

Scorpionfishes (Teleostei: Scorpaenoidei) of Singapore

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Abstract. A total of 34 species of scorpionfishes (Scorpaenoidei: families Scorpaenidae, Apistidae, Tetrarogidae, Synanceiidae and Aploactinidae) have been recorded from Singapore. Of these, three were included in error, and 11 species are unverified. Twenty species were positively identified on the basis of specimens collected, and from photographs reliably obtained in the natural environment in Singapore waters. Among these, *Parascorpaena picta*, *Paracentropogon longispinis*, *Synanceia horrida* and *Trachicephalus uranoscopus* were most commonly collected in Singapore waters. *Scorpaenopsis possi* and *Scorpaenopsis ramaraoi* are herein reported for the first time in Singapore based on specimens previously mis-identified as *Scorpaenopsis cirrosa*.

Key words. scorpionfishes, Scorpaenidae, Apistidae, Tetrarogidae, Synanceiidae, Aploactinidae, Singapore

INTRODUCTION

The present article is a compilation of the diversity of scorpionfishes recorded from Singapore. Scorpionfishes are widely distributed in tropical to temperate seas, with many species distributed across the Indo-Pacific region. They inhabit a wide range of marine environments from coastal intertidal zones to deep offshore habitats. Scorpionfishes broadly include members of the families Scorpaenidae, Apistidae, Tetrarogidae, Synanceiidae and Aploactinidae. Apart from the Aploactinidae, members of all these families were once placed in the family Scorpaenidae. Both the Aploactinidae and Scorpaenidae used to be classified under the order Scorpaeniformes (see Poss, 1999a, 1999b; Nelson et al., 2016: 467). Recent molecular studies have since shown that they are closely related to perches and groupers (Betancur et al., 2013). According to current classification, the families Scorpaenidae, Apistidae, Tetrarogidae, Synanceiidae and Aploactinidae are in the order Perciformes and the suborder Scorpaenoidei (see Van der Laan et al., 2019). Herein, we present an inventory of the known diversity of Scorpaenoidei (after Nelson et al., 2016) recorded in Singapore's territorial waters. They include members of the families Scorpaenidae (including subfamilies Scorpaeninae, Pteroinae), Apistidae, Tetrarogidae, Synanceiidae (including subfamilies Minoinae, Choridactylinae, Synanceiinae) and Aploactinidae. The flatheads, family Platycephalidae, despite being presently located in the Scorpaenoidei (see Van der Laan et al., 2019), are traditionally not regarded as 'scorpionfishes', and thus not covered in this article. Only the families with representatives recorded from Singapore waters are treated here.

The earliest scorpionfish recorded from Singapore appears to be *Synanceia grossa* named by Gray with an illustration in 1830 (Gray, 1830: pl. 97). This name is now regarded as a junior synonym of *Synanceia horrida* (Linnaeus, 1766), the estuarine stonefish. In his then comprehensive coverage of Malayan fishes, Cantor (1849) recorded *Prosopodasys trachinoides* (= *Trichosomus trachinoides*) from Singapore. He also described the velvetfish, *Corythobatus echinatus*, from the sea of Penang, which was erroneously included in a later compilation (see Fowler, 1938: 1026). Bleeker (1861: 49) made what appears to be the earliest inventory of Singapore's fish fauna, in which 12 species of scorpionfish were recorded. In 1874, Bleeker described *Pelor brachyrhynchus* based on a specimen from Singapore (Bleeker, 1874: 5, pl. 3 fig. 2, pl. 2 fig. 4). This species is presently considered valid as *Inimicus brachyrhynchus* but is apparently extremely rare, being known only from two specimens—the holotype, and another obtained later in Hong Kong. von Martens (1876: 389) recorded *Scorpaena diabolus* (= *Scorpaenopsis diabolus*) from Singapore. Károli (1882), after having studied a collection of fishes made between 1868 and 1870 in Singapore, recorded seven species, including *Synancidium erosum* (= *Erosa erosa*), which was then new to the area.

At the start of the 20th century, Duncker (1904: 152–153) recorded eight species, including *Scorpaena haplodactylus* (= *Parascorpaena bandanensis*) and *Pterois antennata*. Herre (in Herre & Myers, 1937: 33–34) added *Scorpaenodes guamensis*, *Paracentropogon cyanocephalus* (= *Cottapistes cottoides*) and *Paracentropogon leucoprospan* (= *Paracentropogon longispinis*) as new records. Fowler (1938: 199–203) compiled an annotated checklist of the fishes recorded from Malaya based on literature and past collections, and listed altogether 19 species of scorpionfish from Singapore. However, two species (*Corythobatus echinatus* [= *Cocotropus echinatus*] and *Pterois radiata*) were included

by mistake. Tweedie (1940: 79–80) made a list of the fish collection of the Raffles Museum that included five species of scorpionfish that were obtained in Singapore. Herre (1940: 48) added *Vespicola leucogaster* (= *Richardsonichthys leucogaster*) and *Trichopleura mollis* (= *Sthenopus mollis*) to Singapore's scorpionfish fauna. Sinoda et al. (1978: 598) recorded *Hypodytes carinatus* (= *Apistus carinatus*) and *Minous trachycephalus* from the South China Sea around Horsburgh Lighthouse, the surrounding 10 kilometres of sea around which is within Singapore's political boundaries. No new additions were made thereafter until a checklist by Chou et al. (1994: 103) included *Choridactylus multibarbus* and two species of lionfish—*Dendrochirus brachypterus* and *Dendrochirus zebra*—without supporting evidence.

New Singapore records of scorpionfishes continue to be reported in the new millennium. The additions include the stonefish *Leptosynanceia asteroblepa* (see Wang & Lim, 2011: 471), the lionfish *Pterois volitans* (see Heng & Lim, 2015: 68) and the velvetfishes *Paraploactis* sp. (see Choo & Lim, 2013: 49) and *Acanthosphelex leurynnis* (see Tan & Lim, 2019: 87).

MATERIAL & METHODS

The geographical coverage of the present article includes the inland waterways and sea within the political boundaries of Singapore. Records from the South China Sea around Horsburgh Lighthouse (e.g., Sinoda et al., 1978) are excluded. Unless stated otherwise, all material examined are from Singapore territorial waters, or purchased in markets in Singapore. Specimens obtained from markets and fish ports should be regarded as unconfirmed records because there is no certainty that they were collected from Singapore's territorial waters.

Presentation of each species is as follows:

* *Currently valid scientific name* and author (as in Fricke et al., 2019); English vernacular name (mostly used by Allen & Erdmann, 2012; Lim & Low, 1998; and Poss, 1999a, 1999b). Species name in bold print indicate that its occurrence in Singapore waters is confirmed, and supported by specimens in museums and photographs. Species name in normal print indicate its presence in Singapore is unconfirmed or erroneously recorded.

* *Original scientific name* and synonyms restricted to those with Singapore records, following the compilation of Fricke et al. (2019). For these names, identified by the absence of a comma between the authors' names and year of publication, the publications of the original descriptions are not listed in LITERATURE CITED. The type localities are given in brackets.

* **Material examined.** Most specimens examined in this article are preserved material lodged in the Zoological Reference Collection (ZRC) of the Lee Kong Chian Natural History Museum (LKCNHM) at the National University of Singapore. These are cited in the following sequence: Locality – ZRC catalogue number (number of specimens in series) year of collection. The size of the largest specimen from Singapore examined is given as SL (standard length) or TL (total length).

* **Remarks.** Comments pertaining to the current taxonomic and abundance status of the species, specimens examined and nomenclature.

SCORPAENOIDEI RECORDED FROM SINGAPORE

Family Scorpaenidae (scorpionfishes and lionfishes)

Subfamily Scorpaeninae (scorpionfishes)

***Parascorpaena picta* (Cuvier)**; painted scorpionfish (Fig. 1)

Scorpaena picta Cuvier in Cuvier & Valenciennes 1829 (type locality: Java, Indonesia).

Synonym: *Scorpaena polyprion* Bleeker 1849 (type locality: Bali and Sumatra, Indonesia).

Material examined. Beting Bronok – ZRC 56707 (1) 2003; Changi Beach – ZRC 50522 (6) 2006; Labrador Beach – ZRC 30555 (1) 1993; Lazarus Island – ZRC 54738 (1) 2015; Marina East – ZRC 50522 (1) 2006; Pulau Seringat – ZRC 41456 (2) 1997; Pulau Ular / Terumbu Bayan – ZRC 54486 (1) 2006; Raffles Lighthouse – ZRC 40723 (2) 1977, ZRC 40727 (1) 1977, ZRC 49310 (1) 2004; Semakau – ZRC 35355 (2) 1993, ZRC 35356 (1) 1993; Sentosa – ZRC 17444 (1) 1977; Sultan Shoal – ZRC 741 (1) 1969; Tanah Merah Beach – ZRC 55754 (2) 2017, ZRC 56423 (1) 2017; Fish market – ZRC 213 (1), 1936. Largest specimen examined 129 mm SL (ZRC 54738).



Fig. 1. Lateral view of preserved specimen of *Parascorpaena picta*, 123.3 mm SL (ZRC 50522), from Marina East, Singapore, in 2006. (Photograph by: J. T. B. Kwik).

Remarks. In Singapore waters, *Parascorpaena picta* occurs largely on coral reef (see Lim & Low, 1998: 81; Chua, 2007: 59; Kwik, 2012: 96). It was first recorded as *Scorpaena picta* (see Bleeker, 1861: 31; Károli, 1882: 157) and *Scorpaena polyprion* (see Bleeker, 1861: 31, 49; Duncker, 1904: 152). The specimen identified as *Sebastapistes tristis* by Herre (in Herre & Myers, 1937: 33) and then as *Sebastapistes bynoensis* by de Beaufort & Briggs (1962: 28) has been determined as *Parascorpaena picta* by Motomura et al. (2009: 51). Thus, there is no record of the genus *Sebastapistes* in Singapore waters. We have examined the specimen obtained from a fish market (ZRC 213) identified as *Scorpaena bleekeri* by Tweedie (1940: 80), and found that it is *Parascorpaena picta*.

Parascorpaena bandanensis (Bleeker); Banda scorpionfish

Scorpaena bandanensis Bleeker 1851 (type locality: Banda Neira, Banda Islands, Indonesia).
Tentative synonym: *Scorpaena aplodactylus* Bleeker 1853 (type locality: Wahi, Ceram, Indonesia).

Material examined. None.

Remarks. Recorded as *Scorpaena haplodactylus* by Duncker (1904: 152) and cited as *Merinthe bandanensis* by Fowler (1938: 200), and *Parascorpaena bandanensis* by de Beaufort & Briggs (1962: 10) and Allen & Erdmann (2012: 225). It is not known if the original record by Duncker (1904: 152) was identified accurately. *Parascorpaena bandanensis* is differentiated from *Parascorpaena picta* in having 15–16 (vs. 17–18) pectoral fin rays and having (vs. lacking) spine on the suborbital ridge below the eye (Motomura et al., 2009: 54). We have not identified any specimen of *Parascorpaena bandanensis* from Singapore waters in the ZRC, and are unable to verify its present occurrence there.

Scorpaenodes guamensis (Quoy & Gaimard); Guam scorpionfish

Scorpaena guamensis Quoy & Gaimard 1824 (type locality: Guam, Mariana Islands).

Material examined. None.

Remarks. *Scorpaenodes guamensis* was recorded by Herre (in Herre & Myers, 1937: 33) based on eight specimens of 22–79 mm SL from Singapore reefs. We have not seen the material to be certain that the specimens were correctly identified as there are no subsequent records of this species from Singapore.

Scorpaenodes smithi Eschmeyer & Rama-Rao; Smith's scorpionfish

Scorpaenodes smithi Eschmeyer & Rama-Rao 1972 (type locality: Andaman Sea off western Malay Peninsula).

Material examined. None.

Remarks. The inclusion of Singapore as a locality for this species by Allen & Erdmann (2012: 232) appears to be erroneous. In the original description of *Scorpaenodes smithi*, 10 paratypes of this species are cited as having been collected from “near Singapore”. However, the geographic co-ordinates, given as “5°59'06”N, 99°08'33”E” (Eschmeyer & Rama-Rao, 1972: 61), point to a location in the Andaman Sea off Penang Island, which is not quite near Singapore. These 10 paratypes that are supposed to be at the “NMS” (National Museum Singapore) are not present at the collection's present base in the ZRC (pers. obs.). Although *Scorpaenodes smithi* is widespread over the East Indies and can be expected from Singapore waters, there is no actual record from there.

Scorpaenopsis cirrosa (Thunberg); weedy scorpionfish

Perca cirrosa Thunberg 1793 (type locality: Miyake-jima, Izu Islands, Japan).

Material examined. None.

Remarks. This species was recorded from Singapore by Bleeker (1861: 31, 49; 1876: 33, as *Scorpaenopsis cirrhosus*), but his material was not seen by us. Scorpionfishes recorded as *Scorpaenopsis cirrhosa* from reefs around Singapore's southern islands by Khoo & Tay (1990: 75) and Low & Chou (1994: 96) are likely to be *Scorpaenopsis possi* or *Scorpaenopsis ramaraoi*. However, it is not possible to determine their identities for their records were based solely on sightings. *Scorpaenopsis cirrosa* is otherwise known to be restricted to the northern west Pacific as far south as Hong Kong (see Randall & Eschmeyer, 2001: 18).

Scorpaenopsis diabolus (Cuvier); devil scorpionfish, false stonefish
(Fig. 2)



Fig. 2. Lateral view of preserved specimen of *Scorpaenopsis diabolus*, 160 mm SL (ZRC 40650), from Singapore Strait in 1971. (Photograph by: K. K. P. Lim).

Scorpaena diabolus Cuvier 1829 (type locality: Indo-West Pacific).

Material examined. Singapore Strait between Pulau Pawai and Pulau Sudong – ZRC 40650 (1) 1971. Specimen examined 160 mm SL.

Remarks. von Martens (1876: 324, as *Scorpaena diabolus*) apparently was the first to record this species from Singapore. It was subsequently mis-assigned to *Scorpaenopsis gibbosa* by Fowler (1938: 203, as *Scorpaenopsis gibbosus*) and de Beaufort & Briggs (1962: 21), a congener which is believed to be restricted to the western Indian Ocean (see Randall & Eschmeyer, 2001: 26).

Scorpaenopsis possi Randall & Eschmeyer; Poss's scorpionfish
(Fig. 3)



Fig. 3. Lateral view of preserved specimen of *Scorpaenopsis possi*, 165 mm SL (ZRC 43373), from Raffles Lighthouse, Singapore, in 1998. (Photograph by: K. K. P. Lim).

Scorpaenopsis possi Randall & Eschmeyer 2001 (type locality: Pitcairn Island).

Material examined. Marina Bay – ZRC 52365 (1) 2005; Raffles Lighthouse – ZRC 40729 (1) 1996, ZRC 43373 (1) 1998. Largest specimen examined 165 mm SL (ZRC 43373).

Remarks. The *Scorpaeniopsis* [sic] *oxycephala* recorded from the Marina Channel by Tan et al. (2010: 143) has been identified by H. Motomura as this species.

Scorpaenopsis ramaraoi Randall & Eschmeyer; Rama Rao's scorpionfish
(Fig. 4)



Fig. 4. Lateral view of preserved specimen of *Scorpaenopsis ramaraoi*, 109.1 mm SL (ZRC 45743), from Raffles Lighthouse, Singapore, in 2003. (Photograph by: K. K. P. Lim).

Scorpaenopsis ramaraoi Randall & Eschmeyer 2001 (type locality: off Hikkaduwa, Sri Lanka).

Material examined. Raffles Lighthouse – ZRC 41240 (1) 1997, ZRC 45743 (1) 1999, ZRC 52481 (1) 2003; Saint John's Island – ZRC 47371 (1) 1998; Sultan Shoal – ZRC 40728 (1) 1990. Largest specimen examined 153 mm SL (ZRC 52481).

Remarks. The above materials were identified by H. Motomura.

Subfamily Pteroinae (lionfishes)

Dendrochirus brachypterus (Cuvier); shortfin lionfish

Pterois brachyptera Cuvier in Cuvier & Valenciennes 1829 (type locality: unknown).

Material examined. None.

Remarks. The source of the record of *Dendrochirus brachypterus* by Chou et al. (1994: 103) is unknown. Although this species occurs in the region around Singapore and can be expected to appear in its territorial waters, the record cannot be verified, and should be regarded as erroneous.

Dendrochirus zebra (Cuvier); zebra lionfish

Pterois zebra Cuvier in Cuvier & Valenciennes 1829 (type locality: Mauritius).

Material examined. None.

Remarks. As per *Dendrochirus brachypterus*, the source of the record of *Dendrochirus zebra* by Chou et al. (1994: 103) is unknown and should be regarded as erroneous.

Pterois antennata (Bloch); spotfin lionfish

Scorpaena antennata Bloch 1787 (type locality: Ambon, Indonesia).

Material examined. None.

Remarks. We have not seen the original material reported from Singapore by Duncker (1904: 152), and thus are unable to confirm the presence of *Pterois antennata* in Singapore.

Pterois radiata Cuvier; clearfin lionfish

Pterois radiata Cuvier in Cuvier & Valenciennes 1829 (type locality: Tahiti, French Polynesia).

Material examined. None.

Remarks. The records of this species from Singapore and Pulau Tioman are erroneously cited by Fowler (1938: 202) from Smedley (1928: 64), who mentions neither Singapore nor Tioman in his article. He does mention that a single specimen of *Pterois radiata* from Sipora (not Singapore), one of the Mentawi Islands off western Sumatra, was presented to the Raffles Museum.

Pterois miles (Bennett); Indian lionfish

Scorpaena miles Bennett 1828 (type locality: south coast of Sri Lanka).

Material examined. None.

Remarks. Based on the photograph in Kuitert & Debelius (2006: 192) that was presumably obtained in Singapore. Earlier records of *Pterois miles* were referred to as *Pterois russelii* (see below). This species is supposed to be restricted to the Indian Ocean.

Pterois russelii Bennett; plintail lionfish, Russel's lionfish
(Fig. 5)



Fig. 5. Lateral view of preserved specimen of *Pterois russelii*, 120.3 mm TL (deposited at Sentosa Development Corporation), from Sentosa, Singapore, in 2011. (Photograph by: J. T. B. Kwik).

Pterois russelii Bennett 1831 (type locality: Coromandel coast, India).

Synonym: *Pterois kodipungi* Bleeker 1852 (type localities: Jakarta, Java, Indonesia and Padang, Sumatra).

Material examined. Changi Beach – ZRC 4298-4299 (2) 1972; Sentosa – Sentosa Development Corporation (2) May 2011; Tuas at Raffles Marina – ZRC 54300 (1) 2014; Tuas – ZRC 54662 (1) 1986. Largest specimen examined 181 mm SL (ZRC 54662).

Remarks. This large lionfish was first recorded from Singapore by Bleeker (1861: 49, as *Pterois Ruselli*). It has subsequently been referred to as *Pterois lunulata* (non-Temminck & Schlegel) by Steindachner (1870: 561). Bleeker (1876: 46, 48) listed both *Pseudomonopterus (Pterois) kodipungi* and *Pseudomonopterus (Pterois) lunulatus* as occurring in Singapore. The species was identified as *Pterois kodipungi* by Károli (1882: 158). This seems to be the most frequently seen lionfish in Singapore waters (see Loh, 2014: 240; Tan & Lim, 2014a: 11; Ng et al., 2015: 335, all as *Pterois russelii*). The two recent specimens from Sentosa were captured with traps and hand nets from a coral reef at 4 m depth.

Pterois volitans (Linnaeus); Volitans lionfish

Gasterosteus volitans Linnaeus 1758 (type locality: Ambon, Indonesia).

Material examined. Photograph in Heng & Lim (2015: 68).

Remarks. Listed as present in Singapore by Chou et al. (1994: 103, as *Pterois volitans* [sic]) without supporting evidence. The only confirmed record is based on photographs taken of a juvenile off Pulau Hantu (Heng & Lim, 2015: 68). This species is distinguished from *Pterois russelii* mainly by the presence of black spots on its clear fins.

Family Apistidae (wasp scorpionfishes)

Apistus carinatus (Bloch & Schneider); ocellated waspfish
(Fig. 6)

Scorpaena carinata Bloch & Schneider 1801 (type locality: Tranquebar, India).

Material examined. Punggol fishery port – ZRC 60850 (1) 1990. Specimen examined 69.7 mm SL.



Fig. 6. Lateral view of preserved specimen of *Apistus carinatus*, 69.7 mm SL (ZRC 60850), from Punggol Fishery Port, Singapore, in 1990. (Photograph by: K. K. P. Lim).

Remarks. This unverified record is based on a specimen obtained from the Senoko fish port, which may or may not have been taken from Singapore's territorial waters. Sinoda et al. (1978: 598, as *Hypodytes carinatus*) recorded this species from the South China Sea around Horsburgh Lighthouse.

Family Tetrarogidae (waspfishes)

***Cottapistus cottoides* (Linnaeus); yellow waspfish
(Fig. 7)**



Fig. 7. Lateral view of preserved specimen of *Cottapistus cottoides*, 69.4 mm SL (ZRC 4310), from Pasir Panjang, Singapore, in 1975. (Photograph by: J. T. B. Kwik).

Perca cottoides Linnaeus 1758 (type locality: East Indies).

Synonym: *Paracentropogon cynocephalus* Weber 1913 (type locality: Molo Strait, Flores Sea, Indonesia).

Material examined. Singapore – ZRC 3528 (1) no date; Bedok – ZRC 207 (4) 1940; kelong off Pasir Panjang – ZRC 50567 (4) 1975. Largest specimen examined 77.8 mm SL (from ZRC 207).

Remarks. Herre & Myers (1937: 33) reported that one 42 mm SL specimen of *Paracentropogon cynocephalus* was taken on a reef in Singapore. Tham (1950: 35, as *Amblyapistus* sp.) caught examples at kelongs in the Singapore Strait. There have been no local records of this species since 1975. It may prefer deeper subtidal waters and may have avoided capture by trawl as this form of fishing has been locally banned for the past few decades. *Cottapistus cottoides* has been known to be part of the by-catch in trawling activities around the region (Sinoda et al., 1978).

***Paracentropogon longispinis* (Cuvier); longspine waspfish
(Fig. 8)**



Fig. 8. Lateral view of preserved specimen of *Paracentropogon longispinis*, 55.6 mm SL (ZRC 53082), from Changi Beach, Singapore, in 2006. (Photograph by: J. T. B. Kwik).

Apistus longispinis Cuvier in Cuvier & Valenciennes 1829 (type locality: Ambon, Indonesia).

Synonyms: *Apistus fusco-virens* Cuvier in Cuvier & Valenciennes 1829 (type locality: Ambon, Indonesia); *Apistus leucoprosopos* Bleeker 1856 (type locality: Ambon, Indonesia).

Material examined. Bedok – ZRC 65 (4 ex.) 1954; Changi Beach – ZRC 17584 (1 ex.) 1990, ZRC 17585 (1 ex.) 1990, ZRC 40683 (1 ex.) 1994, ZRC 40704 (5 ex.) 1994, ZRC 41752 (3 ex.) 1997, ZRC 46542 (1 ex.) 2000, ZRC 46657 (3 ex.) 2001, ZRC 47808 (15 ex.) 2003, ZRC 54870 (5 ex.) 2016, ZRC 56335 (9 ex.) 2017, ZRC 56400 (2 ex.) 2017; Pulau

Seringat – ZRC 41471 (1 ex.) 1997; Pulau Ubin – ZRC 41024 (1 ex.) 1995, ZRC 48486 (9 ex.) 2001; Semakau – ZRC 54600 (9 ex.) 2014; Sentosa – ZRC 48672 (1 ex.) 1995; Sungei Punggol – ZRC 3580 (5 ex.) 1963, ZRC 7570 (16 ex.) 1973, ZRC 11499 (5 ex.) 1967; Sungei Seletar – ZRC 765 (1 ex.) 1966. Largest specimen examined 77.3 mm SL (ZRC 56335).

Remarks. Probably the most commonly collected scorpionfish in Singapore waters, being found in intertidal areas in both Johor Strait and Singapore Strait. It has been recorded by many authors (e.g., Bleeker, 1861: 31, 49, as *Apistus fuscovirens*; Bleeker, 1876: 68; Károli, 1882: 158, as *Tetraroge longispinis* and *Centropogon fuscovirens*; Duncker, 1904: 152, as *Tetraroge longispinis*; Herre & Myers, 1937: 33, as *Paracentropogon leucoprosopon* and *Paracentropogon longispinis*; Chua, 1973: 526; Tham, 1973: 218; Lim & Low, 1998: 81; Tan & Yeo, 2003: 200; Ng et al., 2007: 167; Kwik et al., 2010: 128, as *Paracentropogon longispinus* [sic]; Tan & Lim, 2014b: 241, fig. 9; Ng et al., 2015: 333; Tan, 2016: 98; Theng et al., 2016: 300). Although most of the material examined were collected from intertidal areas, Alfred (1969: 46, as *Paracentropogon longispinnis* [sic]) has found this species at a depth of 246 ft off Saint John's Island.

***Richardsonichthys leucogaster* (Richardson); whiteface waspfish**
(Fig. 9)



Fig. 9. Lateral view of preserved specimen of *Richardsonichthys leucogaster*, 35.3 mm SL (ZRC 54902), bleached, from Singapore Strait off Bedok in the 1950s. (Photograph by: K. K. P. Lim).

Apistes leucogaster Richardson 1848 (type locality: sea of China).

Material examined. Singapore Strait off Bedok at 22 fathoms – ZRC 54902 (1) 1950s. Specimen examined 35.3 mm SL.

Remarks. Apart from the material examined (Fig. 9), Herre (1940: 48, as *Vespicula leucogaster*) also recorded five examples of 32–67 mm SL taken from a reef in outer harbour of Singapore.

***Trichosomus trachinoides* (Cuvier); mangrove waspfish, goblinfish**
(Fig. 10)



Fig. 10. Lateral view of preserved specimen of *Trichosomus trachinoides*, 47.3 mm SL (ZRC 766) from Sungei Poyan in 1966. (Photograph by: J. T. B. Kwik).

Apistus trachinoides Cuvier in Cuvier & Valenciennes 1829 (type locality: Java, Indonesia).

Material examined. Punggol – ZRC 54123 (1) 1988; Sarimbun – ZRC 51088 (2) 2005; Sungei Buloh – ZRC 27210-27212 (3) 1992, ZRC 27213 (1) 1992, ZRC 29311 (1) 1992; Sungei Poyan – ZRC 766 (1) 1966; Sungei Seletar – ZRC 767 (1) 1969. Largest specimen examined 51 mm SL (ZRC 767).

Remarks. This mangrove-dwelling species has been recorded from Singapore since 1849 as *Prosopodasys trachinoides* (Cantor, 1849: 1026; Bleeker, 1876: 79; Károli, 1882: 158; Duncker, 1904: 153), *Apistus trachinoides* (Bleeker, 1858: 245; Bleeker, 1861: 49; Fowler, 1938: 199), *Vespicula trachinoides* (Herre, 1940: 48; de Beaufort & Briggs, 1962: 73; Lim & Low, 1998: 83; Theng et al., 2016: 299) and *Trichosomus trachinoides* (Ng et al., 2015: 333). The material examined here have all been obtained in estuarine environments in the Johor Strait.

Family Synanceiidae (stonefishes)

Subfamily Minoinae (stingfishes)

***Minous monodactylus* (Bloch & Schneider)**; grey goblinfish, one-finger stinger
(Fig. 11)



Fig. 11. Lateral view of preserved specimen of *Minous monodactylus*, 51.8 mm SL (ZRC 53084), from Changi Beach, Singapore, in 2006. (Photograph by: J. T. B. Kwik).

Scorpaena monodactyla Bloch & Schneider 1801 (type locality unknown).

Material examined. Bedok – ZRC 2002 (1) 1956; Changi Beach – ZRC 40684 (1) 1994, ZRC 53084 (1) Apr. 2006, ZRC 56442 (1) Mar. 2001; Punggol – ZRC 7293-7294 (2) 1973; Sungei Seletar – ZRC 768 (1) 1969. Largest specimen examined 63 mm SL (ZRC 7293).

Remarks. *Minous monodactylus* has been recorded from Singapore waters, in both Johor Strait and Singapore Strait, by many authors (e.g., Bleeker, 1861: 31, 49; Bleeker, 1876: 64; Károli, 1882: 158; Herre & Myers, 1937: 34; Fowler, 1938: 200; de Beaufort & Briggs, 1962: 111; Eschmeyer et al., 1979a: 461; Tan et al., 2010: 143; Ng et al., 2015: 333; Matsunuma & Motomura, 2018: 253). A congener, *Minous trachycephalus* (Bleeker 1855), was recorded in the South China Sea around Horsburgh Lighthouse by Sinoda et al. (1978: 598). It is distinguished from *Minous monodactylus* in having its first dorsal spine much shorter than the second spine (vs. nearly equal to or longer than second spine) (see Matsunuma & Motomura, 2018: 226).

Subfamily Choridactylinae (stingers)

Choridactylus multibarbus Richardson; multi-barbed stinger, three-finger scorpionfish

Choridactylus multibarbus Richardson 1848 (type locality: sea of China).

Material examined. None.

Remarks. The source of the record by Chou et al. (1994: 103 as *Choridactylus multibarbis* [sic]) is unknown, and thus the presence of this species in Singapore waters cannot be confirmed.

***Inimicus brachyrhynchus* (Bleeker)**; Singapore stinger

Pelor brachyrhynchus Bleeker 1874 (type locality: Singapore).

Material examined. None.

Remarks. This species was described by Bleeker (1874: 5, pl. 3 fig. 2, pl. 2 fig. 4) as *Pelor brachyrhynchus* from a specimen apparently collected in Singapore. The holotype resides at the Leiden Museum (RMNH 5907). According to Inaba & Motomura (2018: 56), the species seems to be rare, known only from the holotype and another specimen from Hong Kong. *Inimicus brachyrhynchus* is characterised by its relatively short snout that is shorter than the postorbital length; inner surface of pectoral fin light brown with white vertical band centrally; caudal fin with two vertical broad black bands (Inaba & Motomura, 2018: 56).

***Inimicus cuvieri* (Gray); longsnout stinger**
(Fig. 12)



Fig. 12. Lateral view of preserved specimen of *Inimicus cuvieri*, 177 mm SL (ZRC 53737), from Sentosa, Singapore, in 2008. (Photograph by: K. K. P. Lim).

Pelors cuvieri Gray 1835 (type locality: India).

Material examined. Sentosa at Palawan Beach – ZRC 53737 (1) 2008. Specimen examined 177 mm SL.

Remarks. *Inimicus cuvieri* was recorded in Singapore by Bleeker (1861: 49). It is characterised by the following features—snout length equal to or longer than postorbital length; inner surface of pectoral fin uniformly dark-brown without distinct blotches or bands; caudal fin with three vertical bands, first and third bands extending onto fin base and margin respectively (Inaba & Motomura, 2018: 64).

***Inimicus didactylus* (Pallas); bearded ghoulfish, demon stinger**
(Fig. 13)



Fig. 13. Lateral view of preserved specimen of *Inimicus didactylus*, 55.3 mm SL (ZRC53085), from Changi Beach, Singapore, in 2006. (Photograph by: J. T. B. Kwik).

Scorpaena didactyla Pallas 1769 (type locality: Indian Ocean).

Synonym: *Pelor obscurum* Cuvier in Cuvier & Valenciennes 1829 (type locality: Port Praslin, New Ireland).

Material examined. Sultan Shoal – ZRC 208 (1) 1931; Changi Beach – ZRC 53082 (2) 2006. Largest specimen examined 123 mm SL (ZRC 208).

Remarks. This species has been recorded in Singapore as *Pelor didactylus* by Bleeker (1861: 49), *Pelor obscurum* by Kner (1867: 119), *Pelor didactylum* by Tweedie (1940: 79) and *Inimicus didactylus* by Kwik (2012: 96) and Ng et al. (2015: 333). It is differentiated from *Inimicus brachyrhynchus* by having a broad dark transverse bar along the medial surface of the pectoral fin (Eschmeyer et al., 1979b: 489; Poss, 1999a: 2316). *Inimicus didactylus* appears to prefer habitats with soft sediment, and is characterised by its snout being longer than postorbital length; inner surface of pectoral fin with white vertical band centrally and black marginal band, with white to yellow irregular blotches on marginal band; caudal fin with two vertical broad black bands, first band on fin base, second band on centre, margin white (Inaba & Motomura, 2018: 68).

Subfamily Synanceiinae (stonefishes)

Erosa erosa (Cuvier); monkeyfish

Synanceia erosa Cuvier in Cuvier & Valenciennes 1829 (type locality: seas of Japan).

Material examined. None.

Remarks. Fowler (1938: 199) suspects that the sole Singapore record by Károli (1882: 158, as *Synancidium erosum*) may have been based on misidentification or erroneous locality. Without having examined the original material on which Károli's record is based, we cannot be sure. This species is distributed over the Indo-West Pacific and it should not be surprising if it occurs in Singapore waters.

Leptosynanceia asteroblepa (Richardson); star-eyed stonefish
(Fig. 14)

Synanceia asteroblepa Richardson 1844 (type locality: coast of New Guinea).



Fig. 14. Lateral view of preserved specimen of *Leptosynanceia asteroblepa*, 76.7 mm SL (ZRC52524), from Lim Chu Kang, Singapore, in 2011. (Photograph by: J. T. B. Kwik).

Material examined. Lim Chu Kang – ZRC 52524 (1) Apr 2011; Pasir Ris – ZRC 54690 (1) Feb 2015; Sungei Buloh – ZRC 53156 (1) Aug 2011; Sungei Mandai Kechil – ZRC 40644 (2) Dec 1996. Largest specimen examined 156 mm SL (ZRC 54690).

Remarks. Recorded in Singapore by Wang & Lim (2011: 471), and from the eastern Johor Strait by Ng et al. (2015: 333). This species inhabits estuarine habitats in the Strait of Johor.

Synanceia horrida (Linnaeus); estuarine stonefish, hollow-cheeked stonefish
(Fig. 15)



Fig. 15. Lateral view of preserved specimen of *Synanceia horrida*, 124 mm SL (ZRC 53598), from Marina Bay, Singapore, in 2005. (Photograph by: Tan Heok Hui).

Scorpaena horrida Linnaeus 1766 (type locality: Ambon, Indonesia).
Synonym: *Synanceia grossa* Gray 1830 (type locality: Singapore).

Material examined. Singapore – ZRC 3583 (3 ex.) 1993, ZRC 50570 (1 ex.) no date; Cyrene Reef – ZRC 56596 (1 juv.) 2017; Johor Strait off Pulau Ubin – ZRC 49861 (1 ex.) 2004; Kusu Island – ZRC 48675 (2 ex.) 1986, ZRC 48676 (1 ex.) 1986, ZRC 48677 (2 ex.) 1986; Labrador Beach – ZRC 48669 (1 ex.) 1994, ZRC 53267 (1 ex.) 2011; Marina Bay – ZRC 53598 (1 ex.) 2005, ZRC 53674 (1 ex.) 2005; Pulau Hantu – ZRC 40989 (1 ex.) 1997, ZRC 48666 (1 ex.) 1995; Raffles Lighthouse – ZRC 215 (1 ex.) 1931, ZRC 49325 (1 ex.) 2004; Semakau – ZRC 35368 (1 ex.) 1993, ZRC 54595 (1 ex.) 2014; Sentosa – ZRC 10614 (1 ex.) 1985, ZRC 17422 (1 ex.) 1991, ZRC 48667 (1 ex.) 1985, ZRC 48670 (2 ex.) 1985; Sentosa at Palawan Beach – ZRC 53736 (6 ex.) 2008; Singapore Strait – ZRC 48668 (1 ex.) 1985; Tanah Merah – ZRC 55643 (1 ex.) 2016, ZRC 55762 (1 ex.) 2017, ZRC 56351 (1 ex.) 2017; Tuas at Raffles Marina – ZRC 53712 (1 ex.) 2000; market in Singapore – ZRC 3069 (1 ex.) 1921. Largest specimen examined 207 mm SL (ZRC 55762).

Remarks. First recorded from Singapore by Gray (1830, as *Synanceia grossa*), the estuarine stonefish appears to be locally common. It has been found on coral reef, rocky shores, as well as soft sediment habitats. There are numerous records from both the Johor Strait and the Singapore Strait (e.g., Duncker, 1904: 153, as *Synancidium horridum*; Bleeker, 1858: 242, 245; Bleeker, 1861: 49; Phoon & Alfred, 1965: 158; Tham, 1973: 218; Khoo & Tay, 1990: 75; Lim & Low, 1998: 82; Chua, 2007: 118; Tan et al., 2010: 143; Kwik, 2012: 96; Tan & Lim, 2014b: 241, fig. 8; Ng et al., 2015: 333; Toh et al., 2016: 92; Wong, 2017: 94). Records of the large and distinctive reef stonefish, *Synanceia verrucosa*, from Singapore (e.g., Tweedie, 1940: 80; Johnson, 1964: 65) appear to have been based on misidentification of *Synanceia horrida*. The six specimens of 74–143 mm SL obtained by Herre & Myers (1937: 34) on reefs in Singapore are assumed to be *Synanceia horrida*, for the authors seem to make no distinction between this species and *Synanceia verrucosa*.

Synanceia verrucosa Bloch & Schneider; reef stonefish

Synanceia verrucosa Bloch & Schneider 1801 (type locality: India).

Material examined. None.

Remarks. This is based on the record by Bleeker (1861: 49) who recognised and also listed *Synanceia horrida* in the same article. It is possible that *Synanceia verrucosa* may have previously occurred in Singapore, but we have yet to come across specimens or photographs of the species from the country.

Trachicephalus uranoscopus (Bloch & Schneider); Stargazer stonefish
(Fig. 16)



Fig. 16. Lateral view of preserved specimen of *Trachicephalus uranoscopus*, 70.5 mm SL (ZRC 53081), from Changi Point Beach, Singapore, in 2006. (Photograph by: J. T. B. Kwik).

Synanceia uranoscopa Bloch & Schneider 1801 (type locality: Tranquebar, India).

Synonym: *Synanceia elongata* Cuvier in Cuvier & Valenciennes 1829 (type localities: Coromandel coast, India and Java, Indonesia).

Material examined. Singapore – ZRC 4528 (2) 1975; Angler Buoy – ZRC 2004 (5) 1956; Punggol Beach – ZRC 40585 (1) 1967; Sungei Punggol – ZRC 40585 (1) 1967, ZRC 40586 (1) 1968; Changi Beach – ZRC 17460 (1) 1990, ZRC 40571 (3) 1986, ZRC 40677 (1) 1994, ZRC 40711 (1) 1994, ZRC 41751 (3) 1997, ZRC 46539 (2) 2000, ZRC 47816 (2) 2003, ZRC 51959 (2) 2003, ZRC 53081 (1) 2006; Pulau Ubin – ZRC 53448 (1) 2005. Largest specimen examined 78.5 mm SL (ZRC 53448).

Remarks. Recorded in Singapore by Bleeker (1861: 49, as *Synanceia elongata*), Duncker (1904: 152, as *Polycaulus elongatus*), Herre & Myers (1937: 34, as *Polycaulis uranoscopus*), Tham (1950: 35, as *Polycaulus* sp.), Kwik et al. (2010: 128, as *Trachicephalus uranoscopus* [sic]) and Ng et al. (2015: 333). *Trachicephalus uranoscopus* was commonly found inhabiting the soft sediment of estuarine waters in sympatry with *Paracentropogon longispinis*, and was consistently caught in seines.

Family Aploactinidae (velvetfishes)

Acanthosphex leurynnis (Jordan & Seale); dwarf velvetfish
(Fig. 17)



Fig. 17. Lateral view of preserved specimen of *Acanthosphex leurynnis*, 15.2 mm SL (ZRC 60879), from Changi Beach, Singapore, in 2004. (Photograph by: Tan Heok Hui).

Prosopodasys leurynnis Jordan & Seale 1905 (type locality: Hong Kong, China).

Material examined. Changi Beach – ZRC 60879 (2) 2004. Largest specimen examined 15.2 mm SL.

Remarks. Recorded by Tan & Lim (2019: 87) based on the material examined.

Cocotropus ecinatus (Cantor); spiny velvetfish

Corythobatus echinatus Cantor 1849 (type locality: sea of Penang, Malaysia).

Material examined. None.

Remarks. As per *Pterois radiata*, the record of this species in Singapore appears to be erroneously cited by Fowler (1938: 199). His record refers to Cantor's (1849: 1026) original description of *Corythobatus echinatus*, whose type locality is "sea of Penang". There is no mention of Singapore in that passage.

Paraploactis sp.; velvetfish

Material examined. Photographs in Choo & Lim (2013: 49).

Remarks. Unidentified species of the genus *Paraploactis* recorded by Choo & Lim (2013: 49) based on an in situ photograph of a fish off Little Sister Island in the Singapore Strait.

Sthenopus mollis Richardson; soft velvetfish
(Fig. 18)



Fig. 18. Lateral view of preserved specimen of *Sthenopus mollis*, 46.8 mm SL (ZRC 53083), from Changi Beach, Singapore, in 2006. (Photograph by: J. T. B. Kwik).

Sthenopus mollis Richardson 1848 (type locality: sea of China).

Material examined. Bedok – ZRC 2006 (2), 1956; Changi Beach – ZRC 53083 (1) 2006, ZRC 51991 (1) 2008; Singapore Strait at 40 m depth – ZRC 2005 (1) 1955; Singapore Strait at 82 m depth – ZRC 2112 (1) 1956; Singapore Strait off Semakau – ZRC 36711 (1) 1994. Largest specimen examined 54 mm SL (ZRC 51991).

Remarks. Herre (1940: 48, as *Trichopleura mollis*) reported a specimen of 42 mm SL taken on a Singapore reef. This species has been reported from Changi (Ng et al., 2015: 332), as well as from a depth of 246 ft off Saint John's Island (Alfred, 1969: 46, as *Stenopus* [sic] *mollis*).

DISCUSSION

A total of 34 species of scorpionfishes have been recorded from Singapore. Of these, three were included in error, and 11 species are considered unconfirmed because they were either listed without supporting evidence, or are based on material which was not examined to determine if the names were correctly identified. Twenty species were positively identified on the basis of specimens collected and from photographs reliably obtained in the natural environment in Singapore waters.

Fowler (1938) mistakenly cites *Cocotropus echinatus* and *Pterois radiata* as present in Singapore. As did Allen & Erdmann (2012) for *Scorpaenodes smithi*. The stingfish *Choridactylus multibarbus* as well as the lionfishes *Dendrochirus brachypterus* and *Dendrochirus zebra* have been listed as occurring in Singapore waters by Chou et al. (1994) without evidence. The records of *Parascorpaena bandanensis*, *Scorpaenodes guamensis*, *Scorpaenopsis cirrosa*, *Pterois antennata*, *Erosa erosa* and *Synanceia verrucosa* are unconfirmed because we have not examined the relevant specimens to determine if they were accurately identified. The record of *Pterois miles* is based on a photograph, but we are unable to determine if it was photographed in the wild in Singapore. The record of *Apistus carinatus* comes from the fishing port, and it is not possible to know if its location of capture was within Singapore's political boundaries. Except, possibly, for *Scorpaenopsis cirrosa*, which seems restricted to the western Indian Ocean, it should be noted that all the afore-mentioned scorpionfishes occur in surrounding seas in the Indo-West Pacific and can reasonably be expected to occur in Singapore. However, their occurrence in Singapore should be regarded as tentative until reliable evidence in the form of specimens or photographs become available.

This article reveals the occurrence of *Scorpaenopsis possi* and *Scorpaenopsis ramaraoi* in Singapore waters based on specimens previously (mis)identified as *Scorpaenopsis gibbosa* or *Scorpaenopsis venosa* in the ZRC.

The abundance of certain species seems to be linked to the habitats where they are found, and the representation of museum specimens are directly linked to the frequency and thoroughness in the sampling of these habitats. The relatively large numbers of *Paracentropogon longispinis*, *Trachicephalus uranoscopus* and *Synanceia horrida* in the ZRC can be attributed to frequent sampling in intertidal areas where these species were obtained by seine nets and local fish traps (see Kwik et al., 2010; Kwik, 2012). Species represented in small numbers such as *Cottapistus cottoides* and *Richardsonichthys leucogaster* appear to inhabit deeper waters and would be significantly more difficult to obtain. It is not possible to compare Singapore's scorpionfish fauna through time from museum collections and records simply because such data have not been collected in a consistent manner.

The popularity of a few of the more attractively marked species (such as lionfishes) as ornamental fish could affect local biodiversity, through the abandonment of pets or deliberate release (for religious or personal reasons) of specimens imported from neighbouring areas via the aquarium trade. However, this is very difficult or impossible to determine as most species have a wide range across the Indo-West Pacific in the middle of which Singapore is located. Certain species could be locally rare simply because the marine habitats in Singapore are not favoured by them. Their occurrence at very low densities could be natural. For example, the lionfish fauna is dominated by *Pterois russelii*, and *Synanceia horrida* seems to be the only stonefish in our waters. The apparent rarity of *Pterois volitans* and possible absence of *Synanceia verrucosa* appear to suggest their preference for clearer waters and more pristine reef conditions.

Underwater photography has produced some new records, or confirmed some others for Singapore's scorpionfish fauna. *Pterois volitans* and *Paraploactis* are examples where records are based solely on photographic images. However, many of the scorpionfishes with benthic habits can become covered with fouling organisms, which may obscure or hide diagnostic characters that allow for more precise identification. With social media and the availability of affordable equipment for underwater photography, it is certainly possible to discover additional species in the years to come.

ACKNOWLEDGEMENTS

J. T. B. Kwik would like to acknowledge many people who assisted on sampling trips during both fair and foul weather, in particular Paul Chen, Jose Mendoza, Tran Anh Duc, Tan Heok Hui, Zeehan Jaafar and Martyn Low. Thanks to all staff from the Beach Patrol at Sentosa Island who helped with the trap retrievals and specimen collections. K. K. P. Lim is grateful to Hiroyuki Motomura for his help in correcting the identities of many scorpionfish specimens in the Lee Kong Chian Natural History Museum, and to Tan Heok Hui for helping to acquire certain crucial literature and photographs.

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