Journal of the
Ocean Science Foundation

2017, Volume 28

Ocosia sphex, a new species of waspfish from New Hanover, Papua New Guinea (Teleostei: Tetrarogidae)

RONALD FRICKE
Im Ramstal 76, 97922 Lauda-Königshofen, Germany
Email: ronfricke@web.de

Abstract

The tetrarogid waspfish *Ocosia sphex* n. sp. is described on the basis of a single specimen that was trawled from a steep rocky slope with gorgonian corals in 155–120 m depth at New Hanover, Bismarck Archipelago, Papua New Guinea. It is characterized by 14 spines and 8 soft rays in the dorsal fin, the last ray divided; 3 spines and 6 soft rays in the anal fin, the last ray divided; 13 pectoral-fin rays; 3+8=11 gill rakers (some rudimentary); 5 preopercular spines; 26–27 lateral-line scales; the second and third dorsal-fin spines not markedly elongate relative to succeeding spines; the membranes of the mid-spinous portion of the dorsal fin incised for one-fourth to one-third of length of the succeeding spine; the origin of the dorsal fin at or about the level of the middle of the eye; the first lachrymal spine about one-third the length of the second spine, pointing downward and out rather than back; and minute stubby papillae confined to the anteriormost part of premaxillary or absent. A key to the eight known species of *Ocosia* is presented.

Key words: ichthyology, taxonomy, systematics, coral-reef fishes, Pacific Ocean, Scorpaenoid fishes.

Citation: Fricke, R. (2017) *Ocosia sphex*, a new species of waspfish from New Hanover, Papua New Guinea (Teleostei: Tetrarogidae). *Journal of the Ocean Science Foundation*, 28, 1–9.

doi: http://dx.doi.org/10.5281/zenodo.854757

urn:lsid:zoobank.org:pub:86182119-6337-44DD-92F1-3F83089CE9A5

Date of publication of this version of record: 31 August 2017

creative commons-BY

Introduction

Waspfishes of the family Tetrarogidae are a group of unusual scorpaenoid fishes with a highly mobile lacrimal bone (infraorbital 1), hinged to the lateral ethmoid dorsally and abutting, but not firmly bound to, the first suborbital bone (infraorbital 2) posteriorly. They are further characterized by the ventralmost pectoral-fin rays not detached or separated from the more dorsal rays in the pectoral fin; the second suborbital (third infraorbital) bone notably longer than deep, not covering the entire cheek and usually not forming a wide connection to preopercle; and the skin at the gill openings not broadly connected to the isthmus, but connected to the opposing skin or connected to the isthmus only narrowly anteriorly (Poss 1999). The group was treated as a subfamily of the family Scorpaenidae Risso, 1817 by Nelson *et al*. (2016: 471), but as a valid family by van der Laan *et al*. (2014: 84) and the majority of other recent authors. An identification key to the genera of waspfishes together with a list of species in the Western Pacific was presented by Poss (1999, as the subfamily Tetraroginae). The family includes 42 species belonging to 17 genera (Eschmeyer *et al*. 2017), all confined to the Indo-West Pacific Ocean, including the Red Sea.

Ocosia Jordan & Starks, 1904 (Jordan & Starks 1904: 162; type *Ocosia vespa* Jordan & Starks, 1904 by original designation and monotypy) is the genus of waspfishes with the highest number of species. It comprises a group of relatively small-sized species characterized by the combination of the body entirely without scales, except for the lateral line; the body notably compressed; the head profile angular; 11–13 pectoral-fin rays; and XIV–XVII, 7–9 dorsal-fin elements (Poss 1999).

Ocosia was reviewed by Poss & Eschmeyer (1975), who recognized five valid species: *Ocosia apia* Poss & Eschmeyer, 1975 (p. 8, figs. 2D, 6, Kermadec Islands; also recorded from Chesterfield Islands, New Caledonia by Fricke *et al*. [2011: 380], and from Grande Terre, New Caledonia by Fricke *et al*. [2015: 5, fig. 9]); *O. fasciata* Matsubara, 1943 (p. 443, fig. 147, Kumano-nada, Kii Peninsula, Japan; distributed from Hong Kong and Taiwan to southern Japan, see Poss & Eschmeyer [1975]); *O. ramaraoi* Poss & Eschmeyer, 1975 (p. 7, figs. 2 C, 5, Quilon coast, southwestern India); *O. vespa* Jordan & Starks, 1904 (p. 162, fig. 17, Sagami Bay, Japan; recorded from Taiwan by Shao *et al*. [2008: 246]); and *O. zaspilota* Poss & Eschmeyer, 1975 (p. 9, figs. 2E, 7, Batangas, Balayan Bay, Luzon Island, Philippines). Subsequently, two additional species were described: *Ocosia spinosa* Chen, 1981 from Taiwan (p. 41, figs. 4, 28); *O. possi* Mandrytsa & Usachev, 1990 from the Saya de Malha Bank, western Indian Ocean [p. 325 (130), 1 fig.]; making a total of seven valid species at present; with the addition of the species described herein the total is eight valid species in the genus.

During the expedition "KAVIENG 2014" around northern New Ireland Province, Papua New Guinea, the R/V *Alis* trawled a single specimen of an undescribed species of *Ocosia* from 155–120 m depth on a steep rocky slope with gorgonian corals, northwest of New Hanover. Although the new species described from only a single specimen, it is clearly separable from its congeners and it is likely that additional material may not be available in the foreseeable future due to its relatively inaccessible habitat.

Materials and Methods

Methods follow Eschmeyer (1969), and Poss & Eschmeyer (1975). Fin rays are counted using the method of Fricke (1983). The standard length is abbreviated as SL and head length abbreviated as HL. The identification key is based on Poss & Eschmeyer (1975), but updated according to subsequent findings. Institutional acronyms are quoted according to Leviton *et al*. (1985); the fish collection of the National Taiwan University Museum, Taipei is abbreviated as NTUM.

Ocosia sphex, n. sp.

Bismarck Waspfish

urn:lsid:zoobank.org:act:6677CB35-F9E4-4FA3-9560-E4A1F08A1D4D

Figures 1 & 2; Table 1.

Holotype. NTUM 11318, 38.6 mm SL, western Pacific Ocean, Papua New Guinea, New Ireland Province, northwest of New Hanover, 2°24.64' S 149°58.74' E to 2°25.32' S 149°57.79' E, 155–120 m depth, hard substrate with gorgonian corals, R/V *Alis*, St. CP4490-22, 6 Sept. 2014, 09:30–10:00 h.

Diagnosis. A species of *Ocosia* with dorsal-fin elements XIV, 8 (last ray divided), anal-fin elements III, 7 (last ray divided); 13 pectoral-fin rays; 3+8=11 gill rakers (some rudimentary); 5 preopercular spines; 26–27 lateral-line scales; second and third dorsal-fin spines not markedly elongate relative to succeeding spines; membranes of mid-spinous portion of dorsal fin incised for one-fourth to one-third of length of succeeding spine; origin of dorsal fin at or about level of middle of eye; first lachrymal spine about one-third length of second spine, pointing downward and out rather than back; minute stubby papillae confined to anteriormost part of premaxillary or absent.

Description. Dorsal-fin rays XIV,vii,1; anal-fin rays III,vi,1; pectoral-fin rays xiii (missing on right side); pelvic-fin elements I,5; caudal-fin rays (ii),iii,10,iii,(ii); gill rakers 3+8=11 (some rudimentary); lateral-line scales 26 (right) and 27 (left).

Head length 41.2% SL. Snout obliquely upturned, in an angle of about 48º to horizontal midline of body. Snout length (preorbital length) 10.6% SL, 25.8% HL. Orbit diameter 12.2% SL, 29.6% HL. Postorbital length 17.4% SL, 42.1% HL. Interorbital with two weak ridges, each ending in a small lump near midline just before origin of dorsal fin. A small spine on supraocular ridge at upper rear margin of orbit. Two ridges (parietal and nuchal) in a row behind upper orbit, nearing two small spines. Two ridges (pterotic and posttemporal) in a row behind mid-orbit bearing a pterotic spine, followed by a small supracleithral spine. Opercle with two ridges. Lower jaw slightly protruding, bearing a small knob at symphysis, flanked by two small papillae. Frontal bone with a rhomboidal knob above premaxillary. Upper-jaw length 17.4% SL, 42.1% HL. No papillae on premaxillary. Lachrymal bone with two prominent spines, anterior spine about 1/3 length of second; first points down, not backward, second points backward. No small spine present on lateral face of lachrymal bone above base of second spine. No spine on second infraorbital bone. Preopercle with first spine prominent, second about 1/4 length of first, third to fifth smaller but present. First sensory pores of lower jaw separated; mandibular pores 3+2+3 (Fig. 2C). Position of

Figure 1. *Ocosia sphex* new species, fresh after collection, holotype, NTUM 11318, 38.6 mm SL, western Pacific Ocean, Papua New Guinea, New Ireland Province, northwest of New Hanover (J.-N. Chen).

anterior tip of isthmus shortly behind level of third sensory pore. Interorbital width 9.1% SL, 22.0% HL. Body depth 37.9% SL. Body width 17.7% SL. Preanus length 61.0% SL. Head and body naked except for lateral-line scales. Each lateral-line scale anteriorly with two retrorse spinules; last lateral-line scale reaching to bases of median caudal-fin rays. Caudal-peduncle length 13.0% SL. Caudal-peduncle depth 10.1% SL.

Predorsal-fin length 23.6% SL. Dorsal fin originates above posterior margin of pupil. No dorsal-fin spines especially elongate. First dorsal-fin spine short, second and third longer but not especially elongate in relation to succeeding spines (Fig. 2A). Membranes of spinous portion of dorsal fin (at middle of spinous dorsal) incised for about 1/4 of spine length. Length of first dorsal-fin spine 13.0% SL, second dorsal-fin spine 21.6% SL, third dorsal-fin spine 23.6% SL, fourth dorsal-fin spine 19.7% SL, 8th dorsal-fin spine 15.6% SL, penultimate dorsal-fin spine 17.1% SL, last dorsal-fin spine 20.8% SL. Length of first dorsal-fin ray 21.2% SL. Length of dorsal-fin base 81.3% SL. Preanal length 69.3% SL. Length of first anal-fin spine 11.2% SL, second anal-fin spine 13.0% SL, third anal-fin spine 15.6% SL. Length of anal-fin base 27.1% SL. Pectoral-fin length 43.9% SL. Pelvic-fin spine length 20% SL. Pelvic-fin length 31.4% SL. Caudal-fin length 33.0% SL.

Color in life. (Fig. 1) Head and body rose; dorsally greenish silver, upper side of head and back mottled with dark gray, posteriorly with dark brown; eye silver, with an oblique dark gray cross-bar, iris surrounded by yellowish and dark-brown spots; dorsal fin silvery, with four oblique dark-gray cross bars; anal fin yellowish,

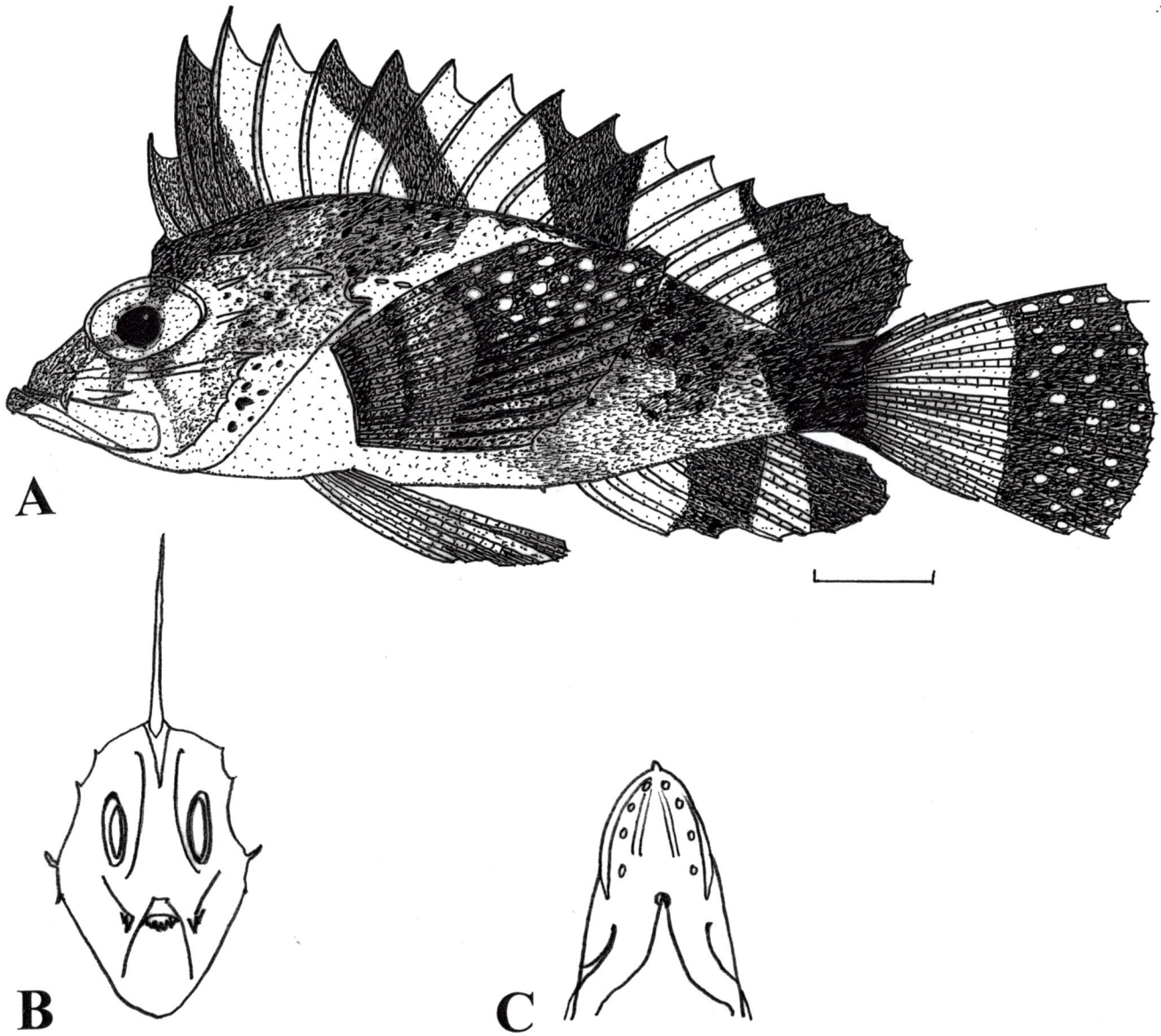

Figure 2. *Ocosia sphex* new species, holotype, NTUM 11318, 38.6 mm SL, western Pacific Ocean, Papua New Guinea, New Ireland Province, northwest of New Hanover: A) Lateral view B) Head, frontal view C) Head, ventral view; scale bar indicates 5 mm.

with two oblique cross bars; basal half of caudal fin yellowish, distal half bluish silver mottled with dark gray; pectoral fin bluish silver, with vertical dark gray bars, upper distal part mottled with dark gray; pelvic fin basally yellowish, distally gray.

Color in preservative. (as in Fig. 2A) Head and body yellowish, back and sides irregularly spotted with dark brown; lower sides of head, body, and pectoral-fin base with small melanophores. Eye dark gray. Dorsal fin yellowish brown, with four oblique dark-gray bars; anal fin yellowish with small melanophores, and with two oblique drak gray bars. Proximal half of caudal fin whitish, with each a dorsal and a ventral dark gray spot at base, distal half of fin dark gray. Pectoral and pelvic fins dark gray.

Etymology. The specific name σφήξ (Greek), latinized to *sphex*, means wasp. The name refers to the wasp-like sting associated with the fin spines that is characteristic of this family, and also alludes to the vernacular name, of this species of waspfish. The species name is treated as a noun in apposition.

Distribution. The new species is known only from the type locality; northwest of New Hanover, New Ireland Province, Papua New Guinea (Fig. 3), where it was trawled on hard substrate with gorgonians at 155–120 m depth.

Comparisons. The species of *Ocosia* are compared in Table 1. The new species is distinguished from all congeners by 26–27 lateral-line scales (vs. 12–21), 7 anal-fin soft rays (vs. 4–6), 14 dorsal-fin spines (vs. 15–17 in all other species, except *O. fasciata* with 14–16 spines); it further differs from *O. apia* in its dorsal-fin membranes that are only 1/4 incised in the middle of the spinous dorsal fin (vs. 1/3–1/2 incised), the second dorsal-fin spine not markedly elongate relative to the fourth spine (vs. markedly elongate), the first lachrymal spine 1/3 of the

TABLE 1

Comparative features for species of *Ocosia*

	O. sphex n. sp.	*O. apia*	*O. fasciata*	*O. possi*	*O. ramaraoi*	*O. spinosa*	*O. vespa*	*O. zaspilota*
Dorsal-fin spines	XIV	XVI–XVII	XIV–XVI	XV	XV–XVI	XVI	XV–XVII	XV
Dorsal-fin soft rays	8	7–8	7–9	8	8–9	8	7–9	8
Anal-fin spines and soft rays	III,7	III,5–6	III,4–6	III,5	III,5	III,5–6	III,4–6	III,5–6
Pectoral-fin rays	13	12–13	11–13	12	13	13	12–13	12–13
Lateral-line scales	26–27	16–21	12–17	16–20	14–18	17	13	15–18
Total gill rakers	11	12–21	7–10	14–16	13–14	10	9–11	10–13
Dorsal-fin membranes incised?	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
If incised, how deep at midfin	1/4	1/3–1/2	1/2	1/4–1/3	1/4–1/3	1/4–1/3	n/a	1/3–1/2
2nd dorsal-fin spine markedly elongate (vs. 4th spine)?	No	Yes	No	Yes	No	Yes	No	Yes
3rd dorsal-fin spine markedly elongate (vs. 4th spine)?	No	No	No	No	No	No	No	Yes
1st lachrymal spine length (vs. 2nd spine length)	1/3	1/2	1/2	1/2	1/2	1/3	1/3	1/3
1st lachrymal spine direction	downward	backward	backward	backward	backward	downward	downward	backward
Spine on lateral surface of lachrymal	absent	present	absent	absent	absent	present	present	absent
Spine on lower margin of 2nd infraorbital bone	absent	present	absent	absent	absent	present	absent	absent

length of the second spine (vs. 1/2), and the first spine directed downward (vs. backward); from *O. fasciata* in its dorsal-fin membranes that are only 1/4 incised in the middle of the dorsal fin (vs. 1/2 incised), the first lachrymal spine 1/3 the length of the second spine (vs. 1/2), and the first spine directed downward (vs. backward); from *O. possi* in its 11 total gill rakers (vs. 14–16), the second dorsal-fin spine not markedly elongate relative to the fourth spine (vs. markedly elongate), the first lachrymal spine 1/3 the length of the second spine (vs. 1/2), and the first spine directed downward (vs. backward); from *O. ramaraoi* in its 11 total gill rakers (vs. 13–14), the first lachrymal spine 1/3 of the length of the second spine (vs. 1/2), and the first spine directed downward (vs. backward); from *O. spinosa* in its the second dorsal-fin spine not markedly elongate relative to the fourth spine (vs. markedly elongate), the spine on lateral surface of lachrymal absent (vs. present), and the spine on the lower margin of the second infraorbital bone absent (vs. present); from *O. vespa* in its incised dorsal-fin membranes (vs. not incised), and the spine on lateral surface of lachrymal absent (vs. present); from *O. zaspilota* in its dorsal-fin membranes that are only 1/4 incised in the middle of the dorsal fin (vs. 1/3–1/2 incised), the second and third dorsal-fin spines not markedly elongate relative to the fourth spine (vs. markedly elongate), and the first lachrymal spine directed downward (vs. backward). A key to the species of *Ocosia* is presented below (updated from Poss & Eschmeyer 1975).

Remarks. The species of the genus *Ocosia* are known from scattered localities in the Indo-West Pacific (Fig. 3). Several species are rare in collections, known only from very few specimens. The new species fills a previous distributional gap between the Philippines and New Caledonia in the western Pacific Ocean. Species of the genus are likely more widespread, but apparently occur in a habitat where it is extremely difficult to collect and collections are thus scarce. The biology of *Ocosia* species is poorly known. The holotype of the new species was trawled from a deep, hard-bottom slope with gorgonian corals. Lacking *in situ* underwater observations, it is uncertain whether the species is specifically associated with rocky island slopes, gorgonians, or a combination of these two habitats.

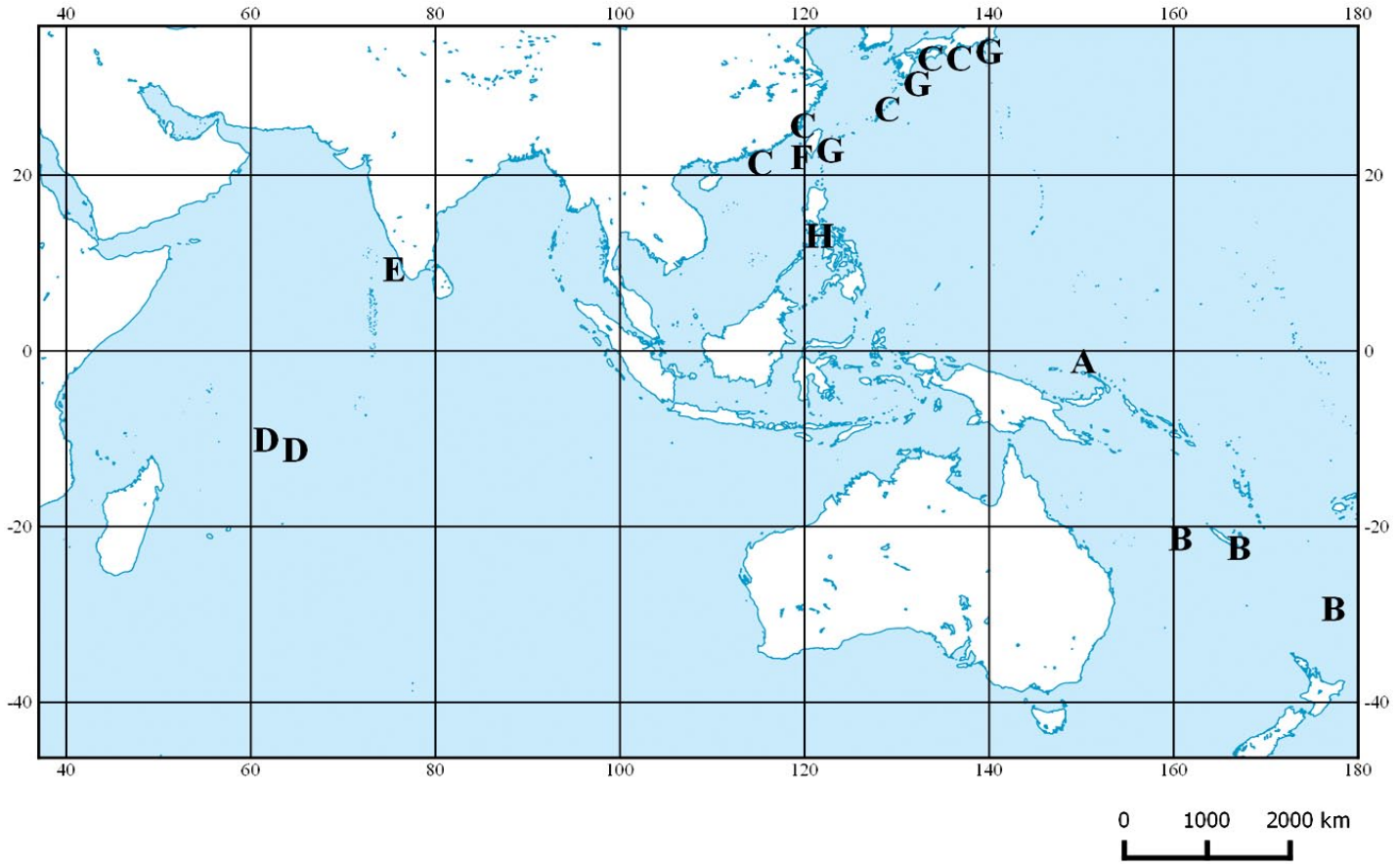

Figure 3. Geographical distribution of the species of the genus *Ocosia* in the Indo-West Pacific: A) *O. sphex* n. sp. B) *O. apia* C) *O. fasciata* D) *O. possi* E) *O. ramaraoi* F) *O. spinosa* G) *O. vespa* H) *O. zaspilota.*

Key to the species of *Ocosia* Jordan & Starks, 1904

1a. Dorsal-fin membranes not incised; stubby papillae covering upper jaw and anterior part of lower jaw [Taiwan to southern Japan] ..... ***Ocosia vespa***

1b. Dorsal-fin membranes incised; minute stubby papillae absent or confined to anteriormost part of premaxillary 2

2a. Second and third dorsal-fin spines not markedly elongate compared to succeeding spines 3

2b. Second and usually third dorsal-fin spines markedly elongate compared to succeeding spines 5

3a. Membranes of mid-spinous portion of dorsal fin incised for about half of length of succeeding spine; origin of dorsal fin at or behind rear margin of eye [China to southern Japan] ..... ***Ocosia fasciata***

3b. Membranes of mid-spinous portion of dorsal fin incised for one-fourth to one-third of length of succeeding spine; origin of dorsal fin at or about level of middle of eye 4

4a. First lachrymal spine about half length of second spine, pointing mostly backward and nearly parallel to second spine; lateral-line scales 14–18; dorsal-fin spines 15; total gill rakers 13–14 [southern India] ..... ***Ocosia ramaraoi***

4b. First lachrymal spine about one-third length of second spine, pointing downward and out rather than back; lateral-line scales 26–27; dorsal-fin spines 14; total gill rakers 11 [New Hanover, Papua New Guinea] ..... ***Ocosia sphex*, n. sp.**

5a. Second dorsal-fin spine noticeably elongate compared to succeeding spines, third spine not elongate 6

5b. Second and third dorsal-fin spines not relatively elongate [Philippines] ..... ***Ocosia zaspilota***

6a. A small spine on lower margin of second infraorbital bone; small flecks of brown on sides, but no distinct large round spots 7

6b. No small spine on lower margin of second infraorbital bone; upper sides of body with distinct large round spots [Saya de Malha Bank] ..... ***Ocosia possi***

7a. Second dorsal-fin spine much longer than third spine; pectoral-fin rays usually 12; total gill rakers 12–21 [New Caledonia to Kermadec Islands] ..... ***Ocosia apia***

7b. Second and third dorsal-fin spines about equal length; pectoral-fin rays 13; total gill rakers 10 [Taiwan] ..... ***Ocosia spinosa***

Acknowledgments

The KAVIENG 2014 expedition (Principal Investigators: Philippe Bouchet, Jeff Kinch, Claude Payri) was part of the "Our Planet Reviewed" expeditions organized jointly by Muséum National d'Histoire Naturelle (MNHN), Pro-Natura International (PNI), and the Institut de Recherche pour le Développement (IRD), with support from Papua New Guinea's National Fisheries Authority. The lagoon survey took place in June 2014, based at the Nago Island Mariculture and Research Facility, and in August 2014 on board R/V *Alis*; the deep-water component took place in September 2014 on board R/V *Alis*. The organizers acknowledge supporting funding from the Total Foundation, the Laboratoire d'Excellence Diversités Biologiques et Culturelles (LabEx BCDiv, ANR-10-LABX-0003-BCDiv), the Programme Investissement d'Avenir (ANR-11-IDEX-0004-02), the Fonds Pacifique, and CNRS Institut Ecologie et Environnement (INEE). The expedition was endorsed by the New Ireland Provincial Administration. It operated under a Memorandum of Understanding with University of Papua New Guinea (UPNG), with a permit delivered by the Papua New Guinea Department of Environment and Conservation (DEC).

I am grateful to W.-J. Chen (NTUM) for his hospitality during several visits to Taiwan, and to J.-N. Chen (NTUM) for providing access to the material, catalogue numbers, and information. The manuscript was reviewed by two anonymous reviewers.

References

Bleeker, P. (1852) Bijdrage tot de kennis der ichthyologische fauna van de Moluksche eilanden. Visschen van Amboina en Ceram. *Natuurkundig Tijdschrift voor Nederlandsch-Indie*, 3, 229–309.

Cantor, T.E. (1849) Catalogue of Malayan fishes. *Journal of the Asiatic Society of Bengal*, 18 (2), i–xii + 81–1443, pls 1–14.

Chen, L.-C. (1981) Scorpaenid fishes of Taiwan. *Quarterly Journal of the Taiwan Museum*, 34 (1/2), 1–60.

Day, F. (1875) *The fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma, and Ceylon. Part 1*, pp. 1–168, pls 1–40; London (W. Dawson & Sons). Date of publication see Menon & Rama-Rao (1974: 143).

Eschmeyer, W.N. (1969) A systematic review of the scorpionfishes of the Atlantic Ocean (Pisces: Scorpaenidae). *Occasional Papers of the California Academy of Sciences*, 79, i–iv + 1–143.

Eschmeyer, W.N., Fricke, R. & van der Laan, R. (Eds.) (2017) *Catalog of Fishes, electronic version* (31 July 2017). San Francisco, CA (California Academy of Sciences). Available at http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp (accessed 25 August 2017).

Fricke, R. (1983) A method for counting caudal fin rays of actinopterygian fishes. *Braunschweiger Naturkundliche Schriften*, 1 (4), 729–733.

Fricke, R., Kulbicki, M. & Wantiez, L. (2011) Checklist of the fishes of New Caledonia, and their distribution in the Southwest Pacific Ocean (Pisces). *Stuttgarter Beiträge zur Naturkunde A, Neue Serie*, 4, 341–463.

Fricke, R., Teitelbaum, A. & Wantiez, L. (2015) Twenty-one new records of fish species (Teleostei) from the New Caledonian EEZ (south-western Pacific Ocean). *Marine Biodiversity Records*, 8 (e123), 1–12.

Jordan, D.S. & Starks, E.C. (1904) A review of the scorpaenoid fishes of Japan. *Proceedings of the United States National Museum*, 27 (1351), 91–175, pls. 1–2.

van der Laan, R., Eschmeyer, W.N. & Fricke, R. (2014) Family-group names of recent fishes. *Zootaxa*, 3882 (2), 1–230.

Leviton, A.E., Gibbs, R.H. Jr., Heal, E. & Dawson, C.E. (1985) Standards in herpetology and ichthyology: part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia*, 1985, 802–832.

Mandrytsa, S.A. & Usachev, S.I. (1990) A new species of the genus *Ocosia* Jordan and Starks (Scorpaeniformes, Tetrarogidae) from the western part of the Indian Ocean. *Voprosy Ikhtiologii*, 30 (2), 325–327. [In Russian. English translation appeared in *Journal of Ichthyology*, 30 (3), 1990, 130–134. First author as Mandritsa.]

Matsubara, K. (1943) Studies on the scorpaenoid fishes of Japan (II). *Transactions Sigenkagaku Kenkyusyo*, 2, 171–486, pls. 1–4.

Nelson, J.S., Grande, T.L. & Wilson, M.V.H. (2016) *Fishes of the world. Fifth Edition*. John Wiley & Sons, Hoboken, NJ, USA, xli + 707 pp.

Poss, S.G. (1999) Scorpaenidae *In*: Carpenter, K.E. & Niem, V. H. (Eds.) *FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Vol. 4. Bony fishes part 2 (Mugilidae to Carangidae)*. FAO, Rome, Italy, pp. 2291–2352.

Poss, S.G. & Eschmeyer, W.N. (1975) The Indo-West Pacific scorpionfish genus *Ocosia* Jordan and Starks (Scorpaenidae, Tetraroginae), with description of three new species. *Matsya*, 1, 1–18.

Shao, K.-T., Ho, H.-C., Lin, P.-L., Lee, P.-F., Lee, M.-Y., Tsai, C.-Y., Liao, Y.-C. & Lin, Y.-C. (2008) A checklist of the fishes of southern Taiwan, Northern South China Sea. *Raffles Bulletin of Zoology, Supplement*, 19, 233–271.