ELEVATION OF SPICOMACRURUS (GADIFORMES: MACROURIDAE) TO GENERIC STATUS, WITH DESCRIPTIONS OF TWO NEW SPECIES FROM THE SOUTHWESTERN PACIFIC

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ABSTRACT

Spicomacrus, formerly classified as a subgenus of Hymenogadus, is elevated to full generic status after the discovery of two new species from the southwestern Pacific. The following synapomorphies characterizing the genus are not shared with either Hymenogadus or Hymenocephalus, although Spicomacrus obviously belongs within this clade of grenadiers: net-like pattern of black epithelium covering gular region; elongate posterior dermal window of light organ; membranous flange on distal portion of outer pelvic fin ray; and protruding snout formed by three broad horizontally flattened processes of the nasal bones. Spicomacrus dictyogadus sp. nov. is described from one collected off Vanuatu in 657–685 m. It can be distinguished by its relatively deep and compressed body and head, greatest body width about 2 times into greatest depth; suborbital depth about 3.5 into orbit diameter; and scale rows below origin of second dorsal fin 5½. Spicomacrus mccoskeri sp. nov. is described from six specimens collected off Chesterfield Plateau in 650–710 m. It can be distinguished by its shallow, cylindrical body and head, greatest body width slightly less than greatest depth; suborbital depth 5–6 into orbit diameter; and scale rows below origin of second dorsal fin 3½. A key to all four species of Spicomacrus is provided.

During a recent visit to the Muséum national d’Histoire naturelle (MNHN), one of us (HCH) examined large collections of southwestern Pacific fishes resulting from cruises of the French “Tropical Deep-Sea Benthos” (formerly MUSORSTOM). In a drum of unsorted deepwater fishes collected in slope waters of Vanuatu, HCH found among many grenadiers one that was unusual and not familiar to him. He informed the lead author (TI) of this find and sent along some digital images of the fish. From the images alone, it was apparent that the specimen represented an undescribed species of Hymenocephalus (subgenus Spicomacrus). A further search of the drums failed to turn up additional specimens.

A closer examination of the MNHN specimen and comparison with other representatives of the genera Hymenocephalus and Hymenogadus revealed profound differences in the structure of the light organ, the snout, and the outer pelvic fin ray, and in the net-like pattern on the gular region. We determined that not only does the specimen warrant recognition as a new species, but also that based on these characters, Spicomacrus deserves elevation to full generic status. A further examination of other specimens of what were identified as Hymenogadus (Spicomacrus) kuronumai (Kamohara, 1938), including six that were recorded from the southwestern Pacific by Iwamoto and Merrett (1997), three from near the type locality off Tosa Bay (Shikoku Island), Japan, and two from northeastern Taiwan, revealed that the southwestern Pacific specimens were misidentified and represented another undescribed species of Spicomacrus. The genus now includes
four species: the type species *S. kuronumai* from southern Japan and northeastern Taiwan, *Spicomacrurus adelscotti* Iwamoto and Merrett, 1997 from the Wallis and Futuna Islands (north of Fiji), and two new species described in the present work. Here we redefine the genus *Spicomacrurus*, present descriptions of the two new species, and provide a key to the four species. We recognize that in describing the single Vanuatu specimen as new, we are forced to omit some aspects of the morphology of this unique species for fear of further damaging the single fragile and imperfect specimen. We acknowledge that a more intensive search of the MNHN collections may have revealed additional material, but time constraints prevented this. The possibility of additional collections being made in deep waters off Vanuatu in the near future is remote.

**Material and Methods**

Comparative materials used were from the extensive grenadier holdings of the California Academy of Sciences (CAS) and the Research Center for Biodiversity, Academia Sinica, Taiwan (ASIZ). Additional specimens were borrowed from MNHN and Department of Natural Science, Kochi University (BSKU). Methods for taking counts and measurements follow Iwamoto (1970) and Iwamoto and Sazonov (1988). Anatomical terminology generally follows Okamura (1970a,b). Complete references to scientific names can be found in Eschmeyer’s *Catalog of Fishes* (1998), available and continually updated online at http://research.calacademy.org/ichthyology/catalog.asp. Abbreviations for institutions follow Fricke and Eschmeyer (2009), available at http://research.calacademy.org/research/ichthyology/catalog/collections.asp.

**Systematics**

*Spicomacrurus* Okamura, 1970

*Spicomacrurus* Okamura 1970a: 63 (as subgenus of *Hymenogadus* Gilbert and Hubbs, 1920)

*Type species.*—*Hymenoccephalus kuronumai* Kamohara 1938: 70 (by original designation and monotypy; type-locality Tosa Bay, Kochi, Japan). Figs. 1A–C.

*Etymology.*—Presumably from the Latin *spica* or *spiculum*, dart, spike, probably in reference to the dartlike shape of the fish, and *macrurus*, a genus of grenadier; treated as a masculine noun.

*Diagnosis.*—A member of the family Macrouridae, subfamily Macrourinae. Branchiostegal rays 7. Anus and urogenital pore situated within a small periproct area that lies immediately before anal fin. The so-called “ventral striae” of Gilbert and Hubbs (1916: 186) “consisting of fine parallel lines of dark, alternating with silvery pigment” associated with a light-producing function (Cohen 1964: 406–409) on abdominal wall, parts of chest, and shoulder girdle. A small, elongated, translucent lens of the light organ immediately anterior to anus; a small, round, sometimes indistinct lens mesially on chest slightly anterior to a transverse line connecting anterior ends of pelvic-fin bases (Fig. 1C). Gular region covered with fine black strands of epithelium in a net-like pattern, the whole resting upon underlying layer of dermis. Nasal bones forming broad, horizontal, lateral, and medial processes; nasal bones of both sides in broad contact (two species), or widely separated by rostral cartilage...
IWAMOTO ET AL.: NEW SPECIES OF SPICOMACRURUS GRENAUDR

(two species). No serrations on leading edge of spinous dorsal-fin ray. Pelvic fin rays 8–10, outer ray greatly elongated, flattened with narrow ribbon-like flange on free distal portion, penultimate portion sometimes more-broadly expanded. Barbel short but well developed. Gill membranes narrowly attached to isthmus, with a narrow free fold; opercular opening extending forward to vertical under or slightly anterior to posterior margin of orbit. Gill rakers on short, slightly raised bases, 12 or fewer on inner side of first arch, < 14 total. Small, conical teeth in long narrow bands in both jaws; teeth sharply pointed or bluntly flanged. Scales large, highly deciduous, of "Hymenogadus-type" (of Okamura 1970b: 11) with complete concentric rings and radial grooves basally, and exposed fields either covered with short, sharp, conical, recurved spinules or lacking spinules (see Okamura 1970a: 63–64 for other characters).

Remarks and Comparisons.—Spicomacrus was first erected as a monotypic subgenus of Hymenogadus based on the single species, H. kuronumai (Figs. 1A–C). The large horizontal processes of the nasal bone, the low, subcylindrical body, and the "moth’s tentacle-like" outer pelvic ray were among the characters used by Okamura (1970a: 63–64) to distinguish that taxon from the subgenus Hymenogadus. In most species of Hymenocephalus, the tip of the snout is formed by a thin, weak, laterally flattened mesial extension of the nasal bones. In Spicomacrus, however, the large median and lateral nasal processes are flattened horizontally to form three broad, stout plates. The mesio-distal margin of the outer pelvic ray has a membranous flange, which in H. kuronumai has also a fleshy, somewhat glandular covering that is easily sloughed off (Fig. 1D). Whether this covering is present in life in the other species is unknown, as all examined specimens of these other species currently lack such structures. The membranous flange is best developed in H. kuronumai, and less so in the other species. The net-like pattern ("reticulate pattern" of Okamura 1970a: 66) of the gular epidermis is unique among the Macrouridae; in other genera, these black epidermal strands run perpendicular to the median line. In some species of Hymenocephalus [e.g., Hymenocephalus longibarbis Günther, 1887 (Fig. 1E) and Hymenocephalus megalops Iwamoto and Merrett, 1997], a layer of ventral striae underlies this epidermal net, whereas in Spicomacrus, an opaque ivory layer lies underneath. The gular region is also broad and flat, lacking a median trough. This may be unique to the genus, but a thorough survey of all Macrouridae must be made to verify this. The two ventral lenses of the light organ characteristic of Hymenocephalus and Hymenogadus are relatively less developed in Spicomacrus, although in Hymenocephalus subgenus Papyrocephalus, these lenses are generally small and somewhat obscure. Comparable lens-like structures associated with the luminous organ of these three genera are not found in other gadiforms, so far as we know, although Okamura (1970a,b) considers the lenses of these genera to be comparable with those in Malacocephalus, Ventrifossa, Nezumia, and perhaps others. However, in those genera, the structure through which light is emitted is a scaleless depressed part of the skin and not a distinct convex structure that one might liken to a tiny translucent button. Whereas the posterior lens that lies immediately anterior to the anus is round or oblate in outline in Hymenocephalus and Hymenogadus, in Spicomacrus, the posterior lens is notably slender and elongated, its length 2.5–3.0 or more times the width. In Spicomacrus, the bones of the skull are relatively stout and the canals housing the cephalic sensory organs are more-normally developed, whereas in members of Hymenocephalus, the skull bones are thin and membranous and the cephalic canals are expansive.
Figure 1. (Opposite page) (A–C) *Spicomacrus kuronumai*, ASIZP 65232, fresh specimen. (B) Ventral view of front body. Arrows (left to right) point to net-like gular membrane, anterior lens of light organ, and posterior lens of light organ. (C) Dorsal view of head. Membranous integument of snout partially torn exposing lateral and mesial nasal processes. (D) Same species, BSKU 13385, outer pelvic-fin ray showing fleshy coating and membranous flange (arrowed) at distal end. (E) *Hymenocephalus longibarbis*, CAS 86-489, ventral view of head. Note transverse orientation of black thread-like lines on gular region in D and E (which in turn are underlain by finer black lines of ventral striae—faintly visible—running at a diagonal to transverse lines).
Key to the Species of Spicomacrurus

1a. Nasal bones closely adjoined along mesial edges, not broadly separated by rostral cartilage (Fig. 1C); interorbital width 20%–21% HL, 1.2–1.8 into orbit; upper jaw 36%–42% of Hl... 2

1b. Nasal bones broadly separated by rostral cartilage (Figs. 2B, 3B); interorbital width 8%–15% HL, 2.0–4.2 into orbit; upper jaw 46%–50% of HL................................................................. 3

2a. Pelvic fin rays 9, outer ray only slightly flattened and expanded distally................................................................. Spicomacrurus adelscotti

2b. Pelvic fin rays 8, outer ray distinctly flattened and expanded distally................................................................. Spicomacrurus kuronumai

3a. Body and head deep, compressed, greatest body width about 2 times into greatest depth; suborbital depth about 3½ into orbit diameter; scale rows below origin of second dorsal fin 5½................................................................. Spicomacrurus dictyogadus sp. nov.

3b. Body and head shallow, cylindrical, greatest body width slightly less than greatest depth; suborbital depth 5–6 into orbit diameter; scale rows below origin of second dorsal fin 3½ ................................................................. Spicomacrurus mccoskeri sp. nov.

Spicomacrurus dictyogadus new species
[New English name: net-throat grenadier]
Fig. 2A–D

Holotype.—MNHN 2009-1455 (♀, 53.8 mm HL, 243+ mm TL, with small pseudo-caudal), Vanuatu, Coral Sea, South Pacific Ocean, 16°18’00”S, 167°46’59”E, 657–685 m, Campagne Boa 1, R/V ALIS, stn. CP2473, 14 September, 2005.

Diagnosis.—A species of Spicomacrurus with 9–10 pelvic fin rays; nasal bones broadly separated mesially by the rostral cartilage; interorbital width narrow, 1.95 into orbit; upper jaw long, 2 times into HL; body and head relatively deep and compressed, greatest body width about 2 times into greatest depth; suborbital depth about 3.5 into orbit diameter; scale rows below origin of second dorsal fin 5½.

Condition of Specimen.—Mouth widely gaping, throat region distended; nasal bones apparently broken off anteriorly, and no horizontal “plates” remain in place, although the left lateral plate hangs on a thin strip of skin (this condition affects measurements that start at the snout tip); opercular bones damaged on right side; opercle almost torn off, subopercle detached from opercle; right branchiostegal rays mostly free. Tissue surrounding shoulder girdle damaged, abdominal cavity partially exposed through tear in abdominal wall; internal organs appear poorly preserved, whole of abdomen soft. Scales almost entirely missing except anteriorly on chest behind isthmus and small patch on interorbital space. Distal tip of outer pelvic ray and most tips of anal fin rays apparently broken off.
**Description.**—Selected measurements and counts of the four species are compared in Table 1.

1D. II,12; P. i20 (left)/i19 (right); V. 9(left)/10(right); gill rakers on first arch 0+7 (lateral)/ 3+11 (mesial), on second arch 2+8/1+1+9; scale rows below origin of first dorsal fin about 7½, below midbase of first dorsal fin 6½, below origin of second dorsal fin 5½, lateral-line scales from anterior origin over distance equal to predorsal length about 25. Measurements in mm, percent of head length in parentheses: greatest width of head 23 (43); snout length 11.8 (22); internasal width 7.6 (14); interorbital width 8.2 (15); orbit diameter horizontal 16.0 (30), vertical 11.7 (22); suborbital depth 4.6 (9); postorbital length 27.1 (50); distance orbit to angle of preopercle 20.6 (38); length upper jaw 26.7 (50); length premaxillary ramus 22.2 (41); height ascending process of premaxilla 8.9 (17); length barbel 5.4 (10); length outer gill slit 14.3 (27); preanal length 101 (188); distance between base of outer pelvic ray and origin of anal fin 37.7 (70); distance scaled tip of isthmus to origin of anal fin 63.0 (117); greatest

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Figure 2. (Opposite page) (A–B) *Spicomacrurus dictyogadus* sp. nov., holotype, MNHN 2009-1455. (A) Lateral view of front body, scale bar = 2 cm. (B) Dorsal view of head, arrows point to left nasal bone (left arrow) and rostral cartilage (right arrow). Distal tips of nasal bones apparently broken off. (C) Radiograph, scale bar = 1 cm. (D) Lateral-ventral view of head showing net-like pattern of covering of gular region (arrowed).
body depth 40 (74); depth over origin of anal fin 30 (56); body width over pectoral bases about 18 (about 33); distance between first and second dorsal fins 29.6 (55); height first dorsal fin about 33 (about 61); length base of first dorsal fin 21.5 (40); length pectoral fin 33 (61); length outer pelvic ray more than 46 (86+).

Dorsal profile from nape to first dorsal fin slightly elevated, then leveling behind fin to end of tail; ventral profile shallowly rounded over abdomen to origin of anal fin, where depth is about $\frac{3}{4}$ greatest body depth (under first dorsal fin); tail greatly compressed, gradually tapering posteriorly to pseudocaudal terminus. Head relatively long, length more than greatest body depth, probably about five times or more into total length (estimate because tip of tail formed into small pseudocaudal); head laterally compressed, greatest width less than postorbital length. Snout low, rounded in profile in holotype and not protruding beyond large, almost-terminal mouth, but with nasal bones fully intact, a short projection of snout probable. Upper jaw extending posteriorly to below posterior $\frac{1}{4}$ of orbit. Protrusion index (see Okamura 1970b: 28; height premaxillary ascending process/length premaxillary ramus × 100) 40. Orbit large, somewhat egg-shaped, narrower at anterior end. Nasal bones of each side broadly separated by premaxillary ascending process (premaxillary pedicel of Okamura 1970a,b) and rostral cartilage; anterior tips of nasals turning mesially toward each other but failing to join, at least in present condition (if nasal bones have three horizontal projections as predicted, then mesial anterior tips probably joined to some degree); nasals narrowly connected posteriorly along median line (Fig. 2B). Lateral nasal ridge low, edged in black, not joined to orbital rim. Rim of orbit anterodorsally almost ridge-like; at point about over anterior margin of pupil, the low ridge turning mesially to join at a sharp angle the supraorbital ridge running along upper orbital margin (Fig. 2B). Suborbital region shallow, smoothly contoured, without a defined horizontal ridge; infraorbital 1 (lachrymal) narrow, extending forward almost to tip of upper jaw, along each side of ascending premaxillary process. Barbel short, slender, length about $\frac{1}{5}$ orbit diameter. Gill rakers tubercular, all coarsely peppered with melanophores, contrasting with pale gill arch and filaments. Branchiostegal membrane of each side narrowly connected over isthmus at point under posterior end of lower jaw, roughly under posterior margin of orbit. Fourteen thoracic vertebrae; five or six anal pterygiophores before first haemal spine (Fig. 2C).

First dorsal fin elevated, greatest height about $\frac{3}{4}$ of head length; first spinous ray rudimentary and not externally visible (evident in radiograph, Fig. 2C); second spinous ray rounded in cross-section, lacking serrations on leading edge, its height about equal to anterior segmented rays. First and second dorsal fins widely separated; anterior rays of second dorsal fin about half length of opposing rays of anal fin. Origin of first dorsal fin about on same vertical as posterior margin of gill cover and slightly ahead of those of pectoral and pelvic fins, these last fins about on same vertical. Origin of second dorsal fin above 9th ray of anal fin. Outer, prolonged ray of pelvic fin extending to at least 9th or 10th ray of anal fin.

Jaw teeth short, stout, conical, recurved, in long narrow bands in both jaws. No teeth on roof or floor of mouth. Premaxillary ascending process low, about 40% of premaxillary length.

Body and tail of holotype devoid of scales with exception of a small patch on chest just behind isthmus and of a few scales on interorbital space. Scale pockets, however, prominent and sharply marked, indicating relatively large scales in life. Scale pockets atop head extend onto frontal region and anteriorly to level of posterior end of
supranarial ridges. Scales remaining on chest covered with short, conical, slightly recurved spinules; those on interorbital space similarly spinulated, but smaller.

Holotype a ripe female; eggs measuring 0.8–0.9 mm diam recovered from tear in abdominal wall at shoulder girdle. Internal organs not examined for fear of additional damage to already deteriorated and fragile specimen.

**Coloration.**—Silvery on sides of head extending onto pelvic-fin base and trunk ventral to lateral line; whether silvery color extends posteriorly onto tail unknown. Silvery pigmentation on abdomen underlain by a bluish layer, presumably a product of black peritoneal membrane showing through translucent flesh. Nape, dorsum of trunk, and tail with creamy-brown ground color overlain with dark margins of scale pockets. Integument anteriorly on head translucent, especially over snout, with black margins and dark inner bones obscured but visible. Lips and jaws black, although maxillary and connective tissue between maxilla and lower jaw white. Gular region covered by black net-like pattern (Fig. 2D). Buccal cavity white or ivory, gullet gray; black color of vomer, premaxilla, and dentary bones showing through buccal membrane as dark gray. Barbel black at base, fading to pale distally. Gill cavity pale around gills, but black on margin over cleithrum and branchiostegal rays. A blotch of ivory coloration at anterior end of isthmus beneath gill membranes. Paired fins black or blackish; median fins dark, anal fin blackish, but first dorsal more dark-dusky with distal margins black.

**Distribution.**—Known only from the single specimen taken off Vanuatu in 657–685 m.

**Etymology.**—From the Greek *diktyon*, meaning net or mesh, in reference to the net-like or mesh-like epithelium of gular membrane, and *gados*, cod fish.

**Comparisons.**—*Spicomacrurus dictyogadus* sp. nov. is distinctive among the species in the genus in having a deep, compressed body and head, a relatively obscure anterior lens of the light organ, and more scale rows below the first and second dorsal fins (a reflection of the deeper body). Table 1 provides other characters by which the species can be distinguished from its congeners.

**Spicomacrurus mccoskeri** new species

[New English name: McCosker’s grenadier]

Fig. 3A–E

*Hymenocephalus kuronumai* (non Kamohara, 1938): Iwamoto and Merrett 1997: 518–519, fig. 21a (6 spec., herein listed as type series, Chesterfield and Bellona Plateau, 650–710 m).

**Holotype.**—MNHN 1994-0879 (♀, 47.7 mm HL, 192+ mm TL), Chesterfield Plateau, Coral Sea, South Pacific Ocean, 19°45.40′S, 158°45.62′E, 650 m, MUSORSTOM 5, Stn. CC366, 19 October, 1986.

**Paratypes.**—MNHN 1994-0880 (♀, 42.6 mm HL, 177+ mm TL), Chesterfield Plateau, Coral Sea, South Pacific Ocean, 19°48′00″S, 158°43′59″E, 685–700 m; MUSORSTOM 5, stn. CP363, 15 October, 1986. MNHN 1994-881(2♂, 1♀, 40.0-ca. 55 mm HL, 173+ to 250+ mm TL) and CAS 86459 (1♀, 49 mm HL, 215+ mm TL),
Diagnosis.—A species of *Spicomacrurus* with 9 pelvic fin rays; nasal bones broadly separated mesially by the rostral cartilage; interorbital width relatively narrow, 8%–11% HL, 2.0–4.2 into orbit; upper jaw relatively long, 46%–50% of HL; body and head relatively shallow and cylindrical, greatest body width about equal to greatest depth; suborbital depth 5–6 into orbit diameter; scale rows below origin of second dorsal fin 3½.

Description.—Selected measurements and counts of the four species are compared in Table 1. The following values are provided for the holotype, followed by those of paratypes, if different, in parenthesis. 1D. II.10; A. 82+ (72+ to 90+); p. i19 (left) and i17 (right); i17–i20; V. 9; gill rakers on first arch 0+9 (0+7–9) (lateral)/2+12 (2–3+10–12; mesial) = 14 (12–14), on second arch 2+9 (1–2+9–11) = 11 (11–13)/2+11 (1–3+8–11) = 13 (10–13); scale rows below origin of first dorsal fin about 5, below midbase of first dorsal fin 3½, below origin of second dorsal fin 3½, lateral line scales from anterior origin over distance equal to predorsal length about 26 (24–26). Measurements of holotype in millimeters, ranges in parenthesis in percent of head length: greatest width of head 20.5 (43–51); snout length 11.4 (23–27); internasal width 6.4 (12–14); interorbital width 4.4 (8–11); orbit diameter horizontal 14.8 (30–35); suborbital depth 2.7 (5–7); postorbital length 22.2 (44–49); distance orbit to angle of preopercle 15.5 (30–35); length upper jaw 22.0 (46–50); height premaxillary ascending process 6.8 (13–15); length premaxillary ramus 18.3 (38–48); length barbel 4.1 (10–12); length outer gill slit 11.7 (24–27); preanal length 82 (169–185); distance between base of outer pelvic ray and origin of anal fin 38 (69–87); distance scaled tip of isthmus to origin of anal fin 63 (116–133); greatest body depth 21.5 (44–50); depth over origin of anal fin 18.5 (32–42); body width over pectoral bases about 21.5 (41–48); distance between first and second dorsal fins 26 (51–71); height first dorsal fin about 25 (53–55, three specimens); length base of first dorsal fin 12.2 (25–31); length pectoral fin 26 (53–53, three specimens); length outer pelvic ray 30 (62–70).

Dorsal profile (Fig. 3A) from orbit to first dorsal fin scarcely elevated, essentially horizontal behind fin to end of tail; ventral profile almost straight from lower jaw to abdomen, slightly rounded to origin of anal fin; tail gradually tapering posteriorly to terminus. Head and trunk long, slender, cylindrical, becoming laterally compressed posteriorly on tail. Greatest body width about equal to its height. Head long, its length 2 or more times greatest body depth, about 4.5 into total length; its greatest width slightly more than head depth, about equal to or more than postorbital length. Head dorsally and ventrally rather flat; broad gular region also flat. Snout low, protruding beyond large mouth; viewed dorsally, snout forming narrow, blunt tip (Fig. 3B). Nasal bones of each side broadly separated by premaxillary pedicel and rostral cartilage, anterior tip of each nasal forming a broad horizontal lateral process, mesially anterior ends meeting to form broad terminal process; posterior ends of nasals narrowly connected along median line. Interorbital space very narrow, viewed dorsally orbits deeply incised into skull. Orbit large, somewhat teardrop-shaped, with anterior end narrower. Prefrontal bone stout, forming sharp ridge anterodorsally on orbit; about over anterior margin of pupil, the low ridge turning mesially to join at a sharp angle the supraorbital ridge running along upper orbital margin. Preorbital (lachrymal) narrow, extending forward under nasals to tip of jaws. Suborbital re-
region shallow, smoothly contoured, with a low longitudinal ridge separating upper and lower halves. Mouth wide, gape about equal to length of rictus, which extend to below mid-orbit; upper jaw extending posteriorly to below posterior margin of orbit. Protrusion index 30–39. Barbel short, slender, length about \( \frac{1}{2} \) orbit diameter. Branchiostegal membranes narrowly connected over isthmus at point under posterior end of lower jaw, roughly under posterior margin of orbit; a narrow free fold developed (Fig. 3C). Gill arches long, little restricted, outer gill slit wide; rakers widely spaced, low, tubercular. Pores of cephalic lateralis system rather large on interorbital, mandibular rami, lower margin of suborbital, and outer margins of preopercle.

Jaw teeth all short, stout, conical, with rather blunt, flanged tips, in long narrow bands in both jaws. No teeth on roof or floor of mouth. First dorsal fin relatively low, its greatest height slightly more than half head length; no prolonged rays; second dorsal fin rudimentary over almost entire length; anal, pectoral and pelvic fins well developed. Outer ray of pelvic fin slightly flattened along free distal margin to form narrow flange, ray tapering to fine terminal tip (Fig. 3D).

Scales of body and tail mostly missing, those remaining on dorsum of trunk covered with short, needle-like, reclined spinules with slightly recurved tips arranged in 5–8 somewhat convergent rows. Scales on chest mostly devoid of developed spinules, but with low ridges, each terminating posteriorly in a few short, rudimentary spinules along posterior margin of scale. Scales on interorbital region small, densely covered with short, sharp, conical, slightly reclined spinules in no apparent pattern or in more-or-less quincunx arrangement. Few scales remaining on suborbital region and lower jaw thin, without spinules, in single row on mandibular rami.

Posterior lens notably slender and elongated (Fig. 3E), its length 2.5–3.0 or more times the width.

Fourteen large, thick pyloric caeca in a male of 173+ mm TL (MNHN 1994-880). Three of six type specimens are ripe females with large ovaries; egg diameters variable, largest measured 1.2 mm diam. Two specimens (MNHN 1994-881, 250+ mm TL and 190+ mm TL) each with a large shrimp in its stomach (removed by a previous worker).

**Coloration.**—In ethanol, body with dark dorsolateral stripe originating behind upper end of gill opening and ending at tail tip; stripe broader posteriorly, essentially covering entire caudal half of tail. Dorsum pale, flesh-colored; body below lateral stripe silvery, but bluish over abdomen and dark bluish-black on chest, gular, and branchiostegal membranes (Fig. 3C). Silvery on shoulder girdle under gill cover, where ventral striae prominent; striae continuing posteriorly above pelvic fin bases, one branch extending dorsally to base of pectoral fin, the other onto abdomen to proximity of posterior lens of light organ. Head ridges generally sharply marked off with black streaks, rather boldly over nasal ridges and down along suborbital; leading edge of snout with narrow black margin. Mouth and gullet pale, white to ivory on roof of mouth, but blackish on dorsal oral valve, dusky around tooth bands, and a small black spot on each side of vomer. Premaxilla mostly blackish, including front face of ascending process; maxilla darkly pigmented except on posterior end. First dorsal fin blackish, but pale at base; anal and second dorsal fins pale except anteriormost rays of anal fin blackish; pectoral fins dusky to black; pelvic fins white. Barbel pale, but base black. Periproct black; anterior and posterior lenses of light organ translucent, but large melanophores interspersed within darkly obscure parts
Figure 3. (Opposite page) (A–C) Spicomacrurus mccoskeri sp. nov. (A) Lateral view of body, from holotype, scale bar = 2 cm. (B) Dorsal view of head, from holotype. (C) Ventral view of head, MNHN 1994-0881, paratype. Left arrow points to net-like gular membrane and right arrow points to anterior lens of light organ. (D) Ventral view of abdomen, MNHN 1994-0881, paratype, the expended distal pelvic fin is arrowed. (E) Same specimen, closed view of periproct region shows the elongated posterior lens of light organ (left arrow) and anus (right arrow).
of structure. Gill cavity almost entirely pale; gill arches and filaments pale, but rakers sparsely peppered with black melanophores.

**Distribution.**—Known only from the type specimens taken off the Chesterfield Plateau in the southwestern Pacific in 650–710 m.

**Etymology.**—Named for the intrepid adventurer, diver, raconteur, expert fly fisherman, conservationist, ichthyological colleague and friend John E McCosker.

**Comparisons.**—*Spicomacrus mccoskeri* is readily differentiated from its congener by the combination of broad separation of nasal bones by the rostral cartilage; greatly elongated, shallow, cylindrical trunk and head; narrow interorbital and suborbital spaces; and large mouth. Table 1 provides other characters by which the species can be distinguished from its congeners.

**Discussion**

The closely related genera, *Hymenocephalus* and *Hymenogadus*, have several species that appear to be widely distributed, notably *Hymenogadus gracilis* Gilbert and Hubbs, 1920, which has been recorded from the Atlantic, Indian, and Pacific Oceans, and *Hymenocephalus aterrimus* Gilbert, 1905 (Pacific and Atlantic) and *Hymenocephalus italicus* Giglioli in Giglioli and Issel, 1884 (Atlantic and Indian). Why their distributions are so broad, yet others of the three genera are relatively restricted, belies adequate explanation for now. Eschmeyer et al. (2010: 43) allude to this in their paper on marine fish biodiversity: “The important unanswered question is how widespread are deep-slope species? We do not have this information, an important unknown for estimating undiscovered marine fish biodiversity.”

The discovery of two new species of a small, little-known genus of Macrouridae provides evidence of how little we know the demersal deepwater fauna of the vast region of the southwestern Pacific lying between ~10°N and 30°S. The convergence of several plates, including the Australian, Bismarck, Solomon, and Fiji plates, and the Philippine and China plates farther to the north and east, produces a tectonically active region whose bottom topography is highly dissected and massively convoluted. The presence of a multitude of oceanic elevations, such as islands, oceanic ridges, guyots, seamounts, and plateaus, offer potential sites for evolutionary divergence of the bottom-dwelling fishes contained. The shore fishes of this vast region have been rather well documented, but the deepwater fishes at slope depths exceeding 200 m remain poorly known and virtually unsampled except in a few restricted localities. Most of the slope bottoms of the region are exceedingly rough, steep, and difficult or impossible to sample using standard bottom trawls. An indication of the unknown diversity that still remains hidden to ichthyologists is the recent sampling conducted in depths beyond 100 m by divers using mixed-gas re-breather SCUBA equipment. Collections by these divers off steep island slopes of the Pacific have produced astonishing numbers of new taxa (see Eschmeyer et al. 2010). Most grenadiers live at depths exceeding 200 m and extending down to > 4000 m. Collecting at such depths over rough steep bottoms is still a challenge and often results in lost or damaged gear. Deep-submersible vehicles (manned or unmanned), hook and line, tangle or gill nets, and deep-set longlines offer mere glimpses of the faunal diversity. The feasibility and economic justification for extensive sampling of this deepwater fauna
is minimal. Thus, we are restricted in increasing our knowledge of the fauna of this deep biome to occasional, limited samples, often arising serendipitously from other directed activities.

Comparative Materials.—Spicomacrus kuronumai: ASIZP 65232 (1, 165 mm TL), Tashi Fish Market, NE Taiwan, bottom trawler, 27 March, 2004, coll. H-C Ho. ASIZP 70247 (1, 97 mm TL), Nan-gang-ao, NE Taiwan, 1 March, 1999, coll. M-L Chiou. BSKU 1377 (1, 160 mm TL), BSKU 13376, 182 TL, BSKU 13383, 191+ TL; Tosa Bay, Shikoku, Japan. Hymenoccephalus longibarbis: CAS 86478 (2, 210-262 + mm TL), New Caledonia, 18°54′02″S, 163°11′12″E, MUSORSTOM 4, R/V Vauban, stn. CP169, 600 m, 17 September, 1985. CAS 86489 (1, 230 mm TL), New Caledonia, 18°58′00″S, 163°10′30″E, MUSORSTOM 4, R/V Vauban, stn. CC202, 580 m, 20 September, 1985.

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