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Preliminary list of ophiuroids (Echinodermata: Ophiuroidea) collected from the Johor Straits, Singapore

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Abstract. Ophiuroids were collected during the Singapore Biodiversity Workshop at Pulau Ubin in 2012. About 520 specimens were provisionally identified and 22 species of ophiuroids recognised. Fourteen species are new to Singapore waters.

Key words. echinoderm, ophiuroid, brittle star, Singapore, Pacific Ocean

INTRODUCTION

The ophiuroid fauna of Singapore has not been intensively studied. Earlier reports (Lim & Chou, 1988; Wee & Ng, 1994; Lane & VandenSpiegel, 2004) list 33 species of 8 families of ophiuroids from Singapore waters (Table 1) but there has been no comprehensive taxonomic work on ophiuroids for this location.

During the Singapore Marine Biodiversity Workshop in 2012, a major collection was made around Pulau Ubin in the Johor Strait to explore the biodiversity in Singapore waters. In this short report, we provide provisional identification results of ophiuroid species collected.

MATERIAL AND METHODS

Ophiuroids were collected in October 2012 from relatively deeper waters of the Johore Strait using dredges and trawls deployed from the National University of Singapore research vessel, RV *Galaxea*. Specimens were also collected by hand picking from intertidal waters around Pulau Ubin (Table 2). Collected specimens were relaxed in magnesium chloride solution, photographed, and preserved in 95% ethanol. The specimens were deposited at the National University of Singapore Zoological Reference Collection (Lee Kong Chian Natural History Museum) and the National Museum of Nature and Science, Tsukuba-shi, Japan.

Clark & Rowe's monograph (1971) is an essential reference for identifying Indo-West Pacific shallow-water ophiuroid species. Many species collected in this study appear in this monograph. Current valid species names follow the World Ophiuroidea Database (Stöhr et al., 2014) and the arrangement of families is adopted from Smith et al. (1995).

RESULTS

A total of about 520 specimens were provisionally identified to 22 species belonging to 12 genera of six families (Table 1). The most diverse family is the Ophiotrichidae (eight species) followed by Amphiuridae (seven species). Fourteen species were not included in previous studies of Singapore ophiuroids (Table 1).

Family Ophiuridae Müller & Troschel, 1840

Genus *Ophiura* Lamarck, 1801

Ophiura pteracantha Liao, 1982

Material examined. Six specimens; St. DW4, DW40, DW87; 6.9–21.0 m deep; coarse sand/dead shells?, mud.

Remarks. This species is very similar to *Ophiura kinbergi* (Ljungman, 1867), which was frequently reported widely in the Indo-west Pacific Ocean (A. M. Clark & Rowe, 1971: 90, 128; Rowe & Gates, 1995: 437). Many historical records of *O. kinbergi* from tropical waters are probably *O. pteracantha* (Tim O'Hara, pers. comm.). This species is distinguished from *O. kinbergi* in having the enlarged uppermost arm spines in distal arm segments (Liao, 1982; Liao & A. M. Clark, 1985).

Family Amphiuridae Ljungman, 1867

Genus *Amphioplus* Verrill, 1899

Amphioplus (*Amphioplus*) *lucidus* Koehler, 1922

Material examined. Seven specimens; St. DW4, DW86; 6.9–14.7 m deep; mud, coarse sand/dead shells?

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Table 1. Species list of Sigapore ophiuroids based on Lim & Chou (1988), Wee & Ng (1994), Lane & VandenSpiegel (2003) and this study. Synonymies appearing in the previous papers are shown in square brackets. The species found in this study are shown in bold font. Asterisks denote the species recorded for the first time in this study. Valid species names follow Stöhr et al. (2014).

	Lim & Chou (1988)	Wee & Ng (1994)	Lane & Vanden Spiegel (2003)	This study
Family Euryalidae				
Euryale aspera Lamarck, 1816		×	×	
Family Ophiuridae				
Ophiura kinbergi (Ljungman, 1867a)			×	
Ophiura pteracantha* Liao, 1982				×
Family Amphiuridae				
Amphioplus* (*Amphioplus*) *lucidus* Koehler, 1922				×
Amphioplus (*Lymanella*) *andreae* (Lütken, 1872)			×	
Amphioplus* (*Lymanella*) *depressus* (Ljungman, 1867b)			?	×
Amphipholis misera* (Koehler, 1899)				×
Amphiura* (*Amphiura*) *duncani* Lyman, 1882				×
Amphiura* (*Amphiura*) *instans* Koehler, 1905				×
Amphiura* (*Ophiopeltis*) *phalerata* (Lyman, 1874)				×
Dougaloplus echinatus* (Ljungman, 1867b)				×
Ophiocentrus dilatata (Koehler, 1905)			×	
Ophiosphaera insignis Brock, 1888			×	
Family Ophiotrichidae				
Macrophiothrix demessa (Lyman, 1862)			×	
Macrophiothrix fumaria (Müller & Troschel, 1842) [= *Ophiothrix* (*Placophiothrix*) *fumaria*]			×	
Macrophiothrix galatheae (Lütken, 1872)		×		
Macrophiothrix hybrida [= *Ophiothrix* (*Placophiothrix*) *lineocaerulea*]		×	×	×
Macrophiothrix longipeda [= *Ophiothrix longipeda*]	×	×	×	×
Macrophiothrix lorioli* A. M. Clark, 1968				×
Macrophiothrix melanosticta (Grube, 1868) [= *Ophiothrix* (*Placophiothrix*) *melanosticta*]			×	
Macrophiothrix nereidina (Lamarck, 1816) [= *Ophiothrix* (*Keystonia*) *nereidina*]		×		
Macrophiothrix propinqua (Lyman, 1862) [= *Ophiothrix propinqua*]			×	
Macrophiothrix robillardi* (de Loriol, 1893a)				×
***Ophiocnemis marmorata* Lamarck, 1816**	×	×	×	×
Ophiomaza cacaotica Lyman, 1871		×	×	
***Ophiothela danae* Verrill, 1869**			×	×
Ophiothela venusta (de Loriol, 1900)			×	
Ophiothrix (*Acanthophiothrix*) *leucotrigona* H. L. Clark, 1918			×	
***Ophiothrix* (*Acanthophiothrix*) *spinosissima* Koehler, 1905**	×		×	×
***Ophiothrix* (*Ophiothrix*) *ciliaris* (Lamarck, 1816)**	×		×	×
Ophiothrix (*Ophiothrix*) *exigua* Lyman, 1874			×	
Ophiothrix (*Ophiothrix*) *miles* Koehler, 1905			×	
Ophiothrix sp.			×	
Family Ophiactidae				
Ophiactis delagoa* Balinsky, 1957				×
Ophiactis macrolepidota* Marktanner-Turneretscher, 1887				×
***Ophiactis modesta* Brock, 1888**			×	×
Ophiactis savignyi [= *Ophiactis versicolor, Ophiactis maculosa*]	×	×	×	×
Ophiactis picteti (de Loriol, 1893b) [= *Ophiactis sinensis*]			×	
Family Ophionereididae				
Ophionereis dubia* (Müller & Troschel, 1842)				×

	Lim & Chou (1988)	Wee & Ng (1994)	Lane & Vanden Spiegel (2003)	This study
Family Ophiocomidae				
Ophiarthrum elegans Peters, 1851		×		
Ophiopsila pantherina Koehler, 1898			×	
Ophiopsila* sp.				×
Family Ophiodermatidae				
Ophiarachnella gorgonia (Müller & Troschel, 1842)		×		
Family Ophiolepididae				
Ophiolepis cincta cincta Troschel, 1842 [= *Ophiolepis cincta*]	×	×	×	
Ophiolepis nodosa Duncan, 1887		×		
Ophiolepis superba H.L. Clark, 1915 [= *Ophiolepis annulosa*]		×		

? "*Amphiura depressum*" in the article.

Remarks. The specimens look like *Amphioplus* (*Amphioplus*) *lucidus* reported from the Philippines and Australia (A. M. Clark & Rowe, 1971: 78, 101; Rowe & Gates, 1995: 343). This species has a characteristic arm spine with a small hyaline tooth at the tip (Koehler, 1922: 176).

***Amphioplus* (*Lymanella*) *depressus* (Ljungman, 1867b)**

Material examined. Forty six specimens; St. DW4, DW18, DW20, DW21, DW29, DW40, DW86; 6.2–24.3 m deep; mud, sand and mud, coarse sand/dead shells?

Remarks. *Amphioplus* (*Lymanella*) *depressus* has marginal scales without spiny processes on the outer edge of the disc (A. M. Clark & Rowe, 1971: 102; James, 1971; Baker, 1976: 46). This species is distributed in Indo-west Pacific (A. M. Clark & Rowe, 1971: 80, 102; Rowe & Gates, 1995: 345)

Genus *Amphipholis* Ljungman, 1867a

***Amphipholis misera* (Koehler, 1899)**

Material examined. Twelve specimens; St. DW6, SW24; 0–15.2 m deep; sand and rock, sand/seagrass.

Remarks. The specimens were very small in size. According to the key of A. M. Clark & Rowe (1971: 99), this species can be distinguished from *Amphipholis squamata* (Delle Chiaje, 1828) which is one of the most widely and commonly found species of *Amphipholis*, in having distinct primary plates and as long as or longer than wide oral shields. The arms of this species are also longer than those of *A. squamata*.

Genus *Amphiura* Forbes, 1843

***Amphiura* (*Amphiura*) *duncani* Lyman, 1882**

Material examined. Three specimens; St. SW24; 0 m deep; sand and rock.

Remarks. According to the key of A. M. Clark & Rowe (1971: 97), these specimens should be *Amphiura luetkeni* Duncan, 1879. However, *Amphiura luetkeni* Duncan, 1879 is a junior homonym of *Amphipholis luetkeni* Ljungman, 1872, and *Amphiura duncani* Lyman, 1882 was established as a replacement name for *Amphiura luetkeni* Duncan, 1879 (Rowe & Gates, 1995: 348).

***Amphiura* (*Amphiura*) *instans* Koehler, 1905**

Material examined. Seven specimens; St. DW4; 6.9–7.3 m deep; coarse sand/dead shells?

Remarks. These specimens have thick arms and arm spines with terminal spicules and look like *Amphiura* (*Amphiura*) *instans* from Palau (Koehler, 1905).

***Amphiura* (*Ophiopeltis*) *phalerata* (Lyman, 1874)**

Material examined. Seven specimens; St. SW13, SW47, SW48; 0 m deep; mud flat with abundant seagrass/sandbank, mud.

Remarks. The specimens resemble *Amphiura* (*Ophiopeltis*) *phalerata* described from the Philippines (A. M. Clark & Rowe, 1971: 95). The subgenus *Ophiopeltis* has disc scales only around radial shields.

Genus *Dougaloplus* A. M. Clark, 1970

***Dougaloplus echinatus* (Ljungman, 1867b)**

Material examined. Six specimens; St. DW18, DW29, DW86, SW24; 0–24.7 m deep; sand and mud, mud, sand and rock.

Remarks. *Dougaloplus* resembles *Amphioplus* in jaw structure but has spines on their aboral and oral disc surfaces. The specimens have numerous spines on the disc. This species is distributed in the western Pacific and the Red Sea (A. M. Clark & Rowe, 1971: 80, 100; Rowe & Gates, 1995: 353)

Family Ophiotrichidae Ljungman, 1867

Genus *Macrophiothrix* H. L. Clark, 1938

***Macrophiothrix hybrida* H. L. Clark, 1915**

Material examined. Thirteen specimens; St. DW6, DW57, DW58, DW78, DW80, DW82, DW86, SW42, SW42, SW46; 0–23.6 m deep; laterite gravel, some dead wood, clean, mud, sand/seagrass, rock.

Remarks. *Ophiothrix* (*Placophiothrix*) *lineocaerulea* H. L. Clark, 1928 was synonymised with *Macrophiothrix hybrida* by Liao & A. M. Clark (1985). This species is characterised by characteristic blue longitudinal lines on the aboral surface of arms that continue onto the disc.

***Macrophiothrix longipeda* (Lamarck, 1816)**

Material examined. one specimen; St. DW6; 15.2 m deep.

Remarks. *Macrophiothrix longipeda* is one of the most common species of this genus in the Indo-West Pacific (A. M. Clark & Rowe, 1971: 82, 114).

***Macrophiothrix lorioli* A. M. Clark, 1968**

Material examined. Two specimens; St. SW26; 0–1.2 m deep; sand/a little mud.

Remarks. *Macrophiothrix lorioli* can be distinguished from *Macrophiothrix longipeda* in having its dorsal arm plate with curving distal edge and tall dorsal disc stumps usually with trifid tips (Hoggett, 1991).

***Macrophiothrix robillardi* (de Loriol, 1893a)**

Material examined. One specimen; St. DW82; 8.1–11.6 m deep; laterite gravel.

Remarks. This species was misinterpreted in the key of A. M. Clark & Rowe (1971). Radial shields are conspicuously naked with only a few granules present on the outer edges, rugose dorsal arm plates are fan-shaped to hexagonal, and arm spines have short thorns (Hoggett, 1991).

Genus *Ophiocnemis* Müller & Troschel, 1842

***Ophiocnemis marmorata* (Lamarck, 1816)**

Material examined. Fifteen specimens; St. DW20, DW27, DW36, DW79, DW86, SW32; 0–19.1 m deep; mainly window pane shell, mud and rubbish/dead wood, mud, sand and mud.

Remarks. These specimens were collected from the sandy bottom, although this species has often been found on jellyfish (see Fujita & Namikawa, 2006; Ohtsuka et al., 2010).

Genus *Ophiothela* Verrill, 1867

***Ophiothela danae* Verrill, 1869**

Material examined. Twenty nine specimens; St. DW8, DW19, DW57, SW16, SW75; 0–16.4 m deep; sand/a little mud, abandoned cage (unbaited trap).

Remarks. The specimens were collected from gorgonean coral colonies.

Genus *Ophiothrix* Müller & Troschel, 1840

***Ophiothrix* (*Acanthophiothrix*) *spinosissima* Koehler, 1905**

Material examined. One hundred and fifty six specimens; St. DW4, DW8, DW17, DW18, DW19, DW20, DW21, DW36, DW40, DW61, DW64, DW66, DW79, DW86, SW46, SW47, SW48, SW75, SW93; 0–21.0 m deep; mud, coarse sand/dead shells?, mud and rubbish dead, rock, abandoned cage (unbaited trap), attached to pontoon.

Remarks. These abundant specimens look like *Ophiothrix* (*Acanthophiothrix*) *spinosissima*. They have bare radial shields and slender spines on dorsal disc.

***Ophiothrix* (*Ophiothrix*) *ciliaris* (Lamarck, 1816)**

Material examined. Twenty nine specimens; St. DW6, DW57, DW58; 10.9–15.2 m; laterite gravel.

Remarks. *Ophiothrix ciliaris* is widely disributed in the West Pacific and Indian Ocean (A. M. Clark & Rowe, 1971). This species is distinguished from many congeneric species in having ventral arm plates with a convex distal edge.

Family Ophiactidae Matsumoto, 1915

Genus *Ophiactis* Lütken, 1856

***Ophiactis delagoa* Balinsky, 1957**

Material examined. Ten specimens; St. SW49; 0 m deep; mud/mangrove/sand.

Remarks. These specimens resemble *Ophiactis delagoa* from Mozambique in the Indian Ocean described by Balinsky (1957: 12). Dorsal arm plates are trapezoid and not broadly in contact with each other.

***Ophiactis macrolepidota* Marktanner-Turneretscher, 1887**

Material examined. Seventeen specimens; St. DW6, DW17, DW57; 10.3–15.2 m deep.

Remarks. *Ophiactis delicata* H. L. Clark, 1915 and *Ophiactis parva* Mortensen, 1926, which appeared in A. M. Clark &

Table 2. Sampling sites.

Station	Date	Time	Locality	Latitude (N)	Longitude (E)	Depth (m)	Sampling method	Habitat
DW4	October 16, 2012	1133–1150	near Pulau Sekudu	1°24.176' 1°24.132'	103°59.489' 103°59.686'	6.9–7.3	Rectangular dredge	coarse sand/dead shells?
DW6	October 16, 2012	0958–1008	near Pulau Sekudu	1°24.035' 1°23.997'	103°59.885' 103°59.997'	15.2	Beam trawl	
DW8	October 16, 2012	1110–1117	near Pulau Sekudu	1°24.132' 1°24.149'	103°59.544' 103°59.641'	8.9–5.3	Beam trawl	
DW17	October 16, 2012	overnight	Pulau Ubin	1°25.110'	103°55.722'		Gill net, Tangle net	
DW18	October 17, 2012	0912–0927	Pulau Ubin	1°25.794' 1°25.647'	103°55.897' 103°55.592'	12.9–6.2	Beam trawl	
DW19	October 17, 2012	1019–1030	Pulau Ubin	1°25.740' 1°25.738'	103°56.128' 103°56.375'	13.8–16.4	Beam trawl	
DW20	October 17, 2012	1313–1328	Pulau Ubin	1°25.570' 1°25.492'	103°56.524' 103°56.765'	10.6–10.3	Beam trawl	
DW21	October 17, 2012	1205–1211	Pulau Ubin	1°25.687' 1°25.739'	103°56.331' 103°56.241'	13.8–16.2	Rectangular dredge	very muddy
DW27	October 18, 2012	0945–1003	off Chek Jawa	1°24.927' 1°25.273'	103°59.980' 103°59.692'	19.1–9.9	Beam trawl	mainly window pane shell, muddy.
DW29	October 18, 2012	1236–1241	off Chek Jawa	1°24.954' 1°24.956'	103°59.906' 103°59.995'	13.4–24.7	Rectangular dredge	sandy and muddy
DW36	October 19, 2012	0906–0921	off Pulau Serangoon	1°24.545' 1°24.780'	103°55.992' 103°59.764'	16.8–18.6	Beam trawl	
DW40	October 19, 2012	1242–1247	Opposite Changi Chalet Radar	1°23.797' 1°23.768'	103°58.751' 103°58.908'	21–15.6	Rectangular dredge	
DW57	October 22, 2012	1034–1049	Pulau Tekong	1°25.342' 1°24.949'	104°04.775' 104°05.080'	10.3–10.6	Beam trawl	
DW58	October 22, 2012	1108–1119	Pulau Tekong	1°25.064' 1°25.248'	104°04.992' 103°04.895'	11.3–10.9	Beam trawl	laterite gravel
DW61	October 23, 2012	1020–1030	Pulau Serangoon	1°24.962' 1°25.207'	103°55.341' 103°55.154'	7.4–11.0	Beam trawl	muddy
DW64	October 23, 2012	1204–1219	Pulau Seletar	1°26.290' 1°26.584'	103°51.752' 103°51.511'	4.2–4.8	Beam trawl	

Table 2...continued

Station	Date	Time	Locality	Latitude (N)	Longitude (E)	Depth (m)	Sampling method	Habitat
DW66	October 23, 2012	1408–1423	Pulau Ponggol	1°25.729’ 1°25.623’	103°53.367’ 103°53.687’	13.9	Otter trawl	
DW78	October 24, 2012	0933–0948	Channel between Changi Ferry Terminal and West Pulau Tekong (Kuala Johor)	1°22.720’ 1°22.997’	104°01.221’ 104°00.962’	20.5–23.6	Beam trawl	some dead wood
DW79	October 24, 2012	1046–1101	Channel between Pengerang and East Pulau Tekong (off Tanjung Pengelih)	1°21.612’ 1°21.972’	104°04.572’ 104°04.657’	11.7–12.6	Beam trawl	mud and rubbish, dead wood
DW80	October 24, 2012	1140–1148	Pulau Tekong	1°25.073’ 1°25.241’	104°05.028’ 103°04.891’	11.7–10.3	Beam trawl	clean
DW82	October 24, 2012	1252–1305	Pulau Tekong	1°25.241’ 1°25.119’	104°04.827’ 104°04.964’	8.1–11.6	Rectangular dredge	laterite gravel
DW86	October 25, 2012	0906–0921	Changi Park	1°23.581’ 1°23.529’	103°59.593’ 103°59.990’	5.6–14.7	Beam trawl	mud
DW87	October 25, 2012	1019–1034	Changi East off restricted area	1°20.178’ 1°19.732’	104°02.322’ 104°02.507’	7.3–8.1	Beam trawl	mud
DW88	October 25, 2012	1112–1127	Changi East off restricted area	1°20.296’ 1°20.503’	104°03.348’ 104°03.110’	8.5–8.7	Beam trawl	mud
SW13	October 16, 2012	1700–1930	Chek Jawa	1°24’25.65”	103°59’33.85”	0	Yabby pump, hand collection of algae	mudflat with abundant seagrass / sandbank
SW16	October 16, 2012	1700–1930	Tuas	1°19.771’	103°37.842’	0	Hand collection	sandy, a little muddy with lots of algae
SW24	October 17, 2012	1700–1900	Sekudu	1°24.263’ 1°24.147’ 1°24.315’ 1°24.246’	103°59.241’ 103°59.268’ 103°29.296’ 103°59.322’	0	Hand collection, yabby pump	sandy and rocky
SW26	October 17, 2012	1700–1900	Tuas	1°19’45.9”	103°37’50.9”	0 or 0–1.2	Hand collection, beach seine, cast net	sandy, a little muddy, shallow rocky coral.
SW32	October 18, 2012	1700–1930	Chek Jawa	1°24’44.5”	103°59’43.2”	0	Hand collection, 15 feet seine net	sandy and muddy
SW42	October 19, 2012	1830–2000	Chek Jawa	1°24’25.65”	103°59’33.85”	0	Hand collection	sandy, seagrass
SW46	October 20, 2012	1815–1845	OBS* Camp 1	1° 25.120’	103° 55.743’	0	Hand collection	rocky

Table 2...continued

Station	Date	Time	Locality	Latitude (N)	Longitude (E)	Depth (m)	Sampling method	Habitat
SW47	October 20, 2012	1900–2115	OBS Camp 1	1° 25.120'	103° 55.743'	0	Hand collection	muddy
SW48	October 20, 2012	1900–2115	Between OBS Camp 1 and Camp 2	1°24.983'	103°56.021'	0	Yabby pump, hand collection	muddy
SW49	October 20, 2012	1950–2100	Changi Creek	1° 23.393'	103° 59.484'	0	Hand collection, seine net, hand net	muddy, mangrove, sandy
SW75	October 24, 2012	0908	OBS Camp 1	1° 25.117'	103° 55.702'		Hand collection	abandoned cage (unbaited trap)
SW93	October 26, 2012	1030–1200	Fishfarm	1° 23.933'	103° 57.841'		hand net, fish net	attached to pontoon

*OBS denotes Outward Bound School.

Rowe's key (1971: 104), are synonyms of this species (Rowe & Gates, 1995: 379).

***Ophiactis modesta* Brock, 1888**

Material examined. Forty specimens; St. DW61, SW24; 0–11.0 m deep; mud, sand and rock.

Remarks. Most of the specimens were collected from sponges. A. M. Clark & Rowe (1971: 105) suggested that five similar species with six arms and elliptical dorsal arm plates including *Ophiactis modesta* are possibly all synonymous.

***Ophiactis savignyi* (Muller & Troschel, 1842)**

Material examined. Ninety two specimens; St. DW6, DW17, DW18, DW57, DW61, SW16, SW24, SW42, SW75, SW93; 0–15.2 m deep; sand and rock, mud, sand/a little mud, sand/sea grass, mud/mangrove/san, attached to pontoon.

Remarks. Many specimens were collected from sponges. *Ophiactis savignyi* is the most common species of *Ophiactis* in tropical and subtropical waters in the world (Rowe & Gates, 1995: 380). It is distinguished from the other *Ophiactis* species from Singapore in having two oral papillae.

Family Ophionereididae Ljungman, 1867

Genus *Ophionereis* Lütken, 1859

***Ophionereis dubia* (Müller & Troschel, 1842)**

Material examined. One specimen; St. SW24; 0 m deep; sand and rock.

Remarks. *Ophionereis* has a pair of supplementary dorsal arm plates on each arm segment. This species is widely distributed in Indo-west Pacific Ocean (A. M. Clark & Rowe, 1971: 88, 122; Rowe & Gates, 1995: 408).

Family Ophiocomidae Ljungman, 1867

Genus *Ophiopsila* Forbes, 1843

***Ophiopsila* sp.**

Material examined. Thirteen specimens; St. DW18, DW20, DW21; 6.2–16.2 m deep; mud.

Remarks. *Ophiopsila* has very characteristic tentacle scales: the inner ones of the two tentacle scales are elongated and crossing the corresponding one of the opposite side in the middle of the ventral arm plates. These specimens are similar to *Ophiopsila pantherina* Koehler, 1898. However, the two species differ in coloration. The dorsal discs of these specimens from the East Johor Strait are greyish with black spots before fixation. There are many confusing species of *Ophiopsila* distributed in the western and central Pacific (Stöhr et al. 2014; Tim O'Hara, pers. comm.), and a taxonomical revision of this genus may be required.

DISCUSSION

Although this study is preliminary, it includes 14 species of new records from Singapore waters suggesting still more new records may be discovered in the collection by the Singapore Strait workshop in 2013 and future works. Ophiotrichidae and Amphiuridae were the most diverse families in this study. Many ophiotrichid species have been already reported in previous papers. While many amphiurid species were newly found from the Johor Strait (Table 1), probably because the environment there is predominantly sandy/muddy. Amphiurids are relatively small-sized ophiuroids and emerge to feed only during periods of strong water flow. Consequently, they are scarcely noticed by divers and infrequently studied in past faunal surveys. On the other hand, ophiocomids are one of the dominant families in coral-reef communities but they were very rare in the Johor Straits.

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LITERATURE CITED

Baker AN (1974) New species of brittle-stars from New Zealand (Echinodermata: Ophiuroidea). Records of the Dominion Museum, 8: 247–266.

Balinsky JB (1957) The Ophiuroidea of Inhaca Island. Annals of the Natal Museum, 14(1): 1–32, 4 pls.

Brock J (1888) Die Ophiuridenfauna des indischen Archipels. Zeitschrift Für Wissenschaftliche Zoologie, 47: 465–539.

delle Chiaje S (1828) Memorie sulla storia e notomia degli animali senza vertebre del regno di Napoli, 3: i-xx, 1–232.

Clark AM (1968) Notes on some tropical Indo-Pacific ophiotrichids and ophiodermatids (Ophiuroidea). Bulletin of The British Museum (Natural History) Zoology, 16: 277–322, 271 pls.

Clark AM (1970) Notes on the family Amphiuridae (Ophiuroidea). Bulletin of the British Museum (Natural History), Zoology, 19: 1–81.

Clark AM & Rowe FWE (1971) Monograph of Shallow-Water Indo-West Pacific Echinoderms. Trustees of the British Museum (Natural History), London, 238 pp., 31 pls.

Clark HL (1915a) Catalogue of Recent ophiurans based on the collections of the Museum of Comparative Zoology. Memoirs of the Museum of Comparative Zoology, 25: 165–376, 120 pls.

Clark HL (1915b) The Echinoderms of Ceylon other than Holothurians. Spolia Zeylandica, 10: 83–102.

Clark HL (1918) Brittle-stars, new and old. Bulletin of the Museum of Comparative Zoölogy, 62: 265–338, pls. 1–8.

Clark HL (1928) The sea-lilies, sea-stars, brittle stars and sea-urchins of the South Australian Museum. Records of South Australian Museum, 3: 361–482.

Clark HL (1938) Echinoderms from Australia. An account of collections made in 1929 and 1932. Memoirs of the Museum of Comparative Zoology at Harvard College, 55: 1–596, 528 pls.

Duncan PM (1879) On some Ophiuroidea from the Korean seas. The Journal of the Linnean Society, 14: 445–482.

Duncan PM (1887) On the Ophiuridae of the Mergui Archipelago, collected for the trustees of the Indian Museum, Calcutta, by Dr. John Anderson, F. R. S., Superintendent of the Museum. The Journal of the Linnean Society of London, 21: 85–106, pls. 8, 9, 11.

Forbes E (1843) On the Radiata of the eastern Mediterranean. Part I. Ophiuridae. Transaction of the Linnean Society of London, 19: 143–153.

Fujita T & Namikawa H (2006) New observations of *Ophiocnemis marmorata* (Echinodermata: Ophiuroidea) associated with *Rhopilema esculentum* (Cnidaria: Scyphozoa: Rhizostomeae) in the Philippines and Japan. Memoirs of the National Science Museum, Tokyo, 44: 31–37.

Grube AE (1868) Über einige seltenere oder neue Ophiuriden. Jahresberichte der schlesischen Gesellschaft für vaterländische Kultur, 45: 44–45.

Hoggett AK (1991) The genus *Macrophiothrix* (Ophiuroidea: Ophiotrichidae) in Australian waters, 4: 1077–1146.

James D (1971) Studies on Indian echinoderms—4 On the brittle-stars *Amphioplus gravelyi* sp. nov., and Amphioplus depressus (Ljungman) from the Indian coasts. Journal of the Marine Biological Association of India, 12: 139–145.

Koehler R (1898) Échinodermes recueillis par l'Investigator dans l'Océan Indien. Les Ophiures littorales. Bulletin Scientifique de la France et de la Belgique, 31: 55–125, 124 pls.

Koehler R (1899) Ophiures recueillies par l'Investigator dans l'Océan Indien. I. Les ophiures de mer profonde. The Trustee of the Indian Museum, Calcutta, 74 pp., 14 pls.

Koehler R (1905) Ophiures de l'Expédition du Siboga. 2éme Partie Ophiures littorales. Siboga Expeditie, 45b: 1–142, 143 pls.

Koehler R (1922) Ophiurans of the Philippine Seas and adjacent waters. Bulletin Smithsonian Institution United States National Museum, 100: 1–486, 103 pls.

de Lamarck JB (1801) Systême des animaux sans vertèbres; ou, Tableau génral des classes, des classes, des orres et des genres de ces animaux. L'Auteur, Paris, 452 pp.

de Lamarck JB (1816) Histoire naturelle des animaux sans vertèbres. Tome Deuxième. J. B. Baillière, Paris, 683 pp.

Lane DJW & VandenSpiegel D (2003) A Guide to Sea Stars and Other Echinoderms of Singapore. Singapore Science Centre, Singapore, 187 pp.

Liao Y (1982) Two new ophiurans from the Gulf of Beibuwan. Oceanologia et Limnologia Sinica, 13: 562–569, 1 pl.

Liao Y & Clark AM (1995) The Echinoderms of Southern China. Science Press, Beijing, 614 pp., 23 pls.

Lim GSY & Chou LM (1988) The echinoderm fauna of sediment stressed reefs in Singapore. In: Choat JH (ed.) Proceedings of the Sixth International Coral Reef Symposium, Townsville, Australia, 8th–12th August 1988, Volume 2. 6th International Coral Reef Symposium Executive Committee, Townsville. Pp. 245–250.

Ljungman, AV (1867a) Om några nya arter af Ophiurider. Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, 23: 163–166.

Ljungman, AV (1867b). Ophiuroidea viventia huc usque cognita enumerat. Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar, 23: 303–336

Ljungman, AV (1872). Förteckning öfver uti Vestindien af Dr A. Goës samt under korvetten Josefinas expedition i Atlantiska Oceanen samlade Ophiurider. Öfversigt af Kungliga Vetenskapsakademiens Förhandlingar, 28: 615–658.

de Loriol P (1893a) Catalogue raisonné des Échinoderms recueillis par M. V. de Robillard a l'Ile Maurice. III. Ophiurudes et Astrophytides. Memoires de la Société de Physique et d'Histoire naturelle de Geneve, 32: 1–63, pls. 23–25.

de Loriol P (1893b) Echinodermes de la baie d'Amboine. Revue suisse de Zoologie, 1: 359–426, pls. 13-15.

de Loriol P (1900) Notes pour servir a l'étude des Echinodermes. VIII. Revue suisse de Zoologie, 8: 55–96, pls. 6-9.

Lütken CF (1856) Bidrag til Kundskab om Slangestjernerne. II. Oversigt over de vestindiske Ophiurer. Videnskabelige meddelelser fra den naturhistoriske Forening i Kjövenhavn, 1856: 1–19.

Lütken CF (1859) Additamenta ad historiam Ophiuridarum. Beskrivelser af nye eller hidtil kun ufuldstaendigt kjendte Arter af Slangestjerner. Anden Afdeling. Kongelige Danske Videnskabernes selskabs skrifter, 5: 77–169, 5 pls.

Lütken C (1872) Ophiuridarum novarum vel minus cognitarum descriptiones nonnullae. Nogle nye eller mindre bekjendte Slangestjerner beskrevne — med nogle Bemaerkninger om Selvdelingen hos Straaledyrene. Oversigt over det Kongelige Danske Videnskabernes Selskabs Forhandlinger og dets Medlemmers Arbejder, 77: 75–158, pls. 1–2.

Lyman T (1862) Descriptions of new Ophiuridae. Proceedings of the Boston Society of Natural History, 8: 75–86.

Lyman T (1871) Supplement to the Ophiuridae and Astrophytidae. Illustrated Catalogue of the Museum of Compartive Zoölogy at Harvard College, 6: 1–17, 2 pls.

Lyman T (1874). Ophiuridae and Astrophytidae: new and old, Bulletin of the Museum of Comparative Zoology, 3: 221–272, 7 pls

Lyman T (1882) Report on the Opiuroidea. Report of the Scientific Results of the voyage of H.M.S. Challenger 1873–76, Zoology, 5(1), 1–386.

Marktanner-Turneretscher G (1887) Beschreibung neuer Ophiuriden und Bemerkungen zu bekannten. Annalen des K. Naturhistorischen Hofmuseums, Wien, 2: 291–315, pls.12–13.

Matsumoto H (1915) A new classification of the Ophiuroidea: with descriptions of new genera and species. Proceedings of the Academy of Natural Sciences of Philadelphia, 67: 43–92.

Mortensen T (1926) Cambridge Expedition to the Suez Canal in 1924. VI. Report on the Echinoderms. Transactions from the Zoological Society London, 22, 117–131.

Müller J & Troschel FH (1840) Ueber die Gattungen der Asterien. Arch. Naturgesch., 6: 318–326.

Müller J & Troschel FH (1842) System der Asteriden. Braunschweig, xx+134 pp., 112 pls.

Ohtsuka S, Kondo Y, Sakai Y, Shimazu T, Shimomura M, Komai T, Yanagi K, Fujita T, Nishikawa J, Miyake H, Maran BAV, Go A, Nagaguchi K, Yamaguchi S, Dechsakulwatana C, Srinui K, Putchakarn S, Mulyadi, Mujiono N, Sutomo & Yusoff FM (2010) In-situ observations of symbionts on medusae occurring in Japan, Thailand, Indonesia and Malaysia. Bulletin of the Hiroshima University Museum, 2: 9–18.

Peters W (1851) Übersicht der von ihm an der Kuste von Mossambique eigesammelten Ophiuren, unter denen sich zwei neue Gattungen befinden. Bericht über die zur Bekanntmachung geeigneten Verhandlungen der Königlich Preussischen Akademie der Wissenschaften zu Berlin, 1851: 463–466.

Rowe FWE & Gates J (1995) Echinodermata. Zoological Catalogue of Australia, Volume 33. CSIRO, Merbourne, 510 pp.

Smith AB, Paterson GLJ & Lafay B (1995) Ophiuroid phylogeny and higher taxonomy: morphological, molecular and paleontological perspectives. Zoological Journal of the Linnean Society, 114: 213–243.

Stöhr S, O'Hara T & Thuy B (eds.) (2014) World Ophiuroidea Database. http://www.marinespecies.org/ophiuroidea (Accessed 27 June 2014).

Verrill AE (1867) Notes on Radiata in the museum of Yale college, with descriptions of new genera and species. Transactions Connecticut Academy of Arts and Sciences, 1: 247–351.

Verrill AE (1869) New and imperfectly known Echinoderms and Corals. Proceedings of the Boston Society of Natural History, 12: 381–391.

Verrill AE (1899) Report on the Ophiuroidea collected by the Bahama expedition in 1893. Bulletin from the Laboratories of Natural History of the State University of Iowa, 5: 1–88

Wee YC & Ng PKL (1994) A First Look at Biodiversity in Singapore. National Council on the Environment, Singapore, 163 pp.