Journal of the
Ocean Science Foundation

2013, Volume 8

Nemateleotris exquisita, a new microdesmid fish from the Indian Ocean (Perciformes: Microdesmidae)

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Abstract

A key and color illustrations are provided for the four species of the microdesmid fish genus *Nemateleotris*: *N. magnifica* (Fowler), *N. helfrichi* (Randall & Allen), *N. decora* (Randall & Allen), and the new species *Nemateleotris exquisita*, described in this paper from nine specimens collected from Mauritius (type locality), KwaZulu-Natal, and the Red Sea from depths of 35–69 m. The new species is distinguished from the western Pacific sibling species *N. decora* by having a more slender body, longer snout, usually shorter first dorsal spine, and by color (the pale anterior part of the body is yellow and extends more posterior). Also there appears to be a difference in the maximum size of the two species. The largest *N. decora* measures 49.5 mm standard length, compared to 66 mm for *N. exquisita*. The first author photographed an individual of the genus *Nemateleotris* in the Maldives in 1988 that is identified as a probable hybrid, *N. decora* x *N. exquisita*.

Key words: taxonomy, dartfishes, Microdesmidae, *Nemateleotris*, new species, coral reef fishes

Introduction

Immense collections of fishes were made in 1907–1910 in the Philippines and Indonesia (then the Dutch East Indies) from the United States Bureau of Fisheries steamer *Albatross*. Specimens were collected by dredging, seining, trapping, dynamiting, use of night lights, and by the purchase of market material. The collections were deposited primarily in the United States National Museum of Natural History. Henry W. Fowler, often in coauthorship with Barton A. Bean, reported on the bulk of these fish collections in a series of bulletins of the of the U.S. National Museum from 1928 to 1941.

Fowler (1938) described 25 new genera, six new subgenera, and 61 new species of fishes from 15 families of the *Albatross* fish collections in a separate paper published in the *Proceedings of the U. S. National Museum*. One of his new genera, *Nemateleotris* (then placed in the Eleotridae, now in the family Microdesmidae, subfamily Ptereleotrinae), was represented by a single specimen that he named *N. magnifica*, though unaware of the magnificent life color. He referred to it as an "exquisite little eleotrid." The prefix *nemat* of his new generic name is from the Greek meaning thread, in reference to the filamentous anterior part of the dorsal fin.

Randall and Allen (1973) published a revision of the genus *Nemateleotris*, one of five genera of the subfamily Ptereleotrinae. They recognized three species, *N. magnifica* Fowler, and two new species, *N. decora* and *N. helfrichi*. *Nemateleotris decora* was reported from Palau (type locality), Solomon Islands, Papua New Guinea, and the Coral Sea. Specimens were collected from the depth range of 30.5–52 m. Localities for specimens of *N. helfrichi* included Vanuatu, New Caledonia, and islands of Micronesia and French Polynesia (type locality, Tahiti) from depths of 28–61 m.

In 1973 the first author collected a specimen of *Nemateleotris* from Mauritius at a depth of 56 m, identified in Randall and Allen (1973) as *N. decora*, but with a question mark because of some color differences. In 1977 he collected a second specimen from 69 m in the northern Red Sea. Daniel Pelicier provided additional specimens from Mauritius in 1978 and 1990.

Satapoomin (2007) and Shibukawa in Kimura *et al.* (2009) reported *Nemateleotris decora* from the Andaman Sea off southwestern Thailand. Satapoomin's color illustration matches that of the western Indian Ocean species of *Nemateleotris*. The same illustration was used by Shibukawa. The second author collected a specimen of this color form at a depth of 42 m off Sodwana Bay, KwaZulu-Natal in August 2011, where it had been recognized for some time by local divers. In March 2012 he collected three additional specimens from the same locality. He also observed it in about 45 m off Inhaca Island in southern Mozambique, and singly or in pairs in 45 m in the Aliwal Shoal Marine Protected Area off Scottburgh, about 60 km south of Durban.

The study of these additional specimens has enabled us to conclude that the Indian Ocean population represents a new species, which we describe here. The status of the individual photographed in the Maldives requires the collection of specimens.

Materials and Methods

Type specimens of the new species of *Nemateleotris* have been deposited at the following institutions: Bernice P. Bishop Museum, Honolulu (BPBM); California Academy of Sciences, San Francisco (CAS); South African Institute for Aquatic Biodiversity, Grahamstown, South Africa (SAIAB); Senckenberg Museum, Frankfurt (SMF); and U. S. National Museum of Natural History, Washington, D.C. (USNM).

Lengths of specimens are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured at the origin of the pelvic fins, and body width at the axil of the pectoral fins (as viewed from the ventral side); head length is taken from the median anterior point of the upper lip to the posterior end of the opercular membrane; orbit diameter is the greatest fleshy diameter, and interorbital width the least fleshy width; snout length is measured from the median anterior point of the upper lip to the nearest fleshy edge of the orbit; upper-jaw length from the same anterior point to the posterior end of the maxilla; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; lengths of spines and rays are measured to their extreme bases; caudal- and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic spine to the tip of the longest soft ray; scales in longitudinal series are counted from the upper end of the gill opening to the base of the caudal fin; gill-raker counts include rudiments, the raker at the angle contained in the lower-limb count.

We obtained the sequence for the mitochondrial DNA "barcode" gene, cytochrome-c-oxidase I (Hebert *et al.* 2003), for specimens of *Nemateleotris* from the South African paratypes as well as from several specimens from the aquarium trade, reportedly originating in the Philippines. DNA extraction, polymerase chain reaction (PCR), and sequencing were performed at the University of Guelph, following standard DNA barcoding methods (Hajibabaei *et al.* 2005). DNA sequences have been incorporated into the BOL database (http://www.barcodinglife.org) and GenBank, while the voucher material for the South African fish is housed at SAIAB.

Genus Nemateleotris Fowler 1938

Nemateleotris Fowler 1938: 131 (type species, *N. magnifica* Fowler, by original designation).

Diagnosis. Dorsal rays VI + I,28–32; anal rays I,27–32; pectoral rays 19–21; pelvic rays I,5; segmented caudal rays 17; longitudinal scale series 110–190; scales cycloid, becoming ctenoid posteriorly in three species, and somewhat embedded; no lateral line; no scales on head except laterally on nape; no scales on fins except base of caudal fin; gill rakers 5 or 6 + 15–17; vertebrae 26; body elongate, the depth 4.4–5.7 in SL, and moderately compressed, the width 1.6–2.0 in body depth; head length 4.2–5.0 in SL; snout short and obtuse, 4.0–7.5 in head length; eye large, the orbit diameter 2.5–3.7 in head length; eye not extending above dorsal profile of head; interorbital space slightly convex, the bony width 5.1–7.5 in head length; caudal peduncle deeper than long, the least depth 1.6–2.1 in head length.

Mouth terminal or with lower jaw slightly protruding, oblique, forming an angle of about 50° to horizontal axis of head; upper jaw nearly truncate anteriorly, the maxilla reaching to beneath anterior third of orbit, with an outer row of 6, well-spaced, incurved, canine teeth on each side, and a medial band of small, incurved, conical teeth that narrows posteriorly; lower jaw slightly rounded anteriorly with an outer row of three incurved canine teeth anteriorly on each side of jaw, separated by a band of smaller incurved conical teeth from an inner pair of strongly incurved canines at corner of jaw, the more posterior tooth largest; no teeth on vomer or palatines; tongue truncate, set far back in mouth.

A low median fleshy ridge on head from interoribtal space to origin of dorsal fin; no opercular or preopercular spines; preopercular margin free only ventrally; upper end of gill opening at or slightly dorsal to level of middle of eye, the ventral end extending to below posterior margin of preopercle.

No visible lateral line on body. The cephalic pores and sensory papillae as shown for *Nemateleotris magnifica* by Prince Akihito in Masuda *et al.* (1984: fig. 62) and Winterbottom and Emery (1986: fig. 107) are remarkably similar for other species of the genus.

First dorsal fin elevated, the first spine varying from head length to slightly more than one-half standard length, the second spine only slightly shorter; fourth to sixth dorsal spines shorter than spine of second dorsal fin; penultimate dorsal soft ray longest, 1.3–2.0 in head length; caudal fin slightly emarginate to rounded, 3.5–5.6 in SL; pectoral fins varying from slightly shorter to slightly longer than head length; pelvic fins fully divided, their origin directly below pectoral-fin base, about equal in length to pectoral fins or slightly longer.

Key to Species of *Nemateleotris*

1a. Caudal fin rounded; first dorsal fin spine extremely elongate, less than 2.0 in SL; body depth 4.4–4.9 in SL; posterior scales on body with 11-22 cteni; body in life pale gray to white anteriorly, grading through orange to blackish posteriorly; spinous dorsal fin mainly pale yellow with an orange leading edge (Indo-Pacific; Figs. 1, 2).....*N. magnifica*

1b. Caudal fin slightly emarginate to truncate; first dorsal spine not extremely long, 2.5 or more in SL; body depth 4.85–6.3 in SL; posterior scales on body with 0–12 cteni; color not as 1a.....2

2a. Anal soft rays 26–28; body violet anteriorly, grading posteriorly to lavender; caudal fin light yellow (islands of Oceania, except Hawaiian Islands and Pitcairn Islands; Figs. 3, 4)….....*N. helfrichi*

2b. Anal soft rays 28–31 (rarely 28); color not as in 2a.....3

3a. Body depth 4.85–5.7 in SL; snout length 5.0–7.5 in head length; orbit diameter 2.4–3.3 in head length; posterior scales of body with 6–12 cteni; vertical demarcation of pale anterior and blackish posterior part of body in middle of standard length (central and western Pacific; Figs. 5–8).....*N. decora*

3b. Body depth 5.7–6.3 in SL; snout length 4.0–4.65 in head length; orbit diameter 3.1–3.7 in head length; posterior scales of body with 0–3 cteni; vertical demarcation of pale anterior and blackish posterior part of body above middle of anal fin (Indian Ocean, including Red Sea; Figs. 9–12).....*N. exquisita* n. sp.

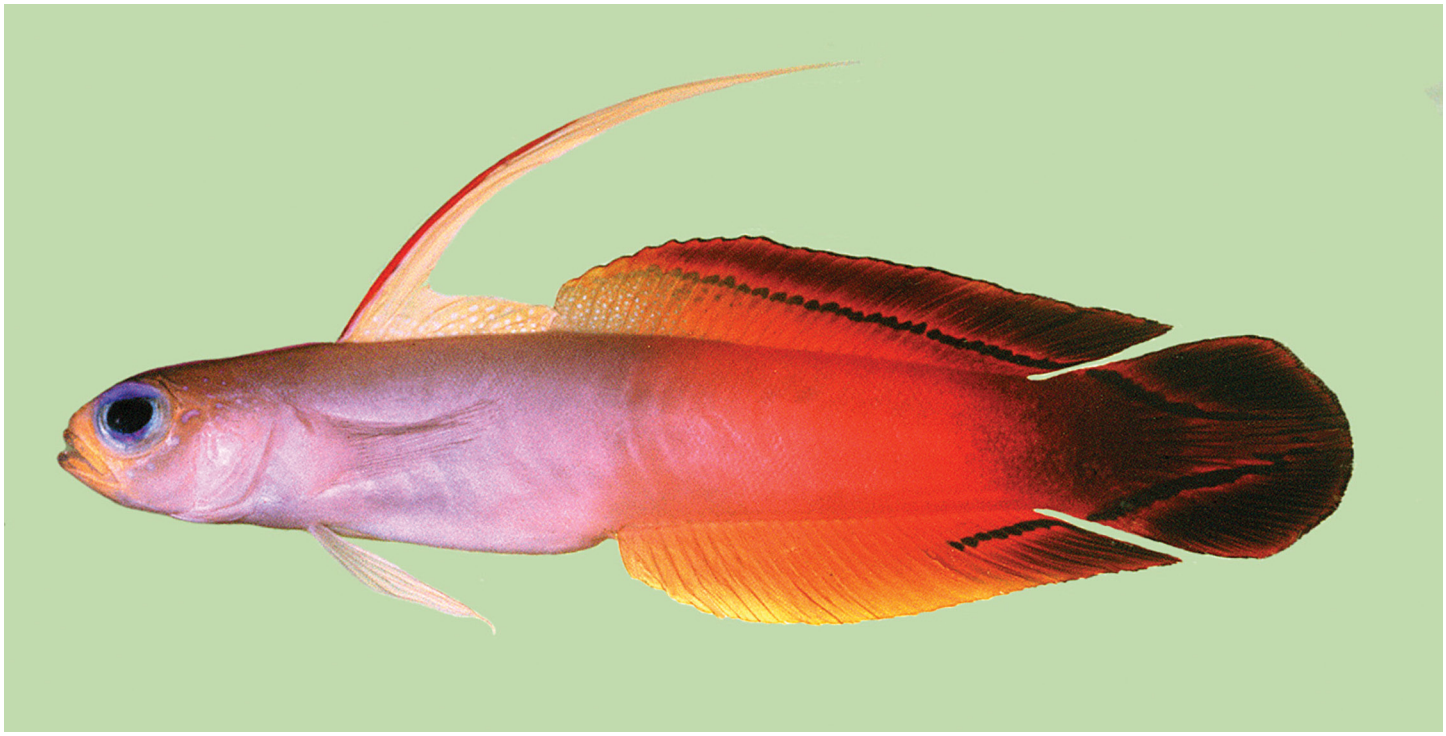

Figure 1. *Nemateleotris magnifica*, BPBM 6316, 58 mm, Moorea, Society Islands (J.E. Randall).

Figure 2. *Nemateleotris magnifica*, Johnston Island (J.E. Randall).

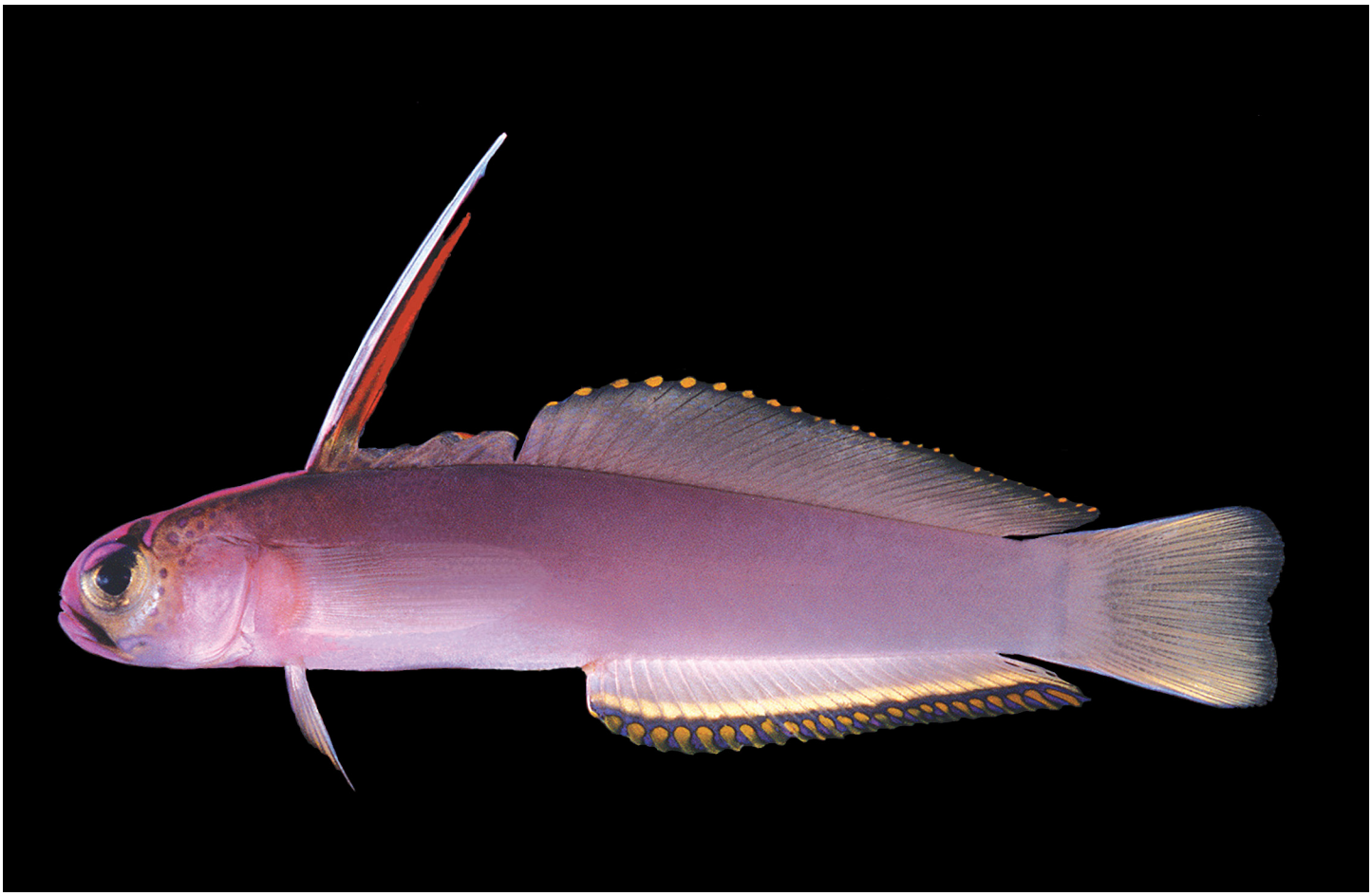

Figure 3. *Nemateleotris helfrichi*, holotype, BPBM 11595, 43.3 mm, Tahiti, Society Islands (J.E. Randall).

Figure 4. *Nemateleotris helfrichi*, Kwajalein Atoll, Marshall Islands (J.E. Randall).

Figure 5. *Nemateleotris decora*, holotype, BPBM 9533, 34 mm, Palau, Micronesia (J.E. Randall).

Figure 6. *Nemateleotris decora*, Halmahera, Indonesia (J.E. Randall).

Figure 7. *Nemateleotris decora*, Raja Ampat, Papua (G.R. Allen).

Figure 8. *Nemateleotris decora*, Bali, Indonesia (J.E. Randall).

Nemateleotris exquisita, n. sp.

Figures 9–11; Table 1

Nemateleotris decora? Randall & Allen 1973: 367, addendum (Mauritius).
Nemateleotris decora Randall & Anderson 1993: 38 (Maldive Islands).
Nemateleotris decora Randall & Shen 2002: 493. pl. 2 (Daedalus Reef, Egypt, northern Red Sea).
Nemateleotris decora Satapoomin 2009: 166, fig. 1 (Andaman Sea).
Nemateleotris decora Kimura *et al.* 2009: 290, lower fig. (west coast of southern Thailand).
Nemateleotris decora Allen & Erdmann 2012: 993, lower fig. (Andaman Islands).

Holotype. BPBM 16173, female, 60.5 mm, Mauritius, west coast off Wolmar, rubble and sand bottom near base of vertical drop-off, 56 m, multiprong spear, J. E. Randall, 5 December 1973.

Paratypes. USNM 405534, 66.5 mm, same data as holotype; BPBM 21528, 55 mm, Red Sea, Ras Muhammed (southern tip of Sinai Peninsula), sand near base of vertical drop-off, 69 m, multiprong spear, J E. Randall, 2 May 1977; BPBM 22544, 64 mm, Mauritius, west coast off Flic en Flac, 55 m, hand nets, D. Pelicier, 1978; BPBM 34640, 2: 48.5–51 mm, same locality as preceding, depth probably over 50 m, D. Pelicier, 1980; CAS 234071, 54 mm and SMF 34718, 62.5 mm, same data as BPBM 34640; SAIAB 185925, 46 mm, South Africa, KwaZulu-Natal, Sodwana Bay, 27°32’ S, 32°40.4’E, at 42 m, on sand-rubble near base of a 5-m drop-off, A.D. Connell, multiprong spear, 4 August 2011; SAIAB 186384 3: 55–63 mm, KwaZulu-Natal, Sodwana Bay, 22 March 2012, same locality and collector as preceding, 42–45 m.

Diagnosis. Dorsal rays VI + I,30–33; anal rays I,30–32; pectoral rays 20 or 21 (usually 21); longitudinal scale series 163–195; all scales cycloid (none or very few cteni on posterior body scales); gill rakers 5 or 6 + 14–17; body elongate, the depth 5.7–6.3 in SL; head length 4.7–4.95 in SL; snout length 3.95–4.65 in head length; orbit diameter 3.1–3.7 in head length; first dorsal spine 3.9–4.3 in SL; caudal fin slightly emarginate to nearly truncate; color in alcohol uniformly pale beige with a blackish dash mark on side of maxilla below eye and dark brown tips on pelvic fins; body in life yellow to white anteriorly (usually yellowish), grading to dusky deep purple well posterior to origin of anal fin; lips, snout, interorbital, dorsoanterior edge of eye, and a narrowing medial band on nape varying from bright pink to purple, this color continuing on margins of dorsal fins and upper and lower margins of caudal fin; broad central part of caudal fin purple, grading basally to body color, the lobes orange-red streaked with black; dorsal and anal fins with a broad deep red stripe edged in purple, the anal fin margin green; pectoral fins translucent; pelvic fins colored like body on basal half, orange-red on outer half, with a purple to

Figure 9. *Nemateleotris exquisita*, holotype, BPBM 16173, 60.5 mm SL, Mauritius, 56 m (J.E. Randall).

Figure 10. *Nemateleotris exquisita*, a pair with *Labroides dimidiatus*, 69 m, Daedalus Reef, Egypt, Red Sea (D. Shen).

pink line separating the two zones, the ray tips blackish; a short narrow black band on maxilla below eye. Largest specimen, 66 mm SL.

Description. Dorsal rays VI + I,33 (VI + I,30–33); anal rays I,30 (I,30–32); pectoral rays I,21 (20 or 21); pelvic ray I,5; segmented caudal rays 17; upper and lower unsegmented caudal rays 11(10 or 11); longitudinal scale series 166 (163–195); gill rakers 6 + 15 (5 or 6 + 14–17); vertebrae 26.

Body moderately elongate, the depth 6.0 (5.9–6.3) in SL; body width 2.0 (1.85–2.05) in body depth; head length 4.75 (4.7–4.75) in SL; snout length 4.2 (3.95–4.6); orbit diameter 3.25 (3.2–3.7) in head length; interorbital space flat, the least width 5.85 (5.6–6.3) in head length; caudal peduncle short, much deeper than long, the least depth 1.95 (1.85–2.0) in head length.

Mouth strongly oblique, forming an angle of about 50° to horizontal axis of body; maxilla reaching a vertical at centre of eye, the upper-jaw length 2.7 (2.5–2.75) in head length; upper jaw with an outer row of six, well-spaced, incurved, canine teeth on each side, and a medial band of small, incurved, conical teeth that narrows posteriorly; lower jaw slightly protruding when mouth closed, with an outer row of three incurved canine teeth anteriorly on each side of jaw, separated by a band of smaller incurved conical teeth from an inner pair of strongly incurved canines at corner of jaw, the more posterior tooth largest; no teeth on vomer or palatines; tongue truncate, set far back in mouth.

A low median fleshy ridge on head from interorbital space to origin of dorsal fin; no opercular or preopercular spines; preopercular margin free only ventrally; upper end of gill opening at or slightly dorsal to level of middle of eye, the ventral end extending to below posterior margin of preopercle.

Scales very small, not in regular rows, and difficult to count (three independent counts of scales in longitudinal series on holotype: 163, 166, and 170); scales becoming embedded on nape; only a few scales with small cteni were found dorsoposteriorly on body.

Cephalic pores and sensory papillae as shown by Prince Akihito in Masuda *et al.* (1984: fig. 62) and Winterbottom and Emery (1986: fig. 107) for *Nemateleotris magnifica*.

First dorsal fin very elevated anteriorly, the first spine longest, 4.1 (3.85–3.9) in SL, the second and third spines only slightly shorter (fourth spine short, about equal to eye diameter); fifth spine about 1.3 in head length; sixth spine about 2.0 in head length; spine of second dorsal fin 3.8 (3.5–4.05) in head length; penultimate dorsal

soft ray usually longest, 2.4 (1.25–2.0) in head length; caudal fin slightly emarginate, lobe tips pointed, the fin length 4.5 (4.2–4.55) in SL; pectoral fins moderately pointed, the middle rays longest, 6.2 (6.05–6.2) in SL; pelvic fins fully divided, their origin directly below pectoral-fin base, the length 6.15 (5.45–6.6) in SL.

Color of holotype in alcohol pale beige, whitish on abdomen, the fins translucent pale yellowish, the pelvics tipped with dark brown; a blackish dash on side of maxilla below anterior fourth of eye, its length two-thirds pupil diameter.

Figure 9 provides the color of the holotype when fresh (after fixing the fins erect with formalin). The purple color in life has changed to pink. Figure 10 is taken in the field underwater and Figure 11 is from an aquarium.

Genetic analysis. The COI mtDNA barcode sequences for four specimens of the new species broadly overlap with barcode sequences for four *Nemateleotris decora* obtained from the aquarium trade, reportedly from the Philippines (GenBank accession numbers KF489661–KF489664 and FJ583701–FJ583704, respectively). The similarity of barcode sequences does not indicate populations are the same species, since new-sprung species can develop differences first in color before sequences diverge and even a small degree of hybridization can commingle mitochondrial haplotypes (e.g. Kerr *et al.* 2007). A number of sibling reef fish species with obvious marking or morphological differences have been found to share mitochondrial lineages (Victor, in prep.). Since these sibling species can occur sympatrically at the edges of their ranges, or are even broadly sympatric, they do not represent subspecies. Further studies with nuclear gene sequences would be required to further assess these taxonomic questions. In the case of *N. exquisita* vs. *N. decora*, the morphological differences clearly support species status.

Etymology. This dartfish well deserves the species name *exquisita* for both form and color.

Distribution. *Nemateleotris exquisita* is presently known from Mauritius, KwaZulu-Natal, southern Mozambique, Red Sea, Thai coast of the Andaman Sea, and the Andaman Islands. *Nemateleotris decora* is known in Indonesia from Sulawesi (Severns 1994: 70) and by the first author's underwater photographs from Halmahera, Moyo Island, and Bali. It is also illustrated from Christmas Island (Allen & Steene 1988: 141, fig. 428).

Figure 11. *Nemateleotris exquisita*, aquarium photograph (J. Bukkems).

Remarks. *Nemateleotris exquisita* is usually seen on deep outer-reef slopes over sand or sand and rubble substrata, generally in clear-water areas with moderate current. It is often encountered in pairs. Specimens were collected from depths of 42 to 69 m.

Nemateleotris exquisita is distinguished by body depth (it is more slender, the depth 5.7–6.3 in SL, compared to 4.85–5.7 for *N. decora*); a longer snout (snout length 4.0–4.65 in head length, compared to 5.0–7.5 for *N. decora*); by eye size when specimens of the same size are compared (larger in *N. decora*), usually a shorter first dorsal spine, and by color. The pale anterior part of the body of *N. exquisita* is more yellow, in general, compared to the near-white of the body of *N. decora*, and it extends much more posterior. Also, there is a difference in the maximum size of the two species based on available specimens. The 11 type specimens of *N. decora decora* measure 23.3–49.5 mm SL; four Bishop Museum specimens collected since the original description measure 23–52.5 mm SL. The 11 type specimens of *N. exquisita* measure 46–66 mm SL, eight of them longer than 52.5 cm.

The height of the first dorsal fin was initially believed to be a good distinguishing character of the two species, high in *N. decora* and short in *N. exquisita*. However, too many exceptions were apparent, such as the relatively high fin of the 54-mm paratype from KwaZulu-Natal, and the short fin of the photographed individual of Figure 6 from Halmahera, Indonesia. The first dorsal fin of the fish of Figure 11 looks like it may have been shortened by a traumatic event.

Like other species of *Nemateleotris*, *N. exquisita* may be seen rapidly flicking its pennant-like first dorsal fin forward and backward, along with the pelvic fins. Yunokawa (1993) reported this as an alarm signal.

Probable Hybrid. The first author took an underwater photograph of an individual of *Nemateleotris* in the Maldive Islands in 1988 (Fig. 12) that was first identified as *N. decora*. However, it is now believed to be the hybrid, *N. decora* x *N. exquisita*. The relatively deep body and relatively long snout favor *N. decora*, whereas the small eye suggests *N. exquisita*. The pale coloration of the anterior part of the body is clearly neither white or yellow, but yellowish, and the transition of the anterior pale and dark posterior part of the body seems intermediate. With *N. decora* presently known westward only to Sulawesi and Bali, and *N. exquisita* east to the Thai coast of the Andaman Sea, one might expect hybridization could occur at some intermediate sites such as Sumatra. Because of its deep-reef habitat and being difficult to collect, we do not know the definitive distribution of *N. exquisita*. It might range to Sri Lanka like such species as *Chaetodon andamanensis* and *Halichoeres timorensis* and stray to the Maldives. Or it might be a valid undescribed species of the genus, paralleling the example of the newly described *Coris latifasciata* from the Maldives and the Chagos Archipelago, intermediate to the Pacific and Andaman Sea *Coris batuensis* and the Red Sea *Coris variegata* (Randall 2013).

Figure 12. *Nemateleotris decora* x *exquisita*, probable hybrid, North Malé Atoll, Maldive Islands (J.E. Randall).

Acknowledgments

We thank foremost Daniel Pelicier of Mauritius for alerting the first author to the presence of this species and for collecting five of the nine type specimens. We are also grateful to Drs. Dirk Steinke and Benjamin C. Victor for their help in the genetic sequencing, to Arnold Y. Suzumoto and Loreen R. O'Hara of the Bishop Museum for x-rays and curatorial assistance, and to Drs. Seishi Kimura and Hiroshi Senou for requested information on literature. Sequence analysis of some of the specimens was supported by grants from the Ontario Ministry of Research and Innovation and from Genome Canada through the Ontario Genomics Institute to Paul Hebert. The manuscript was reviewed by Dr. Gerald R. Allen and Helen A. Randall.

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