

Annotated checklist of sea cucumbers from Pakistan with new records of *Holothuria (Theelothuria) hamata* (Pearson, 1913) and *Stichopus herrmanni* (Semper, 1868)

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Abstract

Sea cucumbers (class Holothuroidea) are among the least-studied group of marine invertebrates of Pakistan, and previously, only 19 species of holothurians were recorded from there. Among these, *Holothuria (Thymiosycia) arenicola* (Semper, 1868) seems to be the most dominant species, which is exported in small quantities in the form of beche-de-mer. The present paper provides an annotated checklist of holothurian species found along Pakistan's coast. In addition, a new record of *Holothuria (Theelothuria) hamata* (Pearson, 1913) is included, which seems to be occasionally found in the offshore waters on the continental shelf along Pakistan's coast. In addition, *Stichopus herrmanni* (Semper, 1868) has been photographed from Churna Island, Balochistan, which is also reported for the first time from Pakistan.

Keyword: holothurian, Pakistan, *Stichopus herrmanni*, *Holothuria (Theelothuria) hamata*, beche-de-mer

Introduction

Despite their common occurrence in intertidal and subtidal areas, holothurians are among the least-studied group of marine invertebrates in Pakistan. It was possibly Haque (1969) who first studied holothurians during his work on Pakistan's echinoderms, and he reported five species. Clark and Rowe (1971), in their review of Indo-Pacific echinoderms, reported 12 species of sea cucumbers from the west coast of India and Pakistan. Anonymous (1972) reported four species from rocky shores and one species from muddy and sandy shores along Pakistan's coast. Tahera and Kazmi (2005) reported 12 species from Pakistan, and Tahera and Kazmi (1995), Tahera (1992, 1996) and Massin (1999) reported five species from the country. Munir and Almas (2005) reported six species from the collection of Pakistan's Zoological Survey Department. Finally, Ahmed et al. (2016) reported 2 species whereas Ahmed and Ali (2018) recently reported 10 species from the Karachi coast.

The present paper provides an annotated list of sea cucumber species of the class Holothuroidea recorded from Pakistan. It also reports on a new record of *Holothuria (Theelothuria) hamata* (Pearson, 1913), which was collected from offshore waters on Pakistan's continental shelf. In addition, *Stichopus herrmanni* (Semper, 1868), which was photographed at Churna Island is reported for the first time from Pakistan. This paper also describes Pakistan's sea cucumber fishery.

Methods

A review of publications that reported holothurians from Pakistan was made, and species were arranged in alphabetical order. Samples of *Holothuria (Theelothuria) hamata* – collected from cruises onboard the Iranian research vessel R/V *Firdous* and the FAO/NORAD³ research vessel R/V *Fridtjof Nansen* – were included.⁴ In addition, a number of specimens were collected during commercial trawling operations along Pakistan's coast in 2015 and 2016. Samples of sea cucumbers were photographed before preservation in 5% formalin, and are now housed at the Museum of Marine Fisheries Department in Karachi. Information about processing and exports was obtained from the Marine Fisheries Department and exporters that are engaged in this trade.

Results

To date, 21 species of sea cucumbers have been reported from Pakistan, with Quratulan and Qadeer, in this issue of the *Beche-de-mer Information Bulletin* (p. 40), adding the last two species *Actinocucumis typica* and *Holothuria notabilis*. Most specimens were collected from intertidal areas. An annotated list of known species, in alphabetical order, follows.

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⁴ The research cruise by the R/V *Firdous* occurred in 2009 and the cruise by the R/V *Fridtjof Nansen* occurred in 2010.

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Figure 1. The Pakistan coast.

Actinocucumis typica (Ludwig, 1875). This species was reported from Pakistan by Clark and Rowe (1971). It is known to be widely distributed in the Indo-Pacific region. Its type specimen was collected from Queensland, Australia (O'Loughlin et al. 2014). No record of this species from Pakistan has been made since Clark and Rowe (1971). See also Quratulan and Qadeer in this issue of the *Beche-de-mer Information Bulletin* (p. 40).

Actinopyga mauritiana (Quoy and Gaimard, 1834). Haque (1969) reported this species for the first time from Cape Monze near Karachi, Pakistan. It was also reported on by Anonymous (1972) from the same area. Clark and Rowe (1971) and Munir and Almas (2005) also reported this species from Pakistan's coast but with no mention of a specific location. Tahera (1996) and Tahera and Kazmi (2005) reported it from intertidal areas, where it was found hiding under small rocks exposed to surge and currents.

Aslia forbesi (Bell, 1886). Clark and Rowe (1971) reported this species for the first time from the west coast of India and Pakistan, but with no mention of a specific location. Ahmed and Ali (2018) reported it from Sorana and Buleji near Karachi. According to Tahera (2004) and Tahera and Kazmi (2005), this species is found on rocks and in crevices. Tahera (1996, 2004) reported this species from Buleji and Paccha on the Karachi coast. Anonymous (1972) and Haque (1969) reported this species as *Shereoderma forbesi* from rocky shores at Cape Monze near Karachi.

Cladolabes aciculus (Semper, 1867). This species has only been reported on by Clark and Rowe (1971). Its holotype was collected from the Philippines. It is reported to occur in intertidal areas of the Indo-west Pacific. No record of this species in Pakistan exists since Clark and Rowe (1971).

Hemithyone semperi (Bell, 1884). This species was recorded from Pakistan by Clark and Rowe (1971) and Massin (1999), but with no mention of a specific location. It has pliable body that is variably coloured white-brown and red with purple tentacles and tube feet. It is mainly found in intertidal areas of the Indian Ocean, Mozambique, Madagascar, Sri Lanka, India, Indonesia, Viet Nam, South China Sea, Australia, Singapore and Pakistan (Ong et al. 2016; Pawson 1967).

Holothuria (Halodeima) atra (Jaeger, 1833). Tahera (1996) and Tahera and Kazmi (2005) reported this species from shallow waters with sandy bottoms. Ahmed and Ali (2018) reported it from Buleji and Sonara along the Karachi coast. Ahmed et al. (2018b) studied length-weight relationships and condition factors in this species from the Karachi coast.

Holothuria (Lessonothuria) pardalis (Selenka, 1867). Clark and Rowe (1971), Massin (1999) and Tahera and Tirmizi (1995) reported this species from Pakistan's coast but with no mention of a specific location. Tahera (1996) and Tahera and Kazmi (2005) reported this species from the intertidal zone under rocks. Ahmed and Ali (2018) reported this species from Buleji and Sonara on the Karachi coast. Ahmed et al. (2018b) studied length-weight relationships and condition factors in this species from the Karachi coast. Samyn et al. (2019) recently redescribed *Holothuria lineata* based on a morphological study, which revealed that *H. lineata* is a distinct and well-described taxon, despite earlier claims (Panning 1935) to consider it as a junior subjective synonym of *H. pardalis*. *Holothuria lineata* can be distinguished on the basis of: its large body – up to 12 cm as compared with 6 cm for *H. lineate*; rods of massive tube feet (slender in the case of *H. lineata*) that are curved, with 1–3 distal perforations; perforated plates of dorsal tube feet with three to four rows of holes (with two to seven holes at the

extremities, and perforated plates of dorsal tube feet with two rows of holes in the case of *H. lineata*).

Holothuria (Lessonothuria) verrucosa (Selenka, 1867). This species was reported from Buleji and Sonara by Ahmed et al. (2016) and Ahmed and Ali (2018). This is a benthic species that lives inshore, and is a deposit feeder. It is a cryptic species that is found buried in sand, seaweed and rubble. Ahmed et al. (2018a) studied the process of asexual reproduction in this species, whereas Ahmed et al. (2018b) studied length-weight relationships and condition factors. Samyn et al. (2019) pointed out that *Holothuria verrucosa* is characterised by fully developed tables with numerous (more than eight) peripheral holes and with the edge of the disk bearing numerous minute spines versus reduced tables in *H. pardalis*. *Holothuria verrucosa* is also characterised by the presence of 24–30 tentacles versus 18–20 for *H. pardalis*.

Holothuria (Mertensiothuria) leucospilota (Brandt, 1835). Clark and Rowe (1971) Tahera and Tirmizi (1995), Massin (1999), and Munir and Almas (2005) all reported this species from Pakistan, but with no mention of a specific location. Ahmed and Ali (2018), Tahera and Kazmi (2005) and Tahera (1996) reported this species from tidal pool under small stones. It was reported for the first time from Solomon Islands by Brandt in 1835. The status and whereabouts of its holotype is undetermined (Rowe and Gates 1995). It is widely distributed in the tropical and subtropical Indo-Pacific region (Massin 1999; Samyn and Massin 2013).

Holothuria (Platyperona) difficilis (Semper, 1868). Haque (1969), Massin (1999), Tahera (1996) and Tahera and Kazmi (1995, 2005) have all reported this species attached to green seaweeds on Pakistan's coast. It is known to occur from the Red Sea and Madagascar to the tropical coasts of Central America and Mexico, and from Japan and China to New Caledonia and Easter Island (Massin 1996).

Holothuria (Semperothuria) cinerascens (Brandt, 1835). Ahmed et al. (2016), and Ahmed and Ali (2018) reported it from Buleji and Sonara along the Karachi coast. This species is benthic, lives inshore, and is a detritus feeder (Ahmed et al., 2016; Rowe and Gates 1995). It can be found on rocky sea bottoms and in crevices with strong wave action where it suspension-feeds on organic particles from the water column (Ahmed et al. 2016; Purcell et al. 2012). Massin (1996) reported its distribution from the Red Sea and Madagascar to Hawaii and Easter Island, and from Japan to northern Australia.

Holothuria (Theelothuria) hamata. Reported on in the present study.

Holothuria (Thymiosycia) arenicola (Semper, 1868). This species was recorded from Cape Monz and Sonara near Karachi by Tahera (1996) and Tahera and Tirmizi (1995). Tahera and Kazmi (2005) and Munir and Almas (2005) also reported this species from Pakistan but did not mention a specific location. Ahmed and Ali (2018) reported this species from Buleji and Sonara. Siddiqui and Ayub (2015) have

studied the population dynamics and reproduction of this species from the Manora and Buleji. Ahmed et al. (2018b) studied length-weight relationships and condition factors in this species from the Karachi coast.

Leptosynapta inhaerens (O.F. Müller, 1776). It was Haque (1969) who reported this species for the first time from the muddy sandy shores of Buleji, Karachi. This was also reported by Anonymous (1972) from the same area. Haque (1969), Tahera (1996), Tahera and Kazmi (2005) and Munir and Almas (2005) reported this species from Pakistan but with no mention of a specific location. According to Massin et al. (2014), the holotype of this species was collected from southern Norway although it is widely distributed from the North Sea to northern Norway, England, the Atlantic coast of Denmark, Germany, France, Spain, Portugal, the Canary Islands, the Mediterranean coast of Spain, France, Italy, the Adriatic Sea (Greece), the Black Sea, Israel, Korea, Japan and China. However, Massin et al (2014) pointed out that it is likely that the so-called *L. inhaerens* specimens from Asiatic populations are, in fact, a different species. The same may be true for specimens from Pakistan.

Obshimella ehrenbergii (Selenka, 1868). Clark and Rowe (1971) reported this species from Pakistan but with no mention of a specific location. Ahmad et al. (2016) reported this species from Buleji, and Ahmed and Ali (2018) reported it from Buleji and Sonara. This species occurs in rock crevices and under stones (Thandar 1989). Its holotype was collected from the Red Sea (Thandar 1989). It is distributed throughout southeast Arabia, India, Pakistan, Maldives, Sri Lanka, the Red Sea and the east coast of Africa (Clark and Rowe 1971; Thandar 1989).

Staurothyone rosacea (Semper, 1869). Haque (1969) reported this species for the first time from Buleji. It was also reported by Anonymous (1972) from the same area, and Ahmed and Ali (2018) reported it from Buleji and Sonara. Tahera (1996) and Tahera and Kazmi (2005) reported it attached to rocks. Clark and Rowe (1971) and Munir and Almas (2005) also reported this species from Pakistan but did not mention a specific location.

Stichopus herrmanni Semper, 1868. Reported on in the present study.

Stolus conjungens (Semper, 1867). Clark and Rowe (1971) reported this species from Pakistan but did not mention a specific area. Tahera and Kazmi (2005) and Tahera (2004) reported this species from seagrass beds. *Stichopus conjungens* has only been encountered four times since its first description (Thandar 2005; Pearson 1903; Gravely 1927; Satyamurti 1976; Rowe and Gates 1995).

Stolus buccalis (Stimpson, 1855). Haque (1969) reported this species for the first time from Buleji, and it was also reported by Anonymous (1972) from the same area. Tahera (1996) and Tahera and Kazmi (2005) reported it occurring under stones and attached to rocks. Clark and Rowe (1971) and Munir and Almas (2005) reported it but did not mention

a specific area in Pakistan. Ahmed and Ali (2018) reported this species from Buleji and Sonara along the Karachi coast.

***Synaptula recta* (Semper, 1867).** This species was reported from Pakistan by Tahera (1997) as *Synaptula hydriformis*. It was reported later on by Massin (1999) and Tahera and Kazmi (2005) from Pakistan but with no mention of a specific location. This species is highly variable in colour (Ong and Wong 2015; Clark 1907; Massin 1999). It is a medium to large species with a length of up to 21.0–25.4 cm (James 1982; Clark 1907; Ong and Wong 2015). According to James (1982) the colour when it is alive is pink with red longitudinal and interrupted stripes. He also noted that this species was found to be gregarious and to live on algae in shallow water. It is known to occur in the Red Sea, Comoros Archipelago, Maldives Sri Lanka, Bay of Bengal, East Indies, Singapore, Micronesia (Chuuk, Pohnpei), Papua New Guinea, Guam, Viet Nam, Philippines, Malaysia, Indonesia, northern Australia, and islands in the South Pacific (James 1982; Lee and Shin 2014; Ong and Wong 2015; Samyn et al. 2005).

***Thyone dura* (Koehler and Vaney, 1908).** This species was reported from Pakistan by Clark and Rowe (1971), and was originally described by Koehler and Vaney (1908) from specimens collected during surveys of the Royal Indian Marine Survey Ship, the *Investigator* from India's west coast (about 150 km southeast of the border with Pakistan). It is reported from continental and insular shelves of the western and central Indo-Pacific, from India and the northeastern Arabian Sea (Koehler and Vaney 1905; Sane and Chhappargar 1962), and the Andaman and Nicobar islands (James 1983; Sastry 2005).

New records

Holothuria (Theelothuria) hamata (Pearson, 1913)



Figure 1. *Holothuria (Theelothuria) hamata*, collected on 19 November 2010 at 24° 06.16' N; 66° 34.24' E (dorsal view)



Figure 2. *Holothuria (Theelothuria) hamata* collected on 29 September 2015 from 24° 00.100' N and 66° 20.350' E (dorsal view).



Figure 3. *Holothuria (Thelothuria) hamata* collected on 29 September 2015 from 24° 00.100' N and 66° 20.350' E (ventral view).

Specimens examined

- two specimens collected by the Iranian research vessel R/V *Firdous* on 1 November 2009 at 24° 57.55' N and 66° 38.12' E (classification code: MFD/INV/HOL/012-13)
- four specimens collected from the FAO/NORAD research vessel R/V *Fridtjof Nansen* on 19 November 2010 at 24° 06.16' N and 66° 34.24' E (classification code: MFD/INV/HOL/014-17)
- seven specimens collected from commercial trawler *Safina-e-Zhoab* on 29 September 2015 at 24° 00.100' N and 66° 20.350' E (classification code: MFD/INV/HOL/037-043)
- two specimens collected from commercial trawler *Al Sultan* on 21 November 2016 at 24° 33.110' N and 66° 21.505' E (classification code: MFD/INV/HOL/044-045)

Description (based on Aydin et al. 2019): Body elongate, tapering at both ends; bivium convex, trivium flattened. Papillae of trivium predominantly in ambulacral areas, but with some spreading into the interambulacral areas, arrangement in 5 rows, about 25 papillae per row. Papillae of bivium only in ambulacral areas, in 2–3 irregular rows; some 30

papillae per row. All dorsal, lateral and ventral papillae non-retractable. Cuvierian tubules absent.

Colour: Body colour (live): dorsal grayish to yellowish-brown with prominent conical brown papillae with lighter tip and surrounded by a lateral papillae ± 20 in number on each side. Pale lilac to white, patterns purplish or brownish. Teo and Ng (2009). Rowe and Doty (1977) noted the great variability of colour patterns.

Distribution: Widely distributed in the Indo-Pacific region. It is known from Suez Bay (Pearson 1913; Panning 1935; Cherbonnier 1955, 1959), the Red Sea (Rowe 1969), Maldives (Clark and Rowe 1971), Seychelles, Aldabra (Sloan et al. 1979), Kenya (Samyn 2003); Singapore (Teo and Ng 2009) and Indian Ocean, exact locality not specified (Domantay 1957), and northern Australia (Rowe and Gates 1995). Rowe and Gates (1995) noted a bathymetric distribution from 9–190 m. Along the coast of Pakistan, it is frequently collected from trawl fishing grounds in offshore waters between depths of 35 m and 190 m. It is mostly found on sandy or muddy bottoms. This is the first record of this species from Pakistan, and the colour and general morphology of specimens are similar to those described by Teo and Ng (2009) from Singapore as *Holothuria ocellata* (Jaeger, 1833).

***Stichopus herrmanni* (Semper, 1868)**

Specimen examined:

- Underwater photograph taken on 3 February 2015 at Churna Island near the Balochistan coast near Karachi.

Description: Body is broad and considerably flattened ventrally. Dorsal side is slightly arched and the lateral sides are almost vertical. The body wall is fairly thick and soft. Dorsal side is wrinkled or deeply ridged, and body is firm and rigid. Irregular and conspicuous conical warts; smaller papillae dispersed in between conical-shaped papillae.

Colour: Body grey mottled with small dark black spots on the dorsal surface. Dorsal papillae bluish-grey with brown tips.

Distribution: Widely distributed in the tropical Indo-west Pacific Ocean (Rowe and Gates 1995; Massin 1999; Woo et al. 2015). It is a benthic and inshore species that is a deposit feeder, and found at depths of 0–20 m (Rowe and Gates 1995). It is widely distributed along the Indian Coast (Deepa and Kumar 2010) and Iran (Majid et al. 2012). This is the first record of this species from Pakistan.



Figure 4. *Stichopus herrmanni* at Churna Island (Karachi) on 3 February 2015.

The sea cucumber fishery in Pakistan

Sea cucumbers are not consumed in Pakistan and there is no organised fishery for harvesting or processing sea cucumbers. A number of attempts have been made since 1990 to process them into beche-de-mer, but none of them were successful until 2012 when one of the seafood processors started producing beche-de-mer from *Holothuria (Thymiosycia) arenicola*. This species is harvested from rocky and sandy shores along the Karachi coast. The sand sea cucumber, as it is commonly known, is found underneath stones and boulders on beaches at Buleji, Manora, Goth Mubbarak and Sonara along the Karachi coast. Sea cucumbers are handpicked and kept in seawater, allowing them to empty the content of their stomachs. Sea cucumbers are processed by cutting, salting, cooking and drying (Fig. 5).

Beche-de-mer produced from *Holothuria (Thymiosycia) arenicola* has been exported to Malaysia, China and Thailand but only about 350 kg of beche-de-mer were exported in 2012. Annual exports of beche-de-mer have been increasing, from 460 kg in 2013, 490 kg in 2014 and 350 in 2015

(Table 1). However, only smaller quantities (less than 200 kg) were exported during 2016 and 2017. No exports of beche-de-mer were made during 2018. The fluctuation in the quantity of exports is attributed to limited stocks of sand sea cucumbers, difficulties with harvesting, and the lack of knowledge about these animals among local communities. In order to enhance the export of beche-de-mer, there is a need to explore new fishing grounds for *Holothuria (Thymiosycia) arenicola* along the Pakistan coast. Possibility of farming of this and other lucrative species may also be examined that could help with the establishment of an organised beche-de-mer processing industry in Pakistan

Table 1. Exports of beche-de-mer from Pakistan (in kg, dry weight).

| Destination | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-------------|------|------|------|------|------|------|------|
| Malaysia | - | 410 | 380 | 310 | 110 | 90 | 0 |
| China | 350 | 50 | 110 | 150 | - | 30 | 0 |
| Thailand | - | - | - | 70 | 60 | 25 | 0 |
| Total | 350 | 460 | 490 | 530 | 170 | 145 | 0 |

Source: Marine Fisheries Department, Government of Pakistan



Figure 5. Beche-de-mer produced from *Holothuria (Thymiosycia) arenicola*.

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