

**ANNOTATED CHECKLIST OF THE ECHINODERMS FROM THE
KIUNGA MARINE NATIONAL RESERVE, KENYA.
PART I: ECHINOIDEA AND HOLOTHUROIDEA**

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ABSTRACT

The echinoderm fauna of the Kiunga Marine National Reserve, Kenya, is documented, based on the results of a field trip, and additional information from the literature. In this first paper, the Holothuroidea and Echinoidea are discussed. A total of 91 specimens representing eight orders, 13 families, 19 genera and 37 species were collected. Five other species were not collected but were identified in the field. Six additional species are reported from literature only and are not discussed. Diagnostic characters of every species recorded are given, as well as an assessment of their abundance in the Kiunga Marine Reserve. *Clypeaster rarispinus*, *Phyllacanthus imperialis*, *Microcyphus rousseaui* (Echinoidea), *Holothuria* (*Cystipus*) *rigida*, *Holothuria* (*Platyperona*) *difficilis*, *Labidodemas pertinax*, *Stichopus chloronotus* and *Stichopus* cf. *monotuberculatus* (Holothuroidea) are new records for Kenya. *Holothuria* (*Theelothuria*) *turriscelsa* is a new record for the Indian Ocean. This study stresses the importance of the Kiunga Marine National Reserve as a sanctuary in the conservation of the marine invertebrate fauna.

INTRODUCTION

Few basic studies have been undertaken to map the distribution of echinoderms in the western Indian Ocean. All information available for echinoderms of shallow-water of the Indo-West Pacific Ocean was reviewed by Clark & Rowe (1971). This work is now at least partly outdated; also, the scale with which the distributions were mapped is too coarse to support management of these important natural resources. Humphreys (1981) lists all species of echinoderms in the Watamu/Malindi area, and in parts of Tanzania. Richmond (1997) compiled a book on most fauna and flora groups of the seashores of eastern Africa, including a chapter on echinoderms (Rowe & Richmond, 1997). But again, geographical ranges are too broad for management purposes. Tortonese (1949, 1951, 1980) studied the echinoderms of

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the Somali coast. Obura *et al.* (1998) surveyed the Kiunga Marine Reserve, but unfortunately did not take any specimens; so their identifications must be treated with caution.

This expedition was a joint effort of the Free University of Brussels (Unit of Ecology & Systematics), WWF Kenya and Kenya Wildlife Service. Collecting was done by hand-picking at low tide, by snorkeling and by SCUBA diving up to depths of 31 m, from 3 to 12 May, 1999. Destructive sampling techniques like dredging were never used.

Analogous to Sloan *et al.* (1979), detailed taxonomic descriptions and geographical distributions are not included; instead we refer to major works (Clark & Rowe, 1971; Clark & Courtman-Stock, 1976; Rowe & Doty, 1977; Cherbonnier, 1988; Rowe & Gates, 1995; Massin, 1996a, 1999) from which the original descriptions and geographical distributions can be traced. A brief field description is included, as are important records for eastern Africa and the western Indian Ocean.

STUDY REGION

The Kiunga Marine National Reserve was gazetted in 1979 as a Marine National Reserve and at 250 km² is the largest marine reserve in Kenya. It is part of the Bajuni Archipelago, which lies at the northernmost extremity of the Kenya coast, bordering Somalia. The seven islands of the archipelago are fringed with mangrove forests, surrounded by extensive seagrass beds and coral reefs. The area is important for biodiversity, and provides nesting sites for marine turtles and migratory birds (Obura *et al.*, 1998). Table 1 lists the names and coordinates of the different sampling sites within the Reserve, together with the depth ranges (see also figure 1).

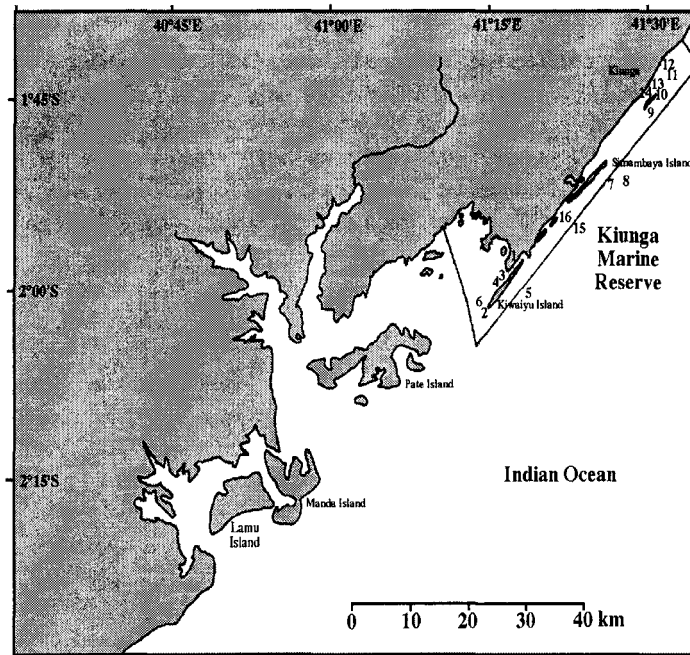


Figure 1. Map with observation and collection sites in the Kiunga Marine Reserve. (1) Mkomani; (2) Kilima Nungu; (3) Mike's Outer Reef; (4) Mike's Inner Reef; (5) Chongo cha Chano; (6) Shimo la Tewa; (7) Chongo cha Kui; (8) Kui; (9) Mwamba Mkuu; (10) Mlango wa Bomani; (11) Wreck; (12) Kaddhika; (13) Mwamba wa Boso; (14) Kiunga Camp; (15) Chongo cha Mvundeni; (16) Hindi.

Table 1. Names and coordinates of the different sampling and observation sites in the Kiunga Marine Reserve. Depths apply to the low water level.

Date	Site Name	Region	Depth range (m)	Latitude	Longitude
4 / 4 / 99	Mkomani	Kiwaiyu	1-4	01°57'42" S	41°18'02" E
4 / 4 / 99	Kilima Nungu	Kiwaiyu	4-8	02°02'40" S	41°15'55" E
5 / 4 / 99	Mike's Outer Reef	Kiwaiyu	1.5-3	01°59'39" S	41°17'28" E
5 / 4 / 99	Mike's Inner Reef	Kiwaiyu	5-8	01°59'40" S	41°17'28" E
6 / 4 / 99	Chongo cha Chano	Kiwaiyu	8-17	02°00'29" S	41°20'01" E
6 / 4 / 99	Shimo la Tewa	Kiwaiyu	3-7	02°02'35" S	41°14'47" E
7 / 4 / 99	Chongo cha Kui	Kui	12-21	01°52'02" S	41°26'55" E
7 / 4 / 99	Kui	Kui	1-4	01°49'29" S	41°26'43" E
8 / 4 / 99	Mwamba Mkuu	Kiunga	7-17	01°46'10" S	41°30'38" E
8 / 4 / 99	Mlango wa Bomani	Kiunga	1-5	01°44'37" S	41°31'09" E
9 / 4 / 99	Wreck	Ishakani	6-10	01°43'14" S	41°32'48" E
9 / 4 / 99	Kaddhika	Ishakani	1-3	01°43'04" S	41°32'28" E
9 / 4 / 99	Mwamba wa Boso	Kiunga	1-3	01°44'18" S	41°31'34" E
9 / 4 / 99	Kiunga Camp	Kiunga	1-8	01°45'14" S	41°30'35" E
10 / 4 / 99	Mwamba Mkuu	Kiunga	8-22	01°44'39" S	41°31'15" E
10 / 4 / 99	Kui	Kui	0.5-5	01°49'29" S	41°26'43" E
11 / 4 / 99	Chongo cha Mvundeni	Rubu	8-28	01°55'29" S	41°23'35" E
11 / 4 / 99	Hindi	Rubu	1-5	01°54'25" S	41°22'22" E
12 / 4 / 99	Chongo cha Chano	Kiwaiyu	11-31	02°00'35" S	41°19'58" E
12 / 4 / 99	Mike's Outer Reef	Kiwaiyu	1-4	01°59'39" S	41°17'29" E
12 / 4 / 99	Kilima Nungu	Kiwaiyu	4-8	02°02'40" S	41°15'55" E

RESULTS

A total of 91 specimens representing 37 species were collected. An overview of the echinoids and holothurians from the Kiunga Marine Reserve (Obura *et al*, 1998; this study) compared to the echinoid and the holothurian fauna of Kenya (Levin, 1979: holothurians only; Humphreys, 1981) and Somalia (Tortonese, 1949–1951; 1951; 1980) is given in table 2. Several important 'historical papers' also describe echinoderms collected in the region of interest. These are not included in table 2, but are separately discussed in the systematic account. A species is considered to belong to the echinoderm fauna of the Kiunga Marine Reserve if it is reported by us or if it is reported from both Somalia and Kenya.

An indication of abundance in the Kiunga Marine Reserve is given in four categories:

- **Very rare:** only one or two specimens seen during the survey;
- **Rare:** spotted up to five specimens during the survey;
- **Common:** seen up to 20 specimens during the survey;
- **Abundant:** spotted more than 20 specimens during the survey.

SYSTEMATIC ACCOUNT

Tables 3 and 4 list the different species with their collection site, depth range, abundance and collection number. This collection is deposited in the Royal Belgian Institute for Natural Sciences, in Brussels, Belgium. Most of the identifications are based on the key provided by Clark & Rowe (1971) for the echinoids and on the keys provided by Cherbonnier (1988) for the holothurians.

Table 2. Littoral Holothuroidea and Echinoidea from the Kiunga Marine Reserve and surrounding regions (recent records only): (1) Tortonese, 1980 (Somalia); (2) Tortonese, 1951 (Somalia); (3) Tortonese, 1949-51 (Somalia); (4) Levin, 1979 (Mombasa, Kenya); (5) Humphreys, 1981 (Kenya and adjacent regions); (6) Obura et al., 1998 (Kiunga Marine Reserve); (7) this study. ** denotes a new record for the Indian Ocean; * denotes a new record for Kenya.

Current species name	1	2	3	4	5	6	7
ECHINOIDEA							
IRREGULARIA							
Brissidae							
<i>Brissus latecarinatus</i> (Leske, 1778)					x		
<i>Metalia sternalis</i> (Lamarck, 1816)					x		
Clypeasteridae							
<i>Clypeaster fervens</i> Koehler, 1922					x		
<i>Clypeaster rarispinus</i> de Meijere, 1902					x	x	*
<i>Clypeaster reticulatus</i> (Linnaeus, 1758)					x		
Echinoneidae							
<i>Echinoneus cyclostomus</i> Leske, 1778	x				x		
Laganidae							
<i>Laganum depressum</i> Lesson in L. Agassiz, 1841	x	x			x	x	
<i>Laganum joubini</i> Koehler, 1922					x		
Schizasteridae							
<i>Schizasterid</i> sp.					x		
Spatangidae							
<i>Marelia planulata</i> (Lamarck, 1816)					x		
Scutellidae							
<i>Echinodiscus bisperforatus</i> Leske, 1778 cited as <i>Echinodiscus biforis</i> (Gmel.)					x	x	
REGULARIA							
Cidaridae							
<i>Eucidaris metularia</i> (Lamarck, 1816)	x				x		
<i>Prionocidaris baculosa</i> (Lamarck, 1816)					x		
<i>Prionocidaris verticillata</i> (Lamarck, 1816)					x		
<i>Phyllacanthus imperialis</i> (Lamarck, 1816)						x	*
Diadematidae							
<i>Astropyga radiata</i> (Leske, 1778)					x	x	
<i>Diadema savignyi</i> Michelin, 1845					x	x	
<i>Diadema setosum</i> (Leske, 1778)					x	x	x
<i>Echinothrix diadema</i> (Linnaeus, 1758)	x				x	x	x
<i>Echinothrix calamaris</i> (Pallas, 1774)		x			x		x
Echinometridae							
<i>Colobocentrotus atratus</i> (Linnaeus, 1758)			x		x		
<i>Echinometra mathaei</i> (de Blainville, 1825) cited as <i>E. mathaei violacea</i>	x	x	x		x	x	x
<i>Echinostrephus molaris</i> (de Blainville, 1825)					x	x	x
<i>Heterocentrotus mammillatus</i> (Linnaeus, 1758)					x		x
<i>Heterocentrotus trigonarius</i> (Lamarck, 1816)			x		x		
Stomopneustidae							
<i>Stomopneustes variolaris</i> (Lamarck, 1816)	x	x			x	x	x
Parasalenidae							
<i>Parasalenia gratiosa</i> A. Agassiz, 1863					x		
Temnopleuridae							
<i>Microcyphus rousseaui</i> L. Agassiz, 1846	x						x
<i>Salmacis bicolor</i> in Agassiz & Désor, 1846		x					*
Toxopneustidae							
<i>Toxopneustes pileolus</i> (Lamarck, 1816)	x	x			x	x	x
<i>Triopneustes gratilla</i> (Linnaeus, 1758)	x	x	x		x	x	x
HOLOTHUROIDEA							
Holothuriidae							
<i>Actinopyga echinites</i> (Jaeger, 1833) cited as <i>A. plebeja</i>	x			x			x
<i>Actinopyga lecanora</i> (Jaeger, 1833)				x			
<i>Actinopyga mauritiana</i> (Quoy & Gaimard, 1833)	x				x	x	x
<i>Actinopyga miliaris</i> (Quoy & Gaimard, 1833) cited as <i>Actinopyga</i> sp.				x	x		x
<i>Actinopyga</i> sp.					x		
<i>Bohadschia atra</i> Massin et al., 1999							x

Current species name	1	2	3	4	5	6	7
<i>Bohadschia subrubra</i> (Quoy & Gaimard, 1833)						x	x
cited as <i>Bohadschia koellikeri</i> (Semper, 1868)					x		
<i>Bohadschia vitiensis</i> (Semper, 1868)						x	
<i>Bohadschia marmorata</i> Jaeger, 1833				x	x		x
<i>Holothuria</i> (<i>Acanthotrapeza</i>) <i>pyxis</i> Selenka, 1867				x			
<i>Holothuria</i> (<i>Cystipus</i>) <i>rigida</i> (Selenka, 1867)							x
<i>Holothuria</i> (<i>Halodeima</i>) <i>atra</i> Jaeger, 1833	x				x	x	x
<i>Holothuria</i> (<i>Halodeima</i>) <i>edulis</i> Lesson, 1830						x	x
<i>Holothuria</i> (<i>Lessonothuria</i>) <i>pardalis</i> Selenka, 1867	x				x		x
<i>Holothuria</i> (<i>Mertensiothuria</i>) <i>leucospilota</i> (Brandt, 1835)	x				x		x
<i>Holothuria</i> (<i>Metriatyla</i>) <i>scabra</i> Jaeger, 1833					x	x	x
<i>Holothuria</i> (<i>Microthele</i>) <i>nobilis</i> (Selenka, 1867)	x				x	x	x
<i>Holothuria</i> (<i>Platyperona</i>) <i>difficilis</i> Semper, 1868							x
<i>Holothuria</i> (<i>Platyperona</i>) <i>strigosa</i> Selenka, 1867							x
cited as <i>Holothuria</i> (<i>Thymiosycia</i>) <i>strigosa</i>	x						
<i>Holothuria</i> (<i>Semperothuria</i>) <i>cinerascens</i> (Brandt, 1835)	x			x	x		x
<i>Holothuria</i> (<i>Selenkothuria</i>) <i>erinaceus</i> Semper, 1868	x						
<i>Holothuria</i> (<i>Selenkothuria</i>) <i>parva</i> Lampert, 1885	x					x	
<i>Holothuria</i> (<i>Stauropora</i>) <i>fuscocinerea</i> Jaeger, 1833					x		x
<i>Holothuria</i> (<i>Stauropora</i>) <i>pervicax</i> Selenka, 1867	x				x		
<i>Holothuria</i> (<i>Theelothuria</i>) <i>turrisceles</i> Cherbonnier, 1980							x
							*
<i>Holothuria</i> (<i>Thymiosycia</i>) <i>arenicola</i> Semper, 1868	x						x
<i>Holothuria</i> (<i>Thymiosycia</i>) <i>hilla</i> Lesson, 1830	x				x		x
<i>Holothuria</i> (<i>Thymiosycia</i>) <i>impatiens</i> (Forskål, 1775)	x				x		x
<i>Labidodemas rugosum</i> (Ludwig, 1875)	x						
<i>Labidodemas pertinax</i> Ludwig, 1875							x
<i>Labidodemas semperianum</i> Selenka, 1867					x		
Stichopodidae							
<i>Stichopus chloronotus</i> Brandt, 1835							x
<i>Stichopus hermanni</i> Semper, 1868							x
cited as <i>Stichopus variegatus</i> Semper, 1868				x	x		
<i>Stichopus monotuberculatus</i> (Quoy & Gaimard, 1833)							x
cited as <i>Stichodactylidae</i> sp. 1						x	
<i>Thelenota ananas</i> (Jaeger, 1833)					x		
Phylloporidae							
<i>Afrocucumis africana</i> (Semper, 1868)	x				x		x
Chiridotidae							
<i>Polycheira fusca</i> (Quoy & Gaimard, 1833)							
cited as <i>Polycheira rufescens</i> (Brandt, 1835)	x						
Synaptidae							
<i>Opheodesoma spectabilis</i> Fischer, 1907					x		
cited as <i>Opheodesoma</i> sp. prob. <i>O. spectabilis</i> Fischer, 1907					x		
<i>Synapta maculata</i> (Chamisso & Eysenhardt, 1821)					x		x

ECHINOIDEA (Local Swahili name: urumba)

We collected 34 specimens, representing 14 species of Echinoidea. No specimens were collected for two species that were reliably identified in the field: *Astropyga radiata* and *Heterocentrotus mammillatus*. According to literature, four more species, *Colobocentrotus atratus*, *Echinoneus cyclostomus*, *Eucidaris metularia* and *Heterocentrotus trigonarius* are expected in the studied region. This would bring the total echinoid fauna of the Kiunga Marine Reserve to 20 species; three of these are reported here for the first time from Kenya: *Clypeaster rarispinus*, *Phyllacanthus imperialis* and *Microcyphus rousseaui*.

Order Clypeasteroidea L. Agassiz & Desor, 1847

Family Clypeasteridae L. Agassiz, 1881

Genus *Clypeaster* Lamarck, 1801

Clypeaster rarispinus de Meijere, 1902. Pl. 1A

Material examined. KKiu/9916 (four specimens).

Table 3. List of echinoids collected at the different localities in the Kiunga Marine Reserve. The number of specimens refers to the number of animals that were encountered during a 60-minute sampling period. i.t. stands for intertidal. Depths apply to the low water level.

Species	Site name	Min -max depth (m)	Approx #	Collection number
IREGULARIA				
Clypeasteridae				
<i>Clypeaster rarispinus</i>	Mkomani	i.t.	No data	KKiun/9916
Laganidae				
<i>Laganum depressum</i>	Mkomani	i.t.	No data	KKiun/9917
Scutellidae				
<i>Echinodiscus bisperforatus</i>	Mkomani	i.t.	No data	KKiun/9915
REGULARIA				
Cidaridae				
<i>Phyllacanthus imperialis</i>	Mkomani	7	1	None
	Kilima Nungu	5	1	KKiun/9901
Diadematidae				
<i>Astropyga radiata</i>	Mlango Bomani	2	1	None
<i>Diadema savignyi</i>	Mkomani	i.t.	2	None
	Mwamba Mkuu	9	1	None
	Kaddhika	1	2	None
	Hindi	1	2	KKiun/9903
<i>Diadema setosum</i>	Shimo La Tewa	3-7	3	None
	Chongo Cha Kui	8	1	None
	Kui	3	1	KKiun/9902
<i>Echinothrix calamaris</i>	Kaddhika	2	1	KKiun/9905
<i>Echinothrix diadema</i>	Mwamba Mkuu	10-12	2	KKiun/9904
	Mlango wa Bomani	1-3	10	None
	Kaddhika	1-3	6	None
	Mwamba wa Boso	1-3	8	None
	Hindi	1-3	5	None
Echinometridae				
<i>Echinometra mathaei</i>	Mkomani	i.t.	10	KKiun/9913
	Kui	2-4	2	None
	Mwamba Mkuu	9-10	10	None
	Mlango wa Bomani	1-3	10	None
	Kaddhika	1-2	1	None
	Mwamba wa Boso	1	1	None
	Chongo cha Chano	10	1	None
<i>Echinostrephus molaris</i>	Mkomani	2	2	KKiun/9914
	Mwamba Mkuu	7-17	>100	None
	Mlango wa Bomani	2-4	>50	None
	Vreck	6-10	15	None
	Kiunga Camp	1-7	20	None
	Chongo cha	14-27	>30	None
	Mvundeni			
	Chongo cha Chano	9-13	3	None
	Mike's Outer Reef	1-2	3	None
<i>Heterocentrotus mammillatus</i>	Mlango wa Bomani	2-5	1	None
Stomopneustidae				
<i>Stomopneustes variolaris</i>	Mkomani	1-2	>100	KKiun/9910
	Mlango wa Bomani	1-3	>50	None
	Kiunga Camp	1-7	>20	None
	Hindi	2	1	None
	Kilima Nungu	4-8	5	None
Temnopleuridae				
<i>Microcyphus rousseaui</i>	Kiunga Camp	7	1	KKiun/9906
	Chongo cha Mvuendi	17	1	KKiun/9907
Toxopneustidae				
<i>Toxopneustes pileolus</i>	Mlango wa Bomani	1-5	1	None
	Mwamba wa Boso	1-2	3	None
	Hindi	1	2	KKiun/9911
<i>Tripneustes gratilla</i>	Mlango wa Bomani	1-2	>50	KKiun/9912
	Kaddhika	1-2	2	None
	Mike's Outer Reef	2	1	KKiun/9908
	Hindi	1.5	1	KKiun/9909

Taxonomic description. See Mortensen, 1948: 58–62, figure 43, pl. 6 figures 1–15, pl. 40 figures 4, 5, 8, 9, pl. 64 figures 11, 12, 14–17, 20 (as *Clypeaster (Leptoclypus) rarispinus*); Clark & Rowe, 1971: 160.

Field description. Relatively small species with lengths smaller than 100 mm; flattened and pentagonal body, only slightly raised centrally; five narrow petal areas reaching to about a third of the diameter, periproct hardly separated from the posterior edge; sutures of oral and aboral plates forming a dark reticulum.

Abundance in the Kiunga Marine Park. Probably *common*, although neither Obura *et al.* (1998) (KMR), nor Tortonese (1949, 1951, 1980) (southern Somalia) were able to find it.

Local distribution. Humphreys (1981) failed to find it in Kenya, but dredged it at Tumbatu, Zanzibar Channel. The burrowing behaviour of this species makes it hard to find, so data on abundance are not reliable, and earlier workers might have easily missed it. It is reported here as a first record for Kenya. Russo (1932) and Tortonese (1936) report it from the Red Sea as *Clypeaster Audouin*; Tortonese (1955) from the Red Sea as *Clypeaster (Leptoclypus) rarispinus*. Price (1982) reports this species from the Arabian Gulf, SE Arabia, the Red Sea, the Gulf of Aqaba and the Gulf of Suez. Clark & Rowe (1971) list it as an Indo-Pacific species from East Africa (with the Red Sea) to the East Indies (see also Mortensen, 1948).

Family Laganidae A. Agassiz, 1872

Genus *Laganum* Gray, 1825

Laganum depressum Lesson in L. Agassiz, 1841

Material examined. KKiun/9917 (seven specimens).

Taxonomic description. See Mortensen, 1948: 313–318, figure 197, pl. 52 figures 12, 14, pl. 53 figures 3, 4, 6–32, pl. 70, figure 20; Clark & Rowe, 1971: 162; figure 77, p. 162; pl. 25 figure 10.

Field description. Flattened, elliptical body with test length up to 40 mm, with rather thick margins and well developed petals reaching up to the thickened margin; five clearly visible pores; periproct nearer to the posterior edge than to the mouth.

Abundance in the Kiunga Marine Park. Probably *common*. Due to its burrowing behaviour this species is easily overlooked, so data on abundance are not reliable.

Local distribution. Humphreys (1981) found it earlier in Kenya (Watamu Marine Park, north Kilifi, Malindi), Tortonese (1951, 1980) in Somalia (unspecified and Sar Uanle, 20 km south of Kismayu). Ludwig (1899) was the first to report it from East Africa (Zanzibar). Clark & Rowe (1971) list it as an Indo-Pacific species from East Africa (with the Red Sea) to the Islands of the South-Pacific (see also Mortensen, 1948; Rowe & Richmond, 1997).

Family Scutellidae Gray, 1825

Genus *Echinodiscus* Leske, 1778

Echinodiscus bisperforatus Leske, 1778

Material examined. KKiun/9915 (one specimen). This sample was fragmented during transport to Belgium, our field description is completely similar to Mortensen's (1948).

Taxonomic description. See Mortensen, 1948: 406–411, figures 241a, 242a, b, pl. 58 figures 2, 6–8, pl. 71 figures 6–9, 18; Clark & Rowe, 1971: 162; pl. 25 figure 9.

Field description. Test length up to 130 mm, flattened body with posteriorly two distinct closed lunules in the posterior paired ambulacra, at least as long as the petals; body covered with fine spines, on the oral side forming a distinct pattern in the ambulacral areas.

Abundance in the Kiunga Marine Park. *Abundant*, however we collected only one specimen, which was unfortunately fragmented during transport. Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve; J. Church reports on the species as being abundant in the Kiunga Marine Reserve (pers. comm.).

Local distribution. Tortonese (1949, 1951, 1980) failed to find it in Somalia, he reported it earlier from the Red Sea (Tortonese, 1936). Later Price (1982) confirms that record by reporting it from the Red Sea, the Arabian Gulf, SE Arabia, and the Gulf of Suez; Ludwig (1899), Ruwa (1989) and Humphreys (1981) report it from Kenya (Lamu), making the species expected and abundant for the examined region. Lambert (1921–22) also reported it from East Africa (Madagascar) as *Tetrodiscus biforis*. *Echinodiscus bisperforatus* ranges geographically from East Africa (with the Red Sea) to the islands of the South Pacific (see also Mortensen, 1948; Clark & Rowe, 1971; Clark and Courtman-Stock, 1976; Rowe & Richmond, 1997).

Order Cidaroidea Duncan, 1899

Family Cidaridae Gray, 1825

Genus *Phyllacanthus* Brandt, 1835

Phyllacanthus imperialis (Lamarck, 1816). Pl. 1B

Material examined. KKiu/9901 (one specimen).

Taxonomic description – See Mortensen, 1928: 504–509, figure 163, pl. 54 figure 4, pl. 57 figure 3, pl. 74 figure 6, pl. 88 figure 4–10; Clark & Rowe, 1971: p. 151; figure 59 b, p. 150; pl. 23 figure 2.

Field description. Large cidaroid with test diameter up to 100 mm; red primary spines of approximately the same length as the horizontal diameter, smooth, white-grey banded, grooved at their tips; surrounded by short reddish spatulate secondary spines. Apical area 29–34 % of the horizontal diameter with a more or less dense covering of spinelets. Primary spines often with epizoic organisms. Nocturnal foraging behaviour. Naked test: pore-pairs in single series, sunken in a common furrow; apical system with exsert ocular plates and with numerous tubercles; peristomial pores in double rows, zig-zagging; genital pores not elevated.

Abundance in the Kiunga Marine Reserve. *Very rare*; not reported by Obura *et al.* (1998); we have seen it twice during night dives (Mkomani and Kilima Nungu).

Local distribution. Reported from Zanzibar by Agassiz (1872, in Ludwig, 1899) as *Leiocidaris imperialis*. Humphreys (1981) didn't report it from Kenya; Tortonese (1949; 1951; 1980) failed to report it in Somalia, making this observation a new record for Kenya. Other important records include those by Hoffman (1874) as *Cidaris fustigera* and Mortensen (1931) from Madagascar (Tuléar and Nosy Bé); by Lambert (1921–22) as *Leiocidaris imperialis* from Réunion; by Sloan *et al.*, 1979 from Aldabra and by A.M. Clark (1984) from the Seychelles. Clark & Rowe (1971) list it as an Indo-Pacific species from East Africa (with the Red Sea) to the East Indies (see also H.L. Clark, 1925; Mortensen, 1928; Rowe & Richmond, 1997).

Order Aulodonta Jackson, 1912

Family Diadematidae Peters, 1855¹

¹ Mortensen (1940) states that Peters, 1855 and not Gray, 1835 (in Mortensen, 1940) or 1855 (in Mortensen, 1940) is the authority for the Diadematidae. This because Gray's paper of 1835 only speaks of the genera *Arbacia*, *Salenia*, *Echinus* and *Echinometra*; and because Gray's

Genus *Astropyga* Gray, 1825

Astropyga radiata (Leske, 1778). Pl. 1C

Material examined. Since only one specimen was spotted in the Kiunga Marine Reserve (at Mlango wa Bomani) no sample was taken; identification in the field is certain (see also pl. 1C).

Taxonomic description. See Mortensen, 1940: 187–196, figures 111–115, pl. 8 figure 6, pl. 9 figures 6–9, pls. 10–12 figures 1–2, pl. 12 figure 1, pl. 14 figures 1–3, pl. 15 figure 2, pl. 16 figure 1, pl. 17 figure 1, pl. 18 figure 1, pl. 20 figure 4, pl. 70 figures 1–3, 7, 13–17, pl. 71 figures 2, 4, 6; Clark & Rowe, 1971: p. 152; figure 63 a, p. 152; pl. 23 figure 3 (juvenile specimen).

Field description. Large sea urchin, test diameter up to 180 mm. Test with intense red bands bordered by fluorescent blue spots; anus red-brown with white-red spots. Periproct flat or low conical. A large colour variation, from almost white to almost black, exists, but the red cross is always clearly visible. Primary spines black, finely ridged, long, easily breakable, filled with loose meshwork. Naked test: crenulate primary tubercles well developed over the total test surface; pore-pairs arranged in arcs, elongated genital plates.

Abundance in the Kiunga Marine Reserve. *Very rare*, not observed by Obura *et al.* (1998)

Local distribution. Humphreys (1981) found a single test in the Watamu Marine Park, Tortonese (1949; 1951; 1980) failed to find it in Somalia. One of us (YS) found it earlier along the Kenyan coastline (in Gazi Bay and in Mombasa). The Kiunga Marine Reserve can however be considered as part of its range, since Price (1982) reports its presence from South East Arabia and several workers recorded it more to the south: Zanzibar (Agassiz, 1872; Pfeffer, 1896), Aldabra (Sloan *et al.*, 1979), Mozambique (Peters, 1854; Bell, 1884) and in the Seychelles (Bell, 1884; Clark, 1984). Its geographical range is the total tropical Indo-Pacific (with the Red Sea) up to Hawaii (see also Mortensen, 1940; Clark & Rowe, 1971; Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Genus *Diadema* Humphreys, 1797

Diadema savignyi Michelin, 1845

Material examined. KKiun/9903 (two specimens: one adult and one juvenile).

Taxonomic description – See Mortensen, 1940: 265–269, figures 136, 141b, 143, pl. 48 figure 1, pl. 49 figure 4, pl. 52 figures 1–2, pl. 53 figures 2–5, pl. 59 figure 1–12, pl. 60 figures 4–6, pl. 74 figures 10–14, 16, 19; Clark & Rowe, 1971: p. 153.

Field description. Small-bodied sea urchin (horizontal test diameter max 50 mm) with long (up to 100 mm), slender, fragile (hollow), finely ridged, black or grey primary spines, which can be white-banded (especially prominent in juveniles); no orange ring around tip of the anal cone, iridescent blue lines around the periproct and down the interambulacra; buccal plates spineless. Naked test: total surface with well-developed primary perforate and crenulate tubercles (decreasing in size towards the peristome); triplet of pore-pairs arranged in arcs for each primary tubercle; genital plates not longer than wide; length-breadth test usually 4–5:1.

paper of 1855 speaks of the Diademadae [*sic*] (however with a correct description of the family in question). Peters, 1855 speaks of the Diadematiden (with a correct description of the family, however without using a scientific, Latinised name) and read his paper in 1853, *i.e.* well before Gray.

Abundance in the Kiunga Marine Reserve. *Common*, however not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Documented as *well distributed* by Humphreys (1981) from Kenya (Watamu and Malindi Marine Park), however not reported from Somalia (Tortonese, 1949; 1951; 1980). Tortonese (1936) reports it as *Diadema Savignyi* from the Red Sea and Price (1982) reports it further south from South-East Arabia making the Kiunga Marine Reserve part of its range. Even more to the south an important local record is that by Décary (1924) as *Diadema Savignyi* from Madagascar. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa (without the Red sea) to the Islands of the South Pacific, however not found on Hawaii (see also Mortensen, 1940; Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Diadema setosum (Leske, 1778)

Material examined KKiun/9902 (one specimen).

Taxonomic description. See Mortensen, 1940: 256–264, figures 140, 141a, pl. 49 figures 1–2, pls. 50, 51, 52 figure 3, pl. 53 figure 1, pl. 54 figures 2–3, pl. 55 figure 1–6, pl. 56 figures 1–13, pl. 60 figures 1–2, pl. 61 figure 1, pl. 73 figures 1, 10–12, pl. 74 figures 15, 17, 18, 20; see Clark & Rowe, 1971: p. 153; figure 62, p. 152; figure 64 b, p. 153; pl. 24 figure 1.

Field description. Small-bodied sea urchin with approximately the same horizontal diameter as *D. savignyi*, with long (up to 100 mm), slender, fragile needle-sharp, black primary spines, which can be banded (especially prominent in juveniles); five white spots on interambulacra, a clear orange ring around the tip of the anal cone; buccal plates without spines. Naked test: very similar to *D. savignyi* but compound plates (pore-pairs no longer correspond to the number of pore triplets) already present in individuals of ca. 40 mm horizontal diameter (see also figures 140 and 143 in Mortensen, 1940).

Abundance in the Kiunga Marine Reserve. *Common*, also reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Reported by Humphreys (1981) from Mida Creek and from the Watamu Marine Park, Kenya; not found in Somalia by Tortonese (1949, 1951, 1980), but documented further north by Price (1981, 1982). Other important records include those by Peters (1854) from Mozambique; by Ludwig (1899) from Zanzibar (Ludwig, 1899 also lists older records from the region); by Haacke (1880) from Mauritius, and by Lambert (1921–22) as *Centrostephanus setosum* from Madagascar. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa (with the Red Sea, see also Tortonese, 1936, 1955) to the Islands of the South Pacific, however not on Hawaii (see also Mortensen, 1940; Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Genus *Echinothrix* Peters, 1853

Echinothrix calamaris (Pallas, 1774)

Material examined. KKiun/9905 (one specimen).

Taxonomic description. See Mortensen, 1940: 285–290, figures 147–149, pl. 39 figure 1, pl. 40, pl. 41 figures 1–2, pl. 42 figures 1–5, pl. 43 figure 3, pl. 44 figures 2–10, pl. 46 figure 1, pl. 47 figures 1–3, 5, pl. 48 figure 3, pl. 71 figures 5–8; Clark & Rowe, 1971: 153; figure 63 b, p. 152; pl. 31 figure 17.

Field description. Small-bodied (horizontal test diameter up to 85 mm) very dark-green to black echinoid with aborally long, barbed, needle-like primary spines. Primary spines

relatively firm, but with a large central cavity. Both the primary and the very fine secondary spines are often banded with green (especially prominent in juveniles); periproct spotted. Ambulacra bulging aborally with apically naked interambulacra. Naked test: usually greenish in colour; primary tubercles perforated and crenulated, similar over total test surface; genital plates approximately as long as wide.

Abundance in the Kiunga Marine Reserve. *Rare*, only observed in one locality (Kaddhika). Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) reports this species from several localities in Kenya, Tortonese (1949; 1951, 1980) failed to find it in the littoral waters of Somalia; Price (1982), however, reports this species from further afield in SE Arabia, the Red Sea (see also Tortonese, 1955), the Gulf of Aqaba and Suez. Other important historical records for the region include those by Ludwig (1899) as *Echinothrix Desori* from Zanzibar and by Lambert (1921–22) as *Diadema Frappieri* from Madagascar. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa up to Hawaii (see also Mortensen, 1940; Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Echinothrix diadema (Linnaeus, 1758)

Material examined. KKiu/9904 (one specimen).

Taxonomic description. See Mortensen, 1940: 290–295, figures 150–152, pl. 43 figures 1–2, pl. 44 figure 1, pl. 45 figures 1–8, pl. 46, figures 2–4, pl. 47 figures 4, 6–7, pl. 48 figure 4, pl. 71 figures 1, 3; Clark & Rowe, 1971: 153; figure 64 a, p. 153; pl. 24 figure 2.

Field description. Large bodied (test diameter up to 140 mm) echinoid; all interambulacral plates covered with fine black backwardly-barbed primary spines, dark-reddish test. Ambulacra not distinctively bulging, aborally no naked ambulacral areas. Primary spines very brittle, medium-long (up to 80 mm), with narrow central cavity. Naked test: similar to *E. calamaris*, but mostly larger and never greenish, sometimes reddish.

Abundance in the Kiunga Marine Reserve. *Abundant*. Reported from the same locality by Obura *et al.* (1998).

Local distribution. Reported from Kenya by Humphreys (1981) in low numbers in Mida Creek, from southern Somalia (Gesira and Sar Uanle) by Tortonese (1980). Other important historical records for the region include those by Ludwig (1899) as *Echinothrix spinosissimum*; by Haacke (1880) as *E. turcarum* from Mauritius; and by Lambert (1921–22) as *Diadema turcarum* from Madagascar. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa up to Hawaii (see also Mortensen, 1940; Rowe & Richmond, 1997).

Order Camarodonta Jackson, 1912

Family Echinometridae Gray, 1855

Genus *Echinometra* Gray, 1825

Echinometra mathaei (de Blainville, 1825)

Material examined. KKiu/9913 (six specimens).

Taxonomic description. See Mortensen, 1943b: 38–3931, figures 185–194, pl. 42 figures 1–10, pl. 47 figures 1–4, pl. 65 figures 16–26; Clark & Rowe, 1971: p. 157; figure 69 b, p. 156; pl. 23, figure 5.

Field description. Small sea urchin (test diameter up to ~ 65 mm) with a distinct oval body (when viewed from above) and a high colour variation (from green to brown to purple to black). Fairly long, slender, tapering, stout primary spines, often with a white band at their

base. Naked test: oval in outline, with long axis of the test through ambulacrum 1 and interambulacrum 3, horizontal test diameter approximately equal to the height of the test; four pore pairs per arc aborally; primary tubercles imperforate; shallow gill slits.

Abundance in the Kiunga Marine Reserve. *Abundant*; together with *Stomopneustes variolaris* and *Echinostrephus molaris*, this species is the most abundant sea urchin in the Kiunga Marine Reserve (see also Obura *et al.*, 1998).

Local distribution. Humphreys (1981) comes to the same conclusion for the Watamu Marine Park and Kilifi. In southern Somalia Tortonese (1951, 1980) reports on large populations. Other important historical records for the region include those by Ludwig (1899) as *Echinometra lucunter* from Zanzibar; by Lambert (1921–22) as *Ellipsechinus lukunter* from Madagascar. Clark & Rowe (1971) list it as a tropical Indo-Pacific species (with the Red Sea, see also Tortonese, 1936, 1955) from East Africa up to Hawaii (see also Mortensen, 1943b; Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Genus *Echinostrephus* A. Agassiz, 1863

Echinostrephus molaris (de Blainville, 1825)

Material examined. KKun/9914 (one specimen).

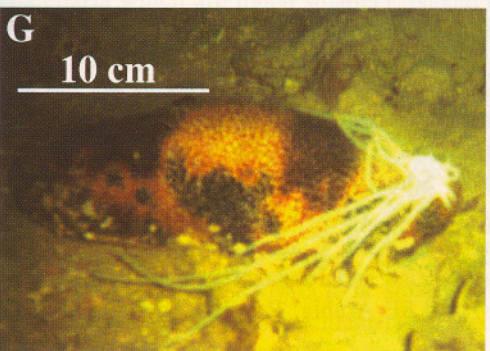
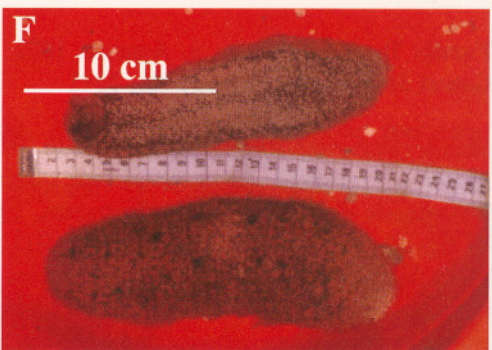
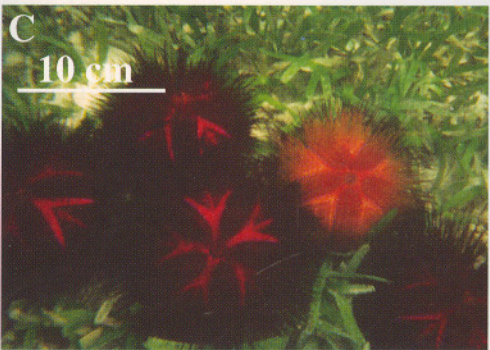
Taxonomic description. See Mortensen, 1943b: 311–316, figure 149a, b, figure 150 a, b, pl. 35 figures 1–10, pl. 58 figures 1, 2, 4, 9; Clark & Rowe, 1971: p. 157.

Field description. Small species with test diameter seldom larger than 30 mm. Test broadest at the flattened aboral side. Always in self-made deep rocky burrows, aboral side flat, with a vertically projecting tuft of long, easily breakable primary spines with variable colouration (whitish-blue to black). Naked test: shallow gill slits; test flattened aborally; invariably three pore-pairs in each arc.

Abundance in the Kiunga Marine Reserve. *Abundant*, also reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Previously reported from Kenya as *common* by Humphreys (1981); however never recorded from the Somalian coast; reported from the Red Sea, the Gulf of Aqaba and the Arabian Gulf but not from South East Arabia (Price, 1982). Further south Agassiz (1872, in Ludwig, 1899) lists records from Zanzibar and Mozambique; Bell (1903) from Zanzibar as *Echinostrephus molaris*. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa to the Islands of the South Pacific (see also Mortensen, 1943b; Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Plate 1. A. Clypeaster rarispinus de Meijere, 1902; *B. Phyllacanthus imperialis* (Lamarck, 1816); *C. Astropyga radiata* (Leske, 1778); *D. Heterocentrotus mammillatus* (Linnaeus, 1758); *E. Microcyphus rousseaui* L. Agassiz, 1846; *F. Actinopyga echinites* (Jaeger, 1833); *G. Bohadschia subrubra* (Quoy & Gaimard, 1833); *H. Holothuria (Cystipus) rigida* (Selenka, 1867). All pictures by Y. Samyn except *A.* (F. Bossuyt); *B.* (J. Church) and *D.* (B. Van Bogaert).



Genus *Heterocentrotus* Brandt, 1835

Heterocentrotus mammillatus (Linnaeus, 1758). Pl. 1D

Material examined – Due to its low population numbers (only few specimens have been seen by one of us, YS, over the total Kenyan coastline), no sample was collected. Moreover identification in the field is certain; picture D on pl. 1, taken at Mlango wa Bomani leaves no doubt over the identification.

Taxonomic description. See Mortensen 1943b: 409–420, figures 204, 205a, 206, 207a, b, 208a, 209, 210, pl. 51 figures 1–6, pl. 52 figures 6–8, pl. 66 figures 7, 9–20; Clark & Rowe, 1971: p. 158; figure 71 b, p. 153; pl. 23 figure 4.

Field description. Large species with horizontal test diameter up to 80 mm; test oval; massive primary spines are long (up to 100 mm at the ambital side), smooth, blunt and tapering, triangular in cross section, distally with transversal white banding; secondary spines distributed over the total test surface, whitish, short and with flattened tips. Naked test: 9–11 pore-pairs in each arc at the ambital region; primary ambulacral tubercles smaller above ambitus.

Abundance in the Kiunga Marine Reserve. *Very rare* to *Rare*, only observed once by us; not reported by Obura *et al.* (1998).

Local distribution. Tortonese (1949; 1951, 1980) failed to record it in Somalian waters; Humphreys (1981) reports it from Kenya (Ras Ngomeni); Price reports from SE Arabia, Red Sea (see also Tortonese, 1955) and the Gulf of Aqaba; Haacke (1880) from Mauritius. Given these records and the fact that *Heterocentrotus mammillatus* is nocturnal this species is probably more abundant than what is deduced from our observations. A.M. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa (with the Red Sea) up to Hawaii (see also Mortensen, 1943b; H.L. Clark, 1925; Rowe & Richmond, 1998).

Family Temnopleuridae A. Agassiz, 1872

Genus *Microcyphus* L. Agassiz, 1841

Microcyphus rousseaui L. Agassiz, 1846. Pl. 1E

Material examined. KKiu/9906 (one specimen); KKiu/9907 (one specimen).

Taxonomic description. See Mortensen, 1943a: 155–159, figure 84, pl. 12 figs 18–25, pl. 47 figs 18–20, 23–24; Clark & Rowe, 1971: p. 156; pl. 24 figure 6.

Field description – Relatively small species with horizontal test diameter rarely exceeding 50 mm. Naked, dark purple areas with a distinct whitish-pink zigzag line; spines beige-brown with distinct darker brown bands. Apical system rounded. Naked test: each ambital and ambulacral plate with a distinct tubercle, which is indistinctly crenulate, the sutural pores are very small; five very distinct naked areas descending from the aboral side over almost the total test

Abundance in the Kiunga Marine Reserve. *Very rare*, only observed twice by us, not seen by Obura *et al.* (1998) in the Kiunga Marine Reserve.

Local distribution. First record for Kenya. Humphreys (1981) failed to find it in Kenya, but it was observed by Tortonese (1980) in southern Somalia (Gesira). Also found by Price (1982) in SE Arabia, the Red Sea and the Gulf of Aqaba. Further South, Lambert (1921–22) describes it as *Microcyphus Decaryi* from Madagascar, A.M. Clark & Rowe (1971) list it as a tropical Indian Ocean species restricted to East Africa and Madagascar, the Red Sea (see also Tortonese, 1936 as *Microcyphus maculatus*) and SE Arabia. Rowe & Richmond (1997)

give as its distribution the Red Sea, the western Indian Ocean to the West Pacific Ocean (see also Mortensen, 1943a).

Family Toxopneustidae Trosschel, 1872

Genus *Toxopneustes* L. Agassiz, 1841

Toxopneustes pileolus (Lamarck, 1816)

Material examined. KKiun/9911 (one specimen).

Taxonomic description. See Mortensen, 1943a: 472–480, figures 240b, 293a, 294, 295a, 296, 297a, b, 298, pl. 26 figure 3, pl. 27 figures 1–4, pl. 28 figures 1, 2, pl. 29 figures 1–5, pl. 30 figures 1–4, pl. 31 figure 9, pl. 33 figures 5, 6, pl. 54 figures 1, 3–6, 8–10, 13–16, pl. 55 figure 13; Clark & Rowe, 1971: p. 156; figure 69, p. 156; pl. 24 figure 7; pl. 31 figure 15.

Field description. Large-bodied sea urchin with low test (horizontal diameter up to 150 mm; with very large, orange, globiferous pedicellariae (diameter up to 3 mm); very short (up to 20 mm) orange, finely-ridged longitudinal primary spines. Naked test: usually sunken towards the mouth; purple banded horizontally; every second ambulacral plate with a primary tubercle; oligoporous ambulacral plates.

Abundance in the Kiunga Marine Reserve. *Common.*

Local distribution. This species has been found by almost all the researchers that sampled in this region. A.M. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa (without the Red Sea) to the Islands of the South Pacific (see also Mortensen, 1943a; A.M. Clark & Courtman-Stock, 1976). Rowe & Richmond (1997) include the Red Sea in the geographical distribution.

Genus *Tripneustes* L. Agassiz, 1741

Tripneustes gratilla (Linnaeus, 1758)

Material examined. KKiun/9908 (one specimen, juvenile); KKiun/9909 (one specimen, juvenile); KKiun/9912 (one specimen).

Taxonomic description. See Mortensen, 1943a: 500–508, figs 306, 307, pls 33 figures 1–3, pl. 34 figures 2–6, pl. 35 figures 3–4, pl. 37 figs 1–2, 4–10, pl. 38 figures 1–4, pl. 56 figure 11; Clark & Rowe, 1971: p. 156; figure 65 b, p. 153; pl. 24 figure 8; pl. 31 figure 16.

Field description. Large-bodied sea urchin (test diameter up to 120 mm) with high almost globular (up to 55 mm) test, with numerous small whitish primary spines in the interambulacral areas, and with 10 darker bands corresponding to the podia (not the pedicellaria which are much smaller). Naked test: only one in three or four ambulacral plates with a primary tubercle; pore-pairs in horizontal arcs and spaced to form three distinct series.

Abundance in the Kiunga Marine Reserve. *Abundant.*

Local distribution. Reported by all the researchers that sampled in this region (see e.g. Bell, 1903 who reports it as *Hipponoe variegata* from Zanzibar or Lambert (1921–22) who reports it from Madagascar). A.M. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa (with the Red Sea) up to Hawaii (see also Mortensen, 1943a; Tortonesi, 1955; A.M. Clark & Courtman-Stock, 1976; Rowe & Richmond, 1997).

Remarks. Although this species is not harvested in the Kiunga Marine Reserve, nor in Kenya (as far as we know), it is suitable for human consumption. The large population numbers and the synchronised lunar reproductive cycle (Muthiga, pers. comm.), whereby the gonads grow large enough for harvesting once a month, make it a species with a high

economic potential. We observed harvesting of this species in northern Kwazulu Natal (Bangha Nek), Republic of South Africa.

Order Stiridonta Jackson, 1912

Family Stomopneustidae Pomel, 1883

Genus *Stomopneustes* L. Agassiz, 1841

Stomopneustes variolaris (Lamarck, 1816)

Material examined. KKiu/9910 (three specimens).

Taxonomic description. See Mortensen, 1935: 507–512, figure 301, 302, pl. 71 figures 3–5, pl. 72 figs 1, 2, pl. 89 figures 16–26; Clark & Rowe, 1971: p. 153; figure 65a, p. 153; figure 66, p. 154; pl. 23 figure 6.

Field description. Medium sized species (horizontal test diameter up to 80 mm); test round, with large (up to 80 mm long), solid, slightly tapering green-blue primary spines. Naked test: tubercles neither perforated nor crenulated; ambulacral plates doubly compound, at the ambitus one very large ambulacral tubercle corresponds to up to six arcs.

Abundance in the Kiunga Marine Reserve. *Abundant.* This species was present in large numbers in almost all the sampling sites, which is in agreement with the observations made by Obura *et al.* (1998) in the same marine reserve.

Local distribution. Humphreys (1981) reports it as ‘extremely numerous’ in several locations along the Kenyan coast. Also reported by Tortonese (1980) from Sar Uanle (southern Somalia), although he doesn’t describe abundance. Other important records for the region include those by Ludwig (1899) from Zanzibar and by Lambert (1921–22) from Madagascar. A.M. Clark & Rowe (1971) list it as a tropical Indo-Pacific species from East Africa (without the Red Sea) to the Islands of the South Pacific (see also Mortensen, 1935; A.M. Clark & Courtman-Stock, 1976). Rowe & Richmond (1997) also report its presence from the Red Sea. Haacke (1880) reported it from Mauritius.

HOLOTHUROIDEA (Local Swahili Name: majongo ya baharini)

We collected 57 specimens belonging to 23 different species of Holothuroidea. Samples of two more species were lost, due to inadequate preservation: *Bohadschia subrubra* and *Stichopus herrmanni*. According to literature, two more species—*Holothuria* (*Mertensiothuria*) *pervicax* and *Holothuria* (*Selenkothuria*) *parva*—are expected.

The holothurian fauna of the Kiunga Marine Reserve is now represented by 28 species. *Actinopyga echinites*, *Holothuria* (*Cystipus*) *rigida*, *Holothuria* (*Platyperona*) *difficilis*, *Labidodemas pertinax*, *Stichopus chloronotus* and *Stichopus* cf. *monotuberculatus* are new records for Kenya. *Holothuria* (*Theelothuria*) *turriscelsa* is a new record for the Indian Ocean.

Order Apodida Brandt, 1835

Family Synaptidae Burmeister, 1837

Subfamily Synaptinae Burmeister, 1837

Genus *Synapta* Escholtz, 1829

Table 4. List of holothurians collected at the different localities in Kiunga Marine Reserve. The number of specimens refers to the number of animals that were encountered during a 60-minute sampling period. i.t. stands for intertidal. Depths apply to the low water level.

Species	Site name	Min-max depth (m)	Approx #	Collection number
APODIDA				
Synaptidae				
<i>Synapta maculata</i>	Kui	2	1	KKiun/9951
ASPIDOCHIROTIDA				
Holothuriidae				
<i>Actinopyga echinites</i>	Kui	1-4	4	KKiun/9922
	Kaddhika	2-4	2	None
	Chongo cha Chano	9-13	2	None
<i>Actinopyga mauritiana</i>	Kilima Nungu	4	1	None
	Mike's outer reef	1-3	25	KKiun/9921
	Kui	1-3	3	None
	Kaddhika	1-3	6	None
	Mwamba wa Boso	1-3	6	None
	Kui	1-2	1	None
	Hindi	2-4	4	None
<i>Actinopyga miliaris</i>	Kui	3	1	KKiun/9923
	Hindi	2	1	KKiun/9924
	Chongo cha	12	1	None
	Mvundeni			
<i>Bohadschia atra</i>	Mkomani	1-4	4	KKiun/9927
	Hindi	2	1	KKiun/9928
	Chongo cha Chano	14	1	None
<i>Bohadschia marmorata</i>	Mike's Outer Reef	2-3	4	KKiun/9925
	Kui	1-4	2	KKiun/9926
<i>Bohadschia subrubra</i>	Kui	1-4	15	None
	Hindi	3	2	None
<i>Holothuria (Cystipus) rigida</i>	Kui	4	1	KKiun/9948
<i>Holothuria (Halodeima) atra</i>	Kilima Nungu	3-5	4	KKiun/9929
	Chongo cha Chano	8-12	4	None
	Shimo la Tewa	3-4	2	None
	Mlango wa Bomani	1-4	10	KKiun/9930
	Wreck	6-9	3	None
	Mwamba wa Boso	1-5	10	None
	Mwamba Mkuu	12-20	5	None
<i>Holothuria (Halodeima) edulis</i>	Kilima Nungu	6	1	None
	Mike's inner reef	5-7	1	None
	Mwamba Mkuu	10-14	3	KKiun/9931
	Mlango Bomani	4	1	None
	Chongo cha Chano	10-20	2	None
	Kilima Nungu	6	1	None
<i>Holothuria (Lessonothuria) pardalis</i>	Kilima Nungu	4	1	KKiun/9934
	Mlango wa Bomani	1-4	1	KKiun/9935
	Kaddhika	4	1	KKiun/9936
	Kui	1-4	1	KKiun/9937
<i>Holothuria (Mertensiothuria) leucospilota</i>	Mkomani	2-4	5	KKiun/9932
	Mike's Inner Reef	7	1	None
	Mlango wa Bomani	1-2	2	KKiun/9933
	Hindi	1-3	4	None
<i>Holothuria (Metriatyla) scabra</i>	Kui	2	1	KKiun/9939
<i>Holothuria (Microthele) nobilis</i>	Chongo cha Kui	16-21	2	KKiun/9940
	Mwamba Mkuu	15-17	6	None
	Chongo cha	17-24	4	None
	Mvundeni	18	1	None
	Chongo cha Chano			
<i>Holothuria (Platyperona) difficilis</i>	Kui	2	1	KKiun/9949
<i>Holothuria (Semperothuria) cinerascens</i>	Mlango wa Bomani	2	1	KKiun/9941
<i>Holothuria (Stauropora) fuscocinera</i>	Mike's Inner Reef	5	1	KKiun/9938
	Mike's Inner Reef	5	1	KKiun/9946
<i>Holothuria (Theelothuria) turrisclausa</i>	Kilima Nungu	5-7	2	KKiun/9947
<i>Holothuria (Thymiosycia) arenicola</i>	Mkomani	i.t.	1	KKiun/9945
<i>Holothuria (Thymiosycia) hilla</i>	Mlango wa Bomani	2	1	KKiun/9942
	Kaddhika	3	3	KKiun/9943

Species	Site name	Min-max depth (m)	Approx #	Collection number
<i>Holothuria (Thymiosycia) impatiens</i>	Kui	0.5	4	KKiun/9944
<i>Labidodemas pertinax</i>	Mkomani	4	1	KKiun/9919
	Shimo la Tewa	7	1	None
	Mlango wa Bomani	1-4	2	KKiun/9920
	Kilima Nungu	5	1	None
<i>Stichopodidae</i>				
<i>Stichopus hermanni</i>	Kui	1-4	2	None
	Hindi	3	1	None
<i>Stichopus cf. monotuberculatus</i>	Kilima Nungu	5-7	2	KKiun/9950
	Mike's Inner Reef	5-7	4	None
<i>Stichopus chloronotus</i>	Hindi	2	1	None
DENDROCHIROTIDA				
Phyllophoridae				
<i>Afroccumis africana</i>	Kui	i.t.	5	KKiun/9918

Synapta maculata (Chamisso & Eysenhardt, 1821)

Material examined. KKiun/9951 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 251–252; figure 112, p. 253.

Field description. Very large species with a distinct vermiform body, reaching lengths up to 3,000 mm and widths up to 35 mm. Body colour dark green to brown with numerous transverse darker brown bands and radii with a longitudinal brown stripe. Mouth terminal surrounded by 15 feather-like tentacles. Anus terminal. Body wall smooth and thin, but very 'sticky' due to the numerous anchor spicules (visible with the naked eye when skin is held against the light) in the body tissue.

Abundance in the Kiunga Marine Reserve. *Very rare.* Only a single specimen was found in a small seagrass bed (location Kui). Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Recorded in low numbers by Humphreys (1981) in Kenya (Mida Creek). Not found by Tortonese (1980) in Somalia. Other important local records include those by Lampert (1896) as *Synapta beselii* from Zanzibar; by Sloan *et al.* (1979) from Aldabra; and by Clark (1984) from the Seychelles. Massin (1999, figure 92: p. 109) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the Society Islands (Tahiti).

Order Aspidochirotida Grube, 1840

Family Holothuriidae Ludwig, 1894

Genus *Actinopyga* Bronn, 1860

Actinopyga echinites (Jaeger, 1833). Pl. 1F

Material examined. KKiun/9922 (four specimens).

Taxonomic description. See Cherbonnier, 1988: 31, 32; figure 9, p.33.

Field description. Colour in life from light brown to chocolate brown, dorsally and ventrally, sometimes mottled with brown or black. Mouth ventral, with 20 brown peltate feeding tentacles. Anus terminal surrounded by five yellowish teeth. Trivium covered with numerous cylindrical podia, which are distributed distinctively in three ambulacral areas in smaller individuals, and scattered over the interambulacra in the largest individual. Bivium with fewer podia both in the radial and interradial areas.

Abundance in the Kiunga Marine Reserve. *Common*, although Obura *et al.* (1998) didn't report this very recognisable species in the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) was unable to discern between *A. echinites* and *A. miliaris* he collected in Kenya (Mida Creek and Kibirijini Point). Levin (1979) reports this

species (as *A. plebeja*) from Mombasa. Tortonese (1980) reports on two specimens from South Somalia (Sar Uanle, 20 km south of Kismayu). Other important records for eastern Africa/western Indian Ocean include those by Lampert (1896) and Panning (1944) from Zanzibar; by Hughes & Gamble (1977) from Aldabra; by Lampert (1885), Ludwig (1899) and Clark (1984) from the Seychelles. Rowe & Doty (1977) summarise the geographical distribution as “general distribution from scattered localities throughout the tropical Indo-Pacific, but not on Hawaii”.

Remarks. This species is well known by local sea cucumber fishermen; they refer to it as ‘iyongo wimbi’ (like millet), which refers to the body colour and texture. In the Kiunga market it is sold for 1 KSh/fresh specimen.

Obura *et al.* (1998) noted two species of *Actinopyga* in the Kiunga Marine Reserve: *A. mauritiana* and *Actinopyga* sp. While no collections were made by them, we can be quite sure that it is *A. echinites* since this species is easily distinguished from the other two *Actinopyga* species found in the Kiunga Marine Reserve: *A. miliaris* which is uniform black, and *A. mauritiana* (which they did identify). Humphreys (1981) collected an *Actinopyga* in the Channel to Mida Creek and on a wave-cut platform at Kibirijini Point in Kenya, however he was unable to identify it to the species level.

Actinopyga mauritiana (Quoy & Gaimard, 1833)

Material examined. KKiu/9921 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 16–18; figure 2 p. 19.

Field description. Species length up to 350 mm, width up to 85 mm. Colour very variable: dorsally chocolate brown with numerous conical papillae; ventrally white-grey to brown, densely covered with large cylindrical brown to green tube feet scattered over interambulacra and ambulacra. Bivium clearly distinguishable from trivium. Mouth ventral, surrounded by at least 25 short and stout, dark brown feeding tentacles which in turn are surrounded by a distinct collar of papillae. Anus terminal, guarded by five conspicuous teeth.

Abundance in the Kiunga Marine Reserve. *Abundant*, probably the most abundant species in the Reserve. Obura *et al.* (1998) found it in the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) reports on specimens from Kenya (Big Tree Cave at the mouth of Mida Creek), and Tortonese (1980) from Somalia (Gesira, 18 km South of Kismayu). Other important records for eastern Africa/western Indian Ocean include those by Lampert (1896) from Zanzibar (as *Muelleria mauritiana*); by Lampert (1885) (as *Muelleria mauritiana*), Ludwig (1899) (as *Muelleria mauritiana*) and A.M. Clark (1984) from the Seychelles; by Quoy & Gaimard (1833) (as *Holothuria mauritiana*, in Mitsukuri, 1912); by Ludwig (1883) (as *Muelleria mauritiana*) from Mauritius and by Sloan *et al.* (1979) from Aldabra.

Remarks. This species is also well known by local sea cucumber fishermen; they refer to it as ‘iyongo bura’. In the Kiunga market it is sold for 5 KSh/fresh specimen.

Actinopyga miliaris (Quoy & Gaimard, 1833)

Material examined. KKiu/9923 (one specimen); KKiu/9924 (one specimen).

Taxonomic description – See Massin, 1996a: 12–13; figure 6, p. 13; Massin, 1999: 10–12; figures 5, p. 10.

Field description. Species length up to 400 mm, width up to 100 mm. Colour in life uniform dark brown dorsally and ventrally (although some specimens may show a slightly lighter colour ventrally). Mouth ventral surrounded by 16 firm brown tentacles. Anus terminal surrounded by five easily noticeable yellow-orange teeth. Five to eight rows of podia with

the same colouration as the body wall on the ventro-lateral radii, 12–15 rows of podia on the ventro-median radius.

Abundance in the Kiunga Marine Reserve. *Rare*, only spotted in three locations (Kui, Kaddhika and Chongo Cha Chano). Not found by Obura *et al.* (1998) in the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) found it only in one location on the Kenyan Coast (Mida Creek); Levin (1979) reports it from Mombasa; Tortonese (1949, 1951, 1980) didn't report it from Somalia; but Price (1982) found it in the Red Sea, the Gulf of Aqaba and in the Gulf of Suez. Other important records from eastern Africa/western Indian Ocean include those by Lampert (1885) from Zanzibar (as *Muelleria miliaris*); by Haacke (1880) and Ludwig (1883) from Mauritius (as *Muelleria miliaris*). Massin's (1999, figure 6: p. 11) distribution map shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the Fiji Islands. The Kiunga Marine Reserve is now the most northern point along the East African coast.

Remarks. This species is known by local sea cucumber fishermen although they fail to make a distinction with the other black species like *Holothuria atra*, *H. leucospilota* and *Bohadschia atra*; they refer to it as 'iyongo leusi' (black sea cucumber). In the Kiunga markets fishermen get 1 KSh for a fresh specimen.

Genus *Bohadschia* Jaeger, 1833

Bohadschia atra Massin, Rasolofonirina, Conand & Samyn, 1999

Material examined. KKiu/9927 (three specimens); KKiu/9928 (one specimen).

Taxonomic description. See Massin *et al.*, 1999: 151–160; figure 1, p. 152; figure 2, p. 154; pl.1.B, D, p. 159.

Field description. Species up to 400 mm long and 150 mm wide. Deep brown to black bivium with numerous lighter brown to red spots. Trivium slightly lighter in colour, without red spots. Ventral podia scattered over radial and interradii areas, dorsal podia also scattered but less numerous. Mouth ventral, surrounded by 18–20 black tentacles, anus dorsal. Cuvierian tubules present and very readily ejected in large quantities.

Abundance in the Kiunga Marine Reserve. *Common*. Minor range extension from Shariani (some 30 km north of Mombasa). Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. *Bohadschia atra* Massin *et al.*, 1999 was recently described by one of us (YS in Massin *et al.*, 1999). That paper also discusses the distribution. The Kiunga Marine Reserve is now documented here as the most northern point of its range.

Bohadschia subrubra (Quoy & Gaimard, 1833) Pl.1G

Material examined. None, picture G on pl. 1 leaves no doubt over the identification.

Taxonomic description – See Massin *et al.*, 1999: 151–160; figure 3, p. 155; figure 4, p. 156; figure 5, p. 157; pl.1A, C, D, p. 159.

Field description. Species up to 350 mm long and 130 mm wide. Bivium brown to orange with unevenly distributed dark brown areas. Trivium white, with tiny black spots. Numerous ventral podia, white, very long, and scattered over the whole surface. Dorsal podia less numerous, scattered, white, clearly visible against the orange background. Mouth ventral surrounded by 18 stout, white feeding tentacles. Anus dorsal, unguarded by anal teeth or papillae. Cuvierian tubules present and very readily ejected in large quantities.

Abundance in the Kiunga Marine Reserve. *Common*. Also reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Minor range extension from Shariani (some 30 km north of Mombasa). *Bohadschia subrubra* was recently redescribed (Massin *et al.*, 1999). That paper also discusses the distribution.

Remarks. Species well-known by the local fishermen, who refer to it as 'iyongo la tambi' (meaning spaghetti; referring to the readily ejected Cuvierian tubules); the other *Bohadschia* sp. get the same common name. It has a limited commercial value.

The specimens identified by Humphreys (1981) as *Bohadschia koellikeri*, were not seen by us. However, the description (p. 33) of the colour in life ("bold camouflage pattern in deep brown and beige, tube feet spread over surface give white dotted surface and often hold marine angiosperm leaves over the surface of the animal") is characteristic of *Bohadschia subrubra*. This species is quite common in the studied site, which is now considered to be the northern edge of its range.

Bohadschia marmorata Jaeger, 1833

Material examined. KKiun/9925 (three specimens); KKiun/9926 (two specimens).

Taxonomic description. See Cherbonnier, 1988: 36–38; fig 11, p. 37.

Field description. Large species up to 300 mm long and 100 mm wide. Body colour yellow-white ventrally and laterally, brownish dorsally, spotted by numerous small brown spots corresponding to conical podia. Dorsally, transversal banding is sometimes visible. Mouth ventral, surrounded by 15–20 light brown, relatively small tentacles which in turn are surrounded by a circle of brown podia; relatively large terminal anus surrounded by a brown line. Ventral tube feet spread in the ambulacral and the interambulacral zones. Bivium covered by conical tube feet surrounded at their base by a small brownish circle. Cuvierian tubules present.

Abundance in the Kiunga Marine Reserve *Common*. First record for the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) reports it from Kenya in the Mida Channel and throughout the Watamu Marine Park; Levin (1979) from Mombasa. Sloan *et al.* (1979) reports on the species from Aldabra; Clark (1984) from the Seychelles. Another important record for eastern Africa/western Indian Ocean is Haacke (1880) from Mauritius (as *Holothuria utrimquestigmosa*). It is reported throughout the shallow waters of the tropical zone of the Indo-Pacific.

Remarks. Obura *et al.* (1998) only observed one species of *Bohadschia*, which they identified as *Bohadschia vitiensis*. This species is listed and depicted in Richmond's book on the fauna and flora of eastern Africa (1997). However without microscopic examination of the spicules no differentiation with *Bohadschia marmorata* can be made (See also Massin, 1996a for a discussion). Therefore we would include *B. marmorata* in the fauna of Kiunga Marine Reserve, and (for now) not *B. vitiensis*.

Genus *Holothuria* Linnaeus, 1767

Subgenus *Cystipus* Haacke, 1880

Holothuria (Cystipus) rigida (Selenka, 1867) Pl. 1H

Material examined. KKiun/9948 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 126–127 & 129; figure 51, p. 127.

Field description. Medium-sized species (125 mm long and 25 mm wide). Body colour white to yellow ventrally and somewhat lighter dorsally. Podia in trivium evenly distributed over the radial and interradial areas; conical podia in bivium distributed in three interradial areas. Anus terminal, surrounded by conical papillae, mouth ventral, with 20 small, yellow-brown tentacles.

Abundance in the Kiunga Marine Reserve. *Very rare*, only observed once. Not observed by Obura *et al.* (1998) in the Kiunga Marine Reserve.

Local distribution. First record for Kenya. Other important records from eastern Africa/western Indian Ocean include those by Selenka (1867) from Zanzibar (as *Stichopus rigidus*), by Haacke (1880) (as *Cystipus pleuripus*) and by Ludwig (1883) (as *Holothuria pleuripus*) from Mauritius, by Sloan *et al.* (1979) from Aldabra, by Clark (1984) from the Seychelles; by Cherbonnier (1988) from Iles Glorieuses.

Remarks. Selenka's (1867: p. 317) description (as *Stichopus rigidus*) says that *H. (Cystipus) rigida* contains few long tubules of Cuvier. In the single specimen we collected these are not visible.

Subgenus *Halodeima* Pearson, 1914

Holothuria (Halodeima) atra Jaeger, 1833

Material examined. KKiun/9929 (one specimen); KKiun/9930 (five specimens).

Taxonomic description. See Cherbonnier, 1988: 73–74; figure 28, p. 74.

Field description. Uniform black species with a cylindrical body, reaching sizes up to 300 mm long and 70 mm wide. Ventrally short, black, cylindrical podia scattered over the radial and interradial areas; dorsally short, black, conical tube feet over the total surface. Mouth ventral, surrounded by 20 short, black feeding tentacles. Anus terminal, unguarded. Cuvierian tubules always absent. Body wall often covered with fine sand.

Abundance in the Kiunga Marine Reserve. *Abundant*. Also reported in the Kiunga Marine Reserve by Obura *et al.* (1998).

Local distribution. Humphreys (1981) reports *H. atra* from the Watamu Marine Park, and Tortonese (1980) from Somalia (Sar Uanle, 20 km South of Kismayu). Massin's distribution map (1999; figure 13: p. 21) shows an Indo-Pacific distribution from the coast of East Africa (with the Red Sea) to the coast of western America.

Remarks – In the field, this species is easily confused with *H. leucospilota*, the other abundant black species. Table 5 lists some characters recognisable in the field.

Holothuria (Halodeima) edulis Lesson, 1830

Material examined. KKiun/9931 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 75–77; figure 29, p. 76.

Field description. Species can be up to 300 m long and 50 mm wide. Body colour in life: large chocolate brown to dark-grey patches dorsally, salmon pink to red ventrally. Body elongated and slender; somewhat wrinkled. Mouth ventral surrounded by 20 yellow to light-pink tentacles. Anus terminal, unguarded by teeth or papillae, but bordered by a dark-pink circle. Trivium covered by short tube feet, scattered over both ambulacra and interambulacral areas. Bivium with few tube feet in total area. Cuvierian tubules absent.

Abundance in the Kiunga Marine Reserve. *Rare*, although also reported in Obura *et al.* (1998) in the Kiunga Marine Reserve.

Table 5. Field characters to discern *Holothuria* (*Mertensiothuria*) *leucospilota* from *Holothuria* (*Halodeima*) *atra*.

Character	<i>H. atra</i>	<i>H. leucospilota</i>
Colour	Uniform black	Dark brown-red to black, ventral side sometimes lighter
Size	Up to 300 mm long	Often longer than 300 mm
Podia on bivium	Few, conical, radial and interrarial areas	Few, conical, in 2 to 3 rows in the radial areas
Distribution of podia on trivium	Few, cylindrical, black, very short, in radial and interrarial areas	Numerous, cylindrical, short but thick with brown sucking disc, in 4 to 5 rows in radial areas
Morphology of tentacles	20, short, black	20, long, dark brown to black
Habitat	Exposed on sand flats and in sea grass beds	Often partially concealed below coral block
Body covering	Often covered with fine sand, with bare patches	Not covered with sand
Tubules of Cuvier	Always absent	Always present
Red fluid	Release of red fluid after rubbing	No release of toxic red fluid after rubbing

Local distribution. Not observed along the Somali coast by Tortonese (1949; 1951; 1980), nor by Humphreys (1981) along the Kenyan coastline. Other important records for eastern Africa include those by Ludwig (1875) from Zanzibar, by Cherbonnier (1988) from northern Madagascar (Nosy Bé). Massin (1999; figure 14: p. 22) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to Tahiti.

Remarks – Although the name *H. edulis* suggests that this species is edible, in Kenya no real market exists for this low-valued species. The Kiunga fishermen do not have a common name for it.

Subgenus *Lessonothuria* Deichmann, 1958

Holothuria (*Lessonothuria*) *pardalis* Selenka, 1867

Material examined. KKiun/9934 (one specimen); KKiun/9935 (one specimen); KKiun/9936 (one specimen); KKiun/9937 (one specimen).

Taxonomic description. Cherbonnier, 1988: 117–119; figure 47, p. 118; Massin, 1999: 25–27; figure 18, p. 26.

Field description. Relatively small species, up to 100 mm long and 40 mm wide. Total body wall white-yellow, with two rows of conspicuous dark areas on the dorsal side and with innumerable small yellow areas giving the animal a speckled appearance. Rough bivium clearly separated from the smoother trivium. Bivium with small homogeneously spread papillae, more numerous at the posterior side; trivium with long cylindrical podia in the radial areas (two to four rows laterally; four to five rows in the median area), however with some spreading into the interambulacral areas. Mouth ventral, surrounded by 17 long 'dendritic' tentacles, surrounded at their base by long conical papillae. Anus terminal, surrounded by conical papillae. Cuvierian tubules absent

Abundance in the Kiunga Marine Reserve. *Rare*, possibly *common*. Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) reports it as abundant in the channel to Mida Creek, on the rock reefs near Big Tree Caves and in the Watamu Marine Park. Tortonese (1980) reports it abundant at Bender Mtoni (20 km South of Kismayu), Somalia. Other important

records for eastern Africa include those by Selenka (1867) from Zanzibar (as *Holothuria subditiva*); by Haacke (1880) from Mauritius (as *Labidodemas punctulatum*); by Sloan *et al.* (1979) from Aldabra; by Clark (1984) from the Seychelles. Massin (1999, figure 19: p. 27) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the West coasts of central and North America.

Remarks – Since this species lives unexposed, hiding under coral blocks on coral debris and crustose algae, its abundance is possibly much larger than suggested here.

Subgenus *Mertensiothuria* Deichmann, 1958

Holothuria (Mertensiothuria) leucospilota (Brandt, 1835)

Material examined. KKiun/9932 (one specimen); KKiun/9933 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 112–114; figure 45, p. 113; Massin, 1999: 27–30; figure 20, p. 29.

Field description. Relatively large cylindrical and elongate species, reaching lengths of over 300 mm. Its body wall is coloured in life uniform brown to reddish black, sometimes somewhat lighter ventrally. Ventral tube feet large, but relatively short, with brown to grey sucking disc, distributed in the radial areas with major scattering into the interradial areas. Soft, brown papillae in the radial areas of the dorsal side. Mouth ventral with 20 large, black tentacles. Anus terminal. Cuvierian tubules present.

Abundance in the Kiunga Marine Reserve. *Abundant*, although not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) reports it from Mida Creek and the Watamu Marine Park; Tortonese (1980) reports it from Bender Mtoni, 20 km South of Kismayu. Other important records for eastern Africa include those by Selenka (1867) from Zanzibar as *H. vagabunda*; by Sloan *et al.* (1979) from Aldabra; by A.M. Clark (1984) from the Seychelles. Massin (1999, figure 21: p. 29) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the West coasts of tropical America.

Subgenus *Metriatyla* Rowe, 1969

Holothuria (Metriatyla) scabra Jaeger, 1833

Material examined. KKiun/9939 (1 specimen).

Taxonomic description. See Cherbonnier, 1988: 135–137; figure 55, p. 136; Massin, 1999: 30–33; figure 22, p. 31.

Field description. Species can be up to 400 mm long and 150 mm wide. Body colour dorsally grey with transverse narrow white bands; ventral side light grey with numerous homogeneously distributed grey spots corresponding to the tube feet. Grey tube feet in trivium and bivium, spread over the ambulacral and interambulacral areas, in bivium less numerous. Papillae always dorsal, small, and black, surrounded by a narrow grey ring, sparsely distributed over all the bivium. Mouth ventral, surrounded by 20 grey tentacles; anus terminal. Cuvierian tubules absent.

Abundance in the Kiunga Marine Reserve. *Very rare*, also observed in the Kiunga Marine Reserve by Obura and his team (1998).

Local distribution. Humphreys (1981) reports it from Kenya (Malindi Marine Park, Mida Creek, Suda Island); Panning (1941) from Mombasa, and Somalia. Other important records for eastern Africa/western Indian Ocean include those by Selenka (1867) from Zanzibar as *Holothuria tigris*; by Haacke (1880, in Théel, 1886), Ludwig (1883) and Théel (1886) from

Mauritius; and by Clark (1984) from the Seychelles. Massin (1999, figure 23: p. 32) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the Cook Islands.

Remarks. This species probably was abundant up to a few years ago, but extensive fishing caused a sharp decline in the abundance. An old synonym of *Holothuria scabra* Jaeger, 1833 is *Holothuria tigris* Selenka, 1867, the local fishermen refer to that old name in their language: they call this species 'iyongo tigri'. It has a high market value, of 20 KSh/fresh specimen.

Subgenus *Microthele* Brandt, 1835

Holothuria (Microthele) nobilis (Selenka, 1867)

Material examined. KKiun/9940 (two specimens).

Taxonomic description. See Cherbonnier, 1988: 142–144; figure 58, p. 143; Massin, 1999: 33–38; figure 24, p. 34; figure 25, p. 36; figure 26, p. 37.

Field description. Loaf-shaped body, with the dorsal side round and coloured grey to black, and ventral side flattened and uniform white to grey. Lateral four to eight large white-yellow 'teats' (*i.e.* conical projections) separate the trivium from the bivium. Grey tube feet with brown sucking disk scattered all over the ventral surface, black tube feet with brown sucking disk on dorsal side. Mouth ventral with 20 grey to dark brown, large feeding tentacles with brown spots on the stalk. Anus dorsal surrounded by five small white teeth. Body wall approximately 10 mm thick, often covered with sand. Cuvierian tubules present in both specimens.

Abundance in the Kiunga Marine Reserve. *Common.* Also reported from the Kiunga Marine Reserve by Obura *et al.* (1998).

Local distribution . Humphreys (1981) reports it from Kenya in the Watamu Marine Park and in Mida Channel. Other important records for eastern Africa include those by Panning (1941) from Somalia (unspecified locality); by Selenka (1867) and Semper (1869) from Zanzibar as *Muelleria nobilis*; by Sloan *et al.* (1979) from Aldabra; by Clark (1984) from the Seychelles. Massin (1999, figure 27: p. 38) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to Easter Islands.

Subgenus *Platyperona* Rowe, 1969

Holothuria (Platyperona) difficilis Semper, 1868

Material examined. KKiun/9949 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 99–101; figure 40, p. 102; Massin, 1999: 38–40; figure 28, p. 39.

Field description. Cylindrical body up to 120 mm in length (see Rowe, 1969), bivium variegated purple-brown, trivium slightly lighter and more uniform in colouration. Dorsal pedicels dark brown, surrounded at their base by a brown ring-like area, scarce in number, distributed over the total area, ventral tube feet more numerous, distributed mainly in the radial areas (especially posteriorly) in four to six rows, although some spreading into the interradial areas can occur. Anus terminal guarded by five small, brown, pointed teeth and numerous non-calcified papillae. Mouth ventral surrounded by 20 small but firm tentacles, green-brown in colouration. Body wall rough, relatively thin (2–3 mm). Large Cuvierian tubules present, however not readily ejected.

Abundance in the Kiunga Marine Reserve. *Very rare.* Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. First record for Kenya. Previously important records for eastern Africa/western Indian Ocean were made by Haacke (1880) as *Muelleria pervula* and Ludwig (1883) as *Holothuria difficilis* in Mauritius; by Sloan *et al.* (1979) from Aldabra; by Clark (1984) from the Seychelles; by Cherbonnier (1988) from Madagascar. Massin (1999, figure 29: p. 40) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the West coasts of America.

Subgenus *Semperothuria* Deichmann, 1958

Holothuria (Semperothuria) cinerascens (Brandt, 1835)

Material examined. KKiun/9941 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 70–72; figure 27, p. 72.

Field description. Medium sized species up to 120 mm in length and 40 mm in width. Red-brown to purple body colour, somewhat lighter ventrally. Yellow-brown tube feet scattered over the total ventral and dorsal surface. The dorsal tube feet are less numerous, short, and surrounded at their base by a yellow circle. Twenty large and branched red-purple tentacles around the ventral mouth. Anus dorsal, unguarded. Body wall soft and rather smooth. Cuvierian tubules always absent.

Abundance in the Kiunga Marine Reserve. *Very rare.* Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Reported from Kenya—Mida channel and Kibirijini point—by Humphreys (1981), and from Mombasa by Levin (1979). From southern Somalia—Bender Mtoni, 20 km South of Kismayu—by Tortonese (1980). Other important records for eastern Africa/western Indian Ocean include those by Lampert (1896) from Zanzibar; by Ludwig (1883) from Mauritius as *Holothuria pulchella*; by Sloan *et al.* (1979) from Aldabra; by Lampert (1885), Ludwig (1899) and by Clark (1984) from the Seychelles.

Remarks. It is possible that this species is more abundant than reported here, since its hiding behaviour under coral rocks makes it hard to find.

Subgenus *Stauropora* Rowe, 1969

Holothuria (Stauropora) fuscocinerea Jaeger, 1833

Material examined. KKiun/9938 (one specimen).

Taxonomic description. See Massin, 1999: 48–51; figure 38, p. 50.

Field description. Specimens can be up to 200 mm long and 50 mm wide. Bivium mottled green-grey with dark spots (white-tipped conical papillae distributed over the total surface; trivium grey-green with homogeneously distributed brown spots corresponding to cylindrical tube feet (with white sucking disc). Mouth ventral surrounded by 20 yellow-green stout tentacles, in turn surrounded by a collar of small yellow conical papillae. Anus dorsal surrounded by a dark purple ring. Cuvierian present, very thick, white and very readily ejected.

Abundance in the Kiunga Marine Reserve. *Very rare.* Only seen once during a night dive. Obura *et al.* (1998) failed to find it in the Kiunga Marine Reserve.

Local distribution. Humphreys (1981) recorded a single specimen in the Watamu Marine Park; Tortonese (1980) failed to find it in Somalia. Pearson (1913) reports it as a “not very common species with an Indo-Pacific distribution”. Massin (1999, figure 39: p. 51) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the Gulf of California; quite a few records are now known.

Subgenus *Theelothuria* Deichmann, 1958

Holothuria (Theelothuria) turriscelsa Cherbonnier, 1980 Pl. 2A, B

Material examined. KKiun/9947 (two specimens).

Taxonomic description. See Cherbonnier, 1980: 644; figure 15 A–L, pl. 1E.

Field description. Relatively large species reaching lengths of about 250 mm and widths of about 75 mm. Well-developed white to almost translucent Cuvierian tubules, which is very readily ejected (further disturbance results in the ejection of the situs viscerum). Colour yellow-green ventrally with numerous dark green spots corresponding to cylindrical brown tube feet with distinct white sucking discs; mottled dark green to yellow dorsally; the green patches correspond to the basis of the short, well-developed dark brown conical papillae; the smaller yellow spots bear shorter dark brown papillae. Bivium clearly separated from the flattened trivium. Mouth ventral surrounded by 19–20 large, yellow-green tentacles. Anus dorso-terminal, guarded by dark-brown conical papillae. Tube feet spread evenly over the ambulacra and interambulacra in the trivium; papillae in the bivium spread over the total surface. Body wall several mm thick.

Abundance in the Kiunga Marine Reserve. *Rare*. Not reported by Obura *et al.* (1998) in the Kiunga Marine Reserve.

Local distribution. This recently described species is reported here as a new species for the Indian Ocean. Up till now it was only known from four localities: Indonesia (Sulawesi) (Massin, 1999), Mariana Islands (Guam) (Kerr *et al.*, 1992), New Caledonia (Cherbonnier, 1980; Cherbonnier & Féral, 1984; Féral & Cherbonnier, 1986); and the Society Islands (Tahiti) (Cherbonnier & Féral, 1984) (see also distribution map Massin, 1999, figure 43: p. 55). One of us recorded it earlier in Kenya and Tanzania, Pemba Island (Samyn, pers. observation).

Remarks. This species was observed during a night dive in a single location. Due to its nocturnal habits, it is possible that this species is more common than reported here.

Subgenus *Thymiosycia* Pearson, 1914

Holothuria (Thymiosycia) arenicola Semper, 1868

Material examined. KKiun/9945 (one specimen).

Taxonomic description. See Cherbonnier, 1988: 82–84; figure 32, p. 83; Massin, 1996a: 27–30; figure 19, p. 29.

Field description. Small burrowing species, up to 150 mm long and 25 mm wide. Body cylindrical, tapering at both ends. Colour grey to yellow with numerous tiny black spots ventrally; dorsally yellowish-grey with two rows of conspicuous brown areas lying in narrow and shallow longitudinal scars, and with numerous tiny black spots. Mouth terminal surrounded by 18 feeding tentacles. Large terminal anus guarded by five groups of four to five papillae. White cylindrical tube feet in trivium distributed in the radial areas, but with major spreading into the interradiial area; in bivium spread evenly in the total area. Cuvierian tubules absent.

Abundance in the Kiunga Marine Reserve. *Very rare*. Not observed by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution – First record for Kenya. Humphreys (1981) failed to find it in Kenya. It was however recorded from Somalia (Sar Uanle, 20 km South of Kismayu) by Tortonese (1980). Other important records for eastern Africa/western Indian Ocean include those by Sloan *et al.* (1979) from Aldabra; by Haacke (1880) from Mauritius; by Ludwig (1899) as

Holothuria maculata and by Clark (1984) from the Seychelles; by Lampert (1885; 1896) and Ludwig (1899) as *Holothuria maculata* from Zanzibar; by Haacke (1880) and Ludwig (1883) as *Holothuria maculata* from Mauritius. Rowe & Doty (1977) and Massin (1996b) report on the distribution of *H. arenicola* as being tropical Indo-West Pacific (with the Red Sea).

Remarks. The burrowing behaviour of this species makes it very difficult to find: only an in- and outflow in the sand is visible, so abundance is possibly much larger than reported here.

Holothuria (Thymiosycia) hilla Lesson, 1830

Material examined. KKiun/9942 (one specimen); KKiun/9943 (three specimens).

Taxonomic description. See Cherbonnier, 1988: 85–87; figure 34, p. 88; Massin, 1999: 55–57.

Field description. Cylindrical body up to 150 mm long and 35 mm wide. Bivium chocolate brown with longitudinal rows of yellow pointed papillae; trivium slightly lighter with long cylindrical yellow tube feet arranged in two to three rows in the lateral radial areas and in three to four rows in the median ambulacrum. Mouth ventral surrounded by 19 to 20 yellow tentacles. Anus terminal surrounded by small conical papillae. Body wall thin. Cuvierian tubules present but not readily ejected.

Abundance in the Kiunga Marine Reserve. *Common*, although not found by Obura *et al.* (1998) in the Kiunga Marine Reserve.

Local distribution. Previously reported from Kenya by Humphreys (1981) from Big Tree Caves in front of Mida Creek; from southern Somalia (Bender Mtoni) by Tortonese (1980). Other important records for eastern Africa include those by Selenka (1867) as *Stichopus gyrifer* and Ludwig (1899) as *Holothuria monacaria* from Zanzibar; by Haacke (1880) as *Labidodemas neglectum* and Ludwig (1883) as *Holothuria monacaria* from Mauritius; by Sloan *et al.* (1979) from Aldabra; by Ludwig (1899) as *Holothuria monacaria* and by Clark (1984) from the Seychelles. Massin (1999, figure 44: p. 56) shows an Indo-Pacific distribution from East Africa (with the Red Sea) to the Society Islands.

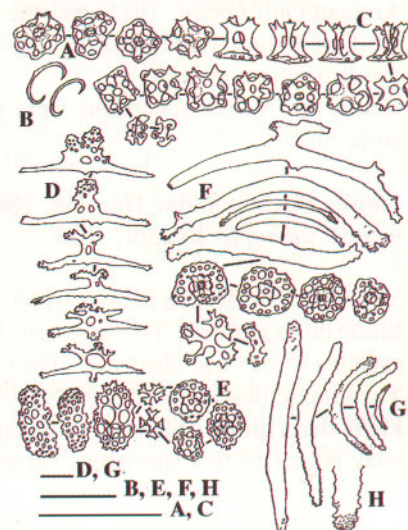
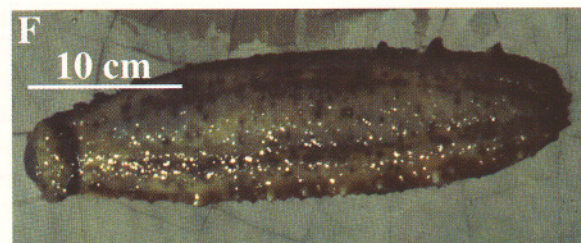
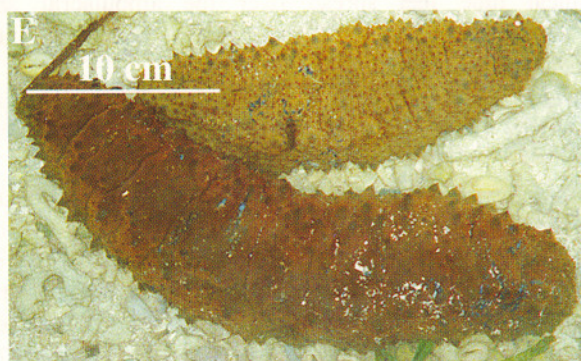
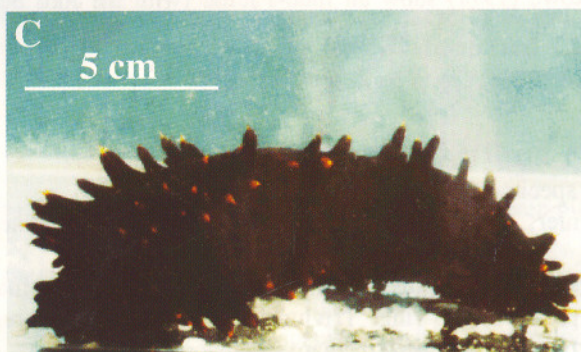
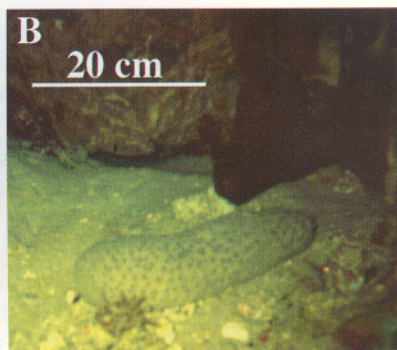
Holothuria (Thymiosycia) impatiens (Forsskål, 1775)

Material examined – KKiun/9944 (four specimens).

Taxonomic description. See Cherbonnier, 1988: 89–91; figure 35, p. 90.

Field description. Species reaching sizes up to approximately 120 mm in length and 30 mm in width. Trivium light brown with some lighter areas corresponding to the basis of the tube feet; bivium somewhat darker with dark brown areas more or less connected to form transverse bands. Mouth terminal, surrounded by 18 relatively small tentacles; anus terminal

Plate 2. A, B. *Holothuria* (Theelothuria) *turriscelsa* Cherbonnier, 1980; C. *Stichopus chloronotus* Brandt, 1835; D. *Labidodemas pertinax* Ludwig, 1875; E. *Stichopus herrmanni* Semper, 1868; F. *Stichopus* cf. *monotuberculatus* (Quoy & Gaimard, 1833), ventral view; G. *Stichopus* cf. *monotuberculatus* (Quoy & Gaimard, 1833), dorsal view; H. *Stichopus* cf. *monotuberculatus* (Quoy & Gaimard, 1833): A. tables from the ventral body wall; B. C-shaped rods from the ventral body wall; C. tables and rosettes from the dorsal body wall; D. modified rods from the ventral body wall; E. plates, tables and X-shaped rods from the ventral tube feet; F. rods and tables from the dorsal papillae; G. rods from the tentacles; H. detail of the distal end of a rod from the tentacle. Scale bars are 100 µm. All pictures by Y. Samyn.



H

with five conical papillae. Thick Cuvierian tubules present but not readily ejected. Body wall only few mm thick and relatively smooth.

Abundance in the Kiunga Marine Reserve. *Rare*, found only in one location under boulders and coral heads over sandy gravel and coarse rubble. Not observed by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local distribution. Previously recorded from Kenya by Humphreys (1981) from Mida creek, Watamu Marine Park and Ras Ngomeni; from Sar Uanle (southern Somalia) by Tortonese (1980); from Aldabra by Sloan *et al.* (1979); and from the Seychelles by Clark (1984). Other important records for eastern Africa include those by Selenka (1867) and Ludwig (1899) from Zanzibar as *Holothuria botellus*; by Haacke (1880) and Ludwig (1883) from Mauritius; by Ludwig (1883) from Madagascar; by Lampert (1885) and Ludwig (1899) from the Seychelles. A.M. Clark & Rowe (1971) show an Indo-Pacific (with the Red Sea, see also Tortonese, 1955) distribution.

Genus *Labidodemas* Selenka, 1867

Labidodemas pertinax Ludwig, 1875. Pl. 2D

Material examined. KKiun/9919 (one specimen); KKiun/9920 (two specimens).

Taxonomic description. See Cherbonnier, 1988: 51–53; figure 17, p. 52; Rowe & Gates, 1995: p. 304.

Field description. Uniform white dorsally with a pinkish shine ventrally. Mouth terminal, surrounded by a 5 mm wide dark purple to brown ring. Trivium with distinct radial areas containing long cylindrical yellow to brown tube feet (median ambulacrum in two rows); bivium with fewer short white conical tube feet spread over the ambulacral and interambulacral areas. Mouth terminal, surrounded by 15 to 20 small feeding tentacles. Anus terminal, sometimes surrounded by conical papillae. Skin thin but leathery.

Abundance in the Kiunga Marine Reserve. *Common*, although this species is rarely seen, due to its hiding behaviour. Not reported by Obura *et al.* (1998) from the Kiunga Marine Reserve.

Local Distribution. Two species of *Labidodemas* are known to occur in the Indian Ocean: *Labidodemas rugosum* and *Labidodemas pertinax* (Rowe, 1969). In eastern Africa *Labidodemas pertinax* is only known from a few localities: Iles Glorieuses (North of Madagascar) (Cherbonnier, 1988). However its range stretches further North towards the Arabian Gulf (Price, 1981) and the Red Sea (Price, 1982) and West via the Bay of Bengal, the East Indies, North Australia and the Philippines up to Hawaii (see Clark & Rowe, 1971 for distribution table).

Remarks. All the specimens were seen under coral boulders on sand gravel or on coarser coral rubble.

Family Stichopodidae Haeckel, 1886

Genus *Stichopus* Brandt, 1835

Stichopus chloronotus Brandt, 1835. Pl. 2D

Material examined. The specimen from the Kiunga Marine Reserve could not be preserved adequately and was discarded. The picture D on pl. 2 leaves no doubt over the identification.

Taxonomic description. See Cherbonnier, 1988: 146–147; figure 60, p. 149.

Field description. Medium sized species up to 150 mm long and up to 60 mm wide. The body colour of live specimens varies from dark green to black-brown. Trivium distinctively

flattened, slightly lighter colour than bivium. The mouth is positioned ventrally and is surrounded by large dark green papillae and 16 to 20 white or grey (after preservation) peltate tentacles. Anus terminal. Relatively long dark green cylindrical tube feet cover the whole ventral side, posteriorly in four distinct rows. On the dorsal side two rows of large conical papillae of the same body colour but with yellow-orange distal ends. The bivium is separated from the trivium by a single row of these papillae. Skin smooth, 3 to 4 mm thick.

Abundance in the Kiunga Marine Reserve. *Very rare*, only recorded as a single specimen from a single locality (Hindi). Not reported by Obura *et al.* (1998) in the Kiunga Marine Reserve.

Local distribution. Not reported from Kenya by Humphreys (1981), nor by Tortonese (1949; 1951; 1980) from Somalia. It is here described for the first time from Kenya, although it is a well-known tropical Indo-Pacific (see Clark & Rowe, 1971: 178–179; Rowe & Doty, 1977) and Red Sea (Price, 1982) species ranging from East Africa to Hawaii. The most representative local records are those by Selenka (1867) who reports it from Zanzibar; by Haacke (1880) as *Stichopus cylindricus* and Ludwig (1883) as *Stichopus (Perideris) chloronotus* from Mauritius; by Sloan *et al.* (1979) from Aldabra; and by Clark (1984) from the Seychelles.

Stichopus hermanni Semper, 1868. Pl. 2 E

Material examined. None from Kiunga, however picture E. on pl. 2 leaves no doubt over the identification.

Taxonomic description. See Rowe & Gates, 1995: 324; Massin, 1996a: 35–38; figure 24, p. 37; Massin, 1999: 63–65; figure 52, p. 64.

Field description. Large species, up to 250 mm long and to 65 mm wide. Body form is squarish, with a smooth surface. The colour of live animals is uniform bright olive-green dorsally and ventrally. Dorsal surface with large transverse scars. Mouth ventral with 16 to 18 greenish tentacles. Anus terminal, without anal teeth or papillae. On the flattened ventral side cylindrical podia positioned both on the ambulacra and the interambulacra. Conical, light green papillae with dark green stripes and yellow to orange distal tips, lateral and dorsal, for the latter side only in the ambulacral areas. Body wall from 3 to 5 mm thick, smooth.

Abundance in the Kiunga Marine Reserve. *Rare*. First record for the Kiunga Marine Reserve.

Local distribution – Recorded from Mombasa by Levin (1979) as *Stichopus variegatus*. It is a well-known Indo-Pacific species (Rowe & Gates, 1995). However, as Massin (1999) notes, its exact distribution is problematic due to confusion with *Stichopus monotuberculatus*.

Stichopus cf. monotuberculatus (Quoy & Gaimard, 1833). Pl. 2F, G, H

Material examined. KKiu/9950 (two specimens).

Taxonomic description. See Cherbonnier, 1952: 23–25, pl. 3 figure 4, text-figure 8 a–t; Massin, 1996b: 163–164; figure 9, p. 165; figure 10, p. 166; pl. 1C, D.

Field description. Large species, in life up to 350 mm long and 80 mm wide. Colour in life: dorsal side from grey green to orange-brown with dark green to black patches, ventral side grey-green with numerous small dark patches. In alcohol the colours fade to light green with patches of light brown. Ventral side flattened, dorsal side swollen, giving the animal a squarish view in cross-section. Mouth ventral surrounded by 20 large tentacles surrounded in turn by a circle of large papillae. Anus terminal, without anal teeth or papillae. Large cylindrical, yellowish brown tube feet in trivium in ambulacral areas only. Large conical papillae distributed more or less randomly in bivium, but with a distinct fringe of 8–10 larger papillae laterally. Skin rather rough compared to the other *Stichopus* species found in the region.

Abundance in the Kiunga Marine Reserve. *Common*. observed at several localities in the Kiunga marine reserve, although not reported by Obura *et al.* (1998).

Local distribution. *Stichopus monotuberculatus* is reported here as a first record for Kenya. It was seen by one of us (YS) further south, Pemba Island, Tanzania. Neither Humphreys (1981), nor Tortonese (1949, 1951, 1980) found it in the immediate surroundings. It is however an expected species since, Massin's distribution map (1996b, map 3, p. 174) shows an Indo-Pacific distribution from the Red sea and Madagascar to Eastern Islands, and from Japan to Australia.

Remarks. The specimens discussed here were only seen at night, although one of us (YS) observed a specimen at Pemba Island (Tanzania) foraging during the day. It is with some hesitation that we refer this species to *S. monotuberculatus*. Although the spicules match the descriptions given by Cherbonnier (1952) and Massin (1996b), the colouration and the pattern of the body wall is somewhat different: the "numerous white spots, often clumped together forming a whitish surface, and deep brown spots" (after Massin, 1996b) are largely absent from our specimens. Pl. 2F and G depict the largest specimen found in the Kiunga Marine Reserve. Pl. 2H shows the spicules found in the various body parts. More specimens of different sizes from different localities are needed to clarify the identity of our specimens.

Order Dendrochirotida Grube, 1840

Family Sclerodactylidae Panning, 1949

Subfamily Cladolabinae Heding & Panning, 1954

Genus *Afrocucumis* Deichmann, 1944

Afrocucumis africana (Semper, 1868)

Material examined. KKiun/9918 (four specimens).

Taxonomic description. See Cherbonnier, 1988: p. 218–220; figure 95, p. 219.

Field description. Small species, length up to 60 mm, width up to 10 mm, tapering at both ends. Total body surface homogeneous dark green to brown. Mouth and anus terminal. Mouth surrounded by 19 small dendritic tentacles. Tube feet long, cylindrical, of the same colour as the rest of the body, distributed ventrally and dorsally in the ambulacra.

Abundance in the Kiunga Marine Reserve. *Rare*, maybe *common*. Only observed in one locality in the reserve. Not reported from the Kiunga Marine Reserve by Obura *et al.* (1998).

Local distribution. It was previously recorded from southern Somalia (Gesira and Bender Mtoni) by Tortonese (1980) and from Mida Creek, Watamu Marine Park, and Kibirijini in Kenya by Humphreys (1981). Other important local records include those by Sloan *et al.* (1979) from Aldabra; by Clark (1984) from the Seychelles; by Ludwig (1887) as *Pseudocucumis theeli* from Zanzibar; and Heding and Panning (1954) as *Orcula cucumiformis* from Zanzibar. Massin (1999, figure 79: p. 96) shows an Indo-Pacific distribution from East Africa (excluding the Red Sea) to the Fiji Islands.

Remarks. Due to its small size and its burrowing behaviour this species is probably easily overlooked.

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REFERENCES

- Agassiz, A. (1872). Revision of the Echini. *Illustrated Catalogue of the Museum of Comparative Zoology*, Harvard University 7(1): vii-xii + 242, pls A-G.
- Bell, F.J. (1884). Echinodermata. In: Coppinger R.W (ed.). *Report on the Zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert", 1881-1882*. London: 117-177 & 509-512, pl. 8-17 & 45.
- Bell, F.J. (1903). Report on a collection of echinoderms from the neighbourhood of Zanzibar. *Annals and Magazine of Natural History, London* (7) 12: 244-248.
- Cherbonnier, G. (1952). Les holothuries de Quoy & Gaimard. *Mémoire de l'Institut royal des Sciences naturelles de Belgique, Deuxième série* 44: 1-50 + 3 pls.
- Cherbonnier, G. (1980). Holothuries de Nouvelle-Calédonie. *Bulletin du Muséum national d'Histoire naturelle de Paris*, Quatrième série, 2, section A (3): 659-700.
- Cherbonnier, G. & J.P. Féral (1984). Les Holothuries de Nouvelle-Calédonie. Deuxième contribution (Première partie: Synallactidae et Holothuridae). *Bulletin du Muséum national d'Histoire naturelle de Paris*, Quatrième série, 6, section A (3): 659-700.
- Cherbonnier, G. (1988). Echinodermes: Holothurides. *Faune de Madagascar* 70: 1-292.
- Clark, A.M. & J. Courtman-Stock (1976). *The echinoderms of southern Africa*. Trustees of the British Museum (Natural History), London. 277 p.
- Clark, A.M. & F.W.E. Rowe (1971). *Monograph of Shallow-water Indo-West Pacific Echinoderms*. London, Trustees of the British Museum (Natural History), London. 238 pp.
- Clark, A.M. (1984). Echinodermata of the Seychelles. In: D.R. Stoddart, (ed.). *Biogeography and Ecology of the Seychelles Islands. Monographiae biologicae* 55: 83-102. Dr Junk, W. Publishers, The Hague.
- Clark, H.L. (1925). *A catalogue of the recent sea-urchins (Echinoidea) in the collection of the British Museum (Natural History)*. London. xxviii + 250 pp., 12 pls.
- Décary, R. (1924). Liste d'Echinodermes recueillis à Madagascar. *Bulletin de l'Académie Malgache* 6: 37-41.
- Féral, J.P. & G. Cherbonnier (1986). Les holothurides. In: A. Richard, P. Laboute & J.L. Menou, (eds). *Guides des étoiles de mer, oursins et autres échinodermes du lagon de Nouvelle-Calédonie*. ORSTOM, Paris: 1-238.
- Haacke, W. (1880). Holothuren. In: K. Möbius (ed.). *Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen*. Berlin: 46-48.
- Heding, S.G. & A. Panning, (1954). *Phyllophoridae. Spolia Zoologica Musei Hauniensis* 13: 1-209, 102 figures

- Hoffman, C.K. (1874). Crustacés et Echinodermes de Madagascar et de l'Île de la Réunion. In: F.P.L. Pollen & D.C. Van Dam (eds). *Recherches sur la faune de Madagascar et de ses dépendances*. Leyden 5(2): 1–58, pls i–x [Echinoderms on pp. 45–56, pl. 10]
- Hughes, R.N. & J.C. Gamble, (1977). A quantitative survey of the biota of intertidal soft substrata on Aldabra Atoll, Indian Ocean. *Philosophical Transactions of the Royal Society of London Series B – Biological Sciences* 279: 327–355.
- Humphreys, W.F. (1981). The Echinoderms of Kenya's Marine Parks and Adjacent Regions. *Zoologische Documentatie Koninklijk Museum voor Midden Africa, Tervuren, België* 19: 1–39.
- Kerr, A., D.R. Norris, P.J. Schupp, K.D. Meyer, T.J. Pitlik, D.R. Hopper, J.D. Chamberlain & L.S. Meyer (1992). Range extension of Echinoderms (Asteroidea, Echinoidea and Holothuroidea) to Guam, Mariana Islands. *Micronesica* 25 (2): 201–216.
- Lambert, J. (1921–22). Echinides vivants et fossiles recueillis à Madagascar par M. Raymond Décary. *Mémoires de la Société Académique de l'Aube* 85: 3–45, 1 pl.
- Lampert, K. (1885). Die Seewalzen (Holothurioida). In: C. Semper, (ed.). *Reisen im Archipel der Philippinen*. Wiesbaden 2(4)(3): 1–312, 1 pl.
- Lampert, K. (1896). Die von Dr. Stuhlmann in den Jahren 1888–1889 an der Östküste Afrika gesammelten Holothurien. *Mittheilungen aus dem Naturhistorischen Museum* 13: 49–71, 3 figures.
- Levin, V.S. (1979). Aspidochirote holothurians of the upper sublittoral zone of Indo-West Pacific: species composition and distribution. *Biologia Marina* 5: 17–23.
- Ludwig, H.L. (1875). Beiträge zur Kenntniss der Holothurien. *Arbeiten aus dem zoolog. zootom. Institut in Würzburg* 2(2): 77–120, pl. 6–7.
- Ludwig, H.L. (1883). Verzeichniss der Holothurien des Kiehler Museums. *Bericht der Oberhessischen Gesellschaft für Natur- und Heilkunde* 4 (10): 127–137.
- Ludwig, H.L. (1887). Drei Mittheilungen über alte und neue Holothurienarten. *Abhandlungen der preussischen Akademie der Wissenschaften* 54: 1–28, pl. 15.
- Ludwig, H.L. (1899). Echinodermen des Sansibargebietes. In: A. Voeltzbow (ed.). *Wissenschaftliche Ergebnisse der Reisen in Madagascar und Ost-Africa in den Jahren 1889–95*. Abhandlungen der Senckenbergischen naturforschenden Gesellschaft 21: 537–563.
- Massin, C. (1996a). Results of the Rumphius Biohistorical Expedition to Ambon (1990). Part 4. The Holothuroidea (Echinodermata) collected at Ambon during the Rumphius Biohistorical Expedition. *Zoologische Verhandelingen* 307: 1–53.
- Massin, C. (1996b). The holothurians of Easter Island. *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Biologie* 66: 151–178.
- Massin, C. (1999). Reef-dwelling Holothuroidea (Echinodermata) of the Spermonde Archipelago (South-West Sulawesi, Indonesia). *Zoologische Verhandelingen* 329: 1–144.
- Massin, C., R. Rasolofonirina, C. Conand, Y. Samyn (1999). A new species of *Bohadschia* (Echinodermata: Holothuroidea) from the Western Indian Ocean with a redescription of *Bohadschia subrubra* (Quoy & Gaimard, 1833). *Bulletin de l'Institut royal des Sciences naturelles de Belgique, Biologie* 69: 151–160, 1 pl.
- Mitsukuri, K. (1912). Studies on Actinopodous Holothuroidea. *Journal of the College of Science, Imperial University of Tokyo* 39(2): 1–284, 55 figures, 8 pls.
- Möbius, K. (1880). *Beiträge zur Meeresfauna der Inseln Mauritius und der Seychellen*. Berlin: 1–352, 22 pls. [Echinoderms on pp. 46–50].
- Mortensen, T. (1928). *A monograph of the Echinoidea 1. Cidaroidea*. Copenhagen. 551 pp., 173 figures, 88 pls.

- Mortensen, T. (1931). Echinodermata. *Faune des Colonies françaises* 4: 590–596.
- Mortensen, T. (1935). *A monograph of the Echinoidea* 2. *Bothriocidaroida, Meonechinoida, Lepidocentroida and Stiridonta*. Copenhagen. 647 pp. 377 figures, 89 pls.
- Mortensen, T. (1940). *A monograph of the Echinoidea* 3(1). *Aulodonta*. Copenhagen. 370 pp., 196 figures, 77 pls.
- Mortensen, T. (1943a). *A monograph of the Echinoidea* 3(2). *Camarodonta* 1. Copenhagen. 553 pp., 321 figures, 56 pls.
- Mortensen, T. (1943b). *A monograph of the Echinoidea* 3(3). *Camarodonta* 2. Copenhagen. 446 pp., 215 figures, 66 pls.
- Mortensen, T. (1948). *A monograph of the Echinoidea* 4(2). *Clypeasteroida*. Copenhagen. 471 pp., 258 figures, 72 pls.
- Obura, D., J. Church, H. Mwadzaya, E. Wekesa, N. Muthiga (1998). *Rapid assessment of coral reef biophysical and socioeconomic conditions in the Kiunga Marine National Reserve, Kenya: methods development and evaluation*. Technical report prepared for FAO and UNEP-Water Branch, Nairobi, Kenya.
- Panning, A. (1941). Über einige Ostafrikanische Seewalzen und ihre Eignung zur Trepanggewinnung. *Thalassia* 6(8): 1–18.
- Panning, A. (1944). Die Trepangfischerei. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* 49: 2–76, 40 figures.
- Pearson, J. (1913). Notes on the Holothuroidea of the Indian Ocean. *Spolia Zeylanica* 9(34): 49–101, pls 5–14.
- Peters, W. (1854). Über die an der Küste von Mossambique beobachteten Seeigel und insbesondere über die Gruppe der Diademen. *Abhandlungen der preussischen Akademie der Wissenschaften* 1854: 101–119, 1 pl.
- Peters, W. (1855). *Seeigel von Mossambique*. *Abhandlungen der preussischen Akademie der Wissenschaften* 1855.
- Pfeffer, G. (1896). Ostafrikanische Echiniden, Asteriden und Ophiuriden, gesammelt von Herrn Dr. F. Stuhlmann im Jahre 1888 und 1889. *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* 13: 43–48.
- Price, A.R.G. (1981). Studies on the echinoderm fauna of the western Arabian Gulf. *Journal of Natural History* 15: 1–15.
- Price, A.R.G. (1982). Echinoderms of Saudi Arabia. Comparisons between echinoderm faunas of Arabian Gulf, SE Arabia, Red Sea and Gulfs of Aqaba and Suez. *Fauna of Saudi Arabia* 4: 3–21.
- Quoy, J.R.C. & J.P. Gaimard (1833). Zoologie: Zoophytes. In: *Voyage de la corvette de l'“Astrolabe”, exécuté par l'ordre du roi pendant les années 1826–1829 sous le commandement de M.J. Dumont d'Urville*: 1–390, pls 1–26. Paris.
- Richmond, M.D. (ed) (1997). *A Guide to the Seashores of Eastern Africa*. 448 pp. Sea Trust, Zanzibar.
- Rowe, F.W.E. (1969). A review of the family Holothuriidae (Holothuroidea: Aspidochirotida). *Bulletin of the British Museum of natural History (Zoology)* 18(4): 119–170.
- Rowe, F.W.E. & J.E. Doty (1977). The shallow-water holothurians of Guam. *Micronesia* 13(2): 217–250, 9 figures
- Rowe, F.W.E. & J. Gates (1995). Echinodermata. In: A. Wells, (ed.). *Zoological Catalogue of Australia*: vol. 33, i–xiii, 1–510. CSIRO Australia, Melbourne.

- Rowe, F.W.E. & M.D. Richmond (1997). Echinodermata. In: M.D. Richmond, (ed.). *A guide to the seashores of eastern Africa and the western Indian Ocean Islands*: 290–321. The SEA Trust, Zanzibar. 448 pp.
- Russo, A. (1932). Echinodermi raccolti dal Prof. L. Stanzo nella campagna della R.N. Ammiraglio Magnaghi in Mar Rosso e zone viciniori 1923-1924. 3. Echinoidea, Ophiuroidea. *Memorie Reale Comitato talassographico italiano, Venezia* **194**: 1–5, 4 figures.
- Ruwa R.K. (1989). Macrofaunal composition and zonation on sandy beaches at Gazi, Kanamai and Malindi Bay, Kenya. *Kenya Journal of Sciences, Series B*, **10** (1–2): 31–45.
- Selenka, E. (1867). Beiträge zur Anatomie und Systematik der Holothurien. *Zeitschrift für wissenschaftliche Zoologie* **17**: 291–374, pls 17–20.
- Semper, C. (1869). Die Holothurien Ostafrika's. In C.C. von der Decken, *Reisen in Ost Afrika*. Leipzig & Heidelberg 3(1): 117–122, 1 pl.
- Sloan, N.A., A.M. Clark, J.D. Taylor (1979). The echinoderms of Aldabra and their habitats. *Bulletin of the British Museum of natural History (Zoology)* **37**(2): 81–128.
- Théel, H. (1886). Holothuroidea. Part 2. *Report of the scientific Results of the Voyage of the Challenger (Zoology)* **39**: 1–290, pl. 1–16.
- Tortonese, E. (1936). Echinodermi del Mar Rosso. *Annali del Museo civico di Storia Naturale Giacomo Doria, Genova* **59**: 202–245; 8 figures.
- Tortonese, E. (1949). Echinodermi della Somalia Italiana. *Annali del Museo civico di Storia Naturale Giacomo Doria, Genova* **64**: 30–42.
- Tortonese, E. (1951). Contributo allo studio dell'Echinofauna della Somalia. *Atti della Società Italiana di Scienze Naturali* **90**: 237–250.
- Tortonese, E. (1955). Spedizione subacquea Italiana nel Mar Rosso. Ricerche Zoologiche. II Echinodermi. *Rivista di Biologia Coloniale* **13**: 25–48, 1 pl.
- Tortonese, E. (1980). Researches on the coast of Somalia. Littoral Echinodermata. *Italian Journal of Zoology* **5**: 99–139.