is Quirimbas Island, Mozambique, depth unknown.



**Fig. 137.** Dorsal disc (top left), ventral disc (top right), dorsal interradial area (bottom left), jaws (bottom right) views of *Ophiopeza fallax fallax* (RMCA MT2251).

### ***Ophiopeza spinosa* (Ljungman, 1867)**

*Ophiarachna spinosa* Ljungman, 1867: 305.

*Ophiopeza fallax* Lütken, 1869 (non Peters 1851): 35.

*Ophiopezella dubiosa* de Loriol, 1893a: 7, pl. 23, fig. 2; Clark 1909: 120; Clark 1915a: 304.

*Ophiopezella luetkeni* de Loriol, 1893b: 392-394, pl. 13, fig. 1.

*Ophiopeza dubiosa*: Clark 1968: 313.

*Ophiopeza spinosa*: Clark & Rowe 1971: 90-91, 127, fig. 44e; Gibbs *et al.* 1976: 130; Cherbonnier & Guille 1978: 227-228, pl. 17, figs 3, 4; Tortonese 1980: 129; Humpreys 1981: 10; Marsh 1986: 71; Vine 1986: 195; Vail & Rowe 1989: 273-275, fig. 3; Marsh *et al.* 1993: 62; Liao & Clark 1995: 285-286, fig. 159; Rowe & Gates 1995: 400-401; Mbongwa 2013: 16; Olbers *et al.* 2015: 107, 109, pl. 8A, B.

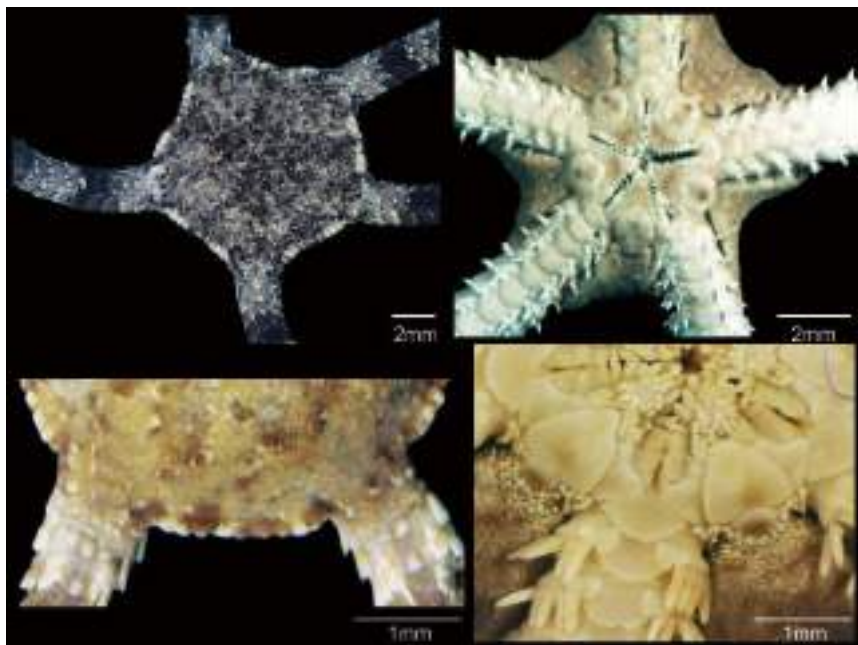
*Ophiopezella spinosa*: Clark 1909: 120; Clark 1915a: 304; Clark 1921: 141; Koehler 1922b: 338-339; Clark 1946: 258.

*Distichophis clarki* Ely, 1942: 46-48, fig. 12.

**Diagnosis** – Adapted from Cherbonnier & Guille (1978). D.D. up to 11 mm. Disc pentagonal, covered with dense coat of small, indented granules, closely packed up to oral shields, extending onto jaws. Disc margin with small, inflated plates in interradial areas. Radial shields concealed by granulation. Oral shields spearhead-shaped, supplementary oral shields not covered by granulation, adoral shields present, relatively large, not contiguous, not distinct, covered in granules. Oral papillae 6-7, elliptical leaf-shaped, pointed but blunt. Teeth four. Genital slits reach half-way to disc margin, genital papillae absent. Dorsal arm plates broadly fan-shaped basally, wider than long, but rounded on distal edge, becoming more



**Fig. 138.** Distribution of *Ophiopeza spinosa* in South Africa.



**Fig. 139.** Dorsal disc (top left), ventral disc (top right), dorsal interradial area (bottom left), jaws (bottom right) views of *Ophiopeza spinosa* (RMCA MT2284).

typical fan-shaped distally, not contiguous distally. Ventral arm plates bell- or fan-shaped, narrowly contiguous. Arm spines up to 12, conical, short, half segment length, slightly longer basally, appressed. Tentacles scales two for most of arm length, inner one large, ovate, almost twice as long as outer one. Colour in life, disc grey to brown yellow, sometimes with patchy patterns, arms banded and marbled.

**Distribution and habitat** – Western Indian Ocean, Mauritius, Aldabra, Seychelles, Red Sea, Mascarene Basin, South East Polynesia, Hawaii (Tortonese 1980; Rowe & Gates 1995), South Africa: Leadsman Shoal (KZN) to Kosi Bay (KZN); depth range: 0-74 m. Habitat: found under rocks and coral rubble, among mixed algae and on coral reefs.

**Remarks** – Olbers *et al.* (2015) noted this species as a new record for South Africa. The syntypes are in the Swedish Museum of Natural History (*Ophiarachna spinosa*: SMNH-Type-1424) and the type locality is Foa, Tonga, depth unknown.

#### 4.4.5. Family OPHIOMYXIDAE Ljungman, 1867

##### Genus *Ophiomyxa* Müller & Troschel, 1842

**Diagnosis** – Adapted from Müller & Troschel (1842) and Lyman (1882). Disc and arms covered in thick, naked skin with few, thin underlying plates. Radial shields flattened. Oral shields more or less distinct. Oral papillae usually very broad, finely serrated, glassy and flattened. Dorsal arm plates whole or fragmented. Arm spines stout, spiny. Tentacle scales absent.

Mortensen (1927) placed the type specimen of *Ophiodera serpentaria* (Lyman 1883) into *Ophiomyxa*, thereby making *Ophiodera* the synonym of *Ophiomyxa*. Clark (1952) ignored this synonymy and described a new species as *Ophiodera punctata*. According to Franklin & O'Hara (2008), regardless if the synonymy is accepted, there is some merit in the characters being shared, i.e., shape of oral plates and the long arm spines becoming serrated on distal segments, which have proved useful in identifying different species.

##### *Ophiomyxa australis* Lütken, 1869

*Ophiomyxa australis* Lütken, 1869: 45, 98, 99; Lyman 1882: 246; Koehler 1907: 341, Benham 1909: 101; Clark 1915a: 168, pl. 1, figs 1-2; Clark 1916: 77; Matsumoto 1917: 19-21, fig. 3, pl. 1, figs 4-7; Clark 1932: 203; Clark 1938: 201, pl. 13, figs 1-21; Clark H.L. 1939: 36-37; Clark 1946: 170-171; Madsen 1967: 141; Clark & Rowe 1971: 78, 92-93, pl. 13, figs 3, 4; Devaney 1974: 115-116; Cherbonnier & Guille 1978: 18-19, pl. 3, figs 1, 2; Sloan *et al.* 1979: 99, figs 5, 6; Irimura 1982: 2-4, fig. 1; Guille & Vadon 1985: 62; Marsh 1986: 70; Sastry 1991: 375-376; Liao & Clark 1995: 155, fig. 64; Rowe & Gates 1995: 406; Mbongwa 2013: 15; Olbers *et al.* 2015: 89, pl. 1E, F.

*Ophiomyxa brevispina* von Martens, 1870: 249-50; de Loriol 1893b: 425-426; Döderlein 1896: 298, pl. 17, fig. 27; Koehler 1905a: 119; Clark 1915a: 170, pl. 1, figs 1, 2; Koehler 1930: 48.

*Ophiomyxa robillardi* de Loriol, 1893a: 53-54, pl. 25, fig. 5.

*Ophiomyxa brevispina* var. *irregularis* Koehler, 1898b: 111-112.

*Ophiomyxa irregularis* Koehler, 1905a: 119-120, pl. 12, fig. 1; Koehler 1922b: 17-20, pl. 2, fig. 18, pl. 5, figs 1, 2, pl. 6, fig. 4, pl. 92, fig. 2; Koehler 1930: 48.

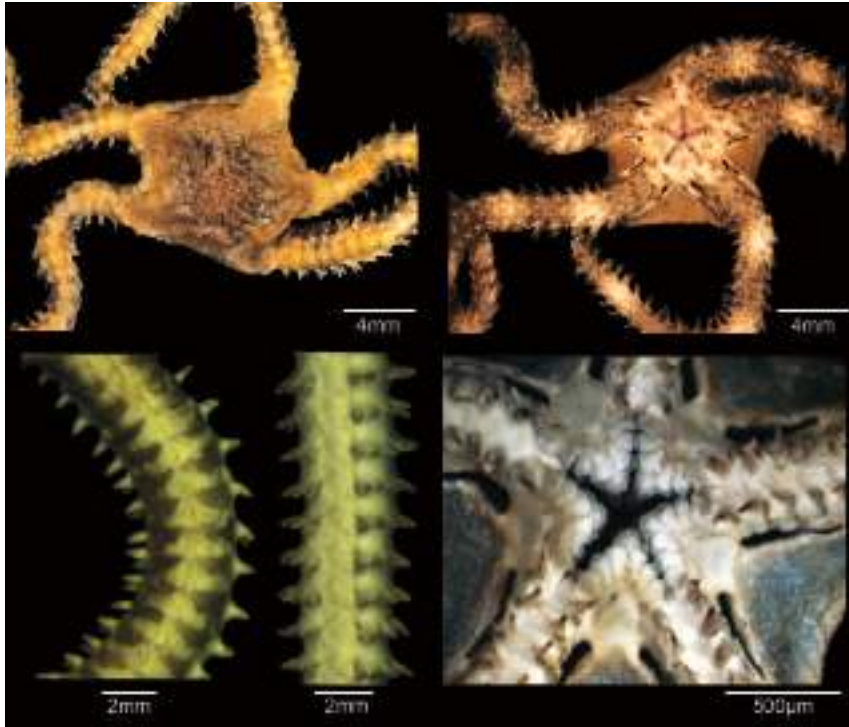
**Diagnosis** – Adapted from Cherbonnier & Guille (1978). D.D. up to 23 mm. Disc pentagonal, covered with thick, opaque, smooth skin. Radial shields short, narrow, separated by width of arm base. Row of overlapping plates along disc margin. Genital slits bordered by plates similar to ones on disc margin, long, narrow. Oral shields oval, triangular, covered by thick skin, longer than wide, abutting genital slit. Oral papillae three, broad, serrated, flattened and transparent on edges. Teeth similar. Arms five, covered in thick, naked skin. Arm spines up to seven, one on segment one, then two and four on first free arm segments. Arm spines slender, serrated and rugose at tip, some becoming curved or slightly hooked. Dorsal arm plates irregular, fragmented, becoming less fragmented distally. Ventral arm plates distinctly wider than long, deep notch on distal side, not contiguous distally. True tentacle scales absent, tube of ossicles surrounding tube foot present. Colour in life blood-red dorsally and ventrally, arms lightly banded with yellow.

**Distribution and habitat** – East Africa and associated Islands, Madagascar, Mascarene Basin, Red Sea, Seychelles, New Zealand (Stöhr 2007d), Indo-West Pacific (Rowe & Gates 1995), South Africa: Mbashe River (EC) to Dog Point (KZN); depth range: 11-75 m. Habitat: in sand, grey ooze, coral, stones, gravel, mud, sandstone rubble, gorgonians.

**Remarks** – First reported in South Africa by Olbers *et al.* (2015). Genetic data indicates that this widespread ‘species’ is a complex of related forms, and the South African population is not conspecific with *O. australis* from Southern Australia (type locality ‘... inter Australian et Tasmaniam’, ZMUC OPH-474). The nearest type locality within this complex is *Ophiomyxa robillardi* from Mauritius.



**Fig. 140.** Distribution of *Ophiomyxa australis* in South Africa.



**Fig. 141.** Dorsal whole (top left), ventral whole (top right), dorsal arm plates (bottom left), ventral arm plates (bottom left), jaws (bottom right) views of *Ophiomyxa australis* (RMCA MT2274).

### ***Ophiomyxa bengalensis* Koehler, 1897**

*Ophiomyxa bengalensis* Koehler, 1897: 363-364, pl. 9. figs 70, 71; Koehler 1922b: 17, pl. 5, figs 5, 6; pl. 92, fig. 1; Koehler 1930: 48; Mortensen 1933a: 306-309, fig. 31; Clark & Courtman-Stock 1976: 134, 111, figs 98, 101.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 30 mm, D.D./A.L. = 1/6-7. Disc pentagonal, covered with thick skin with white embedded ossicles, giving the disc a speckled appearance. Radial shields shorter than width of arm base, narrow. Oral shields oval, with distal lobe. Adoral shields narrow, not contiguous. Oral papillae 3-4, most pointed or rarely broad, serrated, flattened, some tapering to a point and transparent on edges. Teeth broad, serrated and translucent on edges. Dorsal arm plates whole, much longer than wide. Ventral arm plates equally wide and long, with deep distal notch. Arms simple, five, long, covered in thick skin. Arm spines 3-4, long, slender, serrated and rugose at tip, uppermost spine stout, one spine on first two segments, then two spines and 3-4 on free segments. Genital slits long, narrow, approximately



three-quarters length of interradial area, bordered by long plates. Tentacle scales absent. Colour in life red to orange.

**Distribution and habitat** – Andaman Islands, China Sea, Kei Islands (Koehler 1922b; Koehler 1930), South Africa: Treasure Beach (KZN) to Amatikulu (KZN); depth range: 33-1962 m. Habitat: fine, grey mud.

**Remarks** – The two specimens on hand were from a trawler and were quite damaged. This is the only ophiomyxid in South Africa that has pointed oral papillae and an oral shield with a distal lobe, absent in *O. tenuispina* and *O. australis*. The location of the type material is unknown, but the type locality is Andaman Islands, India, depth 316-457 m (Clark & Courtman-Stock 1976).



Fig. 142. Distribution of *Ophiomyxa bengalensis* in South Africa.

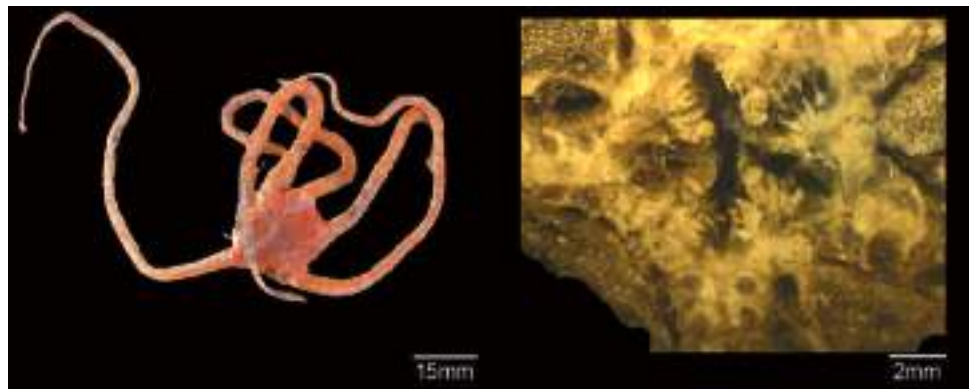


Fig. 143. Dorsal (left) and ventral (right) views of *Ophiomyxa bengalensis* (SAMC A084233).

### *Ophiomyxa tenuispina* Mortensen, 1933

*Ophiomyxa tenuispina* Mortensen, 1933a: 304-306, fig. 30, pl. 19, fig. 27; Clark & Courtman-Stock 1976: 134, 111, figs 99, 100, 101.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. up to 11mm. Disc pentagonal, covered with thick, smooth, naked skin; disc margin with row of marginal plates. Radial shields just shorter than arm base width, narrow, cigar-shaped. Oral shields oval to diamond-shaped. Adoral shields contiguous. Oral papillae 3-4, broad, serrated, flattened and transparent on edges. Teeth similar. Arms simple, five, covered in thick skin. Arm spines 4-5 (not alternating) on free segments, slender, serrated and rugose at tip. One arm spine on first segment, then two on segments two and three, increasing to five on free segments. Dorsal arm plates wider than long, fragmented with two adjacent plates. Ventral arm plates wider than long, with deep distal notch. Genital slits two-thirds interradiar length. Tentacle scales absent. Colour greenish, arms banded.



**Fig. 144.** Distribution of *Ophiomyxa tenuispina* in South Africa.



**Fig. 145.** Dorsal (left) and ventral (right) views of *Ophiomyxa tenuispina* (ZMUC OPH-288).

**Distribution and habitat** – South Africa: off Haga Haga (EC) to Dog Point (KZN); depth range: 74-260 m. Habitat: rock, sandstone rubble, gorgonians, stones, sponges.

**Remarks** – Endemic to South Africa. *O. tenuispina* and *O. australis* are the only South African species that have fragmented dorsal arm plates. The holotype is in the Natural History Museum of Denmark (ZMUC OPH-288), type locality is north east of East London, depth 174 m.

### ***Ophiomyxa vivipara capensis* Mortensen, 1936**

*Ophiomyxa vivipara* Studer, 1876: 462; Lyman 1882: 246; Clark 1915a: 170, pl. 2, figs 1, 2; Clark 1923: 313; Mortensen 1933a: 301-404, figs 27-29.

*Ophiomyxa vivipara capensis* Mortensen, 1936: 242; Clark A.M. 1952: 199; Clark & Courtman-Stock 1976: 134, 101, 111, figs 101, 102; Alva & Vadon 1989: 828-829, 832.

**Diagnosis** – Adapted from Mortensen (1936) and Clark & Courtman-Stock (1976). D.D. up to 23 mm, disc pentagonal. Disc covered with thick, opaque, smooth skin. Radial shields short, narrow, just shorter than arm base width. Oral shields oval with broad distal lobe, longer than wide, abutting the genital slit. Adoral shields not contiguous, narrow. Oral papillae 3-4, broad, serrated, flattened with transparent edges. Teeth similar, 4-5. Arms simple, five, covered in thick naked skin. Tentacle oral scales two, sharp, deep in mouth. Arm spines slender, serrated and rugose at tip, up to four on free segments. One spine on segments 1-5. Dorsal arm plates delicate, whole, with small pits visible, wider than long proximally, then equally wide as long, with distal notch. Ventral arm plates equally wide as long or slightly longer, distally notched and proximal edge straight. Genital slits bordered by long, narrow plates, approximately two-thirds of interradial areas length. Tentacle pores large, tentacle scales absent.

**Distribution and habitat** – South Africa: off Orange River (NC) to East London (EC); depth range: 101-450 m. Habitat: sand, mud, rock, coral, clay and rough bottom.

**Remarks** – Endemic to South Africa. According to Mortensen (1936), the only difference between *O. vivipara* (the Magellanic form) and *O. vivipara* var. *capensis* is that the variety has one spine up to the fifth or sixth segment, while the Magellanic form has two spines from the third or fourth segment. Clark & Courtman-Stock (1976) disputed that this could be used as a difference, but did agree that there was a zoogeographical subspecific difference and retained it as the subspecies *O. vivipara capensis*. A number of specimens within Iziko South African Museum were labelled as *O. vivipara*, these were examined and changed to *O. vivipara capensis* based on the arm spine arrangement described above. Genetically, they are difficult to distinguish (O'Hara *et al.* 2014).

The dorsal arm plates on the ophiomyxids should be carefully examined, as they can break easily, making the plates appear to be fragmented. Mortensen (1924) stated that the dorsal arm plate configuration in *O. vivipara* is a single plate which

is thin, delicate and fenestrated, whereas in *O. australis* and *O. tenuispina*, the dorsal arm plates are fragmented.

Type material of *O. vivipara* is in the Museum of Natural History of Berlin (syntype ZMB Ech 2193) and the type locality is Argentina, depth unknown.



**Fig. 146.** Distribution of *Ophiomyxa vivipara capensis* in South Africa.



**Fig. 147.** Dorsal (left) and ventral (right) views of *Ophiomyxa vivipara capensis* (SAMC A082574).

### Genus *Ophioconis* Lütken, 1869

**Diagnosis** – Adapted from Lütken (1869), Lyman (1882) and Cherbonnier & Guille (1978). Disc covered in closely-packed granules. Oral papillae numerous, up to 14. Supplementary oral shields present. Teeth few, large, blunt with translucent edges. Genital slits two per interradius. Arm spines up to nine.

## ***Ophioconis cupida* Koehler, 1905**

*Ophioconis cupida* Koehler, 1905a: 15-16, pl. 1, figs 19, 20; Clark & Rowe 1971: 88-89, 127; Cherbonnier & Guille 1978: 222-223, pl. 16, figs 3, 4; Marsh 1986: 72; Vine 1986: 195; Rowe & Gates 1995: 399; Olbers *et al.* 2015: 105, 107, pl. 7C, D.

*Ophiurodon cupida*: Matsumoto 1915: 84; Matsumoto 1917: 315.

*Ophiurodon cupidum*: Koehler 1930: 278; Clark H.L. 1939: 95-96; Murakami 1943b: 213; Clark 1946: 255.

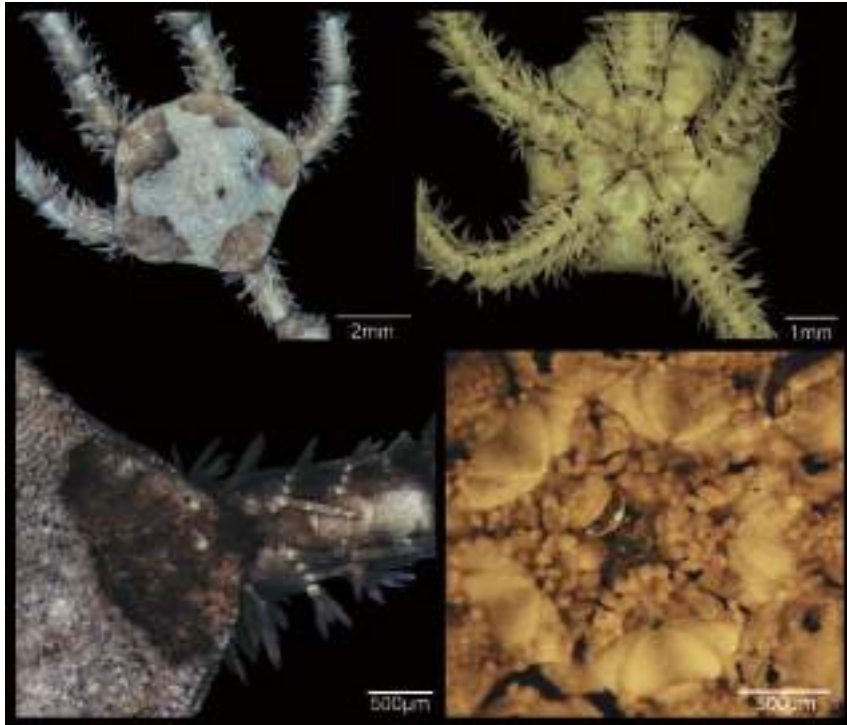
**Diagnosis** – Adapted from Cherbonnier & Guille (1978). D.D. up to 4 mm. Disc pentagonal, disc almost completely covered in granules both dorsally and ventrally. Radial shields concealed by granulation. Oral shields triangular, wider than long; supplementary oral shields present, but concealed by granulation. Adoral shields relatively large, triangular, not contiguous. Oral shields and adoral shields may have granules, but easily rubbed off. Oral papillae 5-6, pointed. Teeth three, lowermost wide, large, square, edges translucent. Genital slits single, almost up to disc margin, genital papillae absent. Dorsal arm plates fan-shaped with distal point, narrowly contiguous. Ventral arm plates pentagonal, distal edge pointed, narrowly contiguous. Arm spines up to eight, tapering, subequal, longest one slightly longer than segment length. Tentacle pores moderately large. Tentacle scales one, elongated oval, translucent. Colour grey or white with large brown patches on radial areas, arms banded with brown.

**Distribution and habitat** – Madagascar, Comoros, Red Sea, Bay of Bengal, China, Japan, Philippines, Australia and Pacific Islands (Cherbonnier & Guille 1978; Rowe & Gates 1995), South Africa: Kosi Bay (KZN); depth range: 10-600 m. Habitat: found among algae, sand and stones.

**Remarks** – Olbers *et al.* (2015) noted this species as a new record for South Africa. Easily recognisable within the family by the translucent teeth and tentacle scales. See Olbers *et al.* (2015) for additional remarks. Type material is in Naturalis (ZMA.ECH.O 2004, ZMA.ECH.O 2005 and ZMA.ECH.O 2035) (Joke Bleeker, pers. comm.).



**Fig. 148.** Distribution of *Ophioconis cupida* in South Africa.



**Fig. 149.** Dorsal (top left), ventral (top right), dorsal disc and basal arms (bottom left), jaws (bottom right) views of *Ophioconis cupida* (SAMC A74041).

### Genus *Ophiarachna* Müller & Troschel, 1842

**Diagnosis** – Adapted from Müller & Troschel (1842) and Lyman (1882). Disc granulated, including radial shields. Supplementary oral shields present. Oral papillae numerous and close-set. Teeth in vertical series. Genital slits two per interradius. Arm spines usually long, erect, typically 4-6, smooth. Tentacle scales 1-2.

### *Ophiarachna affinis* Lütken, 1869

*Ophiarachna affinis* Lütken, 1869: 34, 98; de Loriol 1893b: 411-413; Koehler 1904b: 76-77; Clark 1909: 128; Clark 1915b: 299, pl. 18, figs 1, 2; Koehler 1922b: 333-335, pl. 4, fig. 1; Koehler 1930: 271-272, pl. 14, fig. 1; Clark & Rowe 1971: 88-89, 123, fig. 42a; Devaney 1974: 175-176; Sloan *et al.* 1979: 111, figs 17, 18; Marsh 1986: 71; Rowe & Gates 1995: 395; Olbers *et al.* 2015: 109, pl. 8C, D.

*Ophiarachna clavigera* Brock, 1888: 495-497.

**Diagnosis** – Adapted from Devaney (1974). D.D. up to 28 mm. Disc round, somewhat puffy, densely covered in round granules both dorsally and ventrally,

granules extending onto oral plates. Radial shields not distinct. Oral shields naked, spearhead-shaped with marbled patterns, single supplementary oral shield, naked, half width of oral shield. Adoral shields small, not contiguous. Oral papillae 5-6, shape varies, broad, thin, elliptical leaf-shaped, middle papillae more slender than proximal and distal ones. Oral tentacle scales three, deep in mouth. Teeth five, lowest tooth square becoming pointed. Genital slits long, reaching edge of disc margin, genital papillae absent, but disc granules up to edge of slit. Arm spines up to five, lowermost spine flattened and blunt, others flattened, but conical or tapering, twice segment length, basally lowermost arm spines may reach 3-4 times segment length. Dorsal arm plates rectangular, with slight distal concave notch on distal side, twice as wide as long proximally, becoming equal distally. Ventral arm plates square to fan-shaped proximally, becoming longer than wide distally, distal edges slightly convex, plates have thin lighter-coloured margin along whole arm length. Tentacle scales two, oval, outer one somewhat rectangular. Colour in life, disc brown and grey with widely-spaced spots both dorsally and ventrally, arms banded with broad dark and light brown bands of 4-9 segments, with four longitudinal dark lines down length of arm. Arm spines annulated with grey and brown.

**Distribution and habitat** – Mozambique, Aldabra, Seychelles, Red Sea in East Indies, Philippines, Indonesia, Australia, Fiji, Samoa, South Pacific Islands (Clark 1909; Clark & Rowe 1971; Rowe & Gates 1995; Richmond 2002), South Africa: Sodwana Bay (KZN); depth range: 0-31 m. Habitat: under *Porites* colonies over sandy gravel, under boulders over sand and rubble and among coral rubble.

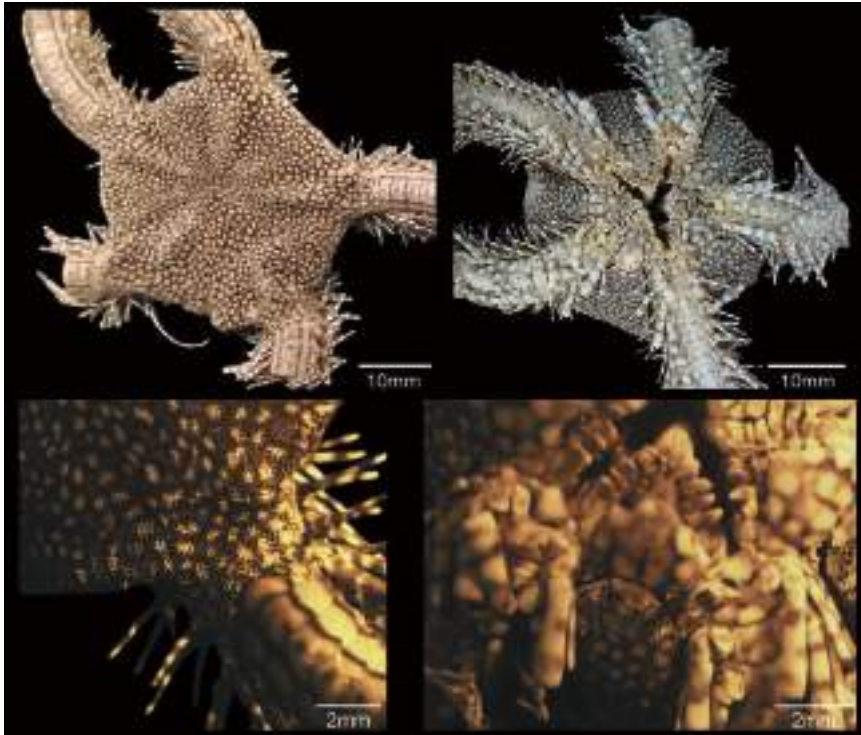
**Remarks** – Apart from the different oral configuration, this species is similar in colouration to *Breviturma doederleini*, but distinguished by the presence of four longitudinal dark lines along arms as well as the elongated ventral arm spines.

Olbers *et al.* (2015) noted this species as a new record for South Africa.

Type material is in the Museum of Natural History of Hamburg (ZMH E4073) and the type locality is Fiji, depth unknown.



**Fig. 150.** Distribution of *Ophiarachna affinis* in South Africa.



**Fig. 151.** Dorsal disc (top left), ventral disc (top right), dorsal disc and arms (bottom left), jaw and ventral interradial area (bottom right) views of *Ophiarachna affinis* (SAMC A28132).

### ***Ophiarachna septemspinosa* Müller & Troschel, 1842**

*Ophiarachna septemspinosa* Müller & Troschel, 1842: 105-106.

*Pectinura septemspinosa* Lütken 1869: 33; Lyman 1882: 17; de Loriol 1893b: 395, pl. 13, fig. 2; Koehler 1905a: 9.

*Pectinura rigida* Lyman, 1874: 224.

*Ophiarachna armata* Troschel, 1879: 137-138.

*Ophiarachnella septemspinosa*: Clark 1909: 126; Koehler 1930: 273; Clark 1938: 349-350; 1946: 263-264; Cherbonnier & Guille 1978: 218-219, pl. 16, figs 1, 2; Humpreys 1981: 10; Guille & Vadon 1985: 64; Marsh 1986: 71; Marsh *et al.* 1993: 62; Rowe & Gates 1995: 397; Mbongwa 2013: 16; Olbers *et al.* 2015: 110-112, pl. 9A, B.

**Diagnosis** – Adapted from Cherbonnier & Guille (1978). D.D. up to 38 mm. Disc round, flat, densely covered in granules both dorsally and ventrally, extending onto jaws. Radial shields naked, contrasting in colour with disc, very small, circular. Oral papillae 3-4, elliptical, slightly pointed. Teeth broad, but not square. Oral



shields naked, oval but truncated distally by large supplementary oral shield, as wide as oral shield, some specimens have marbled oral shields. Adoral shields small, not contiguous. Genital slits long and reaching edge of disc margin, genital plate distinct and slightly higher than interradiar area. Dorsal arm plates elliptical-rectangular, more than twice as long as wide, rounded lateral angles, proximal edges straight, distal margins may appear scalloped due to colouration. Ventral arm plates hexagonal, convex distally, somewhat concave proximally, wider than long, becoming longer toward distal end of arm, tentacle pore indenting lateral edges. Arm spines up to nine, conical or tapering, same length as segment with exception of lowermost arm spine, which is twice as long as segment, cigar-shaped, flattened and square-tipped. Tentacle scales two, oval, outer one somewhat broader than inner, becoming one distally. Colour in life uniformly grey, red, yellow or greenish, ventrally lighter, arms lightly banded.

**Distribution and habitat** – Western Indian Ocean and associated islands, Red Sea, Maldives, East Indies, China, South Japan, Philippines, Australia (Clark & Rowe 1971; Cherbonnier & Guille 1978; Rowe & Gates 1995; Richmond 2002), South Africa: Protea Banks (KZN) to Kosi Bay (KZN); depth range: 0-55 m. Habitat: found under boulders and coral (*Millepora* spp) colonies.

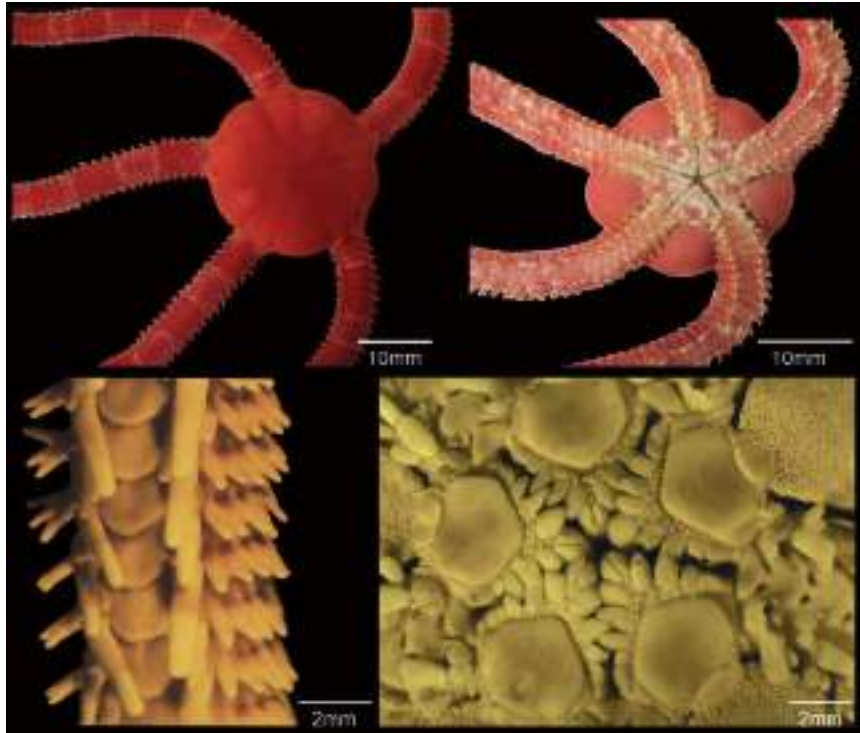
**Remarks** – Easily recognisable by the small radial shields and striking colours. The South African specimens are “very red” in comparison to the Australian red specimens and may represent a cryptic species complex (Tim O’Hara, pers. obs.). The DNA phylogeny of O’Hara *et al.* (2017) indicates that *Ophiarachnella* is polyphyletic, with *O. septemspinosa* being contained within the genus *Ophiarachna*.

Olbers *et al.* (2015) noted this species as a new record for South Africa.

According to Rowe & Gates (1995) the type locality is the Moluccas, Indonesia. Type material is in the Naturalis (ZMA.ECH.O 7084 and RMNH.ECH.3566; Joke Bleeker, pers. comm.).



**Fig. 152.** Distribution of *Ophiarachna septemspinosa* in South Africa.



**Fig. 153.** Dorsal disc (top left), ventral disc (top right), ventral arms (bottom left), jaws (bottom right) views of *Ophiarachna septemspinosa* (EKZNW LSS\_4\_EKZNW).

#### 4.4.6. Family OPHIOCOMIDAE Ljungman, 1867

O'Hara *et al.* 2019 have reclassified the Ophiocomidae according to a genetic phylogeny into four genera: *Breviturma* (including *O. pica*), *Ophiocomella* (including *O. valenciae*), *Ophiocoma*, and *Ophiomastix* (with *Ophiarthrum* a synonym).

Genus *Breviturma* Stöhr *et al.*, 2013

*Breviturma brevipes* Peters, 1851

*Ophiocoma brevipes* Peters, 1851: 466; Marktanner-Turneretscher 1887: 303; de Loriol 1893a: 25, 26, pl. 23, fig. 4; Clark 1908: 296; Clark 1911: 256; Koehler 1922b: 319-322, pl. 72, figs 6-9; Clark 1932: 205; Devaney 1968: 45; Devaney 1970: 13; Clark & Rowe 1971: 86, 119; Devaney 1974: 151-152; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 168-169, pl. 10, figs 3, 4; Sloan *et al.* 1979: 104; Clark 1980: 534; Tortonese 1980: 125, fig. 11; Humpreys 1981: 10, 23; James 1982: 39-40, pl. 2B; Marsh 1986: 71; Sastry 1991: 380, pl. 4, fig. 21; Liao & Clark 1995: 258-260, fig. 138, pl. 19, fig. 6; Rowe & Gates 1995:

385; Rowe & Richmond 2004: 3292; Olbers & Samyn 2012: 140-143, pls 1a-g, 2a-c; Mbongwa 2013: 15.

*Ophiocoma brevispinosa* Smith, 1876: 40.

*Ophiopeza danbyi* Farquhar, 1897: 189-190, pl. 14, figs 7, 8; Clark 1915a: 291.

(Non *Ophiocoma brevipes*: Stöhr *et al.* 2008: 553, 555, fig 5e.)

*Ophiocoma (Breviturma) brevipes* Stöhr *et al.* 2013: 10-13, figs 2d, 4, 5a, d, g, j, m, p.

*Breviturma brevipes* O'Hara *et al.* 2019: 74.

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D. up to 25 mm. Disc with small, fine, spherical granules closely packed on both dorsal and ventral side. Oral shields round to oval with dark markings. Adoral shields not contiguous. Oral papillae 4-5. Teeth wide and rounded. Genital slits clearly visible, elongated and bordered with slightly more prominent granules. Arms banded on the dorsal side. Dorsal arm plates oval, wider than long, broadly contiguous. Ventral arm plates nearly as wide as long, bluntly pointed on the proximal side, not contiguous distally. Arm spines up to six, uppermost thickest on the proximal part of the arm, longest spine shorter than, or equal to, segment length. Tentacle scales two, oval. Colour in life, disc colour patterns variable, with a combination of light greens, whites, yellows and browns in blotchy star, or simply no particular pattern.

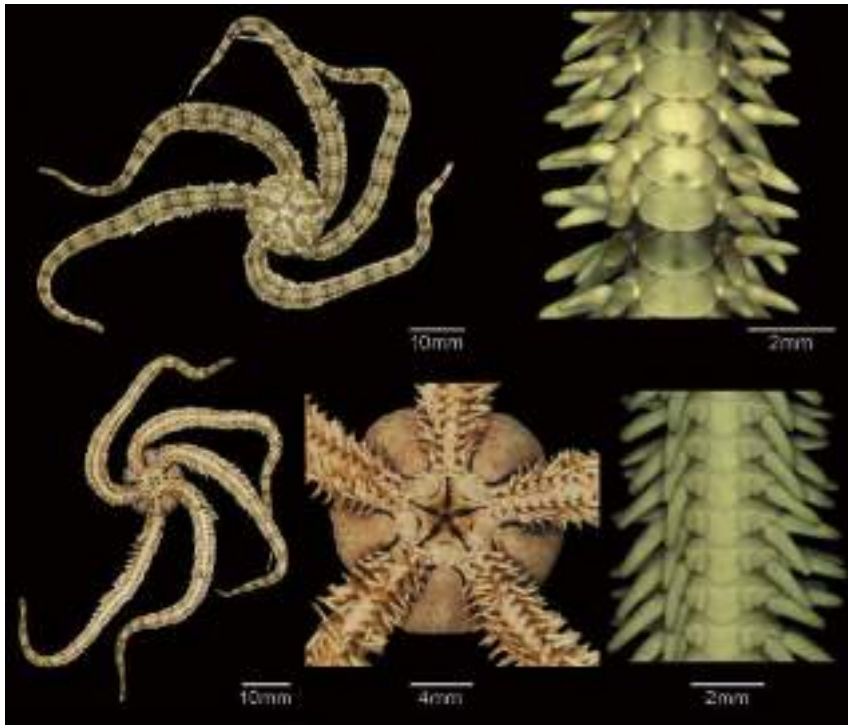
**Distribution and habitat** – Mozambique, north-western parts of the Indian Ocean, tropical Indo-West Pacific (Rowe & Richmond 2004), South Africa: Aliwal Shoal (KZN) to Kosi Bay (KZN); depth range: 0-54 m. Habitat: associated with coral heads or boulders, on fine to coarse sand and at the bases of algae in the sandy littoral zone.

**Remarks** – Additional notes on *B. brevipes* are given by Olbers & Samyn (2012), who describe this as a new record for South Africa and include notes on the juveniles, which differ from the adults. O'Hara *et al.* 2018 raised *Breviturma* to the rank of genus.

The type material is in the Museum of Natural History of Berlin (syntypes ZMB Ech 4660, ZMB Ech 961-3) and the type locality is Quirimbas Island, Mozambique, depth unknown.



**Fig. 154.** Distribution of *Breviturma brevipes* in South Africa.



**Fig. 155.** Dorsal whole (top left; RMCA MT2194), dorsal arm plates (top right; RMCA MT2193), ventral whole (bottom left; RMCA MT2194), jaws (bottom centre; RMCA MT2194), ventral arm plates (bottom centre; RMCA MT2193) views of *Breviturma brevipes* (RMCA MT2194).

### ***Breviturma dentata* Müller & Troschel, 1842**

*Ophiocoma dentata* Müller & Troschel, 1842: 99, pl. 7, figs 3, 3a; Devaney 1968: 45; Devaney 1970: 13; Clark & Rowe 1971: 86, 119, pl. 18, figs 2, 3; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 168, pl. C, figs 3, 4; Tortonese 1980: 125, figs 11A, B; James 1982: 40, pl. 2C, D; Guille & Vadon 1985: 63; Marsh 1986: 71; Sastry 1991: 380, pl. 4, fig. 22; Liao & Clark 1995: 260-261, fig. 139; Rowe & Gates 1995: 386; Price & Rowe 1996: 76; Rowe & Richmond 2004: 3292; Olbers & Samyn 2012: 143-144, pl. 2d, e; Mbongwa 2013: 15.

*Ophiocoma insularia* Lyman, 1862: 80-81; Macnae & Kalk 1958: 130.

*Ophiocoma ternispina* von Martens, 1870: 252-253.

*Ophiocoma variegata* Smith, 1876: 39.

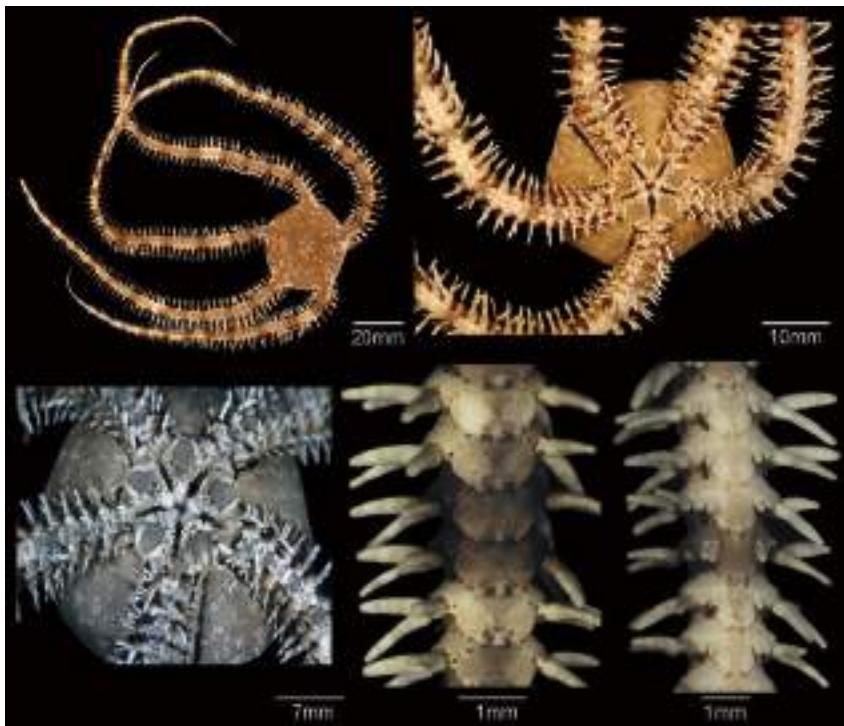
*Ophiocoma (Breviturma) dentata* Stöhr *et al.* 2013: 13-17, figs 2e, f, 5b, e, h, k, n, q.

*Breviturma dentata* O'Hara *et al.* 2019: 74

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D up to 14 mm. Disc covered in granules. Radial shields not distinct. Oral shields round, as long as wide, with marbled pattern. Adoral shields small, not contiguous. Dental papillae broad, not extending far into mouth. Dorsal arm plates broad, elliptical and contiguous. Ventral arm plates square with rounded corners, rounded distal edge, as wide as long, contiguous. Arm spines four, broadly and irregularly banded once



**Fig. 156.** Distribution of *Breviturma dentata* in South Africa.



**Fig. 157.** Dorsal whole (top left), ventral whole (top right), ventral disc (bottom left), dorsal arm plates (bottom centre), ventral arm plates (bottom centre) views of *Breviturma dentata* (RMCA MT2380).

or twice with light brown, upper arm spines thick, blunt, somewhat flattened and slightly shorter than lower ones. Tentacle scales two, oval. Colour in life variegated with brown, white and beige, both dorsally and ventrally with the presence of small dark brown spots.

**Distribution and habitat** – Tropical Indo-West Pacific, Western Indian Ocean (Macnae & Kalk 1958; Rowe & Gates 1995; Rowe & Richmond 2004), South Africa: Aliwal Shoal (KZN) to Kosi Bay (KZN); depth range: 0-35 m. Habitat: sub-littoral zone, under boulders and associated with coral and coral debris on sand or rubble.

**Remarks** – The holotype is in the Museum of Natural History of Berlin (ZMB Ech 931), type locality Celebes (Islands of Sulawesi, Indonesia), depth unknown.

Additional notes on *B. dentata* are given in Olbers & Samyn (2012), where it is described as a new record for South Africa.

### ***Breviturma doederleini* de Loriol, 1899**

*Ophiocoma doederleini* de Loriol, 1899: 30, pl. 3, fig. 2; Devaney 1968: 69; Devaney 1970: 12-18, figs 18, 14, 22; Devaney 1974: 154; Sloan *et al.* 1979: 104, figs 8-10; Clark 1980: 534; Humpreys 1981: 10, 24; Marsh 1986: 71; Rowe & Gates 1995: 396; Olbers & Samyn 2012: 144-145, pls 2f, g, 3a, b.

*Ophiocoma dentata* Lütken, 1859: 165 (non Müller & Troschel 1842); Clark 1921: 121.

*Ophiocoma (Breviturma) doederleini* Stöhr *et al.* 2013: 7-10, figs 2a-c, 3.

*Breviturma doederleini* O'Hara *et al.* 2019: 74.

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D. up to 30 mm. Disc covered in granules both dorsally and ventrally. Radial shields not distinct. Oral shields large, round to oval, longer than wide. Oral papillae up to six, distalmost broadest. Teeth broad, square. Adoral shields not contiguous. Genital slits long, genital papillae present. Dorsal arm plates fan-shaped, wider than long, distal edge rounded, broadly contiguous. Ventral arm plates fan-shaped with distal edge rounded. Arm spines annulated, flat and tapering proximally, but remaining spines tapering, shortest arm spine longer than segment length. Tentacle scales 2-3, large, oval. Colour in life greyish brown dorsally and ventrally either with fine black reticulating lines, white-ringed black spots, or speckled with light spots.

**Distribution and habitat** – Indian Ocean and west central Pacific Ocean (Rowe & Gates 1995), South Africa: Sodwana Bay (KZN) to Kosi Bay (KZN); depth range: 12-20 m. Habitat: under large boulders on gravel.

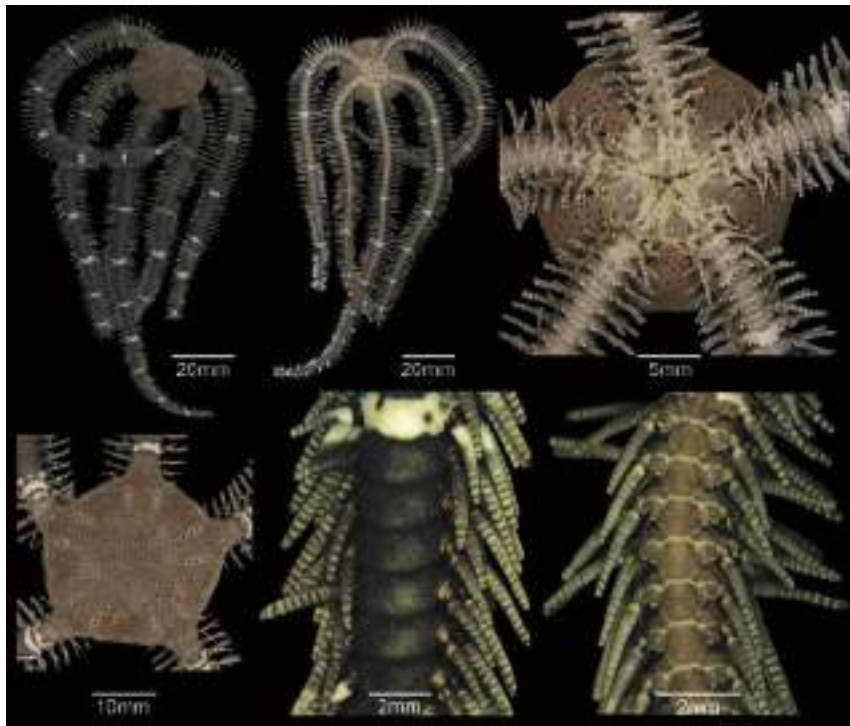
**Remarks** – Additional notes of *Breviturma doederleini* are given in Olbers & Samyn (2012) who describe it as a new record for South Africa.

According to Devaney (1970) the annulation of the arm spines is used in the field as an easy character to separate *Breviturma dentata* from *B. doederleini*, being absent in *dentata* but present in *doederleini*.

The holotype is in the Muséum d'Histoire naturelle, Genève (MHNG INVE 71892) and the type locality is Mauritius, depth unknown.



**Fig. 158.** Distribution of *Breviturma doederleini* in South Africa.



**Fig. 159.** Dorsal whole (top left; RMCA MT2249), ventral whole (top centre; RMCA MT2249), ventral disc (top right; RMCA MT2250), dorsal disc (bottom left; RMCA MT2250), dorsal arm plates (bottom centre; RMCA MT2507), ventral arm plates (bottom centre; RMCA MT2507), views of *Breviturma doederleini*.

***Breviturma pica* Müller & Troschel, 1842**

*Ophiocoma pica* Müller & Troschel, 1842: 101; Clark 1921: 127, pl. 13, fig. 8; Clark 1938: 333; Balinsky 1957: 25-26; Macnae & Kalk 1958: 130; Devaney 1968: 131; Devaney 1970: 19-20, figs 23-25, 27; Clark & Rowe 1971: 86-87, 118; Clark & Courtman-Stock 1976: 173; Cherbonnier & Guille 1978: 172, pl. 11, figs 5, 6; Sloan *et al.* 1979: 106, Clark 1980: 535, 548; Tortonese 1980: 124; Price 1982: 8; James 1982: 36-38, pl. 1C; Marsh 1986: 71; Vine 1986: 195; Sastry 1991: 381, pl. 5, fig. 25; Liao & Clark 1995: 262-263, fig. 141; Rowe & Gates 1995: 387; Price & Rowe 1996: 77; Olbers & Samyn 2012: 146-147, pl. 3e, f.  
*Breviturma pica* O'Hara *et al.* 2019: 74.

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D up to 17 mm. Disc with spherical granules extending onto distal parts of ventral interradiar areas. Radial shields not distinct. Oral shields usually oval. Adoral shields triangular, not contiguous. Oral papillae 3-4, dental papillae 6-10. Teeth one or two, slightly elongated and blunt. Genital slits long, genital papillae present, cone-shaped. Dorsal arm plates fan-shaped, convex on distal side with distal side being longer than proximal side, concave proximally. Ventral arm plates straight to slightly convex distally, plates becoming slightly longer distally. Arm spines five proximally, 4-5 distally, slender, first and second spines longest, c. twice segment length, lower arm spines same length as segment or slightly longer. Tentacle scales two, oval, large, inner one slightly smaller basally. Colour in life dark brown or black with radiating golden lines on disc and often, transverse bands annulating the arms.

**Distribution and habitat** – Indo-Pacific (Clark 1921; Clark & Rowe 1971), South Africa: Qolora (EC) to Kosi Bay (KZN); depth range: 0-24 m. Habitat: under rocks or dead coral rubble.

**Remarks** – Additional notes on *B. pica* are given in Olbers & Samyn (2012). Distribution is here extended from Richards Bay (KZN) south to Qolora (EC).

Location of type material is unknown. According to Müller & Troschel (1842) it is in the Muséum national d'Histoire naturelle in Paris (MNHN), but could not be found



**Fig. 160.** Distribution of *Breviturma pica* in South Africa.



by Nadia Améziiane (pers. comm.). The type locality is also unknown, according to Müller & Troschel (1842).



**Fig. 161.** Dorsal whole (top left), ventral whole (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Breviturma pica* (RMCA MT1496).

### ***Breviturma pusilla* (Brock, 1888)**

*Ophiomastix pusilla* Brock, 1888: 499; Devaney 1970: 25.

*Ophiocoma latilanxa* Murakami, 1943a: 194-196, fig. 13; Murakami 1943b: 218; Devaney 1970: 25-27.

*Ophiocoma pusilla*: Clark 1921: 131; Devaney 1970: 25, figs 26, 29; Clark & Rowe 1971: 86-87, 118; Clark & Courtman-Stock 1976: 122, 174, fig. 190; Cherbonnier & Guille 1978: 173-174, pl. 11, figs 3, 4; Sloan *et al.* 1979: 106; Clark 1980: 535, 544; Tortonese 1980: 127; Humpreys 1981: 10, 24; Price 1982: 8; Guille & Vadon 1985: 63; Marsh 1986: 71; Vine 1986: 195; Liao & Clark 1995: 263-264, fig. 142; Rowe & Gates 1995: 388; Price & Rowe 1996: 77; Olbers & Samyn 2012: 147-148, pl. 4a, b; Mbongwa 2013: 15.

*Breviturma pusilla* O'Hara *et al.* 2019: 74

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D up to 8 mm. Disc with uniformly distributed granules both dorsally and ventrally, concealing radial shields, granules forming a V-shape in interradial area. Oral shields oval, nearly twice as long as wide. Adoral shields triangular, not contiguous. Oral papillae 4-5. Dental papillae in 2-3 rows. Dorsal arm plates fan-shaped proximally, wider than long, with convex distal side contiguous, distally plates longer than wide and less contiguous. Ventral arm plates fan-shaped, wider than long, distally becoming longer than wide. Arm spines 4-5, hollow, glassy and c. two-and-a-half times segment length. Second uppermost arm spines at a third of arm length with pustular distal expansions, while other arm spines tapering. Tentacle scales two. Colour in life, disc slightly speckled, may have banded arms from half way down the arms to the tips.

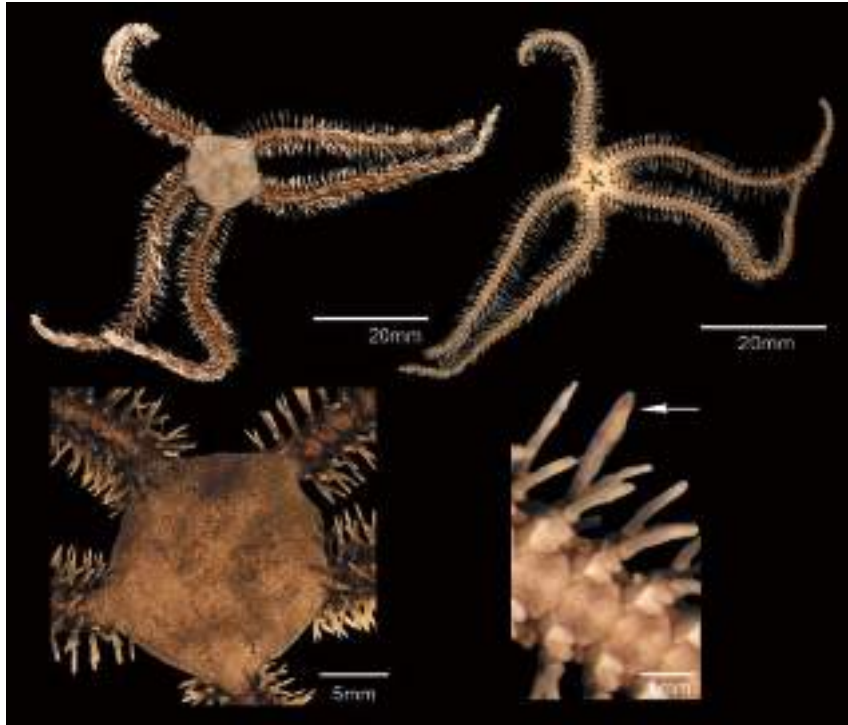
**Distribution and habitat** – Tropical Indo-West central Pacific Ocean (Rowe & Gates 1995), including Red Sea and Mozambique (Clark 1967; Clark & Courtman-Stock 1976). South Africa: Aliwal Shoal (KZN) to Kosi Bay (KZN); depth range: 0-32 m. Habitat: in sand channels, under rubble and associated with coral.

**Remarks** – Additional notes on *O. pusilla* are given by Olbers & Samyn (2012) who report this species as a new record for South Africa.

The type material is in the Museum of Natural History of Berlin (ZMB Ech 5429 and ZMB Ech 4777), type locality is Ambon, Indonesia, depth unknown.



**Fig. 162.** Distribution of *Breviturma pusilla* in South Africa.



**Fig. 163.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), arm spines, arrow indicating swollen spine (bottom right) views of *Breviturma pusilla* (RMCA MT2153).

Genus *Ophiocoma* Agassiz, 1836

***Ophiocoma erinaceus* Müller & Troschel, 1842**

*Ophiocoma erinaceus* Müller & Troschel, 1842: 98; Kalk 1958: 207, 216, 237; Clark 1967: 47; Devaney 1968: 173; Devaney 1970: 33, figs 45-47; Clark & Rowe 1971: 86, 119, pl. 17, figs 5, 6; Clark & Courtman-Stock 1976: 122, 173; Cherbonnier & Guille 1978: 169, pl. 10, figs 5, 6; Sloan *et al.* 1979: 106, figs 11, 12; Clark 1980: 535, 548; Tortonese 1980: 124; Humpreys 1981: 10, 24; James 1982: 38, pl. 1D; Price 1982: 8; Guille & Vadon 1985: 63; Marsh 1986: 71; Vine 1986: 195; Sastry 1991: 380, pl. 4, fig. 23; Liao & Clark 1995: 261-262, fig. 140; Rowe & Gates 1995: 387; Price & Rowe 1996: 77; Rowe & Richmond 2004: 3292; O'Hara *et al.* 2004: 537-541; Benavides-Serrato & O'Hara 2008: 51; Reza Fatemi *et al.* 2010: 44, fig. 2; Olbers & Samyn 2012: 145-146, pl. 3c, d; Mbongwa 2013: 15.

*Ophiocoma similanensis* Bussarawit & Rowe, 1985: 1, figs 1, 2; Price & Rowe 1996: 77.

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D. up to 21.5 mm, dorsal disc covered with coarse granules, ventral interradial area mostly naked with granules forming a V-shape. Radial shields not distinct. Oral shields variable, pear-shaped, circular or hexagonal, broadest distally. Adoral shields small, not contiguous. Dorsal arm plates uniform black, fan-shaped, distally convex, imbricating, more than twice as wide as long. Ventral arm plates uniform brown, from regular hexagons proximally to pentagons distally. Arm spines 3-4, uppermost largest, some specimens have longitudinal stripes on arm spines, spines flattened closest to disc. Tube feet in live specimens red, in preserved specimens white. Tentacle scales two, equal in size. Colour characteristically black, dark brown or dark red dorsally, lighter ventrally.

**Distribution and habitat** – Tropical to subtropical Indo-Pacific (Olbers & Samyn 2012), South Africa: Treasure Beach (KZN) to Kosi Bay (KZN); depth range: 0-27 m. Habitat: associated with coral, found on gravel under boulders. Juveniles found on sponges (*Haliclona* species) or under dead coral boulders.

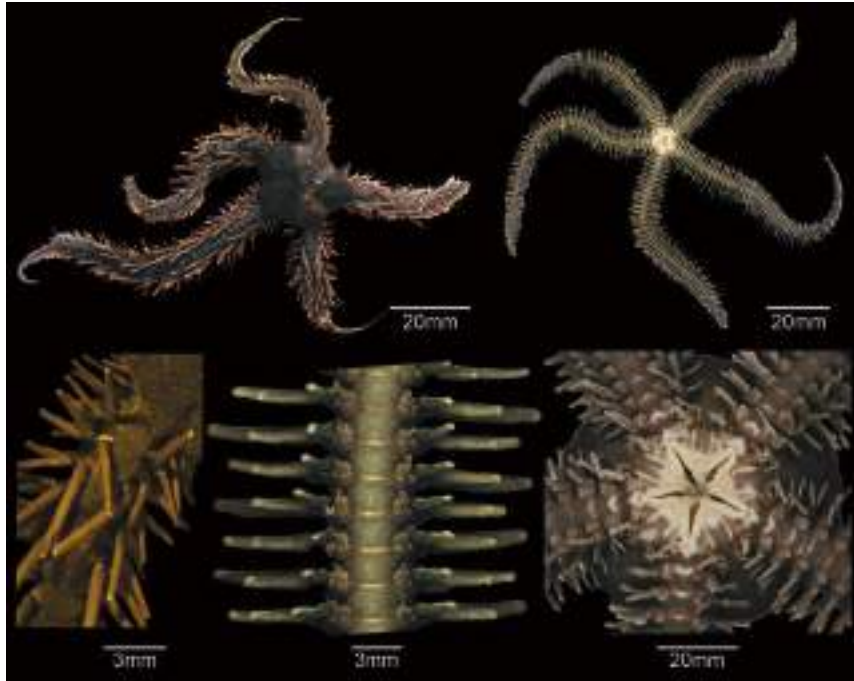
**Remarks** – Additional notes are given in Olbers & Samyn (2012) and even though *O. erinaceus* is one of the most abundant brittle stars in littoral tropical seas, its taxonomy has only recently been resolved. O'Hara *et al.* (2004) used molecular, morphological and day / night colour change data to show that *O. erinaceus* is a species complex of three species: *O. erinaceus*, *O. schoenleinii* Müller & Troschel 1842 and *O. cynthiae* Benavides-Serrato & O'Hara, 2008.

In this study, distribution is extended from Treasure Beach (KZN) to Kosi Bay (KZN).

The type material is in the Museum of Natural History of Berlin (syntypes: ZMB Ech 921, ZMB Ech 922, ZMB Ech 923 and ZMB Ech 924) and the type locality is the Red Sea, depth unknown.



**Fig. 164.** Distribution of *Ophiocoma erinaceus* in South Africa.



**Fig. 165.** Dorsal whole (top left; RBINS, RSAKZN/2016.008 (unaccessioned)), ventral whole (top right; RBINS, RSAKZN/2016.008 (unaccessioned)), dorsal basal arms (bottom left; LSS\_5\_EKZNW), ventral arms (bottom centre; RMCA MT2136), ventral disc (bottom right; LSS\_5\_EKZNW) views of *Ophiocoma erinaceus*.

### ***Ophiocoma scolopendrina* (Lamarck, 1816)**

*Ophiura scolopendrina* Lamarck, 1816: 544.

*Ophiocoma scolopendrina*: Clark 1932: 207; Kalk 1958: 205; Macnae & Kalk 1958: 130; Devaney 1968: 203; Devaney 1970: 33-35; Clark & Rowe 1971: 86, 119, pl. 17, figs 3, 4; Clark & Courtman-Stock 1976: 122, 174; Hughes & Gamble 1977: 355; Sloan *et al.* 1979: 106, fig. 13; Clark 1980: 535; Tortonese 1980: 124; Price 1982: 8; James 1982: 36-39, pl. 2A; Guille & Vadon 1985: 63; Vine 1986: 195; Marsh 1986: 71; Sastry 1991: 381, pl. 4, fig. 24; Liao & Clark 1995: 264-265, fig. 143; Rowe & Gates 1995: 388; Reza Fatemi *et al.* 2010: 45, fig. 3; Olbers & Samyn 2012: 148-150, pl. 4c, d; Mbongwa 2013: 15-16.

**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D. up to 25 mm. Disc round or pentagonal. Dorsal disc densely covered with spherical granules, covering the whole surface including the indistinct radial shields. Ventral disc with same, densely distributed granules, but less dense closer to genital slits. Oral shields oval, shorter than wide. Adoral shields restricted to the lateral

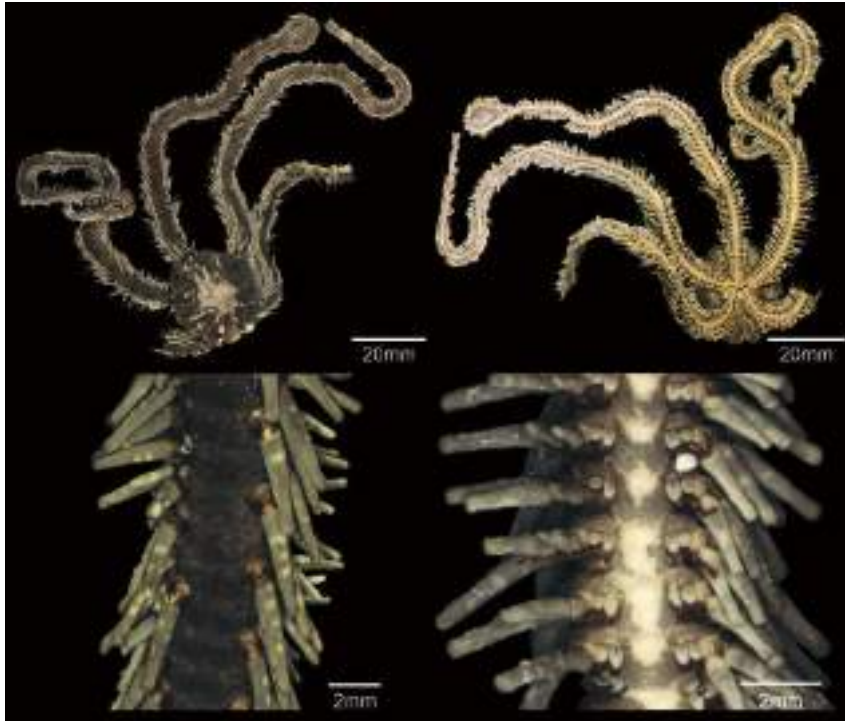
edge of the oral shield, triangular, not contiguous. Oral papillae five, inner ones more pointed. Oral tentacle scale low and wide. Dental papillae 4-9, placed in a cluster below wide, truncated teeth. Genital slit bordered by elongated genital papillae. Dorsal arm plates fan-shaped, wider than long, distal margin straight in first segments, becoming convex in distal segments. First two ventral arm plates distinctly smaller, distal margin indented, lateral margins convex and proximal margin straight, *c.* as long as wide. Remaining ventral arm plates significantly larger, wider than long, distal margin convex, proximal margin concave. Arm spines 3-5, three on segment three, 4-5 on segment eight, uppermost ones thick, short, longer than segments; lower arm spines slender, longer than segment, except for first two segments. Tentacle scales two, oval, inner one a fraction longer. Colour in life, disc uniformly brown both dorsally and ventrally. Dorsal arm plates blotched with brown on beige, giving arms a variegated to banded pattern.

**Distribution and habitat** – Tropical Indo-Pacific (Rowe & Gates 1995), including Red Sea (Clark & Rowe 1971), South Africa: Umgazana (EC) to Kosi Bay (KZN); depth range: 0-179 m. Habitat: common in the upper eulittoral zone and rocky shores.

**Remarks** – A detailed description of *O. scolopendrina* is given in Olbers & Samyn (2012), who also designated a neotype (MNHN EcOh 11043) for *O. scolopendrina*, locality Mauritius. In this study, distribution is extended from KwaZulu-Natal south to Umgazana (EC).



**Fig. 166.** Distribution of *Ophiocoma scolopendrina* in South Africa.



**Fig. 167.** Dorsal whole (top left; RMCA MT1708), ventral whole (top right; RMCA MT1708), dorsal arms (bottom left; RMCA MT1708), ventral arms (bottom right; RMCA MT1708) views of *Ophiocoma scolopendrina*.

Genus *Ophiocomella* A.H. Clark, 1939

***Ophiocomella sexradia*** (Duncan, 1887)

- Ophiocnida sexradia* Duncan, 1887: 92-93, pl. 8, figs 10, 11; Koehler 1905a: 33.  
*Ophiocoma parva* Clark, 1915a: 292, pl. 14, figs 8, 9; Clark 1921: 132, pl. 13, fig. 4; Clark 1938: 331-332; Clark A.H. 1939: 5-7, pl. 1, figs 1, 2; Clark 1946: 247; Balinsky 1957: 27; Kalk 1958: 207, 216, 237; Macnae & Kalk 1969: 104, 106, 130; Clark & Rowe 1971: 86, 87, 118, fig. 38d, pl. 18, fig. 6.  
*Amphilimna sexradia*: Clark 1915a: 259.  
*Amphilimna sexradiata*: Koehler 1927: 3.  
*Ophiocomella schultzi* Clark, 1941: 481-483; Clark & Rowe 1971, fig. 38c, e.  
*Ophiocomella clippertoni* Clark A.H., 1939: Clark A.H. 1952: 296.  
*Ophiomastix sexradiata* Clark A.H. 1952: 297-298; Clark & Rowe 1971: 86, 118, fig. 38a, b.  
*Ophiocomella sexradia*: Clark & Rowe 1971: 86-87, 118, fig. 38c-f; Devaney 1974: 162-164; Clark & Courtman-Stock 1976: 105, 122, 175; Hughes & Gamble

1977: 355; Cherbonnier & Guille 1978: 178-179, pl. 12, figs 5, 6; Sloan *et al.* 1979: 109; Marsh 1986: 71; Vine 1986: 195; Sastry 1991: 374, 382, pl. 4, fig. 20; Liao & Clark 1995: 265, fig. 144; Rowe & Gates 1995: 389; Richmond 2002: 326; Putchakarn & Sonchaeng 2004: 423; Stöhr *et al.* 2008: 547, 555-556; Mbongwa 2013: 16; Olbers *et al.* 2015: 95-96, pl. 3E, F.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 6 mm. Disc covered with short, blunt spines, densities may differ. Radial shields not distinct. Oral shields variable, round, rhombic, spearhead-shaped or hexagonal. Adoral shields not contiguous. Dental papillae 4-6, usually in series. Oral papillae three. Teeth blunt and wide. Genital slits narrow and elongated. Arms six, rarely three or seven. Dorsal arm plates fan-shaped, as wide as long. Ventral arm plates squarish, distal edge rounded, proximal edge truncated. Arm spines up to four, sometimes five, tapering to blunt tips or may be square-tipped, one segment length. Tentacle scale one, oval, first pair of pores may have two. Fissiparous. Colour in life, disc dark brownish or green, arms banded with brown, green or red.

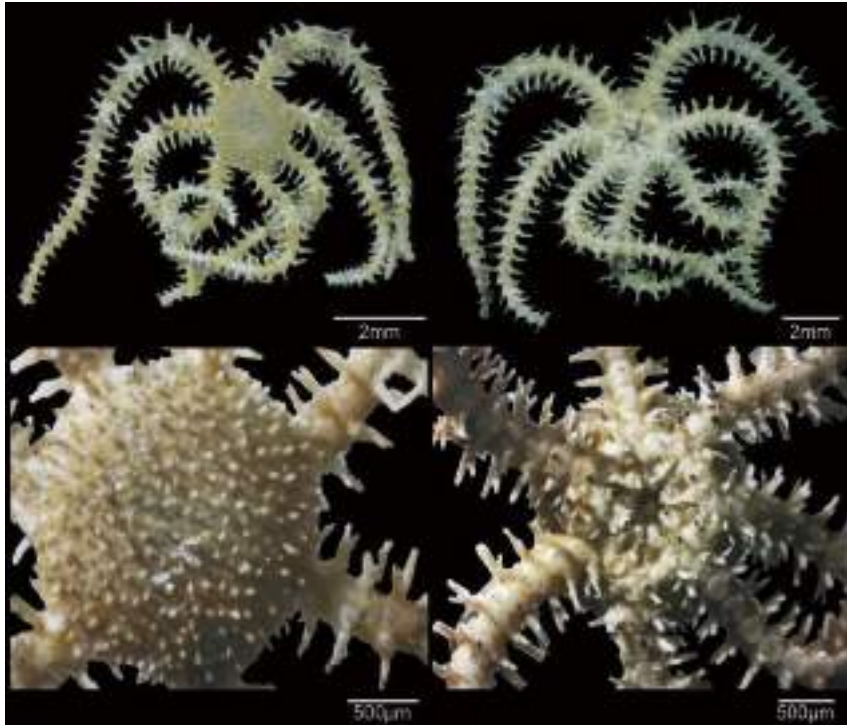
**Distribution and habitat** – Mozambique, Reunion, Rodrigues, India, China, south Japan, Australia, Tasman Sea, Hawaiian Islands (Clark & Rowe 1971; Sastry 1991; Rowe & Gates 1995; Richmond 2002; Rowe & Richmond 2004), South Africa: Isipingo (KZN); depth range: 0-33 m. Habitat: associated with sponges, coral bases and sea grass beds or algae.

**Remarks** – In KwaZulu-Natal, this species appears to be associated with the six-armed species *Ophiactis savignyi* found in and among rocky shore algae scrapings. The type material is housed in the Museum of Comparative Zoology (holotype: MCZ OPH-3758, paratype: MCZ OPH-3759 and MCZ OPH-3855), type locality Torres Strait, Murray Island, Australia, depth unknown.



**Fig. 168.** Distribution of *Ophiocomella sexradia* in South Africa.





**Fig. 169.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), ventral disc (bottom right) views views of *Ophiocomella sexradia* (EKZNW RR\_4\_JMO\_2010).

### ***Ophiocomella valenciae* Müller & Troschel, 1842**

*Ophiocoma valenciae* Müller & Troschel, 1842: 102; Eyre & Stephenson 1938: 38, 43; Kalk 1958: 200, 207, 237; Macnae & Kalk 1958: 130; Clark 1967: 44-45; Devaney 1968: 126; Macnae & Kalk 1969: 101, 106, 130; Clark & Rowe 1971: 86, 119, pl. 18, fig. 1; Hughes & Gamble 1977: 355; Sloan *et al.* 1979: 109, fig. 14; Clark 1980: 535, 548; Tortonese 1980: 125; Humpreys 1981: 10, 24-25; Price 1982: 8; Vine 1986: 195; Olbers & Samyn 2012: 150, pl. 4e, f; Sastry 1991: 382; Milne 2012: 155; Mbongwa 2013: 16.

*Ophiocomella valenciae*: O'Hara *et al.* 2019: 74.

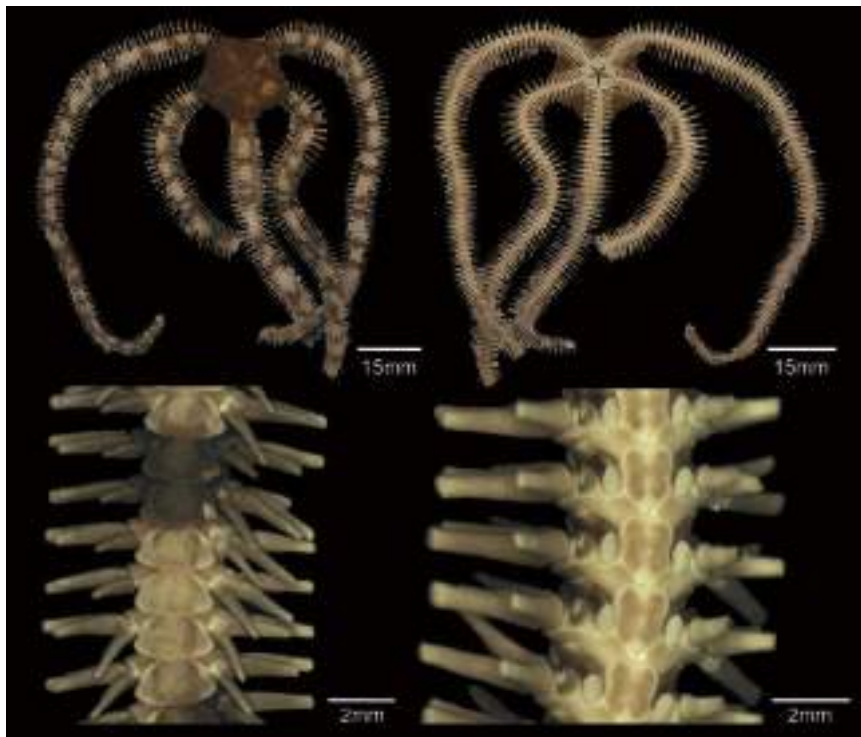
**Diagnosis** – Adapted from Devaney (1970) and Olbers & Samyn (2012). D.D. up to 20 mm. Disc covered dorsally and ventrally with moderately fine granules, which become elongated towards margin of disc. Radial shields defined by lighter colour on some specimens, but this could be an artefact of preservation. Oral shields round to oval. Adoral shields not contiguous. Oral papillae 3-4, dental papillae numerous. Teeth square 3-4. Genital slits long, genital papillae present. Dorsal arm plates broad, oval, broadly contiguous. Ventral arm plates square to pentagonal,

distal edge straight, proximal edge may be slightly convex. Arm spines up to six, uppermost spines shorter than middle spines, one segment length. Tentacle scale one, oval, sometimes two on first segments. Colour in life, disc brown, arms tawny with darker bands.

**Distribution and habitat** – Tropical Indian Ocean, including Red Sea and possibly Persian Gulf (Clark & Rowe 1971; Tortonese 1980), South Africa: Umgazana



**Fig. 170.** Distribution of *Ophiocomella valenciae* in South Africa.



**Fig. 171.** Dorsal whole (top left), ventral whole (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Ophiocomella valenciae* (RMCA MT1750).

(EC) to Kosi Bay (KZN); depth range: 0-18 m. Habitat: associated with coral and sponges, found within rocky crevices, cobbles, rubble and various algal beds.

**Remarks** – Additional notes of *O. valenciae* are given in Olbers & Samyn (2012). The type material is in the Museum of Natural History of Berlin (syntypes ZMB Ech 4625 and ZMB Ech 955) and the type locality is the Gulf of Aden, depth unknown.

### Genus *Ophiomastix* Müller & Troschel, 1842

**Diagnosis** – Adapted from Lyman (1882) and Clark & Courtman-Stock (1976). Disc mostly smooth, or with scattered spinelets or granules, densities differ. Radial shields indistinct, but proportionally larger than in *Ophiocoma*. Oral and dental papillae as in *Ophiocoma*. Adoral shields small and widely separated. Arm spines smooth, solid, up to four, uppermost usually club-shaped or tips clavate. Genital slits usually long, starting close to oral shield. Tentacle scales one or two.

### *Ophiomastix koehleri* Devaney, 1977

*Ophiomastix koehleri* Devaney, 1977: 274-283, figs 1-4; Cherbonnier & Guille 1978: 186-188, pl.11, figs 1, 2; Sloan *et al.* 1979: 92, 109, fig.16; Humpreys 1981: 10, 25; Olbers *et al.* 2015: 96, pl. 4A, B.

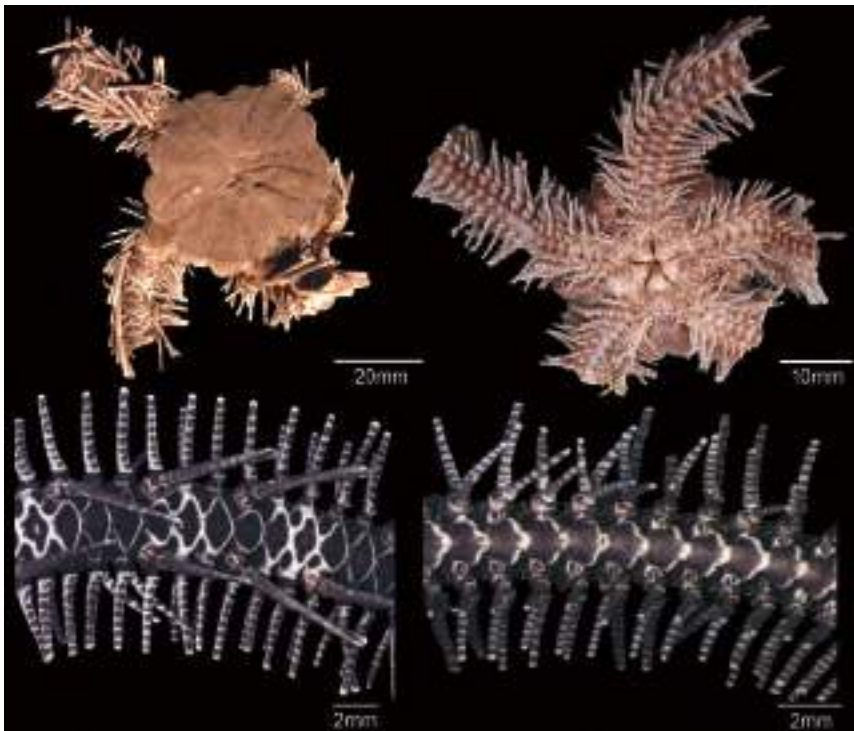
**Diagnosis** – Adapted from Devaney (1977) and Cherbonnier & Guille (1978). D.D. up to 25 mm. Disc round and puffy, dorsally disc covered uniformly by short, rounded granules, disc ventrally with similar granules, but not extending up to oral shields, leaving a broken wide V-shaped interradiar area with scales dark brown, variegated with whitish grey. Oral shields round with dark patch on each surrounded by white on margin, adoral shields small, not contiguous. Genital slits large, almost reaching disc margin, genital papillae present, extending to oral shields. Dorsal arm plates fan-shaped, much wider than long, convex distally, most often a thin white line bordering the plates, narrowly contiguous. Ventral arm plates fan-shaped with convex distal edges, brown with small grey patch surrounded by white margin. Arm spines 3-4 on each side of same or mostly adjacent segments, often alternating. Uppermost spine markedly longer, cigar-shaped, clavate distally and more or less bifurcate at tip, broadly banded, with bands becoming more obvious distally, up to five times segment length. Remaining spines cigar-shaped with blunt tips, greyish bands not always around full circumference of spine, 2-3 times segment length, shortest being one-and-a-half times segment length. Tentacle scales two, becoming one after c. one-third of arm length, oval, similar in size. Colour in life uniformly dark purple, brown, black with white edges, dorsal arm plates off-white with large, irregular purple patches, giving arms banded appearance. Upper arm spines pale or purple mottled, clavate, remaining arm spines purple and white annulations, tentacle scales banded, oral shields with large dark purple blotches.

**Distribution and habitat** – Madagascar, Zanzibar, Kenya, Comoros, Aldabra (Cherbonnier & Guille 1978), South Africa: Aliwal Shoal (KZN) to Sodwana Bay (KZN); depth range: 0-18 m. Habitat: under *Porites* coral colonies and in lagoonal seagrass beds.

**Remarks** – According to Devaney (1977) the type locality is Zanzibar and the holotype is in the Natural History Museum in London (NHMUK 1965.6.1.451). Olbers *et al.* (2015) reported this species as a new record for South Africa and provided additional remarks.



**Fig. 172.** Distribution of *Ophiomastix koehleri* in South Africa.



**Fig. 173.** Dorsal disc (top left), ventral disc (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Ophiomastix koehleri* (SAMC A28130).

## ***Ophiomastix venosa* Peters, 1851**

*Ophiomastix venosa* Peters, 1851: 464-465; Lütken 1869: 44; Lyman 1882: 175; Koehler 1904a: 73-74, figs 28, 29; Clark 1915a: 296; Clark 1921: 134, 138; Clark 1923: 349; Balinsky 1957: 27-28; Kalk 1958: 237; Macnae & Kalk 1969: 130; Clark & Rowe 1971: 88, 120; Clark & Courtman-Stock 1976: 105, 122, 176-177, fig. 191; Devaney 1978: 279, 350-353, figs 41, 42; Cherbonnier & Guille 1978: 190-192, fig. 63, pl. 14, figs 1, 2; Sloan *et al.* 1979: 109-111; Tortonese 1980: 117, 128, fig. 12; Humpreys 1981: 10, 25; Olbers *et al.* 2015: 96, 98, pl. 4C, D.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976), Devaney (1978) and Cherbonnier & Guille (1978). D.D. up to 36 mm. Disc round and puffy, dorsal disc scales fine, light brown, pair of radiating dark brown lines outlined in white starting from base of each arm and meandering in random pattern. Ventral disc scales lighter brown and coarser in proximal interradial areas, some ovate imbricated scales delimiting periphery of disc. Granules sparsely scattered on both dorsal and ventral sides of disc, with scattered cylindrical spines towards margin of dorsal disc. Radial shields visible, but not distinct. Genital slits large, reaching disc margin, genital papillae absent. Oral shields slightly wider than long, adoral shields triangular, not contiguous. Arm spines 2-4, alternating in number, cigar-shaped, but tapering with darker longitudinal line, on every 2-3 segments, upper arm spine enlarged with clavate, cloven or digitate tip, *c.* 3.5 - 4 times segment length, longitudinal line absent on largest spines, other arm spines *c.* twice segment length. Dorsal arm plates broad fan-shaped, wider than long, broadly contiguous, becoming slightly longer than wide, narrowly contiguous. Ventral arm plates pentagonal but truncated, distal side straight or convex, lateral sides may be concave. Tentacle scales two basally, distally one, ovate. Colour in life, disc light brown with radiating lines on disc, radial shields with black petaloid pattern, arm spines with longitudinal dark stripe, dorsal arm plates brownish with a darker faded line down length of arm, ventrally uniformly light brown.

**Distribution and habitat** – Mozambique, Tanzania, Kenya, Somalia, Mascarene Basin, Madagascar, Rodriguez, Comoros, Aldabra, Seychelles, Bay of Bengal, Philippines (Clark & Rowe 1971; Cherbonnier & Guille 1978; Devaney 1978; Tortonese 1980), South Africa: Coffee Bay (EC) to Sodwana Bay (KZN); depth range: 0-21 m. Habitat: shallow lagoons, often on sand and rubble, algal carpet, under boulders, coral heads, and *Porites* in lagoonal seagrass beds, may be in same habitat with *Ophiocoma scolopendrina*.

**Remarks** – Type locality is Mozambique, syntypes are in the Museum of Natural History of Berlin (ZMB Ech 965, ZMB Ech 977, ZMB Ech 978 and ZMB Ech 979), depth unknown.



**Fig. 174.** Distribution of *Ophiomastix venosa* in South Africa.



**Fig. 175.** Dorsal whole (top left), ventral whole (top right), dorsal arm plates (bottom left) and ventral arm plates (bottom right), dorsal disc (inset) of *Ophiomastix venosa* (RMCA MT2353).

#### 4.5. Order OPHIOLEUCIDA O'Hara *et al.*, 2017

##### 4.5.1. Family OPHIERNIDAE O'Hara *et al.*, 2018

#### Genus *Ophiernus* Lyman, 1878

**Diagnosis** – Adapted from Lyman (1878) and Madsen (1977). Disc bearing granules on thick skin. Radial shields usually naked and conspicuous. Arms long and more-or-less flattened. Dorsal arm plates well-developed, contiguous, in some species 3-6 proximal-most plates form triangular-shaped areas covered in skin. Ventral arm plates whole, contiguous. Arm spines small, smooth. In the South African species, only *O. vallincola* has the bristle-like supplementary arm spines, distally directed, appressed and placed in a furrow along the thickened edge of the lateral edge on the lateral arm plate characteristic of the genus. Adoral shields broadly separate oral shields from lateral arm plates and usually contiguous with lateral arm plates. Tentacle pores large, first pair within disc with three scales. Tentacle scales two, in series with three from first tentacle pores, may or may not completely cover tentacle pores. Genital slits long.

#### *Ophiernus quadrispinus* Koehler, 1908

*Ophiernus quadrispinus* Koehler, 1908a: 533, 601-602; pl. 10, figs 102, 103; Koehler 1908b: 142, 146; Madsen 1977: 120-121, fig. 7; Billett *et al.* 2013: 20-25; Olbers *et al.* 2015: 89, 91, pl. 2A, B.

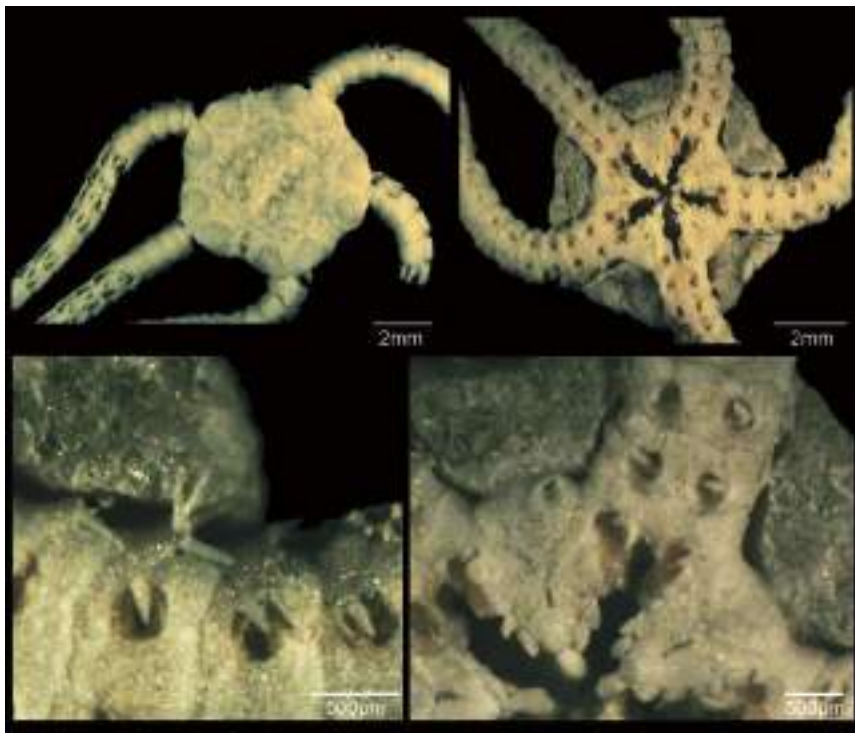
**Diagnosis** – Adapted from Madsen (1977). D.D. up to 7 mm. Disc pentagonal, covered in plates both dorsally and ventrally, plates abutting radial shields and genital slits slightly larger. Sparse granules on disc margin extending onto margins of radial shields. Radial shields large, oval, longer than wide, separated by disc scales. Oral shields spearhead-shaped, naked. Adoral shields not distinct, extending up to first ventral arm plate, may or may not be contiguous proximally. Jaws long. Oral papillae 5-6, including two smaller papillae in series with scales around second oral pore. Teeth 3-4, tapering to blunt point. Genital slits as long as interradiar area, genital papillae absent. Ventral arm plates bell-shaped, first plate sunken, contiguous proximally, becoming reduced and separated distally. Dorsal arm plates wider than long, distal edge straight proximally, becoming convex distally. Lateral arm plates increasing in size distally, with hosting arm spines. Arm spines four, delicate, cylindrical, pointed, shorter than segment length, decreasing distally. Arm spines placed on mid-plate proximally, moving dorsally distally, upper bristle-like arm spines absent. Arms moderately long (all specimens broken), dorsal arm with slight keel. Tentacle scales two, sometimes one, varying in shape from pointed to round, unequal in size.

**Distribution and habitat** – Southern Ocean, Southern Atlantic, near the South Orkneys (Madsen 1977; Billett *et al.* 2013), South Africa: off Saldanha Bay (WC) to off Cape Town (WC); depth range: 1700-3250 m (Madsen 1977). Habitat: no details recorded.

**Remarks** – Similar to *O. vallincola* Lyman, 1878 except in disc granules, dorsal arm plates and the absence of bristles. The granules are less dense adjacent to radial shields and the dorsal arm plates much wider than long in *quadrispinus*. The most obvious difference is the absence of bristles on the lateral arm plates on *vallincola*. Type material is in the National Museums of Scotland (Z.1921.143.1242) from Scotia Station 313; 62°10' S, 041°20' W, 3195 m (Koehler 1908a).



**Fig. 176.** Distribution of *Ophiernus quadrispinus* in South Africa.



**Fig. 177.** Dorsal whole (top left), ventral disc (top right), basal tentacle scales (bottom left), jaws (bottom right) views of *Ophiernus quadrispinus* (SAMC A22018).



## ***Ophiernus vallincola* Lyman, 1878**

*Ophiernus vallincola* Lyman, 1878: 122, pl. 6, figs 170-172; Lyman 1882: 32. pl. 24, figs 16-18, pl. 38, figs 6-9; Koehler 1896a: 244; Clark 1923: 365; Hertz 1927a: 114; Madsen 1977: 112-114, fig. 2; Clark & Courtman-Stock 1976: 185, 106, 124, fig. 201; Baker 1979: 33; Paterson 1985: 98-99, fig. 40a, b; Rowe & Gates 1995: 403; Mah *et al.* 2009: 397; Martynov 2010: 130, figs 5g, r, 11h.

*Ophiernus abyssalis* Koehler, 1896a: 242-244; Koehler 1909b: 138, 143-145, pl. 28, figs 3-4.

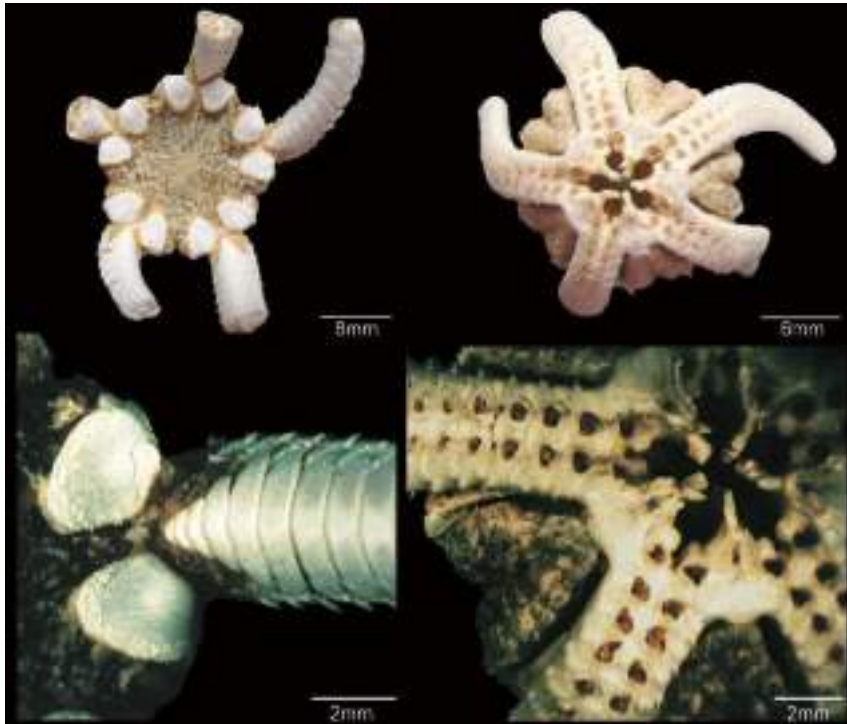
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 20 mm. Disc round, skin naked, plates on periphery of disc around radial shields developed with granules extending onto margins of radial shields. Radial shields distinct, separated, oval or round with proximal edge tapering slightly. Ventral interradii areas have few scattered minute granules (not all specimens). Oral shields spearhead-shaped, naked. Adoral shields not distinct, extending up to first ventral arm plate, may or may not be contiguous proximally. Jaws moderately long. Oral papillae 5-6, including two smaller papillae in series with scales around second oral pore. Teeth 3-4, lowest sometimes tapering to blunt point. Ventral arm plates bell-shaped, first plate sunken, contiguous proximally becoming reduced and separated. Dorsal arm plates wider than long, distal edge straight proximally becoming convex. Lateral arm plates increasing in size distally, hosting arm spines. Arm spines three, cylindrical, pointed, longest spine as long as ventral arm plate, but generally shorter than a segment. Arm spines placed on mid-plate proximally, moving dorsally distally. Bristles present on dorsal side above arm spines. Arms moderately long, dorsal arm with slight keel. Genital slits almost as long as interradii area, with distinct genital plate distally, no genital papillae. Tentacle scales two, seldom three, rounded, equal in size, some distal scales pointed.

**Distribution and habitat** – Mozambique, Atlantic Ocean, Pacific Ocean, south west Ireland, Bay of Biscay and Azores (Mortensen 1933d, Paterson 1985), South Africa: off Saldanha Bay (WC) to off Cape Town (WC); depth range: 460-4065 m. Habitat: green mud.



**Fig. 178.** Distribution of *Ophiernus vallincola* in South Africa.

**Remarks** – The granules on the disc and radial shields were not distinct on the specimens examined, however, Clark & Courtman (1976) did state that the granules are easily rubbed off. The type locality is west of Azores at 1830 m depth. Syntypes are known to be housed in the Museum of Comparative Zoology, MCZ OPH-397 (2 specimens) and MCZ OPH-844 (2 specimens) (Rowe & Gates 1995).



**Fig. 179.** Dorsal whole (top left), ventral disc (top right), radial shields (bottom left), ventral interradial area and jaws (bottom right) views of *Ophiernus vallincola* (SAMC A7539).

#### 4.5.2. Family OPHIOLEUCIDAE Matsumoto, 1915

##### Genus *Ophiopallas* Koehler, 1904

**Diagnosis** – Adapted from Koehler (1904) and Madsen (1983). Dorsal disc covered in granules. Dorsal arm plates well-developed, widely in contact. Ventral arm plates contiguous. Arm spines 2-8, minute, comb-like accessory arm spines. Tentacle pores with 1-2 flat tentacle scales. Genital slit extending up onto dorsal side with papillae.

## ***Ophiopallas paradoxa* Koehler, 1904**

*Ophiopallas paradoxa* Koehler, 1904a: 12-13, pl. 3, figs 1-3; Clark 1915a: 348; Koehler 1922b: 436-437, pl. 79, figs 1, 2; Koehler 1930: 280; Clark 1974: 477-478, fig. 15; Clark & Courtman-Stock 1976: 106, 124, 186, figs 199, 203; Baker 1979: 32, 34, fig. 4c; Madsen 1983: 54-57, figs 1e, f, 10a, b, 11; Liao & Clark 1995: 288, fig 161; Rowe & Gates 1995: 404; O'Hara 2008b: 30; Mah *et al.* 2009: 397; Martynov 2010: 38, fig. 26i, j; Stöhr 2011a: 28, fig. 11d.  
*Ophiopallas paradoxa altera* Hertz, 1927a: 110, pl. 9, fig. 5.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 6 mm. Disc round, covered in granules dorsally and ventrally, extending onto radial shields. Radial shields moderate in size, triangular with round corners, radial shield margins contiguous, but concealed by disc scaling. Oral shields very large, naked, longer than wide, indented laterally just over midway, with broad distal lobe. Adoral shields not distinct, not contiguous, narrow. Few scattered granules on jaws. Oral papillae 4-6, distalmost large and opercular in series with second oral tentacle scale, apical papillae sometimes paired. Teeth two, equal in size and shape as apical papillae. Genital slits long, elongated and reach up onto dorsal disc, genital papillae present, slightly elongated, continuous with the granules on the disc. Arms flattened ventrally and have keel dorsally, tapering. Dorsal arm plates wider than long, becoming longer than wide distally, distal edge straight or slightly rounded, contiguous, granules extend onto first dorsal arm plate. Ventral arm plates rectangular but restricted on sides by tentacle pores, distal edge convex. Arm spines up to eight, slender, uppermost up to one-and-a-half times segment length, lowermost shortest, *c.* half as long as segment. Tiny accessory arm spines from segments 15 present, comb-like, glassy, curved, bifurcate and can only be seen at high magnification. Tentacle scales large, oval, one except on first segment, where there are two.

**Distribution and habitat** – New Zealand, Australia, East Indies, Indonesia, Philippines, Mozambique (Koehler 1904a; Clark 1915a; Hertz 1927a; Koehler 1930; Clark 1974; Clark & Courtman-Stock 1976; Baker 1979; Madsen 1983; Liao

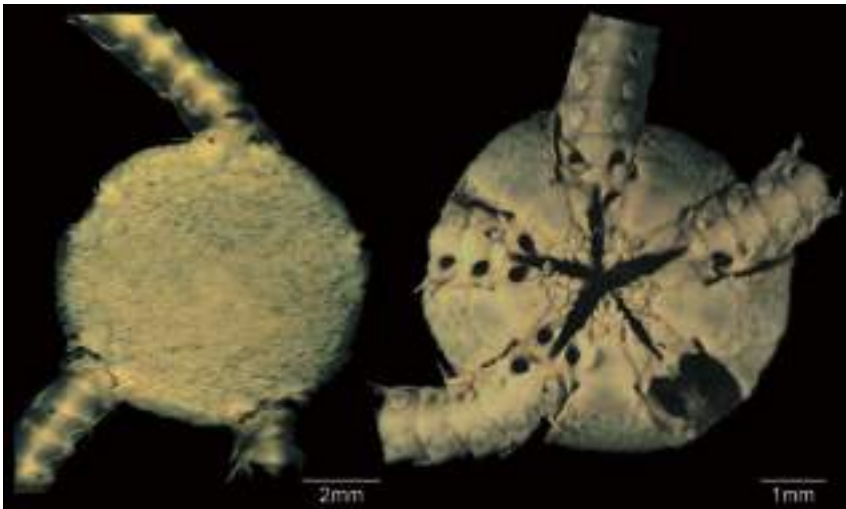


**Fig. 180.** Distribution of *Ophiopallas paradoxa* in South Africa.

& Clark 1995; Rowe & Gates 1995; Mah *et al.* 2009), South Africa: Sodwana Bay (KZN); depth range: 200-500 m. Habitat: coarse shelly sand.

**Remarks** – Single South African specimen found at Sodwana Bay. The specimen examined was in poor condition with the highest arm spine count being five.

The type locality is Macassar (between Celebes and Borneo), Gilolo Passage (New Guinea) and Banda Sea (Indonesia) (Rowe & Gates 1995) with the lectotype being designated by Madsen (1983) as Siboga Station 159, Banda Sea, depth 411 m. Type material is in the Zoological Museum Amsterdam (now Naturalis) (ZMA.ECH.O.2435; ZMA.ECH.O.2436; ZMA.ECH.O.2437; ZMA.ECH.O.2438; ZMA.ECH.O.2439 and ZMA.ECH.O.2440; Joke Bleeker, pers. comm.).



**Fig. 181.** Dorsal (left) and ventral (right) views of *Ophiopallas paradoxa* (SAMC A22801).

#### 4.6. Order AMPHILEPIDIDA O'Hara *et al.*, 2018

##### 4.6.1. Family OPHIOLEPIDIDAE Ljungman, 1867

##### Genus *Ophiolepis* Müller & Troschel, 1840

**Diagnosis** – Adapted from Müller & Troschel (1840) and Lyman (1882). Disc covered in thick plates surrounded by smaller plates, disc notched at each arm base. Teeth present, no dental papillae. Oral papillae numerous. Adoral shields wide, may or may not be contiguous. Genital slits two per interradius, thin, genital plates distinct. Supplementary dorsal arm plates present. Arm spines short, small.

***Ophiolepis cincta cincta* Müller & Troschel, 1842**

*Ophiolepis cincta* Müller & Troschel, 1842: 90; Lyman 1865: 60; Lyman 1882: 19, pl. 37, figs 7-9; Studer 1882: 7; Koehler 1905a: 16-17; Clark 1915a: 342; Clark 1921: 143; Mortensen 1933a: 382-383; Balinsky 1957: 28; Kalk 1958: 207, 216, 238; Macnae & Kalk 1969: 106, 130; Clark & Rowe 1971: 90-91, 129, fig. 46c; Clark & Courtman-Stock 1976: 107, 125, 189-190, fig. 196; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 232-234, fig. 74a-g; Guille & Vadon 1985: 64; Marsh 1986: 72; Vine 1986: 195; Rowe & Gates 1995: 434; Liao & Clark 1995: 292-293, fig. 163, pl. 19, figs 4, 5; Mbongwa 2013: 16.

*Ophiolepis garretti* Lyman 1862: 77-78; Lyman 1865: 61, pl. 2, fig. 4.

*Ophioelegans cincta* James 1981: 15-17, pl. 1A.

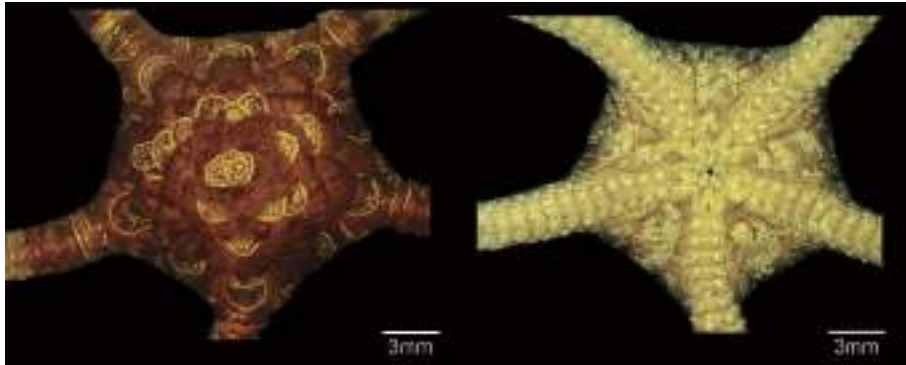
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 18 mm. Disc pentagonal, covered dorsally and ventrally with smooth, imbricating plates, plates surrounded by smaller plates both dorsally and ventrally. Radial shields smooth, elongated, no larger than largest disc plates. Oral shields spearhead-shaped with distal lobe and rounded distal end, as long as wide. Adoral shields broad, contiguous. Oral papillae 3-4, broad, in series with oral tentacle scale. Teeth present, broad, rounded. Genital slits long, narrow, reaching edge of disc margin, genital plates distinct. Dorsal arm plates wider than long, supplementary smaller plates bordering lateral and distal edges of each dorsal arm plate. Ventral arm plates almost square basally, becoming strongly fan-shaped distally and narrowly contiguous. Arm spines 3-4 (usually three), short, conical, about half segment length. Tentacle scales two, oval, large. Colour in life, disc pink to brown, irregularly marbled with grey, white or silver patches, arms banded.

**Distribution and habitat** – Western Indian Ocean, Red Sea, Seychelles, China, south Japan, Philippines, Australia, Fiji (Clark & Rowe 1971; Rowe & Gates 1995), South Africa: Aliwal Shoal (KZN) to Bhanga Nek (KZN); depth range: 0-20 m. Habitat: under boulders over sand and under coral debris.



**Fig. 182.** Distribution of *Ophiolepis cincta cincta* in South Africa.

**Remarks** – Easily recognisable by its pink, white and silver colouration. Type material is in the Museum of Natural History of Berlin (syntype: ZMB Ech 863), type locality is the Red Sea, depth unknown.



**Fig. 183.** Dorsal (left) and ventral (right) views of *Ophiolepis cincta cincta* (RMCA MT2316).

#### 4.6.2. Family HEMIEURYALIDAE von Martens, 1867

##### Genus *Ophioplocus* Lyman, 1862

**Diagnosis** – Adapted from Lyman (1862) and Lyman (1882). Disc covered with close plates dorsally and ventrally. Teeth present. No dental papillae. Oral papillae present, closely set. Adoral shields wide, may or may not be contiguous. Genital slits two per interradius, short, extending only half-way to disc margin, genital plates indistinct. Dorsal arm plates fragmented. Arm spines three, stout.

##### *Ophioplocus imbricatus* (Müller & Troschel, 1842)

*Ophiolepis imbricata* Müller & Troschel, 1842: 93-94.

*Ophioplocus tessellatus* Lyman, 1862: 76-77; Lyman 1882: 20.

*Ophioplocus imbricatus*: Lyman 1865: 69-70; Lyman 1882: 20, pl. 35, figs 10-12; Studer 1882: 7; de Loriol 1893a: 12-13; Bell 1898: 849; Bell 1909: 11; Clark 1915a: 344; Clark 1921: 143, pl. 12, fig. 8, pl. 35, figs 1-3; Koehler 1922a: 48, pl. 84, fig. 12; Koehler 1922b: 435-436; Clark 1938: 365-366; Clark 1946: 275-276; Clark & Rowe 1971: 90-91, 128; Cherbonnier & Guille 1978: 239-242, fig. 77a-f; Humpreys 1981: 11; Guille & Vadon 1985: 64; Rowe 1989: 287; Liao & Clark 1995: 298-299, fig. 169; Putchakarn & Sonchaeng 2004: 423; Stöhr *et al.* 2008: 547, 553; Olbers *et al.* 2015: 111-112, pl. 9C, D.

*Ophioplocus imbricata*: Rowe & Gates 1995: 435.

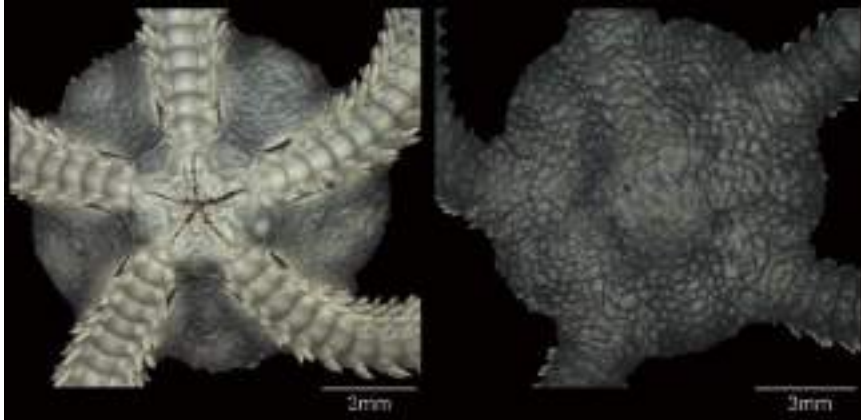
**Diagnosis** – Adapted from Clark & Rowe (1971) and Cherbonnier & Guille (1978). D.D. up to 26 mm. Disc round, disc plates slightly imbricated and distinct, with central plate present, plates naked. Radial shields small, elongated-oval, widely separated, naked. Genital slits small, short, quarter length of interradial area, genital papillae present. Oral shields triangular, moderately large, much wider than long, rounded angles, widest distally. Adoral shields relatively wide, may be contiguous or slightly separated. Jaws slightly sunken, 4-5 oral papillae, distalmost being broadest, remaining papillae elliptical leaf-shaped, apical papillae bluntly pointed. Teeth four, rounded. Oral tentacle scale inside oral slit. Dorsal arm plates fragmented along entire length of arm, with lateral arm plates becoming more prominent distally. Ventral arm plates slightly wider than long, rectangular and contiguous, becoming triangular and non-contiguous distally, distal edge rounded throughout. Arm spines three, stout, thick, conical, mostly appressed to arms, no longer than one segment length, becoming shorter distally, occasionally lowermost longest. Tentacle scales two, ovate or similar to spines in shape, rarely three. Colour in life dark green or grey with irregular patterns and patches on dorsal disc conforming to interradial areas, arms banded, ventrally brown but pale.

**Distribution and habitat** – Mozambique, Madagascar, Mascarene Basin, Reunion, Mauritius, Tanzania, Kenya, Aldabra, Somalia, Red Sea, Seychelles, Andaman Sea, Australia and New Zealand (Rowe & Gates 1995; Putschakorn & Sonchaeng 2004; Stöhr *et al.* 2008; Stöhr *et al.* 2018), South Africa: Sodwana Bay (KZN); depth range: 0-197 m. Habitat: grey sand and mud, angiosperm beds, bases of coral or patch reefs.

**Remarks** – Olbers *et al.* (2015) recorded this species as a new record for South Africa. Syntypes (RMNH.ECH.857) deposited in Naturalis with the type locality as Indian Ocean (Joke Bleeker, pers. comm.), depth unknown.



**Fig. 184.** Distribution of *Ophioplocus imbricatus* in South Africa.



**Fig. 185.** Dorsal (left) and ventral (right) views of *Ophioplocus imbricatus* (RMCA MT2306).

#### 4.6.3. Family AMPHILIMNIDAE O'Hara *et al.*, 2018

Genus *Amphilimna* Verrill, 1899

**Diagnosis** – Adapted from Verrill (1899b), Devaney (1974) and Thomas (1975). Disc with notch at base of each arm, disc plates may have spines or granules. Radial shields variable in size and shape, largely in contact. Oral papillae 2-6. Ventral arm plates abruptly widen distally. Arm spines 6-10, ones under disc flattened and fused to form a flange. Tentacle pores very large and open. Tentacle scales spiniform, round or flat, two (rarely one).

*Amphilimna cribriformis* Clark, 1974

*Amphilimna cribriformis* Clark, 1974: 442-444, fig. 1a-d; Thomas 1975: 131, 132, 137; Clark & Courtman-Stock 1976: 122, 165, 166, figs 182, 183; Liao 1989: 342; Olbers *et al.* 2015: 92, pl. 2C, D.

**Diagnosis** – Adapted from Clark (1974) and Clark & Courtman-Stock (1976). D.D. up to 6.5 mm. Disc round, indented radially, uniformly white both dorsally and ventrally due to preservation. Dorsal and ventral disc covered in medium-sized fine disc plates with scattered, tapering, sharp spinelets, no change in spinelet, scale density or size on disc margin. Radial shields long, narrow, spines may be absent. Oral shields triangular with rounded angles, as long as wide, widest distally. Adoral shields restricted to lateral edge of oral shield, triangular with inner margin curved, not contiguous. Jaws slightly elongated, 2-4 asymmetrical apical oral papillae, three spinose distal papillae, two distalmost being on edge of adoral shield. Teeth single, broad with small elongated oral tentacle scale either side. Genital plates



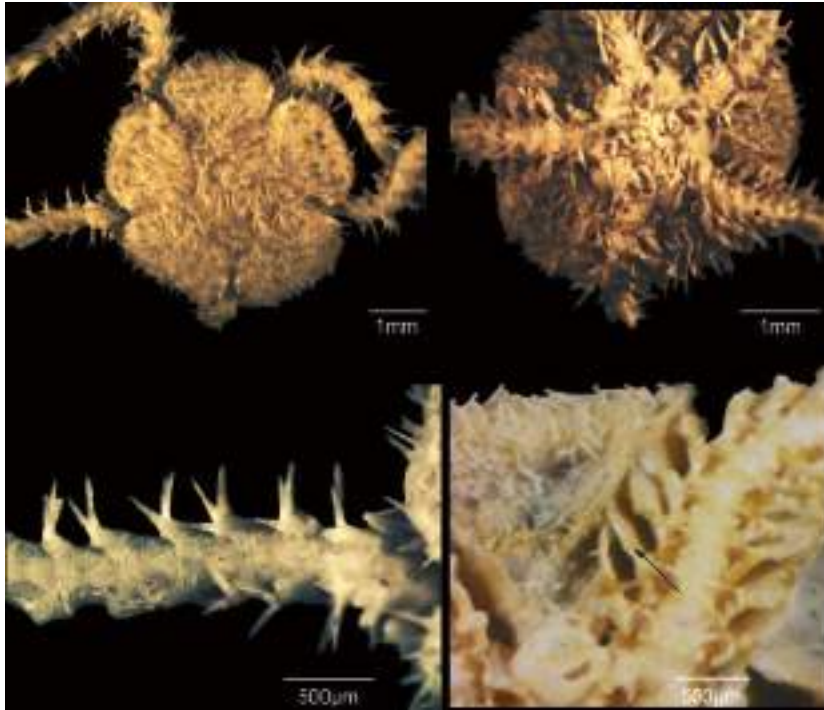
large, lie at angle in which they appear to be overlapping, each plate with two stout spines at dorsal end. Arms long and thin, first 2-4 dorsal arm plates short, compressed or rudimentary, narrow. First free arm plate fan-shaped with convex distal edge, as long as wide, narrowly contiguous, plates translucent, porous and brittle with underlying structure visible. First ventral arm plate appearing triangular, adjacent to adoral shields, second arm plate with straight distal edge, broader between tentacle pores. Ventral arm plates thereafter with slight convex edge, becoming concave distally, narrowing adjacent to tentacle pores, longer than wide. Arm spines six, with first 7-9 arm plates with flattened, webbed arm spines, forming a wing-like flange which excludes lowermost spine. Beyond disc, arm spines free, flattened, becoming round and tapering distally. Tentacle scales two on segments 1- c.10, outer scale small, inner scale spinose, resembling an arm spine, becoming reduced and eventually completely lost, single tentacle scales after segment ten.

**Distribution and habitat** – Mozambique (Clark 1974; Clark & Courtman-Stock 1976), South Africa: Umhlali (KZN) to North of Prince's Grant (KZN); depth range: 86-200 m. Habitat: sandy mud.

**Remarks** – Olbers *et al.* (2015) stated that the holotype in the Iziko South African Museum (SAMC A22784) had disintegrated and they suggested a neotype be erected from the paratype SAMC A22787. Additional paratypes (examined) located in Iziko South African Museum include SAMC A22790, SAMC A22786, SAMC A22785, SAMC A22788, SAMC A22787, SAMC A22789 and SAMC A22791. Type locality off Ballito, depth 118 m.



**Fig. 186.** Distribution of *Amphilimna cribriformis* in South Africa.



**Fig. 187.** Dorsal disc (top left), ventral disc (top right), dorsal arm plates (bottom left), webbed arm spines as indicated by the arrow (bottom right) views of *Amphilimna cribriformis* (SAMC A22787).

***Amphilimna valida*** (H.L. Clark, 1939)

*Anamphiura valida* Clark H.L., 1939: 70-72, figs 26A, 27; Clark 1974: 478-479, fig. 16; Clark & Courtman-Stock 1976: 104, 166-167.

*Amphilimna valida*: Thomas 1975: 134-135, 137.

**Diagnosis** – Adapted from Thomas (1975) and Clark & Courtman-Stock (1976). D.D. up to 5 mm, D.D./A.L.= 1/2. Disc pentagonal, primary rosette distinct, disc plates large and convex with some smaller overlapping plates away from primary rosette. Disc with scattered spines, mostly on disc margin and ventral interradiar areas. Radial shields short, moderately wide, one-third of disc radius, contiguous on proximal side and gaping distally. Genital plates with spines distal to radial shields which give appearance of arm combs. Genital slits long, genital plates large, no genital papillae. Ventral interradiar area covered in overlapping plates. Oral shields diamond-shaped, broad with rounded angles. Adoral shields contiguous. Oral papillae 2-3, infradental papillae on apex of the jaw, flanked by first oral tentacle scale with a diastema before 2-3 oral papillae attached to adoral

shield. Arms short. First dorsal arm plate small, broadly in contact, remaining plates fan-shaped, narrowly in contact. Ventral arm plates constricted by large tentacle pores, distal angle obtuse, contiguous. Arm spines 5-6, short, conical, lowest about one segment length, uppermost shortest, half segment length, spines on first one or two arm segments are flattened and form a flange. Tentacle scales one, large rounded, sometimes two on first segment.

**Distribution and habitat** – Zanzibar, Tanzania (Clark H.L. 1939), South Africa: off Durban (KZN) to off Umhlanga River mouth (KZN); depth range: 238-350 m. Habitat: sandy mud.

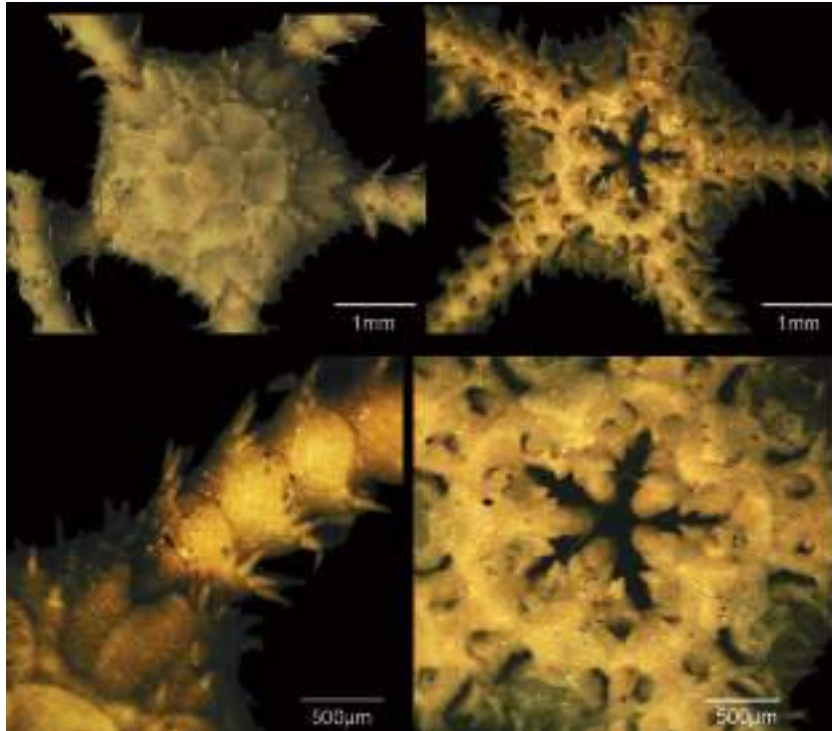
**Remarks** – Thomas (1975) argued that *Anamphiura valida* belongs to the genus *Amphilimna* Verrill, 1899. Clark & Courtman-Stock (1976) did not agree that *Amphilimna valida* (Clark H.L., 1939) was a valid combination and retained the South African specimen as *Anamphiura valida*. In this study, *Anamphiura valida* was treated as a synonym to *Amphilimna valida* in accordance with Stöhr (2007). Historically *Amphilimna* has been considered an ophiacanthid or an amphiurid, however, O'Hara *et al.* (2017) found that it formed its own family sister to the Ophionereididae.

Clark (1974) recorded the locality of the South African specimen as near the Tugela River mouth, but the co-ordinates are in fact closer to the Umhlanga River mouth. In addition, Clark (1974) placed this species as *Anamphiura valida* into the family Amphiuridae and classified it as *incertae sedis*.

The holotype is in the Natural History Museum in London (NHMUK 1948.5.26.87) and the type locality is off Zanzibar, 238-293 m. In addition, the Smithsonian Institution, holds five specimens from Durban (USNM E42872), collected by the *Anton Bruun*, depth 350 m.



**Fig. 188.** Distribution of *Amphilimna valida* in South Africa.



**Fig. 189.** Dorsal disc (top left), ventral disc (top right), radial shields and basal arms (bottom left), jaws (bottom right) views of *Amphilimna valida* (SAMC A23231).

#### 4.6.4. Family OPHIONEREIDIDAE Ljungman, 1867

Genus *Ophionereis* Lütken, 1859

**Diagnosis** – Adapted from Clark (1953) and Clark & Courtman-Stock (1976). Characteristics as for family and distinguished by presence of a pair of supplementary dorsal arm plates.

*Ophionereis australis* (Clark, 1923)

*Ophiochiton australis* Clark, 1923: 345-347, fig. 3, pl. 20, figs 1, 2.

*Ophionereis australis*: Mortensen 1933a: 374-375, fig. 77; Clark & Courtman-Stock 1976: 106, 124, 179, fig. 195; Clark 1953: 66, 67; Balinsky 1957: 24; Kalk 1958: 207; Rowe & Gates 1995: 407; Macnae & Kalk, 1969: 130.

**Diagnosis** – Adapted from Clark (1923). D.D. up to 11 mm. Disc pentagonal, fully scaled, plates coarse, distinct with radiating pattern dorsally. Radial shields small, widely separated, oval to pear-shaped, distinct. Oral shields oval to spearhead-shaped, longer than wide, adoral shields distinct, not contiguous. Oral papillae four, distalmost broad, remaining three elliptical leaf-shaped. Teeth broad. Dental papillae absent. Genital slits entire interradiar length, genital papillae bordering proximal ends of slits. Dorsal arm plates broad fan-shaped, wider than long, convex, being in contact for at least half of width of proximal margin, bordered by distinct triangular supplementary dorsal arm plates, c. no less than half-length of dorsal arm plate. Ventral arm plates fan-shaped, widest distally, distal side convex, longer than wide. Arm spines three, thick, short, blunt, erect, equal in size, just shorter than segment length. Tentacle scale single, oval and large. Colour in life light brown, slightly lighter on ventral side, radial shields whitish with darker brown margin, making them distinct.

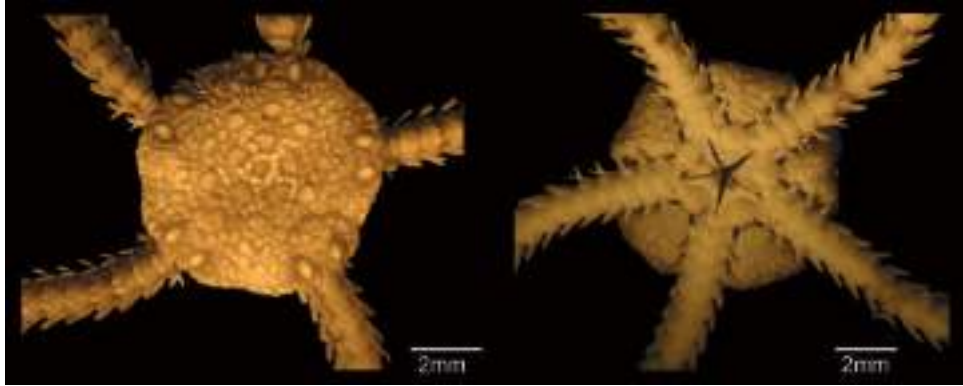
**Distribution and habitat** – Mozambique and Australia (Clark & Courtman-Stock 1976; Rowe & Gates 1995), South Africa: Amanzimtoti (KZN) to Sodwana Bay (KZN); depth range: 0-205 m. Habitat: shell, rock, sand, gravelly bottom with worm tubes.

**Remarks** – In the original description, Clark noted “a complete absence of supplementary upper arm plates”, but his drawing clearly shows these supplementary plates, especially in the first couple of free segments. Mortensen (1933a) was the first to note Clark’s error, and transferred this species from *Ophiochiton* to *Ophionereis*. We have observed supplementary dorsal arm plates for up to half the length of the arm, in the examined material.

The type material is in the Iziko South African Museum (holotype: SAMC A6439) and the Museum of Comparative Zoology (paratype: MCZ OPH-4357), with the type locality being off the Tugela River mouth, depth 86 m.



**Fig. 190.** Distribution of *Ophionereis australis* in South Africa.



**Fig. 191.** Dorsal (left) and ventral (right) views of *Ophionereis australis* (SAMC A088277).

### ***Ophionereis dubia dubia*** (Müller & Troschel, 1842)

*Ophiolepis dubia* Müller & Troschel, 1842: 94; Day *et al.* 1970: 81.

*Ophionereis dubia*: Lyman 1865: 146; Ljungman 1867: 310; Duncan 1879: 448, 480; Lyman 1882: 161, 286, 299, 311, 325; Bell 1909: 19; Clark 1915a: 289; Clark 1923: 343-344; Burfield 1924: 152; Mortensen 1933a: 374; Stephenson *et al.* 1937: 380; Clark 1946: 239-240; Clark 1953: 83-88, figs 9, 10; Day *et al.* 1970: 81; Clark & Rowe 1971: 122; Clark & Courtman-Stock 1976: 106, 124, 179-180, fig. 193; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 203-205, figs 67a-f; Irimura 1979: 5; Humpreys 1981: 10, 25; Irimura 1981: 46; Price 1981: 7, 10; Irimura 1982: 71-72, fig. 43, pl. 2, fig. 6, pl. 13, fig. 1; Guille & Vadon 1985: 63; Vine 1986: 195; Rowe & Gates 1995: 408; Price & Rowe 1996: 77; Marsh & Morrison 2004: 296; Putchakarn & Sonchaeng 2004: 423; Milne 2012: 155.

*Ophionereis dubia sinensis* Duncan, 1879: 464.

*Ophiocrasis dictydisca* Clark, 1911: 175-177, fig. 179.

*Ophiocrasis marktanneri* Matsumoto, 1915: 90-91.

*Ophionereis stigma* Clark, 1938: 325-327; Clark 1946: 237, 239.

*Ophionereis dubia dubia*: Liao & Clark 1995: 274-275, fig. 151.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 9 mm. Disc round, smooth, plates very fine, no armament. Characteristic ‘V’ or ‘Y’ at base of radial shields. Disc scaling moderately fine, continuing off disc onto first dorsal arm plates, ventral scaling complete to jaws. Radial shields small, fairly narrow or oval and well-separated. Oral shields large, spearhead-shaped or oval, longer than wide. Adoral shields wide-triangular, moderate in size, not contiguous. Oral papillae 4-5, distalmost papillae being widest. Teeth lowermost rounded, others square. Genital slits reach disc margin, no genital papillae, genital plates slightly enlarged. Arms long and slender, banded

approximately every 3-5 segments. Dorsal arm plates trapezoid, distal edge rounded, as wide as long. Supplementary dorsal arm plates triangular, length of dorsal arm plate becoming smaller distally. Ventral arm plates rhombic or square, distal edge straight or somewhat convex, distally becoming pentagonal. Arm spines three, thick, stout, somewhat appressed to arms, same length as segment, single light brown band, uppermost spine slightly shorter with middle spine longest, tapering to blunt points. Tentacle scale single, oval. Colour in life pale yellow or greyish yellow green with reddish or dark brown reticulation on dorsal disc, arms banded dorsally only, reddish purple, brown or yellow.

**Distribution and habitat** – Red Sea, Persian Gulf, west India, Pakistan, Maldive area, Ceylon, Bay of Bengal, East Indies, China, south Japan, Philippines and Australia (Burfield 1924; Clark & Rowe 1971; Tortonese 1980; Liao & Clark 1995; Rowe & Gates 1995; Richmond 2002), South Africa: Elands Bay (WC) to Bhanga Nek (KZN); depth range: 0-230 m. Habitat: sand, shell, white mud, coral rubble and rock.



**Fig. 192.** Distribution of *Ophionereis dubia dubia* in South Africa.



**Fig. 193.** Dorsal (left) and ventral (right) views of *Ophionereis dubia dubia* (RMCA MT2360).

**Remarks** – Distribution range was extended both west and east within South Africa. The type material whereabouts is undetermined and the type locality is the Red Sea.

***Ophionereis porrecta* Lyman, 1861**

*Ophionereis porrecta* Lyman, 1861: 260-261; Lyman 1865: 147, figs 14, 15; Ljungman 1867: 310; Lyman 1882: 161, 162, 305, 311, 314, 325; Marktanner-Turneretscher 1887: 302; Koehler 1898b: 75-77; Koehler 1905a: 53-54; Clark 1915a: 289; Clark 1917: 440; Clark 1921: 117, pl. 12, fig. 6, pl. 33, figs 2, 3; Clark 1923: 344-345; Mortensen 1933a: 373-374; Clark 1946: 238; Clark 1953: 80-81; Balinsky 1957: 24; Kalk 1958: 207; Clark 1967: 44; Macnae & Kalk 1969: 130; Clark & Rowe 1971: 122, fig. 40; Devaney 1974: 108, 114, 174-175; Clark & Courtman-Stock 1976: 106, 124, 180; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 207-211, figs 69, 70; Sloan *et al.* 1979: 111; Humpreys 1981: 25-26; Guille & Vadon 1985: 64; Marsh 1986: 71; Vine 1986: 195; Sastry 1991: 383; Liao & Clark 1995: 275-276, fig. 152; Rowe & Gates 1995: 409; Putschakarn & Sonchaeng 2004: 423; Stöhr *et al.* 2008: 547, 553, fig. 5C; Stöhr 2011a: 35-36, figs 14B, 16; Mbongwa 2013: 16.

*Ophionereis crassispina* Ljungman, 1867: 311.

*Ophionereis squamata* Ljungman, 1867: 310-311.

*Ophionereis sophiae* Brock, 1888: 490-491.

*Ophionereis aplacophora* Murakami, 1943b: 215-217, fig. 2.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 15 mm. Disc round, plates imbricating and distinct, dorsal plates naked, interradiial plates smaller than peripheral and radial plates, ventral plates slightly smaller with few rounded granules or tubercles close to the oral area. Radial shields small, elongated oval, not always distinct, well-separated. Oral shields large, spearhead or teardrop-shaped, longer than wide. Adoral shields wide-triangular, moderate in size, not contiguous. Oral papillae 5-6, rounded, distalmost pointed and arises from adoral shield. Teeth 4-5, lowermost rounded, others square. Genital slits reach disc margin, genital papillae present. Arms long and slender, banded approximately every third segment. Dorsal arm plates trapezoidal, distal side flat, wider than long, broader in the proximal end, variety of patterns and colours including blotches and spots and alternating pale and dark patches in the lateral edges. Supplementary dorsal arm plates present along whole arm, one segment length becoming smaller distally. Ventral arm plates square with rounded edges, distal end may be concave or straight, becoming longer than wide distally. Arm spines three, conical, middle spine larger, especially in first half of arm, one-and-a-half times segment length, remaining spines slightly shorter *c.* one segment in length, sometimes banded. Tentacle scale single, elongated oval. Colour in life, disc mottled or spotted in brown, white, grey and yellow with irregular darker markings or blotches, arms banded with similar colouration to disc.

**Distribution and habitat** – East coast of Africa, Red Sea, Maldives, India, East Indies, Bay of Bengal, Ceylon, China, south Japan, Philippines, Australia, Gilbert

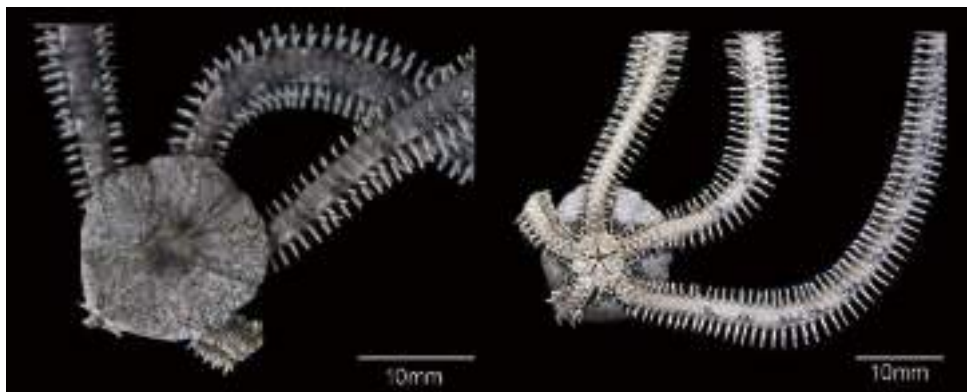


Islands, Saipan, South Pacific islands, Hawaiian Islands (Clark 1953; Kalk 1958; Clark & Rowe 1971; Sastry 1991; Rowe & Gates 1995), South Africa: Cape Town (WC) to Kosi Bay (KZN); depth range: 0-165 m. Habitat: rock, coral sand, shell and stones.

**Remarks** – According to Rowe & Gates (1995) the types are in the Museum of Comparative Zoology (holotype: MCZ OPH-1592 and paratype: MCZ OPH-4105). The type locality is the Sandwich Islands, Pacific Ocean. Hoareau *et al.* (2013) found more than one species within what is now considered to be *O. porrecta*.



**Fig. 194.** Distribution of *Ophionereis porrecta* in South Africa.



**Fig. 195.** Dorsal (left) and ventral (right) views of *Ophionereis porrecta* (EKZNW AS\_2\_JMO\_2008).

### *Ophionereis vivipara* Mortensen, 1933

*Ophionereis vivipara* Mortensen, 1933b: 191-192, fig. 7; Clark 1953: 66, 70; Balinsky 1957: 24; Kalk 1958: 237; Macnae & Kalk 1969: 130; Clark & Rowe 1971: 122; Clark & Courtman-Stock 1976: 106, 124, 180-181; Clark 1980: 545.

**Diagnosis** – Adapted from Mortensen (1933b) and Clark & Courtman-Stock (1976). D.D. up to 3 mm, D.D./A.L. = 1/5. Disc pentagonal, scaling minute with primary plates not distinguishable, scaling extending onto first segment of dorsal arms. Ventrally, the scaling becomes coarser towards oral area. Radial shields small, narrow or not distinguishable, well-separated. Oral shields rounded-triangular. Adoral shields well-developed, wide, contiguous. Oral papillae four, erect, apical papillae slightly larger and distalmost widest. Teeth lowermost rounded. Genital slits reach disc margin, genital papillae absent. Arms long and slender, banded approximately every 4-6 segments. Dorsal arm plates elongated rhomboidal or diamond-shaped, narrowly contiguous, longer than wide. Supplementary dorsal arm plates large, distinct concentric lines on distal side of plates. Ventral arm plates only just contiguous, longer than wide, proximal side pointed, distal side slightly convex, first ventral arm plate elongated and narrow, second plate broadly contiguous with first plate. Arm spines three, slender, only just as long as segment. Tentacle scale single, large, elongated-oval. Colour in life, disc white with large reddish-brown dense spot in middle of disc, sometimes star-shaped with ‘arms’ of star reaching towards each arm, arms banded narrowly with same reddish-brown colour on every 4-6 segments.

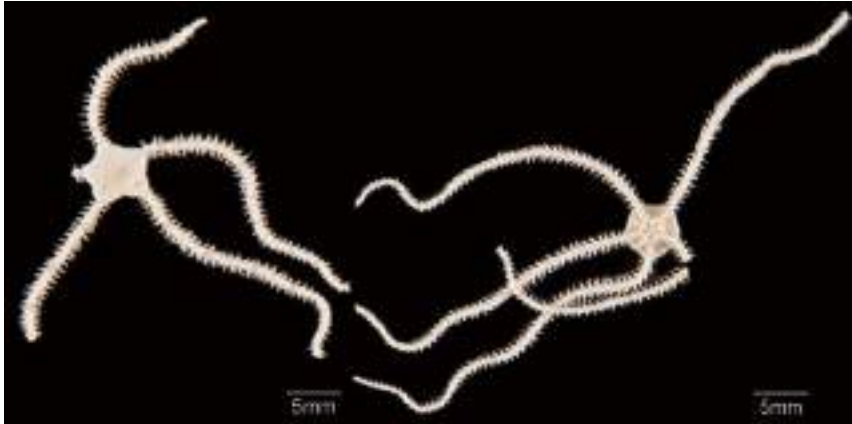
**Distribution and habitat** – East Africa and Madagascar (Kalk 1958; Clark & Rowe 1971), South Africa: East London (EC); depth range: 0-84 m. Habitat: among green algae, occurring with *Amphipholis squamata* on shallow sandy bottom in intertidal zone.

**Remarks** – No specimens were available for examination. The material referred to by Clark & Courtman-Stock (1976) was not located during this study. Type material is recorded in the Museum of Comparative Zoology (syntype: MCZ OPH-5904)



**Fig. 196.** Distribution of *Ophionereis vivipara* in South Africa.

and the Natural History Museum of Denmark (paratype: ZMUC OPH-318). Type locality Cannoniers Point, Mauritius.



**Fig. 197.** Dorsal (left) and ventral (right) views of *Ophionereis vivipara* (ZMUC OPH-318).

#### 4.6.5. Family OPHIOPSILIDAE Matsumoto, 1915

##### Genus *Ophiopsila* Forbes, 1843

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). Moderate size, disc with fine plates, radial shields distinct, bar-like. Oral shields rhombic with rounded angles or spearhead-shaped, proximal lobe may be truncated. Oral papillae 2-3, rounded or spiniform, separated from apical tooth by diastema in which the first oral tentacle scale can be seen. Dental papillae 3-7. Dorsal arm plates fan-shaped or hexagonal. Ventral arm plates pentagonal with rounded angles distally, may be contiguous. Arm spines numerous, about ten, flattened, lowermost longest, middle shortest. Tentacle scales two, inner one placed on ventral arm plate, long, sword-like and lying obliquely across ventral arm plate, outer scale short, papilliform or spiniform.

##### *Ophiopsila bispinosa* Clark, 1974

*Ophiopsila bispinosa* Clark, 1974: 472-475, fig. 13; Clark & Courtman-Stock 1976: 105, 122, 177, figs 185, 188.

**Diagnosis** – Adapted from Clark (1974). D.D. up to 10 mm, D.D./A.L = 1/5. Arms 5-6. Disc round and puffy. Dorsal disc plates fine. Radial shields distinct, length two-thirds disc radius, narrow, not contiguous. Oral shields large, tumid, spearhead-shaped, with distal lobe longer than wide. Adoral shields usually contiguous, with distal lobe between oral shield and first lateral arm plate. Dental papillae 3-5

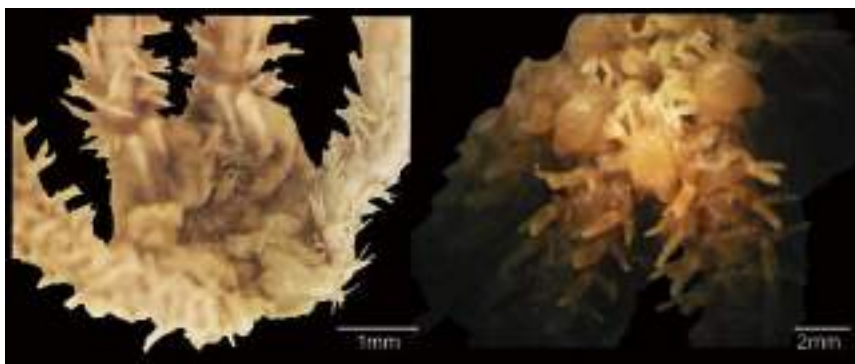
at apex, some have typical amphiuroid-like pair with gap separating them. Oral papillae 2-3, spiniform, slightly flattened, separated from apical tooth by diastema in which the first oral tentacle scale can be seen, this being spiniform. Dorsal arm plates not distinct, equally wide as long, becoming fan-shaped, contiguous for less than half their breadth, longitudinal ridge running down arm. Ventral arm plates proximally wider than long, with middle of distal edge concave, becoming longer than wide and not contiguous distally. Arm spines up to ten, flattened, paddle-like, equal or just more than one segment length, lowest arm spine spiniform, narrow and sharp. Genital slits large, genital papillae absent. Tentacle scales two, inner one placed on ventral arm plate, long, sword-like and lying obliquely across ventral arm plate after second or third segment, outer tentacle scale short, less than half innermost scale.

**Distribution and habitat** – South Africa: Tongaat (KZN) to off Umhlali (KZN); depth range: 38-150 m. Habitat: mud, coarse sand and coral.

**Remarks** – Endemic to South Africa. Type material is in Iziko South African Museum (holotype: SAMC A22793, paratype: SAMC A22794) and the type locality is off the Tugela River mouth, depth 138 m.



**Fig. 198.** Distribution of *Ophiopsila bispinosa* in South Africa.



**Fig. 199.** Dorsal (left) and ventral (right) views of *Ophiopsila bispinosa*, dorsal (SAMC A22794) and ventral (SAMC A22793).

## ***Ophiopsila seminuda* Clark A.M., 1952**

*Ophiopsila seminuda* Clark A.M., 1952: 200, 218-219, fig. 3a, b; Day *et al.* 1970: 81; Clark 1974: 470-472, fig. 12; Clark & Courtman-Stock 1976: 105, 122, 178, figs 184, 187.

**Diagnosis** – Adapted from Clark (1952). D.D. up to 8 mm, disc round. Dorsal disc plates fine, slightly larger around radial shields. Radial shields moderately distinct, long, narrow, not contiguous, separated by two rows of plates, length about one-third disc radius. Oral shields round, rhombic or hexagonal, either as wide as long or wider than long. Adoral shields may or may not be contiguous, outwardly extended, separating oral shield and lateral arm shield. Oral papillae two, broad, flat and blunt, appear similar to those of an amphiuroid. Dental papillae up to seven. Teeth 4-5, in series. Second oral tentacle scale smaller than oral papillae. Dorsal arm plates not distinct, hexagonal or oval, much longer than wide basally, becoming slightly wider than long. Ventral arm plates slightly longer than wide, pentagonal, truncated, distal edge slightly concave. Arm spines up to ten, spatulate, broad round tips, lowermost spines largest in length and thickness, uppermost half segment length, lowermost twice segment length. Genital slits wide and large, genital papillae absent. Tentacle scales two, outer one relatively short and blunt, inner one long, blunt, not tapering.

**Distribution and habitat** – Reunion, South Africa: Cape Town (WC) to Tugela River mouth (KZN), depth range: 9-182 m. Habitat: mud, sand, shell, limestone reef, shingle and gravel.

**Remarks** – Apart from the geographical distinction between *Ophiopsila seminuda* and *O. bispinosa*, *O. bispinosa* has i) finer disc scaling; ii) a spiniform distal oral papillae; iii) more pointed arm spines and iv) a spiniform second tentacle scale.

Clark & Courtman-Stock (1976) reported the lowermost arm spines being half segment length, contradicting the original description, which reads “the lowest is much the largest, both in thickness and in length, being nearly twice in length of a segment, while uppermost is only half as long”. The latter is here confirmed.



**Fig. 200.** Distribution of *Ophiopsila seminuda* in South Africa.

Only one other *O. seminuda* specimen has been found outside South Africa (MNHN-IE-2012-1353). Found off Reunion (-20.9916°S; 55.2516°E), on 27 August 1982 at a depth of 58-70 m the RV *Marion Dufresne*.

The location of the type material is unknown, type locality False Bay, South Africa, depth 27-28 m.



**Fig. 201.** Dorsal (left) and ventral (right) views of *Ophiopsila seminuda* (SAMC A084230).

#### 4.6.6. Family AMPHIURIDAE Ljungman, 1867

##### Genus *Amphioplus* Verrill, 1899

**Diagnosis** – Adapted from Clark (1970), Clark & Courtman-Stock (1976) and Verrill (1899b). Disc usually fully scaled, lacking armament, primary rosette usually distinct. Radial shields contiguous distally, or at least for some of their length, rarely fully separated. Jaws armed with three or four papillae either side, may be spaced or in a series, incapable of closing the oral slit. Tentacle scales one or two, rarely absent or rudimentary.

Three subgenera of *Amphioplus* are recognised as follows:

*Amphioplus*: first oral tentacle scale present in oral slit;

*Lymanella*: four superficial papillae in a straight row, the third enlarged, and no distinct oral tentacle scale; and

*Unioplus*: only three papillae and a single oral tentacle scale, more or less in sequence.

***Amphioplus (Amphioplus) pectinatus* Mortensen, 1933**

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

*Amphioplus (Amphioplus) pectinatus*: Clark 1974: 456-459, fig. 8; Clark & Courtman-Stock 1976: 102, 119, 148, fig. 153.

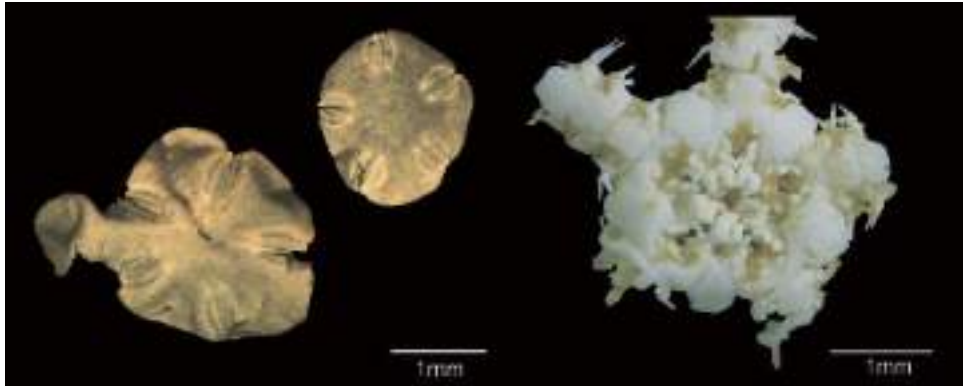
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Mortensen (1933a). D.D. up to 6 mm. Disc plates moderately coarse, primary rosette sometimes distinct, disc fully scaled ventrally, scales finer than dorsal. Radial shields slender, length c. more than one-third disc radius, wedge of scales between them, contiguous or nearly so distally. Plate below and distal to each radial shield hosting a disc scale with a comb of 3-5 hyaline thorns. Oral shields spearhead-shaped, longer than wide, truncated distally. Adoral shields contiguous. Oral papillae four with a diastema between first infradental papillae and second, revealing second oral tentacle scale which are in sequence with papillae, third oral papillae slightly enlarged. Arms slender. Dorsal arm plates triangular with rounded edges, almost elliptical or hexagonal, only just contiguous. Ventral arm plates pentagonal or squarish when proximal angle truncated, contiguous. Arm spines 3-6, tapering. Tentacle scales two.

**Distribution and habitat** – South Africa: Bluff (KZN) to North of Prince's Grant (KZN); depth range: 77-410 m. Habitat: mud and sand.

**Remarks** – Endemic to South Africa. No whole specimens were examined. Most of the specimens examined by Clark (1974) were disc-less or damaged. The syntypes are in the Natural History Museum of Denmark (ZMUC OPH-240 and ZMUC OPH-235) and the type locality is off Durban, depth 410m.



**Fig. 202.** Distribution of *Amphioplus (Amphioplus) pectinatus* in South Africa.



**Fig. 203.** Dorsal (left) and ventral (right) views of *Amphipholis (Amphipholis) pectinatus* (SAMC A23220).

***Amphipholis (Lymanella) depressus* (Ljungman, 1867)**

*Amphipholis depressa* Ljungman, 1867: 312.

*Amphipholis hastata* Ljungman, 1867: 313.

*Ophiophragmus affinis* Duncan, 1887: 89-90, pl. 8, figs 4-6.

*Amphiura relictus* Koehler, 1898b: 69, pl. 4, figs 37, 38; Koehler 1900: 4, pl. 16, figs 15, 16.

*Amphipholis relictus*: Clark 1915a: 256; Clark 1938: 251.

*Amphipholis depressus*: Clark 1915a: 254; Clark 1946: 205; James 1970: 142-144, fig. 1g-k.

*Amphipholis hastatus*: Clark 1915a: 257; Clark 1923: 331; Clark H.L. 1939: 75-76; Day & Morgans 1956: 308; Clark 1967: 47; Vine 1986: 195.

*Amphipholis (Lymanella) hastatus*: Clark 1970: 51, 54-55, fig. 9p, q; Clark & Rowe 1971: 80, 102, fig. 24a; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 81, 83-86, figs 36, 37; Sloan *et al.* 1979: 101; Richmond 2002: 326.

*Amphipholis (Lymanella) depressus*: Clark 1970: 54; Clark & Rowe 1971: 102; Gibbs *et al.* 1976: 117-118; Baker 1979: 46; Liao & Clark 1995: 190, fig. 88; Olbers *et al.* 2015: 92-93, pl. 2E, F.

**Diagnosis** – Adapted from Clark (1970) and Clark & Rowe (1971). D.D. up to 10 mm. D.D./A.L. = 1/6. Primary rosette may or may not be distinct. Disc plates moderate in size, overlapping, central plates may be larger than peripheral plates. Disc margin vertical, sometimes with small projections or thorns. Radial shields contiguous for at least half their lengths, may be half disc radius or less. Oral shields narrow, diamond-shaped, longer than wide, adoral shields triangular, contiguous. Oral papillae four, arranged in a continuous row forming a straight line, third papilla slightly enlarged. Arm length approximately 6-7 times disc diameter. Dorsal arm plates rectangular, wider than long, distal margin convex or straight, contiguous. Ventral arm plates pentagonal, flat distally, narrowly contiguous. Arm

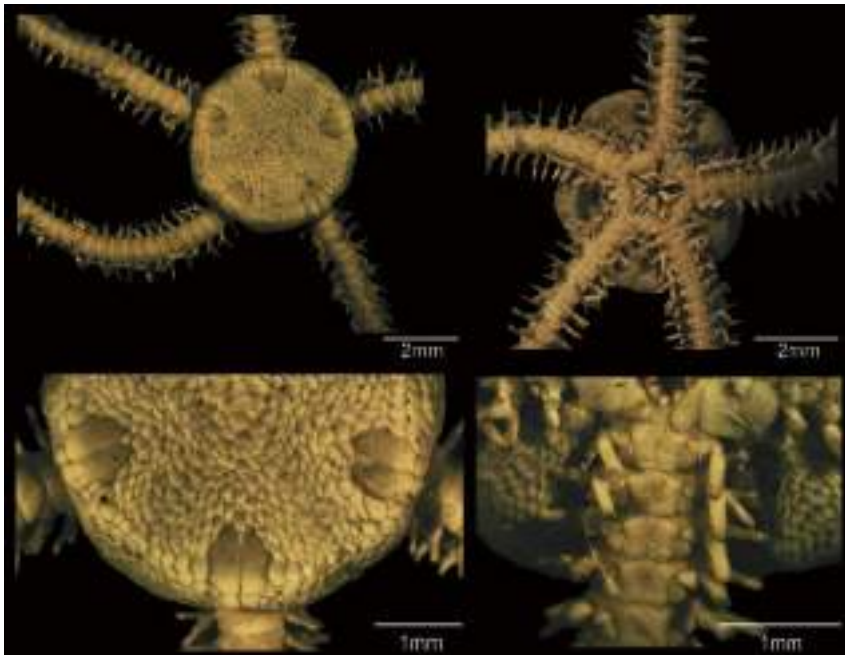


spines up to three, blunt-pointed, c. as long as segment. Tentacle scales two, large, covering pore.

**Distribution and habitat** – Mozambique, Madagascar, Red Sea, Persian Gulf, Arabian Sea, Bay of Bengal, Indonesia, Japan, Philippines, Australia, Fiji (Clark & Rowe 1971; Cherbonnier & Guille 1978; Baker 1979; Rowe & Gates 1995), South Africa: Durban (KZN) to Sodwana Bay (KZN); depth range: 0-160 m. Habitat: associated with seagrass (*Syringodium isoetifolium* and *Cymodocea serrulata*), mud, sand and detritus (James 1970; Cherbonnier & Guille 1978).



**Fig. 204.** Distribution of *Amphioplus (Lymanella) depressus* in South Africa.



**Fig. 205.** Dorsal whole (top left), ventral whole (top right), portion of dorsal disc (bottom left), ventral disc and basal arms (bottom right) views of *Amphioplus (Lymanella) depressus* (SAMC A74078).

**Remarks** – Olbers *et al.* (2015) noted this was a new record for South Africa and synonymised *Amphioplus (Lymanella) hastatus* with *Amphioplus (Lymanella) depressus* based on the South African material.

The holotype is in the Swedish Museum of Natural History (*Amphipholis depressa*: SMNH-Type-1430) and the type locality is between Batavia and Singapore, depth unknown.

### ***Amphioplus (Lymanella) furcatus* Mortensen, 1933**

*Amphioplus furcatus* Mortensen, 1933a: 370-372, fig. 75; Mortensen 1940: 96.

*Amphioplus (Lymanella) furcatus*: Clark 1970: 52; Clark 1974: 452-453; Clark & Courtman-Stock 1976: 102, 117, 149, fig. 149; Cherbonnier & Guille 1978: 81, 82-83, fig. 35.

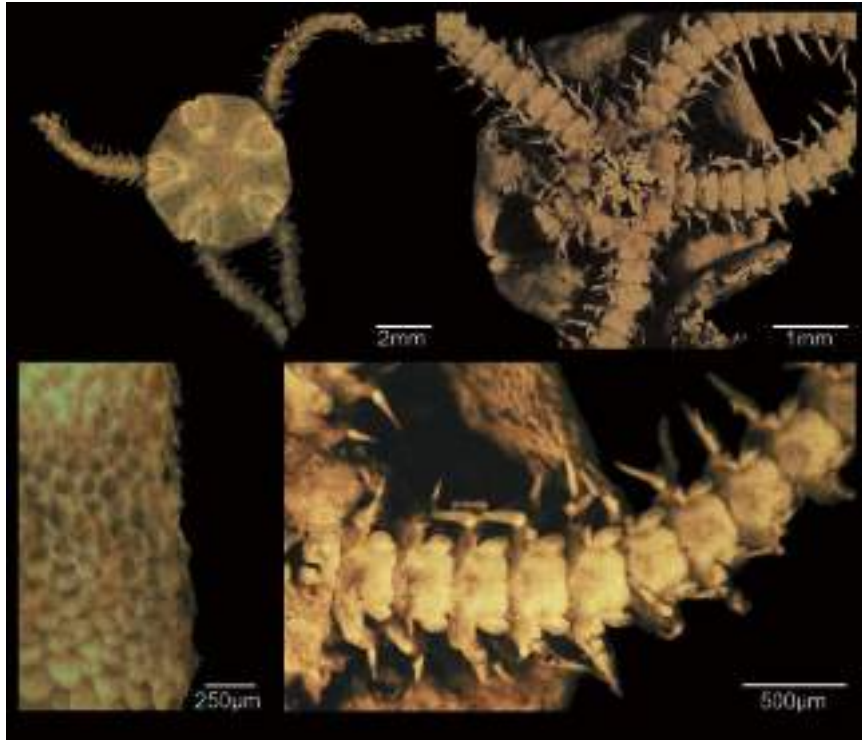
**Diagnosis** – Adapted from Mortensen (1933a) and Cherbonnier & Guille (1978). D.D. up to c. 8 mm, D.D./AL = 1/5-8. Primary rosette may be distinct, disc scaling fine. Edge of disc vertical, with small spines on disc margin. Radial shields almost fully contiguous, one-third to half disc radius, 13 plates between radial shields interradially. Oral shields diamond-shaped, longer than wide, rounded distal lobe, inner angle rounded. Adoral shields triangular, contiguous. Oral papillae four in straight row, third papillae enlarged. Arms slender. Dorsal arm plates oval, wider than long, narrowly contiguous. Ventral arm plates pentagonal, broad, narrowly contiguous. Arm spines three, slender, tapering and pointed, c. equal to segment length. Tentacle scales two, one on ventral arm plate very large.

**Distribution and habitat** – Madagascar (Cherbonnier & Guille 1978), South Africa: Zinkwazi (KZN) to Amatikulu (KZN); depth range: 30-70m. Habitat: mud.

**Remarks** – Clark (1970) transferred *Amphioplus furcatus* to the subgenus *Lymanella*. A single specimen from the Tugela River mouth was examined during this study. The syntypes are in the Natural History Museum of Denmark (ZMUC OPH-363) and the type locality is off the south head, Tugela River, depth 46 m.



**Fig. 206.** Distribution of *Amphioplus (Lymanella) furcatus* in South Africa.



**Fig. 207.** Dorsal whole (top left), ventral disc (top right), interradiar dorsal disc spines (bottom left), ventral disc and basal arms (bottom right) views of *Amphiplus (Lymanella) furcatus* (SAMC A23219).

***Amphiplus (Lymanella) integer* (Ljungman, 1867)**

*Amphipholis integra* Ljungman, 1867: 313.

*Amphiura integra* Lyman 1882: 148; Koehler 1904b: 65-66, figs 16, 17.

*Amphiplus integer*: Clark 1923: 330-331; Mortensen 1933a: 368-370, figs 73, 74; Tortonese 1936: 219; Stephenson *et al.* 1937: 380; Balinsky 1957: 11; Macnae & Kalk 1962: 107; Macnae & Kalk 1969: 106; Day *et al.* 1970: 80; Vine 1986: 195.

*Amphiplus (Lymanella) integer*: Clark 1970: 52; Clark & Rowe 1971: 80, 103; Clark 1974: 453-455, fig. 6; Clark & Courtman-Stock 1976: 102, 117, 149-150, fig. 150; Cherbonnier & Guille 1978: 81, 86-87, fig. 38; Richmond 2002: 326; Mbongwa 2013: 15; Olbers *et al.* 2014: 15, pl. 2D.

**Diagnosis** – Adapted from Cherbonnier & Guille (1978) and Clark & Courtman-Stock (1976). D.D. up to 6 mm. D.D./A.L. = 1/8. Primary rosette distinct. Disc plates

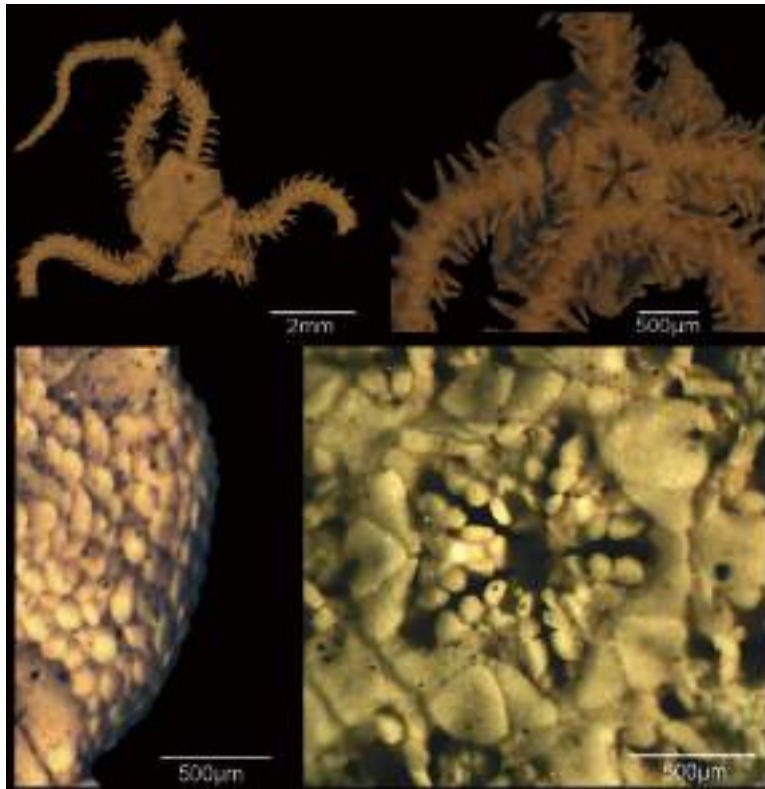
moderate in size, overlapping. Radial shields contiguous for most of their lengths, some have wedge of plates, 7-11 plates between radial shields interradially. No small thorny projections on disc margin. Oral shields spearhead-shaped, rounded distally, longer than wide. Adoral shields triangular, contiguous. Oral papillae four, arranged in a continuous row forming a straight line, third papillae slightly enlarged. Dorsal arm plates oval, wider than long, distal margin convex, narrowly contiguous. Ventral arm plates pentagonal, distal sides flat or slightly convex, narrowly contiguous. Arm spines up to three, blunt, stout, *c.* as long as segment length, proximal-most spines may be longer than segment, uppermost spatulate flattened, becoming cigar-shaped. Tentacle scales two, large, covering pore. Colour in life grey to dirty white (Balinsky 1957).

**Distribution and habitat** – Western Indian Ocean, Red Sea (Clark & Rowe 1971; Cherbonnier & Guille 1978; Richmond 2002), South Africa: Lambert's Bay (WC) to Sodwana Bay (KZN); depth range: 0-82 m. Habitat: rock, sand, mud, shell, kelp beds and limestone.

**Remarks** – Clark & Courtman-Stock (1976) noted a large variation in length and breadth of radial shields in species from South Africa and Mozambique and also that the middle arm spine of specimens from False Bay exceeds the segment length more than in the other specimens. The holotype is in the Swedish Museum of Natural History (*Amphipholis integra*: SMNH-Type-1432) and the type locality is Port Natal (Durban), depth unknown.



**Fig. 208.** Distribution of *Amphipholis (Lymanella) integra* in South Africa.



**Fig. 209.** Dorsal whole (top left), ventral disc (top right), interradial dorsal disc (bottom left), jaws (bottom right) of *Amphioplus (Lymanella) integer* (DNSM ECH23E).

### ***Amphioplus (Unioplus) falcatus* Mortensen, 1933**

*Amphioplus falcatus* Mortensen, 1933a: 365-367, figs 70, 71, pl. 19, figs 18, 19; Fell 1962: 16.

*Amphioplus (Unioplus) falcatus*: Clark 1974: 455-456, fig. 7; Clark & Courtman-Stock 1976: 102, 119, 150, figs 151, 152.

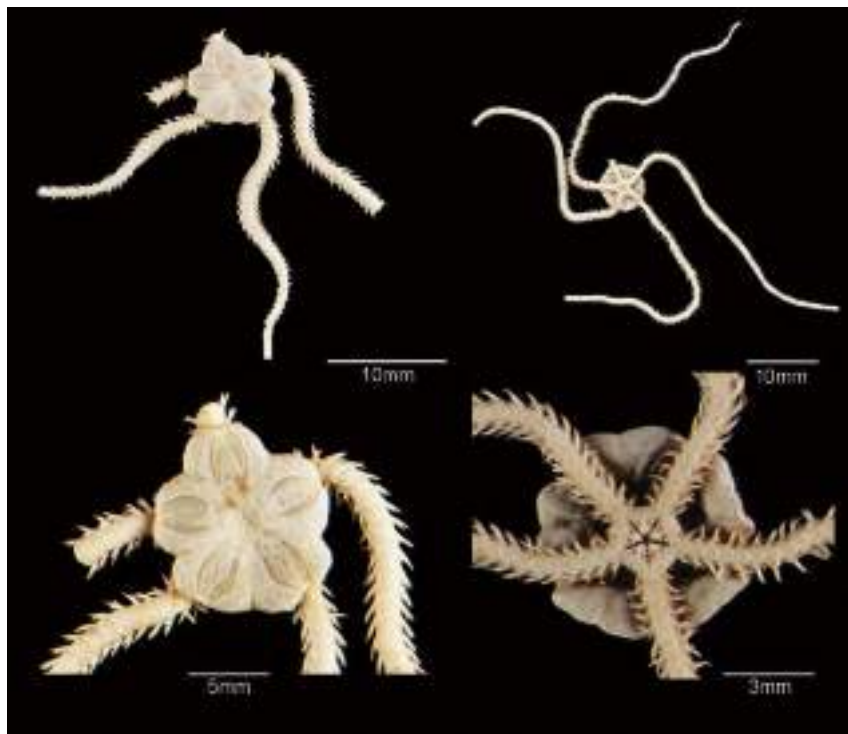
**Diagnosis** – Adapted from Mortensen (1933a). D.D. up to 7 mm, D.D./AL = 1/1.5. Primary rosette not distinct. Disc scaling coarse, overlapping, moderate in size, ventral interradial scales finer. Radial shields narrow, sickle-shaped (falcate), contiguous only on distalmost side, three rows of scales between radial shields interradially, longer than half disc radius. Oral shields triangular, angles rounded, can vary substantially in width. Adoral shields triangular, contiguous. Oral papillae three, with a single oral tentacle scale in series, second oral papillae on lower level than other two, third papillae larger, broader. Dorsal arm plates oval, wider than long, distal margin convex, narrowly contiguous. Ventral arm plates fan-shaped,

truncated proximally, distal sides flat or slightly convex, contiguous. Arm spines three, pointed, middle one longest, ending in small hook. Tentacle scales one, large, elongated, triangular.

**Distribution and habitat** – South Africa: Durban (KZN) to Prince's Grant (KZN); depth range: 57-411 m. Habitat: sandy mud, coarse sand, coral and mud with polychaetes.



**Fig. 210.** Distribution of *Amphioplus (Unioplus) falcatus* in South Africa.



**Fig. 211.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), ventral disc (bottom right) views of *Amphioplus (Unioplus) falcatus* (ZMUC OPH-362).

**Remarks** – Endemic to South Africa. Fell (1962) originally described *Unioplus* as a new genus primarily based on the single tentacle scale, using *Amphioplus falcatus* as the type specimen. The paratype is at Iziko South African Museum (SAMC A22381) while the syntypes are at the Natural History Museum of Denmark (ZMUC OPH-362), the type locality is Durban, depth 411 m.

### Genus *Amphipholis* Ljungman, 1867

**Diagnosis** – Adapted from Clark (1970) and Clark & Courtman-Stock (1976). Disc completely scaled, lacking spines, scaling rarely reduced on ventral side. Rosette often distinct, with the exception of *squamata*, radial shields usually more contiguous for more than half their length, jaws armed with three oral papillae in continuous series, outermost very broad and opercular, no oral tentacle scale visible. Arm spines 3-4. Usually two tentacle scales, sometimes one, rarely none.

### *Amphipholis similis* Mortensen, 1933

*Amphipholis similis* Mortensen, 1933a: 363-364, fig. 69; Clark 1974: 450, fig. 5a; Clark & Courtman-Stock 1976: 151; Milne 2012: 153; Mbongwa 2013: 15.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 3 mm. Primary rosette distinct with plates between them. Disc plates large, coarse, overlapping, ventral interradiial plates similar. Radial shields fairly wide, D-shaped, almost completely contiguous, length c. one-third disc radius. Oral shields rhombic with rounded angles, short distal lobe, as long as wide. Adoral shields contiguous. Oral papillae three in series, outermost very broad and opercular, no oral tentacle scale visible. Genital papillae absent. Dorsal arm plates oval, wider than long, distal margin convex, barely contiguous. Ventral arm plates fan-shaped, as long as wide, distal sides flat or slightly convex, narrowly contiguous. Arm spines three, tapering and pointed, shorter than segment length. Tentacle scales two, fairly large.

**Distribution and habitat** – South Africa: Gouritz (WC) to Sodwana Bay (KZN); depth range: 8-138 m. Habitat: sand, shells and stones.

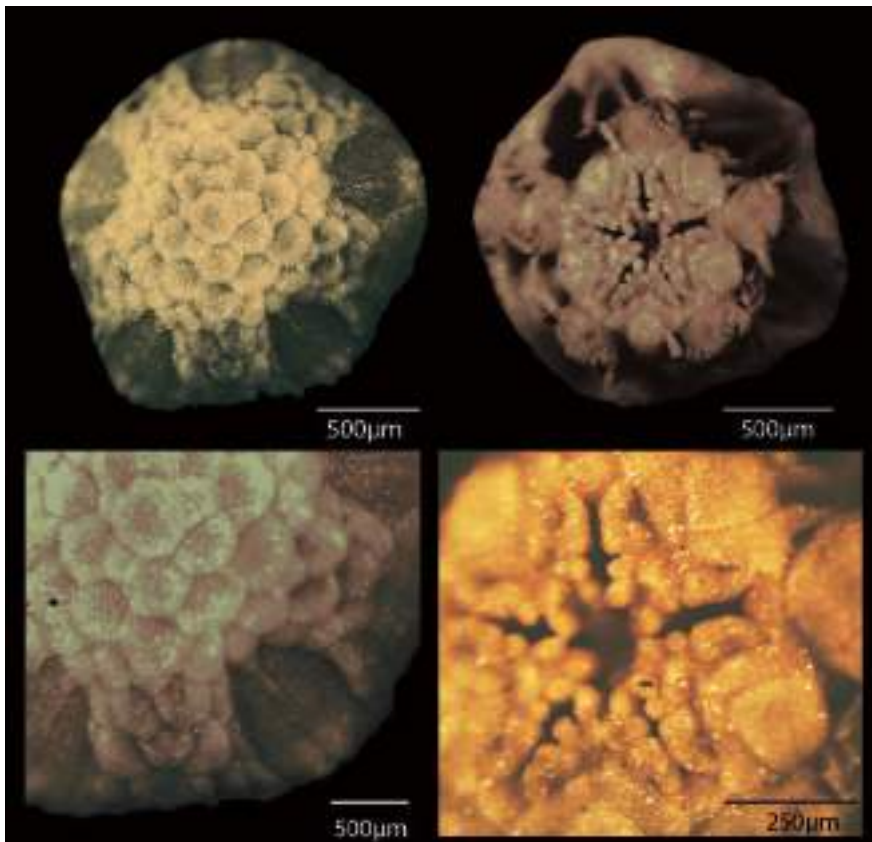
**Remarks** – Endemic to South Africa. During this study, distribution was extended north-east from Amatikulu (KZN) to Sodwana Bay (KZN).

This species may be confused with small specimens of *Amphioplus (Lymanella) integer* by the presence of the under-developed or concealed fourth papilla (Clark 1974). *Amphipholis* can be distinguished from other Amphiuroidae by the third oral papilla being more than twice as broad as the second papilla. In addition, *Amphipholis similis* does not have enlarged tentacle scales and arm spines are all shorter than corresponding segment. Arms on specimens missing.

Holotype in the Natural History Museum of Denmark (ZMUC OPH-275) and the type locality is off Durban, depth 64 m.



**Fig. 212.** Distribution of *Amphipholis similis* in South Africa.



**Fig. 213.** Dorsal disc (top left), ventral disc (top right), radial shields (bottom left), jaws (bottom right) views of *Amphipholis similis* (SAMC A74058).



## ***Amphipholis squamata* (Delle Chiaje, 1828)**

*Asterias squamata* Delle Chiaje, 1828: 74, 77.

*Ophiolepis squamata*: Müller & Troschel 1842: 92.

*Amphipholis kinbergi* Ljungman, 1872: 646.

*Amphiura squamata*: Lyman 1882: 136.

*Amphipholis squamata*: Verrill 1899b: 24; Koehler 1914a: 66; Clark 1923: 330; Mortensen 1927: 221-222, fig. 125; Koehler 1930: 102-103; Mortensen 1933a: 364-365; Stephenson *et al.* 1937: 380; Bright 1937a: 63; Eyre *et al.* 1938: 110; Murakami 1943a: 172; Clark 1946: 202; Clark A.M. 1952: 200; Balinsky 1957:10; Kalk 1958: 200, 207, 215, 237; Macnae & Kalk 1958: 106; Day 1959: 544; Grindley & Kensley 1966: 12; Clark 1967: 47; Clark 1970: 30-31; Day *et al.* 1970: 81; Penrith & Kensley 1970: 234; Clark & Rowe 1971: 80, 81, 99; Devaney 1974: 125-126; Clark & Courtman-Stock 1976: 102, 117, 151-152, fig. 138; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 105-106, fig. 48; Irimura 1982: 41, fig. 26, pl. 2, fig. 1; Marsh 1986: 70; Alva & Vadon 1989: 829; Sastry 1991: 376, pl. 3, fig. 15; Liao & Clark 1995: 194-195, fig. 92; Rowe & Gates 1995: 346; Richmond 2002: 326; Laguarda-Figueras *et al.* 2009: 200-201, pl. 82; Milne 2012: 155; Mbongwa 2013: 15.

*Ophiactis minor* Döderlein, 1910: 253, pl. 5, fig. 3.

*Amphipholis japonica* Matsumoto, 1915: 71; Matsumoto 1917: 186-189, fig. 49; Irimura 1979: 3.

*Amphioplus squamata*: Macnae & Kalk 1962: 111.

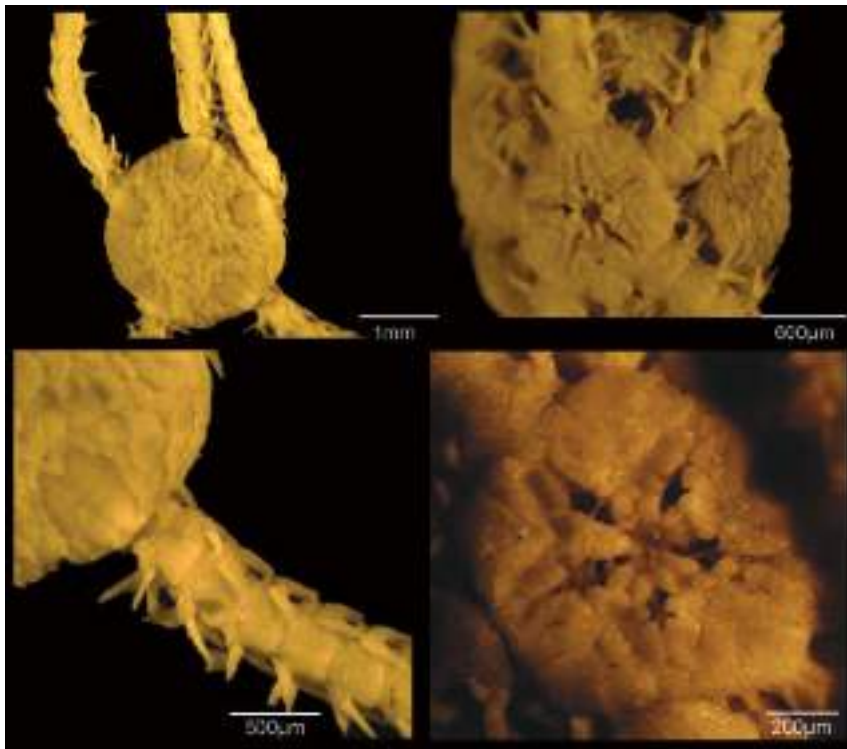
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 20 mm. Primary rosette not always distinct. Disc plates moderately large, coarse, overlapping, ventral interradiial plates similar. Radial shields fairly wide, D-shaped, mostly contiguous, c. one-third disc radius. Oral shields rhombic with rounded angles, wider than long. Adoral shields triangular, contiguous. Oral papillae three, in continuous series, outermost very broad, no oral tentacle scale visible. Genital papillae absent. Dorsal arm plates rounded-triangular, wider than long, distal margin convex, barely contiguous. Ventral arm plates pentagonal, wider than long, distal sides flat or slightly concave, narrowly contiguous. Arm spines up to four, short, tapering, pointed. Tentacle scales two, moderate in size. Colour in life very dark, almost black (Mortensen 1933a), beige to black (Deheyn & Jangoux 1999) or greyish with a bright spot ringed by a darker area on the distal sides of each pair of radial shields (Clark & Courtman-Stock 1976).

**Distribution and habitat** – Cosmopolitan, South Africa: off Orange River (NC) to Kosi Bay (KZN); depth range: 0-1962 m. Habitat: rock, sand, shell, mud, kelp, associated with Patellidae, *Zonaria* and *Zostera*.

**Remarks** – This cosmopolitan species occurs throughout South Africa in a variety of habitat types in depths up to 720 m. Syntypes of the synonym *Amphipholis japonica* (MCZ OPH-3893) and *Amphipholis kinbergi* (MCZ OPH-1407) are in the Museum of Comparative Zoology. The whereabouts of the holotype is unknown (Rowe & Gates 1995) and the type locality is Naples (Clark & Courtman-Stock 1976), depth unknown.



**Fig. 214.** Distribution of *Amphipholis squamata* in South Africa.



**Fig. 215.** Dorsal whole (top left), ventral disc (top right), radial shields (bottom left), jaws (bottom right) views of *Amphipholis squamata* (SAMC A084239).

## ***Amphipholis strata* Mortensen, 1933**

*Amphipholis strata* Mortensen, 1933a: 361-363, pl. 19, fig. 20, fig. 68; Clark 1974: 450-452, fig. 5b-d; Clark & Courtman-Stock 1976: 103, 117, 152, figs 138, 144, 147.

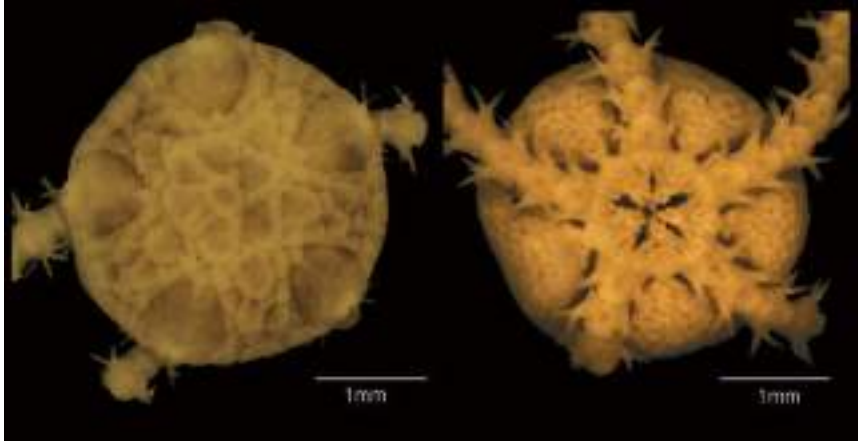
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 9 mm; D.D./A.L. = 1/3. Primary rosette distinct, plates relatively large, with plates between them. Disc plates large, coarse, polygonal. Ventral interradiar areas covered in coarse, imbricated plates. Row of 8-9 square plates just below disc margin. Radial shields broad D-shape, fully contiguous, one-third to two-fifths of disc radius. Oral shields diamond-shaped, as long as wide or slightly longer. Adoral shields contiguous. Oral papillae three, in continuous series, outermost very broad and opercular, no oral tentacle scale visible. Genital papillae absent. Dorsal arm plates broad, fan-shape, wider than long, distal margin slightly convex, contiguous. Ventral arm plates fan-shaped, wider than long, distal sides flat or slightly convex, may or may not be narrowly contiguous. Lateral arm plates large. Arm spines three, middle one longest, slightly cigar or club-shaped, may be pointed. Tentacle scales two, fairly large. Disc pale, arms grey (Clark & Courtman-Stock 1976).

**Distribution and habitat** – South Africa: off Platbaai (NC) to Port Elizabeth (EC); depth range: 12-349 m. Habitat: sand, rock, shells, limestone and with polychaete *Phyllochaetopterus* species.

**Remarks** – Endemic to South Africa and easily distinguished from the other two South African *Amphipholis* species by two main features, i) middle arm spine is longest and cigar-shaped and ii) row of square plates below the disc margin. The syntypes are in the Natural History Museum of Denmark (ZMUC OPH-274 and ZMUC OPH-259) and in the Iziko SA Museum (SAMC A22378), type locality being Cape Point, depth 55 m.



**Fig. 216.** Distribution of *Amphipholis strata* in South Africa.



**Fig. 217.** Dorsal (left) and ventral (right) views of *Amphipholis strata* (SAMC A073832).

### Genus *Amphiura* Forbes, 1843

**Diagnosis** – Adapted from Forbes (1843), Matsumoto (1917), Clark (1970) and Clark & Courtman-Stock (1976). Disc usually fully-scaled, but without armament. Scaling sometimes reduced on ventral side. Jaws armed with one infradental pair of papillae and one distal oral papilla each side, rarely two arising from the point of contact with the adoral shield. Oral tentacle scale inset in oral slit. Arms moderate or long in length. Tentacle scales 0-2.

#### *Amphiura (Amphiura) acutisquama* A.M. Clark, 1952

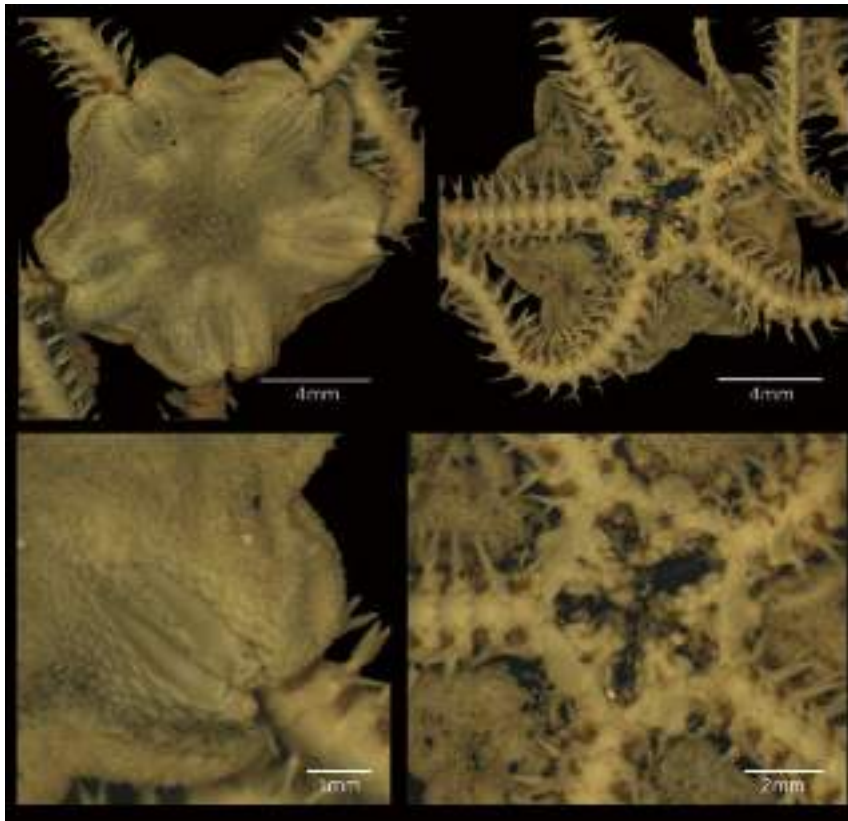
*Amphiura acutisquama* Clark A.M., 1952: 200, 213-215, fig. 1a, b.

*Amphiura (Amphiura) acutisquama*: Clark & Courtman-Stock 1976: 103, 115, 153, fig. 134.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 15 mm, D.D./A.L. = 1/5. Disc indented interradially, disc fully-scaled with small, fine plates, plates slightly larger in vicinity of radial shields and genital slits. Radial shields long and narrow, truncated distally, half disc radius, separated by numerous rows of plates. Ventral interradial area covered in fine plates. Madreporite swollen and circular in outline. Oral shields spearhead-shaped or oval, with lobe on distal side, may be equal or longer than wide. Adoral shields usually not contiguous. Distalmost oral papillae massive, usually with double apex, infradental papillae, elliptical leaf-shaped, sometimes double, ill-defined apex, wide diastema between infradentals and oral papillae. Oral tentacle scale visible between infradental and second oral papillae. Genital slits long, genital papillae absent. Arms moderately long. Dorsal arm plates oval, wider than long, with indistinct rounded distal lobe,



**Fig. 218.** Distribution of *Amphiura (Amphiura) acutisquama* in South Africa.



**Fig. 219.** Dorsal disc (top left), ventral disc (top right), radial shields (bottom left), jaws (bottom right) views of *Amphiura (Amphiura) acutisquama* (SAMC A073830).

not contiguous basally. Ventral arm plates pentagonal, truncated on proximal edge, distally straight or convex on proximal plates, equally long as wide. Arm spines five basally, then three from c. segment 13, tapering to a point, as long as or just longer than segment length. Tentacle scales two, moderate in size, tentacle pores on arm large.

**Distribution and habitat** – South Africa: Zout River (NC) to Port Durnford (KZN); depth range: 340-800 m. Habitat: sand and mud.

**Remarks** – Endemic to South Africa. Until this study, only a single specimen was known. Four additional specimens were found during this investigation, extending the distribution range from the west coast eastwards to Tinley Manor in KZN and further westwards to the Zout River. The type material is presumably in the Natural History Museum (London), but could not be located. The specimen was collected by the *Africana*, station number (AFR798C), but no details other than 'West coast of South Africa' are available.

### ***Amphiura (Amphiura) albella* Mortensen, 1933**

*Amphiura albella* Mortensen, 1933a: 359-361, fig. 67a, b; Clark 1974: 444.

*Amphiura (Amphiura) albella*: Clark & Courtman-Stock 1976: 103, 115, 153, fig. 131.

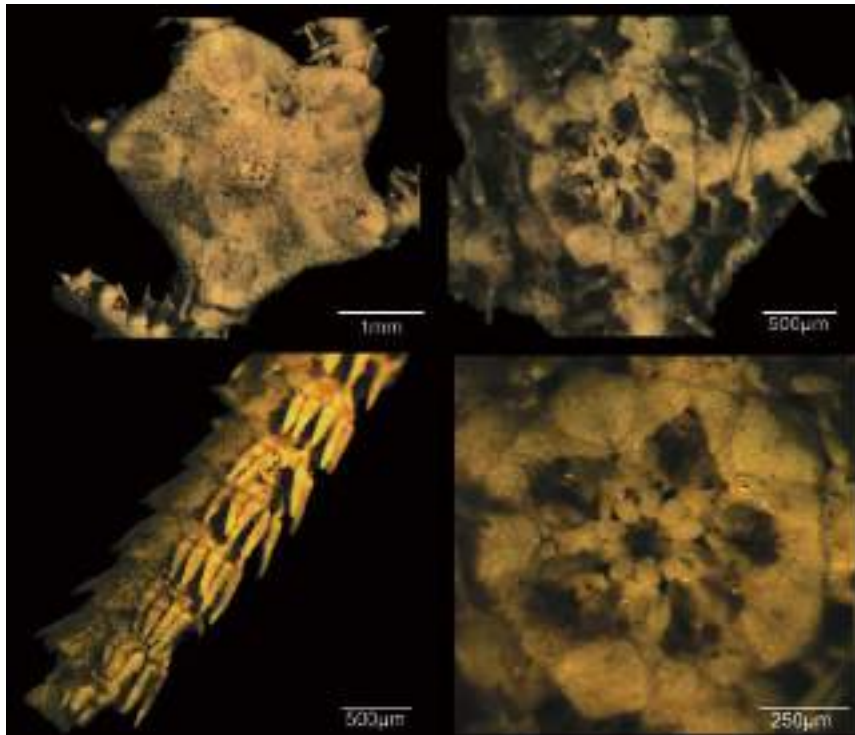
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 6 mm, D.D./A.L. = 1/6. Disc indented interradially, disc fully scaled with fine plates. Radial shields long and relatively narrow, separated by single row of plates, c. one-third disc radius, approximating distally. Ventral interradiial area excavated, naked in proximal areas, then covered in similar plates to dorsal disc. Oral shields vary from spearhead to diamond-shape, may be equal in length and width, or slightly wider. Adoral shields mostly not contiguous. Distal oral papilla one, broad elliptical leaf-shaped, infradental or apical papillae paired, rounded, wide diastema between infradentals and oral papillae. Genital slits long, genital papillae absent. Arms moderately long. Dorsal arm plates broad, fan-shaped with rounded edges, contiguous or barely contiguous proximally, wider than long. Ventral arm plates pentagonal, truncated proximally, as long as wide or slightly longer, broadly contiguous. Lateral arm plates protruding slightly from arm. Arm spines up to five, tapering, proximal ones stout, approximately one segment length. Tentacle scales two proximally, sometimes only one distally.

**Distribution and habitat** – South Africa: Umgababa (KZN) to Island Rock (KZN); depth range: 411-930 m. Habitat: Soft clay and mud.

**Remarks** – Endemic to South Africa. Distribution range here extended from Amatikulu (KZN) to Island Rock (KZN). The holotype (ZMUC OPH-79) and paratype (ZMUC OPH-361) are in the Natural History Museum of Denmark and the type locality is off Durban, depth 412 m.



**Fig. 220.** Distribution of *Amphiura (Amphiura) albella* in South Africa.



**Fig. 221.** Dorsal disc (top left), ventral disc (top right), arm spines (bottom left), jaws (bottom right) views of *Amphiura (Amphiura) albella* (SAMC A22938).

***Amphiura (Amphiura) angularis* Lyman, 1879**

*Amphiura angularis* Lyman, 1879: 25-26, pl. 11, figs 311-313; Lyman 1882: 134-135, pl. 29, figs 1-3; Clark 1923: 327-328; Mortensen 1933a: 354; Downey 1969: 21.

*Amphiura angularis angularis*: Branch *et al.* 1993: 51.

**Diagnosis** – Adapted from Lyman (1879). D.D. up to 9 mm, D.D./A.L. = 1/4. Disc flat, plates indistinct, coarse, overlapping, primary rosette plates slightly larger than other plates. Radial shields short, narrow, longer than wide, tapering distally, separated by two or three rows of irregular plates. Marginal plates continue around outer end of radial shields. One-third ventral interradial areas covered in minute plates, with remaining areas naked. Oral shields large, nearly circular with lobe proximally. Adoral shields not contiguous. Distal oral papillae single, long triangular, tapering, pointed, infradental papillae paired, short, blunt, rounded, wide diastema between infradentals and oral papillae. Arms moderately long. Dorsal arm plates oval, wider than long. First ventral arm plate small and squarish, then nearly square and narrow. Lateral arm plates distinct, sometimes meeting above, but not contiguous ventrally. Arm spines up to five, stout, blunt, tapering, evenly spaced on lateral arm plate. Tentacle scales one, rounded on inner side of tentacle pore.

**Distribution and habitat** – Heard Island and Prince Edward Islands (Lyman 1879; Branch *et al.* 1993), South Africa: Langebaan (WC) to East London (EC); depth range: 0-348 m. Habitat: rock and sand.

**Remarks** – Only specimens from Marion Island were examined from the Iziko South African Museum collection. Clark (1923) and Mortensen (1933a) both reported this species in South Africa, but was not included by Clark & Courtman-Stock (1976) for unknown reasons. Mortensen (1936) found that '*angularis*' from the Southern Ocean differed in being fully scaled ventrally. A.M. Clark (1974) suggested that these small specimens are juvenile *A. capensis*. Additional records in this study derived from the UCT Ecological Survey collection. The syntypes are in the Museum of Comparative Zoology (MCZ OPH-1286 and MCZ OPH-1375) with the type locality being Heard Island, depth 274 m.



**Fig. 222.** Distribution of *Amphiura (Amphiura) angularis* in South Africa.





**Fig. 223.** Dorsal (left) and ventral (right) views of *Amphiura (Amphiura) angularis* (SAMC A23823).

***Amphiura (Amphiura) atlantica* Ljungman, 1867**

*Amphiura atlantica* Ljungman, 1867: 321; Koehler 1926: 4-6, pl.1, figs 4, 6-9; Mortensen 1933d: 449-451, figs 17, 18; Madsen 1970: 181-182, fig. 15; Clark 1977: 135.

*Amphiura dilatata* Lyman, 1879: 26, pl. 9, figs 314-316; Lyman 1882: 135-136, pl. 29, figs 4-6; Clark 1923: 326-327.

*Amphiura (Amphiura) atlantica*: Clark & Courtman-Stock 1976: 103, 115, 153-154, figs 126, 132.

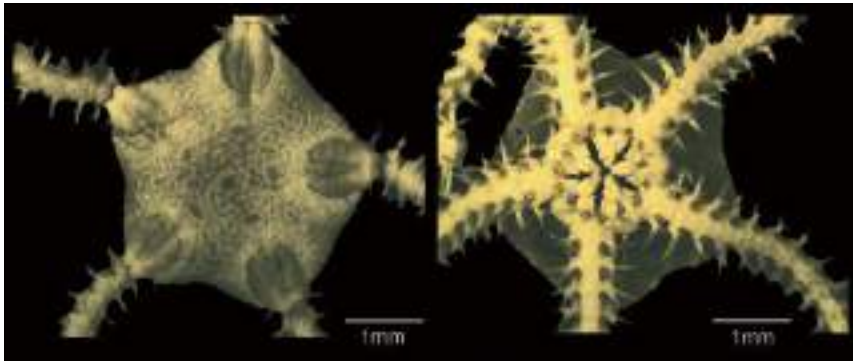
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Madsen (1970). D.D. up to 6 mm, D.D./A.L. = 1/7. Disc indented interradially, disc fully scaled with fine plates. Primary rosette sometimes distinct. Radial shields long and narrow, wider proximally, separated by usually one elongated scale, less than half disc radius. Ventral interradial area excavated, plates absent, sometimes on disc margin only. Oral shields vary in shape, but usually have proximal lobe which may be flat or rounded and a truncated distal lobe, usually equal in length and width or slightly wider. Adoral shields usually not contiguous, or only just touching. Distal oral papilla one, spiniform, infradental papillae, paired, elliptical leaf-shaped, wide diastema between infradentals and oral papillae. Arms moderately long. Dorsal arm plates fan-shaped with rounded edges, wider than long, not contiguous, usually separated by lateral arm plates, some plates have an indistinct distal lobe. Ventral arm plates square or pentagonal, restricted in middle by tentacle pores, slightly concave on distal side, contiguous. Lateral arm plates distinct. Arm spines up to six, tapering, shorter or equal to segment length, second lowest spine slightly broader at tip with lateral projection, giving it a pick-hammer or axe shape. Genital slits long, genital plates distinct. Tentacle scales rudimentary or absent. Colour in life uniformly orange (Clark & Courtman-Stock 1976).

**Distribution and habitat** – St Helena Island, Senegal (Madsen 1970), South Africa: off Galjoen Bay (NC) to off Durban (KZN); depth range: 30-930 m. Habitat: sand, mud, shell, silt, rock and among Foraminifera.

**Remarks** – Distribution range within South Africa here extended from the Northern Cape to KwaZulu-Natal. The syntypes are in the Museum of Comparative Zoology (MCZ OPH-1304) (Downey 1969). The type locality is St Helena Island, South Atlantic Ocean, depth unknown (Ljungman 1867).



**Fig. 224.** Distribution of *Amphiura (Amphiura) atlantica* in South Africa.



**Fig. 225.** Dorsal (left) and ventral (right) views of *Amphiura (Amphiura) atlantica* (SAMC A084229).

***Amphiura (Amphiura) capensis* Ljungman, 1867**

*Amphiura capensis* Ljungman, 1867: 320; Lyman 1882: 129, pl. 18, figs 14-16; Koehler 1908a: 634; Döderlein 1910: 253-254, pl. 5, fig. 2; Koehler 1914b: 190; Clark 1923: 327; Mortensen 1933a: 348-350; Stephenson *et al.* 1937: 380; Bright 1937a: 63; Bright 1937b: 76, 86, 87; Eyre 1939: 304; Clark A.M. 1952: 200; Clark 1955: 18; Day 1959: 544; Grindley & Kensley 1966: 13; Day *et al.* 1970: 81; Clark 1974: 445-447.

*Amphiura adjecta* Mortensen, 1933a: 355-357, fig. 62.

*Amphiura compressa* Mortensen, 1933a: 357-358, figs 63, 64.

*Amphiura (Amphiura) capensis*: Clark & Courtman-Stock 1976: 103, 117, 155, figs 121, 143; Olbers *et al.* 2014: 15, pl. 2F.

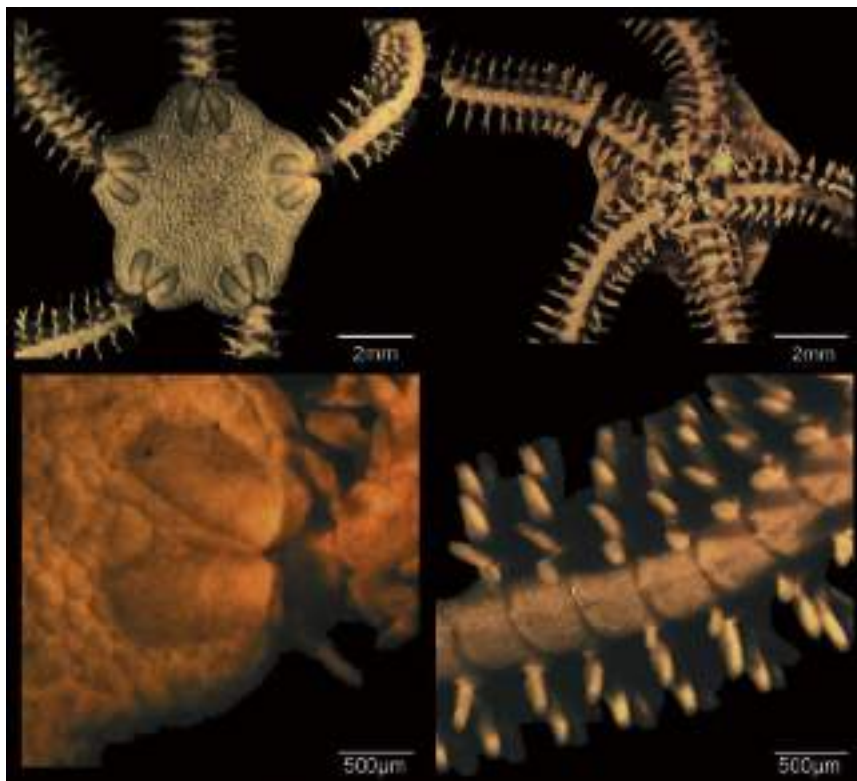
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Mortensen (1933a). D.D. up to 11 mm, D.D./A.L. = 1/5. Disc with moderately coarse plates, primary rosette moderately distinct, ventral interradial areas fully scaled, but sometimes reducing in density proximally and sometimes even naked in patches, plates slightly less coarse than on dorsal surface. Radial shields longer than wide, shorter than half disc radius, diverging and tapering distally, contiguous at distal ends, separated by numerous irregular plates. Oral shields broad spearhead-shaped, equal or longer than wide. Adoral shields not contiguous except in smaller specimens. Distal oral papilla single, short, cone-shaped, flattened, rarely spiniform. Infradental papillae broad with rounded square tips, wide diastema between infradentals and oral papillae. Dorsal arm plates oval to fan-shape, wider than long, contiguous. Ventral arm plates pentagonal or square, truncated, equally or only just wider than long, distal side concave basally. Lateral arm plates distinct, not meeting dorsally or ventrally. Arms moderately long. Arm spines up to seven, upper spines flattened or spatulate and may be axe-shaped at tip. Tentacle scales single, rounded. Colour in life, disc greyish sometimes nearly black, arms yellow or orange, may have dark spots within indistinct bands.

**Distribution and habitat** – Namibia, Angola, Senegambia (Gambia and Senegal) (Koehler 1914b; Clark 1955), South Africa: Orange River (NC) to Sodwana Bay (KZN); depth range: 0-179 m. Habitat: under stones intertidally, rock, stone, sand, mud, shingle, kelp, associated with patellid molluscs and/or *Gunnarea* (reef-worm) colonies, broken *Lithothamnion*.

**Remarks** – Distribution extended north east from Amatikulu (KZN) to Kosi Bay (KZN). Types in the Museum of Comparative Zoology (MCZ OPH-1294; MCZ OPH-1286; MCZ OPH-1375) (Downey 1969) and the Natural History Museum of Denmark with a paratype (as *Amphiura adjecta*) ZMUC OPH-77 (off Durban, depth 64 m) and the holotype (as *Amphiura compressa*) ZMUC OPH-78 (False Bay, depth 55 m).



**Fig. 226.** Distribution of *Amphiura (Amphiura) capensis* in South Africa.



**Fig. 227.** Dorsal disc (top left), ventral disc (top right), radial shields (bottom left), dorsal arms (bottom right) views of *Amphiura (Amphiura) capensis* (SAMC A084226).

***Amphiura (Amphiura) grandisquama natalensis* Mortensen, 1933**

*Amphiura grandisquama natalensis* Mortensen, 1933a: 353-354, fig. 60; Clark 1974: 447-448, fig. 3.

*Amphiura (Amphiura) grandisquama natalensis*: Clark & Courtman-Stock 1976: 103, 115, 155-156, fig. 142.

**Diagnosis** – Adapted from Clark (1974) and Clark & Courtman-Stock (1976). D.D. up to 4 mm. Disc fully scaled, plates fine dorsally, ventral interrarial scaling slightly finer. Dorsally, primary rosette not distinct. Radial shields moderately long and narrow, converging distally, not contiguous. Oral shields triangular, rhombic or spearhead-shaped, wider than long. Adoral shields may be only just contiguous, or not at all. Distal oral papillae single, small, moderate in size. Infradental papillae paired, blunt and elliptical leaf-shaped, wide diastema between infradentals and oral papillae. Dorsal arm plates fan-shaped, slightly rounded, becoming pointed distally. Ventral arm plates truncated pentagonal with distal lobe. Arm spines up to five, pointed, tapering, one segment length, lowest spine longer, up to three times segment length, may be clavate or slightly curved. Tentacle scale single, large, round, covering pore.

**Distribution and habitat** – South Africa: Durban (KZN) to Black Rock (KZN); depth range: 225-825 m. Habitat: green sand and mud.

**Remarks** – Endemic to South Africa, distribution range here extended from Durban to Black Rock in KZN. The paratype (SAMC A22365) is in Iziko South African Museum and a paratype in the Natural History Museum of Denmark (ZMUC OPH-210). The type locality is off Durban, depth 411 m.



**Fig. 228.** Distribution of *Amphiura (Amphiura) grandisquama natalensis* in South Africa.



**Fig. 229.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), ventral disc (bottom right) views of *Amphiura (Amphiura) grandisquama natalensis* (ZMUC OPH-210).

***Amphiura (Amphiura) incana* Lyman, 1879**

*Amphiura incana* Lyman, 1879: 20, pl. 11, figs 285-287; Lyman 1882: 128, pl. 33, figs 5-7, pl. 46, fig. 5; Clark 1923: 328-329; Hertz 1927b: 34, pl. 7, fig. 1; Mortensen 1933a: 351, fig. 60c; Mortensen 1936: 286-287; Clark A.M. 1952: 200; Morgans 1959: 308-310, 312, 313, 315, 322; Downey 1969: 29; Day *et al.* 1970: 81; Madsen 1970: 173-177, figs 8-10.

*Amphiura atlantica* var. *dilatata* Mortensen, 1933a: 351-353, figs 59, 60b; Clark A.M. 1952: 200; Day *et al.* 1970: 81.

*Amphiura sculpta* Clark, 1955: 19, 26, 47-48, fig. 22.

*Amphiura (Amphiura) incana*: Clark & Courtman-Stock 1976: 103, 156.

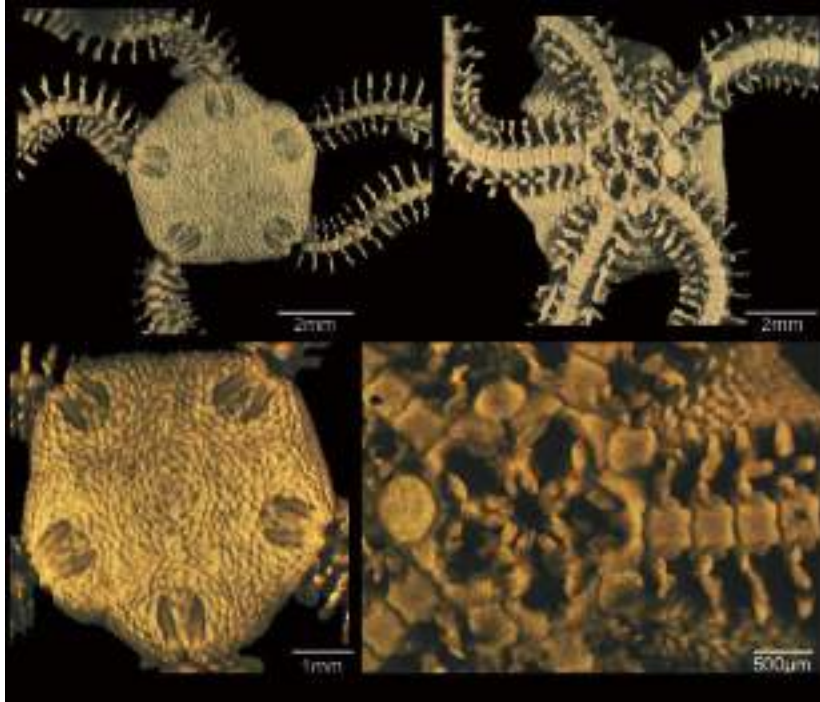
**Diagnosis** – Adapted from Lyman (1879) and Clark & Courtman-Stock (1976). D.D. up to 9 mm, D.D./A.L. = 1/7. Disc with tumid, coarse plates, primary rosette moderately distinct, ventral interradiial areas fully scaled with fine plates. Radial shields short to moderately long, narrow, c. one-quarter to one-third disc radius, tapering distally, separated by two or three rows of irregular plates with marginal plates continuing around outer end of radial shields. Oral shields vary in shape, spearhead-shaped, pentagonal, nearly circular or rhombic, may be sunken centrally, as long as wide or wider. Adoral shields just contiguous or not. Distal oral papillae single, short, very broad. Infradental papillae paired, broad, pointed, wide diastema between infradentals and oral papillae. Arms moderately long. Dorsal arm plates rounded to square in shape, slightly wider than long. Ventral arm plates squarish to pentagonal, with distal edge concave. Lateral arm plates thick but not prominent, not meeting dorsally or ventrally. Arm spines up to eight, short, thick, blunt, flattened and shorter than segment length. Tentacle scales two, rounded, moderate to small in size. Colour in life, disc grey, arms with pink, orange or red longitudinal stripe (Clark & Courtman-Stock 1976).

**Distribution and habitat** – North Atlantic Ocean, West Africa, west Mediterranean (Madsen 1970), South Africa: Lambert's Bay (WC) to Tugela River (KZN); depth range: 7-300 m. Habitat: sand, rock, mud, shell, shingle, limestone and broken *Lithothamnion*.

**Remarks** – Distribution range extended here from Durban (KZN) to off Tugela River mouth (KZN). The distinguishing features of *Amphiura* (*Amphiura*) *incana* include the arm spines, which are short, thick and up to eight. The type material is in the Museum of Comparative Zoology (syntypes: MCZ OPH-1323 and MCZ OPH-1389) and the type locality is Simon's Bay, depth 18-36 m.



**Fig. 230.** Distribution of *Amphiura* (*Amphiura*) *incana* in South Africa.



**Fig. 231.** Dorsal whole (top left), ventral disc (top right), dorsal disc (bottom left), jaws (bottom right) views of *Amphiura (Amphiura) incana* (SAMC A23378).

***Amphiura (Amphiura) linearis* Mortensen, 1933**

*Amphiura linearis* Mortensen, 1933a: 354-355, fig. 61; Clark 1974: 475.

*Amphiura (Amphiura) linearis*: Clark & Courtman-Stock 1976: 103, 115, 157, fig. 141.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Clark (1974). D.D. up to 3.5 mm, D.D./A.L. = 1/5. Disc with small fine plates both dorsally and ventrally. Radial shields narrow, linear or nearly parallel, more than one-third disc radius, not tapering, well-separated. Oral shields broad spearhead-shaped with rounded proximal lobe, as wide as long. Adoral shields triangular, just contiguous. Distal oral papilla single, pointed. Infradental papillae paired, pointed, wide diastema between infradentals and oral papillae. Arms moderately long. Dorsal arm plates narrow, fan-shape, longer than wide. Ventral arm plates narrow, pentagonal, truncated or rounded distal edge. Arm spines up to six, slightly flattened, tapering, pointed, lowermost longest, exceeding segment length. Tentacle scales single, moderately large, slightly elongated, triangular or cone-shaped.

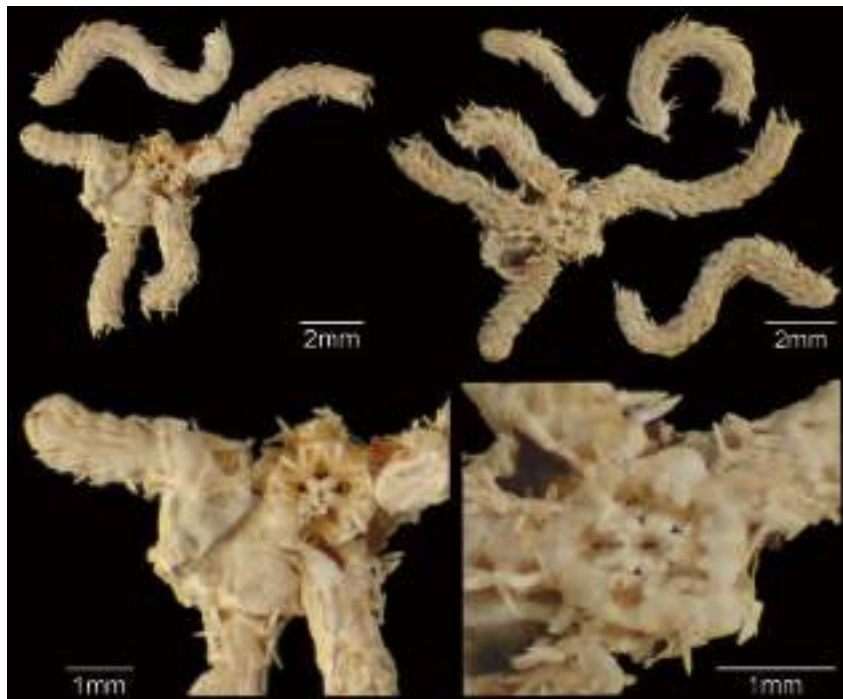
**Distribution and habitat** – South Africa: Amanzimtoti (KZN) to Durban (KZN); depth range: 91-165 m. Habitat: no information available.



**Remarks** – Endemic to South Africa. There are only two damaged specimens known, presumably the two in the Natural History Museum of Denmark. Both Clark (1974) and Clark & Courtman-Stock (1976) mentioned that the type material is damaged and should be re-examined and compared to *Ophiopsila bispinosa*, which has similar radial shields and arm spines. The type material is in the Natural History Museum of Denmark (syntypes: ZMUC OPH-190 and ZMUC OPH-360) with the type locality off Durban, depth 91-165 m.



**Fig. 232.** Distribution of *Amphiura (Amphiura) linearis* in South Africa.



**Fig. 233.** Dorsal whole (top left), ventral whole (top right), dorsal disc (bottom left), jaws (bottom right) views of *Amphiura (Amphiura) linearis* (ZMUC OPH-190).

### ***Amphiura (Amphiura) otteri* Ljungman, 1872**

*Amphiura otteri* Ljungman, 1872: 631-632; Lyman 1879: 32; Lyman 1882: 128; Lyman 1883: 252; Koehler 1907: 302, pl. 11, fig. 19; Koehler 1914a: 61, pl. 8, figs 5-9; Mortensen 1927: 210; Paterson 1985: 86-87, fig. 33.

*Amphiura grandis* Koehler, 1896a: 246-247; Koehler 1907: 301; Koehler 1909b: 175-177; pl. 27, figs 3, 4; Mortensen 1927: 210.

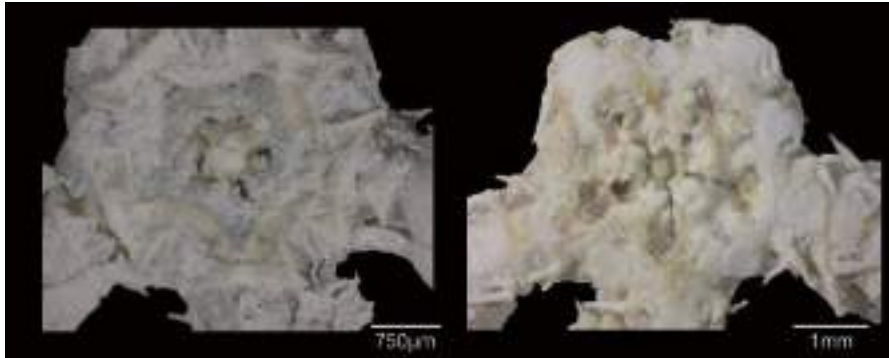
**Diagnosis** – Adapted from Paterson (1985). D.D. up to 11 mm. Disc pentagonal, indented interradially, with moderate coarse plates, primary rosette distinct, ventral interradiial areas fully scaled with fine plates. Radial shields moderately long, about half disc radius, converging distally and touching on distal ends. Oral shields spearhead-shaped, longer than wide. Adoral shields not contiguous. Distal oral papillae one, spiniform, arising from adoral shields. Infradental papillae paired, elliptical leaf-shaped, often contiguous, wide diastema between infradentals and oral papillae. Dorsal arm plates oval or hexagonal, wider than long, proximal plates almost contiguous. Ventral arm plates pentagonal, becoming squarish distally, contiguous, may have slight concave notch on distal side. Tentacle pores large. Arm spines up to eight, pointed, some with terminal hook. Tentacle scales two, small in size, may be missing on some segments.

**Distribution and habitat** – North Atlantic (West Indies to Cape Verde), Gulf of Mexico, Caribbean, British Isles (Paterson 1985), South Africa: off Cape Town (WC) to Port Elizabeth (EC); depth range: 198-3200 m. Habitat: no information available.

**Remarks** – Two specimens (SAMC A22102 and SAMC A22100) were determined by A.M. Clark after 1959, but they were badly damaged. The identification could not be confirmed or disputed, possibly a reason why this species was not included by Clark & Courtman-Stock (1976). This species remains as part of the South African fauna, but is considered dubious. The syntypes are in the Swedish Museum of Natural History (SMNH-Type-1412) and the type locality is off Portugal, depth 1001 m.



**Fig. 234.** Distribution of *Amphiura (Amphiura) otteri* in South Africa.



**Fig. 235.** Dorsal (left) and ventral (right) views of *Amphiura (Amphiura) otteri* (SAMC A22100).

### ***Amphiura (Amphiura) simonsi* A.M. Clark, 1952**

*Amphiura simonsi* Clark A.M., 1952: 215-217, fig. 2; Morgans 1959: 322; Clark 1974: 448-449, fig. 4.

*Amphiura (Amphiura) simonsi*: Clark & Courtman-Stock 1976: 103, 115, 157, figs 129, 133.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Clark (1974). D.D. up to 7 mm, D.D./A.L. = 1/9. Dorsal disc with small, coarse, delicate and thin plates, ventral interradial areas lacking scales, but these easily rubbed off. Primary rosette not distinct. Radial shields relatively small, contiguous distally and diverge proximally, less than one-third of disc radius. Oral shields small, vary in shape, oval or broad triangular. Adoral shields large, with broad distal lobe between oral shield and first lateral arm plate, contiguous. Distal oral papillae two<sup>3</sup>, one short and conical, the other more rounded or blunt. Infradental papillae paired, broad, blunt, wide diastema between infradentals and oral papillae. Arms long. Dorsal arm plates fan-shaped, wider than long, rudimentary on basal segments exposing underlying structure. Ventral arm plates square to rectangular, distal edge slightly concave. Arm spines up to five, as long as segment length, spines flattened and paddle-shaped, second lowest spine conspicuously curved, hook-shaped sometimes with hyaline hooks, lowest spine flattened or cylindrical but tapering. Tentacle scale one, small, usually absent in basal pores. Colour in life, arms pale orange and banded (Clark & Courtman-Stock 1976).

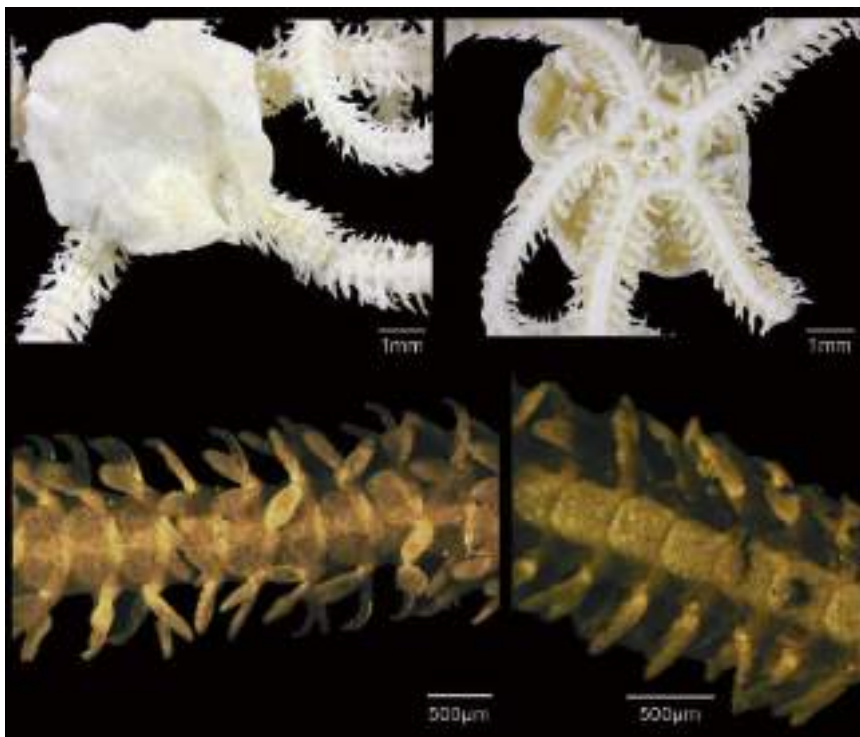
**Distribution and habitat** – South Africa: Cape Town (WC) to Mtunzini (KZN); depth range: 0-110 m. Habitat: sand, shell, shingle, gravel, mud and rock.

<sup>3</sup> Both Clark (1974) and Clark & Courtman-Stock (1976) noted that the outer papilla may not be a true papilla but rather a calcified extension of the rim of the second oral tentacle pore.

**Remarks** – Endemic to South Africa. The type material in Iziko South African Museum (SAMC A23228) is labelled as a ‘cotype’. The type locality is Gordon’s Bay, depth 36 m.



**Fig. 236.** Distribution of *Amphiura (Amphiura) simonsi* in South Africa.



**Fig. 237.** Dorsal disc (top left), ventral disc (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Amphiura (Amphiura) simonsi* (SAMC A084236).

***Amphiura (Amphiura) uncinata* Koehler, 1904**

*Amphiura uncinata* Koehler, 1904a: 76-77, pl. 14, figs 3, 4; Koehler 1922b: 160, pl. 65, fig. 6-8, pl. 96, fig. 4; Mortensen 1933a: 358-359, figs 65, 66; Clark H.L. 1939: 58.

*Amphiura (Amphiura) uncinata*: Clark & Courtman-Stock 1976: 103, 115, 158, fig. 125.

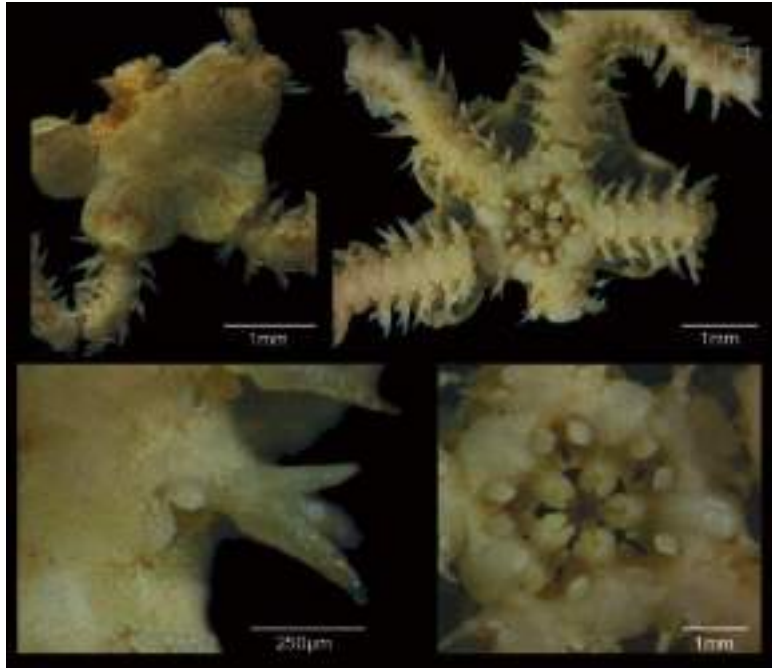
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 11 mm, D.D./A.L. = 1/10. Dorsal disc with moderately large, coarse plates, primary rosette distinct with plates in between. Ventral interradiial area scaled distally with scattered plates proximally. Radial shields large, long and narrow, more than half disc radius, tapering proximally, separated by rows of irregular plates, approximating distally. Oral shields spearhead-shaped to triangular, longer than wide. Adoral shields contiguous, triangular. Distal oral papilla single, short, broad, semi-circular or conical. Infradental papillae paired, moderately broad, pointed, wide diastema between infradentals and oral papillae. Arms long. Dorsal arm plates broad fan-shaped with rounded distal edge, wider than long, contiguous. Ventral arm plates pentagonal to almost fan-shaped, narrowly contiguous. Arm spines up to six basally, pointed, middle spines hyaline and curved with hooked tip, distally some spines not curved. Tentacle scales two, moderate in size.

**Distribution and habitat** – Zanzibar, South Arabian Coast, East Indies, Java, Philippines, Kei Islands (Clark H.L. 1939), South Africa: Durban (KZN) to Umhlanga (KZN); depth range: 100-1415 m. Habitat: sandy and green mud.

**Remarks** – Type material whereabouts unknown, type locality is East of Java, East Indies, depth 250-350 m.



**Fig. 238.** Distribution of *Amphiura (Amphiura) uncinata* in South Africa.



**Fig. 239.** Dorsal disc (top left), ventral disc (top right), arm spines (bottom left), jaws (bottom right) view of *Amphiura* (*Amphiura*) *uncinata* (SAMC A23229).

### Genus *Ophiodaphne* Koehler, 1930

**Diagnosis** – Adapted from Tominaga *et al.* (2004) and Parameswaran *et al.* (2013). A sexually dimorphic genus, male dwarfed and attached to larger female mouth-to-mouth with alternating arms. The female oral structure is indented to accommodate the smaller male. Infradental papillae paired. Oral papillae fused, sometimes forming a serrated flange. Oral shields smaller than adoral shields. All known species are epizoic on other echinoderms.

### *Ophiodaphne scripta* (Koehler, 1904)

*Amphiura scripta* Koehler, 1904b: 70-71, figs 23, 24.

*Amphilycus androphorus* Mortensen, 1933b: 185-188, figs 4-6; Tortonese 1936: 221; Balinsky 1957: 11; Macnae & Kalk 1962: 115, 118; Balinsky 1969: 99, 106, 129.

*Amphilycus scripta*: Clark 1967: 41, fig. 2a, c; Clark & Rowe 1971: 103, fig. 32a, c; Clark & Courtman-Stock 1976: 102, 114, 147, fig. 124; Vine 1986: 195; Liao & Clark 1995: 182, fig. 82.

*Ophiodaphne scripta*: Cherbonnier & Guille 1978: 128-130, fig. 58; Parameswaran *et al.* 2013: 333-339, figs 1, 2, 4.

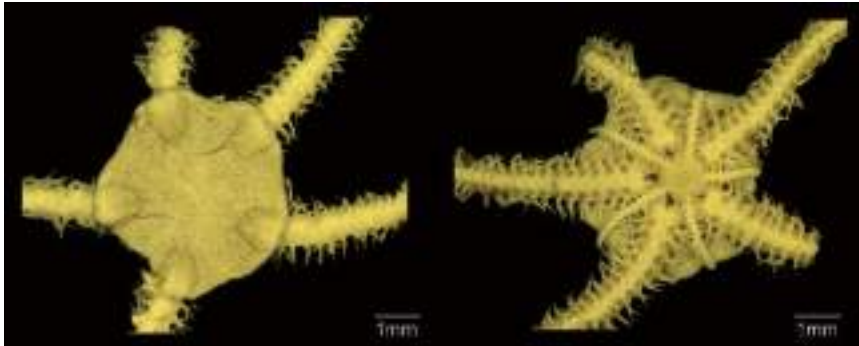
**Diagnosis** – Adapted from Cherbonnier & Guille (1978) and Parameswaran *et al.* (2013). D.D. up to 4 mm (female), up to 1 mm (male). Sexually dimorphic, male dwarfed, attached to underside of female. Female with distinct grooves on ventral side with the whole jaw structure indented. Disc round to pentagonal, dorsal disc plates moderately coarse, primary rosette moderately distinguishable, centre plate present and conspicuous, rows of slightly larger dorsal disc plates in interradial areas, matching where male places his arms, these plates approximately same size as primary rosette plates. Radial shields naked, D-Shaped, moderate in size, just less than half disc radius, contiguous for entire length except proximal-most parts, where small triangular disc scale present. Ventral interradial areas scaled and unarmed. Oral shields diamond-shaped, small. Adoral shields large, contiguous. Infradental papillae more or less symmetrical. Oral papillae none, but long, continuous, serrated flange along oral plate. Genital slits reach disc margin, genital papillae absent. Dorsal arm plates elliptical, with slight lobe distally, narrowly contiguous. Lateral arm plates almost touching dorsally. Ventral arm plates square, very slight distal notch, contiguous. Arm spines five, cylindrical, tapering, slightly longer than segment length, but may be up to twice segment length, some with double or triple hooks at their bases directed proximally. Tentacle scale one, large. Male: identical to female except smaller in size, dorsal disc with primary rosette of five plates and central plate, no indentation of jaws and dorsal arm plates fan-shaped. Colour in life, disc grey or pale lavender-blue, distal edges of radial shields white, arm plates variegated with purple-red, grey and white, arm spines glassy or colourless (Clark 1938).

**Distribution and habitat** – Mozambique, Madagascar, Red Sea, Persian Gulf and India (Mortensen 1933b; Cherbonnier & Guille 1978; Parameswaran *et al.* 2013), South Africa: Sodwana Bay (KZN) to Kosi Bay (KZN); depth range: 0-78 m. Habitat: sand, found on the underside of the cake urchins *Echinodiscus auritus* and *E. bisperforatus*.



**Fig. 240.** Distribution of *Ophiodaphne scripta* in South Africa.

**Remarks** – The southern-most record for southern Africa from Clark & Courtman-Stock (1976) was the degree square (26/33) which overlaps the border between South Africa and Mozambique and perhaps represents the first record for South Africa. However, the two specimens examined during this study, were collected in 1999 together with their dwarfed males from Sodwana Bay and are now housed at Royal Museum for Central Africa in Belgium. The type material was assumed to be in the Muséum national d'Histoire naturelle in Paris (MNHN) but it was not located, type locality is Oman, depth unknown.



**Fig. 241.** Dorsal (left) and ventral (right) views of *Ophiodaphne scripta*, together with dwarf male attached (RMCA MT2311).

### Genus *Ophionephthys* Lütken, 1869

**Diagnosis** – Adapted from Lyman (1882) and Lütken (1869). Disc small and naked except at radial shields and on margin. Arms long, slender. Oral papillae 2-6. Arm spines 4-5, small. Genital slits two, small.

### *Ophionephthys lowelli* Clark, 1974

*Ophionephthys lowelli* Clark, 1974: 462-464, fig. 10a-e; Clark & Courtman-Stock 1976: 103, 116-117, 159-160; Mbongwa 2013: 15; Olbers *et al.* 2015: 93, pl. 3A, B.

**Diagnosis** – Adapted from Clark (1974) and Clark & Courtman-Stock (1976). D.D. up to 8 mm, D.D./A.L. = 1/10. Disc round, in all specimens on hand, dorsal disc 'lid' missing. Oral shields variable, as wide or wider than long, triangular with broadly rounded angles, widest proximally or rhombic with proximal lobe flattened. Adoral shields triangular, widely separated interradially, with broad distal lobe contiguous with lateral arm shield. Jaws slightly sunken, with two large, broad infradental oral papillae, appearing in preserved specimens to be apical papillae. Two spiniform, rugose-tipped oral papillae, one shorter than the other and both attached to oral plate and in series with infradental papillae. Oral tentacle scale distinct, short and



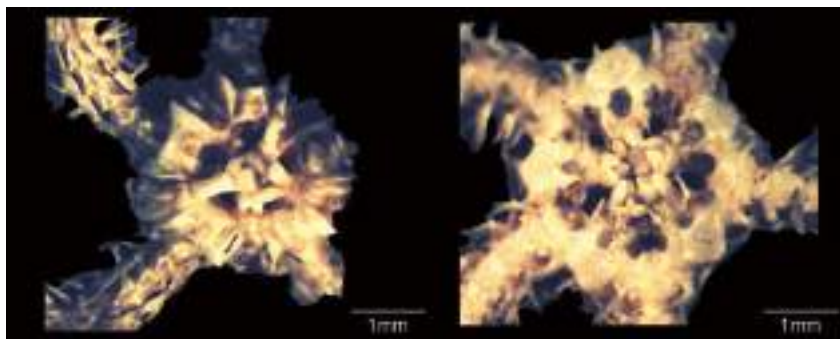
sharp, situated close to teeth. No genital papillae, genital slits small and indistinct. Arms long, first 7-9 dorsal arm plates rudimentary, showing underlying structure, plates becoming whole, square or slightly longer than wide, with rounded edges slightly convex on distal side and concave on proximal side, broadly contiguous. Ventral arm plates identical in shape, convex distally, overlapping each other, longer than wide. Arm spines 4-5, lowest one thick, blunt, approximately segment length, remaining spines slightly shorter and tapering but blunt, covering not smooth, slightly rough. Tentacle scale single, oval, longer than wide, c. half segment length.

**Distribution and habitat** – South Africa: East London (EC) to Sodwana Bay (KZN); depth range: 0-55 m. Habitat: found in brown sand, shell, mud and coral sand.

**Remarks** – Endemic to South Africa. Olbers *et al.* (2015) suggested that a neotype be designated, as the holotype had disintegrated in the jar. The type material is in Iziko South African Museum (holotype: SAMC A22782; paratype: SAMC A22781). Type locality East London, depth 51 m.



**Fig. 242.** Distribution of *Ophionephthys lowelli* in South Africa.



**Fig. 243.** Dorsal (left) and ventral (right) views of *Ophionephthys lowelli* (SAMC A22781).

#### 4.6.7. Family AMPHILEPIDIDAE Matsumoto, 1915

Genus *Amphilepis* Ljungman, 1867

**Diagnosis** – Adapted from Ljungman (1867) and Lyman (1882). Disc flat, large, with naked overlapping scales, radial shields large. Teeth large, no dental papillae. Oral papillae small, unequal, scale-like. Arms flattened, slender. Arm spines usually three, short, tapering. Genital slits single.

*Amphilepis scutata* Mortensen, 1933

*Amphilepis scutata* Mortensen, 1933a: 372-373, fig. 76; Clark 1974: 464; Clark & Courtman-Stock 1976: 103, 119, 146-147, fig. 155; Clark 1977: 135.

**Diagnosis** – Adapted from Mortensen (1933a). D.D. up to 6 mm. Disc round, flat, disc plates moderate in size, overlapping, primary rosette and central plates distinct. Radial shields moderately large, triangular, c. half disc radius, approximating distally but not contiguous, separated by elongated, triangular plates. Ventral interradiar area covered in smaller, overlapping plates. Oral shields moderately large, triangular with rounded edges. Adoral shields contiguous. Oral papillae two, distalmost elongated and much longer than proximal-most. Teeth triangular and long. Genital plates large, thin. Arms moderately long, thin. Dorsal arm plates semi-circular with straight edge on distal edge, wider than long, not contiguous, appear restricted at vertebrae joints. Ventral arm plates bell-shaped, rounded on distal side, pointed on proximal side, longer than wide, not contiguous, restricted at tentacle pores. Arm spines three, slender, pointed, middle spine slightly longer. Tentacle pores large, tentacle scales absent.

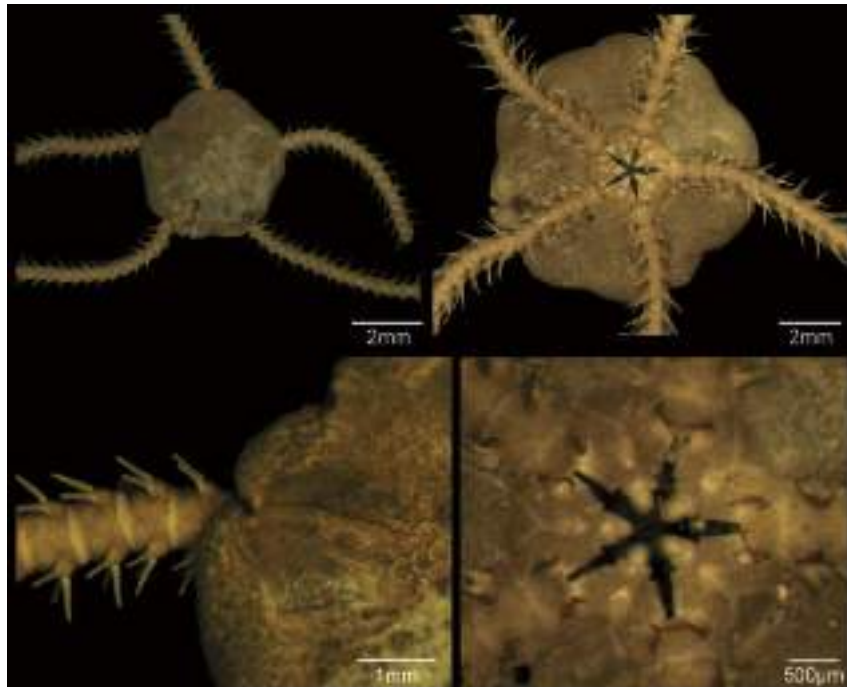
**Distribution and habitat** – South Africa: off Duyker Eiland (WC) to Black Rock (KZN); depth range: 175-810 m. Habitat: sandy mud, with polychaetes.



**Fig. 244.** Distribution of *Amphilepis scutata* in South Africa.

**Remarks** – Endemic to South Africa. Cherbonnier & Guille (1978) synonymised *Amphilepis scutata* with *Amphilepis mobilis* Koehler 1904. The drawings of *A. mobilis* in Koehler (1904) and Cherbonnier & Guille (1978) are quite different from the specimens examined and the drawings of *A. scutata* in Mortensen 1933a. The drawings of *A. mobilis* have round disc plates separating the radial shields, an indistinct primary rosette and lack a central disc scale. In *A. scutata*, radial shields approximate distally and the separating plates are triangular. The primary rosette and central disc scale are distinct. Therefore, *A. scutata* and *A. mobilis* are considered to be separate species here.

A specimen of *A. scutata* was dredged at 440 m offshore of Duyker Eiland on the west coast of South Africa. Although this is the most modern record of this species (2007), it is a peculiar distribution record, because other specimens were found in subtropical waters in KZN. The holotype is in Natural History Museum of Denmark (ZMUC OPH-264) and the type locality is off Durban, depth 411 m.



**Fig. 245.** Dorsal whole (top left), ventral disc (top right), radial shields and basal arms (bottom left), jaws (bottom right) views of *Amphilepis scutata* (SAMC A073834).

#### 4.6.8. Family OPHIOTHAMNIDAE O'Hara *et al.*, 2018

Genus *Ophiothamnus* Lyman, 1869

**Diagnosis** – Adapted from Lyman (1869) and Lyman (1882). Disc tumid and overlying arm bases covered with large plates, scattered with fine thorns or spines. Radial shields naked, large, wide and contiguous for most of their length. Adoral shields long and stout, contiguous, extending outside oral shields, creating a raised pentagon. Teeth present. Oral papillae stout, closely packed. Lateral arm plates meeting dorsally and ventrally. Arm spines numerous (up to eight), serrated, may meet on dorsal midline. Genital slits begin close to oral shields.

*Ophiothamnus remotus* Lyman, 1878

*Ophiothamnus remotus* Lyman, 1878: 149-150, pl. 8, figs 201-203, Studer 1882: 24; Lyman 1882: 212-213, pl. 14, figs 1-3; Bell 1905: 258; Clark 1923: 324-325; Mortensen 1933a: 327-330, figs 46, 47a; Clark & Courtman-Stock 1976: 105, 121, 170-171, fig. 171.

*Ophiothamnus remotus* var. *cordatus* Mortensen, 1933a: 330-331, fig. 47b. Clark 1977: 135.

**Diagnosis** – Adapted from Lyman (1878) and Mortensen (1933a). D.D. up to 3.5 mm. A.L. up to 12 mm, D.D./A.L. = 1/3-4. Disc tumid, dorsally covered with plates and scattered, tapering spines. Radial shields large, triangular, inner sides convex, more than half disc radius, contiguous for more than half their length. Ventral interradiation areas almost not existent as deeply constricted. Oral shields small, triangular or heart-shaped, distal side may be slightly convex or concave. Adoral shields large, broadly contiguous. Oral papillae three, distalmost broad and opercular. Genital slits short. Dorsal arm plates triangular, with rounded corners, wider than long, not contiguous. Ventral arm plates pentagonal, not contiguous. Lateral arm plates meeting dorsally and ventrally. Arm spines seven, slender, smooth or finely serrated, pointed, only two uppermost spines exceeding segment



**Fig. 246.** Distribution of *Ophiothamnus remotus* in South Africa.

length. Tentacle pores small. Tentacle scales small, single, pointed. Colour in life orange.

**Distribution and habitat** – South Africa: Jakkelshoek (NC) to Black Rock (KZN); depth range: 88-900 m. Habitat: rock, sand, stones, mud and gravel.

**Remarks** – Endemic to South Africa. Studer (1882) erroneously recorded this species at 34°13'S; 18°0'W (mid Atlantic Ocean) but Mortensen (1933a) believed this was an error and it should have read 34°13'S; 18°00'E, which places it off the Cape of Good Hope. The type material is in the Natural History Museum of Denmark (syntype: ZMUC OPH-76) and the type locality is Agulhas Bank, depth 275 m.



**Fig. 247.** Dorsal (left) and ventral (right) views of *Ophiothamnus remotus* (SAMC A073875).

### Genus *Histampica* A.M. Clark, 1970

**Diagnosis** – Adapted from Clark (1970). Disc covered with overlapping plates, armament absent. Radial shields moderately large. Oral papillae 4-5 on either side of each jaw, unequal in size, arranged almost in a continuous series. Teeth triangular, with pointed ends. Dental papillae absent. Oral shields large. Adoral shields long and slender. Tentacle scales two.

### *Histampica duplicata* (Lyman, 1875)

*Amphiura duplicata* Lyman, 1875: 19-20, fig. 87, pl. 5, fig. 78; Lyman 1882: 136, pl. 17, figs 10-12; Lyman 1879: 31-32; Koehler 1896a: 244; Koehler 1896b: 208.

*Amphiura partita* Koehler, 1897, 336-337, pl. 7, figs 50, 51.

*Ophiactis duplicata*: Lütken & Mortensen 1899: 142-143; Koehler 1909: 171; Koehler 1914a: 40-41.

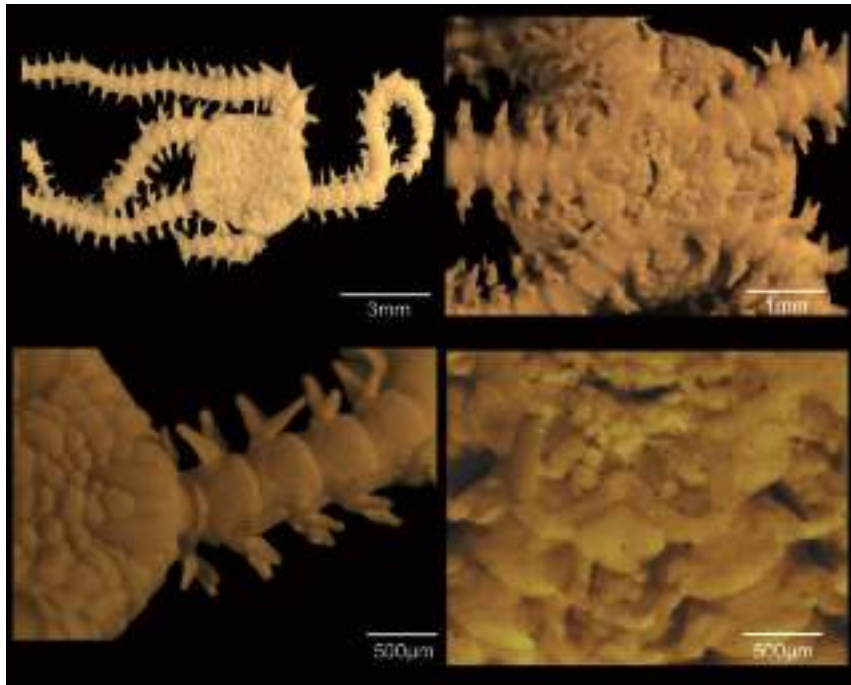
*Amphiactis duplicata* Matsumoto 1915: 66-67; Matsumoto 1917: 146-147; Koehler 1922b: 204-205, pl. 63, figs 1-4; Mortensen 1927: 198.

*Histampica duplicata*: Clark 1970: 73-74; Clark 1977: 142; Paterson 1985: 80, fig. 32.

**Diagnosis** – Adapted from Paterson (1985). D.D. up to 9 mm, D.D./A.L. = c.1/4. Disc round, covered with large, thick overlapping plates. Central plate and primary rosette distinct, primary plates may have knobs in centre. Radial shields twice as long as wide, nearly half disc radius, separated by wedge of plates. Ventral interradiar areas covered in plates slightly smaller than those on dorsal side. Oral shields diamond-shaped, rounded distally, equally long as broad. Adoral shields



**Fig. 248.** Distribution of *Histampica duplicata* in South Africa.



**Fig. 249.** Dorsal whole (top left), ventral disc (top right), radial shields and basal arms (bottom left), jaws (bottom right) views of *Histampica duplicata* (SAMC A22947).

large, separating oral shield from first lateral arm plates, contiguous. Single large tricuspid apical papillae, 3-5 rounded oral papillae. Oral tentacle scale may be superficial and fall into series with oral papilla. Arms moderately long, able to coil. Dorsal arm plates fan-shaped, wider than long, contiguous basally. Ventral arm plates fan- or axe-shaped, may be indented laterally, sometimes contiguous basally. Arm spines three, flattened, conical, middle spine largest, c. same length as segment. Tentacle scales two, large, rounded or slightly elliptical.

**Distribution and habitat** – West Indies, Bay of Biscay to North Africa, east Pacific off Columbia to Ecuador (Paterson 1985), South Africa: North of Richard's Bay (KZN) to Island Rock (KZN); depth range: 125-2870 m. Habitat: no information available.

**Remarks** – The syntypes are in the Museum of Comparative Zoology (MCZ OPH-4092, MCZ OPH-1262 and MCZ OPH-1263) and the type locality is Barbados, depth 183 m.

#### 4.6.9. Family OPHIACTIDAE Matsumoto, 1915

##### Genus *Ophiactis* Lütken, 1856

**Diagnosis** – Adapted from Mortensen (1927). Disc scaling coarse, primary rosette often distinct. Plates with scattered spinelets or granules. Infradental papillae on apex of jaws, one or two distal oral papillae. Arm spines short.

##### *Ophiactis abyssicola* (Sars, 1861)

*Amphiura abyssicola* Sars, 1861: 18-21, pl. 2, figs 7-12.

*Ophiactis abyssicola*: Ljungman 1867: 324; Lyman 1882: 122; Clark 1918: 304-305;

Clark 1923: 334-335; Mortensen 1927: 202-203, fig. 114, Mortensen 1933a: 347;

Clark & Courtman-Stock 1976: 104, 119, 161; Rodrigues *et al.* 2011: 11, fig. 6.

*Ophiactis poa* Lyman, 1879: 40; Lyman 1882: 119.

*Ophiactis corallicola* Koehler, 1895: 460-461, fig. 5.

*Ophiactis echinata* Koehler, 1898a: 48-49, pl. 5, figs 15, 16.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 8 mm, D.D./A.L. = 1/3-8. Disc round, dorsal disc plates overlapping, primary rosette distinct, scattered conical spines on disc, concentrated on margin. Radial shields c. half to slightly more than disc radius in length, naked, D-shaped, large, separated by one or two rows of scales, approximate distally, not contiguous. Ventral interradiar area with finer plates than dorsal, some scattered spines. Oral shields fan-, bell- or diamond-shaped, wider than long, adoral shields broadly contiguous. Apical papillae single, large, round. Distal oral papillae two, large, distalmost slightly larger. Arms five, simple, moniliform distally. Dorsal arm plates diamond-shaped, twice as wide as long, not contiguous distally. Ventral arm plates pentagonal or fan shaped, either rounded distal edge, or with concave notch. Lateral arm plates meeting ventrally on distal arms only. Arm spines 3-4, erect, pointed or blunt, cylindrical, middle spine longest, half to two times longer than segment. Genital papillae absent. Tentacle

scale one, large, oval. Colour in life orange with light purple-orange disc, grey, brown and some specimens with a pinkish tinge (Clark 1923).

**Distribution and habitat** – Atlantic Ocean to South Africa and across to the SW Indian Ocean Ridge (Mortensen 1927; O'Hara *et al.* 2014), South Africa: off Cape Columbine (NC) to off Still Bay (WC); depth range: 167-2743 m. Specimens from Australia and New Zealand are a distinct species *Ophiactis cuspidata* (see O'Hara *et al.* 2014). Habitat: green sand and mud.



Fig. 250. Distribution of *Ophiactis abyssicola* in South Africa.

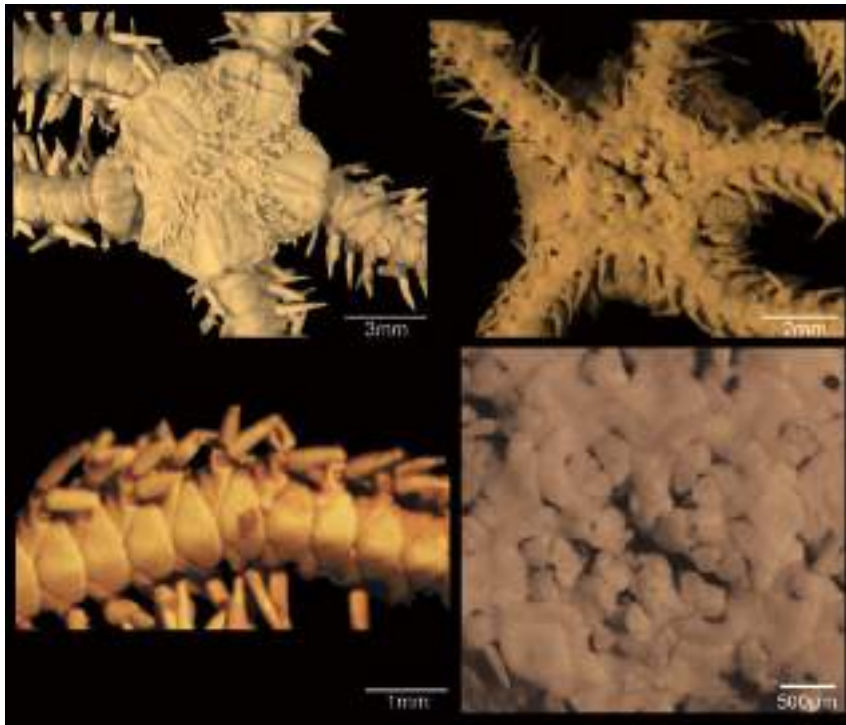


Fig. 251. Dorsal disc (top left; SAMC A23238), ventral disc (top right; SAMC A23333), arm spines and dorsal arms (bottom left; SAMC A23238), jaws (bottom right; SAMC A23333) views of *Ophiactis abyssicola*.



**Remarks** – The type material is in the Museum of Comparative Zoology (syntypes: MCZ OPH-1161 and MCZ OPH-1188), type locality is Norway (Clark & Courtman-Stock 1976), depth unknown. O'Hara *et al.* (2014) found that South African populations were genetically similar to those from the North Atlantic, and distinct from those across southern Australia and New Zealand.

### ***Ophiactis carnea*** Ljungman, 1867

*Ophiactis carnea* Ljungman, 1867: 324-325; Lyman 1882: 120; Clark 1923: 332-333, pl. 20, figs 3, 4; Mortensen 1933a: 342-345, figs 54-56; Stephenson *et al.* 1937: 380; Eyre & Stephenson 1938: 39; Clark H.L. 1939: 76; Clark A.M. 1952: 199; Balinsky 1957: 11-12; Kalk 1958: 197, 200, 215, 237; Morgans 1959: 414, 422; 1962: 303; Macnae & Kalk 1962: 114; Balinsky 1969: 106, 129; Day *et al.* 1970: 81; Clark & Rowe 1971: 82, 104, fig. 31e; Clark & Courtman-Stock 1976: 104, 119, 161, fig. 165; Clark 1980: 548, 549; Vine 1986: 195; Olbers *et al.* 2014: 16, pl. 3A; Mbongwa 2013: 15.

*Ophiactis africana* Koehler, 1911: 17-19, pl. 3, figs 4, 5.

*Ophiactis africana capensis*: Hertz 1927b: 6.

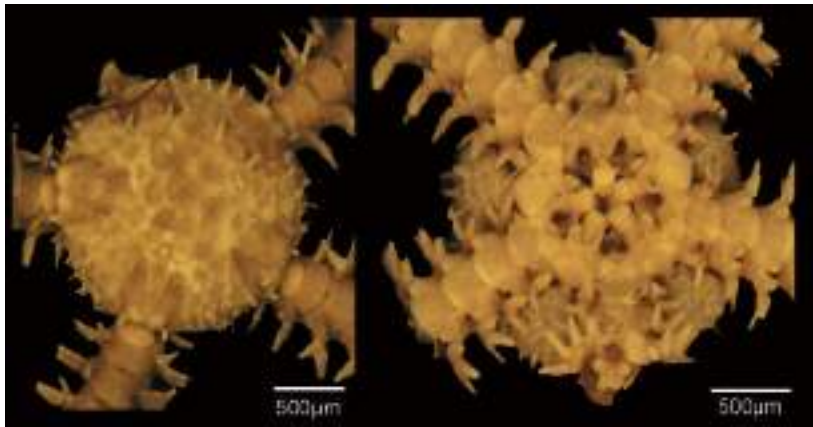
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 6 mm, D.D./A.L. = 1/5-6. Arms five, simple. Disc round, dorsal disc plates thin and overlapping, primary rosette not distinct, sometimes dark spot in centre of disc visible, scattered spines close to disc margin, may be absent. Radial shields elongated D-shaped, moderate in size, single disc scale separating them, touching distally, length half to one-third disc radius. Ventral interradial area covered in plates, no spines. Oral shields diamond-shaped, adoral shields broadly contiguous. Distal oral papillae single, large, round and flattened. Dorsal arm plates broadly rhombic, broadly contiguous, becoming fan-shaped, as long as wide. Ventral arm plates fan-shaped or octagonal, distal ends becoming rounded. Arm spines 3-5, uppermost arm spines thin and tapering, middle spine longest, blunt, lowest spine stubby and short. Longest arm spine slightly longer than length of segment, shortest spine shorter than segment. Tentacle scale one, large, oval. Colour in life reddish brown to brown, with white patches.

**Distribution and habitat** – Mozambique, tropical Indo-Pacific, Red Sea, South East Arabia, Persian Gulf (Kalk 1958; Clark & Rowe 1971; Vine 1986), South Africa: Cape Town (WC) to Cape St Lucia (KZN); depth range: 0-220 m (Clark & Courtman-Stock 1976). Habitat: coral reefs, *Cymodocea* beds, rock, sand and shell.

**Remarks** – Some specimens at hand had light patches on the distal portions of the radial shields, similar to *Ophiactis savignyi* and *O. picteti*, but easily distinguished from those two species by the single oral papillae on each side of the jaw. The syntypes are in the Swedish Museum of Natural History (SMNH-Type-1422) and the type locality is Port Natal (Durban), depth unknown.



**Fig. 252.** Distribution of *Ophiactis carnea* in South Africa.



**Fig. 253.** Dorsal (left) and ventral (right) views of *Ophiactis carnea* (DNSM ECH21B).

### ***Ophiactis nidarosiensis* Mortensen, 1920**

*Ophiactis nidarosiensis* Mortensen, 1920: 60-63, fig. 5; Mortensen 1927: 200, fig. 111; Mortensen 1933a: 346-347, fig. 58a; Clark & Courtman-Stock 1976: 163; Alva & Vadon 1989: 829, 839, fig. 5c, d.

**Diagnosis** – Adapted from Mortensen (1920) and Clark & Courtman-Stock (1976). D.D. up to 3.5 mm, D.D./A.L. = 1/5-6. Disc covered in coarse plates and sparsely scattered short spines, primary rosette not distinct. Radial shields c. half disc radius, not contiguous, separated by 2-3 plates. Ventral interradiar areas with more delicate plates, usually with no spines. Fissiparous, arms usually six but sometimes five or seven. Dorsal arm plates fan-shaped, broadly in contact, longer than wide. Ventral arm plates pentagonal, distal edge convex, longer than wide, proximal edge narrow, truncated and/or convex. Lateral arm plates prominent. Oral shields

rhombic, as long as wide. Adoral shields large, contiguous. Distal oral papillae two, sometimes one. Arm spines up to four, upper spine in larger specimens longer, smoother and thinner, three lower spines equal in size, finely serrated, erect, about equal to segment length. Tentacle scales one, round.

**Distribution and habitat** – Namibia, North Atlantic (Alva & Vadon 1989), South Africa: off Orange River mouth (NC); depth range: 175-307 m. Habitat: no information available.

**Remarks** – Mortensen (1933a) remarked that *Ophiactis nidarosiensis* is very similar to *O. savignyi* and *O. plana* because they are also fissiparous. He suggested that the most reliable character for differentiation is the shape of the dorsal arm plates, which are narrow fan-shaped, broadly in contact and longer than wide, whereas in *O. plana* they are fan-shaped, barely contiguous proximally, separated distally and wider than long and in *O. savignyi* oval to elliptical, twice as wide as long and rounded distally.



Fig. 254. Distribution of *Ophiactis nidarosiensis* in South Africa.



Fig. 255. Dorsal (left) and an atypical 5-armed ventral (right) views *Ophiactis nidarosiensis* (ZMUC OPH-216).

No specimens were available for examination. Clark & Courtman-Stock (1976) and Mortensen (1933a) reported *O. nidarosiensis* to occur in southern Africa, but gave no details of distribution or specimens. Later, Alva & Vadon (1989) reported specimens to have been collected by the Instituto de Ciencias de Mar in Namibia, one specimen was collected on the Namibia / South African border off the Orange River at 307m. The syntypes are in the Natural History Museum of Denmark (ZMUC OPH-322, ZMUC OPH-323, ZMUC OPH-324 and ZMUC OPH-216) and the Museum of Comparative Zoology (MCZ OPH 4781). Type locality is Norway, depth unknown.

### ***Ophiactis cf. picteti*** (de Loriol, 1893)

*Ophiocnida picteti* de Loriol, 1893b: 405-407, pl. 13, fig. 2.

*Ophiactis picteti*: Clark 1915a: 267; Clark & Rowe 1971: 82,104; Cherbonnier & Guille 1978: 123-125, fig. 56; Sloan *et al.* 1979: 101-102; Humpreys 1981: 10, 21; Liao & Clark 1995: 216; Milne 2012: 155; Olbers *et al.* 2015: 95, pl. 3C, D.

*Ophiactis sinensis* Mortensen, 1934: 11, figs 7-9, pl. 1, fig. 3.

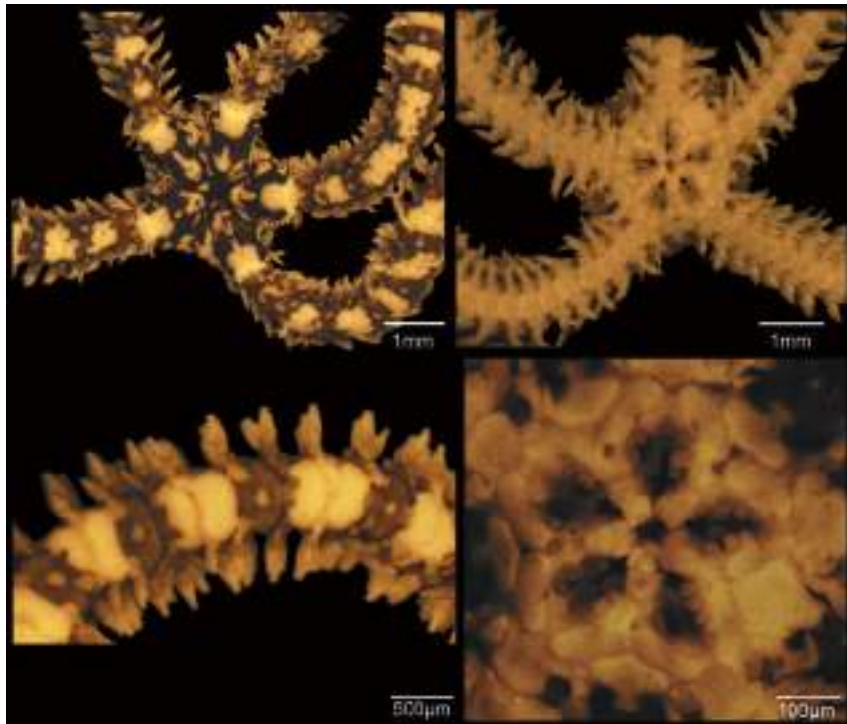
**Diagnosis** – Adapted from Cherbonnier & Guille (1978). D.D. up to 6 mm, D.D./A.L. = 1/9. Disc round, dorsally covered with overlapping plates, many conical small spinelets mainly in interradial areas and on margin. Ventral interradial areas with finer plates, scattered conical spines. Arms five, long, simple. Radial shields elongated, narrow triangular, length at least two-thirds disc radius, each pair separated by four enlarged plates, distally approximating or contiguous, light patch on distal part of each radial shield. Genital slits ending at edge of disc, no distinct plates, genital papillae absent. Oral shields spearhead-shaped or oval, slightly wider than long, may be truncated on distal side. Adoral shields contiguous interradially. Distal oral papillae 2-3. Up to seven arm spines (usually six), short, longest less than twice segment length, tapering to blunt tips, three uppermost ones stout, conical and rugose, remaining spines elongated and decreasing in size toward ventral side. Dorsal arm plates oval, becoming elliptical, wider than long, distal edge convex, broadly contiguous. Ventral arm plates hexagonal, edges rounded in proximal part of arm, becoming flat-truncated on both sides, slightly wider than long. Single tentacle scale large, round. Colour in life, disc and arms brown with white, marbled, arms banded sometimes with dark spots, ventrally arms white, spinelets white.

**Distribution and habitat** – Madagascar, Tanzania, Kenya, East Indies, Indo-Malayan region, Australia (Clark & Rowe 1971; Cherbonnier & Guille 1978; Humpreys 1981; Rowe & Gates 1995), South Africa: Trafalgar (KZN) to Sodwana Bay (KZN); depth range: 0-50 m. Habitat: coral patches and coral reef flats.

**Remarks** – According to Olbers *et al.* (2015) this was a new record for South Africa. They also confirmed that South African specimens of *O. picteti* have a narrow median distal lobe on the oral shields, as suggested by Sloan *et al.* (1979) for Indian Ocean specimens. A closely related species *O. hemiteles* H.L. Clark, 1915 occurs in the east Indo-West Pacific waters.



**Fig. 256.** Distribution of *Ophiactis cf. picteti* in South Africa.



**Fig. 257.** Dorsal whole (top left), ventral whole (top right), dorsal arms (bottom left), jaws (bottom right) views of *Ophiactis cf. picteti* (SAMC A74065).

## ***Ophiactis plana*** Lyman, 1869

*Ophiactis plana* Lyman, 1869: 330-331; Clark 1915a: 264; Clark 1923: 333; Mortensen 1933a: 345-346, fig. 57; Clark H.L. 1939: 76-77; Day & Morgans 1956: 308; Clark 1974: 464-465; Olbers *et al.* 2014: 16, pl. 3B.

**Diagnosis** – Adapted from Mortensen (1933a). D.D. up to 4 mm, D.D./A.L. = 1/3-4. Disc covered with moderately coarse, thin, overlapping plates, may have spines. Interradial areas with finer plates. Radial shields relatively small, D-shaped, less than half disc radius, not contiguous. Oral shields rhombic or rounded triangular, almost circular, as long as wide. Adoral shields may be contiguous. Distal oral papillae one, large, triangular, apical tooth present. Arms simple, usually six, fissiparous species. Dorsal arm plates broad fan-shaped, barely contiguous proximally, separated distally, wider than long. Ventral arm plates truncated pentagonal, distal edge straight or slightly concave. Arm spines up to four, stout, smooth, tapering to blunt tips, shorter than segment length. Tentacle scale one, large, round or oblong. Colour variable, green and reddish in different shades.

**Distribution and habitat** – Mozambique, Red Sea, Gulf of Aden, North Carolina, Gulf of Mexico, Bermuda (Clark 1915a; Clark H.L. 1939; Felder & Camp 2015), South Africa: Cape Town (WC) to Tugela River (KZN); depth range: 0-412 m. Habitat: rock, shell, mud, sand, coral and stones.

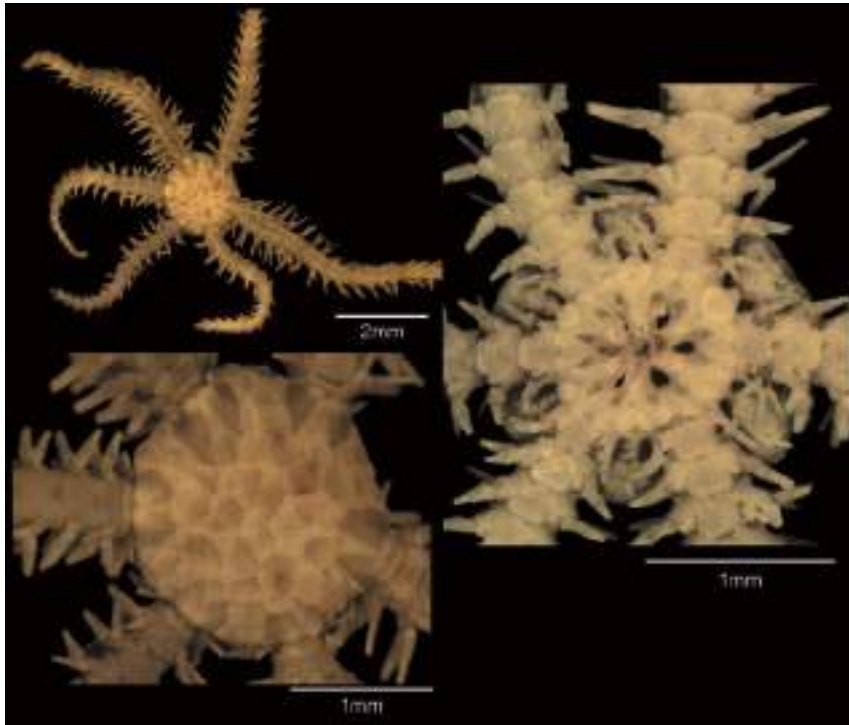
**Remarks** – Even though *Ophiactis flexuosa* only has five arms, Clark (1974) suggested that *O. lymani* Ljungman, 1872 and *O. flexuosa* be synonymised with *O. plana*, while according to Mortensen (1933a) and H.L. Clark (1946), *O. profundus* Lütken & Mortensen, 1899 and *O. plana* may be also be synonyms (Rowe & Gates 1995). In addition, various authors have commented on the similarities of various features among ophiactid species (Lyman 1882; Mortensen 1933a; Madsen 1970). According to Tim O'Hara (pers. comm.), a global phylogeography of this species is required because tropical specimens in the south west Pacific are a separate clade from those in the southern Ocean (including Tasmania and the South west



**Fig. 258.** Distribution of *Ophiactis plana* in South Africa.

Indian Ocean Ridge). Given that *O. plana* was originally from the Caribbean, the correct identity of any South African specimens is therefore unclear at present.

The type material is in the Museum of Comparative Zoology (Holotype MCZ OPH-1184, paratypes MCZ OPH-1185, MCZ OPH-1242 and MCZ OPH-4632). Type locality is off Carysfort Reef, Florida, depth 210 m.



**Fig. 259.** Dorsal whole (left top), ventral disc (right) and dorsal disc (bottom left) views of *Ophiactis plana* (DNSM ECH23B).

### ***Ophiactis savignyi* (Müller & Troschel, 1842)**

*Ophiolepis savignyi* Müller & Troschel, 1842: 95.

*Ophiactis sexradia* Grube, 1857: 343; de Loriol 1893b: 398-401; Koehler 1898b: 72.

*Ophiolepis sexradia* Grube 1857: 343.

*Ophiactis reinhardtii* Lütken, 1869: 262-264, pl. 3, fig. 7a, b.

*Ophiactis maculosa* von Martens, 1870: 248.

*Ophiactis savignyi*: Lyman 1882: 115; Clark 1932: 204; Clark H.L. 1939: 77; Day & Morgans 1956: 308; Balinsky 1957: 14; Clark & Rowe 1971: 82, 83, 103; Clark & Courtman-Stock 1976: 104, 119, 164, figs 156, 161; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 125-128, fig. 57; Sloan *et al.* 1979: 102;

Marsh 1986: 70; Vine 1986: 195; Sastry 1991: 376, pl. 3, fig. 14; Hendler *et al.* 1995: 148-150, fig. 70; Liao & Clark 1995: 217-218, fig. 110; Pomory 2003: 74-76, fig. 33; Laguarda-Figueras *et al.* 2009: 178, fig. 71; Picker & Griffiths 2011: 76; Milne 2012: 155; Mbongwa 2013: 15.

*Ophiactis conferta* Koehler, 1905a: 25-26, pl. 3, figs 15-17.

*Ophiactis versicolor* Clark H.L., 1939: 81-82, fig. 36.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 5 mm, D.D./A.L. = c.1/7. Arms up to seven, usually six, sometimes three, fissiparous. Disc round, dorsal disc plates armed with scattered spinelets, usually marginal. Radial shields moderately large, naked, elongated triangular or D-shaped, length varies from approximately half to just over disc radius, each pair separated by single row of elongated plates, contiguous distally. Ventral interradial area with thick imbricating plates, sometimes with scattered spines. Oral shields rhombic, longer than wide, adoral shields not always contiguous. Oral papillae two, with apical tooth, tooth may be rubbed off. Genital slits surrounded by larger plates. Dorsal arm plates oval to elliptical, twice as wide as long, rounded distally, with median distal lobe emphasised by two spots, developing after first 2-3 segments. Ventral arm plates hexagonal, wide as long, proximally becoming pentagonal and longer than wide. Arm spines up to six, short, finely serrated, no more than single segment length, stouter proximally, becoming slightly elongated and blunt. Tentacle scale single, large, rounded. Colour in life variable, generally green with green and white markings, arms similarly banded, ventrally lighter, arms banded with green, some specimens with white patch on distal edge of each radial shield.

**Distribution and habitat** – Cosmopolitan (Clark 1915a; Kalk 1958; Hendler *et al.* 1995), South Africa: Umgazana (EC) to Kosi Bay (KZN); depth range: 0-1000 m. Habitat: associated with sponges, sea-grass, rock, coral fragments, coralline algae, fouling communities and intertidal algal turf.

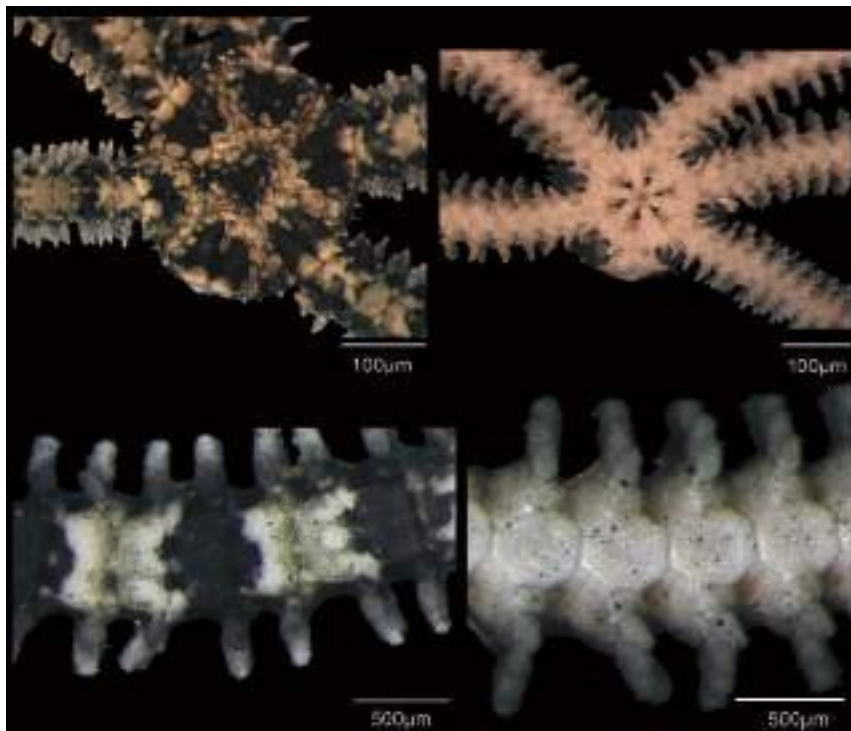
**Remarks** – Abundant in KZN on rocky shores, among turf algae. A well-studied species, known to have variable morphological characters.



**Fig. 260.** Distribution of *Ophiactis savignyi* in South Africa.



High polymorphism (coloration, number of arms, shape of arm plates, radial shields, number of oral papillae and arm spines) in Indo-Pacific species of *Ophiactis* is astounding. The uncertainty of characters and identity of many specimens is documented by many authors (de Loriol 1893b; Clark 1915a; Clark 1923; Mortensen 1933a; Mortensen 1933d; Clark H.L. 1939; Balinsky 1957; Madsen 1970; Clark 1974; Clark & Courtman-Stock 1976; Sloan *et al.* 1979). The Indo-Pacific ophiactids require comprehensive revision, as it is believed that many of the species are in fact the same. In this study, the differences between *O. hemiteles* and *O. picteti* were so minor that it is doubtful both exist in South African waters. Two noteworthy studies, Hendler *et al.* (1995) and Pomory (2007), both reported that specimens may have three oral papillae as opposed to two, as reported here. The type material came from Egypt but their location is unknown.



**Fig. 261.** Dorsal whole (top left), ventral whole (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Ophiactis savignyi* (RMCA MT2259).

#### 4.6.10. Family OPHIOTRICHIDAE Ljungman, 1867

**Diagnosis** – Adapted from Clark (1966) and Clark & Courtman-Stock (1976). D.D./A.L. = 1/10 or more commonly D.D./A.L. = 1/5-8. Disc plates small, juveniles with enlarged central plate. Dorsal disc often covered with armament of thorny stumps, spines or granules or a thick skin, but rarely naked. Radial shields more or less conspicuous, unless covered in armament. Jaw structure consistent in all species, with oral shields broadly rhombic, teeth broad-rectangular with compact cluster of small, rounded tooth papillae on apex, oral papillae absent, leaving the second oral tentacle exposed. Arms stout or slender, sometimes very long, arms usually five, rarely six (only in fissiparous species). Successive dorsal and ventral arm plates usually contiguous, dorsal arm plates reduced in epizoic species. Arm spines more or less serrated and terminally rugose, may be glassy. Tentacle scale usually single and inconspicuous, if any.

#### Genus *Macrophiothrix* H.L. Clark, 1938

**Diagnosis** – Adapted from Clark (1938), Clark (1968), Clark & Courtman-Stock (1976) and Hoggett (1991). Species often exceeding D.D. 20 mm with arms being moderate to long (up to 200 mm), disc soft and puffy with fine scaling covered in low thorny stumps, thorny granules, short spinelets or rugose granules, granules often obscure large radial shields. Oral papillae absent. Arms mostly flexible horizontally, arm segments relatively broad. Dorsal arm plates broad, usually wider than long, hexagonal, trapezoidal, elliptical or fan-shaped, broadly contiguous. Arm spines long, serrated, sometimes smooth basally, glassy or opaque at tip (especially if clavate). Tentacle scales one.

#### *Macrophiothrix demessa* (Lyman, 1862)

*Ophiothrix demessa* Lyman, 1862: 82; Lyman 1865: 172-173; Marktanner-Turneretscher 1887: 310; Brock 1888: 513; Koehler 1905a: 91-92, pl. 9, figs 5, 6; Clark 1915a: 270; Clark 1921: 109; Clark H.L. 1939: 83.

*Ophiothrix mauritiensis* de Loriol, 1893a: 38, pl. 24, fig. 5.

*Ophiothrix coronata* Koehler 1905a: 91, pl. 9, figs 8, 9; Koehler 1922b: 217-218, pl. 40, fig. 5, pl. 41, figs 1-4, pl. 98, fig. 1; Koehler 1930: 137; Vine 1986: 195.

*Amphiothrix demessa*: Clark 1946: 217; Edean 1957: 243; Fell 1960: 24.

*Macrophiothrix mossambica* Balinsky, 1957: 18, fig. 7, pl. 3, figs 11, 12.

*Macrophiothrix demessa*: Clark 1968: 289-291, figs 3e, f, 4h, 5h, 7e; Clark & Rowe 1971: 82, 114, pl. 37f; Devaney 1974: 139-140; Clark & Courtman-Stock 1976: 111, 138, fig. 114; Cherbonnier & Guille 1978: 151-152, pl. 4, figs 1, 2; fig. 61: 7-9; Sloan *et al.* 1979: 102-103; Marsh 1986: 70; Hoggett 1991: 1089-1094, figs 6, 7; Sastry 1991: 374, 377, pl. 3, fig. 16; Liao & Clark 1995: 221-222, figs 112g, 113h, 114h, 115f, 116f; Milne 2012: 155; Olbers *et al.* 2015: 98-99, pl. 4E, F.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 12 mm, arms up to 300 mm, D.D./A.L. = 1/25. Disc

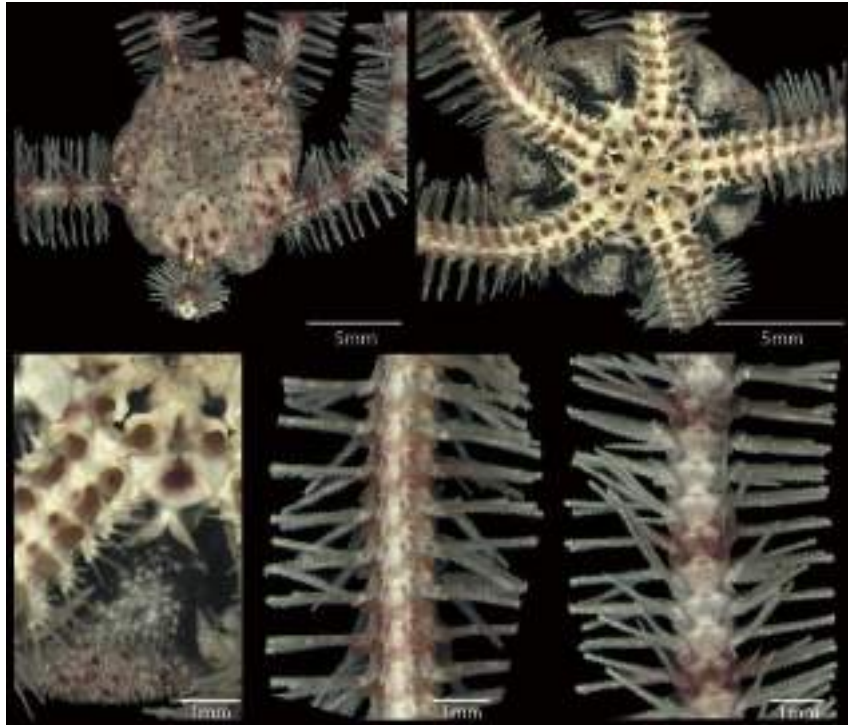
puffy, covered dorsally with long, thorny stumps, 2-6 terminal points, disc ventrally covered with similar stumps, but more scattered and typically with single terminal points. Radial shields triangular, two-thirds length of disc radius, covered with shorter and less numerous stumps than those on disc. Jaws elongated, oral shields broadly triangular, much wider than long. Adoral shields not contiguous. Genital slits half-way to disc margin, genital plate large, adjacent to slit, with disc spinelets not continuing to edge of genital slit. Dorsal arm plates broadly fan-shaped, about twice as wide as long or wider, broadly in contact, armed with small rugose granules or sparse stumps. Ventral arm plates wide, square to fan-shaped, but with rounded proximal edges, as long as wide, sometimes slightly longer than wide, contiguous. Arm spines up to 14, thorny over entire length, glassy, longest spine at least three times segment length, shortest ventrally. Tentacle scale single, triangular. Colour in life, dorsal side of disc greyish with more or less conspicuous dark pink spots, ventrally lighter with less spots. Arms banded purple, pink or red with white dorsally and lighter ventrally, with 2-3 arm segments between bands. One specimen with a white longitudinal band from c. half way down arms.

**Distribution and habitat** – Mozambique, Zanzibar, Red Sea, Mauritius, Seychelles, Maldives, India, China Sea, Philippines, Australia, Hawaiian Islands (Clark & Rowe 1971; Hoggett 1991; Sastry 1991; Rowe & Gates 1995), South Africa: Aliwal Shoal (KZN) to Bhanga Nek (KZN); depth range: 0-128 m. Habitat: concealed in coral, deep rocky crevices, under stones, coarse sand and with *Lithothamnion*.

**Remarks** – Olbers *et al.* (2015) recorded this as a new species to South Africa, although it was previously recorded from Mozambique (Clark & Courtman-Stock 1976). According to Rowe & Gates (1995) the type locality is Hawaiian Islands (recorded as Sandwich Islands) and specimens are in the Museum of Comparative Zoology (holotype: MCZ OPH-2278; paratypes: MCZ OPH-2279, MCZ OPH-2280, MCZ OPH-2281 and MCZ OPH-4095).



**Fig. 262.** Distribution of *Macrophiothrix demessa* in South Africa.



**Fig. 263.** Dorsal disc (top left), ventral disc (top right), ventral interradial (bottom left), ventral arms (bottom centre), dorsal arms (bottom right) views of *Macrophiothrix demessa* (RMCA MT2156).

***Macrophiothrix hirsuta cheneyi* (Lyman, 1862)**

*Ophiothrix cheneyi* Lyman, 1862: 84; Lyman 1865: 175-176.

*Ophiothrix hirsuta* Müller & Troschel, 1842: Ludwig 1899: 549; Koehler 1905a: 95; Koehler 1922b: 234-235, pl. 31, fig. 1, pl. 33, fig. 13; pl. 99, fig. 2.

*Macrophiothrix brevipeda* Clark 1938: 290-292, fig. 20; Clark H.L. 1939: 91.

*Macrophiothrix hirsuta*: Balinsky 1957: 17-18; Kalk 1958: 207, 214; Macnae & Kalk 1962: 118; Macnae & Kalk 1969: 99, 101, fig. 27b.

*Macrophiothrix hirsuta cheneyi*: Clark 1968: 296-298, figs 3k, 4n, 5n, 7j; Clark & Courtman-Stock 1976: 101, 112, 138, fig. 115; Clark 1980: 548; Tortonese 1980: 123; Milne 2012: 155.

**Diagnosis** – Adapted from Clark (1938) and Clark & Courtman-Stock (1976). D.D. up to 20 mm, arms up to 160 mm; D.D./A.L. = 1/8. Disc round, covered in stumps dorsally and ventrally ending in three to several points, flaring, peripheral stumps mostly with 2-3 terminal points, armament close to oral shields more spiniform and scattered. Radial shields large, conspicuous, length c. one- to two-thirds disc

radius, triangular, almost completely naked, some thorny granules along the lateral edges. Jaws slightly elongated, oral shields naked, spearhead-shaped. Adoral shields moderate in size, sometimes contiguous. Genital slits almost reaching disc margin with large genital plate on lateral side, stumps reaching edge of genital slit. Dorsal arm plates hexagonal, up to three times wider than long, lateral angles more or less rounded, distal side with a median angle, the broadest part near middle of plate, broadly contiguous, armed with tiny spines. Ventral arm plates hexagonal but almost squarish, almost as wide as long, distal edge slightly concave, proximal edge convex, contiguous. Arm spines up to ten, middle spines longest, length more than three times segment length and somewhat clavate, glassy, opaque at tip, serrated for most of length. Tentacle scales one, small, flattened and pointed. Colour in life grey and dark blue or purple, both dorsally and ventrally, dorsal arms with longitudinal light stripe bordered by two dark blue lines, ventral arms with similar stripe but less conspicuous, radial shields variegated with blue.

**Distribution and habitat** – Mozambique, Tanzania, Somalia, Red Sea and Southern Arabia (Clark 1968; Clark & Courtman-Stock 1976; Clark 1980; Tortonese 1980), South Africa: Zotsha River (KZN) to Bhanga Nek (KZN); depth range: 7.5-70 m. Habitat: coarse sand, stones, pebbles and dead coral rubble.

**Remarks** – A number of authors have indicated the distribution of *M. hirsuta cheneyi* in South Africa as extending as far south as Mossel Bay (Clark 1968; Tortonese 1980), but this seems unlikely (this specimen was not located in the Natural History Museum catalogue) because the southern-most record for this species found in this study was in the vicinity of the Zotsha River (KZN) more than 300 km north east of Mossel Bay.

The paratype is in the Museum of Comparative Zoology (MCZ OPH-4097) and the type locality is Zanzibar, depth unknown. Location of holotype is unknown.



**Fig. 264.** Distribution of *Macrophiothrix hirsuta cheneyi* in South Africa.



**Fig. 265.** Dorsal disc (top left), ventral disc (top right), disc armament (bottom left), dorsal arms (bottom right) views of *Macrophiothrix hirsuta cheneyi* (RMCA MT2333).

***Macrophiothrix longipeda* (Lamarck, 1816)**

*Ophiura longipeda* Lamarck, 1816: 544.

*Ophiothrix longipeda* Müller & Troschel 1842: 113; Lyman 1879: 54; Clark 1911: 263; Clark 1921: 110, pl. 15, fig. 5, pl. 33, fig. 1; Clark 1923: 340; Clark 1932: 204.

*Ophiothrix punctolimbata* von Martens, 1870: 257-258.

*Ophiothrix microplax* Bell, 1884: 143-144.

*Macrophiothrix longipeda* Clark 1938: 288-290; Clark 1946: 221; Balinsky 1957: 17; Fell 1960: 24; Clark 1968: 300-302, figs 3m-o, 4p-r, 5p-r, 7l, m; Clark & Rowe 1971: 82, 83, 114; Devaney 1974: 140-141; Clark & Courtman-Stock 1976: 101, 112, 139; Hughes & Gamble 1977: 355; Cherbonnier & Guille 1978: 153-154; pl. 4, figs 3, 4, figs 61: 28, 29; Sloan *et al.* 1979: 102-103; Guille & Vadon 1985: 62; Marsh 1986: 70; Hoggett 1991: 1103-1108, figs 14, 15; Sastry 1991: 377, pl. 3, fig. 17, pl. 4, fig. 31; Liao & Clark 1995: 226-228, figs 112b, 113b, 114b, 115b, 116b; Rowe & Gates 1995: 413; Mbongwa 2013: 16.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 37 mm, A.L. up to 625 mm; D.D./A.L. = 1/17. Disc round, puffy. Dorsal disc with thorny stumps, becoming sharper on ventral side near oral shields. Radial shields large, triangular, with some short stumps, distally concave, more than three-quarters disc radius. Arms very long. Genital slits almost up to disc margin, sharp stumps to edge of genital slit. Jaws elongated, making oral shield far from teeth / oral papillae. Adoral shields most often contiguous. Dorsal arm plates broadly fan-shaped, at least twice as wide as long, broadly contiguous, in smaller individuals plates may be split into two, fan-shaped proximally. Ventral arm plates square, almost as long as wide, also more or less with dark spots or small blotches. Arm spines up to ten, translucent, long, three times segment length, shortest spines on ventral side, one segment length, cigar-shaped, though middle ones somewhat club-shaped. Tentacle scales single, moderately large, round. Colour in life, disc dorsally and ventrally blue or purple with blue or purple spots and blotches, radial shields spotted, ventrally similar but lighter, arms banded with white, or spotted with purple.

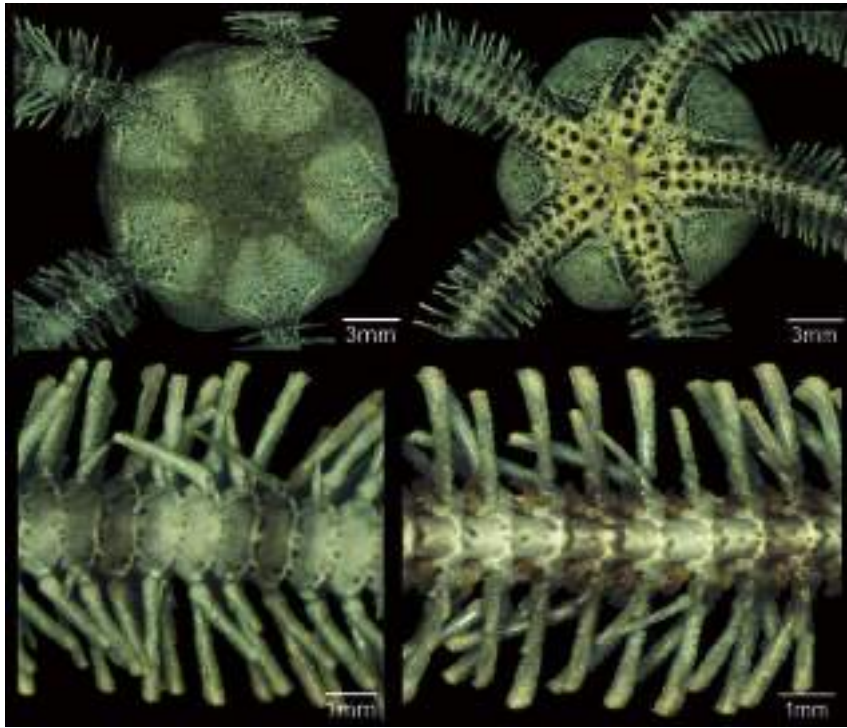
**Distribution and habitat** – Mozambique, Tanzania, Zanzibar, Aldabra, Red Sea, Madagascar, Chagos, Mauritius, Mascarene Basin, Seychelles, Sri Lanka, Singapore, south Japan, China, Philippines, Australia (Hoggett 1991; Rowe & Gates 1995), South Africa: Port Edward (KZN) to Kosi Bay (KZN); depth range: 8-92 m. Habitat: under coral boulders, crevices, stone slabs and broken shell. Characteristically buries its disc in crevices, or deep within coral, with two arms holding onto substrate and remaining three arms held up in water column.

**Remarks** – Clark & Courtman-Stock (1976) commented that *Macrophiothrix aspidota* (Müller & Troschel 1842) should be synonymised with *M. longipeda* and suggested a revision, but the synonym was not accepted by Hoggett (1990). In addition, *M. longipeda* was recorded from Port Elizabeth by A.M. Clark in 1968, but later it was suggested this was incorrect (Clark & Courtman-Stock 1976). Hoggett (1990) suggested that two specimens referred by A.M. Clark (1980) to *M. aspidota* were actually *M. robillardi* (de Loriol, 1893). A revision of South African *Macrophiothrix* species is required.



**Fig. 266.** Distribution of *Macrophiothrix longipeda* in South Africa.

The type material is in the National Museum of Natural History (neotype: USNM 4291) and the type locality is “L’océan austral, près de l’île de France” (Mauritius), depth unknown.



**Fig. 267.** Dorsal disc (top left), ventral disc (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Macrophiothrix longipeda* (RMCA MT2160).

***Macrophiothrix propinqua* (Lyman, 1862)**

*Ophiothrix propinqua* Lyman, 1862: 83-84; Ljungman 1867: 333; Lyman 1874: 234; Marktanner-Turneretscher 1887: 308; Brock 1888: 510; Koehler 1898b: 98-100, pl. 3, figs 20-22; Koehler 1905a: 81; Clark 1915a: 277; Clark 1921: 113; Koehler 1922b: 256-257, pl. 38, figs 1, 2, pl. 101, fig. 4; Murakami 1943b: 207-208.

*Ophiothrix triloba* von Martens, 1870: 260-261.

*Ophiothrix bedoti* de Loriol, 1893b: 420-422, pl. 15, fig. 1.

*Ophiothrix schmidtii* Djakonov, 1930: 237-239, pl. 12, figs 1, 2.

*Ophiotrichoides propinqua*: Clark 1946: 232; Balinsky 1957: 21; Eudean 1957: 244.

*Macrophiothrix schmidtii*: Clark 1966: 649.

*Ophiothrix (Keystonea) propinqua* Lyman, 1861: Clark 1966: 648; Clark 1968: 283, fig. 2e; Clark & Rowe 1971: 86-87, 107; Clark & Courtman-Stock 1976: 102, 111, 145; Gibbs *et al.* 1976: 127; Cherbonnier & Guille 1978: 149, pl. 5, figs 1,



2, fig. 61: 11, 12; Sloan *et al.* 1979: 103; Guille & Wolff 1984: 6; Marsh 1986: 71; Liao & Clark 1995: 244-245, figs 116a, 129.

*Ophiothrix (Placophiothrix) westwardi* Devaney, 1974: 143-148, figs 8-14.

*Macrophiothrix propinqua*: Clark 1980: 537; Guille & Vadon 1985: 62; Hoggett 1991: 1130-1133, figs 28, 29; Sastry 1991: 378, pl. 3, fig. 18; Milne 2012: 155; Olbers *et al.* 2015: 99, 101, pl. 5A, B.

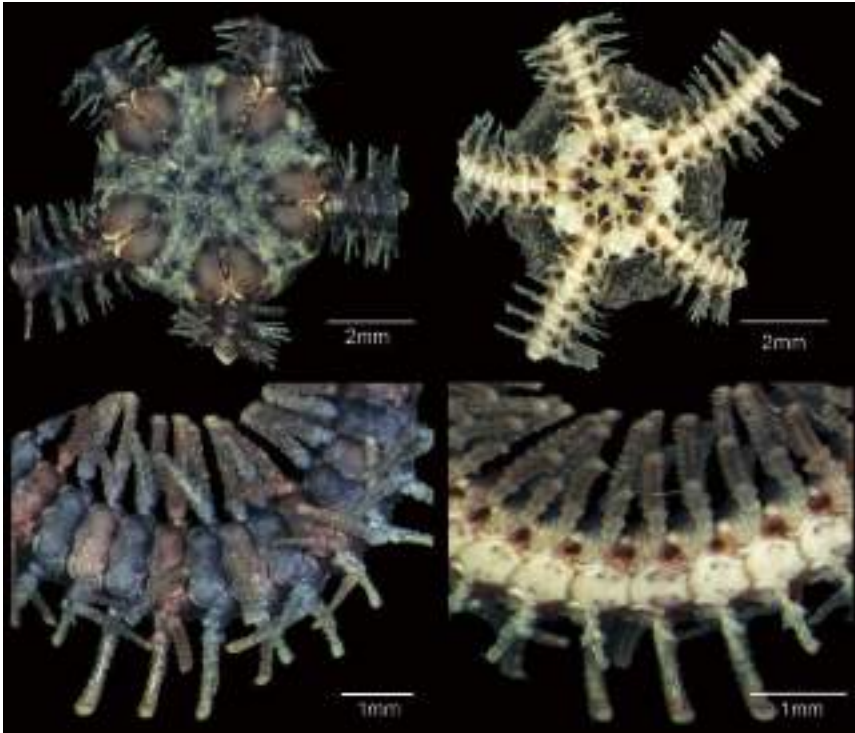
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 12 mm, arms up to 120 mm; D.D./A.L. = 1/10. Disc round, plates clearly visible, with or without armament. Radial shields large, more than half disc radius, naked, disc plates in single or multiple rows between radial shields, some with tubercles or spines. Ventral interradial areas with tubercles, but somewhat sharper than dorsal ones. Oral shields diamond-shaped, wider than long, adoral shields sometimes touching. Genital slits narrow, reaching margin of disc, genital papillae absent, genital plate conspicuous. Dorsal arm plates fan-shaped to elliptical, much wider than long, especially distally, with proximal edge short, distal edge slightly trilobed, broadly contiguous for more than one-third of their breadth, some proximal-most plates with point on distal end. Ventral arm plates square and slightly wider than long, most often with slight distal notch. Arm spines up to eight, finely serrated over total length and distal spines with long thorn, orientated proximally, glassy, longest twice segment length, shortest on ventral side. Tentacle scale one, large, oval. Colour in life pink, purple with patterns on disc, arms banded every 3-4 segments. Radial shields reddish, sometimes with blue patches, distal edge outlined with white.

**Distribution and habitat** – Mozambique, Tanzania, Kenya, Somalia, Red Sea, Madagascar, Mauritius, Mascarene Basin, Aldabra, Comoros, Seychelles, India (Rowe & Gates 1995; Richmond 2002), South Africa: Aliwal Shoal (KZN) to Kosi Bay (KZN); depth range: 0-80 m. Habitat: associated with coral, coral slabs, beach rock, sponges and found in crevices.

**Remarks** – See Olbers *et al.* (2015) for additional remarks. The type material is in the Museum of Comparative Zoology (holotype: MCZ OPH-2399) and the type locality is Kiribati (as Kingsmill IIs), depth unknown.



**Fig. 268.** Distribution of *Macrophiothrix propinqua* in South Africa.



**Fig. 269.** Dorsal disc (top left), ventral disc (top right), dorsal arms (bottom left), ventral arms (bottom right) views of *Macrophiothrix propinqua* (RMCA MT2216).

### Genus *Ophiocnemis* Müller & Troschel, 1842

**Diagnosis** – Adapted from Müller & Troschel (1842), Lyman (1882), Cherbonnier & Guille (1978). Dorsal disc plates with granules, radial shields very large, naked. Ventral disc finely scaled, teeth present, no oral papillae, dorsal arm plates trapezoid and wider than long. Arm spines numerous, rounded, not translucent.

### *Ophiocnemis marmorata* (Lamarck, 1816)

*Ophiura marmorata* Lamarck, 1816: 543.

*Ophiocnemis marmorata*: Müller & Troschel 1842: 87-88; Lyman 1865: 152; Lyman 1882: 229, pl. 42, figs 14, 15; Duncan 1887: 103-104; Döderlein 1888: 833, pl. 31, figs 6a-c; Koehler 1905a: 112; Clark 1923: 341; Koehler 1926: 27; Koehler 1930: 187-188; Clark 1915a: 283; Mortensen 1934: 5; Clark 1938: 318; Clark 1946: 229; Clark & Rowe 1971: 84-85, 106, pl. 17, fig. 2; Clark 1974: 94; Clark & Courtman-Stock 1976: 101, 111, 139, fig. 107; Cherbonnier & Guille 1978: 154-155; pl. 3, figs 5, 6; Liao & Clark 1995: 231-232, fig. 118; Fujita & Namikawa 2006: 31-34; Mbongwa 2013: 16.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 20 mm, D.D./A.L. = c.1/6. Arms relatively long, triangular in cross section. Disc round, dorsally covered with scales and granules, granules restricted to narrow bands between radial shields and in interradial areas, peripheral granules slightly elongated and disc scaling ends abruptly at disc margin. Ventral interradial areas with naked skin, with fine plates, sometimes with scattered granules close to oral shields. Radial shields naked, large, almost full disc radius. Genital slits reach half-way to disc margin and genital papillae present on large genital plates. Oral shields triangular, about three times wider than long. Adoral shields rounded and sometimes contiguous. Dorsal arm plates elliptical, four times as wide as long, convex on proximal side. Ventral arm plates not contiguous, hexagonal, with distal notch both proximally and distally, wider than long, becoming square distally but still slightly wider than long. Arm spines up to five, tapering, finely serrated or smooth. Middle spine up to four times segment length with uppermost spine same length as segment. Tentacle scale one, very small. Colour in life dorsally green, grey and white with white patches along dorsal arms, lighter ventrally, interradial areas brown, some with darker patches adjacent to genital slits.

**Distribution and habitat** – Tanzania, Mozambique, Madagascar, Sri Lanka, East Indies, Bay of Bengal, China, south Japan, Philippines, Australia (Clark & Rowe 1971; Liao & Clark 1995; Rowe & Gates 1995), South Africa: Isipingo (KZN) to Dog Point (KZN); depth range: 0-100 m. Habitat: sand, shells and associated with rhizostome jellyfish (*Rhopilema nomadica* (Berggren 1994); *R. hispidum* (Liao & Clark 1995); *R. esculentum* (Fujita & Namikawa 2006), *Cephea cephea* (Marsh 1998) and *Netrostoma* sp. (Marsh 1998)).

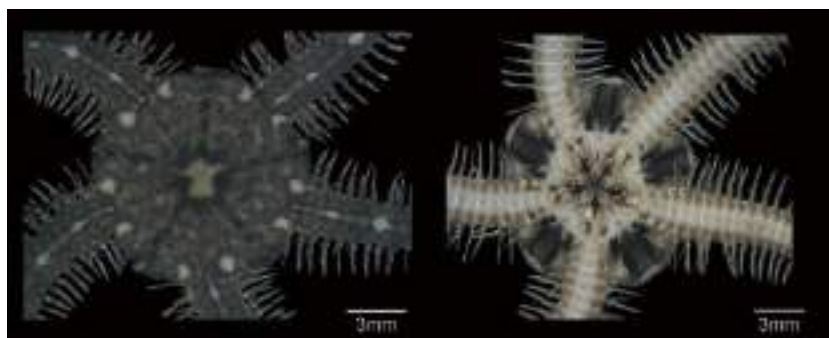
**Remarks** – Clark & Courtman-Stock (1976) stated that the tentacle scales were absent on large tentacle pores, but this was not the case in the material examined, in which the tentacle scales were visible but very small. This species is known as the ‘hitch-hiker brittle star’ as it is most often found on jellyfish; most of the records in the Iziko South African Museum collection being from jellyfish that have



**Fig. 270.** Distribution of *Ophiocnemis marmorata* in South Africa.

washed ashore. There does not appear to be a difference between size classes living within jellyfish versus specimens found in sand and shelly sediment.

The type material was suspected to be in the Muséum national d'Histoire naturelle, Paris (MNHN) (Rowe & Gates 1995), but was not located and the type locality is unknown.



**Fig. 271.** Dorsal (left) and ventral (right) views of *Ophiocnemis marmorata* (RMCA MT2510).

### Genus *Ophiogymna* Ljungman, 1866

**Diagnosis** – Adapted from Koehler (1922) and Clark & Courtman-Stock (1976). Disc soft and puffy; disc plates and majority of radial shields obscured by thick skin; plates bearing thorny stumps or spinelets. Arms very long, flexible, often forming circles; dorsal arm plates fragmented in large specimens but entire in small specimens; arm spines slender, opaque, fairly smooth except towards tips; tentacle scale present proximally, or possibly absent.

### *Ophiogymna capensis* (Lütken, 1869)

*Ophiothrix capensis* Lütken, 1869: 59, 100; Clark 1923: 340.

*Ophiogymna capensis*: Mortensen 1933a: 340-341, figs 52b, 53b, pl. 19, fig. 26;

Clark & Courtman-Stock 1976: 101, 113-114, 140, fig. 119.

**Diagnosis** – Adapted from Mortensen (1933a) and Clark & Courtman-Stock (1976). D.D. unknown. Disc puffy, soft, covered in skin, armed with slender spines placed between large radial shields. Dark line between each pair of radial shields extending onto approximately first five arm segments, but ending abruptly. Arms banded with dark bands every third to sixth segment dorsally, with colour extending onto uppermost arm spine, band may be constricted to sides or complete. Skin also somewhat finely dotted on dorsal side. Dorsal arm plates fragmented, but obscured by skin. Arm spines up to eight, long and thin. Tentacle scales absent.

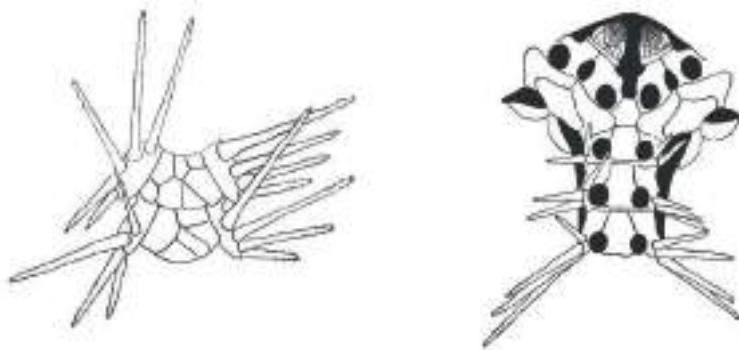
**Distribution and habitat** – South Africa: off Cape of Good Hope (WC); depth range: unknown. Habitat: epizoic on gorgonians.

**Remarks** – Endemic to South Africa. This species has not been recorded again since its original description. Mortensen (1933a) suggested that *Ophiogymna capensis* may be *O. pulchella* (Koehler, 1905a), as he could not find any reliable characters that differed. There is no material of *O. pulchella* or *O. capensis* in the Iziko South African Museum collection, therefore no material was examined or compared.

According to Clark & Courtman-Stock (1976), the type material is in the Natural History Museum of Denmark (syntype: ZMUC OPH-478). The type locality is given as 'Cap' by Lütken, creating uncertainty that he was in fact referring to the Cape of Good Hope in South Africa.



**Fig. 272.** Distribution of *Ophiogymna capensis* in South Africa.



**Fig. 273.** Dorsal (left) and ventral (right) views of *Ophiogymna capensis* (ZMUC OPH-478, from Mortensen (1933a)).

## ***Ophiogymna fulgens*** (Koehler, 1905)

*Ophiothrix fulgens* Koehler, 1905a: 107-109, pl. 10, figs 3-6.

*Ophiogymna fulgens* Koehler 1922: 288-292, pl. 42, figs 1-8, pl. 43, figs 9, 10, pl. 44, fig. 8, pl. 60, fig. 6, pl. 103, fig. 8; Koehler 1930: 189; Mortensen 1933a: 338-340, figs 52a, 53a, pl. 19, fig. 25; Clark & Courtman-Stock 1976: 101, 114, 140, fig. 106; Irimura 1982: 62, fig. 37, pl. 11, fig. 6; Imaoka *et al.* 1991: 147.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Mortensen (1933a). D.D. up to 12 mm. Disc armament variable, many slender spines and/or rugose stumps. Radial shields large, triangular, sometimes contiguous, covered in skin except in distal parts. Ventral interradiar areas covered in thin skin, sometimes armed with spines. Oral shields variable in shape, rhombic, elliptical or pentagonal, wider than long. Adoral shields slender. Genital slits long and slender. Arms long, twisting, covered in skin. Dorsal arm plates only fragmented basally, if at all, trapezoid, proximal side concave, distal edge convex, lateral angles blunt, contoured with a median distal swelling but sunken proximally, plates not contiguous, separated narrowly by skin, plates slightly wider than long. Ventral arm plates similar. Arm spines serrated, hyaline, slender, up to eight, spines on segments two, three and four may be clavated or rounded at tip. Tentacle scale small, sometimes present on proximal pores only. Colour in life completely white or pink, or rosy red with pink patches, arms banded dorsally.

**Distribution and habitat** – Indo-West Pacific, Indonesia, Japan (Koehler 1922b, Imaoka *et al.* 1991); South Africa: Durban (KZN); depth range: 3-923 m. Habitat: clinging to gorgonians.

**Remarks** – *Ophiothrix fulgens* has been put forward as a synonym of *Ophiogymna pellicula* (Duncan, 1887) (Rowe & Gates 1995). Unfortunately the types of both species were not available and thus this could not be investigated.

No specimens were examined and no records were found in the Iziko South African Museum. The type material is in the Muséum national d'Histoire naturelle (syntype



**Fig. 274.** Distribution of *Ophiogymna fulgens* in South Africa.

of *Ophiothrix fulgens*: MNHN-IE-2013-10205), type locality is Paternoster Island, Lesser Sunda Islands (Indonesia), depth 36 m.



**Fig. 275.** Dorsal (left) and ventral (right) views of *Ophiogymna fulgens* (holotype of *Ophiothrix fulgens*, from Koehler (1905)).

### Genus *Ophiothela* Verrill, 1867

**Diagnosis** – Adapted from Verrill (1869) and Clark & Courtman-Stock (1976). Body covered by thick skin obscuring arm plates, radial shields very large, dorsal disc armament variable with tubercles, spines or granules, interradial areas minimal and covered in spines. Dorsal arm plates covered in granules, may be fragmented or rudimentary and restricted to few basal segments. Ventral arm plates may be visible through skin. Arms relatively short, flexible dorso-ventrally. Arm spines short and finely rugose, turned slightly downwards. Tentacle scales reduced or absent. Associated with gorgonians, crinoids, cidarids and pennatulids.

### *Ophiothela danae* Verrill, 1869

*Ophiothela danae* Verrill, 1869: 391; Lyman 1882: 230; Marktanner-Turneretscher 1887: 313-314; Döderlein 1896: 297, pl. 17, fig. 25; Koehler 1898b: 89; Koehler 1905a: 117-118; Koehler 1907: 340; Clark 1915a: 284; Matsumoto 1917: 230-232, fig. 67; Koehler 1922b: 297-298, pl. 59, figs 1-3, pl. 103, fig. 1; Mortensen 1933a: 342; Clark & Rowe 1971: 116, pl. 14, fig. 5; Clark 1974: 470; Cherbonnier & Guille 1978: 158-159, pl. 8, figs 3, 4; Mortensen 1940: 68; Murakami 1942: 20; Murakami 1943a: 180; Clark & Spencer Davis 1966: 599; Clark & Courtman-Stock 1976: 101, 114, 141; Humphreys 1981: 22; Price 1981: 7, 10; Irimura 1982: 57-59, fig. 32, pl. 11, figs 1-6; pl. 12, figs 1, 2; Guille & Vadon 1985: 62; Marsh 1986: 71; Vine 1986: 195; Liao & Clark 1995: 238, fig. 124; Rowe & Gates 1995: 419-420; Price & Rowe 1996: 74.

*Ophiothela isidicola* Lütken, 1872: 92, pls 1, 2, fig. 4; de Loriol 1893a: 52-53; Clark 1915a: 285.

*Ophiothela dividua* von Martens, 1879: 127-130, figs 1-4; Clark 1923: 343; Balinsky 1957: 22.

*Ophiothela verrilli* Duncan, 1879: 477-479, pl. 11, fig. 33.

*Ophiothela danae* var. *involuta* Koehler, 1898b: 88-90.

*Ophiothela caerulea* Clark, 1915a: 283, pl. 14, fig. 1

*Ophiothela hadra* Clark, 1915a: 284-285, pl. 14, fig. 2.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Clark & Rowe (1971). D.D up to 7 mm. Disc and arms covered in skin, disc armament extremely variable with rounded tubercles and granules, rough appearance or smooth with few granules or tubercles. Radial shields tumid with few tubercles on periphery, contiguous for full length. Dorsal interradiar areas with larger tubercles. Ventral disc with no spines. Oral shields inconspicuous, triangular. Genital slits round. Arms usually six, but very small individuals may have only three arms and only half a disc. Dorsal arm plates covered with tubercles large and small intermixed, proximal part of arms banded with darker bands, up to six arms. Ventral arm plates hexagonal with distal edge either straight or slightly convex. Arm spines up to six, blunt, rugose, tips barbed, becoming narrow distally. Colour in life variable, black to white, pinkish grey with dark bands or spots dorsally, blue linear patterns and reddish markings, yellow, orange with white radial shields, purple with purple and white banded arms.

**Distribution and habitat** – Mozambique, Kenya, Red Sea, Madagascar, Mascarene Basin, Persian Gulf, Pakistan, India, Sri Lanka, Bay of Bengal, East Indies, Maldives, China, south Japan, Philippines, Indonesia, Sumatra, south Pacific Islands and Australia (Murakami 1942; Clark & Rowe 1971; Rowe & Gates 1995; Price & Rowe 1996), South Africa: Port Elizabeth (KZN) to Durban (KZN); depth range: 0-220 m. Habitat: associated with gorgonians, macro-algae, *Millepora* species and sponges.

**Remarks** – Eleven syntypes of *Ophiothela dividua* were examined at the Royal Belgian Institute of Natural Sciences (RBINS I.G. 6752/OPH.187).

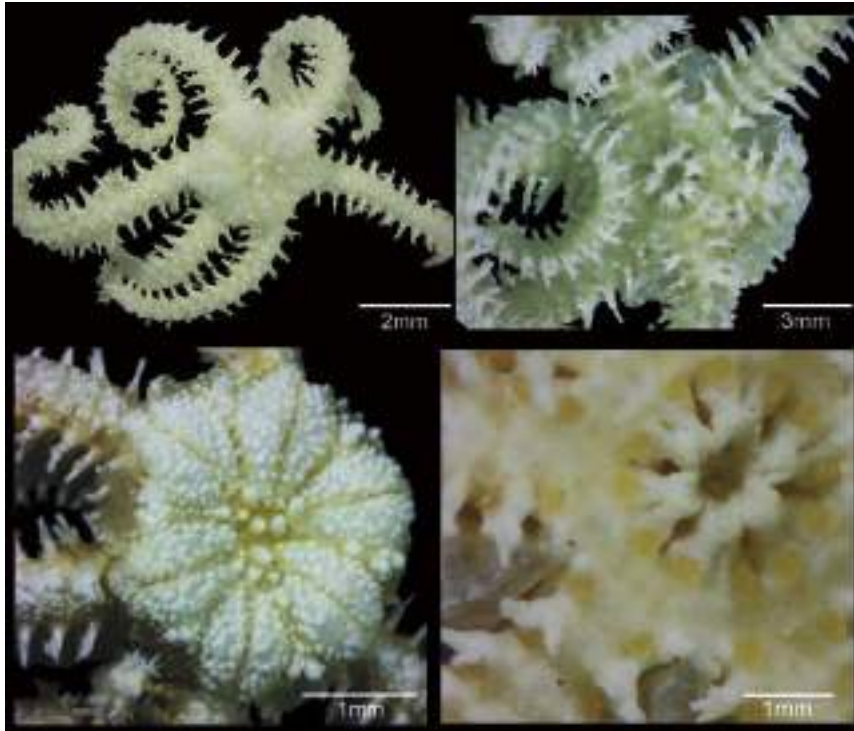
Clark (1974) reported that the syntypes were attached to the Indo-Pacific gorgonian *Melithaea ochracea* (Linnaeus, 1758) (presumably misspelled as *Melitaea ochracea*). Type material is in the Museum of Comparative Zoology (MCZ OPH-



**Fig. 276.** Distribution of *Ophiothela danae* in South Africa.



2492 and MCZ OPH-2631) and the type locality is Fiji (Rowe & Gates 1995), depth unknown.



**Fig. 277.** Dorsal whole (top left), ventral disc (top right), dorsal disc (bottom left), jaws (bottom right) views of *Ophiothela danae* (SAMC A23259).

### ***Ophiothela venusta*** (de Loriol, 1900)

*Ophiocnemis venusta* de Loriol, 1900: 81-84, pl. 8, figs 2, 3.

*Ophiopsammium nudum* Clark, 1923: 341.

*Ophioteris beauforti* Engel, 1949: 139-143, figs 1, 2.

*Ophiothela beauforti*: Balinsky 1957: 22-24, pl. 4, fig. 16; Clark & Rowe 1971: 117, pl. 14, figs 10-12.

*Ophiothela nuda*: Clark 1974: 469; Clark & Courtman-Stock 1976: 101, 114, 141, fig. 120; Cherbonnier & Guille 1978: 160-162, pl. 9, figs 1-6, fig. 62.

*Ophiothela venusta*: Clark & Rowe 1971: 117, pl. 14, fig. 6; Olbers *et al.* 2014: 14, pl. 2A.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976) and Cherbonnier & Guille (1978). D.D. up to 10 mm. Disc round or pentagonal, armament shows

great variability, may be naked or with scattered blunt spines or granules over interradial areas both dorsally and ventrally. Radial shields very large, triangular, reaching almost centre of disc, mostly naked, large tubercles present in single row between radial shields, with disc plates present in interradial areas and at centre of disc, radial shields not contiguous. Whole specimen covered in thick skin, concealing dorsal and ventral arm plates. Arms five, dorsal arm plates absent, may be naked, densely or sparsely covered in small round tubercles. Ventral arm plates triangular if visible, with shallow furrow down length of arm. Arm spines up to seven, mostly six, short, opaque and finely rugose, basal ones sometimes webbed, some lowermost spines have hooks facing proximally. Ventral disc with spines in interradial areas. Oral shields half-moon or quadrangle in shape. Genital slits moderate in size, about half way to disc margin, no genital papillae. Tentacle scales absent. Disc colour from pale pink to dark purple, lighter ventrally, arms mostly banded dorsally, but not ventrally.

**Distribution and habitat** – Mozambique, Tanzania, Kenya, Madagascar, Comoros, Seychelles, South East Arabia, East Indies and Australia (Clark & Rowe 1971; Rowe & Gates 1995; Stöhr 2007g), South Africa: Zotsha River (KZN) to Kosi Bay (KZN); depth range: 0-66 m. Habitat: stones, muddy sand, shells and sponges and among macro algae.

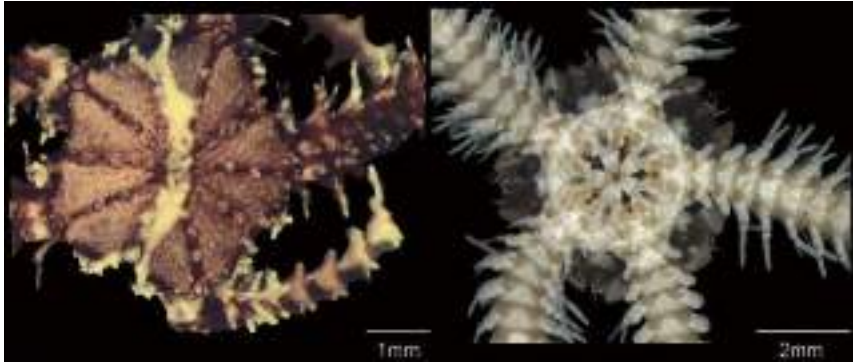
**Remarks** – Various authors have successfully separated *Ophiothela* species on morphological characters with Cherbonnier & Guille (1978) tabulating these differences. In the case of the South African material, these differences are not obvious and it is uncertain that the two South African species are in fact distinct. Clark (1976) suggested that the Indo-West Pacific *Ophiothela* species are conspecific and molecular analysis was suggested by Hendler *et al.* (2012). Similarly, further investigations are required for the South African material.

On one specimen, a smaller individual was found (D.D. = 1 mm) attached to the dorsal side of a larger specimen (D.D. = 3 mm). This may be a juvenile of *O. venusta*, but this requires confirmation.



**Fig. 278.** Distribution of *Ophiothela venusta* in South Africa.

The type material is in the Muséum d'Histoire naturelle, Genève (syntypes: MHNG-INVE-78692; Jean Mariaux, pers. comm.) and the type locality is Singapore, depth unknown.



**Fig. 279.** Dorsal (left; RMCA MT2213) and ventral (right; RMCA MT2356) views of *Ophiothela venusta*.

#### Genus *Ophiothrix* Müller & Troschel, 1840

**Diagnosis** – Adapted from Clark (1966) and Clark & Courtman-Stock (1976). D.D/A.L rarely more than 1/10, usually c. 1/4-8. Disc scaling obscured by spines, spinelets or stumps, sometimes extending onto radial shields. Ventral disc with thorny stumps and granules, ventral armament always present. Radial shields flat. Dorsal arm plates rhombic or fan-shaped, hexagonal, trapezoidal, may or may not be broadly contiguous. Arms mostly flexible horizontally. Arm spines usually long and glassy, more or less serrated and tapering. Tentacle scale single.

#### **Subgenera of *Ophiothrix* are distinguished as follows:**

*Acanthophiothrix*: Disc often contracted in interradial areas, disc covered in spines and thorny stumps. Radial shields naked, but may have few small and marginal stumps and / or granules. Dorsal arm plates hexagonal, trapezoidal or fan-shaped, broadly contiguous, may be as long as wide. Disc diameter rarely more than 17 mm.

*Ophiothrix*: Disc covered in spines, stumps and granules. Radial shields naked, or sometimes with small and marginal stumps. Dorsal arm plates elliptical or fan-shaped, not broadly contiguous, slightly wider than long. Disc diameter rarely more than 20 mm.

#### ***Ophiothrix (Acanthophiothrix) proteus* Koehler, 1905**

*Ophiothrix proteus* Koehler, 1905a: 100-101; Koehler 1922b: 260-261, pl. 36, fig. 3, 4, pl. 101, fig. 3; Koehler 1930: 147-148; Clark 1915a: 277; Day 1974: 94; Vine 1986: 195.

*Placophiothrix proteus*: Clark H.L. 1939: 86; Balinsky 1957: 21; Clark 1967: 47; Macnae & Kalk 1969: 130.

*Ophiothrix (Acanthophiothrix) proteus*: Clark 1966: 648; Clark & Rowe 1971: 111, pl. 15, fig. 5; Clark 1974: 465-466, fig. 11a, b; Clark & Courtman-Stock 1976: 101, 112, 142, figs 110, 114; Cherbonnier & Guille 1978: 147-148, pl. 6, figs 3, 4; fig. 61: 10-14; Guille & Vadon 1985: 63; Liao & Clark 1995: 240-241, fig. 125; Rowe & Gates 1995: 424; Olbers *et al.* 2014: 14, pl. 2B; Milne 2012: 155.

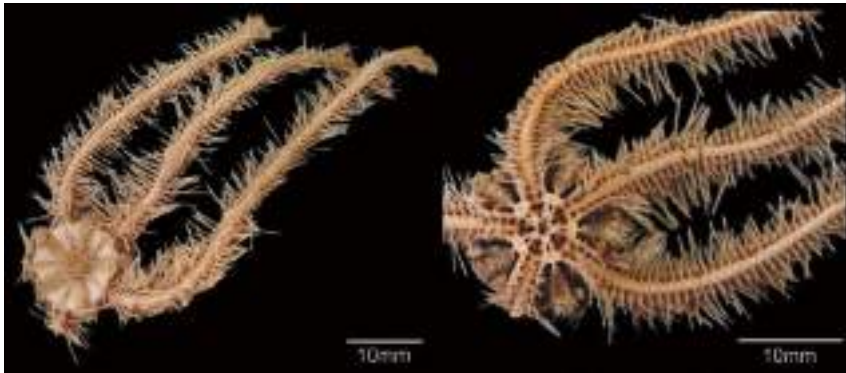
**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 17 mm, D.D./A.L. = 1/10. Disc round, dorsally disc armed with both spinelets and scattered tubercles with thorny tips, spines densely scattered between radial shields and in interradiial areas, with marginal spines being thinner and sharper, centre of disc with dense cluster of spines. Radial shields large, triangular, with distal edge concave, long but do not reach centre of disc, mostly naked with few scattered spines or stumps. Ventrally, interradiial areas densely packed with spines. Genital plate relatively small, but distinct. Genital slits half-way to disc margin, genital papillae absent. Oral shields elliptically oval with sharp point on proximal side, much wider than long. Adoral shields may or may not be contiguous. Dorsal arm plates hexagonal or fan-shaped, wider than long, consecutive plates in contact for less than one-third of their width, dorsal ridge on arm plates giving arm carinate appearance. First 3-4 ventral arm plates convex on distal side, but becomes straight, plates rectangular, wider than long. Arm spines up to six, serrated, six times segment length, uppermost spines longest with lowermost being just longer than stumps, serrated more than at base of spines with spines becoming smoother distally. Arms with large tentacle pores, especially basally. Tentacle scale one, small, slightly elongated. Colour in life brownish green with yellow or white line bordered by two dark lines of dark purple or green, longitudinal white stripe along entire length of arm, with two darker lines on either side.

**Distribution and habitat** – Mozambique, Madagascar, Red Sea, East Indies, southern China, Indonesia, Australia (Clark & Courtman-Stock 1976; Liao & Clark 1995; Rowe & Gates 1995; Stöhr 2007f), South Africa: Port Shepstone (KZN) to Kosi Bay (KZN); depth range: 0-125 m. Habitat: stones, mud, sand, shells and *Cymodocea* beds.



**Fig. 280.** Distribution of *Ophiothrix (Acanthophiothrix) proteus* in South Africa.

**Remarks** – A distinctive feature of this species is the keel along the dorsal arm plates and the white longitudinal line with dark lines either side. This is a shallow water species. Similarly coloured animals in deep water are actually colour forms of *O. aristulata* (Tim O'Hara unpublished data). The type material is in the Zoological Museum Amsterdam (now Naturalis) (ZMA.ECH.O.2548; ZMA.ECH.O.2544; ZMA.ECH.O.2551 and ZMA.ECH.O.2547) and the type locality is Indonesia, depth unknown.



**Fig. 281.** Dorsal (left) and ventral (right) views of *Ophiothrix (Acanthophiothrix) proteus* (SAMC A23264).

### ***Ophiothrix (Acanthophiothrix) purpurea* von Martens, 1867**

*Ophiothrix purpurea* von Martens, 1867: 346; Döderlein 1896: 296, pl. 14, fig.12, pl. 17, figs 23-23a; Koehler 1905a: 102; Clark 1915a: 277; Koehler 1922b: 261, pl. 58, figs 3-4, pl. 101, fig. 6; Vine 1986: 195.

*Ophiothrix fallax* de Loriol, 1893a: 47-48, pl. 25, fig. 2.

*Ophiothrix lorioli* Döderlein, 1896: 297, pl. 14, fig. 13a, b, pl. 17, fig. 24a, b.

*Placophiothrix purpurea*: Clark H.L. 1939: 86-87; Clark & Spencer Davis 1966: 599.

*Ophiothrix (Acanthophiothrix) purpurea*: Clark & Rowe 1971: 86-87, 112, figs 35d, 36, pl. 15, figs 4, 11; Devaney 1974: 141-142; Cherbonnier & Guille 1978: 148-149, pl. 5, figs 5-6, fig. 61: 5-6; Sloan *et al.* 1979: 103; Humpreys 1981: 23; Guille & Vadon 1985: 63; Marsh 1986: 71; Liao & Clark 1995: 241; Rowe & Gates 1995: 424-425; Price & Rowe 1996: 75; Putschakarn & Sonchaeng 2004: 422; Olbers *et al.* 2015: 101, pl. 5C, D.

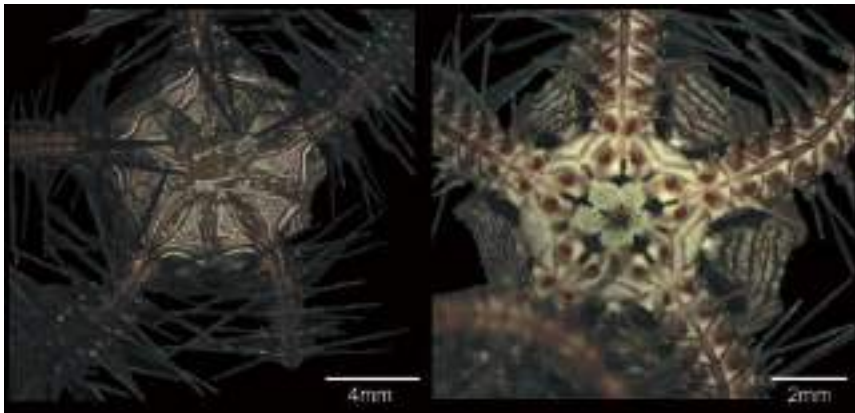
**Diagnosis** – Adapted from Clark & Rowe (1971) and Cherbonnier & Guille (1978). D.D. up to 17 mm. Disc pentagonal, dorsally scaled with armament of scattered tubercles and spinelets (long and short) interradially and between radial shields, smaller spinelets on disc margin. Disc ventrally with small spinelets. Radial shields triangular, naked, large, about two-thirds disc radius, more or less conspicuous dark purple stripe along distal edge, central area more or less variegated whitish

and purple, distal edge concave. Oral shields elliptical, with sharp point on proximal side, much wider than long. Adoral shields contiguous. Genital slits almost reach disc margin, with genital plate from about half-way, genital papillae absent. Dorsal arm plates hexagonal, distal side convex, as long as wide or longer, consecutive plates in contact for less than one-third of their width. Ventral arm plates somewhat fan-shaped, distal side concave, proximal edge convex becoming straight, as long or longer than wide. Arm spines up to seven, mostly five, glassy, upper spines smooth becoming serrated, up to five times segment length, lower spines shorter and more serrated, lowest arm spine often very short with hooks. Tentacle pores large. Tentacle scale one, small, pointed. Colour in life dorsally varying shades of reds, pinks and whites, some with striking lines, arms with thin dark longitudinal line along length of arm both dorsally and ventrally, dorsal arm plates with some lateral whitish patches.

**Distribution and habitat** – Tanzania, Red Sea, Madagascar, Mascarene Basin, Aldabra, Seychelles, Australia (Rowe & Gates 1995; Stöhr 2007g), South Africa:



**Fig. 282.** Distribution of *Ophiothrix (Acanthophiothrix) purpurea* in South Africa.



**Fig. 283.** Dorsal (left) and ventral (right) views of *Ophiothrix (Acanthophiothrix) purpurea* (RMCA MT2185).

Sodwana Bay (KZN) to Kosi Bay (KZN); depth range: 5-508 m. Habitat: epizoic on *Millepora* species, soft corals, gorgonians, sponges and crinoids.

**Remarks** – A distinctive feature of this species is the dark longitudinal lines on both dorsal and ventral arms.

Type material is in the Museum of Natural History of Berlin (syntype: ZMB Ech 1331), type locality is Amboina, Indonesia (Rowe & Gates 1995). For additional remarks, see Olbers *et al.* (2015), where this is also reported as a new record for South Africa.

### ***Ophiothrix (Ophiothrix) aristulata* Lyman, 1879**

*Ophiothrix aristulata* Lyman, 1879: 50-51, pl. 15, figs 421-424; Lyman 1882: 223-224, pl. 21, figs 9-12; Bell 1905: 258; Clark 1915a: 269; Koehler 1922b: 205-208, figs 1-3; Clark 1923: 336-337; Mortensen 1933a: 336-337; Clark A.M. 1952: 200; Clark 1966: 646.

*Ophiothrix aristulata* var. *investigatoris* Koehler, 1897: 361-363, pl. 9, figs 72, 73.

*Ophiothrix megaloplax* Koehler, 1930: 170-172, pl. 9, figs 8, 9.

*Placophiothrix aristulata*: Clark H.L. 1939: 86.

*Ophiothrix (Ophiothrix) aristulata*: Clark 1974: 466-467, fig. 11c, d; Clark & Courtman-Stock 1976: 101, 110, 112, 142, figs 111, 115; Rowe & Gates 1995: 420.

**Diagnosis** – Adapted from Clark (1974) and Clark & Courtman-Stock (1976). D.D. up to 16 mm, D.D./A.L. = 1/9. Disc pentagonal, dorsally scaled with armament of spinelets both dorsally and ventrally, including between radial shields. Radial shields triangular, naked, large, distal edge concave, not reaching centre of disc. Genital slits not reaching disc margin, distinct genital plate, genital papillae absent. Oral shields diamond-shaped with rounded corners, proximal point blunt, much wider than long. Adoral shields may or may not be contiguous. Dorsal arm plates fan, rhomboidal or diamond-shaped, distal side strongly convex, as long as wide or slightly wider, consecutive plates in contact for less than one-third of their width. Ventral arm plates square or rectangular, mostly wider than long, distal edge convex becoming straight or slightly concave. Arm spines up to ten, upper spines serrated, up to six times the segment length, lower spines short, often just stumps. Tentacle pores large, tentacle scales single, relatively small, square. Colour in life grey, red, pink, arms similar, red or pink, light white longitudinal line sometimes with pink or red stripes bordering the line.

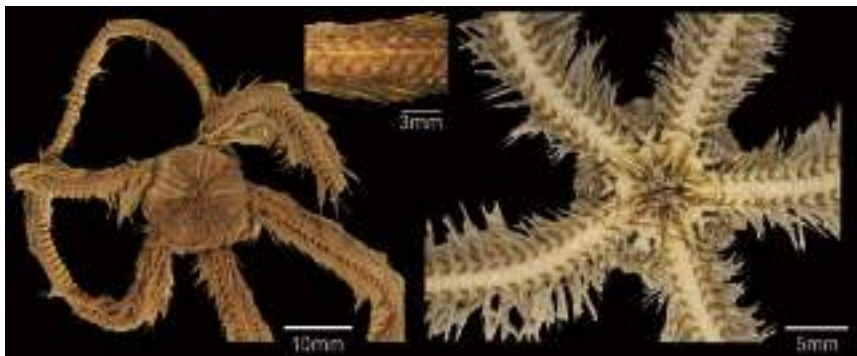
**Distribution and habitat** – Australia, New Zealand (Rowe & Gates 1995; Mah *et al.* 2009), South Africa: off Orange River (NC) to Sodwana Bay (KZN); depth range: 55-620 m. Habitat: stones, coral rock, sand, clay and shells.

**Remarks** – Koehler (1922), Mortensen (1933a) and Clark (1923) suggested that a number of authors have misidentified *Ophiothrix (Ophiothrix) aristulata* as *Ophiothrix triglochis* or *vice versa*, but maintained that *aristulata* was easily distinguished by its arm spines, which are seldom stout, and that this species occurs deeper than *O. triglochis*. See additional comments under *Ophiothrix fragilis* var. *triglochis* (below).

The type material is at the Natural History Museum (holotype: NHMUK 1882.12.23.194), the Museum of Comparative Zoology (paratype: MCZ OPH-2270) and the type locality is south of Cape Point, depth 275 m (Rowe & Gates 1995).



**Fig. 284.** Distribution of *Ophiothrix (Ophiothrix) aristulata* in South Africa.



**Fig. 285.** Dorsal (left; SAMC A7516), ventral (right; SAMC A7536), dorsal arm plates (inset; SAMC A7516) views of *Ophiothrix (Ophiothrix) aristulata*.

### ***Ophiothrix (Ophiothrix) echinotecta* Balinsky, 1957**

*Ophiothrix (Ophiothrix) echinotecta* Balinsky, 1957: 16-17, fig. 6, pl. 3, figs 9, 10; Kalk 1958: 198; Macnae & Kalk 1969: 99, 106, 129; Clark & Rowe 1971: 84-85, 109; Clark & Courtman-Stock 1976: 112, figs 112, 116, 101, 143; Tortonese 1980: 122; Humpreys 1981: 23; Olbers *et al.* 2015: 101-102, pl. 5E, F.

*Ophiothrix echinoteta*: Mbongwa 2013: 16 (*lapsus calami*).

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 8 mm. Disc round, covered with stumps with density on radial shields being slightly less,



stumps bicuspid, tricuspid and multifid, stumps reaching ventral interradial areas. Radial shields length about half disc radius. Oral shields diamond-shaped, twice as wide as long. Adoral shields narrow and contiguous. Genital slits reaching half-way up to margin with distinct genital plate adjacent to slit, genital papillae absent. Dorsal arm plates fan-shaped with single, short rugose stump between many successive plates, narrowly contiguous. Ventral arm plates slightly wider than long with straight or slightly concave distal edge. Arm spines up to ten, serrated for total length, glassy, middle spine longest, c. three times segment length, upper spines shorter with uppermost spine being short stumps, lowermost being transformed into a hook. Tentacle scale one, small, may bear one or two sharp points at tip. Colour in life, dorsal disc light and dark greens, greys and blues. Radial shields variegated white and green, slightly darker than remaining disc, dorsal arm plates sometimes with dark transverse line or light chevron on distal side, ventral side slightly lighter.

**Distribution and habitat** – Mozambique, Madagascar, Tanzania, Kenya, Somalia (Balinsky 1957; Clark & Rowe 1971; Tortonese 1980; Humpreys 1981), South Africa: Isipingo (KZN) to Bhanga Nek (KZN); depth range: 0-64 m. Habitat: in rock hollows and under echinoids *Echinometra mathaei* and *Stomopneustes variolaris* (Balinsky 1957), also on coarse sand, gravel, shell debris, stones and sponges.

**Remarks** – Olbers *et al.* (2015) noted that this species was the most characteristic South African *Ophiothrix*, due to the rugose stumps present on many successive dorsal arm plates.

Type specimens are in the Iziko South African Museum (holotype: SAMC A22355 and paratype: SAMC A22356) and the type locality is Lighthouse Rocks, Inhaca Island, Mozambique, depth 0 m.



**Fig. 286.** Distribution of *Ophiothrix (Ophiothrix) echinotecta* in South Africa.



**Fig. 287.** Dorsal (left), ventral (right), rugose stump (as indicated by arrow) on dorsal arm plate (inset) views of *Ophiothrix* (*Ophiothrix*) *echinotecta* (RMCA MT2257).

***Ophiothrix* (*Ophiothrix*) *foveolata* Marktanner-Turneretscher, 1887**

*Ophiothrix foveolata* Marktanner-Turneretscher, 1887: 313, pl. 13, figs 32, 33; Koehler 1905a: 76-77; Clark 1915a: 280; Koehler 1922b: 238-239, pl. 47, figs 4-7, pl. 98, fig. 6; Koehler 1930: 140; Clark & Spencer Davis 1966: 599; Clark 1966: 647; Clark & Rowe 1971: 84, 85, 110, pl. 15, fig. 3; Day 1974: 94; Putchakarn & Sonchaeng 2004: 423; Mbongwa 2013: 16; Olbers *et al.* 2015: 102, 104, pl. 6A, B.

*Ophiothrix insidiosa* Koehler, 1898b: 92-93, pl. 4, figs 34-36.

*Ophiothrix poecilodisca* Clark, 1915a: 276-277, pl. 13, fig. 5; Clark 1923: 341.

*Placophiothrix foveolata*: Balinsky 1957: 20, pl. 4, fig. 15; Kalk 1958: 207, 214; Macnae & Kalk 1962: 111; Macnae & Kalk 1969: 102, 106, 130.

*Ophiothrix* (*Ophiothrix*) *foveolata*: Day 1969: 184; Clark & Courtman-Stock 1976: 101, 112, 143-144, fig. 118.

**Diagnosis** – Adapted from Clark & Courtman-Stock (1976). D.D. up to 13 mm. Disc round, sparsely covered in plates and some scattered small granules, if any at all, though peripherally some scattered large trifold stumps, disc plates moderately large. Radial shields triangular, naked, more than two-thirds disc radius, single row of plates between radial shields. Oral shields broad diamond-shaped, much wider than long. Adoral shields moderate in size, may or may not be contiguous. Genital slits half-way to disc margin, genital papillae absent, distinct genital plate. Dorsal arm plates fan-shaped, distal edge convex, consecutive plates in contact for less than half their width. Ventral arm plates square or rectangular, wider than long, distal edge concave, proximal edge slightly convex or straight distally. Arm spines up to eight, glassy, serrated, longest 4-5 times segment length, some spines with dark longitudinal bands and some with clavate tips. Tentacle scale one, small, tapering. Colour in life ranging from orange, light brown to violet, young specimens may be bright red, radial shields whitish, patterned with dark purple

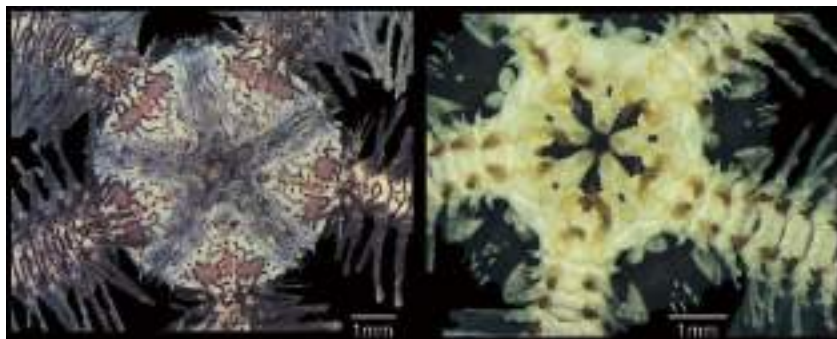
lines and pinkish patches, adradial edges of radial shields may have dark lines. Arms transversed with same striking dark lines as on disc.

**Distribution and habitat** – Mozambique, Madagascar, Thailand (Clark & Rowe 1971; Cherbonnier & Guille 1978; Clark 1980; Putchakarn & Sonchaeng 2004; Stöhr 2011b), South Africa: Amanzimtoti (KZN) to Kosi Bay (KZN); depth range: 9-305 m. Habitat: coral reefs, sponges, under dead coral blocks, rock crevices and in *Cymodocea* beds.

**Remarks** – In addition to recording *Ophiothrix* (*Ophiothrix*) *foveolata* as a new species for South Africa, Olbers *et al.* (2015) also recognised that *O.* (*Ophiothrix*) *foveolata* is similar to *Macrophiothrix propinqua*, with the exception of the radial shield size. The type material is in the Museum of Comparative Zoology (holotype: MCZ OPH-2476, paratype: MCZ OPH-3928), type locality is Zanzibar, depth unknown.



**Fig. 288.** Distribution of *Ophiothrix* (*Ophiothrix*) *foveolata* in South Africa.



**Fig. 289.** Dorsal (left) and ventral (right) views of *Ophiothrix* (*Ophiothrix*) *foveolata* (RMCA MT2174).

## *Ophiothrix fragilis* (Abildgaard in O.F. Müller, 1789)

*Asterias fragilis* Abildgaard in Müller, 1789: 28-29, figs 1-3, pl. 98.

*Asterias pentaphylla* Pennant, 1777: 51.

*Ophiothrix fragilis*: Müller & Troschel 1842: 110; Koehler 1908a: 635; Koehler 1914b: 209-210; Clark 1923: 337; Mortensen 1927: 174-176, fig. 98; Mortensen 1933a: 338; Madsen 1970: 213-214, fig. 36c; Clark 1974: 467-469; Clark & Courtman-Stock 1976: 102, 112, 144-145, fig. 105, 113; Mbongwa 2013: 16; Alva & Vadon 1989: 829.

**Diagnosis** – Adapted from Clark (1974) and Clark & Courtman-Stock (1976). D.D. up to 20 mm, D.D/A.L. = 1/5. Dorsal disc plates covered in thorny spinelets, stumps and spines, may be intermixed. Radial shields triangular, more than half disc radius (larger than *O. fragilis* var. *triglochis*), naked. Ventral interradiar area of disc with spinelets, areas closest to oral shields naked. Oral shields diamond-shaped, with proximal lobe wider than long. Adoral shields may or may not be contiguous. Genital slits more than half to disc margin, genital plates distinct, genital papillae absent. Dorsal arm plates fan-shaped, sometimes wide as long, but often wider than long, distal edge convex, slightly contiguous. Ventral arm plates rectangular, distal edge distinctly concave, contiguous. Arm spines up to ten (usually seven), glassy, thorny over total length, not tapering, sometimes lowermost transformed into a hook, longest one not more than three times segment length. Tentacle scale single, small, usually with one tip, but sometimes two or three. Colour in life various combinations of greens, greys, browns, purples, yellows, pinks and reds, arms banded and often with dots associated with dorsal arm plates longitudinally along arms.

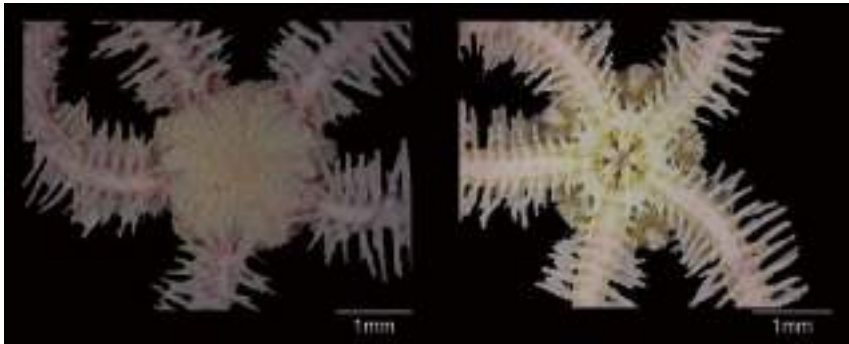
**Distribution and habitat** – European marine waters, Mediterranean Sea, North Sea, North East Atlantic (Stöhr & Hansson 2010), South Africa: off Orange River (NC) to Kosi Bay (KZN); depth range: 0-148 m. Habitat: among kelp, sand, shells, rock, limestone, gravel, sandstone and sponge.



**Fig. 290.** Distribution of *Ophiothrix fragilis* in South Africa.

**Remarks** – Endemic to the region, also being found in Namibia. Also see remarks on *Ophiothrix fragilis* var. *triglochis*.

Two types are in the Swedish Museum of Natural History, *Ophiothrix lusitanica*: SMNH-Type-1423 (5 syntypes, type locality Setúbal harbour, Portugal) and *Ophiothrix rubra*: SMNH-Type-1437 (holotype, type locality sound between Faial and Pico, Portugal, depth 27 m).



**Fig. 291.** Dorsal (left) and ventral (right) views of *Ophiothrix fragilis* (SAMC A088480).

### ***Ophiothrix fragilis* var. *triglochis* Müller & Troschel, 1842**

*Ophiothrix triglochis* Müller & Troschel, 1842: 114; Lütken 1869: 59-60; Lyman 1882: 218; Koehler 1904b: 81-84, figs 41-45; Bell 1905: 259; Koehler 1908a: 635; Clark 1923: 337-339; Mortensen 1933a: 337-338; Stephenson *et al.* 1937: 380; Bright 1937a: 63; Stephenson *et al.* 1938: 18; Eyre 1939: 304; Stephenson 1944: 317, 347; Clark A.M. 1952: 201; Day *et al.* 1952: 412; Day 1959: 502, 544; Morgans 1959: 303, 322; Morgans 1962: 414, 422, 425; Day *et al.* 1970: 80; Penrith & Kensley 1970: 201, 206, 208, 234.

*Ophiothrix fragilis* var. *triglochis*: Stöhr 2011c.

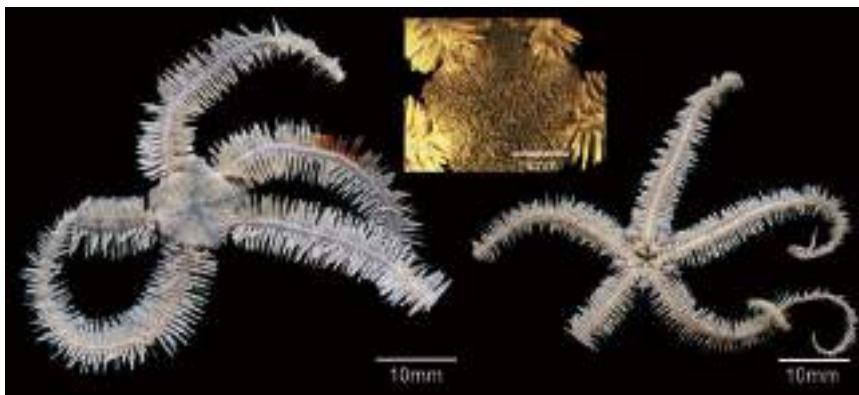
**Diagnosis** – Adapted from Clark (1923) and Clark & Courtman-Stock (1976). D.D. up to 20 mm, D.D./A.L. = 1/5. Dorsal disc plates covered in spinelets, stumps and spines, never intermixed. Radial shields triangular, more than half disc radius (smaller than *O. fragilis*), covered in stumps, sometimes sparsely so. Ventral side of disc with spinelets, with interradiial areas closest to oral shields naked. Genital slits extending more than half way to disc margin, genital plate distinct, genital papillae absent. Oral shields diamond-shaped with proximal lobe, wider than long. Adoral shields may or may not be contiguous. Arm spines up to ten (usually seven), glassy, thorny over total length, not tapering, sometimes lowermost transformed into a hook, longest one not more than three times segment length. Dorsal arm plates fan-shaped, sometimes wider than long, distal edge convex,

slightly contiguous. Ventral arm plates rectangular, wider than long, distal edge distinctly concave, not always contiguous. Tentacle scale single, small, usually with one tip, but sometimes two or three. Arms may be banded green, grey, brown, purple or red.

**Distribution and habitat** – South Africa: off Orange River (NC) to off Tugela Mouth (KZN), depth range: 0-348 m. Habitat: sponges, sand, shell, coral, mud, broken *Lithothamnion*, rock and under stones.



**Fig. 292.** Distribution of *Ophiothrix fragilis* var. *triglochis* in South Africa.



**Fig. 293.** Dorsal whole (left), ventral whole (right), dorsal disc (inset) views of *Ophiothrix fragilis* var. *triglochis* (SAMC A084242).

**Remarks** – Endemic to South Africa.

Clark (1923) and Mortensen (1927) separated var. *triglochis* based on i) the disc not having spinelets in among the disc stumps, ii) radial shields more or less well covered by stumps, iii) radial shields smaller than in *fragilis*, iv) disc spines less

thorny than in *fragilis*, v) dorsal arm plates wider than in *fragilis*, and vi) ventral arm plates shorter, wider and more widely separated than *fragilis*. Of the many specimens examined, some determined by A.M. Clark, there appeared to be no consistent characters to separate these forms. The most reliable difference should be stumps on the radial shields, with *fragilis* being naked or having few stumps, while *triglochis* can be covered to a varying degree by stumps. The stumps, however, also appeared to be an unreliable characteristic. In order to prove separation of *O. fragilis* var. *triglochis* and *O. fragilis*, a molecular study should be undertaken to compare the differences between a) the subtropical and temperate species within South Africa, and b) South African specimens and European specimens.

The type material is in the Museum of Comparative Zoology (syntype: MCZ OPH-2448), type locality is Port Natal (Durban), depth unknown.

As in the remarks for *Ophiothrix* (*Ophiothrix*) *aristulata*, Koehler (1922), Mortensen (1933a) and Clark (1923) suggested a number of authors may have misidentified *O. aristulata* as *O. triglochis*, or *vice versa*, but they maintained that *O. triglochis* was easily distinguished by its long arm spines and occurs in shallower depths than *aristulata*. However, the arm spines in *triglochis* have been reported as no longer than three arm segments, while the depth range of *aristulata* is 55-620 m, which overlaps with *triglochis* (0-130 m). In this study, the three South African species (*aristulata*, *fragilis* and var. *triglochis*) are all treated as separate species. It is recommended that these three species should be revised to establish if they are distinct.





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*Basket star on open reef* p. 17, fig. 3D

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*Amphiopiura sculptilis* p. 93, fig. 71

*Astroglymma cf. sculptum* p. 66, fig. 43

### **Didier VandenSpiegel (Royal Museum for Central Africa)**

*Macrophiothrix demessa* p. 260, fig. 263

*Macrophiothrix hirsuta cheneyi* p. 262, fig. 265

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*Ophiura kinbergi* p. 86, fig. 63

### **Lara Atkinson (South African Environmental Observation Network)**

*Ophiecten affinis simulans* p. 80, fig. 57

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*Astrodendrum capensis* p. 65, fig. 41

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*Ophioscolex inermis* p. 110, fig. 91

### **Wayne Evans (Ezemvelo KZN Wildlife)**

*Ophiiothrix* spp. on soft coral p. 17, fig. 3B



## Taxonomic index

The names of the species described in this work are put in bold. The numbers in bold indicate the page where this description starts. Other taxa mentioned throughout the text have also been included, in plain font.

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## Checklist

Checklist of all Ophiuroidea species known for South Africa, also indicating endemic species and those species new to South Africa since Clark & Courtman-Stock (1976).

Taxon	Endemic	New to South Africa
<b>EURYALIDA Lamarck, 1816</b>		
<b>Asteronychidae Ljungman, 1867</b>		
<i>Asteronyx loveni</i> Müller & Troschel, 1842		
<b>Euryalidae Gray, 1840</b>		
<i>Asteroschema salix</i> Lyman, 1879		x
<i>Asteromorpha capensis</i> (Mortensen, 1925)		
<i>Asterostegus tuberculatus</i> Mortensen, 1933		
<i>Astroceras spinigerum</i> Mortensen, 1933		
<b>Gorgonocephalidae Ljungman, 1867</b>		
<i>Astroboa nuda</i> (Lyman, 1874)		x
<i>Astrocladus africanus</i> Mortensen, 1933		
<i>Astrocladus euryale</i> (Retzius, 1783)	x	
<i>Astrocladus hirtus</i> Mortensen, 1933	x	
<i>Astrodendrum capensis</i> (Mortensen 1933)		
<i>Astroglymma</i> cf. <i>sculptum</i> (Döderlein, 1896)		x
<i>Astrothorax papillatus</i> (Benham, 1909)		
<i>Gorgonocephalus chilensis</i> (Philippi, 1858)		
<i>Gorgonocephalus pustulatum</i> (H.L. Clark, 1916)		
<b>OPHIURIDA Müller &amp; Troschel, 1840</b>		
<b>Ophiomusaidae O'Hara <i>et al.</i>, 2018</b>		
<i>Ophiomusa lymani</i> (Wyville Thomson, 1873)		
<b>Astrophiuridae Sladen, 1879</b>		
<i>Astrophiura permira</i> Sladen, 1879		
<i>Ophiomisidium pulchellum</i> (Wyville Thomson, 1878)		
<b>Ophiuridae Müller &amp; Troschel, 1840</b>		
<i>Ophiocten affinis simulans</i> (Mortensen, 1936)	x	
<i>Ophiocten amitinum</i> Lyman, 1878		
<i>Ophiocten hastatum</i> Lyman, 1878		
<i>Ophiura kinbergi</i> Ljungman, 1867		
<i>Ophiura ljunmani</i> (Lyman, 1878)		
<i>Dictenophiura anoidea</i> Clark, 1923	x	
<i>Ophiura trimeni</i> Bell, 1905	x	

Taxon	Endemic	New to South Africa
<b>Ophiopyrgidae Perrier, 1893</b>		
<i>Amphiophiura sculptilis</i> (Lyman, 1878)		x
<i>Amphiophiura trifolium</i> Hertz, 1927		
'Ophiura' <i>flagellata</i> (Lyman, 1878)		
<i>Ophiuroglypha costata</i> (Lyman, 1878)	x	
<i>Ophiuroglypha tumida</i> Mortensen, 1933		
<i>Ophiuroglypha irrorata irrorata</i> (Lyman, 1878)		
<i>Ophiuroglypha schmidtotti</i> Hertz, 1927		
<i>Anophiura simplex</i> H.L. Clark, 1939		
<i>Aspidophiura corone</i> Hertz, 1927		
<b>OPHIOSCOLECIDA</b>		
<b>Ophioscolecidae Lütken, 1869</b>		
<i>Ophiolycus dentatus</i> (Lyman, 1878)		
<i>Ophioscolex inermis</i> Mortensen, 1933	x	
<b>OPHIACANTHIDA</b>		
<b>Ophiotomidae O'Hara <i>et al.</i>, 2018</b>		
<i>Ophiotoma</i> cf. <i>alberti</i> (Koehler, 1896)		x
<i>Ophiotoma</i> cf. <i>gracilis</i> (Koehler, 1914)		x
<i>Ophiotreta durbanensis</i> (Mortensen, 1933)	x	
<i>Ophiotreta matura</i> (Koehler, 1904)		
<b>Ophiacanthidae Ljungman, 1867</b>		
<i>Ophiacantha baccata</i> Mortensen, 1933		
<i>Ophiacantha nertheptisila</i> H.L. Clark, 1923	x	
<i>Ophiacantha scutigera</i> Mortensen, 1933	x	
<i>Ophiacantha striolata</i> Mortensen, 1933	x	
<i>Ophiolimna perfida</i> (Koehler, 1904)		
<i>Ophiomitrella corynephora</i> H.L. Clark, 1923	x	
<i>Ophiomitrella hamata</i> Mortensen, 1933	x	
'Ophiophthalmus' <i>relictus</i> (Koehler, 1904)		
<i>Ophioplinthaca papillosa</i> H.L. Clark, 1939		
<i>Ophioplinthaca rudis</i> (Koehler, 1897)		
<i>Ophioplinthaca sexradia</i> Mortensen, 1933	x	
<b>Ophiodermatidae Ljungman, 1867</b>		
<i>Cryptopelta aster</i> (Lyman, 1879)	x	
<i>Ophiodyscrita acosmeta</i> H.L. Clark, 1938		x
<i>Ophiarachnella capensis</i> (Bell, 1888)		

Taxon	Endemic	New to South Africa
<i>Ophiarachnella gorgonia</i> (Müller & Troschel, 1842)		x
<i>Ophiochasma nitida</i> Hertz, 1927	x	
<i>Ophioderma wahlbergii</i> Müller & Troschel, 1842		
<b>Ophiopezidae O'Hara et al., 2018</b>		
<i>Ophiopeza fallax fallax</i> Peters, 1851		
<i>Ophiopeza spinosa</i> (Ljungman, 1867)		x
<i>Ophiochaeta hirsuta</i> Lütken, 1869		x
<b>Ophiomyxidae Ljungman, 1867</b>		
<i>Ophiomyxa australis</i> Lütken, 1869		x
<i>Ophiomyxa bengalensis</i> Koehler, 1897		
<i>Ophiomyxa tenuispina</i> Mortensen, 1933	x	
<i>Ophiomyxa vivipara capensis</i> Mortensen, 1936	x	
<i>Ophioconis cupida</i> Koehler, 1905		x
<i>Ophiarachna affinis</i> Lütken, 1869		x
<i>Ophiarachna septemspinosa</i> (Müller & Troschel, 1842)		x
<b>Ophiocomidae Ljungman, 1867</b>		
<i>Breviturma brevipes</i> Peters, 1851		x
<i>Breviturma dentata</i> Müller & Troschel, 1842		x
<i>Breviturma doederleini</i> de Loriol, 1899		x
<i>Breviturma pica</i> Müller & Troschel, 1842		
<i>Breviturma pusilla</i> (Brock, 1888)		x
<i>Ophiocoma erinaceus</i> Müller & Troschel, 1842		
<i>Ophiocoma scolopendrina</i> (Lamarck, 1816)		
<i>Ophiocomella valenciae</i> Müller & Troschel, 1842		
<i>Ophiocomella sexradia</i> (Duncan, 1887)		x
<i>Ophiomastix koehleri</i> Devaney, 1977		x
<i>Ophiomastix venosa</i> Peters, 1851		x
<b>OPHIOLEUCIDA</b>		
<b>Ophiernidae O'Hara et al., 2018</b>		
<i>Ophiernus quadrispinus</i> Koehler, 1908		
<i>Ophiernus vallincola</i> Lyman, 1878		
<b>Ophioleucidae Matsumoto, 1915</b>		
<i>Ophiopallas paradoxa</i> Koehler, 1904		
<b>AMPHILEPIDIDA</b>		
<b>Ophiolepididae Ljungman, 1867</b>		
<i>Ophiolepis cincta cincta</i> Müller & Troschel, 1842		

Taxon	Endemic	New to South Africa
<b>Hemieuryalidae von Martens, 1867</b>		
<i>Ophioplocus imbricatus</i> (Müller & Troschel, 1842)		x
<b>Amphilimnidae O'Hara et al., 2018</b>		
<i>Amphilimna cribriformis</i> A.M. Clark, 1974		
<i>Amphilimna valida</i> (H.L. Clark, 1939)		
<b>Ophionereididae Ljungman, 1867</b>		
<i>Ophionereis australis</i> (H.L. Clark, 1923)		
<i>Ophionereis dubia dubia</i> (Müller & Troschel, 1842)		
<i>Ophionereis porrecta</i> Lyman, 1861		
<i>Ophionereis vivipara</i> Mortensen, 1933		
<b>Ophiopsilidae Matsumoto, 1915</b>		
<i>Ophiopsila bispinosa</i> A.M. Clark, 1974		x
<i>Ophiopsila seminuda</i> A.M. Clark, 1952		
<b>Amphiuridae Ljungman, 1869</b>		
<i>Amphioplus (Amphioplus) pectinatus</i> Mortensen, 1933		x
<i>Amphioplus (Lymanella) depressus</i> (Ljungman, 1867)		
<i>Amphioplus (Lymanella) furcatus</i> Mortensen, 1933		
<i>Amphioplus (Lymanella) integer</i> (Ljungman, 1867)		
<i>Amphioplus (Unioplus) falcatus</i> Mortensen, 1933		x
<i>Amphipholis similis</i> Mortensen, 1933		x
<i>Amphipholis squamata</i> (Delle Chiaje, 1828)		
<i>Amphipholis strata</i> Mortensen, 1933		x
<i>Amphiura (Amphiura) acutisquama</i> A.M. Clark, 1952		x
<i>Amphiura (Amphiura) albella</i> Mortensen, 1933		x
<i>Amphiura (Amphiura) angularis</i> Lyman, 1879		
<i>Amphiura (Amphiura) atlantica</i> Ljungman, 1867		
<i>Amphiura (Amphiura) capensis</i> Ljungman, 1867		
<i>Amphiura (Amphiura) grandisquama natalensis</i> Mortensen, 1933		x
<i>Amphiura (Amphiura) incana</i> Lyman, 1879		
<i>Amphiura (Amphiura) linearis</i> Mortensen, 1933		x
<i>Amphiura (Amphiura) otteri</i> Ljungman, 1872		
<i>Amphiura (Amphiura) simonsi</i> A.M. Clark, 1952		x
<i>Amphiura (Amphiura) uncinata</i> Koehler, 1904		
<i>Ophiodaphne scripta</i> (Koehler, 1904)		
<i>Ophionephthys lowelli</i> A.M. Clark, 1974		x

Taxon	Endemic	New to South Africa
<b>Amphilepididae Matsumoto, 1915</b>		
<i>Amphilepis scutata</i> Mortensen, 1933	x	
<b>Ophiothamnidae O'Hara <i>et al.</i>, 2018</b>		
<i>Ophiothamnus remotus</i> Lyman, 1878	x	
<i>Histampica duplicata</i> (Lyman, 1875)		
<b>Ophiactidae Matsumoto, 1915</b>		
<i>Ophiactis abyssicola</i> (M. Sars, 1861)		
<i>Ophiactis carnea</i> Ljungman, 1867		
<i>Ophiactis nidarosiensis</i> Mortensen, 1920		
<i>Ophiactis</i> cf. <i>picteti</i> (de Loriol, 1893)		x
<i>Ophiactis plana</i> Lyman, 1869		
<i>Ophiactis savignyi</i> (Müller & Troschel, 1842)		
<b>Ophiotrichidae Ljungman, 1867</b>		
<i>Macrophiothrix demessa</i> (Lyman, 1862)		x
<i>Macrophiothrix hirsuta cheneyi</i> (Lyman, 1862)		
<i>Macrophiothrix longipeda</i> (Lamarck, 1816)		
<i>Macrophiothrix propinqua</i> (Lyman, 1862)		x
<i>Ophiocnemis marmorata</i> (Lamarck, 1816)		
<i>Ophiogymna capensis</i> (Lütken, 1869)	x	
<i>Ophiogymna fulgens</i> (Koehler, 1905)		
<i>Ophiothela danae</i> Verrill, 1869		
<i>Ophiothela venusta</i> (de Loriol, 1900)		
<i>Ophiothrix (Acanthophiothrix) proteus</i> Koehler, 1905		
<i>Ophiothrix (Acanthophiothrix) purpurea</i> von Martens, 1867		x
<i>Ophiothrix (Ophiothrix) aristulata</i> Lyman, 1879		
<i>Ophiothrix (Ophiothrix) echinotecta</i> Balinsky, 1957		x
<i>Ophiothrix (Ophiothrix) foveolata</i> Marktanner, 1887		x
<i>Ophiothrix fragilis</i> (Abildgaard, in O.F. Müller, 1789)		
<i>Ophiothrix fragilis</i> var. <i>triglochis</i> (Müller & Troschel, 1842)	x	





## Glossary

Terms used in taxonomic studies of brittle and baskets stars of South Africa.

<b>Term</b>	<b>Definition / explanation</b>
<b>Abut</b>	Touching, or being next to.
<b>Adjacent</b>	Next to, nearest in space or position, immediately adjoining without a space.
<b>Adoral</b>	Situated near mouth.
<b>Adoral shields</b>	Pair of plates in each ventral interradius adjacent to an unpaired oral shield (Fig. 10).
<b>Adradial</b>	Situated near or beside arms.
<b>Ambulacrum / ambulacral grooves</b>	Structure/s which run along the ventral side of the arm, through which tube feet protrude.
<b>Annulated</b>	Furnished with or composed of rings, structural or in colouration.
<b>Apical papillae</b>	Papillae on apex of jaws, on dental plate, homologous to teeth.
<b>Apical</b>	Apex, tip or top of a conical or spherical structure.
<b>Appressed</b>	Pressed up against or close to another structure.
<b>Approximating</b>	Close to or similar to something.
<b>Arm comb</b>	Series of papillae or small spines arising from the distalmost end of the abradial genital plate distal to each radial shield at base of arm (Fig. 8).
<b>Arm plates</b>	Plates on arms for rigidity and protection, may be distinct or not, found dorsally, ventrally and laterally (Figs 7, 8, 10, 13 & 14).
<b>Arm spines</b>	Projections hosted by lateral arm plates; also see spines (Figs 10 & 16).
<b>Attenuate</b>	Becomes thin or fine; to lessen.
<b>Autotomise</b>	Separation of an appendage or body part.
<b>Basal</b>	Part nearest to disc; see also proximal (Fig. 7).
<b>Belts of hooks</b>	Fine arm spines arranged in belts encircling arm; also see girdle belts.

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<b>Term</b>	<b>Definition / explanation</b>
<b>Bifurcate</b>	Divided into two (Fig. 21), y-shaped.
<b>Branched</b>	Arms forming tree-like formation by splitting.
<b>Carinate</b>	With a keel or keel-like ridge.
<b>Central plate</b>	Plates in centre of disc, may be a variety of shapes (Fig. 9).
<b>Clavate</b>	Club-shaped; gradually becoming thicker towards end; having an enlarged terminal end (Fig. 21).
<b>Concentric</b>	Formation of circles or arcs which share a common centre.
<b>Constricted</b>	To make narrower, may be in a non-uniform manner.
<b>Contiguous</b>	Touching or very close, unable to see separation.
<b>Dental papillae</b>	Papillae are modified teeth, positioned on dental plate on jaw, dental plates can only be seen during dissections (Figs 11 & 12).
<b>Diastema</b>	Space or gap between two adjacent papillae or teeth.
<b>Digitate</b>	Shape of a spread hand, many lobes (Fig. 21).
<b>Disc margin</b>	Outer edge or periphery of disc.
<b>Distal notch</b>	Inner area within oral slit where two jaws join.
<b>Distal</b>	Part of a structure farthest from centre of body, opposite to proximal (Fig. 7).
<b>Dorsal</b>	Top or upper side of an organism.
<b>Dorso-ventrally</b>	Direction in which arms bend i.e., towards ventral side.
<b>Excavate</b>	Form a hollow.
<b>Fenestrated</b>	Small opening.
<b>Fissiparous</b>	Self-dividing across disc, followed by regeneration.
<b>Flatten</b>	Compressed or to decrease in height.
<b>Flange</b>	Projection, rim or collar on a structure, serving for strength or attachment.
<b>Fork</b>	Position where arm splits.
<b>Genital papillae</b>	Papillae located on or adjacent to genital slit (Fig. 10).

<b>Term</b>	<b>Definition / explanation</b>
<b>Genital plate</b>	Plate adjacent to genital slit.
<b>Genital slits</b>	Genital openings on ventral side of disc, often lying where arm and disc connect or on lateral side of disc (Fig. 10).
<b>Girdle belts</b>	Encircling or ring-like structure of fine arm spines arranged in belts encircling arm; also see belts of hooks.
<b>Glassy</b>	Almost transparent, glossy or shiny.
<b>Hyaline</b>	Clear or transparent.
<b>Imbricating</b>	Structures overlapping.
<b>Infra-</b>	Prefix, down, below, beneath.
<b>Infradental papillae</b>	Oral papillae that originate at the lateral edge of the dental plate and may move below the teeth to varying degree (Fig. 10). Not apical papillae.
<b>Inter-</b>	Prefix, among or between.
<b>Interradial area</b>	Area between arms on disc, found both dorsally and ventrally.
<b>Interstitial</b>	Small spaces between.
<b>Jaws</b>	Mouth parts containing oral papillae, teeth and oral tentacle scales. Also see oral plates (Figs 10, 11 & 12).
<b>Lacking</b>	Non-existent, absent.
<b>Lamina</b>	Inner side of hooks or hooklets of arm spine, present in Euryalida (Fig. 18).
<b>Lateral</b>	Situated at, coming from, or directed towards a side.
<b>Lateroventral</b>	Situated to a side and below or underside.
<b>Lobe</b>	Round protrusion from a surface (Fig. 20).
<b>Lowermost (referring to teeth)</b>	Position when ventral side is being examined, lowermost tooth is closest tooth while uppermost tooth is deep in mouth.
<b>Madreporite</b>	Perforated plate by which entry of seawater into vascular system is controlled.
<b>Marbled</b>	Streaked, patterned or variegated in appearance.
<b>Marginal plates</b>	Plates on disc margin.

<b>Term</b>	<b>Definition / explanation</b>
<b>Median projection</b>	Protrusion in middle.
<b>Moniliform</b>	Like a string of beads in appearance.
<b>Multifid</b>	End or tip of a structure, has multiple protrusions, divisions or tips; also see multi-toothed (Fig. 21).
<b>Multi-toothed</b>	End or tip of a structure, has multiple protrusions, divisions or tips; also see multifid (Fig. 21).
<b>Notch</b>	Indentation on edge or surface of a structure (Fig. 20).
<b>Opaque</b>	Structure not being translucent or clear.
<b>Opercular</b>	Flap-like or broad in shape.
<b>Oral</b>	Lower or underside of an echinoderm or pertaining to area close to mouth. Also see ventral and adoral.
<b>Oral bridge</b>	Structure covering part of the ambulacral groove on the underside of vertebrae in arms.
<b>Oral frame</b>	Outer edges of jaws.
<b>Oral papillae</b>	Papillae fringing jaws, may be one or few (Figs 7, 10, 11 & 12).
<b>Oral plates</b>	Internal skeletal elements of the jaws, two per jaw.
<b>Oral shield</b>	Single plate on each jaw, adjacent to adoral shields.
<b>Oral slit</b>	Mouth or opening on ventral side, slit between two jaws.
<b>Oral tentacle pore</b>	Pore in oral / jaw area from which tube feet arise (Fig. 10).
<b>Oral tentacle scales</b>	Single or sometimes paired papillae adjacent to first one or two tentacle / oral pores, more or less inset into oral slit, sometimes in series with or may be indistinguishable from oral papillae.
<b>Ossicles</b>	Small calcified structures referred to in Euryalida structures.
<b>Papilla</b>	Nipple-like elevation or feature.
<b>Papilliform</b>	Shape of nipple-like structures.
<b>Paved</b>	Where plates cover a surface or interlocking without gaps or overlapping.

<b>Term</b>	<b>Definition / explanation</b>
<b>Plates</b>	Structures used in reinforcement, protection or creating structure; also see shields and scales.
<b>Polygonal</b>	Two-dimensional shapes formed with straight lines, 3 or more sides and angles.
<b>Primary rosette</b>	Group of five primary radial plates and central plate on dorsal side of disc (Fig. 9).
<b>Proximal</b>	Toward or nearer centre of body; see also basal (Fig. 7).
<b>Pustular</b>	Small swelling or slightly enlarged structure at tip of a structure, similar to clavate or club.
<b>Pyriform</b>	Pear-shaped (Fig. 20).
<b>Radial plates</b>	Primary plates located in centre of disc, not to be confused with radial shields which are located at disc margin.
<b>Radial shields</b>	Pair of plates on dorsal side of disc opposite base of each arm, may be reduced or concealed by disc armament. In Euryalida, may be rib-like and sometimes referred to as radial ribs (Figs 7, 8 & 19).
<b>Rudimentary</b>	Immature, undeveloped or basic form.
<b>Rugose</b>	Structure being corrugated or rough.
<b>Scales</b>	Structures which cannot be identified individually and have no defined position; also see plates and shields.
<b>Secondary tooth</b>	Secondary hook on arm spines where end has more than a single hook (Fig. 18).
<b>Segment</b>	External structure of arm vertebrae.
<b>Shields</b>	Flat structures used in reinforcement, protection or creating structure; also see plates.
<b>Simple</b>	Arms not branched or do not split.
<b>Sinuuous</b>	Having many curves and turns.
<b>Spines</b>	Projections and protrusions which are hard and articulated, on disc and arms.
<b>Spinelets</b>	Small spines.

<b>Term</b>	<b>Definition / explanation</b>
<b>Spiniform</b>	Narrow and elongated, may diminish or reduce in thickness towards one end; also see tapering (Figs 20 & 21).
<b>Squat</b>	Short and wide.
<b>Stereotropism</b>	Growth or movement determined by contact with a solid.
<b>Stout</b>	Thick and visibly strong.
<b>Striations</b>	Series of ridges, furrows or linear marks.
<b>Subcutaneous</b>	Under skin.
<b>Subequal</b>	Nearly equal in length.
<b>Superimposed</b>	Placed or laying over another, usually so both structures are still evident.
<b>Supplementary plates / shields</b>	Additional plates adjacent to dorsal disc plates, oral shields or arm plates, only found in some families or genera.
<b>Tapering</b>	Diminishes or reduces in thickness towards one end; also see spiniform (Figs 20 & 21).
<b>Teeth</b>	Structures on dental plates (Figs 10, 11 & 12).
<b>Tentacle pore</b>	Pore from which tube feet arise (Fig. 10).
<b>Tentacle scale</b>	Papillae adjacent to tentacle pores, may cover tentacle pore (Fig. 10).
<b>Terminal tooth</b>	Primary hook on arm spines. Arm spines may have more than a single hook (Fig. 18).
<b>Tessellated</b>	Repeated use of a single shape, without gaps or overlapping.
<b>Tinge</b>	Trace of a colour.
<b>Trefoil</b>	Three-lobed (Fig. 20).
<b>Trifid</b>	Three points, parts or branches (Fig. 21).
<b>Truncated</b>	Abrupt termination or square end of a structure.
<b>Tube feet</b>	Appendages at end of water vascular system, project through tentacle pores.
<b>Tumid</b>	Puffy, swollen, enlarged, bulging.

<b>Term</b>	<b>Definition / explanation</b>
<b>Umbrella</b>	Fringe of modified arm plates, only found in <i>Astrophisura</i> .
<b>Undulating</b>	Wavy form or outline.
<b>Ventral groove</b>	Furrow along midline of ventral arm.
<b>Ventral</b>	Lower or underside of an organism.
<b>Vertebrae</b>	Internal structures/ossicles in arms, articulated with each other.
<b>Wanting</b>	Lacking, being non-existent or absent.

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## About the authors



**Dr Jennifer M. Olbers** (1981) has been a Marine Ecologist for Ezemvelo KZN Wildlife in KwaZulu-Natal for 12 years and is a Research Associate at the University of Cape Town. She has a PhD in Zoology. Her research interests are in marine invertebrate biodiversity and reef ecology. She has published numerous scientific and popular articles, presenting at various national and international conferences.



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**Dr Tim O'Hara** (1961) a marine curator at Museums Victoria in Melbourne Australia since 2001, is a world expert on the taxonomy, evolution and biogeography of brittle stars. These animals are abundant on the seafloor and his mission is to use distributional and DNA data from these animals to develop an understanding of how and when life spread around the oceans and their future conservation needs.



**Dr Yves Samyn** (1972) has been employed since 2004 by the Royal Belgian Institute of Natural Sciences in Brussels. First as responsible scientist for the Belgian Global Taxonomy Initiative, then, since 2012 as curator of the recent invertebrate collections. His research interests continue to be with the taxonomy of echinoderms, sea cucumbers in particular. In the last 2 decades he organised and participated to several expeditions to the Indian Ocean, resulting in important voucher collections from, a.o, South Africa.







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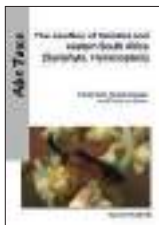
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