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MONOGRAPH

Review of the waspfish genus *Neocentropogon* (Tetrarogidae), with a key to genera in the family

Sirikanya Chungthanawong[1] · **Hiroyuki Motomura**[2]

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Abstract

A taxonomic review of the waspfish genus *Neocentropogon* Matsubara 1943 (Tetrarogidae), diagnosed by the following combination of characters: body sparsely covered with small embedded cycloid scales, palatine teeth present, XIII–XVI dorsal-fin spines, the first dorsal fin originating above the orbit, five pelvic-fin soft rays, and membrane of lower four pectoral-fin rays deeply incised, resulted in the recognition of six species: *Neocentropogon aeglefinus* (Weber 1913), *Neocentropogon affinis* (Lloyd 1909a), *Neocentropogon japonicus* Matsubara 1943, *Neocentropogon mesedai* Klausewitz 1985, *Neocentropogon profundus* (Smith 1958), and *Neocentropogon trimaculatus* Chan 1966. *Neocentropogon trimaculatus* (anti-tropically distributed in East Asia and Australia) can be distinguished from its congeners by the presence of three dark blotches on the body (vs. absent or a single blotch); *N. affinis* (eastern Indian Ocean) and *N. aeglefinus* (Philippines to Australia) differ from other congeners in having a black blotch behind the opercle (vs. blotch absent), with the former distinguishable from the latter by dorsal rows of dark spots on the body, and pectoral and caudal fins (vs. spots absent), and 79–96 scale rows in the longitudinal series (vs. 94–137); *N. mesedai* (Red Sea) differs from *N. profundus* (southwestern Indian Ocean) and *N. japonicus* (northwestern Pacific Ocean) in having the lowermost four pectoral-fin rays elongated and XIII (vs. XIV–XVI) dorsal-fin spines, the latter species being separated by the symphyseal knob condition (unremarkable, *N. profundus* vs. pronounced, *N. japonicus*), dark dorsal spots on the body (vs. absent), and 5 anal-fin soft rays (vs. 6 or 7). Keys to the genera of Tetrarogidae and species of *Neocentropogon* are given, including taxonomic status of *Vespicula* Jordan and Richardson 1910 and *Pseudovespicula* Mandrytsa 2001.

Keywords *Vespicula* · *Pseudovespicula* · Taxonomy · Morphology · Redescription

Introduction

The Indo-West Pacific family Tetrarogidae (waspfishes) has been regarded as comprising 18 valid genera, viz., *Ablabys* Kaup 1873, *Centropogon* Günther 1860, *Coccotropsis* Barnard 1927, *Cottapistus* Bleeker 1876a, *Glyptauchen* Günther 1860, *Gymnapistes* Swainson 1839, *Liocranium* Ogilby 1903, *Neocentropogon* Matsubara 1943, *Neovespicula* Mandrytsa 2001, *Notesthes* Ogilby 1903, *Ocosia* Jordan and Starks 1904, *Paracentropogon* Bleeker 1876b, *Pseudovespicula* Mandrytsa 2001, *Richardsonichthys* Smith 1958, *Snyderina* Jordan and Starks 1901, *Tetraroge* Günther 1860, *Trichosomus* Swainson 1839, and *Vespicula* Jordan and Richardson 1910, with 43 valid species overall (Fricke et al. 2020). The family is characterized by a compressed body, head spines, a mobile lacrimal bone, skin at the gill opening not broadly connected to the isthmus, and the lower pectoral-fin rays not separated from other pectoral-fin rays (Poss 1999).

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✉ Sirikanya Chungthanawong
myrthaceae@yahoo.com

Hiroyuki Motomura
motomura@kaum.kagoshima-u.ac.jp

[1] The United Graduate School of Agricultural Sciences, Kagoshima University, 1-21-24 Korimoto, Kagoshima 890-0065, Japan

[2] The Kagoshima University Museum, 1-21-30 Korimoto, Kagoshima 890-0065, Japan

The genus *Neocentropogon* (type species: *Paracentropogon aeglefinus* Weber 1913), one of the most poorly known genera in the family, comprises relatively small, bottom dwelling fishes, characterized by an oblique head profile, the body covered with numerous cycloid scales, palatine teeth present, the dorsal fin with 13–16 spines, its origin anterior to the orbit posterior margin, the last dorsal-fin soft ray membrane posteriorly connected to the dorsal caudal peduncle but not extending onto the upper base of the caudal fin, pelvic fin with 1 spine and 5 soft rays, and lowermost four pectoral-fin rays detached but with their basal half connected by a low membrane. Apart from numerous brief treatments in general classifications and regional faunal studies, *Neocentropogon* has at no time been reviewed on the basis of type and non-type materials; thus, some taxonomic confusion has resulted. Accordingly, the present review of the genus has been made on an Indo-West Pacific basis. Examination of all available type specimens and a large number of non-type specimens of *Neocentropogon* representing wide distributional ranges in this study resulted in six species being regarded as valid. They are redescribed here in detail. Similarly, a key to all genera of Tetrarogidae on the basis of examination of all valid species has never been published, although some authors (e.g., Poss and Rama-Rao 1984; Poss 1999) provided a regional key to some genera. This study aims to provide complete keys to the genera of the family and to the species of the genus, and diagnoses of six species to establish comprehensive taxonomy of *Neocentropogon*, based on examination of numerous specimens.

Materials and methods

Counts and proportional measurements followed Motomura (2004a) and Motomura et al. (2008), except scale counts followed Chungthanawong and Motomura (2018). Standard and head lengths are expressed as SL and HL, respectively. Head spine terminology follows Randall and Eschmeyer (2002: fig. 1) and Motomura (2004b: fig. 1). Osteological characters, including vertebral counts, were observed on radiographs of *Neocentropogon aeglefinus* (8 specimens: CSIRO H 4032-01, MNHN 2006-0256, 2014-0992, QM I. 21498, 32707, 34291, 38959, 38964), *Neocentropogon affinis* Lloyd 1909a (3: KAUM–I. 33280, SAIAB 65706, 2 specimens), *Neocentropogon japonicus* Matsubara 1943 (11: FAKU S511, 103972, KAUM–I. 20392, 20393, 30815, MNHN 1984-0635, 2005-0624, 2005-0709, 2005-1006, 2005-1298, NSMT-P 119710), *Neocentropogon profundus* Smith 1958 (1: MNHN 2006-0008), and *Neocentropogon trimaculatus* Chan 1966 (11: BMNH 1965.11.6.3, FAKU 75091, KAUM–I. 40487, 77115, 88804, MNHN 2003-1850, 2005-2624, 2014-1040, NSMT-P 112288, QM I. 22111, 38768). The formula for configuration of the supraneural bones, anterior neural spines and anterior dorsal-fin pterygiophores follows Ahlstrom et al. (1976). Swimbladder absence was confirmed by dissection of the abdomen on the right side of the body in *N. aeglefinus* (2: QM I. 21498, 2), *N. affinis* (KAUM–I. 33280), *N. japonicus* (8: FAKU S511, S512, 103972, KAUM–I. 20393, 30815, 81861, 114281, 114289), *N. trimaculatus* (5: KAUM–I. 77115, 77117, 88804, 97509, 97510). Color descriptions are based on preserved specimens. The key to genera was based on specimens representing 39 species in 17 genera examined during this study (see Material examined for key to genera), and the original descriptions of four species (Bleeker 1848; Weber 1913; Poss and Eschmeyer 1975; Fricke 2017). Comparative features for the genera are provided in Table 1. Institutional codes follow Sabaj (2019).

Key to the genera of Tetrarogidae

1a. Body covered with small scales 2
1b. Body not covered with scales 13
2a. Pelvic-fin rays I, 4 3
2b. Pelvic-fin rays I, 5 6
3a. Three anteriormost dorsal-fin spines forming separate fin; cirri or papillae on head and dorsal surface of body; lateral line running along dorsal-fin base; first dorsal-fin spine origin posterior to posterior margin of orbit ..... *Trichosomus*
3b. Anteriormost dorsal-fin spines not forming separate fin; cirri and papillae absent from body; lateral line not close to dorsal-fin base; first dorsal-fin spine origin anterior to posterior margin of orbit 4
4a. Dorsal-fin origin distinctly anterior to anterior margin of orbit ..... *Cottapistus*
4b. Dorsal-fin origin distinctly posterior to anterior margin of orbit 5
5a. Dorsal-fin spines XIII or XIV (usually XIII); pectoral-fin rays 13–15; palatine teeth absent ..... *Liocranium*
5b. Dorsal-fin spines XIV or XV, pectoral-fin rays 10 or 11; palatine teeth present ..... *Paracentropogon*
6a. Dorsal-fin origin distinctly anterior to posterior margin of orbit 7
6b. Dorsal-fin origin distinctly posterior to posterior margin of orbit 9
7a. Head profile almost vertical, slightly concave; dorsal-fin spines XV–XVIII; membrane of last dorsal-fin soft ray posteriorly connected to caudal peduncle and upper base of caudal fin ..... *Ablabys*
7b. Head profile oblique, straight; dorsal-fin spines XII–XVI; membrane of last dorsal-fin soft ray posteriorly connected to dorsal caudal peduncle but not extending onto upper base of caudal fin 8

Table 1 Comparative features for genera in the family Tetrarogidae

	Dorsal-fin spines	Pelvic-fin soft rays	Pectoral-fin rays	Lateral-line pores	Upper jaw length (% of HL)	Orbit diameter (% of SL)	Cirri, papillae, or tentacles on		
							Head	Body	Eyes
Ablabys	15–18	5	11–13	12–13*, 18–25	26.1–40.4	8.2–12.7	Absent	Absent	Absent
Centropogon	15–17	5	13–14	24–28	30.3–43.8	11.1–16.0	Absent	Absent	Absent
Coccotropsis	14–15	3	11–12	7–10	41.7–47.3	7.7–10.3	Absent	Absent	Absent
Cottapistus	14–15	4	14	20–24	51.9–53.0	9.1–10.7	Absent	Absent	Absent
Glyptauchen	17	5	13–14	24–26	22.7–29.2	11.9–13.4	Absent	Absent	Absent
Gymnapistes	13	5	11–12	23–25	40.8–42.4	10.9–14.0	Absent	Absent	Absent
Liocranium	13–14	4	13–15	19–23	41.6–45.9	12.3–15.7	Absent	Absent	Absent
Neocentropogon	13–16	5	13–16	18–26	37.4–49.9	10.5–17.0	Absent	Absent	Absent
Neovespicula	13	5	10–11	19–21	37.9–44.0	8.8–9.6	Absent	Absent	Absent
Notesthes	15	5	11–12	28–29	39.5–41.3	7.7–8.4	Absent	Absent	Absent
Ocosia	14–17	5	12–13	14–19, 26–27**	31.2–41.8	9.1–13.0	Absent	Absent	Absent
Paracentropogon	14–15	4	10–11	15–22	30.4–38.9	10.9–13.7	present	Absent	Absent
Pseudovespicula	12–14	5	11–14	15–21	35.7–49.6	9.6–14.0	Absent	Absent	Present***
Richardsonichthys	12–13	5	14–17	9–14	48.8–52.9	14.0–16.4	Absent	Absent	Present
Snyderina	12–13	5	13–16	20–26	34.6–51.1	9.9–15.5	Present/Absent	Absent	Absent
Tetraroge	13–14	5	12	14–18	36.5–45.9	9.4–12.7	Present	Present	Present
Trichosomus	15–16	4	12–13	11–17	42.8–52.4	6.7–9.6	Present	Present	Present

	Head profile	Nape profile	Position of opercular tip relative to dorsal-fin base	Teeth on palatines	Scales on body	Position of lateral line relative to dorsal-fin base
Ablabys	Almost vertical, slightly concave	Flattened	Well separated	Present	Present	Well separated
Centropogon	Oblique, convex	Flattened	Well separated	Present	Present	Well separated
Coccotropsis	Oblique, slightly convex	Flattened	Well separated	Absent	Absent	Well separated
Cottapistus	Oblique, slightly convex	Flattened	Well separated	Present	Present	Well separated
Glyptauchen	Vertical, squarish	Concave	Well separated	Present	Present	Well separated
Gymnapistes	Oblique, slightly convex	Flattened	Well separated	Present	Absent	Well separated
Liocranium	Oblique, straight	Flattened	Well separated	Absent	Present	Well separated
Neocentropogon	Oblique, straight	Flattened	Well separated	Present	Present	Well separated
Neovespicula	Oblique, straight	Flattened	Well separated	Present	Present	Well separated
Notesthes	Oblique, straight	Flattened	Well separated	Present	Present	Well separated
Ocosia	Oblique, straight	Flattened	Well separated	Present	Absent	Well separated
Paracentropogon	Oblique, straight	Flattened	Well separated	Present	Present	Well separated
Pseudovespicula	Oblique, straight	Flattened	Well separated	Present	Present	Well separated
Richardsonichthys	Oblique, convex	Flattened	Adjacent	Present	Absent	Close
Snyderina	Oblique, straight	Flattened	Well separated	Absent	Present	Well separated
Tetraroge	Oblique, straight	Flattened	Well separated	Present	Absent	Well separated
Trichosomus	Oblique, straight	Flattened	Adjacent	Present	Present	Close

	Cleithral spines	Position of dorsal-fin origin relative to posterior margin of orbit	Anterior dorsal-fin spines forming separate fin	Membrane of last dorsal-fin soft ray posteriorly connected to upper basal caudal fin	Lowermost four pectoral-fin rays detached
Ablabys	Absent	Anterior	No	Yes	No
Centropogon	Present	Posterior	No	No	No
Coccotropsis	Present	Anterior	No	No	No

Table 1 (continued)

	Cleithral spines	Position of dorsal-fin origin relative to posterior margin of orbit	Anterior dorsal-fin spines forming separate fin	Membrane of last dorsal-fin soft ray posteriorly connected to upper basal caudal fin	Lowermost four pectoral-fin rays detached
Cottapistus	Absent	Anterior	No	No	No
Glyptauchen	Present	Posterior	No	No	No
Gymnapistes	Absent	Posterior	No	No	No
Liocranium	Absent	Anterior	No	No	No
Neocentropogon	Absent	Anterior	No	No	Yes
Neovespicula	Absent	Posterior	No	No	No
Notesthes	Present	Posterior	No	No	No
Ocosia	Absent	Anterior	No	No	No
Paracentropogon	Absent	Anterior	No	No	No
Pseudovespicula	Absent	Posterior	No	No	No
Richardsonichthys	Absent	Anterior	No	No	No
Snyderina	Absent	Anterior	No	No	No
Tetraroge	Far away	Anterior	No	No	No
Trichosomus	Close	Posterior	Yes	No	No

* In *A. pauciporus*

** In *O. sphex*

*** In *V. cypho*

8a. Palatine teeth present; dorsal-fin spines XIII–XVI; four lowermost pectoral-fin rays detached, basal half connected by low membrane ..... *Neocentropogon*

8b. Palatine teeth absent; dorsal-fin spines XII–XIII; lowermost four pectoral-fin rays not detached ..... *Snyderina*

9a. Head profile vertical, squarish; mouth small, 22.7–29.2% of HL; nape deeply and broadly concave ..... *Glyptauchen*

9b. Head profile oblique; mouth large, greater than 30.0% of HL; nape flattened 10

10a. Dorsal fin continuous, without deeply incised membrane between third and fourth dorsal-fin spines; cleithral spine present 11

10b. Dorsal fin continuous with deeply incised membrane between third and fourth dorsal-fin spines (almost to dorsal-fin base); cleithral spine absent 12

11a. Pectoral-fin rays 13 or 14; dorsal-fin origin vertical through preopercular margin; orbit diameter 11.1–16.0% of SL ..... *Centropogon*

11b. Pectoral-fin rays 11 or 12; dorsal-fin origin distinctly posterior to preopercular margin; orbit diameter 7.7–8.4% of SL ..... *Notesthes*

12a. Dorsal-fin origin vertical through preopercular margin ..... *Neovespicula*

12b. Dorsal-fin origin distinctly anterior to preopercular margin ..... *Pseudovespicula*

13a. Pelvic-fin rays I, 3; palatine teeth absent ..... *Coccotropsis*

13b. Pelvic-fin rays I, 5; palatine teeth present 14

14a. Dorsal-fin origin distinctly posterior to posterior margin of orbit ..... *Gymnapistes*

14b. Dorsal-fin origin distinctly anterior to posterior margin of orbit 15

15a. Head profile oblique, convex; dorsal tentacles on eye; lateral line running just below dorsal-fin base; tip of opercle curved dorsally, almost reaching to dorsal-fin base ..... *Richardsonichthys*

15b. Head profile oblique, straight; tentacles absent on eyes; lateral line well separated from dorsal-fin base; tip of opercle not reaching to dorsal-fin base 16

16a. Small papillae on eyes, head, and body; dorsal-fin spines XIII or XIV ..... *Tetraroge*

16b. No small papillae on eyes, head, and body; dorsal-fin spines XIV–XVII ..... *Ocosia*

Taxonomic status of *Vespicula* and *Pseudovespicula*

Vespicula was originally proposed by Jordan and Richardson (1910) as a new monotypic genus for *Prosopodasys gogorzae* Jordan and Seale 1905, originally described on the basis of a single specimen from the Philippines. Jordan and Richardson (1910) also distinguished *Vespicula* from *Prosopodasys* Cantor 1849 on the basis of the dorsal fin with the three anteriormost spines forming an almost completely

separated fin (vs. not forming a separate fin in the latter). Recently, Mandrytsa (2001) regarded *Prosopodasys* as an objective synonym of *Apistus* Cuvier 1829 (Apistidae). Previously, Dor (1984) and Randall (1995) had treated *Apistus bottae* Sauvage 1878 and *Apistus dracaena* Cuvier 1829 as members of *Vespicula*, and Poss (1999) had included *Prosopodasys cypho* Fowler 1938 (type locality: Philippines), *Apistes depressifrons* Richardson 1848 (Japan), *Apistus trachinoides* Cuvier 1829 (Indonesia), and *Apistus zollingeri* Bleeker 1848 (Indonesia) in the genus *Vespicula*. Due to *A. depressifrons*, *A. dracaena*, and *A. trachinoides* being recently placed into three monotypic genera, *Neovespicula*, *Pseudovespicula*, and *Trichosomus*, respectively (Mandrytsa 2001; Kottelat 2013), and *V. bottae* and *V. gogorzae* being regarded as junior synonyms of *Trichosomus trachinoides* (Kottelat 2013; this study, see Material examined for key to genera), only two species, *V. cypho* and *V. zollingeri*, are currently regarded as members of *Vespicula*.

Pseudovespicula was proposed by Mandrytsa (2001) for *A. dracaena* following comparison with *A. trachinoides*, which he regarded as belonging to *Vespicula* (but later placed in *Trichosomus* – see above). Although Mandrytsa (2001) did not compare *P. dracaena* with either *V. cypho* or *V. zollingeri*, the three species are herein regarded as belonging to a single genus due to their sharing the following major generic characters: dorsal-fin membrane between third and fourth spines deeply incised, forming a nearly separate fin; dorsal-fin origin directly above posterior margin of orbit; 5 pelvic-fin soft rays; pectoral-fin rays not detached; body with small cycloid scales, without cirri or papillae; lateral line well separated from dorsal-fin base; teeth on palatine; head profile oblique, straight; and nape flattened.

Because *P. gogorzae*, the type species of *Vespicula*, has been regarded as a junior synonym of *Trichosomus trachinoides*, *Vespicula* is considered a junior synonym of *Trichosomus*. Therefore, *V. cypho* and *V. zollingeri* are regarded herein as species of *Pseudovespicula*.

Neocentropogon Matsubara 1943

Neocentropogon Matsubara 1943: 429 (type species: *Paracentropogon aeglefinus* Weber 1913, by original designation)

Gadapistus de Beaufort, 1949: 68 (type species: *Paracentropogon aeglefinus*)

Diagnosis. A genus of the family Tetrarogidae with the following combination of characters: XIII–XVI, 6–8 dorsal-fin rays, its origin anterior to vertical through posterior margin of orbit; anteriormost dorsal-fin spines not forming separate fin; membrane of last dorsal-fin soft ray not connected posteriorly to upper caudal-fin base; I, 5 pelvic-fin rays; 13–16 pectoral-fin rays, four lowermost rays simple and detached, their basal half connected by low membrane; head and snout profile oblique; nape flattened; mouth large [37.4–49.9 (mean 45.2)% HL]; body sparsely covered with small embedded, non-imbricate cycloid scales; cirri and papillae absent on head and body; cleithral spine absent; small conical teeth on palatines; 18–26 lateral-line pores; lateral line running along upper one-third of body; tip of opercle directed backward, below lateral line.

Description. Body somewhat elongated, laterally compressed, progressively more compressed posteriorly, caudal peduncle short. Scales absent on head, pre-dorsal-fin area, dorsal- and anal-fin bases. Tentacles, cirri and skin flaps absent on head, body and fins. Lateral line straight, extending from above supracleithral spine to caudal-fin base, one lateral-line pore near caudal-fin base.

Head profile oblique with shallow concavity in front of eyes. Two nasal openings in front of orbit, subequal in diameter, tubular; anterior nostril higher than posterior nostril. Interorbital space convex; interorbital ridges weakly developed; median interorbital ridge and spines absent; ascending process of premaxilla intruding slightly into interorbital space. Nuchal, pterotic, upper posttemporal, lower posttemporal, and supracleithral forming ridges with minute spines, entirely covered with skin. Suborbital ridge weak, without spines, connected posteriorly to base of uppermost preopercular spine. Preopercle with 5 simple spines; uppermost longest, sharp, projecting from skin; second and third short, sharp, projecting from skin; fourth and fifth blunt, with broad base, hidden under skin. Opercle with smooth V-shaped crests; upper crest with minute sharp spine projecting from skin; lower crest with weak blunt spines. Cleithral bone flattened, covered with thick skin. Lacrimal with 2 simple sharp spines; anterior lacrimal spine short, directed ventrally; its tip extending well beyond dorsal margin of maxilla; posterior lacrimal spine longer, directed posteriorly. Mouth moderately large, terminal, slightly oblique; maxillary extending posteriorly to about level with middle of eye, symphyseal knob present. Lips thick; gill rakers rather short, blunt; no slit behind last gill arch.

Dorsal fin continuous; origin anterior to posterior margin of orbit; 3 anteriormost dorsal-fin spines somewhat separated from rest of fin; spinous membrane of fin deeply notched; last dorsal-fin ray membrane connected posteriorly to caudal peduncle. Anal fin continuous, III, 5–8 anal-fin rays; origin about level with origin of eleventh dorsal-fin spine; membranes of spinous portion notched; membrane of last dorsal-fin ray posteriorly connected to caudal peduncle. Pectoral fin with 13–16 rays; uppermost and lower four rays unbranched, reaching or extending beyond origin of first anal-fin spine; posterior margin of fin rounded. Origin of pelvic fin level with vertical through lower end of pectoral-fin base; posterior tip of depressed fin usually almost reaching anus. Caudal fin rounded. Vertebrae 11 + 14, including hypural. Swimbladder present. Formula for configuration of supraneural bones, anterior neural spines and

anterior dorsal pterygiophores 2+1/1/1/1/1/1/1/1/1/1/1/1/ (2+1/1/1/1/1/1/1/1/1/1/1/1/1/ in *N. japonicus*). Epineurals usually 13 (14 in *N. japonicus*).

Remarks. *Neocentropogon aeglefinus* was originally described by Weber (1913) as a species of *Paracentropogon* on the basis of the following six characters: body covered with small cycloid scales, 4 or 5 preopercular spines, 8 or 9 dorsal-fin soft rays, 4–6 anal-fin soft rays, 6 branchiostegal rays, and no slit behind the last gill arch. Subsequently, Matsubara (1943) recognized that *P. aeglefinus* differed from *Paracentropogon* in eight characters: I, 5 pelvic-fin rays (vs I, 4 in the latter); symphyseal knob present (vs absent); all branchiostegal rays enlarged (vs 5 posteriormost rays only enlarged); actinosts narrow (vs wide); pyloric caeca teat-like (vs tube-like); posttemporal forked anteriorly, firmly attached to but not forming an integral part of the cranium (vs thick and strong, slightly emarginated anteriorly, immovably attached to and forming an integral part of the cranium), first pair of parapophyses on eighth vertebra (vs on fifth or sixth vertebra), vertebrae 25 including hypural (vs 24–27, usually 26), and placed the species in his new genus *Neocentropogon*, which was also regarded here as a valid genus.

Neocentropogon is distinguished from all other genera in the family by the combination of characters given in the Diagnosis (above). The simple four lowermost pectoral-fin rays with their basal half connected by low membrane is a unique character within the family.

De Beaufort (1949) proposed a new genus, *Gadapistus*, for *P. aeglefinus* on the basis of three characters: dorsal-fin origin anterior to posterior margin of orbit (vs above orbit in *Paracentropogon*); 5 pelvic-fin soft rays (vs 4), and symphyseal knob present (vs absent). However, *Gadapistus* is regarded as an objective junior synonym of *Neocentropogon*, the type species of the two genera being the same (Mandrytsa 2001; this study).

After detailed examination of 202 specimens of *Neocentropogon*, this study recognizes the following six species in it: *N. aeglefinus*; *N. affinis*; *N. japonicus*; *N. mesedai*; *N. profundus*; *N. trimaculatus.* This membership is newly recognized here because a comprehensive taxonomic revision of this genus has not been performed before.

Key to the species of *Neocentropogon*

1a. Body with single large dark blotch behind opercle 2
1b. Body without large dark blotch behind opercle 4
2a. Two dark blotches basally on dorsal fin; head with brownish stripes radiating from pupil; symphyseal knob unremarkable; postocular spine present; four lowermost pectoral-fin rays elongated; anal-fin soft rays 6–8 (usually 7) ..... *N. trimaculatus*
2b. No dark blotches basally on dorsal fin; head without brownish stripes; symphyseal knob pronounced; postocular spine absent; four lowermost pectoral-fin rays not elongated; anal-fin soft rays 5 or 6 (usually 6) 3
3a. Rows of dark spots on dorsal half of trunk, and dorsal, pectoral and caudal fins; scale rows in longitudinal series 79–96; scale rows above lateral line 0–8 .... *N. affinis*
3b. Dark spots absent from trunk and fins; scale rows in longitudinal series 94–137; scale rows above lateral line 8–17 ..... *N. aeglefinus*
4a. Dorsal-fin spines XIII; four lowermost pectoral-fin rays elongated; lateral-line pores 18 ..... *N. mesedai*
4b. Dorsal-fin spines XIV–XVI; lowermost pectoral-fin rays not elongated; lateral-line pores 19–24 5
5a. Symphyseal knob unremarkable; irregular dark spots on dorsal body surface; dorsal-fin spines XIV; anal-fin soft rays 5; scale rows in longitudinal series 71–76; scale rows above lateral line 5–8; postocular spine absent; orbit diameter 15.4–17.0 % of SL .... *N. profundus*
5b. Symphyseal knob pronounced; no dark spots on dorsal body; dorsal fin spines XIV–XVI (usually XV); anal-fin soft rays 6 or 7 (usually 7); scale rows in longitudinal series 97–139; scale rows above lateral line 10–21; postocular spine present; orbit diameter 11.4–14.1% of SL ..... *N. japonicas*

Neocentropogon aeglefinus **(Weber** 1913)
(English name: Onespot Waspfish)
(Figs. 1a, 3, 4a–c, 5; Tables 2, 3)

Paracentropogon aeglefinus Weber 1913: 500, pl. 6, fig. 8 (type locality: Halmahera Sea, Timor Sea, Savu Sea, Sumbawa, Indonesia); Nijssen et al. 1993: 81 (Indonesia)

Neocentropogon aeglefinis [sic]: Hutchins 2001: 27 (Western Australia, Australia)

Neocentropogon aeglefinus: Allen et al. 2006: 900 (Northwest Shelf, Western Australia; tropical, east-Indo-west Pacific)

Neocentropogon affinis (not of Lloyd): Iwamoto and McCosker 2014: 287, pl. 16, fig. 92 (between Luzon and Mindoro, Philippines)

Material examined. 77 specimens (29.6–116.4 mm SL)—**AUSTRALIA:** AMS I. 16725-007, 29.6 mm SL, Sydney Heads, New South Wales (NSW), 33°87′S, 151°62′E, FRV *Kapala*; AMS I. 33598-002, 31.6 mm SL, NSW, 32°88′S, 152°00′E, FRV *Kapala*; AMS I. 37355-018, 3 specimens, 67.2–113.0 mm SL, Swain Reefs, Queensland (Qld), 22°13′08″S, 153°03′12″E, J. Lowry and K. Dempsey; AMS I. 37476-003, 30.6 mm SL, off Newcastle, NSW, 33°12′S, 151°75′E, FRV *Kapala*; AMS I. 37492-001, 33.8 mm SL,

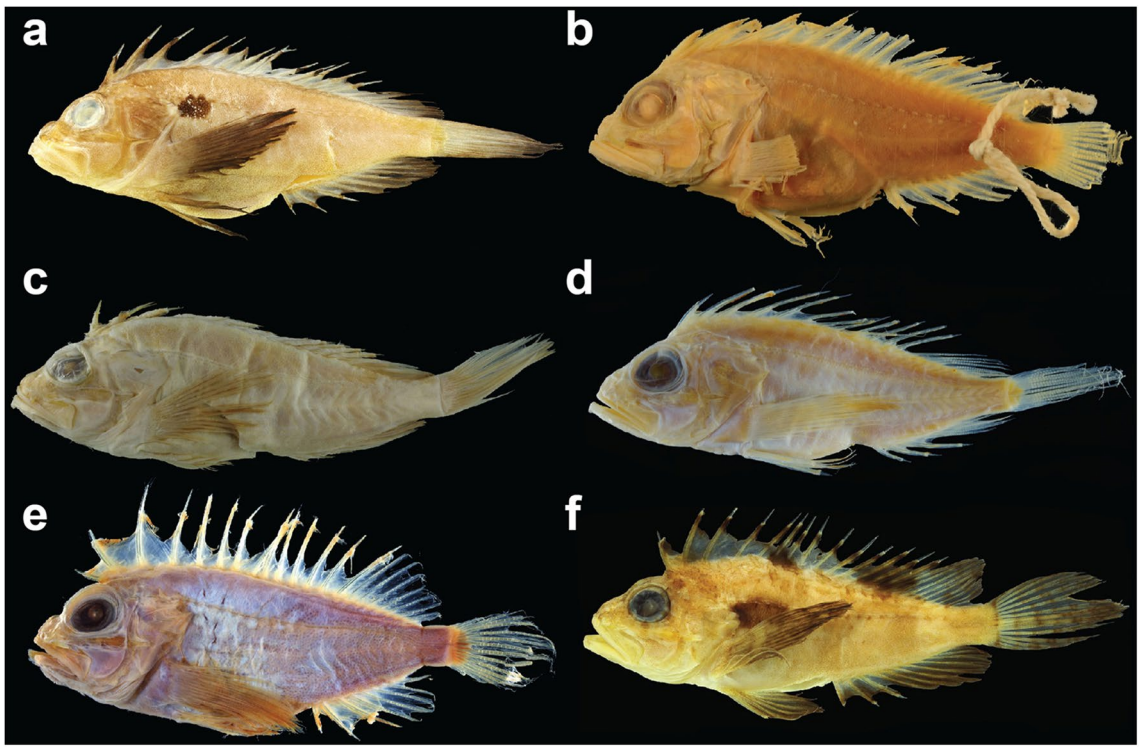

Fig. 1 Preserved specimens of **a** *Neocentropogon aeglefinus*, QM I. 38596, 1 of 2 specimens, 88.7 mm SL, Australia; **b** *N. affinis*, ZSI 1172/2–1178/2, syntype, 1 of 4 specimens, 59.8 mm SL, India; **c** *N. japonicus*, FAKU 1761, holotype, 97.9 mm SL, Japan; **d** *N. mesedai*, SMF 20198, holotype, 62.1 mm SL, Red Sea; **e** *N. profundus*, SAIAB 300, holotype, 56.4 mm SL, off Mozambique; **f** *N. trimaculatus*, BMNH 1965.11.6.3, holotype, 80.8 mm SL, off Hong Kong

Table 2 Frequency distribution of selected meristics in species of *Neocentropogon*

	Dorsal-fin spines				Dorsal-fin soft rays			Pectoral-fin rays (one side/other side)					Anal-fin soft rays			
	13	14	15	16	6	7	8	13/14	14/14	14/15	15/15	15/16	5	6	7	8
N. aeglefinus	3	63	1		1	57	9	1	7	3	53	3	1	66		
N. affinis		7^{S}				6^{S}	1^{S}				7^{S}			7^{S}		
N. japonicus		1	65^{H}	6	9	63^{H}			3	2	67^{S}			19	53^{H}	
N. mesedai	1^{H}						1^{H}		1^{H}				1^{H}			
N. profundus		5^{S}				5^{S}				1^{H}	4		5^{H}			
N. trimaculatus																
Northern Hemisphere		9^{H}	3		2	6	4^{H}		1	3	7^{H}	1			11^{H}	1
Southern Hemisphere	1	24	1			5	21		2	6	18			2	23	1

	Lateral-line pores									Total gill rakers								
	18	19	20	21	22	23	24	25	26	12	13	14	15	16	17	18	19	20
N. aeglefinus			1	7	20	34	5			1	1	17	21	14	5	5	1	
N. affinis					2^{S}	4^{S}	1^{S}					1^{S}	1^{S}	3^{2S}	2			
N. japonicus		2	5	11	31^{H}	20	3					1	2^{H}	13	23	26	7	
N. mesedai	1^{H}													1^{H}				
N. profundus					1^{H}	3	1			1^{H}	1	3						
N. trimaculatus																		
Northern Hemisphere					1		8^{H}	3						2	7^{H}	1	2	
Southern Hemisphere				2	2	1	12	8	1						7	11	6	2

^{H} and ^{S} indicate holotype and syntype, respectively

Table 3 Counts and measurements in *Neocentropogon aeglefinus*, *N. affinis*, *N. japonicus,* and *N. mesedai*

	N. aeglefinus		*N. affinis*			*N. japonicus*			*N. mesedai*
	Non-types $n = 77$		Syntypes $n = 4$	Non-types $n = 3$		Holotype FAKU 1761	Non-types $n = 73$		Holotype SMF 20198
Standard length (SL; mm)	29.6–116.4		56.2–67.2	60.6–73.9		97.9	27.5–108.5		62.1
Counts		Modes			Modes			Modes	
Dorsal-fin rays	XIII–XV, 6–8	XIV, 7	XIV, 7–8	XIV, 7	XIV, 7	XV, 7	XIV–XVI, 6–7	XV, 7	XIII, 8
Anal-fin rays	III, 5–6	III, 6	III, 6	III, 6	III, 6	III, 7	III, 6–7	III, 7	III, 5
Pectoral-fin rays (one side/other side)	14–16/13–15	15/15	15/15	15/15	15/15	15/15	14–15/15	15/15	14/14
Pelvic-fin rays	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5
Scale rows in longitudinal series	94–137	104	79–96	86–94	80	114	97–139	117	85
Scale rows above lateral line	8–17	14	0–7	7–8	7	15	10–21	14	2
Scale rows below lateral line	28–42	35	28–34	28–36	28	38	29–44	32	30
Scale rows between last dorsal-fin spine base and lateral line	8–14	10	8–10	8–10	10	12	8–16	10	7
Scale rows between sixth dorsal-fin spine base and lateral line	9–19	16	8–13	10–13	10	21	12–23	16	5
Lateral-line pores	21–24	23	22–24	22–23	23	22	19–24	22	18
Gill rakers (upper + lower = total)	2–5 + 9–14 = 12–19	4 + 12 = 15	2–4 + 12 = 14–16	4 + 12–13 = 16–17	4 + 12 = 16	4 + 11 = 15	3–5 + 11–14 = 14–19	4 + 13 = 18	4 + 12 = 16
Measurements (% of SL)		Means			Means			Means	
Head length (HL)	37.1–44.0	40.6	40.3–40.8	41.6–42.0	41.1	39.3	36.7–42.8	39.6	42.5
Head width	19.5–27.4	23.2	20.8–24.4	19.3–24.1	22.5	21.2	18.1–25.3	21.5	20.1
Snout length	8.1–11.8	9.7	8.8–10.1	9.0–10.3	9.5	9.4	7.6–11.7	10.0	11.1
Body depth	27.5–37.1	30.7	31.6–33.9	29.4–31.8	32.0	29.7	27.7–38.6	31.5	32.2
Body width	16.7–28.7	21.1	17.6–21.5	16.7–21.0	19.3	16.7	13.6–24.2	18.8	17.4
Orbit diameter	11.8–15.3	13.5	13.0–14.8	13.2–13.5	13.7	12.5	11.4–14.1	12.7	13.7
Suborbital width	2.5–5.2	3.8	3.1–4.0	3.6–3.8	3.6	3.6	1.7–5.2	3.8	6.4
Interorbital width	3.6–7.3	5.2	5.4–5.9	5.3–5.9	5.6	5.4	4.4–6.5	5.5	–
Upper-jaw length	16.3–20.1	18.3	19.1–19.4	18.1–19.6	19.1	18.3	16.6–19.6	18.2	18.4
Postorbital length	17.2–20.2	18.9	17.6–19.8	19.4–20.6	19.4	18.1	15.7–20.2	18.4	19.8
Pre-dorsal-fin length	18.9–24.6	21.8	20.5–23.8	21.9–23.1	22.7	21.7	18.4–26.0	21.4	23.5
Pre-anal-fin length	56.7–70.0	64.8	62.4–68.7	64.1–64.7	65.2	65.6	58.9–70.5	65.0	68.1
Pre-pelvic-fin length	31.7–44.5	35.9	35.4–42.3	34.8–36.4	36.6	32.7	31.6–45.3	35.5	38.0
Caudal-peduncle depth	7.4–10.0	8.8	8.8–9.6	8.0–9.1	8.9	11.2	8.0–14.3	8.8	8.1

Table 3 (continued)

	N. aeglefinus		*N. affinis*			*N. japonicus*			*N. mesedai*
	Non-types $n = 77$		Syntypes $n = 4$	Non-types $n = 3$		Holotype FAKU 1761	Non-types $n = 73$		Holotype SMF 20198
Standard length (SL; mm)	29.6–116.4		56.2–67.2	60.6–73.9		97.9	27.5–108.5		62.1
Caudal-peduncle length	10.8–19.6	15.8	14.9–18.2	15.3–17.7	16.2	16.3	12.3–18.1	15.7	13.8
Dorsal-fin base length	63.7–77.0	71.0	65.5–78.4	73.5–74.6	72.8	72.5	68.3–82.0	74.3	71.3
Anal-fin base length	20.0–27.2	23.6	20.2–23.3	21.8–24.0	22.3	23.5	18.4–27.6	23.0	–
Caudal-fin length	26.2–38.3	32.9	26.6	27.6–31.9	29.1	30.3	28.5–37.4	32.5	–
Pectoral-fin length	31.5–43.4	36.2	33.0–36.9	32.9–35.2	34.4	31.0	29.0–43.5	33.8	40.0
Posterior lacrimal spine length	6.4–13.4	10.0	8.9–9.8	9.2–10.1	9.5	8.8	5.4–11.5	9.0	8.7
First dorsal-fin spine length	6.7–18.3	11.6	8.0–10.3	9.6–12.5	10.2	9.3	7.9–14.9	9.8	13.2
Second dorsal-fin spine length	13.6–30.0	18.8	16.1–18.5	15.5–20.4	17.9	14.4	11.1–22.0	15.0	–
Third dorsal-fin spine length	15.2–33.6	19.5	15.2–15.5	16.1–19.9	16.7	15.8	12.6–22.0	16.4	24.3
Fourth dorsal-fin spine length	12.5–22.5	16.1	11.6–13.6	12.0–15.7	13.5	14.4	12.3–19.0	14.5	23.5
Fifth dorsal-fin spine length	10.1–20.0	15.3	11.9–14.5	10.7–14.3	13.0	14.1	11.3–18.7	14.0	22.4
Sixth dorsal-fin spine length	11.1–18.2	15.2	11.0–14.5	11.5–14.6	12.8	13.9	11.1–19.2	13.9	–
Penultimate dorsal-fin spine length	13.0–20.4	16.7	–	15.2–15.4	15.3	15.0	13.1–19.5	16.1	–
Last dorsal-fin spine length	14.2–20.6	17.4	14.2–17.4	15.5–15.6	15.6	15.6	13.9–19.5	16.4	18.4
Longest dorsal-fin soft ray length	17.2–23.9	20.9	–	20.0–20.8	20.4	18.5	15.6–23.7	19.4	22.1
First anal-fin spine length	4.3–11.3	7.6	5.2–6.2	6.5–7.9	6.7	7.3	5.5–11.5	7.8	10.8
Second anal-fin spine length	8.7–15.7	11.3	9.9–14.8	10.4–12.6	11.8	10.0	9.1–16.9	11.2	15.6
Third anal-fin spine length	11.7–18.8	14.4	13.4–14.7	12.4–15.0	14.0	11.8	11.3–18.5	14.1	20.1
Longest anal-fin soft ray length	11.9–25.5	19.3	14.1	18.3–20.9	18.3	18.8	13.6–22.4	19.2	22.7
Pelvic-fin spine length	14.2–25.1	17.4	16.7–18.5	16.2–19.4	17.9	13.7	13.1–23.9	16.1	21.3
Longest pelvic-fin soft ray length	18.6–29.7	24.0	25.5	21.6–25.4	24.5	20.9	17.7–27.3	22.1	27.7
Measurements (% of HL)									
Upper-jaw length	40.1–49.2	45.0	47.1–47.7	43.3–46.8	46.5	46.7	42.9–49.9	46.1	43.2

off Newcastle, NSW, 32°90′S, 151°97′E, FRV *Kapala*; AMS I. 37600-009, 2, 86.2–108.9 mm SL, Swain Reefs, Qld, 22°26′45″S, 153°09′10″E, J. Lowry and K. Dempsey; AMS I. 38419-001, 86.3 mm SL, off Newcastle, NSW, 32°09′S, 152°00′E, K. Graham; CSIRO B 4106, 6, 32.2–44.5 mm SL, off Monte Bello Islands, Western Australia (WA), 19°36′S, 116°12′E, 124 m depth, mesh wing trawl, CSIRO, 1 June 1980; CSIRO H 4032-01, 6, 47.0–62.4 mm SL, off Cape Lambert, WA, 19°03′S, 117°23′E, 146–154 m, Frank and Bryce demersal trawl, A. Graham and G. Yearsley, 30 Aug. 1995; CSIRO H 7267-04, 3, 84.1–108.2 mm SL, Swain Reefs, Qld, 22°51′S, 152°30′E, 132–134 m, prawn trawl, C. Rigby, 6 June 2011; CSIRO H 7277-01, 113.3 mm SL, Swain Reefs, Qld, 22°43′S, 152°38′E, 130 m, prawn trawl, C. Rigby, 24 June 2011; QM I. 21498, 2, 86.7–102.9 mm SL, Swain Reefs, Qld, 22°06′S, 153°02′E, 150 m, trawl, 28 Aug. 1983; QM I. 32707, 81.0 mm SL, Coolum, Qld, 26°35′S, 153°36′E, 114 m, trawl, 17 May 2001; QM I. 34047, 3, 35.6–97.3 mm SL, Qld, 27°48′S, 153°49′E, trawl, 17 July 2003; QM I. 34291, 10, 48.1–64.5 mm SL, Dampier, WA, 19°03′S, 117°22′E, 146 m, trawl, 30 Aug. 1995; QM I. 34330, 48.6 mm SL, east of Noosa, Qld, 26°25′S, 153°40′E, 119 m, trawl, 19 July 2002; QM I. 37930, 45.5 mm SL, Swain Reefs, Qld, 22°17.01′S, 152°47.07′E, 108 m, dredge, 16 Nov. 2005; QM I. 38595, 66.6 mm SL, east of Noosa, Qld, 26°19′S, 153°46′E, 109 m, trawl, 1 May 2009; QM I. 38596, 2, 69.9–88.7 mm SL, east of Noosa, Qld, 26°18.27′S, 153°46.15′E, 108 m, trawl, 30 Apr. 2009; QM I. 38959, 2, 87.0–100.9 mm SL, off Swain Reefs, Qld, 22°46.67′S, 152°36.49′E, 132–134 m, trawl, 5 June 2011; QM I. 38960, 107.0 mm SL, off Swain Reefs, Qld, 22°55.12′S, 152°14.86′E, 124–126 m, trawl, 27 June 2011; QM I. 38964, 102.7 mm SL, east of Swain Reefs, Qld, 22°08′S, 153°03′E, 150 m, trawl, 30 Apr. 2009; QM I. 38965, 2, 86.0–116.4 mm SL, south of Swain reefs, Qld, 22°42′S, 152°49′E, 138 m, trawl, 20 June 2009; QM I. 38966, 89.0 mm SL, Swain Reefs, Qld, 22°48.00′S, 153°36.00′E, 133 m, trawl, 25 Apr. 2009. **INDONESIA:** AMS I. 24305-001, 93.53 mm SL, South Java, 08°45′S, 117°78′E, T. Gloerfelt-Tarp. **PHILIPPINES:** CAS 235562, 3, 51.4–82.7 mm SL, between Luzon and Mindoro, 13°53′08″N, 120°07′47″E, Department of Agriculture, Bureau of Fisheries and Aquatic Resources, 1 June 2011; CAS 235572, 3, 65.9–78.9 mm SL, CAS 235749, 2, 78.6–80.4 mm SL, between Luzon and Mindoro, 13°53′17″N, 120°06′27″E, Department of Agriculture, Bureau of Fisheries and Aquatic Resources, 1 June 2011. **SOLOMON ISLANDS:** MNHN 2005-3411, 90.1 mm SL, RV *Alis*,; MNHN 2006-0086, 88.6 mm SL, 08°38′13″S, 157°23′02″E, 17–76 m, RV *Alis*, 6 Nov. 2004; MNHN 2006-0237, 47.7 mm SL, 08°36′03″S, 157°23′02″E, 176 m, RV *Alis*, 6 Nov. 2004; MNHN 2006-0256, 48.1 mm SL, 08°36′14″S, 157°25′08″E, 150–160 m, RV *Alis*, 6 Nov. 2004; MNHN 2006-0315, 7, 68.2–86.7 mm SL, 08°36′25″S, 157°23′02″E, 148–253 m, RV *Alis*, 6 Nov. 2004; MNHN 2014-0992, 85.3 mm SL, 10°25′60″S, 161°24′00″E, 190–232 m, RV *Alis*, 23 Sep. 2007. **VANUATU:** MNHN 2009-0099, 113.6 mm SL, 15°01′25″S, 166°53′45″E, 630–705 m, RV *Alis*, 8 Sep. 2005; MNHN 2009-0103, 95.1 mm SL, 15°09′06″S, 166°54′24″E, 220–277 m, 10 Sep. 2005, RV *Alis*.

Diagnosis. A species of *Neocentropogon* with the following combination of characters: dorsal-fin rays XIV, 7 (rarely XIII or XV, 6 or 8); anal-fin soft rays 6 (rarely 5); lateral-line pores 20–24; scale rows in longitudinal series 94–137; scale rows above lateral line 8–17; symphyseal knob pronounced; postocular spine usually absent; four lowermost pectoral-fin rays not elongated; orbit diameter 11.8–15.3% (mean 13.5%) of SL; large dark blotch behind opercular margin; blotches absent on dorsal fin base; spots absent on body dorsal surface and dorsal fin; pectoral fin black.

Distribution. Currently known from the Philippines to Indonesia, Australia, the Solomon Islands, and Vanuatu in depths of 17–705 m [based on collected specimens (Fig. 3)].

Remarks. *Neocentropogon aeglefinus* was originally described as *Paracentropogon aeglefinus* by Weber (1913) on the basis of 14 specimens from Indonesia (Halmahera, Timor and Savu seas, and Lesser Sunda Islands). The syntypes, registered as ZMA 110234 (2 specimens), 110235 (4), 110236 (5), 110237 (1), and 110240 (2) (Fricke et al. 2020), are deposited at Naturalis Biodiversity Center, Leiden, the Netherlands. Because the Naturalis fish collection has long been inaccessible due to building renovations (and currently the covid-19 pandemic), the syntypes were unavailable for the present study. However, examination of the original description and figure (Weber 1913: 500, pl. 6, fig. 8) of *P. aeglefinus* showed it to be identical with specimens considered here as conspecific, the former having small embedded cycloid scales on the body; XIV, 8 dorsal-fin rays; 15 pectoral-fin rays, the four lowermost rays detached with their basal half connected by low membrane; I, 5 pelvic-fin rays; palatine teeth; 22 lateral-line pores; no slit behind the last gill arch; and a large dark blotch behind the opercular margin. Ontogenetic morphological change of *N. aeglefinus* is described in Remarks of *N. trimaculatus*.

Iwamoto and McCosker (2014) reported five specimens (CAS 235572, 3, 65.9–78.9 mm SL; CAS 235749, 2, 78.6–80.4 mm SL) as *N. affinis* from between Luzon and Mindoro, Philippines. Re-examination of these specimens in this study showed them to be *N. aeglefinus*.

Neocentropogon affinis (Lloyd 1909a)
(English name: Andaman Waspfish)
(Figs. 1b, 2a, 3; Tables 2, 3)

Gymnapistus affinis Lloyd 1909a: 162 (type locality: Gulf of Martaban, Myanmar, 14°50′N, 96°00′E); Lloyd 1909b: pl.

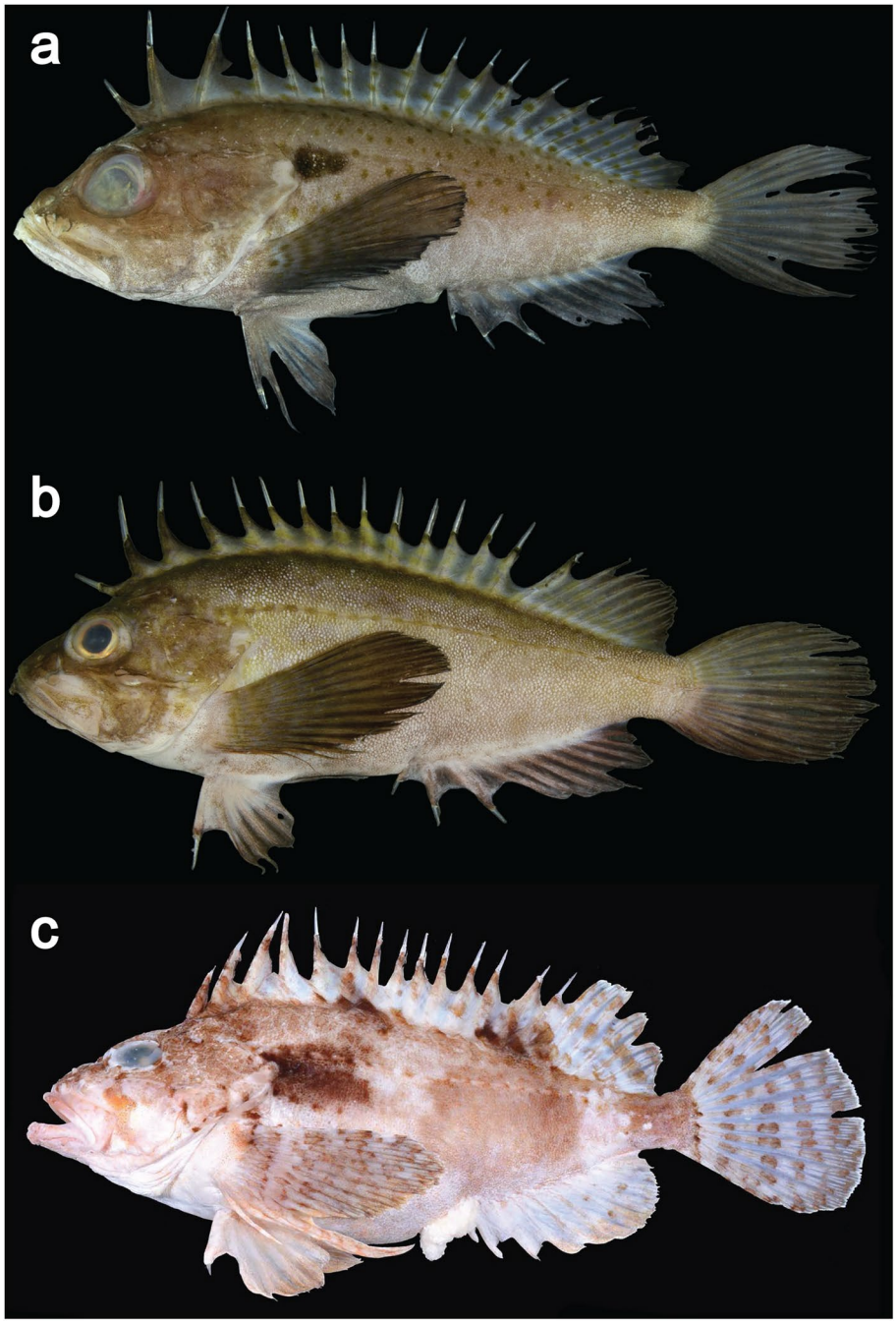

Fig. 2 Fresh specimens of **a** *N. affinis*, KAUM–I. 33280, 73.9 mm SL, Thailand; **b** *N. japonicus,* KAUM–I. 30815, 85.8 mm SL, Japan**; c** *N. trimaculatus*, KAUM–I. 17716, 130.7 mm SL, Japan

47 (Gulf of Martaban, Myanmar); Menon and Rama-Rao 1971: 344 (Gulf of Martaban, Myanmar)

Neocentropogon affinis: Poss and Rama-Rao 1984: 12 (key only); Poss 1999: 2308 (key only); Psomadakis et al. 2020: 363, pl. 24, fig. 175 (Myanmar)

Syntypes. ZSI 1172/2–1178/2, 4 syntypes, 56.2–67.2 mm SL, Gulf of Martaban, Myanmar, 14°50′N, 96°00′E, 84 m depth.

Other material examined. 3 specimens (60.6–73.9 mm SL)—**INDONESIA:** SAIAB 65706, 2 specimens, 60.6–62.8 mm SL, Nias Island, 02°43′60″N, 97°25′00″E, 23 Aug. 1980. **THAILAND:** KAUM–I. 33280, 73.9 mm SL, Ranong, 09°56′N, 98°35′E (purchased at Pak Nam Ranong Fishing Port), trawl.

Diagnosis. A species of *Neocentropogon* with the following combination of characters: dorsal-fin rays XIV, 7 (rarely XIV, 8); anal-fin soft rays 6; lateral-line pores 22–24; scale rows in longitudinal series 79–96; scale rows above

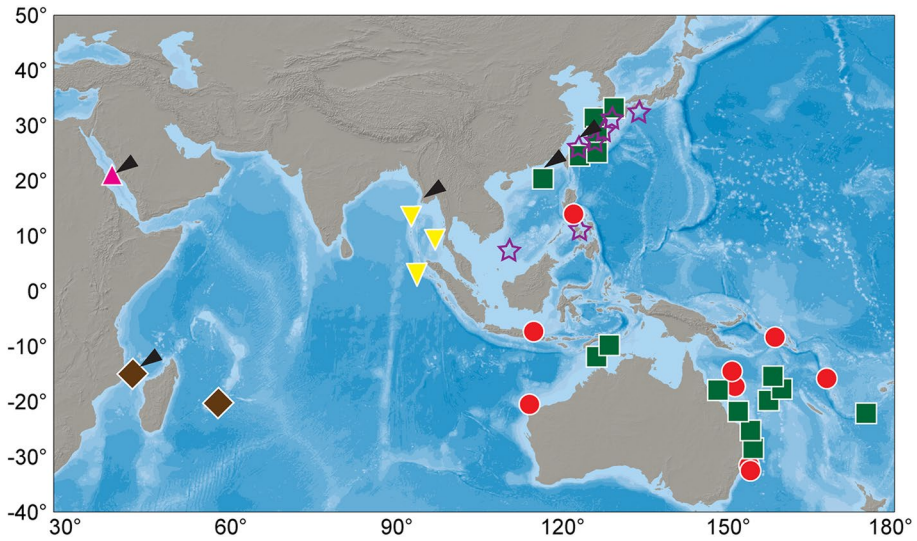

Fig. 3 Distributional map of *Neocentropogon aeglefinus* (*red circles*), *N. affinis* (*yellow triangles*), *N. japonicus* (*open purple stars*), *N. mesedai* (*pink triangle*), *N. profundus* (*brown diamonds*), and *N. trimaculatus* (*green squares*). *Arrowheads* indicate type localities

lateral line 0–8; symphyseal knob pronounced; postocular spine absent; four lowermost pectoral-fin rays not elongated; orbit diameter 13.0–14.8% (mean 13.7%) of SL; a large dark blotch behind opercular margin; no blotches on dorsal-fin base; rows of dark spots scattered on dorsal body surface and dorsal, pectoral, and caudal fins.

Distribution. Currently known only from the eastern Indian Ocean from the Gulf of Martaban and Andaman Sea to Nias Island, Indonesia [based on collected specimens (Fig. 3)]. The type specimens were collected in a depth of ca. 84 m.

Remarks. *Neocentropogon affinis* was originally described by Lloyd (1909a) as *G. affinis* on the basis of seven specimens (three specimens since lost) from the Gulf of Martaban, Myanmar. Although the remaining four syntypes are no longer in good condition and with fading color, Lloyd's (1909a) description of *G. affinis* matched the non-type specimens considered here as conspecific with *N. affinis* and characterized by a greyish-brown body with a greyish blotch behind the opercular margin, two irregular rows of spots above the lateral line, and the dorsal, pectoral, and caudal fins with obscure grey spots. Because no other specimens are known, the non-type specimens listed here represent only the second and third records of the species. Those collected from Nias Island, Indonesia, indicate that the species is widely distributed in the eastern Indian Ocean.

Neocentropogon japonicus Matsubara 1943
(New English name: Spotless Waspfish)
(Figs. 1c, 2b, 3; Tables 2, 3)

Neocentropogon aeglefinus japonicus Matsubara 1943: 432, fig. 144 (type locality: Kochi, Japan); Nakabo 1984: 319 (Kochi, Japan); Nakabo 2002: 599 (Kochi, Japan; key); Shinohara et al. 2001: 314 (Kochi, Japan); Ogihara and Motomura 2012: 139 (Kagoshima, Japan)

Neocentropogon japonicus: Poss 2000: 604 (South China Sea); Chan 1966: 635; Ho et al. 2009: 28 (Taiwan)

Neocentropogon aeglefinus (not of Weber): Mohsin and Ambak 1996: 572, fig. 924 (South China Sea and Indonesia); Iwamoto and McCosker 2014: 287, pl. 16, fig. 91 (between Luzon and Mindoro, Philippines)

Holotype. FAKU 1761, 97.9 mm SL, Kochi, Japan.

Other material examined. 73 specimens (27.5–108.5 mm SL)—**JAPAN:** BSKU 1923, 86.6 mm SL, Mimase Fish Market, Kochi, 24 May 1952; BSKU 2230, 108.5 mm SL, BSKU 2231, 67.4 mm SL, Mimase Fish Market, Kochi, 11 Dec. 1952; BSKU 13753, 106.6 mm SL, Mimase Fish Market, Kochi, 3 Jan. 1968; BSKU 64652, 72.7 mm SL, 6 June 2003; BSKU 89660, 84.1 mm SL, Saga Fishing Port, Kuroshio, Hata, Kochi, 24 Dec. 2003; BSKU 106457, 89.8 mm SL, Irino Fishing Port, Kuroshio, Hata, Kochi, 15 Dec. 2011; FAKU S511, 98.9 mm SL, FAKU S512, 76.4 mm SL, Mimase, Kochi, 28 Dec. 1958; FAKU 103972, 94.0 mm SL, Kochi; KAUM–I. 30815, 85.8 mm SL, Shibushi, Kagoshima, 31°38′N, 131°14′E, 70–100 m depth, trawl, G. Ogihara et al., 8 July 2010; KAUM–I. 81861, 104.9 mm SL, Tosa Bay, Kuroshio, Hata, Kochi, 33°03′N, 133°08′E, 80–120 m, bottom trawl, M. Matsunuma, 10 June 2016; KAUM–I. 91601, 27.4 mm SL, Okinawa, 27°10′N, 125°09′E, 114 m, trawl, M. Okamoto, 24 May 2015; NSMT-P 92005, 41.5 mm SL, Saga Fishing Port, Kuroshio, Hata, Kochi, K. Matsuura et al, 27 July 2008. **SOUTH CHINA SEA**: BSKU 17283, 89.8 mm SL, BSKU 17284, 95.8 mm SL, 06°51.6′N, 108°47.2′E, 135–137 m, beam trawl, O. Okamura, 10–11 July 1972. **TAIWAN:** FRLM 46985, 91.1 mm SL, FRLM 46986, 69.4 mm SL, Tungkang,

Pingkang, Y. Hibino and H.-C. Ho, 22 Feb. 2014; KAUM–I. 20392, 79.7 mm SL, KAUM–I. 20393, 89.8 mm SL, Dong-gang, Pingtung, H.-C. Ho, 19 May 2008; KAUM–I. 110326, 81.7 mm SL, off Ke-tzu-liao, Ziguan, Kaohsiung, K. Koeda and H. Hata, 14 Dec. 2017; KAUM–I. 110810, 83.1 mm SL off Dong-gang, Pingtung, 22°39′N, 120°24′E, trawl, K. Koeda and S. Tashiro, 27 Nov. 2017; KAUM–I. 110877, 51.8 mm SL, off Dong-gang, Pingtung, 22°39′N, 120°24′E, K. Koeda and H. Hata, 14 Dec. 2017; KAUM–I. 114281, 98.4 mm SL, KAUM–I. 114282, 88.3 mm SL, KAUM–I. 114283, 99.5 mm SL, KAUM–I. 114284, 78.9 mm SL, KAUM–I. 114285, 79.3 mm SL, KAUM–I. 114286, 90.2 mm SL, KAUM–I. 114287, 91.9 mm SL, KAUM–I. 114288, 89.9 mm SL, KAUM–I. 114289, 106.9 mm SL, off Dong-gang, Pingtung, 22°39′N, 120°24′E, K. Koeda and H. Hata, 8 Mar. 2018; KAUM–I. 115464, 66.9 mm SL, KAUM–I. 115465, 63.8 mm SL, KAUM–I. 115466, 75.9 mm SL, off Dong-gang, Pingtung, 22°39′N, 120°24′E, K. Koeda and H. Wada, 10 May 2018; KAUM–I. 115573, 83.6 mm SL, off Dong-gang, Pingtung, 22°39′N, 120°24′E, K. Koeda and H. Wada, 8 May 2018; KAUM–I. 150450, 71.5 mm SL, Dong-gang, Pingtung, 22°27′N, 120°25′E, 100–400 m, trawl, M. Matsunuma, 27 Feb. 2017; NSMT-P 115111, 92.2 mm SL, Dong-gang Fishing Port, Pingtung, 17 Oct. 2013; NSMT-P 119710, 72.3 mm SL, Dong-gang Fishing Port, Pingtung, G. Shinohara et al., 7 Nov. 2013. **PHILIPPINES:** MNHN 1984-0635, 3 specimens, 59.0–86.8 mm SL, Luzon, 13°07′58″N, 122°39′00″E, 280–440 m, RV *Coriolis*, 25 Nov. 1980; MNHN 2005-0624, 3, 79.2–87.2 mm SL, 14°00′07″N, 120°19′04″E, RV *Coriolis*, 31 May 1985; MNHN 2005-0684, 5 of 7, 63.5–100.9 mm SL, MNHN 2005-1006, 3, 72.6–92.2 mm SL, 14°00′00″N, 120°10′48″E, RV *Coriolis*, 1 June 1985; MNHN 2005-0709, 8, 66.3–95.8 mm SL, 14°00′07″N, 120°19′04″E, 191–197 m, RV *Coriolis*, 31 May 1985; MNHN 2005-0973, 3, 77.8–89.5 mm SL, 14°00′00″N, 120°11′24″E, RV *Coriolis*, 2 June 1985; MNHN 2005-1298, 8, 57.7–83.9 mm SL, 14°00′00″N, 120°16′58.8″E, 190–198 m, RV *Coriolis*, 2 June 1985; **LOCALITY UNKNOWN:** BSKU 11853, 107.0 mm SL.

Diagnosis. A species of *Neocentropogon* with the following combination of characters: dorsal-fin rays XV, 7 (rarely XIV or XVI, 6); anal-fin soft rays 7 (rarely 6); lateral-line pores 19–24; scale rows in longitudinal series 97–139; scale rows above lateral line 10–21; symphyseal knob pronounced; postocular spine present; four lowermost pectoral-fin rays not elongated; orbit diameter 11.4–14.1% (mean 12.7%) of SL; no large blotches behind opercular margin and on dorsal-fin base; no spots on dorsal body surface or dorsal fin; pectoral fin black.

Distribution. Currently known from the Pacific coast of southern Japan (Kochi to Kagoshima prefectures) south to Taiwan, Hong Kong, the Philippines, and the South China Sea in depths of 70–440 m [based on collected specimens examined in this study (Fig. 3)].

Remarks. *Neocentropogon japonicus* was originally described by Matsubara (1943) as a subspecies of *N. aeglefinus* on the basis of four specimens from Kochi, Japan. Subsequently, Chan (1966) regarded *N. a. japonicus* as a separate species, *N. japonicus*, because morphological differences between *N. a. japonicus* and *N. aeglefinus*, e.g., XV dorsal-fin spines in *N. a. japonicus* (vs XIV dorsal-fin spines in *N. aeglefinus*) and absence of black blotch behind opercle (presence of single large black blotch), were equivalent to those of species level in this family; we also agreed with this in this study.

A photograph reported by Mohsin and Ambak (1996: 572, fig. 924) as *N. aeglefinus* was re-identified here as *N. japonicus* on the basis of having XV, 7 dorsal-fin rays and 7 anal-fin soft rays, and lacking a dark blotch behind the opercular margin. Iwamoto and McCosker (2014) reported *N. aeglefinus* from between Luzon and Mindoro as the first record from the Philippines. However, since a photograph of a fresh specimen (Iwamoto and McCosker 2014: 287, pl. 16, fig. 91) showed no dark blotch behind the opercular margin, it was herein identified as *N. japonicus*.

Two specimens (BSKU 17283, 89.8 mm SL; BSKU 17284, 95.8 mm SL) from the South China Sea, midway between Indochina and Borneo, represent the southernmost distribution records of *N. japonicus.*

Neocentropogon mesedai Klausewitz 1985
(English name: Meseda Waspfish)
(Figs. 1d, 3; Tables 2, 3)

Neocentropogon mesedai Klausewitz 1985: 17, figs. 1–3 (type locality: Mismaris-Trough, southwest of Jeddah, Saudi Arabia, Red Sea, 21°22′N, 39°04′E); Fricke et al. 2017: 1863, fig. 1 (Red Sea); Bogorodsky and Randall 2018: 261 (Red Sea); Golani and Fricke 2018: 56 (Red Sea)

Holotype. SMF 20198, 62.1 mm SL, Mismaris Trough, southwest of Jeddah, Saudi Arabia, Red Sea, 21°22′N, 39°04′E, 363–383 m depth, RV *Valdivia*, 17 Apr. 1979.

Diagnosis. A species of *Neocentropogon* with the following combination of characters: dorsal-fin rays XIII, 8; anal-fin soft rays 5; lateral-line pores 18; scale rows in longitudinal series 85; scale rows above lateral line 2; symphyseal knob pronounced; postocular spine absent; four lowermost pectoral-fin rays elongated; orbit diameter 13.7% of SL; no large blotches behind opercular margin and on dorsal-fin base; spots absent on dorsal body surface, faint on dorsal fin; pectoral fin not black (whitish with poorly defined dark blotches) [color features based on Fricke et al. (2017: fig. 1) due to holotype completely faded (Fig. 1d)].

Table 4 Counts and measurements in *Neocentropogon profundus* and *N. trimaculatus*

	N. profundus			*N. trimaculatus*			
	Holotype SAIAB 300	Non-types $n = 4$		Holotype BMNH 1965.11.6.3	Northern Hemisphere $n = 11$	Southern Hemisphere $n = 26$	
Standard length (SL; mm)	56.4	66.9–85.10		80.8	24.5–145.6	48.8–139.3	
Counts			Modes				Modes
Dorsal-fin rays	XIV, 7	XIV, 7	XIV, 7	XIV, 8	XIV–XV, 6–8	XIII–XV, 7–8	XIV, 8
Anal-fin rays	III, 5	III, 5	III, 5	III, 7	III, 7–8	III, 6–8	III, 7
Pectoral-fin rays (one side/other side)	14/15	15/15	15/15	15/15	14–16/14–15	14–15/14–15	15/15
Pelvic-fin rays	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5	I, 5
Scale rows in longitudinal series	71	71–76	71	110	118–143	92–104	138
Scale rows above lateral line	5	5–8	5	12	7–16	1–19	2
Scale rows below lateral line	25	24–28	27	39	40–50	25–55	46
Scale rows between last dorsal-fin spine base and lateral line	5	5–8	5	13	9–16	6–19	16
Scale rows between sixth dorsal-fin spine base and lateral line	10	8–10	10	11	11–27	1–26	9
Lateral-line pores	22	23–24	23	24	22–25	21–26	24
Gill rakers (upper + lower = total)	3 + 9 = 12	3 + 10–11 = 13–14	3 + 11 = 14	4 + 13 = 17	4–5 + 12–14 = 16–19	3–5 + 12–15 = 17–20	4 + 13 = 17
Measurements (% of SL)			Means				Means
Head length (HL)	40.6	40.4–42.1	41.1	39.3	35.4–38.8	37.0–42.5	38.7
Head width	26.3	23.6–24.4	24.3	26.4	19.9–24.0	19.2–25.0	18.2
Snout length	11.7	10.9–12.4	11.7	11.5	7.4–12.5	9.2–13.0	10.5
Body depth	36.2	32.0–34.9	33.7	32.2	30.3–37.8	28.2–34.9	31.6
Body width	21.8	17.3–22.7	20.2	19.3	18.4–22.1	15.7–21.3	19.4
Orbit diameter	16.0	15.4–17.0	15.9	12.9	10.5–12.2	11.6–14.7	12.7
Suborbital width	3.8	3.2–3.9	3.7	3.3	1.4–8.4	3.1–7.1	4.2
Interorbital width	7.5	6.6–7.4	7.1	6.8	5.4–6.9	4.8–7.4	6.1
Upper-jaw length	18.8	17.1–18.3	18.0	16.8	13.4–17.3	16.4–18.5	17.0
Postorbital length	16.6	16.8–15.4	16.2	16.8	14.4–17.4	14.6–18.1	16.5
Pre-dorsal-fin length	19.1	22.9–24.4	22.6	22.9	16.2–24.4	20.6–25.6	22.2
Pre-anal-fin length	69.3	68.1–73.1	70.0	62.6	58.6–66.2	60.5–68.5	64.2
Pre-pelvic-fin length	39.0	38.9–43.1	40.0	36.8	31.6–35.9	33.5–41.5	35.9
Caudal-peduncle depth	9.6	8.2–9.3	8.9	9.5	8.1–10.5	7.4–9.6	8.6
Caudal-peduncle length	13.4	13.0–15.4	13.8	17.0	12.0–17.4	13.0–19.5	15.5
Dorsal-fin base length	75.7	68.9–74.9	72.6	71.0	67.5–77.4	67.5–75.8	71.7

Table 4 (continued)

	N. profundus			*N. trimaculatus*			
	Holotype SAIAB 300	Non-types $n = 4$		Holotype BMNH 1965.11.6.3	Northern Hemisphere $n = 11$	Southern Hemisphere $n = 26$	
Standard length (SL; mm)	56.4	66.9–85.10		80.8	24.5–145.6	48.8–139.3	
Anal-fin base length	–	19.8–21.2	20.3	26.2	21.6–28.8	22.1–25.9	24.4
Caudal-fin length	29.9	26.9–30.5	29.3	36.5	30.9–35.9	31.0–39.2	34.1
Pectoral-fin length	35.5	32.0–34.8	33.8	35.8	29.2–66.7	30.0–37.5	34.8
Posterior lacrimal spine length	9.8	8.7–11.4	9.9	8.1	4.6–9.4	6.9–10.6	8.4
First dorsal-fin spine length	–	10.0–10.7	10.3	10.6	8.7–25.6	7.2–13.6	11.5
Second dorsal-fin spine length	–	15.9–17.5	16.8	–	13.7–38.0	13.6–20.0	18.2
Third dorsal-fin spine length	–	19.1–20.9	19.9	–	16.6–43.1	15.7–23.1	20.4
Fourth dorsal-fin spine length	–	18.8–20.9	19.7	17.4	14.7–37.5	12.4–20.6	18.3
Fifth dorsal-fin spine length	–	16.6–18.9	18.0	17.8	14.9–33.1	13.6–19.8	17.3
Sixth dorsal-fin spine length	–	17.4–17.9	17.6	16.6	14.5–31.4	13.0–17.5	16.4
Penultimate dorsal-fin spine length	–	16.5–18.8	17.8	22.5	17.1–32.0	14.3–20.9	19.3
Last dorsal-fin spine length	20.0	18.4–19.0	18.9	–	17.6–30.8	15.1–21.1	19.2
Longest dorsal-fin soft ray length	21.6	20.0–21.4	21.0	23.1	19.7–28.8	18.5–23.7	21.7
First anal-fin spine length	–	6.7–7.8	7.4	7.0	6.2–15.4	6.6–9.8	8.3
Second anal-fin spine length	–	11.2–13.0	12.3	11.5	8.8–23.2	9.6–14.0	12.0
Third anal-fin spine length	–	14.4–18.1	16.0	14.1	11.5–29.7	11.6–16.8	14.9
Longest anal-fin soft ray length	–	18.5–19.2	18.9	22.6	16.3–25.5	15.8–22.3	19.4
Pelvic-fin spine length	–	14.7–16.0	15.2	15.0	12.0–35.2	12.2–18.1	15.3
Longest pelvic-fin soft ray length	–	23.5–24.5	24.1	27.1	19.4–38.0	21.2–25.7	24.4
Measurements (% of HL)							
Upper-jaw length	46.3	42.4–46.3	42.8	42.7	37.4–46.3	41.7–47.6	43.9

Distribution. Currently known only from the Red Sea (Fig. 3), the type specimens having been collected from the central area at a depth of 363–383 m, and an additional specimen (Fricke et al. 2017) from the Gulf of Aqaba, northern Red Sea, at a depth of 300–350 m.

Remarks. *Neocentropogon mesedai* was originally described by Klausewitz (1985) on the basis of five specimens from Mismaris-Trough, southwest of Jeddah, Saudi Arabia, Red Sea. The dorsal-fin spine number (XIII) in *N. mesedai* is unique in the genus.

Neocentropogon profundus (Smith 1958)
(English name: Deep Waspfish)
(Figs. 1e, 3; Tables 2, 4)

Paracentropogon profundus Smith 1958: 171, pl. 7, fig. I (type locality: off Mozambique)

Neocentropogon profundus: Poss and Rama-Rao 1984 (off Mozambique); Klausewitz 1985: 21 (off Mozambique); Quéro et al. 2011: 99, fig. 1 (Réunion)

Holotype. SAIAB 300, 56.4 mm SL, off Mozambique, western Indian Ocean, 146 m depth.

Other material examined. 4 specimens (70.7–85.1 mm SL)—**RÉUNION:** MNHN 2006-0008, 4 specimens, 70.7–85.1 mm SL, 21°04′01″S, 55°10′58.8″E, 210–227 m, RV *Marion-dufresne*, 22 Aug. 1982.

Diagnosis. A species of *Neocentropogon* with the following combination of characters: dorsal-fin rays XIV, 7; anal-fin soft rays 5; lateral-line pores 22–24; scale rows in longitudinal series 71–76; scale rows above lateral-line 5–8; symphyseal knob unremarkable; postocular spine absent; four lowermost pectoral-fin rays not elongated, orbit diameter 15.4–17.0% (mean 15.9%) of SL; no large blotches behind opercular margin and on dorsal-fin base; dark spots scattered on dorsal body surface, faint on dorsal fin; pectoral fin not black (white with scattered melanophores).

Distribution. Currently known only from the western Indian Ocean (Mozambique and Réunion) (Fig. 3). The specimens examined in this study were collected in depths of 146–227 m. Eleven specimens of *N. profundus* were collected on the sea surface after the eruption of Piton de la Fournaise, Réunion (Quéro et al. 2011).

Remarks. *Neocentropogon profundus* was originally described (as *Paracentropogon profundus*) by Smith (1958) on the basis of a single specimen taken from the stomach of a rosy snapper, *Pristipomoides microlepis* (Bleeker 1869) [currently *Pristipomoides filamentosus* (Valenciennes *in* Cuvier and Valenciennes 1830)], caught in 146 m off Mozambique, western Indian Ocean. The species has been regarded as belonging to *Neocentropogon* due to the lack of cirri on the posterior end of the interorbital ridge (Poss and Rama-Rao 1984; Klausewitz 1985).

Neocentropogon trimaculatus Chan 1966
(English name: Threespotted Waspfish)
(Figs. 1f, 2c, 3, 4d–f, 6; Tables 2, 4)

Neocentropogon trimaculatus Chan 1966: 635, fig. 1 (type locality: about 85 miles southeast of Hong Kong, South China Sea, 21°01.6′N, 115°30.0′E); Poss 1999: 2321, unnumbered fig. (South China Sea, off the northwestern Shelf of Australis, Chesterfield Bank, and New Caledonia); Allen et al. 2006: 900 (off Northwest Shelf, Western Australia; tropical, west Pacific); Fricke et al. 2011: 380 (New Caledonia); Larson et al. 2013: 84 (northwestern Shelf of Australia)

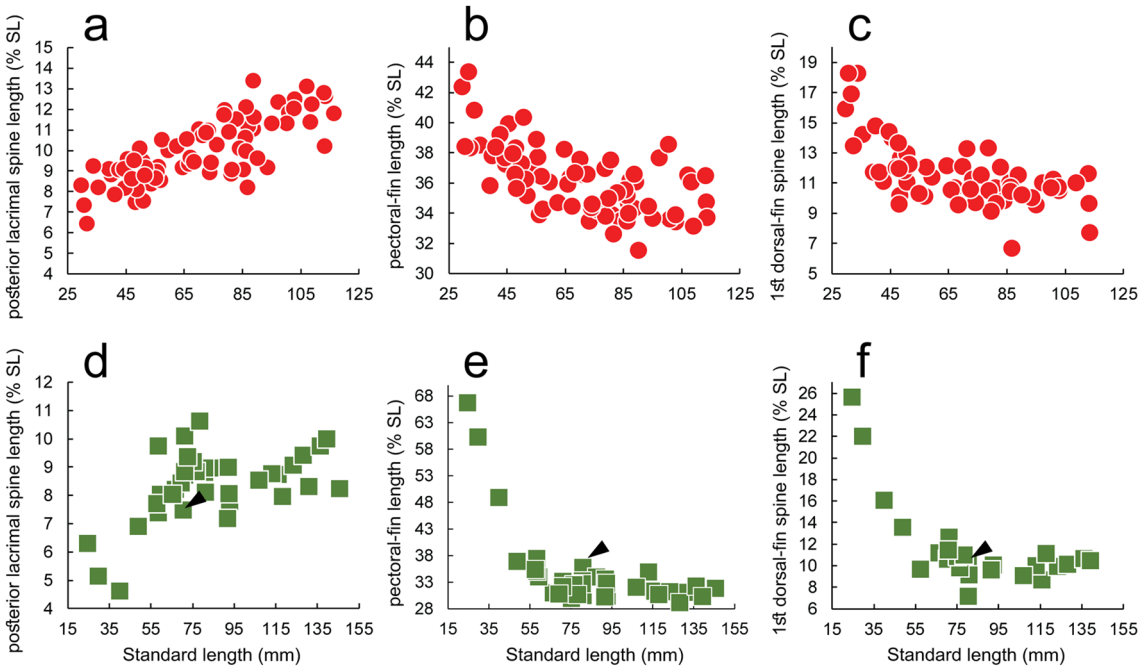

Fig. 4 Relationships of **a, d** posterior lacrimal spine length; **b, e** pectoral-fin length; **c, f** first dorsal-fin spine length (all percentages of standard length) to standard length (mm) in *Neocentropogon aeglefinus* (*red circles*) and *N. trimaculatus* (*green squares*). *Arrowheads* indicate holotype

Holotype. BMNH 1965.11.6.3, 80.8 mm SL, off Hong Kong, South China Sea, 21°01′N, 115°30′E, 121 m depth, Agassiz trawl, D. Eggleston, 14 Aug. 1965.

Other material examined. 37 specimens (24.5–145.6 mm SL)—**AUSTRALIA:** AMS I. 33448-001, 70.5 mm SL, off Clarence River, NSW, 29°04′S, 153°06′E, FRV *Kapala*; CSIRO H 580-10, 3 specimens, 80.6–92.4 mm SL, Cairns, Qld, 17°33.08′S, 149°52.09′E, 302 m, lobster trawl, CSIRO, 3 Dec. 1985; CSIRO H 1358-08, 136.1 mm SL, Dunk Island, Qld, 18°06.2′S, 147°08.05′E, 200 m, lobster trawl, CSIRO, 9 Dec. 1985; NTM S. 12926-002, 71.1 mm SL, north of Bathurst Island, Arafura Sea, Northern Territory (NT), 10°04′S, 130°32′E, 15 Nov. 1990; NTM S. 12927-010, 2, 58.3–80.5 mm SL, north of Bathurst Island, Arafura Sea, NT, 09°59′S, 130°10′E, 16 Nov. 1990; NTM S. 13301-003, 6, 57.6–78.3 mm SL, west of Lynedoch Bank, Arafura Sea, NT, 10°05′S, 130°18′E, 16 Nov. 1990; NTM S. 14366-005, 2, 65.3–71.1 mm SL, Vulcan Shoal, Timor Sea, WA, 12°50′20″S, 124°26′E, 13 June 1996; NTM S. 14367-003, 72.2 mm SL, Barracouta Shoal, Timor Sea, WA, 12°42′50″S, 123°57′58″E, 13 June 1996; QM I. 22111, 106.8 mm SL, Swain Reefs, Qld, 22°00′S, 153°31′E, 270 m, trawl, 1 Nov. 1983; QM I. 34231, 117.9 mm SL, Coolum, Qld, 26°32′S, 153°39′E, trawl, 123 m, 8 Aug. 2001; QM I. 38768, 91.6 mm SL, Surfers Paradise, Qld, 28°00′S, 153°42′E, 102 m, trawl, 16 Sep. 2009. **JAPAN:** FAKU 75091, 87.5 mm SL, East China Sea, 27°23.56′N, 125°48.13′E, 130–132 m, U. Yamada, 6 July 1998; KAUM–I. 9519, 29.6 mm SL, Kataura, Kasasa, Minamisatsuma, Kagoshima, 31°25′N, 130°11′E, 27 m, set net, Y. Tsuji, 14 Apr. 2008; KAUM–I. 22469, 39.8 mm SL, west of Goto Islands, Nagasaki, midwater trawl, June 2009; KAUM–I. 77115, 145.6 mm SL, KAUM–I. 77116, 130.7 mm SL, East China Sea, 28°27′N, 126.25′E, 127 m, bottom trawl, 28 May 2015; KAUM–I. 77117, 116.0 mm SL, East China Sea, 26°47′N, 125°06′E, 138 m, bottom trawl, 17 May 2014; KAUM–I. 88804, 112.9 mm SL, East China Sea, bottom trawl, T. Uejo, 19 June 2016; KAUM–I. 97509, 123.1 mm SL, KAUM–I. 97510, 128.1 mm SL, Amami Islands, Kagoshima, 28°16′N, 126°15′E, 126 m, trawl, 5 Dec. 2016. **TAIWAN:** KAUM–I. 40487, 92.7 mm SL, Tashi, Yilan, 500 m, trawl, KAUM Fish Team, 6 July 2011. **NEW CALEDONIA:** MNHN 2003-1850, 139.3 mm SL, Chesterfield Islands, 24°46′58″S, 159°40′01″E, 285 m, RV *Coriolis*, 9 Oct. 1986, MNHN 2005-2624, 25.4 mm SL, Chesterfield Islands, 20°00′00″S, 158°46′01″E, 225 m, RV *Coriolis* , 22 July 1984; MNHN 2014-1040, 2, 48.8–59.3 mm SL, 18°30′17″S, 163°04′07″E, 275–305, RV *Alis*, 7 May 2008. **TONGA TRENCH:** NSMT-P 112288, 66.4 mm SL, NSMT-P 129034, 80.91 mm SL, 22°10.8′S, 175°23.6′E, 288–312 m, RV *Kaiyo-maru*, 11 Jan. 1977.

Diagnosis. A species of *Neocentropogon* with the following combination of characters: dorsal-fin rays usually XIV, 8 (rarely XIII or XV, 6 or 7); anal-fin soft rays usually 7 (rarely 6 or 8); lateral-line pores 21–26; scale rows in longitudinal series 92–143; scale rows above lateral line 1–19; symphyseal knob unremarkable; postocular spine present; four lowermost pectoral-fin rays elongated; orbit diameter 10.5–14.7% (mean 12.7%) of SL; head with brownish stripes radiating from pupil; large dark blotch behind opercular margin; 2 large dark blotches on dorsal-fin base; spots absent on dorsal body surface; poorly defined blotches on dorsal fin; pectoral fin whitish with dark blotches.

Distribution. Currently known from southern Japan (including East China Sea) to Taiwan, Hong Kong, northern and eastern Australia, New Caledonia, and the Tonga Trench, from depths of 27–500 m [based on collected specimens (Fig. 3)], *N. trimaculatus* is considered to have an anti-equatorial distribution.

Remarks. *Neocentropogon trimaculatus*, originally described by Chan (1966) on the basis of a single specimen from waters off Hong Kong, is allopatrically distributed in the Northern and Southern hemispheres (Fig. 3). Although gene flow between the two hemispheres is considered unlikely, comparisons of specimens did not show any significant

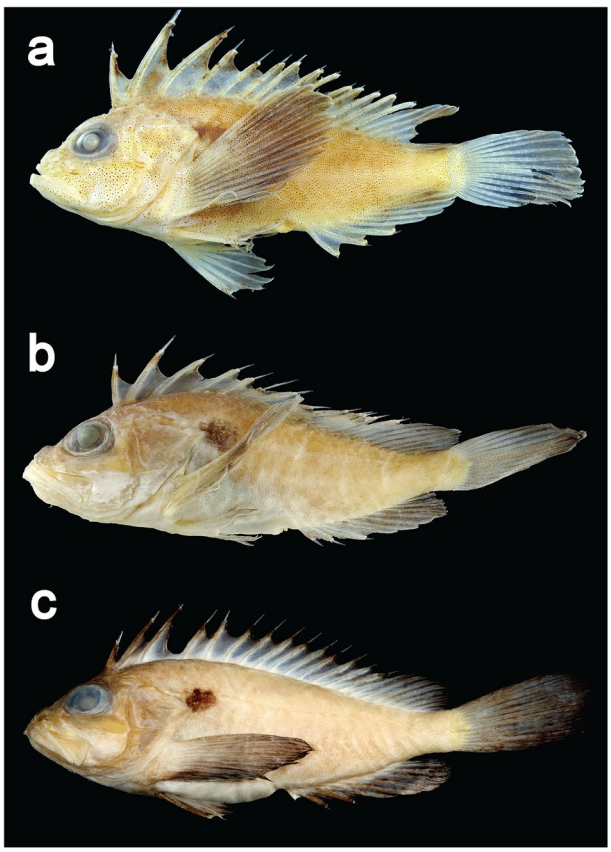

Fig. 5 Preserved specimens of *Neocentropogon aeglefinus* at different growth stages. **a** AMS I. 37476-003, 30.6 mm SL, Australia; **b** CAS 235562, 1 of 3 specimens, 71.4 mm SL, Philippines; **c** CSIRO H. 7277-01, 113.3 mm SL, Australia

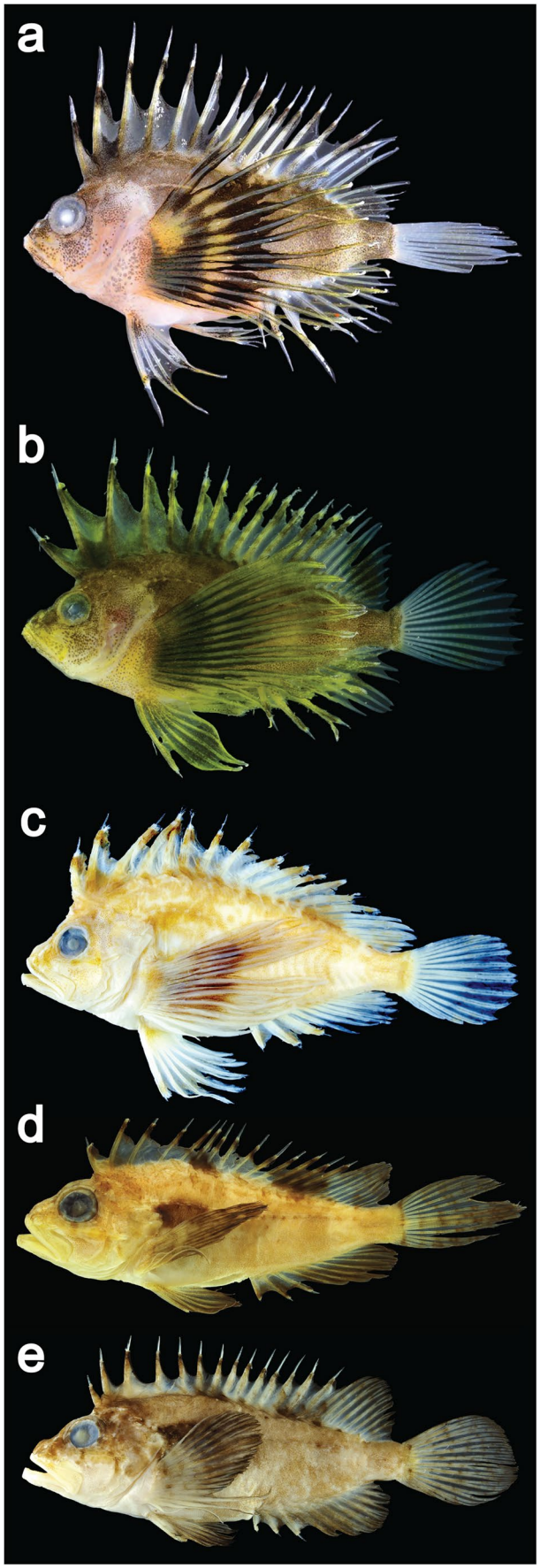

Fig. 6 Preserved specimens of *Neocentropogon trimaculatus* at different growth stages. **a** KAUM–I. 77119, 24.5 mm SL, East China Sea; **b** KAUM–I. 09519, 29.6 mm SL, Japan; **c** KAUM–I. 22469, 39.8 mm SL, Japan; **d** BMNH 1965.11.6.3, holotype, 80.8 mm SL, South China Sea; **e** KAUM–I. 77117, 116.0 mm SL, East China Sea

differences in coloration or meristic and morphometric characters (Tables 2, 4). Accordingly, the northern and southern populations are regarded here as a single species. Although the relative length of the pectoral fin shortens with growth (Fig. 4e), the lower four pectoral-fin rays remained elongated in larger specimens (Fig. 6). Analyses of 35 measurements taken from 38 specimens (24.5–145.6 mm SL) of *N. trimaculatus* and 77 specimens (29.6–116.4 mm SL) of *N. aeglefinus* indicated similar proportional changes with growth between the two species (selected characters in Fig. 4). In addition, the relative lengths of fin rays of *N. trimaculatus* decreased remarkably with growth compared with those of *N. aeglefinus* (Figs. 4b,c,e,f, 5, 6). Analyses of ontogenetic morphological changes in the other species of *Neocentropogon* could not be made because of the limited number of available specimens.

Comparisons

Previous comparisons among species of *Neocentropogon* were based on major meristics (such as numbers of dorsal- and anal-fin rays) and coloration, mostly only following original descriptions. In this study, additional characters (i.e., condition of head spines and symphyseal knob, numbers of pores, and some morphometrics) based on the examination of numerous specimens were used for comparisons for the first time in this genus.

Although *N. trimaculatus* (Fig. 1f) resembled *N. aeglefinus* (Fig. 1a) and *N. affinis* (Fig. 1b) in sharing 13–15 (mode 14) dorsal-fin spines and a dark blotch behind the opercular margin above the pectoral fin, it could be easily distinguished from the latter two species by the two blotches on the dorsal-fin base extending up to the fin (vs. absent), head with brownish stripes radiating from the pupil (vs. absent), lowermost four pectoral-fin rays elongated (vs. not elongated), postocular spine present (vs. absent), 6–8 (mode 7) anal-fin soft rays [vs. 5 or 6 (6)], and symphyseal knob unremarkable (vs. pronounced). *Neocentropogon affinis* is clearly separated from *N. aeglefinus*, the former having rows of dark spots on the dorsal body surface, dorsal fin, pectoral fin, and caudal fin (vs. spots absent), 79–96 scale rows in the longitudinal series (vs. 94–137), and 0–8 scale rows above the lateral line (vs. 8–17). *Neocentropogon mesedai* (Fig. 1d) is similar to *N. profundus* (Fig. 1e) and *N. japonicus* (Fig. 1c)

in lacking a dark blotch behind the opercular margin. However, it differs from the latter two species in having the four lowermost pectoral-fin rays elongated (vs. not elongated), 13 dorsal-fin spines (vs. 14–16), and 18 lateral-line pores (vs. 19–24). *Neocentropogon profundus* can be distinguished from *N. japonicus* by the unremarkable symphyseal knob (vs. pronounced), postocular spine absent (vs. present), 5 anal-fin soft rays (vs. 6–7), 71–76 scale rows in the longitudinal series (vs 97–139), 5–8 scale rows above the lateral line (vs. 10–21), greater orbit diameter [15.4–17.0% (mean 15.9%) of SL vs. 11.4–14.1% (12.7%)], and irregular dark spots present on the dorsal body surface (vs. absent).

Material examined for key to genera

Ablabys binotatus (Peters 1855): 3 specimens (90.6–95.2 mm SL), including holotypes of *Apistus binotatus* and *Amblyapistus marleyi* Regan 1919, listed in Chungthanawong and Motomura (2018). *Ablabys taenianotus* (Cuvier 1829): 36 specimens (16.4–100.9 mm SL), including holotype of *Amblyapistus slacksmithi* Whitley 1958 listed in Chungthanawong and Motomura (2018). *Ablabys gymnothorax* Chungthanawong and Motomura 2018: 4 specimens (47.9–82.8 mm SL), including holotype of *A. gymnothorax*, listed in Chungthanawong and Motomura (2018). *Ablabys macracanthus* (Bleeker 1852): 5 specimens (57.2–70.2 mm SL), listed in Chungthanawong and Motomura (2018). *Ablabys pauciporus* Chungthanawong and Motomura 2018: 3 specimens (43.6–52.4 mm SL), including holotype of *A. pauciporus*, listed in Chungthanawong and Motomura (2018). *Centropogon australis* (Shaw *in* White 1790): 17 specimens (20.0–70.5 mm SL) — MNHN 6640, holotype of *Scorpaena jacksoniana* Quoy and Gaimard 1824, 69.3 mm SL, Australia; QM I. 116, syntype of *Tetraroge hamiltoni* De Vis 1884b, 70.5 mm SL, Australia; AMS I. 44632-040, 48.9 mm SL, Australia; AMS I. 46994-004, 44.5 mm SL, Australia; QM I. 30889, 31.4 mm SL, Australia; QM I. 26091, 6, 20.0–48.2 mm SL, Australia; WAM P. 27070-001, 58.8 mm SL, Australia; WAM P. 27119-001, 48.4 mm SL, Australia; WAM P. 28828-013, 1 of 6, 55.1 mm SL, Australia; WAM P. 28850-004, 2, 53.5–64.3 mm SL, Australia; WAM P. 28861-002, 60.8 mm SL, Australia. *Centropogon latifrons* Mees 1962: 17 specimens (34.9–84.6 mm SL)—WAM P. 5140, holotype of *Centropogon australis latifrons*, 76.7 mm SL; WAM P. 4871-001, paratype of *C. a. latifrons*, 72.7 mm SL, Australia; WAM P. 4872, paratype of *C. a. latifrons*, 53.8 mm SL, Australia; WAM P. 5376, 9, 34.9–45.3 mm SL, Australia; WAM P. 5398-001, 44.3 mm SL, Australia; WAM P. 12667, 74.2 mm SL, Australia; WAM P. 15680-001, 64.7 mm SL, Australia; WAM P. 25761-004, 84.6 mm SL, Australia; WAM P. 27645-003, 55.5 mm SL, Australia. *Centropogon marmoratus* Günther 1862: 17 specimens (13.6–67.2 mm SL)—BMNH 1862.1.6.44, holotype of *C. marmoratus*, 55.6 mm SL, Australia; QM I. 1597, holotype of *Tetraroge vestitus* De Vis 1884a, 57.2 mm SL, South Seas; AMS I. 12643, 66.0 mm SL, Australia; AMS I. 12644, 57.1 mm SL, Australia; AMS IA. 4214, 3, 50.2–54.1 mm SL, Australia; QM I. 365, 67.2 mm SL, Australia; QM I. 13106, 2, 40.6–47.9 mm SL, Australia; QM I. 13367, 4, 13.6–31.5 mm SL, Australia; QM I. 14305, 50.2 mm SL, Australia; QM I. 20635, 63.2 mm SL, Australia; QM I. 32241, 17.2 mm SL, Australia; QM I. 32455, 17.1 mm SL, Australia. *Coccotropsis gymnoderma* (Gilchrist 1906): 9 specimens (17.5–29.1 mm SL)—BMNH 1930.1.14.6, 2 syntypes of *Tetraroge gymnoderma*, 23.9–28.7 mm SL, South Africa; CAS 48416, 7 of 18, 17.5–29.1 mm SL, South Africa. *Cottapistus cottoides* (Linnaeus 1758): 4 specimens (54.6–68.6 mm SL)—AMS E. 2945, holotype of *Paracentropogon scorpio* Ogilby 1910, 57.1 mm SL, Australia; AMS E. 2681, paratype of *P. scorpio*, 62.4 mm SL, Australia; QM I. 1578, paratype of *P. scorpio*, 68.6 mm SL, Australia; KAUM–I. 17161, 54.6 mm SL, Malaysia. *Glyptauchen panduratus* (Richardson 1850): 8 specimens (37.3–150.9 mm SL)—AMS B. 5786, holotype of *Glyptauchen insidiator mirandus* Whitley 1931, 150.9 mm SL, Australia; AMS IA. 4634, holotype of *Glyptauchen insidiator* Whitley 1931, 100.9 mm SL, Australia; AMS A. 12900, 119.8 mm SL, Australia; AMS I. 2103, 115.4 mm SL, Australia; AMS I. 14477, 99.53 mm SL, Australia; AMS I. 19359-002, 37.3 mm SL, Australia; AMS I. 20526-001, 95.0 mm SL, Australia; WAM P. 26006-008, 60.7 mm SL, Australia. *Gymnapistes marmoratus* (Cuvier *in* Cuvier and Valenciennes 1829): 5 specimens (68.6–115.1 mm SL) — MNHN 6523, 2 syntypes of *Apistus marmoratus*, 98.1–115.1 mm SL, Indonesia; AMS I. 26833-009, 69.3 mm SL, Australia; CAS 028249, 68.6 mm SL, Australia; CAS-SU 31909, 87.4 mm SL, Australia. *Liocranium pleurostigma* (Weber 1913): 5 specimens (28.6–90.4 mm SL)—QM I. 17045, 56.1 mm SL, Australia; QM I. 23557, 90.4 mm SL, Australia; QM I. 38512, 2, 28.6–29.8 mm SL, Australia; QM I. 38529, 29.9 mm SL, Australia. *Liocranium praepositum* Ogilby 1903: 6 specimens (27.4–86.5 mm SL)—QM I. 509, paralectotype of *L. praepositum*, 81.1 mm SL, Australia; QM I. 1582, lectotype of *L. praepositum*, 61.7 mm SL, Australia; QM I. 32346, 86.5 mm SL, Australia; QM I. 37831, 27.4 mm SL, Australia; QM I. 40056, 2, 31.7–55.0 mm SL, Australia. *Neovespicula depressifrons* (Richardson 1848): 5 specimens (33.4–51.39 mm SL)—CAS 214258, 2, 44.3–46.4 mm SL, locality unknown; QM I. 40708, 2, 47.8–51.4 mm SL, Papua New Guinea; USNM 396233, 33.4 mm SL, Philippines. *Notesthes robusta* (Günther 1860): 3 specimens (167.7–202.3 mm SL)—NMW 78424, syntype of *Centropogon troschelii* Steindachner 1866, 186.6 mm SL, Australia; NMW 12094, syntype of *C. troschelii*, 202.3 mm SL, Australia; QM I. 954, holotype of *Centropogon nitens* De Vis 1884b, 167.7 mm SL, Australia. *Ocosia apia* Poss

and Eschmeyer 1975: 8 specimens (45.6–90.6 mm SL)—AMS I. 18496-001, paratype of *O. apia*, 49.5 mm SL, New Zealand; MNHN 2005-0623, 2, 80.0–90.6 mm SL, Australia; QM I. 21499, 2, 86.7–87.5 mm SL, Australia; QM I. 23903, 76.5 mm SL, Australia; QM I. 34221, 48.9 mm SL, Australia; QM I. 34263, 45.6 mm SL, Australia. *Ocosia fasciata* Matsubara 1943: 21 specimens (31.0–88.0 mm SL)—USNM 99513, holotype of *Ocosia gracile* Fowler 1943, 36.4 mm SL, Japan; NSMT-P 8374, 88.0 mm SL, Japan; NSMT-P 61707, 42.8 mm SL, Japan; NSMT-P 64365, 2, 35.6–39.8 mm SL, Japan; NSMT-P 101405, 32.1 mm SL, Japan; USNM 122289, 33.6 mm SL, Japan; USNM 135658, 31.0 mm SL, Japan; USNM 135663, 34.3 mm SL, locality unknown; USNM 136422, 10, 34.9–43.7 mm SL, Hong Kong; USNM 231702, 37.4 mm SL, Japan. *Ocosia possi* Mandrytsa and Usachev 1990: 4 specimens (63.8–76.7 mm SL) — ZIN 48785, holotype of *O. possi*, 67.4 mm SL, Seychelles; ZIN 48786, 3 paratypes of *O. possi*, 63.8–76.7 mm SL, Seychelles. *Ocosia spinosa* Chen 1981: 1 specimen (101.8 mm SL) — KAUM–I. 43828, 101.8 mm SL, Taiwan. *Ocosia vespa* Jordan and Starks 1904: 26 specimens (34.0–71.7 mm SL) — USNM 50911, holotype of *O. vespa*, 37.8 mm SL, Japan; NSMT-P 94549, 39.3 mm SL, Japan; NSMT-P 94698, 21 , 34.0–45.7 mm SL, Japan; NSMT-P 117609, 71.7 mm SL, Japan; NSMT-P 117610, 63.4 mm SL, Japan; NSMT-P 117611, 71.6 mm SL, Japan. *Ocosia zaspilota* Poss and Eschmeyer 1975: 6 specimens (64.6–87.4 mm SL) — CAS 34024, 68.9 mm SL, Philippines; CAS 235825, 64.6 mm SL, Philippines; MNHN 2005-1300, 2 of 4, 70.5–87.4 mm SL, Philippines; MNHN 2005-0280, 2 of 7, 72.3–81.0 mm SL, Philippines. *Paracentropogon longispinis* (Cuvier *in* Cuvier and Valenciennes

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