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Grenadiers (Pisces, Gadiformes) from the Continental Slope  
of Western and Northwestern Australia

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SAN FRANCISCO

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## Grenadiers (Pisces, Gadiformes) from the Continental Slope of Western and Northwestern Australia

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This is the first taxonomic treatment of the grenadiers (Macrouridae and Bathygadidae) from Australia's western and northwestern continental slope. Collections made during two trawl cruises by CSIRO vessels in 1984 and 1991 contributed most of the material for this study. A remarkably diverse grenadier fauna was discovered with 63 species in 20 genera, of which 18 species (about 29%) are here described as new. All species are treated, with complete descriptions and illustrations for 37 species and more limited accounts for the 26 remaining species. Keys to genera and species are provided. *Caelorinchus* had by far the most species represented (20), followed by *Nezumia* (7), *Ventrifossa* (6), *Hymenocephalus* (5), *Coryphaenoides* (4), and *Trachonurus* (3). New species described include: *Caelorinchus amydrozosterus*, *C. charius*, *C. gaesorhynchus*, *C. goobala*, *C. lasti*, *C. mayiae*, *C. pardus*, *C. thurla*; *Gadomus pepperi*, *Nezumia kapala*, *N. leucoura*, *N. merretti*, *N. soela*, *N. wularnia*; *Trachonurus yiwardaus*, *Ventrifossa gomoni*, *V. paxtoni*, *V. sazonovi*.

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In recent years the number of species of grenadiers (rattails or whiptails, families Macrouridae and Bathygadidae) recorded from Australian waters has increased markedly as a result of exploratory trawling for commercial fishery resources on the continental slope. Grenadiers are now recognized as forming a large component of the Australian fish fauna: the 57 species recorded in Paxton et al. (1989) ranked them the 11th most speciose family. Despite this, they were poorly known, with 25 of the 57 species either unidentified to species level or undescribed. In reality, closer to 100 grenadier species in the family Macrouridae (sensu lato, including Bathygadidae) are represented in collections from Australian waters (TI, unpublished data), ranking the group among the 10 most species-rich

families. A high number of these species remain either undescribed or unrecorded from Australia in the published literature.

Collections of grenadiers from the extensive Australian western and northwestern slope region came primarily from two exploratory fishing surveys undertaken by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Marine Research. Records from the first of these surveys, on the northwestern slope (Davis and Ward 1984), were included in the list compiled by Paxton et al. (1989). The collection from the western slope, a region virtually unsampled until 1991, elevated the number of undescribed species and added considerably to the species recorded from Australian waters. Some material had been collected from this area during expeditions of the former Soviet Union in the 1970s, but only a few grenadier species are treated in the published literature to date (Sazonov and Shcherbachev 1982, 1985; Iwamoto and Shcherbachev 1991).

The purpose of this paper is to provide the first regional taxonomic treatment of grenadiers from Australia's northwestern and western slope regions. It is also the first large-scale account of this rich and abundant group of fishes from Australian waters. Included are descriptions for 37 species and diagnoses only for the remaining 26 species. Keys are provided for genera with more than one species, viz., *Caelorinchus*, *Coryphaenoides*, *Gadomus*, *Hymenocephalus*, *Kuronezumia*, *Mataeocephalus*, *Mesobius*, *Nezumia*, *Trachonurus*, and *Ventrifossa*.

#### METHODS AND MATERIALS

Most of the material examined during this study was collected during CSIRO trawl surveys of 30 days duration off northwest Australia (1984) and western Australia (1991). However, many additional specimens were provided by scientific observers aboard commercial fishing vessels from both areas. Also, many reference specimens from eastern Australia were collected by the NSW *FRV Kapala*.

The northwestern survey, using the *FRV Soela*, covered an area of the upper slope between 19°30'S, 115°30'E and 12°30'S, 123°03'E in depths from 300 to 500 m (Davis and Ward 1984). The western survey, using the *FRV Southern Surveyor*, covered an area between 20°00'S, 114°00'E and 35°00'S, 115°15'E in depths from 200 to 1,400 m (Williams et al. 1996). In addition, one deeper trawl (station SS1/91/12) was undertaken during the western survey; it started in 1,460 m but lost ground contact somewhere between 1,500 m and 1,700 m over steeply sloping topography. (Plate 1)

Figure 1 shows the location of stations off Western Australia from which grenadiers were collected. Appendix 1 provides station data for *FRV Southern Surveyor*, NSW Fisheries *FRV Kapala*, and *FRV Soela*. (Note that coordinates and dates are not given in the Specimens Examined sections where vessel stations are known.)

The northwestern survey, which was primarily targeted at crustacean resources, used an Engels deep-sea lobster trawl with a 61 m ground rope. Mesh sizes ranged from 12 cm in the wings to 4 cm in the codend. Ground gear was a combination of rubber discs weighted with chain and a tickler chain. During the western survey, an Engels High-Lift fish trawl was used throughout. The trawl had a headline length of 35.5 m, headline height of about 4 m, wingspread of 19 m, and was fitted with a 4 cm liner in the codend. The trawl was fitted with heavy rubber-bobbin ground gear and towed from twin warps. Full details of net construction were given by May and Blaber (1989). A variety of gear types was used by commercial vessels in both areas.

Fish specimens retained for museum collections were placed in 10% formaldehyde solution aboard the research vessels. On commercial vessels specimens were frozen and preserved in the laboratory at a later stage. Most of the material examined in this study are deposited in the I.S.R. Munro Ichthyological Collection at CSIRO Marine Research Laboratories in Hobart (CSIRO), the Australian Museum in Sydney (AMS), the Museum of Victoria in Melbourne (NMV), the Northern Territory Museum in Darwin (NTM), and the Western Australian Museum in Perth (WAM). Other

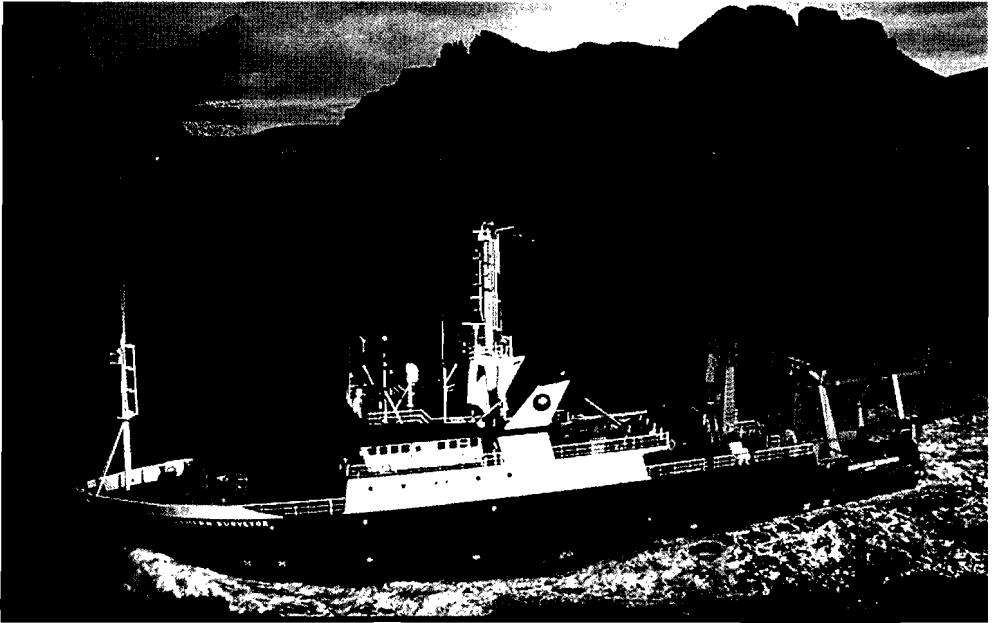


PLATE 1a. The CSIRO fishery research vessel *Southern Surveyor*.

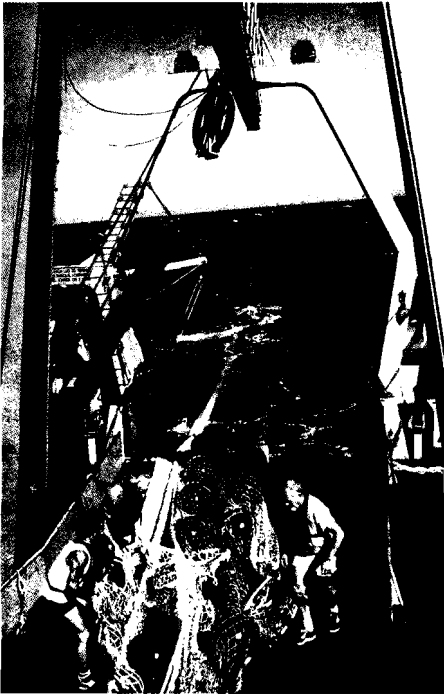


PLATE 1b. Hauling in trawl aboard *Southern Surveyor* off Western Australia.

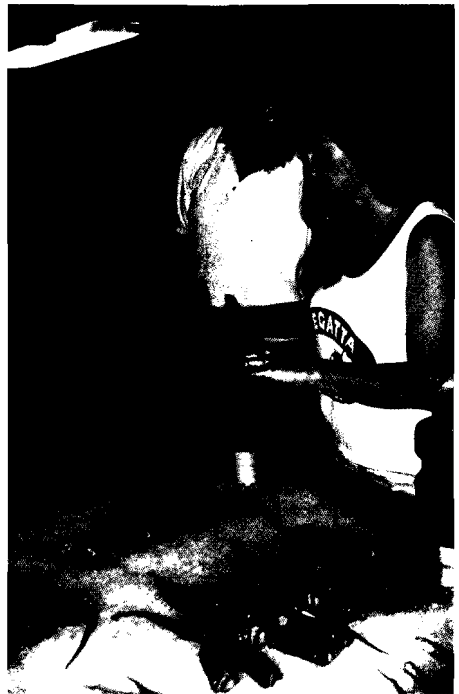


PLATE 1c. Fishery scientists from CSIRO Marine Laboratories aboard *Southern Surveyor* examining deep-water grenadiers from off Western Australia.

specimens were examined at the California Academy of Sciences, San Francisco (CAS); Queensland Museum, Brisbane (QM); The Natural History Museum, London (BMNH); Zoological Museum, Moscow State University, Moscow (ZMMGU); Muséum National d'Histoire Naturelle, Paris (MNHN); the New Zealand Oceanographic Institute, Wellington (NZOI), now housed in the Museum of New Zealand (NMNZ); and the National Museum of Natural History, Washington, DC (USNM).

We use the term grenadier to include bathygadids and macrourids, recognizing that they might not be sister taxa and may actually belong in separate suborders (see Howes 1989; Howes and Crimmen 1990).

Methods for taking counts and measurements follow Iwamoto and Sazonov (1988) and are given in a condensed version in the Abbreviations section below. In the genus *Caelorinchus*, the fusion of the lateral and medial nasal processes along the anterolateral margin of the snout is an important character, described as “anterolateral margin fully supported by bone” or “. . . incompletely supported.” Whether or not the margin is fully or incompletely supported is easily determined by lightly pressing along the margin with one’s fingernail. If there is a soft spot or some give to the pressure, the margin is incompletely supported and there is a gap along the outer margin of the nasal bone; if it feels solid, the margin is complete. Alternatively, the skin below the margin can be cut away to view the bone. References to genera and type-species of genera are not provided, as Eschmeyer’s (1990) *Catalog of the Genera of Recent Fishes* gives complete citations as well as type species designation. (An updated Internet version of the *Catalog of the Genera of Recent Fishes* is available at the WWW address <http://www.calacademy.org>.)

#### ABBREVIATIONS

Institutional abbreviations follow Leviton et al. (1985) and Leviton and Gibbs (1988). For political entities, the following abbreviations are used: CSIRO – Commonwealth Scientific and Industrial Research Organisation; GAB – Great Australian Bight; NSW – New South Wales; NT – Northern Territory; QLD – Queensland; SA – South Australia; TAS – Tasmania; VIC – Victoria; WA – Western Australia. Vessel abbreviations include: SS – *FRV Southern Surveyor*; SO – *FRV Soela*; K – *FRV Kapala*.

#### Counts

1D. and 2D. – counts of the first and second dorsal fins; the Roman numerals “II” refer to the two spinous rays of the first dorsal fin.

P. – count of pectoral fin rays; the lowercase “i” refers to the rudimentary uppermost ray.

V. – pelvic fin ray count.

A. – anal fin ray count.

GR-I, GR-II – gill raker counts of the first (outermost) and second arches. Counts of outer and inner gill raker series are given and separated by a slash mark. Raker counts of the upper arm are separated from those of the lower arm by a plus sign.

Scales 1D., 2D., midbase 1D., lat.line – scale row counts, respectively, below the origin of the first dorsal fin, second dorsal fin, midbase of first dorsal fin, and lateral line scales counted from the anterior end over a distance equal to the predorsal length. Half-scale counts (0.5) are given when the uppermost scale is considerably smaller than others of the series.

Caeca – pyloric caeca count.

#### Measurements

TL – total length; a plus sign following the length indicates that a portion of the tail tip was missing.

HL – head length, taken from snout tip to upper posterior angle of opercle.

Head width – the greatest transverse measurement, usually across the opercles and including the bony scutes of the suborbital ridge.

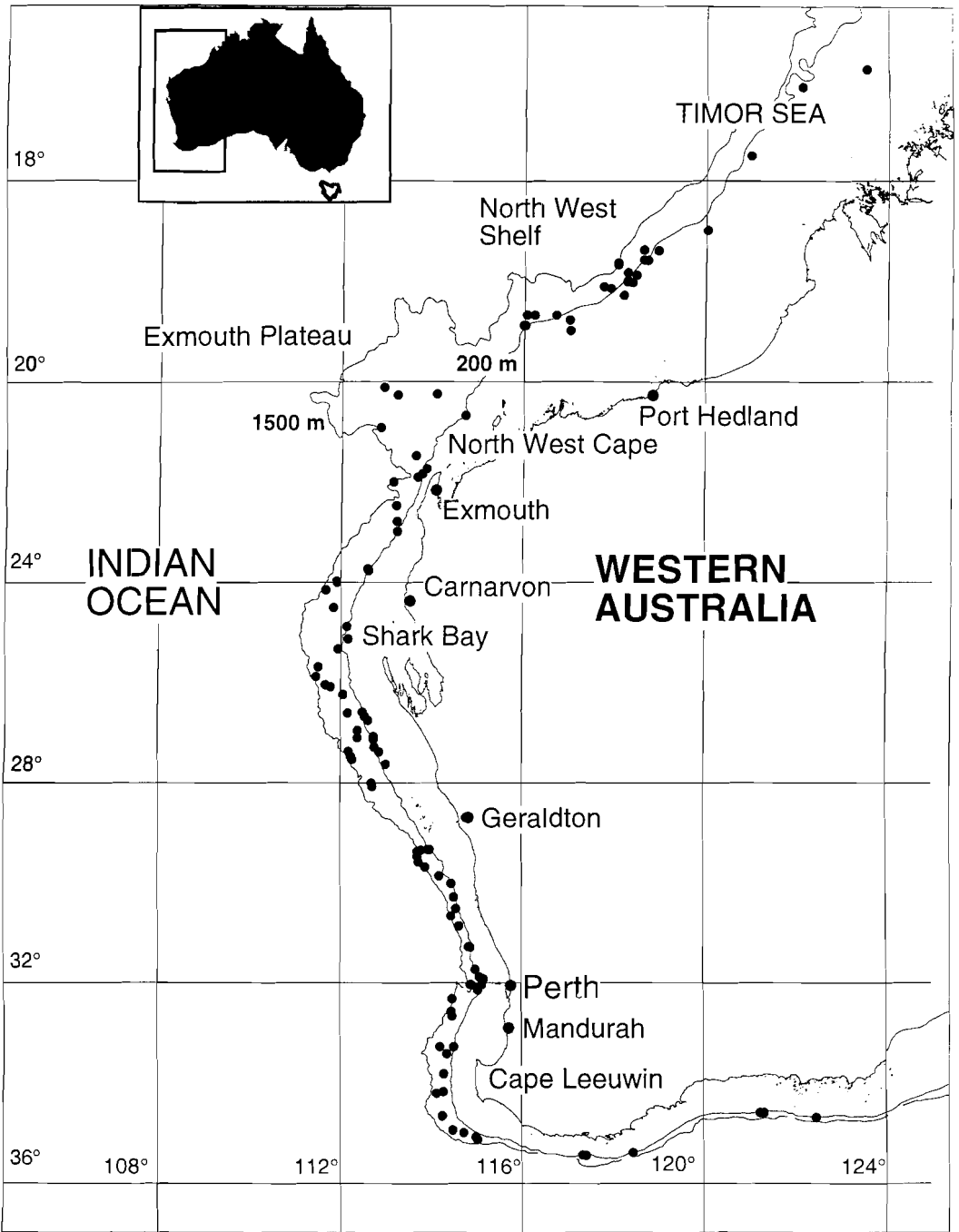


FIGURE 1. Station localities off Western Australia at which grenadiers were collected by the fishery research vessels *Soela* and *Southern Surveyor*, and by other vessels.



Snout – length from tip of snout to anterior margin of orbit.

Preoral – median ventral length of snout from tip to upper margin of lips.

Internasal – least distance between supranarial ridges.

Interorb. – least distance between bony orbits.

Suborb. – least width of suborbital space.

Postorb. – distance from posterior margin of orbit to upper posterior angle of opercle.

Orb.-preop. – oblique measurement from posteroventral margin of orbit to posteroventral margin of preopercle.

Up.jaw – length from anterior tip of premaxillary to posterior end of maxillary.

Pmx. – premaxillary; height measured from dorsal tip of anterior ascending process to anteroventral margin of bone, not including teeth; length the greatest measure from anterior tip to posterior end; gap measured between dentition bands of each premaxilla.

Barbel – length of free portion of barbel, from posterior insertion to distal tip.

Gill slit – greatest diameter of outermost gill slit.

Pre-A. – distance from tip of snout to origin of anal fin.

Pre-vent – distance from tip of snout to anal opening.

V.-A. – distance between base of outer pelvic ray to anal fin origin.

Isth.-A. – distance between anterior end of isthmus to anal fin origin.

Body depth; depth at A. - greatest body depth, usually below origin of first dorsal fin; depth at origin of anal fin.

1D.-2D. – distance between posterior edge of 1st dorsal fin and anterior origin of 2nd dorsal fin.

Ht. 1D., len. 1D. base, len. P., len. V. – height of first dorsal fin, length of base of first dorsal, lengths of pectoral and pelvic fins, respectively.

Post. nostril – greatest diameter of posterior nostril.

Len. rictus – length of lateral opening of mouth measured from anterior tip of premaxillary to posterior angle of mouth.

Other abbreviations: cf., to be compared with; coll., collector; compass directions are given as n., ne., nw., etc., for north, northeast, northwest, etc.; collection dates are given as "10.II.1990" indicating 10 February 1990 (day, month, year); est., estimate; fm, fathom(s); ht., height; I. (Island), Is. (Islands); len., length; no., number; NW, North West [as part of a proper noun]; pmx., premaxilla; Pt., Point; spec., specimen(s); sta., station; uncat., uncataloged.

## TAXONOMIC DESCRIPTIONS

The remarkably diverse grenadier fauna of the western Australian region, the relative paucity of solid taxonomic works on the species of that region, and the inadequate reference collections for many species has made the current species treatments difficult, and in several instances, impossible to fully resolve. Our treatments of the genera *Hymenocephalus*, *Trachonurus*, and *Ventrifossa* are of particular concern in this respect, and they must be viewed as only tentative. We leave their full taxonomic resolution to others who have more material and who are able to devote time and effort to more extensive studies than we could. Many of the problems suit themselves to regional ichthyologists who have access to fresh local material as well as comparative material from outside the area. In some examples where an apparent species shows a broadly disjunct distribution (e.g., *Caelorinchus mycterismus*, *Trachonurus sentipellis*, *Ventrifossa macropogon*), access to material from intervening areas will be necessary to show whether or not the populations represent the same species. In several species descriptions, we list specimens in an uncertain-variant category. Such specimens did not properly fit our species concepts for one reason or another, but we could not justify recognizing them as distinct taxa. Again, such problematic species and specimens will require a more thorough study than we were able to give them.

We do not provide diagnoses for families and genera as this paper is not intended to be a taxonomic review of the grenadiers. For these we refer the reader to recent publications by Howes and Crimmen (1990), Iwamoto (1990), Iwamoto and Sazonov (1994), Sazonov and Iwamoto (1992), Sazonov and Shcherbachev (1982, 1985), and Shcherbachev et al. (1992). Of the 63 species here treated, full descriptions are given for 18 new taxa. Of the 45 remaining species, 16, that in our opinion seemed to require detailed description, are also fully described; the other 29 species, because of being so well known or already well described, are diagnosed only. Three undescribed species are diagnosed but not named, two of these (*Coryphaenoides* sp. A and *Mataeocephalus* "shortsnout") because others are currently preparing descriptions for them, and a third species (*Hymenocephalus* sp. 1) because we lacked adequate material. Synonymies are limited to the original description, a few principal references, and to references germane to the area.

It is apparent from our studies that the number of grenadiers known from the western Australian region will increase over time as the fauna becomes better studied, and as more effort is made to collect over greater geographic areas and depths, and over a variety of terrain. As an example, that our study material was limited to depths shallower than 1,700 m precluded the possibility of the deeper-living *Coryphaenoides* species being represented. A broad expanse of shelf and slope north and east of Port Hedland to the Arafura Sea was not sampled by CSIRO vessels. Valuable trawl collections from the Timor and Arafura seas housed at the Northern Territory Museum include species not collected by CSIRO vessels, suggesting that the area is ripe for more collecting.

We are a long way from knowing the full extent of the grenadier fauna of Western Australia, and this paper is only a preliminary report with many species left out and many questions left unanswered. The western Australian region holds the potential for many more stimulating and valuable research projects.

#### KEY TO GENERA OF WESTERN AUSTRALIAN GRENADIERS

[Mostly based on Iwamoto (1990) and Iwamoto and Merrett (1997). Species and genera listed in brackets have not been recorded from the area but may be expected. Note that the genera *Mataeocephalus* and *Ventrifossa* are keyed out twice.]

- 1a. One continuous dorsal fin, anterior portion not elevated; orbit small, 10 or more times in head length . . . . . 2
- 1b. Two dorsal fins, the first elevated; orbit less than 10 times in head length . . . . . 3
- 2a. Pelvic fins small, rays 5–6 . . . . . *Squalogadus modificatus*
- 2b. Pelvic fins absent . . . . . [*Macrouroides inflaticeps*]
- 3a. Origin of second dorsal fin immediately behind first and equally or better developed than anal fin; outer gill arch free from gill cover; gill-rakers on first arch slender, not tubercular . . . . . 4
- 3b. A distinct gap between dorsal fins; anal fin usually much better developed than second dorsal fin; outer gill arch restricted by folds of skin connecting upper and lower limbs to gill cover; gill rakers tubercular . . . . . 7
- 4a. Snout long and sharply pointed; mouth inferior; heavy scutelike scales on body . . . . . 5
- 4b. Snout bluntly rounded, not protruding; mouth essentially terminal; all scales thin, deciduous, lacking spinules . . . . . 6
- 5a. Large platelike scutes in three or four longitudinal rows on body; body color black . . . *Idiolorphorhynchus andriashevi*
- 5b. Two rows of scutes on body, one along second dorsal fin, the other along anal fin; body color brownish . . . . . [*Trachyrincus*]
- 6a. Chin barbel well developed; first dorsal, pectoral, and pelvic fins with a greatly elongated ray; pelvic fin rays 8 or 9 (usually 8) . . . . . *Gadomus*
- 6b. No chin barbel; outer pelvic ray sometimes elongated, but other fins lacking a greatly elongated ray; pelvic fin rays 8–10 (usually 9) . . . . . *Bathygadus spongiceps*
- 7a. Second spinous ray of first dorsal fin smooth . . . . . 8
- 7b. Second spinous ray of first dorsal fin serrated (weakly or much reduced in some) . . . . . 14
- 8a. Snout strongly pointed, armed with coarse spiny scales that form a stout continuous ridge extending from snout tip to preopercle angle and terminating in a sharp point . . . . . *Caelorinchus*
- 8b. Snout rounded to moderately pointed, no sharp ridge of modified scales extending from snout tip to preopercle angle . . . . . 9

- 9a. Broad areas of fine (microscopic), parallel black lines (ventral striae) overlying silvery ground on ventral surfaces of chest, shoulder girdle, along each side of isthmus, and belly . . . . . 10
- 9b. No ventral striae . . . . . 11
- 10a. Ventral striae extends alongside anterior half or more of anal fin base; six branchiostegal rays; no lenslike light organ on chest; attains 53 cm TL . . . . . *Lepidorhynchus denticulatus*
- 10b. Ventral striae rarely extends posterior to anus; seven branchiostegal rays; a small lens or light organ on chest; small species, usually attains less than 23 cm TL . . . . . *Hymenocephalus*
- 11a. Lower jaw with large, widely spaced teeth in 1 row . . . . . 12
- 11b. Lower jaw with rather small teeth in more than 1 row . . . . . 13
- 12a. Canine teeth in 1 row in both jaws; grooved lateral line not developed beyond second dorsal fin; 10–11 pectoral fin rays; 6 branchiostegal rays; color mostly blackish . . . . . [*Odontomacrus murrayi*]
- 12b. Teeth in 2 rows in upper jaw; lateral line complete to end of tail; 16 or more pectoral rays; 7 branchiostegal rays; color usually grayish, somewhat silvery below ventral midline . . . . . *Malacocephalus laevis*
- 13a. Pelvic rays 6–7; scales coarsely spinulated; broad, naked, black periproct region immediately before anal fin . . . . . *Trachonurus*
- 13b. Pelvic rays 9–10; scales finely spinulated; periproct region separated from anal fin by many scale rows . . . . . *Ventrifossa*
- 14a. Head massive, globose, soft; interopercle tightly adnate to preopercle; body scales along each side of second dorsal fin base enlarged . . . . . 15
- 14b. Head not especially massive or globose; interopercle not strongly adnate to preopercle; no enlarged scales along second dorsal fin base . . . . . 16
- 15a. Pelvic fin bases posterior to vertical through origins of first dorsal and pectoral fins; interorbital width 31–34% of HL . . . . . *Cetonurichthys subinflatus*
- 15b. Pelvic fin bases about at or anterior to vertical through origin of first dorsal and pectoral fins; interorbital width 36–48% of HL . . . . . *Cetonurus globiceps*
- 16a. Scales of head elongated, with spinules longitudinally aligned to give striated pattern to head surfaces; chin barbel absent . . . . . *Mesobius*
- 16b. Head scales not elongated, no striated pattern to head surfaces . . . . . 17
- 17a. Snout low, narrow, rounded, devoid of scales; no ridges on head; scales on head and front of body without spinules or ridges; maxilla reaches vertical to front margin of orbit . . . . . [*Haplomacrus nudirostris*]
- 17b. Snout angular, completely naked to variously covered with scales; ridges usually present on head, sometimes coarsely scaled; almost all scales covered with spinules or low ridges; maxilla usually extends well posterior to front of orbit (except in *Sphagemacrus* and *Lucigadus*) . . . . . 18
- 18a. Branchiostegal rays 7 . . . . . 19
- 18b. Branchiostegal rays . . . . . 28
- 19a. Pelvic fin rays 5–7 . . . . . *Pseudonezumia pusilla*
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- 22b. Olfactory organ normal, posterior nostril much less than half diameter of orbit . . . . . [*Asthenomacrus victoris*]
- 23a. Anus closer to anal origin than to pelvic insertions . . . . . 24
- 23b. Anus closer to pelvic insertions than to anal origin . . . . . 25
- 24b. Outer gill slit about 10% or less of head length; outer rakers of first arch rudimentary or absent; snout prominently pointed; dorsal fin base not elevated . . . . . *Mataeocephalus acipenserinus*
- 24b. Outer gill slit about 20% or more of head length; outer rakers of first arch tubercular and distinctly developed; snout blunt, upturned; dorsal fin base elevated . . . . . *Sphagemacrus pumiliceps*
- 25a. A stout suborbital shelf formed of 2 rows of coarsely spined scales; ventral edge of shelf forming a sharp ridge; snout variously naked or scaled ventrally . . . . . *Nezumia*
- 25b. Suborbital shelf covered with several rows of small, relatively unmodified scales, no sharp ridge developed; underside of snout mostly scaled . . . . . 26
- 26a. Ventral region of body appearing to have swung far forward so that gill membranes unite below orbit, pelvic fins below opercle . . . . . *Lucigadus ori*
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- 27a. Inner gill-rakers of first arch 13–17 . . . . . *Ventrifossa*
- 27b. Inner gill-rakers of first arch 12 or fewer . . . . . *Kuronozumia*
- 28a. Anus far removed from anal fin, closer to pelvic fins . . . . . *Mataeocephalus* sp.
- 28b. Anus immediately anterior to anal fin . . . . . *Coryphaenoides*

FAMILY BATHYGADIDAE  
*Bathygadus* Günther, 1878

Although Howes and Crimmen (1990) recently reviewed the genus, it is obvious that a more in-depth study using much more material is needed to resolve the many taxonomic problems within this group. Iwamoto and Anderson (1994) and Iwamoto and Merrett (1997) discuss some of the problems with Howes and Crimmen's work.

*Bathygadus spongiceps* Gilbert and Hubbs, 1920

Fig. 2

*Bathygadus spongiceps* Gilbert and Hubbs, 1920:381–384, fig. 1 (Borneo; 1628 m). Howes and Crimmen 1990:189–190, table 4.

*Bathygadus cottoides*: Iwamoto and Merrett, 1997:7–8 (in part; New Caledonia).

DIAGNOSIS (for WA spec. only). — Barbel absent; first dorsal fin rays II,8–10; pectoral fin rays i14–i17; pelvic fin rays 9 (occasionally 8 or 10); GR-I (outer) (4–6)+(19–21) = 23–27 total; caeca 19–27, length about equal to orbit diameter; orbit diameter 18–22% of HL, about 1.6–2.2 times into interorbital, 2.4–2.8 into distance orbit to preopercle; interorbital width 32–40% of HL.

SPECIMENS EXAMINED. — WA: (Dark form): CSIRO H3017-08 (male, 67.2 HL, 325+ TL), CSIRO H.3017-13 (male, 67.7 HL, 310+ TL), CSIRO H3017-14 (male, 78.2 HL, 385 TL); nw. of Cape Leeuwin; 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; coll. A. Williams; 24.XII.89. CSIRO H2544-16 (2 females, 51.1–64.0 HL, 240+–315+ TL); Exmouth Plateau; 1,128 m; SS1/91/04. (Pale form): CSIRO H2615-05 (2 males, 79.0–85.5 HL, 425+–400 TL); w. of Mandurah; 1,140 m; SS1/91/83. CSIRO H3017-12 (male, 84.2 HL, 435+ TL), CSIRO H3017-11 (female, 90 HL, 440+ TL), CSIRO H3017-07 (male, 79.4 HL, 440+ TL); nw. of Cape Leeuwin; 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; coll. A. Williams; 24.XII.89.

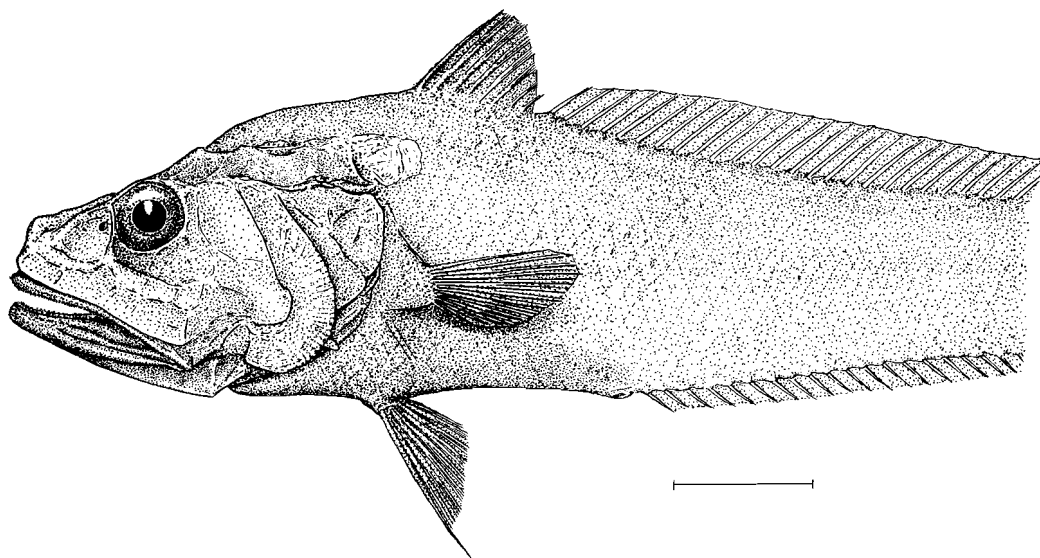


FIGURE 2. *Bathygadus spongiceps* Gilbert and Hubbs, 1920 (dark form). CSIRO H3017-13 (310+ mm TL) from continental slope northwest of Cape Leeuwin, Western Australia, in 1,030 m. Fin rays partially reconstructed. Scale bar equals 25 mm.

COUNTS AND MEASUREMENTS (for WA spec. only). — 1D. II,8–10; GR-I (inner series) 3+(16–17), GR-II (2–3)+(15–16). Total length 240+–490+ mm; HL 51.5–107 mm. The following in percent of HL: snout 29–32; postorb. 50–57; orb.-preop. 46–52; suborb. (fleshy) 14–18; up.jaw 52–56; ht. pmx. 15–17 (30–36% of len. pmx.); pmx. gap 9–19% of len. pmx.; len. outer gill rakers 11–14; len. gill filaments 6–10.

DESCRIPTION. — General features of fish best seen in Figure 2. Head bones and integument relatively weak and readily damaged. Body scales highly deciduous, all lost in specimens examined; scale pockets damaged in most specimens examined, often only faintly present. Head width about one-half or more of head length; interorbital space broad, more than 1.6 times diameter of orbit, about one-third or more of head length. Fin rays weak, most with tips broken off; outer pelvic ray in one specimen thin, slightly prolonged, but not reaching to anus; spinous second ray of first dorsal thin, flexible, slightly prolonged.

Color of dark form (see Comparisons) overall swarthy, region around belly, chest, head and gill membranes black, fins dark dusky to blackish; oral, branchial, and abdominal cavities black; gill rakers and arches dark, gill filaments pale. Pale form with body mostly pale, black regions of dark form mostly grayish in pale form; fins dusky; chest and gular regions somewhat paler than in dark form.

SIZE. — To at least 46 cm TL, possibly to 50 cm.

DISTRIBUTION. — Known from off the Kermadecs, New Caledonia region, New Zealand, Australia, the Philippines, and Indonesia, usually in depths of approximately 900–1,500 m (842–1,140 m off WA between latitudes 20°S and 35°S).

COMPARISONS AND REMARKS. — *Bathygadus spongiceps* appears to be a relatively widespread species in the western Pacific and Australia. Iwamoto and Merrett (1997) erroneously thought their specimens from New Caledonia were *B. cottoides* Gunther, 1878, partly owing to the proximity of their collection sites to the Kermadecs, the type locality for *B. cottoides*. However, most of their study material (excluding CAS 90556 and CAS 90835) were *B. spongiceps*. They listed a number of characters that differed significantly between their specimens and what has been called *B. cottoides* from southern Africa (see Iwamoto and Anderson 1994). Subsequent examination (by TI) of numerous specimens of *B. cottoides* from the Kermadecs and New Zealand (currently housed in NMNZ) has revealed that *B. cottoides* is a small species, less than about 26 cm TL, with low pyloric caeca counts (9–12), and few pectoral finrays (i10–i15, usually i12–i14). This contrasts with *B. spongiceps*, a large species attaining lengths of more than 46 cm, with 15–27 pyloric caeca, and i14–i17 pectoral finrays. Gill raker lengths also differed, *B. spongiceps* having raker lengths of 9–13% HL, compared with 14–19% in *B. cottoides*. We are uncertain of Howes and Crimmen's (1990, table 4) counts of 6 and 12 pyloric caeca for paratypes of *B. spongiceps*. Gilbert and Hubbs (1920:383) in their original description gave counts of 21, 16, and 17 for three paratypes, and Iwamoto and Merrett (1997:8) recorded 15 each in two recently collected specimens from off eastern Luzon, Philippines.

Our specimens agreed well with specimens from the New Caledonia region (see Iwamoto and Merrett 1997). We found in our WA collections two "forms" that we differentiated by color: a dark form, with more prominent blackish scale pockets on the body giving a darker overall cast, most of head, gill membranes, chest and abdomen black, fins blackish; and a pale form, with relatively pale body and fins, the head, gular and gill membranes gray to blackish, the chest and abdomen light brown to grayish. The overall physiognomy of the two forms seemed to differ, but we were unable to quantify any specific differences. These differences are not sexual, as we have found both sexes represented in each form, and the forms are sympatric, some of each having been taken in the same haul off Cape Leeuwin (CSIRO H3017). We have been unable to determine whether these forms represent simple color variants of a single species or are actually distinct species. More specimens and study are needed before we can confidently state that either one or two species are represented in our WA material.

McMillan (in Gomon et al. 1994:344, fig. 305) recorded *B. cottoides* from the Great Australian Bight. His description agrees well with that species, especially in pyloric caeca counts (7–11), low pectoral ray counts (14–15), and small size (“at least 24 cm”). The presence of that species in the Great Australian Bight suggests that it is likely to also occur off Western Australia at appropriate depths.

### *Gadomus* Regan, 1903

A world review of the genus (Howes and Crimmen 1990) included a key to eight species from the Indo-Pacific region. Two species of the genus are represented in Western Australian waters. They each differ slightly from known species, but because of inadequate descriptions and insufficient comparative material, we had difficulty ascribing them with confidence to any known species. One was sufficiently different that we have described it as new. The other we relate to a known species but with qualifications. The only account of *Gadomus* from Australian waters is that of McMillan (in Gomon et al. 1994:357, fig. 317), who provides description of an unnamed species from off southern Australia that is similar to our new species. There is need of thorough revision of the genus based on recent collections available in different museums. In the Comparisons sections for the two species, data for other species are from the literature, as well as from personal observations of one of us (TI). Peter McMillan (National Institute of Water and Atmosphere, Wellington, New Zealand) provided valuable information on *G. aoteanus*, for which we are grateful.

#### KEY TO SPECIES OF *GADOMUS* FROM WESTERN AUSTRALIA

- 1a. Total outer gill rakers on first arch 25–28; rakers relatively short, about equal to or slightly longer than longest gill filament; barbel 65–91% of HL; pyloric caeca 100–136; mouth, tongue, and gill cavity pale . . . . . *G. sp. cf. colletti*  
 1b. Total outer gill rakers on first arch 30–33; rakers relatively long, more than twice longest gill filament; barbel 48–56% of HL; pyloric caeca about 75; mouth, tongue, and gill cavity dark . . . . . *G. pepperi* n.sp.

#### *Gadomus* sp. cf. *colletti*

Fig. 3

*Gadomus* sp. A: Williams et al., 1996:149 (listed).

DIAGNOSIS. — Gill rakers on first arch 25–28 total; snout long, 23–29% HL; head short, postorbital length 45–50% HL and 47–51% preanal distance; barbel more than three times orbit diameter, extending beyond end of jaws; about 100–136 pyloric caeca.

SPECIMENS EXAMINED (15 spec.). — WA: CSIRO H2596-03 (61.9 mm HL, 275+ mm TL); wnw. of Green Head; 760–770 m; SS1/91/62. CSIRO H2550-09 (58.6 HL, 302 TL); 1,100–1,158 m; SS1/91/11. CSIRO H3156-35 (5, 41.9–56.5 HL, 203+–268+ TL); n. of Monte Bello I.; 18°53'S, 115°59'E; 550 m; Surefire; coll. D. Evans; 16.III.1992. AMS I.22809-010 (2, 46.5–53.9 HL, 224–290 TL); off Rowley Shoals; 492–584 m; SO2/82/19-21. AMS I.22810-005 (59.2 HL, 287 TL); NW Shelf; 736 m; SO2/82/22-24. LACM 43620-1 (51.2 HL, 240 TL); approx. 95 km wsw. of Rowley Shoals; coll. N. Sinclair and P. Berry; 22.VIII.1983. NSW: AMS I.19862-006 (53.5 HL, 285 TL), se. of Sydney; 768 m; K76-23-01. AMS I.24659-001 (56.9 HL, 285 TL); off Broken Bay; 915 m; K84-08-04. AMS I.24979-011 (33.3 HL, 166 TL); e. of Broken Bay; 759 m; K84-16-04. AMS I.29813-006 (38.3 HL, 195 TL); e. of Budgewoi; 722–768 m; K89-06-05.

COUNTS AND MEASUREMENTS (based on 10 spec.). — 1D. II,10–11; P. (i16) i17–i20; V. 8; GR-1 (outer) 4–6+21–23; scales 1D. 6–7, 2D. 7–7.5; about 100 and 136 pyloric caeca in two specimens.

Total length 203+–302+ mm; HL 41.9–61.9 mm. The following in percent of HL: postrostral 75–79; internasal 16–18; interorb. 15–19; orb. 24–28; suborb. 10–14; orb.-preop. 45–49; up.jaw

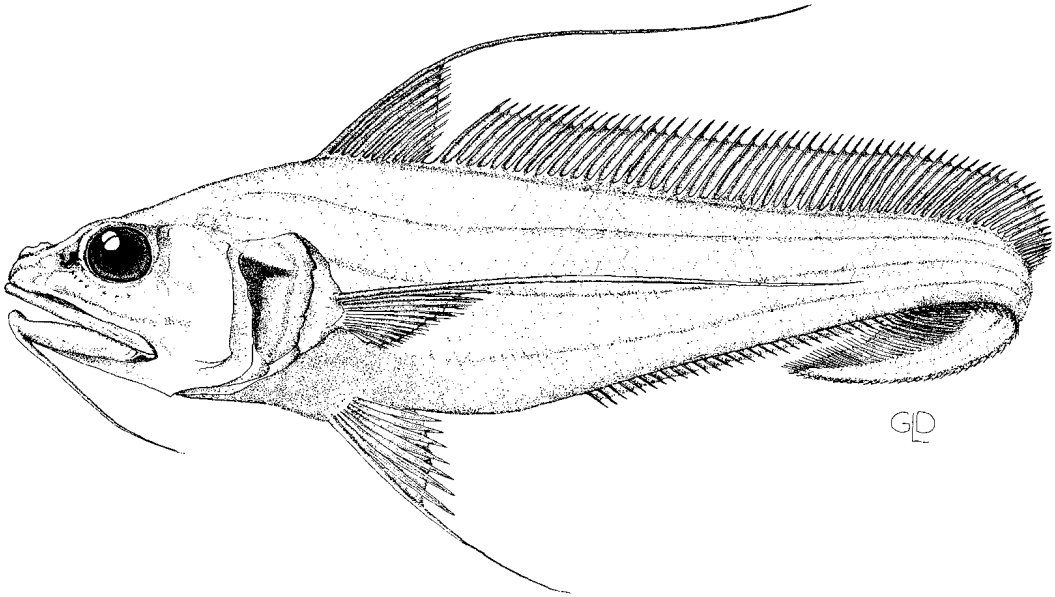


FIGURE 3. *Gadomus* sp. cf. *colletti*, CSIRO H2596-03 (275+ mm TL), from west-northwest of Green Head, WA, in 760–770 m, *Southern Surveyor* station SS1/91/62. Drawn by Georgina L. Davis.

53–57; pmx. 49–54; post. nostril 4–7. barbel 65–91; pre-A. 190–215; pre-vent 171–191; V.-A. 78–104; isth.-A. 154–178; body depth 72–85; depth at A. 59–66; 1D.-2D. 7–8; ht. 1D. (88)137–171; len. P. (143)179–191; len. V. 86–97. The following in percent of pmx. length: pmx. ascending process 20.9–27.8; distance across midline between pmx. dentigerous surfaces 3.4–5.3. The following in percent of pre-A.: HL 47–51; len. P. 87–95.

**DESCRIPTION.** — Head and body moderately compressed; tail slender (but damaged and shortened in most specimens). Snout blunt, rostral cartilage forming distinct knob at snout tip. Dorsal profile rather straight over head; largest fish rather humped anterior to first dorsal fin where body depth is greatest. Head ridges poorly developed and lacking modified body scales or scutes; bones of operculum and snout particularly weak. Membranes of head thin (usually damaged). Orbit relatively large, interorbital narrow. Mouth large and terminal, extending beyond posterior margin of orbit; premaxillary ascending process well developed. Chin barbel prominent, fleshy, long, tapering to a fine point, extending well beyond posterior margin of jaws.

Teeth minute, villiform, arranged in numerous rows, forming bands on both premaxilla and dentary. Dentigerous bands of premaxilla broad, widest below anterior margin of orbit, separated by a narrow gap at symphysis; dentigerous band of dentary relatively narrow, of uniform width.

Gill opening wide, first arch unrestricted; outer gill rakers on first arch well developed, slender, flattened with tiny conical spines; inner rakers relatively short, about 2.0–2.5 into length of outer rakers, clublike, slightly expanded distally with short curved spines; longest gill filaments of first gill arch about 1.0–1.3 into longest outer gill rakers.

Scales large, thin, and deciduous. Gular and branchiostegal membranes unscaled. Light organ absent.

All fins well developed; rays of second dorsal considerably longer than those of anal fin; second ray of first dorsal and outer ray of pectoral (= second element) greatly extended; outer ray of pelvic fin moderately extended, just reaching anal origin; extended rays of pectoral broad and fleshy; dorsal fins separated by a narrow, rather variable space; pelvic fin bases broad and widely separated.

Body color pale pinkish on dorsal surface; pale silvery below midline from level of dorsal margin of opercle; abdominal region between pelvic fin bases and vent bluish. Entire body speckled with melanophores; these most dense on underside of head, gular membranes, around nostrils, along posterior margin of opercle, and over ventral region anterior to pelvic fins. Buccal cavity, tongue, and opercular cavity pale. Dorsal fin dark; pectoral and pelvic fins dusky.

SIZE. — To about 30 cm TL.

DISTRIBUTION. — Collected from the upper and midslope region (320–1,158 m) off the central west and northwest coasts of Australia (latitudes 10°S–32°S) and off NSW (722–768 m).

COMPARISONS AND REMARKS. — The Indo-Pacific species of *Gadomus* can be separated into two broad groups based on the number of lower-limb gill rakers on the first arch (Howes and Crimmen 1990). (Note: The “ceratobranchial” counts of Howes and Crimmen are actually counts for rakers on the ceratobranchial + hypobranchial bones and are equivalent to our “lower-limb” gill raker counts.) The low count (21–23) of *G. pepperi* differentiates it from four species with high counts (25–29): *G. aoteanus* McCann and McKnight, 1980, *G. capensis* (Gilchrist and von Bonde, 1924), *G. melanopterus* Gilbert, 1905, and *G. multifilis* (Günther, 1887).

Four species comprise the Indo-Pacific group with low gill rakers counts (17–23): *G. colletti* Jordan and Gilbert, 1904 from the Pacific coast of Japan and the Kyushu-Palau Ridge, and *G. magnifilis* Gilbert and Hubbs, 1920, *G. denticulatus* Gilbert and Hubbs, 1920, and *G. introniger* Gilbert and Hubbs, 1920 from the Philippines and New Caledonia. *Gadomus* sp. cf. *colletti* is most similar to *G. colletti* in having substantial overlap with the characters detailed by Howes and Crimmen (1990) and Okamura (1970). Notably, it shares a high pectoral fin ray count (i17–i20) that differentiates *G. colletti* from the three other similar species, and it has strikingly similar external coloration when fresh (see Okamura 1982, pl. 84). It differs from *G. colletti* in having a pale buccal cavity—lacking the blackish pigmentation described by Okamura (1970, 1982). This character may be geographically variable and unimportant, but it is a distinct difference between the two western Australian species of *Gadomus* and can be reliably used to separate them in the field. Because of this uncertainty, and because *G. colletti* is known only from waters around Japan, we refer this material to *G. sp. cf. colletti* pending a more detailed study. *Gadomus* sp. cf. *colletti* differs from *G. introniger* in its relatively narrower interorbital (15–19% HL cf. 21–23% in our specimens and 20–22% as recorded by Gilbert and Hubbs (1920) for the type specimens from the Philippines and Indonesia), and from *G. denticulatus* in having more lower-limb gill rakers on the first arch (21–23 cf. 17–20). *Gadomus magnifilis* is distinct among this group in having an extremely elongate second pectoral fin ray (141–143% of preanal length cf. 87–95% in *Gadomus* sp. cf. *colletti*) and a longer head (52–55% of preanal distance cf. 47–51%).

*Gadomus* sp. cf. *colletti* can be most easily differentiated from the other Australian species, *G. pepperi* by the lack of dark pigmentation of the buccal cavity and tongue, the relatively short outer gill rakers on the first arch (similar or only marginally longer than the longest filaments cf. twice as long), and the lower number of rakers on the first gill arch (25–28 total cf. 30–33).

### *Gadomus pepperi* new species

Fig. 4

*Gadomus* sp. B: Williams et al., 1996:149 (listed).

DIAGNOSIS. — Gill rakers on first arch 30–33 total; a narrow space separating the premaxillary dentigerous bands (5.3–6.6% of premaxillary length); first dorsal rays II,9–10; pectoral rays i16–i19; barbel less than three times orbit diameter, not extending beyond jaws. About 75 pyloric caeca.

SPECIMENS EXAMINED. — WA: HOLOTYPE: CSIRO H2541-04 (50.7 mm HL, 275 mm TL); Exmouth Plateau; 913–914 m; SS1/91/2. PARATYPES: CSIRO H3008-12 (2, 56.1–66.0 HL, 280–365



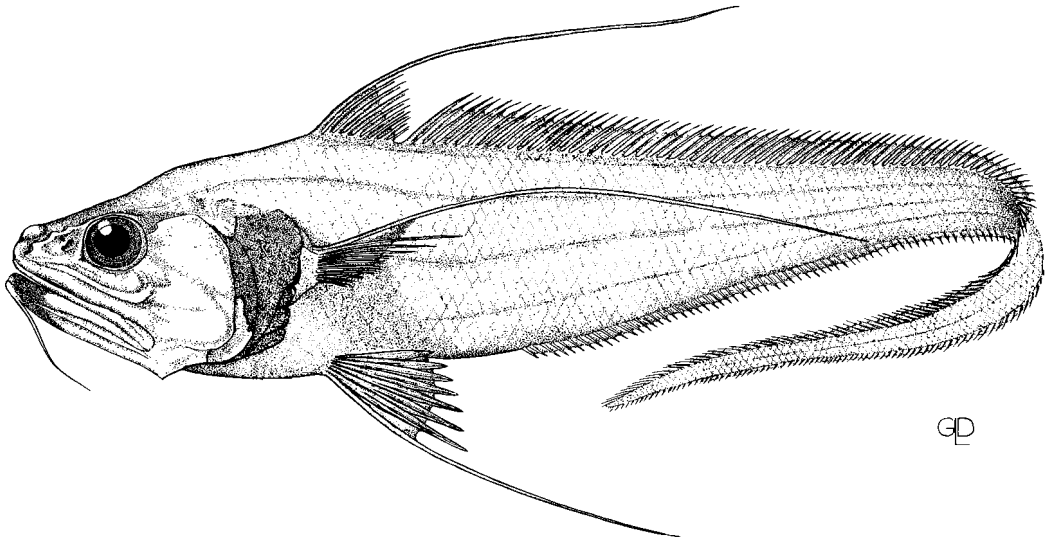


FIGURE 4. *Gadomus pepperi* n.sp. Holotype, CSIRO H2541-04 (275 mm TL), from Exmouth Plateau, WA, in 913–914 m, Southern Surveyor station SS1/91/02. Drawn by Georgina L. Davis.

TL); sw. of Albany; 35°25'S, 117°21'E; 842 m; *Akebono Maru No. 3*, shot 8; coll. A. Williams; 22.XII.1989. CSIRO H3017-01 (2, 53.0–60.0 HL, 290–306 TL); nw. of Cape Leeuwin; 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; coll. A. Williams; 24.XII.89. CSIRO H2563-05 (3, 51.0–67.5 HL, 268–345 TL); w. of Quobba Pt.; 895–901 m; SS1/91/25. NSW: AMS I.24059-002 (4 of 7: 45.1–62.0 HL, 238+–383 TL); off Norah Head; 942–978 m; K83-09-02. QLD: AMS I.20920-004 (54.7 HL, 290 TL); 10–11 miles ne. of Raine I.; 11°32'S, 144°10'E; 1,000 m.

COUNTS AND MEASUREMENTS (based on 8 spec.). — V. 8; GR-I (outer) 5–6(7)+24–26; about 75 pyloric caeca counted in one QLD specimen.

Total lengths 268–365+ mm; HL 50.7–67.5 mm. The following in percent of HL: postrostral 73–76; snout 25–29; internasal 18–20; interorb. 18–23; orb. 23–26; suborb. 9–12; postorb. 49–53; orb.-preop. 44–49; barbel 48–56; pre-A. 175–193; pre-vent 163–180; V.-A. 63–81; isth.-A. 133–154; body depth 72–83; depth at A. 57–64; 1D.–2D. 3–6; ht. 1D. 157–208; len. P. 193–253; len. V. 132–175; post. nostril 3–6; up.jaw 57–62; pmx. 54–57. The following in percent of pmx.: pmx. ascending process 19.8–24.3; distance across midline between pmx. dentigerous surfaces 5.3–6.6. The following in percent pre-A.: HL 52–57; len. P. 40–52.

DESCRIPTION. — Head and body moderately compressed; tail slender (but damaged and shortened in most specimens). Snout blunt, rostral cartilage forming distinct knob at tip. Dorsal profile rather straight over head; slightly humped at level of posterior margin of orbit. Bones of operculum and snout particularly weak. Membranes of head thin, usually damaged. Orbit small to moderate; interorbital relatively wide. Mouth extending beyond posterior margin of orbit; premaxillary ascending process well developed. Chin barbel prominent, fleshy and long, tapering to a fine point, not extending beyond posterior margin of jaws.

Teeth minute, villiform, arranged in numerous rows forming bands on both premaxilla and dentary. Dentigerous bands of premaxilla relatively narrow, of near-uniform width, separated by a narrow gap at symphysis; dentigerous band of dentary relatively narrow and of even width.

Outer gill rakers on first arch long, slender, flattened, with tiny conical spines; inner rakers medium length, about twice into length of outer rakers, clublike, expanded distally and armed with

medium-length, upward-pointing, curved spines; longest gill filaments of first arch about twice into length of longest outer rakers.

Gular and branchiostegal membranes unscaled.

Second ray of first dorsal and upper ray of pectoral (= second element) greatly extended; outer ray of pelvic fin extending well beyond anal origin; extended rays of pectoral slender. Pelvic fin bases broad and widely separated.

Body color creamy yellow to sandy brown; color uniform above and below lateral midline; abdominal region between pelvic fin bases and vent blue. Dusky pigmentation on anterior region of jaws and lips, underside of head posterior to barbel, gular region, and around nostrils. Buccal cavity, tongue, distal portion of branchiostegal membranes, and opercular cavity dark to black. Dorsal fin dark to black; pectoral and pelvic fins dusky.

SIZE. — To more than 38 cm TL.

DISTRIBUTION. — Collected at upper- and mid-slope depths (817–1,500 m) off the west coast of Australia (latitudes 20°S–35°S). Range extends eastwards to western Bass Strait (southeastern Australia), NSW, and QLD.

ETYMOLOGY. — The new species is named to acknowledge Roger Pepper, the fishing master of *FRV Southern Surveyor* and *FRV Soela*, for his contribution to many scientific fishing expeditions, including those that provided much of the material for this study.

COMPARISONS AND REMARKS. — The outer, lower-limb gill raker count (24–26) of *Gadomus pepperi* is similar to those of four Indo-Pacific species with a high raker count (25–29): *G. aoteanus*, *G. capensis*, *G. melanopterus*, and *G. multifilis* (see Howes and Crimmen 1990, and note under *Gadomus* sp. cf. *colletti*).

*Gadomus pepperi* is closest to *G. multifilis* from the northern and western Indian Ocean, sharing a range of characters including a relatively longer head than in other species of *Gadomus*. However, based on data from the holotype and [presumably] eight other specimens of *G. multifilis* provided by Howes and Crimmen (1990:196, table 13), the new species has more rays in the first dorsal fin (II,9–10 cf. II,8(9) and pectoral fin (i16–i19 cf. “15–16”), and a narrower separation of the premaxillary dentigerous areas (5.3–6.6% of premaxilla length cf. 8.2–13.1%). (Note that Howes and Crimmen use premaxillary length, which should not be confused with our use of upper jaw length. The latter is significantly longer as it includes the lengths of both premaxilla and maxilla.) Interestingly, Okamura (1970) recorded II,9 dorsal rays and 19 pectoral rays in his description of a single specimen of *G. multifilis* from the Philippines. However, the orbit diameter of that specimen is the same as the interorbital width; in contrast, in the Australian species and in *G. multifilis* from the Indian Ocean, the orbit is larger than the interorbital width.

*Gadomus aoteanus* from New Zealand is easily separated from *G. pepperi* by its relatively short barbel (19–27% HL cf. 48–56%) and fewer pectoral fin rays (i14–i17 cf. i16–i19). (Data from 12 specimens of *G. aoteanus* as provided by Peter McMillan, NIWA, Nov. 1996.) It should be noted that the mensural characters for *G. aoteanus* in table 14 of Howes and Crimmen’s (1990) article are, for the most part, wrong. The two authors used McCann and McKnight’s (1980:21) measurements thinking they were in millimeters, but the measurements were actually expressed as a percentage of the snout-to-anus length, viz, McCann and McKnight’s “standard length.” The pelvic fin ray count that McCann and McKnight gave as eight is actually nine, from TI’s examination of the holotype, NZOI 189, now deposited in NMNZ. Howes and Crimmen also gave the pyloric caeca count as 14–100+, numbers they obviously obtained from that given by McCann and McKnight for the entire genus. McMillan has counted 18–25 caeca in 10 specimens, and 33 in an 11th specimen.

*Gadomus capensis* from the Indian Ocean is also distinguished from the new species by its much shorter barbel (2–7% HL cf. 48–56%). The high count of lower-limb gill rakers of first arch (27–29) of the Hawaiian *G. melanopterus* separates it from *G. pepperi* (24–26 rakers) and the other species

in the "high-count" group. *Gadomus melanopterus* also has a shorter premaxillary ascending process than the new species (18–20% of premaxillary length cf. 20–24%).

*Gadomus pepperi* can be most easily differentiated from the other Australian species, *Gadomus* sp. cf. *colletti*, by the dark pigmentation of the buccal cavity and tongue (cf. unpigmented), the relatively long outer rakers on the first gill arch (twice as long as the longest filament cf. similar length or marginally longer), and the higher number of rakers on the first gill arch (total 30–33 cf. 25–28). A possible third Australian species has been recorded as "*Gadomus* sp." by McMillan in Gomon et al. (1994:357, fig. 317). That species is similar in many ways to *Gadomus* sp. cf. *colletti*, including length of elongated fin rays, lengths of barbel, orbit, upper jaw, and snout, width of interorbital, and counts of fin rays and gill rakers. However, it differs significantly in numbers of pyloric caeca (18–33 vs. about 75). A close comparison of more specimens of the two is in order.

Considerably broader collections from the Indo-Pacific are probably required before the identity and distributions of *Gadomus* species from this region can be fully determined.

FAMILY MACROURIDAE  
SUBFAMILY MACROURINAE  
***Caelorinchus* Giorna, 1810**

This genus, the largest in the family, contains more than 100 species, many of which are still to be described. The Western Australian collections included representatives of at least 20 species, eight of which are new.

KEY TO SPECIES OF *CAELORINCHUS* FROM WESTERN AUSTRALIA

(Names followed by an asterisk are species that have yet to be recorded from Western Australia, but could be expected.)

- |  |                                |
|--|--------------------------------|
| 1a. Snout short, blunt, usually less than orbit diameter . . . . .   | 2                              |
| 1b. Snout acutely pointed, longer than orbit diameter . . . . .  | 6                              |
| 2a. Anal fin black on anterior 1/3 to 1/2, pale posteriorly; trunk completely encircled by a broad dark band; underside of head fully scaled . . . . .   | <i>C. matamua</i>              |
| 2b. Anal fin light dusky to pale or with blackish stripe extending to end of tail; trunk not encircled by a dark band; underside of head naked or with a few scales posterior to mouth (in <i>C. mirus</i> ) . . . . . | 3                              |
| 3a. Anterior dermal window of light organ extends forward to or beyond line connecting origins of pelvic fins (Fig. 20a"); a distinct black spot on pelvic fins . . . . .  | <i>C. mirus</i>                |
| 3b. Anterior dermal window falls short of line connecting pelvic fin bases (Fig. 18c); no distinct spot on pelvic fins . . . . .   | 4                              |
| 4a. Snout lacking naked areas dorsally behind leading edge (Fig. 18b); saddle marks on body prominent, dark . . . . .  | <i>C. maurofasciatus</i>       |
| 4b. Snout with naked, translucent areas dorsally behind leading edge (Fig. 20b); saddle marks on body rather faint or almost lacking . . . . .   | 5                              |
| 5a. Saddle marks obscure on trunk and nape; pale interspaces posteriorly on tail spotlike, especially viewed dorsally; median nasal process dark anteriorly . . . . .  | <i>C. parvifasciatus</i> *     |
| 5b. Saddle marks faint but distinct along trunk and nape, with pale interspaces not spotlike and directed diagonally downward and forward; median nasal process without dark pigmentation . . . . .                    | <i>C. amydrozosterus</i> n.sp. |
| 6a. Underside of head naked . . . . .  | 7                              |
| 6b. Underside of head scaled, at least posteriorly . . . . .   | 14                             |
| 7a. Light organ long, extends from anus to just behind isthmus; anus immediately before anal fin (Fig. 19a') . . . . .   | 8                              |
| 7b. Light organ extends to just forward of pelvic fin bases at most, but usually well behind; anus slightly removed from anal fin origin (Fig. 16c, 18c) . . . . .   | 12                             |
| 8a. Anterolateral margins of snout completely supported by bone; body scales small, 7–8.5 below origin of second dorsal fin . . . . .  | <i>C. acutirostris</i>         |
| 8b. Anterolateral margins of snout incompletely supported by bone; body scales moderate, 4.5–5.5 below origin of second dorsal fin . . . . .   | 9                              |

- 9a. Spinules on body scales in discrete parallel rows (Fig. 8b); dorsal aspects of trunk covered with small to large spots or elongated blotches; dorsal stripe absent or poorly developed . . . . . *C. pardus* n.sp. 10
- 9b. Spinules on body scales in widely divergent to quincunx pattern (Fig. 8a, c); trunk either lacking spots, or large spots and blotches in series forming broken longitudinal streaks; dorsal stripe present from near origin of second dorsal to tail tip . . . . . 10
- 10a. Upper jaw 22–24% of head length; snout length 49–50% . . . . . *C. gaesorhynchus* n.sp. 11
- 10b. Upper jaw 30–36% of head length; snout length about 40–46% . . . . . 11
- 11a. Pectoral fin rays i13–i15; dark color on dorsum from nape to second dorsal essentially continuous, not broken into multiple spots; gular membrane uniformly peppered with fine melanophores . . . . . *C. mayiae* n.sp. 11
- 11b. Pectoral fin rays i15–i18; dark color pattern of dorsum broken into multiple spots or blotches from below first dorsal fin to origin of second dorsal fin; melanophores on gular membrane forming striated or reticulated pattern . . . . . *C. argentatus* 11
- 12a. A large prominent pectoral spot (usually above and behind pectoral fin base) present at all sizes . . . . . 13
- 12b. Pectoral spot absent . . . . . *C. goobala* n.sp. 13
- 13a. Pectoral spot close to pectoral fin base; spot higher than wide . . . . . *C. maculatus* 13
- 13b. Pectoral spot removed from pectoral fin base by 4 or 5 scale rows; spot wider than high . . . . . *C. thurla* n.sp. 13
- 14a. Second dorsal fin about as high anteriorly as anal fin; spinules on body scales fine, needlelike, in 10 or more parallel rows . . . . . *C. innotabilis* 14
- 14b. Second dorsal fin much lower than anal fin anteriorly; spinules on body scales not fine and needlelike, in fewer than 10 rows . . . . . 15
- 15a. Anterolateral margin of snout completely supported by bone; a short dermal window of light organ present before anus; anus slightly removed from anal fin origin . . . . . 16
- 15b. Anterolateral margin of snout incompletely supported by bone; no dermal window of light organ visible; anus immediately before anal fin . . . . . 18
- 16a. Orbit 2.0–2.5 into snout length; 8–10 gillrakers on first arch, 9–10 rakers on inner side of second arch; nasal fossa almost entirely scaled . . . . . *C. macrorhynchus* 16
- 16b. Orbit 1.3–2.1 into snout length; 7–8 gillrakers on first arch, 7–9 rakers on inner side of second arch; nasal fossa naked to sparsely scaled anteriorly and ventrally . . . . . 17
- 17a. Color overall dark, swarthy to chocolate-brown in adults, grayish in juveniles; pectoral fin rays i16–i17 . . . . . *C. smithi* 17
- 17b. Color dorsally light brownish gray, ventrally pale to whitish; pectoral fin rays i17–i19 . . . . . *C. charius* n.sp. 17
- 18a. Free neuromasts on head prominent, appearing as series of black dots; nasal fossa naked; triangular area bordered by nasal fossa, orbit and suborbital ridge naked . . . . . *C. trachycarus* 18
- 18b. Free neuromasts on head not conspicuous; nasal fossa partially or wholly scaled; area bordered by nasal fossa, orbit, and suborbital ridge scaled . . . . . 19
- 19a. Color light brown to grayish; mouth, lips, gums pale; most trunk scales with 2 or more incomplete spinule rows, not extending posteriorly to edge of scale . . . . . *C. acanthiger* 19
- 19b. Color overall dark brown to black; mouth, lips, gums dark-dusky to black; most trunk scales with all spinule rows complete to edge of scale . . . . . *C. lasti* n.sp. 19

### *Caelorinchus acanthiger* Barnard, 1925

Fig. 5

*Coelorhynchus acanthiger* Barnard, 1925:502 (off Cape Point, South Africa; 841 m).

*Coelorhynchus pseudoparallelus* Trunov, 1983:895 (Namibia; Walvis Ridge, Discovery Tablemount; 800–1,800 m).

*Caelorinchus acanthiger*: McMillan in Gomon et al. 1994:350, fig. 310 (southern Australia). Williams et al. 1996:148 (WA).

DIAGNOSIS. — Snout of moderate length, about 40–43% HL, with dorsal profile straight to slightly concave and tipped with a sharp, narrow scute; anterolateral margin not fully supported by bone; orbit diameter 27–30% HL; upper jaw extends to below midorbit. A small, inconspicuous, black scaleless fossa (length much less than posterior nostril) immediately anterior to anus. Underside of head covered with small, fine, embedded scales having short, erect clusters of spinules; nasal fossa usually entirely naked; body scales with a median keel-like row of broad-based, enlarged spinules flanked by two to four short rows of smaller spinules. Pyloric caeca 9–12.

SPECIMENS EXAMINED. — WA: AMS I.31181-013 (2, 86.9–91.3 mm HL, 340–341 mm TL); sw. of Shoal Point; 853–854 m; SS1/91/41. AMS I.3177-009 (83.1 HL, 300+ TL); off Shark Bay;

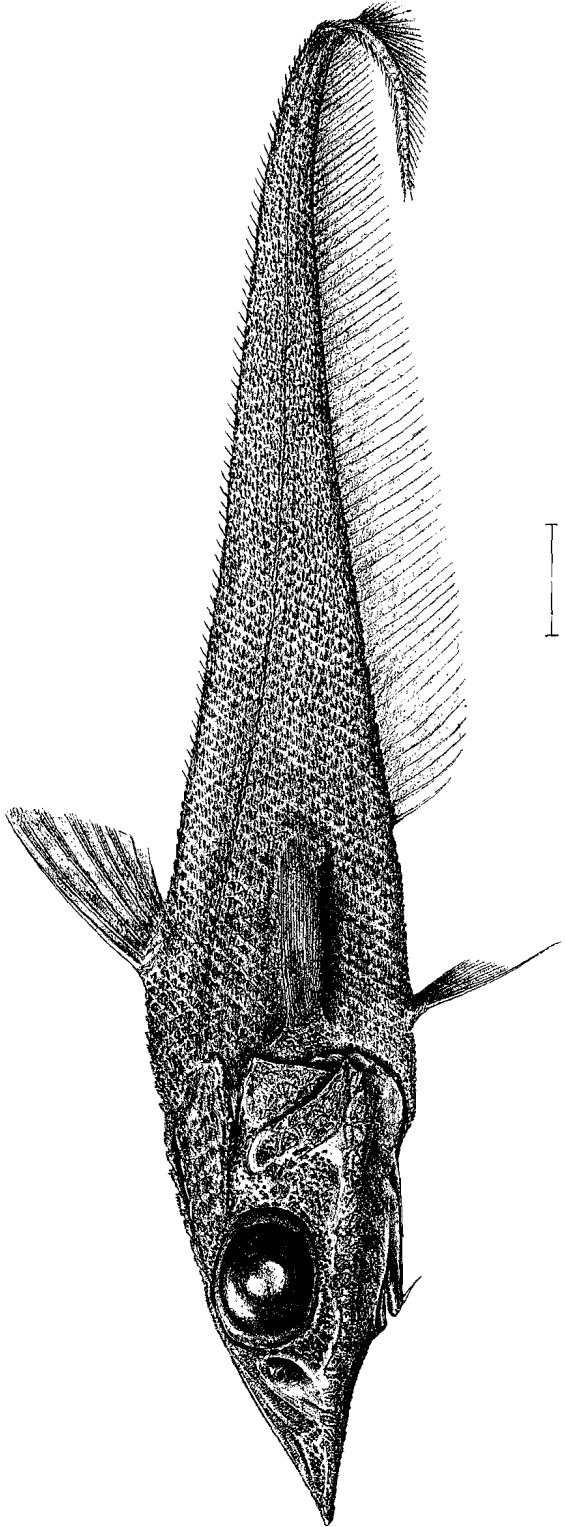


FIGURE 5. *Caelorinchus acanthiger* Barnard, 1925. Lectotype, SAM 12632 (390+ mm TL), from off Cape Point, South Africa, in 460 fathoms. Fins and scales partially reconstructed. Scale bar represents 25 mm.

996–1,009 m; SS1/91/44. AMS I.31180-012 (112.6 HL, 390+ TL); nw. of Shoal Point; 945–960 m; SS1/91/48. NMV uncat. (3, 86.2–92.9 HL, 290–347+ TL); s. of Cape Leeuwin; 870–920 m; SS1/91/96. CSIRO H3002-03 (130 HL, 450+ TL); se. of Albany; 35°23'S, 118°27'E; 1,030 m; *Akebono Maru No. 3*, shot 2; coll. A. Williams; 21.XII.1989. CSIRO H3008-08 (4, 88.5–108 HL, 335–355+ TL); sw. of Albany; 35°25'S, 117°21'E; 842 m; *Akebono Maru No. 3*, shot 8; coll. A. Williams; 22.XII.1989.

COUNTS AND MEASUREMENTS (for 12 WA spec.). — 1D. II,8–9; P. (i17) i18–i20; GR-I (inner) 2+6; GR-II (outer/inner) 0+6 / 2+(6–7); scales 1D. 7 or 8, midbase 1D. 5–7, 2D. 6.5–7.5, lat.line 33–39 (43).

Total lengths 290–450+ mm; HL 83–130 mm. The following in percent of HL: preoral 37–42; internasals 19–20; interorb. 22–24; suborb. 15–17; postorb. 30–32; orb.-preop. 32–36; up.jaw 23–26; barbel 7–11; gill slit 11–12 (4 spec.); body depth 42–58; 1D.-2D. 18–31; ht. 1D. 36–50; len. P. 32–37; len. V. 31–38; len. post. nostril (6) 7–8 (9).

SIZE. — Attains at least 50 cm.

DISTRIBUTION. — Widespread from southern Africa across Indian Ocean to Australia and New Zealand. Relatively common in temperate waters of Australia, from NSW, VIC, TAS, SA, WA.

COMPARISONS AND REMARKS. — *Caelorinchus acanthiger* is most likely to be mistaken for *C. trachycarus* from southern Australia and New Zealand, but can be distinguished by its smaller body scales and finer scale spinulation that imparts a generally smoother texture to the head and body, the lack of notably enlarged and coarsened scales on the head exclusive of the ridges, fewer pyloric caeca, and paler body and fin color lacking violet/purplish tinge on naked areas. *Caelorinchus mycterismus* is also closely similar but has a longer snout with a pronounced upturned tip (snout profile relatively straight in *C. acanthiger*). In this regard, Western Australian specimens of *C. acanthiger* have a slightly upturned snout compared to specimens from NSW, but agree well in all other features. We attribute this slight difference to geographic variation. Compared to *C. acanthiger*, *C. lasti* has a darker overall color, broader spinules on scales of snout, scales present ventrally on nasal fossa, and a number of different proportions in head measurements, which are compared in Table 1.

### *Caelorinchus acutirostris* Smith and Radcliffe, 1912

Fig. 6a

*Coelorhynchus acutirostris* Smith and Radcliffe in Radcliffe, 1912:134–136, pl. 30, fig. 2, text-fig. 10 (Philippines between Cebu and Bohol, 291 m; *Albatross* sta. 5418; holotype, USNM 72947). Gilbert and Hubbs, 1920:512–514 (descr.; Cebu, Bohol, Mindanao; 291–320 m).

*Caelorinchus* sp. 1: Arai in Gloerfelt-Tarp and Kailola, 1984:85, fig. p. 84, and photograph of specimen without caption on p. 82 (s. Indonesia and nw. Australia).

*Caelorinchus acutirostris*: Iwamoto and Merrett, 1997:485–486, fig. 6a (specimen from New Caledonia, Queensland, Philippines).

DIAGNOSIS. — Snout notably slender, attenuate, and sharply tipped, its length 47–58% of HL; anterolateral margin fully supported by bone; orbit diameter 20–23% of HL; upper jaw short, length 17–22% HL, restricted laterally, extending to below posterior one-third of orbit; barbel short, fine, 5–7% of HL. Premaxillary teeth band short, broad; mandibular band longer and more narrow; subopercle lacking a prolonged narrow flap. Light organ a long, blackish, scale-covered streak extending from just behind isthmus to front of anus. Underside of head completely naked; nasal fossa usually naked, but small scattered scales in some specimens; body scales small, their exposed field covered with conical erect spinules in 5–7 slightly divergent rows, 7–8.5 scale rows below origin of second dorsal fin, 42–58 lateral line scales over a distance equal to predorsal length. A dark streak (sometimes faint) on belly extending horizontally from pectoral fin base to above anal fin origin; a curved dark streak (often faint) passing below base of first dorsal fin from nape to second dorsal;

TABLE 1. Comparison of characters of *Caelorinchus acanthiger*, *C. trachycarus*, *C. mycterismus*, and *C. lasti*.

	<i>C. acanthiger</i>	<i>C. trachycarus</i>	<i>C. mycterismus</i> *	<i>C. lasti</i>
nasal fossa scales	naked or sparse	naked	sparse-extensive	sparse
snout length (%HL)	40-43	39-49	45-51	37-38
orbit (%HL)	27-30	22-30	24-29	26-32
snout/orbit	1.3-1.6	1.4-1.9	1.8-2.0	1.4-1.6
upper jaw len (%HL)	23-26	17-24	15-26	32
barbel (%HL)	7-11	4-8	4-10	9-10
preoral len.	37-42	36-48	43-51	30-32
internasal width (%HL)	19-20	18-23	16-20	18-20
interorbital width (%HL)	22-24	20-27	19-24	25-28
gill slit	11-12	-	9-11	14
pyloric caeca	9-12	7-9	8-11	-

\* Data for *C. mycterismus* from McMillan and Paulin (1993) and current specimens examined.

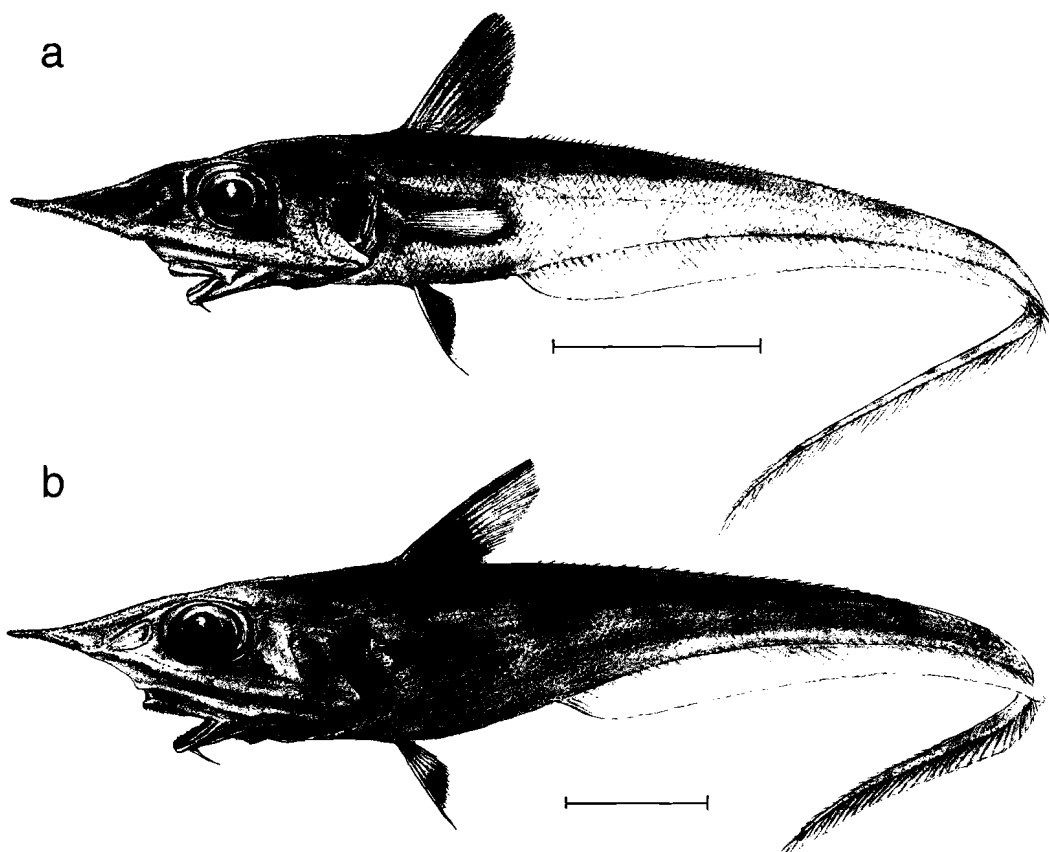


FIGURE 6. (a) *Caelorinchus acutirostris* Smith and Radcliffe, 1912. MNHN 1996-961 (44.6 mm HL), from off New Caledonia in 415-435 m. (From Iwamoto and Merrett 1997, fig. 6a.) (b) *Caelorinchus argentatus* BMNH 1996.7.19.2 (61 mm HL), from off New Caledonia in 415-435 m. (From Iwamoto and Merrett 1997, fig. 6b.)

chest and vent areas darkly punctulate to black; anterior 10–15 rays of anal fin blackish; suproccipital scute well developed; second dorsal fin moderately well developed for genus.

**SPECIMENS EXAMINED.** — **WA:** CSIRO CA405; NW Shelf, Mermaid Reef, Rowley Shoals; 17°24'S, 119°54'E; 305–322 m; *FRV Courageous*; 10.VI.1978. CSIRO CA344; NW Shelf; 1978 (no other data). CSIRO CA345 (76 HL, 270+ TL); NW Shelf; *FRV Courageous*; V.1978. AMS I.23423-011 (59.0 HL, 216+ TL); NW Shelf; 376 m; SO4/82/leg1. AMS I.22825-13 (4, 61+–79.5 HL, 200+–252 TL); NW Shelf; 300–326 m; SO2/82/43.44. WAM P.26209-003 (3, 45.8–67.0 mm HL, 142–202+ mm TL); 225 km nnw. of Port Hedland; 297–330 m. **Philippines:** USNM 72947 (holotype, 205 mm TL); Philippines between Cebu and Bohol; *Albatross* sta. 5418; 291 m. (Also, specimens cited in Iwamoto and Merrett 1997)

**COUNTS AND MEASUREMENTS.** — 1D. II, (7)8–9(10); P. i15–i17; total GR-I (inner) (1–2)+(5–6), 6–8, GR-II 5–6/(1–2)+(5–6), 6–8; scales 1D. 7–9, midbase 1D. 5–7.

Total length 110+–238+ mm; HL 38.3–69.2 mm. The following in percent of HL: preoral (40) 43–52; internasal 13–20; interorb. 18–22; suborb. 11–13; postorb. 23–30; orb.-preop. 27–32; gill slit 8–12 (13); pre-A. 126–153; V.-A. 26–44; isth.-A. 48–68; body depth 36–57; 1D.-2D. 8–13; ht. 1D. 32–42; len. P. 28–41; len. V. 23–34; post. nostril 4–9.

**SIZE.** — Largest specimen known is 24 cm TL.

**DISTRIBUTION.** — Known from the Philippines, off WA and QLD, and off New Caledonia; probably occurs throughout Indonesia.

**COMPARISONS AND REMARKS.** — *Caelorinchus acutirostris* is a peculiar species among the *Caelorinchus* of Iwamoto's Group IV (Iwamoto 1990) in that it has a long light organ typical of the group and a complete bony support of the anterolateral snout margin. All other Group IV macrourids have the anterolateral snout margin incompletely supported by bone. The small scales and distinctive body markings in fresh specimens coupled with other diagnostic features make the species unlikely to be mistaken for any other.

### *Caelorinchus amydrozosterus* new species

Fig. 7

*Caelorinchus* sp. 2: McMillan in Gomon et al., 1994:348, fig. 308 (descr.; VIC, 300–600 m).

*Caelorinchus* sp. A: Williams et al., 1996:148 (WA).

**DIAGNOSIS.** — Snout short, anterolateral margin incompletely supported by bone; orbits longer than snout and postorbital. Naked fossa of ventral light organ (ADW) (Fig. 7c) relatively large, anterior end reaches about to line connecting pelvic fin insertions. Underside of head and nasal fossa naked; broad, naked, translucent areas dorsally behind leading edges of snout (Fig. 7b). A series of scales on midline of nape with median spinule row elevated into low crests, forming weak but distinct ridge from supraoccipital scute to dorsal fin. A series of 12–13 faint saddle marks, the anterior four directed anteriorly downwards. Pyloric caeca 15–16.

**SPECIMENS EXAMINED.** — **HOLOTYPE:** NMV A3405 (52.5 mm HL, 200+ TL); 42 km sw. of Portland; 297–334 m. **PARATYPES:** **WA:** NMV A7108 (5 of 7, 41.1–48.5 mm HL, 185+–221+ mm TL); 100 km se. of Esperance; 34°41.1'S, 122°27.0'E; 717–710 m; *Saxon Progress*; field no. RP-1; 14.VIII.1988. CAS 79576 (formerly NMV A6191) (4, 41.3–50.2 HL, 194–226 TL); 80 km ssw. Of Esperance; 34°34'36"S, 121°32'48"E; 504–477 m; *Saxon Progress*; coll. RJP; 15.VIII.1988. CSIRO H2604-02 (39.4 HL, 180+ TL); sw. of Ledge Pt.; 512 m; SS1/91/70. CSIRO H2605-03 (37.9 HL, 183 TL); nw. of Rottneest I.; 485 m; SS1/91/71. CSIRO H2607-01 (41.1 HL, 197+ TL); Rottneest Canyon; 550 m; SS1/91/73. CSIRO H2618-04 (39.7 HL, 193 TL); 430 m; SS1/91/87. AMS E3583 (51.6 HL, 220+ TL), E3585 (52.0 HL, 245+ TL), E3586 (48.9 HL, 195+ TL); Great Australian Bight se. from Eucla; *Endeavour*; 6.V.1913. **VIC:** NMV A3405 (2, 43.3–52.5 HL, 200+–210 TL); 42 km



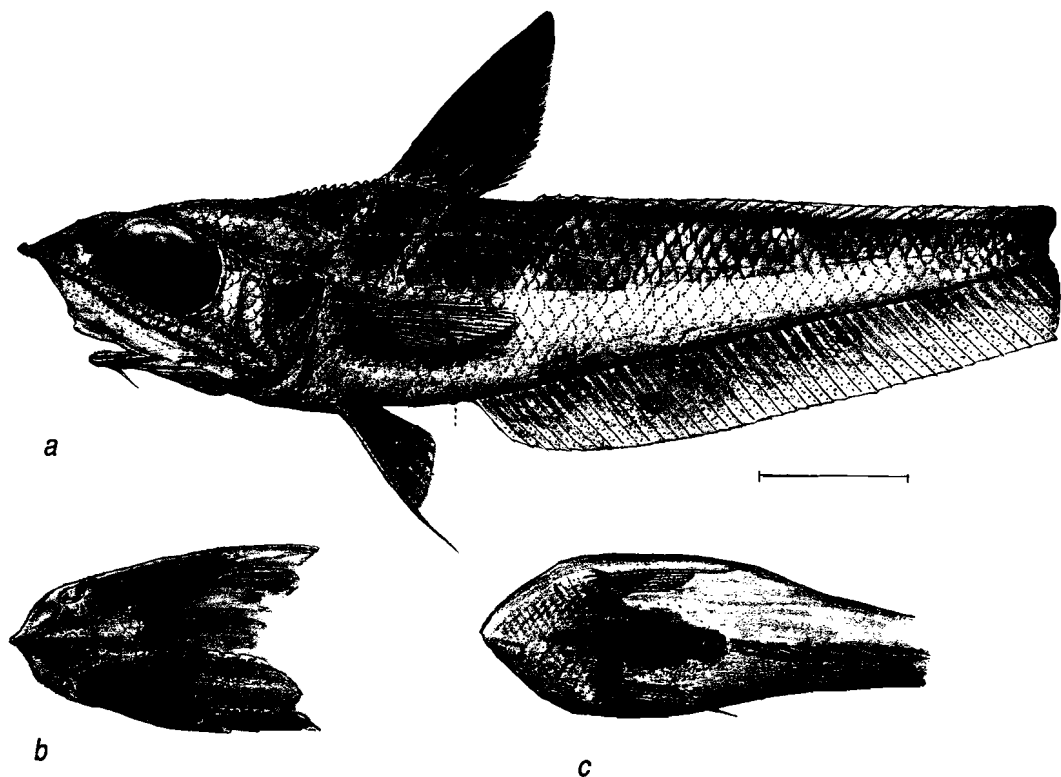


FIGURE 7. *Caelorinchus amydrozosterus* n.sp. Holotype (NMV A3405, 200+ mm TL) from 42 km southwest of Portland, VIC, in 297–334 m. (a) Lateral view (fins and scales partially reconstructed); (b) dorsal view of head to show snout shape and naked areas behind leading edge of snout; (c) ventral view of abdomen to show shape and location of light organ and anus. Scale bar represents 25 mm.

sw. of Portland; 297–334 m. NMV A803 (2, 44.2–46.8 HL, 198+–225+ TL); Bass Strait off Portland; 38°50'S, 141°46'E; 549 m; coll. M. Gomon (MFG-15); 6.III.1980. NSW: AMS I.15975-036 (42.9 HL, 200+ TL); 35 miles se. of Newcastle; 33°11'S, 152°23'E; K71-08-05. SA: AMS I.8711-006 (3, 40.7–44.6 HL, 182+–214 TL); "off southern Australia," *Dmitry Mendeleev*; 28.II.1976.

COUNTS AND MEASUREMENTS. — 1D. II,9–10, P. (i15) i16–i18; GR-I (inner) (1–2)+7, GR-II (outer/inner) 7–8 total /2+(7–8); scales 1D. 5–6, midbase 1D. 3.5–4.5, 2D. 3.5–4.5, lat.line 23–27; caeca 15–16.

Total length 177–245 mm; HL 37.9–52.0 mm. The following in percent of HL: snout 29–34; preoral 27–35; internasal 21–26; interorb. 17–22; orb. 38–43; suborb. 15–18; postorb. 30–33; orb.-preop. 30–34; up.jaw 26–30; barbel 8–14; gill slit 13–17; pre-A. 139–159; V.-A. 66–81; body depth 56–70; 1D.-2D. 18–28; ht. 1D. 63–81; len. base 1D. 22–33; len. P. 54–61; len. V. 46–51; post. nostril 6–13 (13); len. ADW 14–21.

DESCRIPTION. — General features of fish seen in Figure 7. Snout short, acute in lateral profile, but blunt with broadly convex sides in dorsal view; terminal scute small, broad; subopercle forming a short, acute flap ventrally; mouth small, upper jaw extends posteriorly to below midorbit or beyond. Chin barbel short, length less than least width of interorbital space.

Scales typical of other members of clade (*C. fasciatus*, *C. maurofasciatus*, *C. parvifasciatus*, *C. mirus*, etc.); those on body with 8–12 (more in larger specimens) close, parallel rows of short, recumbent spinules. A modified median series on nape (see Diagnosis).

Fins well developed, typical of genus; high first dorsal lacking prolonged spinous ray; second dorsal rays low throughout. Pelvic fin with slightly prolonged outer ray.

Naked fossa of ventral light organ (Fig. 7c) separated from periproct region by a gap of several scale rows, extending to line connecting pelvic fin insertions (black streak extends farther forward, however); anus at anal fin origin.

Anterior four saddle marks on body directed anteriorly downwards, 1st saddle over nape, separated by pale interspace 2 rows wide running from origin of first dorsal through hind margin of occipital region, terminating at upper margin of opercle; 2nd oblique pale interspace originating under midbase of first dorsal; 3rd pale interspace originating under origin of second dorsal; saddle bands more pronounced posteriorly on tail, 8th saddle extending to anal base, pale interspaces not "spotlike"; underside of head, including jaws and gill membranes, and most of body pale creamish to white, trunk dark only around ventral light organ; opercle with a small black blotch; first dorsal fin dark dusky with pale base and posteriormost rays; pectoral fin clear to light dusky; pelvic fin with blackish blotch; anal fin dusky with fine, scattered speckling; anterior rim of orbits distinctly black; lips and gums cream, mouth cavity dark.

SIZE. — To about 25 cm.

DISTRIBUTION. — Broadly distributed from WA, SA, VIC, and NSW. So far not known from TAS. Depth distribution from about 297 m to 717 m.

ETYMOLOGY. — From the Greek *amydros*, indistinct, obscure, and *zosteros*, belt, girdle, in reference to the faint bands on the body.

COMPARISONS AND REMARKS. — *Caelorinchus amydrozosterus* is another species of the *C. fasciatus* group. It is most likely to be confused with *C. parvifasciatus* because of its small size, similar general appearance, and overlapping distribution in Australia. The two are readily distinguished, however, by *C. amydrozosterus* having a larger ADW; more pronounced banding pattern on body, with pale interspaces not spotlike and angled diagonally down and forward (at least in first four); fewer pyloric caeca (15–16 cf. 22–28, *vide* McMillan and Paulin 1993:827); a small dark blotch on opercle, not extending onto subopercle and preopercle; and a series of modified scales along midline of nape. *Caelorinchus maurofasciatus* differs in having the dorsal surface of the snout entirely scaled; a smaller light organ; more pyloric caeca (22–32 *vide* McMillan and Paulin 1993:826); more prominent saddles, the anteriormost saddle ending at origin of the first dorsal fin and the pale interspaces directed ventrally and posteriorly; and a dark marginal stripe on the anal fin. *Caelorinchus fasciatus* differs in having a smaller ADW; larger, more prominent scutelike scales on nape that form a high, sharp, median ridge anterior to first dorsal fin; and a completely scaled dorsal snout surface. *Caelorinchus cookianus* from New Zealand differs in having darker saddles, no modified scales on the nape, and 19–27 pyloric caeca (McMillan and Paulin 1993:827). *Caelorinchus mystax* and *C. bollonsi* from New Zealand waters differ from *C. amydrozosterus* in having many more pyloric caeca, among other differences (see McMillan and Paulin 1993:827).

### ***Caelorinchus argentatus* Smith and Radcliffe, 1912**

Fig. 6b

*Caelorhynchus argentatus* Smith and Radcliffe, in Radcliffe 1912:137, 138 (holotype USNM 72949, Philippines, vicinity of Jolo, 582 m).

DIAGNOSIS. — Snout moderately long, 40–44% of HL, with a slight humplike rise in dorsal profile over nostril; anterolateral margins not fully supported by bone; snout scales anterolaterally overlap onto ventral surfaces; orbit diameter 22–27% of HL; upper jaw about one-third of HL, extending posteriorly to below hind margin of orbit; barbel 6–14% of HL; subopercle without a slender projecting tab. Broad, median-ventral streak of light organ extends from anus onto chest just

behind isthmus. Underside of head completely naked (except for overlapping scales on snout); nasal fossa naked, naked area extending posteriorly onto suborbital shelf below anterior half of orbit; body scales thin, spinules short, fine, conical, in slightly divergent rows to somewhat quincunx pattern. Second spinous ray of first dorsal fin blackish over distal three-quarters; median nasal bone blackish; body markings variable, often faint, but in most specimens, an elongate, horizontal blotch behind occipital region over anterior end of lateral line, area below dorsal interspace with small blotches, a narrow tapered stripe from below origin of second dorsal to end of tail, with anterior end somewhat club-shaped; gular membrane with finely striated or reticulated pattern.

SPECIMENS EXAMINED. — **WA:** NTM S.12728-028 (83.1 mm HL, 275+ mm TL); sw. of Rowley Shoals; 420 m. NTM S.12727-007 (79.5 HL, 250+ TL); sw. of Rowley Shoals; 410 m. AMS I.22808-037 (2, 71.6–78.0 HL, 224+–270 TL); NW Shelf, 220 km n. of Port Hedland; 420 m; SO2/82/17-18. AMS I.22821-010 (3, 63.8–76.2 HL, 229–265+ TL); NW Shelf, ne. of Port Hedland; 298–320 m; SO2/82/36-38. AMS I.23425-015 (4, 66.6–93.4 HL, 250–326+ TL); NW Shelf; 298–320 m; SO4/82/leg1. **NT:** NTM S.12458-002 (2, 64.6–76.3 HL, 242–250 TL); Arafura Sea, se. of Tanimbar I.; 9°17'S, 131°08'E; 297 m; 5.VII.1988. NTM S.13146-017 (63.5 HL, 222+ TL); Arafura Sea, n. of Bathurst I.; 9°45'S, 130°14'E; 265 m; 6.II.1990. **Timor Sea:** AMS I.21804-002 (est. 66 HL, 235+ TL); 190 m; 1979. **QLD:** AMS I.22469-001 (93 HL, 300 TL); Great Barrier Reef, off No Name Reef; 14°39'S, 145°43'E; *Samarai*; 30.X.1981. AMS I.25814-003 (37 HL, 135 TL); n. of Townsville; 260–264 m; SO1/86/29. AMS I.25817-002 (38 HL, 140 TL); n. of Townsville; 296 m; SO1/86/35. AMS I.25826-004 (42.1 HL, 147 TL); n. of Townsville; 300 m; SO1/86/53. CSIRO H691-02 (79.0 HL, 279 TL); Queensland Trough, e. of Hinchinbrook I.; 402 m; SO6/85/47. **Philippines:** USNM 72949 (holotype, 93.2 mm HL, 365 mm TL), vicinity of Jolo; *Albatross* sta. 5172; 582 m. CAS 34436 (82.7 HL, 300 TL); Batangas Prov., Balayan Bay, se. of San Pedrina Pt.; 144–170 m; coll. J. E. Norton; 22.VII.1966. CAS 34857 (59.3 HL, 228 TL); se of Pagapas Bay; 326–362 m; coll. J. E. Norton; 4.VIII.1966.

COUNTS AND MEASUREMENTS (see Tables 3–5 for additional measurements). — 1D. II, 8–9 (10); P. i15–i17 (i18); total GR-I (inner) 7–9, GR-II (outer/inner) 5–7/8–9; scales 1D. 6–8, midbase 1D. 3.5–5.5, 2D. 4.5–5.5(7.5), lat.line 35–48; caeca 9–13.

Total lengths 135–365 mm; HL 42.1–93.2 mm. The following in percent of HL: preoral 27–37; internasal 18–23; interorb. 22–27; suborb. 11–14; up.jaw 30–36; gill slit 13–18; pre-A. 137–167; V.-A. 39–60; isth.-A. 71–96; body depth 43–60; 1D.-2D. 14–29; base 1D. 17–21; len. P. 32–43; post. nostril 4–9.

DESCRIPTION. — Iwamoto and Merrett (1997) provided a detailed description of *C. argentatus*. General proportions and shapes of fins, head, and body much as in *C. mayiae* and *C. pardus*.

Body scales of *C. argentatus* relatively deciduous; few scales remain in specimens examined except on head, chest, and over dorsal aspects of trunk. Scales dorsally below origin of second dorsal fin (Fig. 8a) having short, conical, slightly recurved spinules, arranged in irregularly divergent rows to quincunx pattern. Posteriormost spinules in each row scarcely extend beyond edge of scale. Scales ventrally on chest with broader, flatter spinules, more triangular in shape; few remaining scales over abdomen and above anal fin origin with short triangular spinules, similar to those illustrated for *C. kamoharai* Matsubara, 1943 by Okamura (1970, fig. 64). Scales over snout and over interorbital space rather thin, but abundantly covered with short, conical spinules. Underside of snout with tiny black punctations and small, black, hairlike papillae, as also found in *C. kamoharai*. Body markings rather similar to those of *C. mayiae*, but more spotted and not as prominent. Blotchy markings dorsally on nape and trunk fairly extensive but blotches broken below dorsal interspace. Elongated horizontal blotch behind occipital region present in most specimens, but faint in others. Thin, tapering dark stripe beginning below origin of second dorsal fin extends length of tail. Anterior end of dorsal stripe expanded and directed ventrally, but fading before joining darkened area of periproct. Lateral aspects of abdomen peppered with large dots under a thin silvery surface covering; ventrally on abdomen,

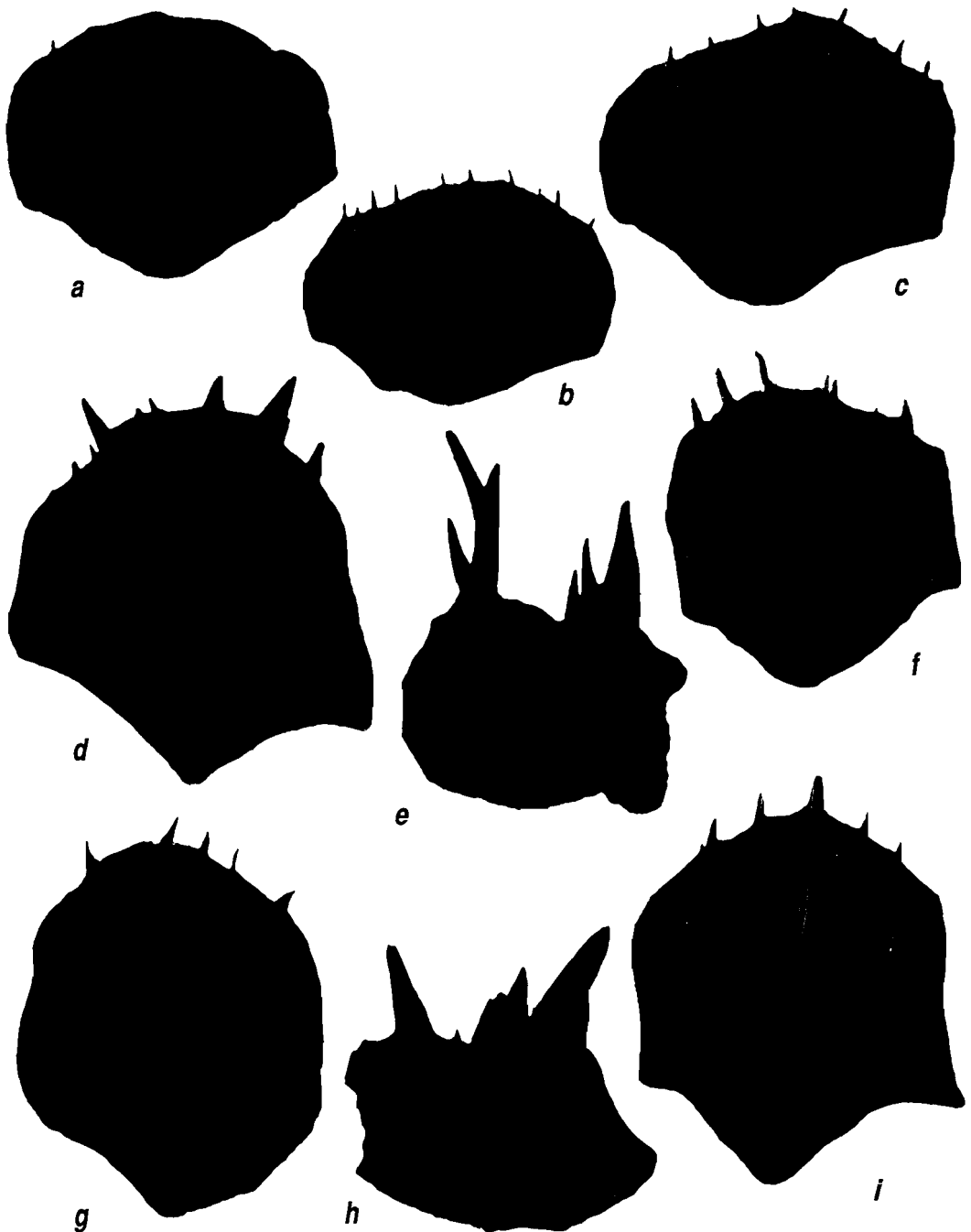


FIGURE 8. Scanning electron micrographs of scales of seven species of *Caelorinchus*: (a) *C. argentatus*; (b) *C. pardus*; (c) *C. mayiae*; (d) and (e) *C. charius*; (f) *C. goobala*; (g) *C. maculatus*; (h) and (i) *C. mycterismus*. All scales except (e) and (h) are from the region below or near the interspace of the first and second dorsal fins; (e) and (h) are from the underside of the snout.

from periproct region to anterior end of pelvic fin bases, dots sparse to moderate. Pelvic fin bases and pelvic girdle whitish, with scattered black punctations. Dark chest strongly contrasts with pale belly. Pelvic fins dark at base, tip, and along outer ray, but pale in middle. Segmented first dorsal rays with faint trace of broad darkish stripe across middle. Anal fin somewhat blackish on anterior few rays, but otherwise clear to light dusky posteriorly, with no blackened margin. Barbel dark to dusky, paler distally. Maxillary and lips densely pigmented.

SIZE. — To about 37 cm TL.

DISTRIBUTION. — Widespread in warm-water regions of Australia, from Northwest Shelf (about 118°E) to Arafura Sea (to 133°39'W) to QLD, in 260–420 m. Also known from Philippines, Indonesia, and New Caledonia.

COMPARISONS AND REMARKS. — *Caelorinchus argentatus* is so similar to *C. mayiae* that meristic and morphometric differences are minimal. Selected characters of the two species are compared in Tables 2–4. The generally fewer pectoral fin rays (Table 3) are helpful in distinguishing *C. argentatus* from *C. mayiae*. The scales atop the snout in *C. mayiae* are much weaker and sparser than in *C. argentatus*, giving the snout a more transparent and smoother appearance. Color patterns appear to be the best features for distinguishing the two species. In *C. mayiae* the dorsum from nape to second dorsal fin is continuously dark, whereas in *C. argentatus* the dark color is broken into smaller blotches, especially under the space between the dorsal fins and around the base of the first dorsal fin. (The dorsal color patterns are faint or almost absent in Philippines and some large Queensland specimens of *C. argentatus*.) In *C. argentatus* the pigmentation on the gular membrane of adults is in the form of fine striations or reticulations, in contrast to the uniformly peppered appearance in *C. mayiae*. The pelvic fin base and pelvic girdle of *C. mayiae* are almost entirely without pigmentation except along the edges, whereas those areas in *C. argentatus* have large scattered melanophores. In specimens of *C. argentatus*, the underside of snout is densely covered with short, minute, hairlike papillae (in addition to short, small, paired papillae), whereas in *C. mayiae*, these hairlike papillae are sparse or almost entirely absent.

*Caelorinchus argentatus* differs from *C. pardus* in scale spinulation, color pattern on dorsum, and in having a rather dense covering of papillae on the underside of head.

*Caelorinchus denticulatus* Barnard, 1925 from the western Indian Ocean, and four species from southern Japan and the East China Sea (*C. formosanus* Okamura, 1963; *C. longissimus* Matsubara, 1943; *C. kamoharai* Matsubara, 1943; and *C. multispinulosus* Katayama, 1942) also belong in this species clade. They are all very similar in general features to *C. argentatus* but can be distinguished from *C. argentatus* by their gular membrane being uniformly punctate and not striate or reticulate. *Caelorinchus denticulatus* is further distinguished by having somewhat fewer pectoral fin rays (i14–i15); *C. formosanus* by scales on the underside of head posterior to the lower jaw; *C. longissimus* by more pyloric caeca (16–23) and somewhat more pectoral fin rays (16–20); *C. kamoharai* by somewhat more pectoral rays (16–20) and more gill rakers ([1–2]+[8–10] on inner side of first arch); and *C. multispinulosus* by its much different pigmentation pattern on the body.

### ***Caelorinchus charius* new species**

Fig. 9

*Caelorinchus* sp. E: Williams et al. 1996:148 (WA).

DIAGNOSIS. — Snout moderate in adults to long in young, sharply pointed, 38–50% of HL; anterolateral margin fully supported by bone; orbit diameter slightly less than postorbital length of head (in young about equal to or slightly greater than), 24–30% of HL, 1.3–2.1 times into snout length; upper jaw extends posteriorly to below hind margin of pupil; subopercle produced into a short, narrow, pointed flap. Short, naked black fossa of light organ immediately anterior to anus; anus removed from

TABLE 2. Selected measurements (%HL) compared for *Caelorinchus argentatus* and *C. mayiae*; specimens of the former species separated by regions (P. I. = Philippines, WA = Northwest Shelf of Western Australia; A&T = Arafura and Timor seas, QLD = Queensland).

Region	<i>Caelorinchus argentatus</i>				<i>C. mayiae</i>
	P. I.	WA	A&T	QLD	A&T
No. of spec.	13	8	3	3	10
HL	42-93	67-93	64-76	42-93	46-54
Snout	36-43	41-44	41-42	43-44	43-46
Preoral	27-35	31-37	33-34	33-37	34-37
Internas.	18-23	18-22	18-20	18-21	20-21
Interorb.	23-27	25-26	24-25	22-25	25-26
Postorb.	31-42	34-37	35-37	31-37	33-34
Orb.-preop.	35-42	38-42	39-41	35-39	36-38
Barbel	6-13	11-14	11-13	13-14	13-15
Ht ID	39-50	38-46*	40-45	32-36	46-53
V. len.	28-38	25-28**	27-33	23-24	34-48
P. len.	33-36	34-41*	34-37	32	39-43

\* Range for four specimens.

\*\* Range for six specimens.

TABLE 3. Pectoral fin ray counts compared for *Caelorinchus argentatus* and *C. mayiae*, specimens of the former species separated by regions (P. I. = Philippines, WA = Northwest Shelf of Western Australia, QLD = Queensland, A&T = Arafura and Timor seas).

	Pectoral fin rays (excluding uppermost rudiment)							x
	13	14	15	16	17	18	N	
<i>C. mayiae</i>	1	16	7	—	—	—	24	14.3
<i>C. argentatus</i>								
P. I.	—	—	12	9	2	1	24	15.7
WA	—	—	1	9	9	—	19	16.4
QLD	—	—	2	2	2	—	6	16.0
A&T	—	—	2	4	—	—	6	15.7

anal fin by one or two scale rows. Underside of head covered with small, finely spinulated scales, except along border of mouth, ventral and posterior margins of preopercle, and anteriorly on lower jaw; nasal fossa with small scattered scales, most confined ventrally; body scales with short, overlapping spinules arranged in 4-7 divergent rows, none especially broad-based or enlarged. No prominent markings on fins.

SPECIMENS EXAMINED. — **WA:** HOLOTYPE: AMS I.31166-005 (79.5 mm HL, 265+ mm TL); off Shark Bay; 610-612 m; SS1/91/31. PARATYPES: AMS I.31166-005 (7, 72.4-98.5 HL, 265+-370+ TL); same data as for holotype. CSIRO H1492-14 (51.7 HL, 170 TL)); NW Shelf; 420 m; SO/05/88/70. CSIRO H1514-34 (5, 57.1-87 HL, 185-296 TL); NW Shelf; 582 m; SO5/88/190. CSIRO H2554-10 (74.0 HL, 225+ TL); sw. of Point Cloates; 544 m; SS1/91/15. CSIRO H2557-05 (3, 63.1-103 HL, 180+-370 TL); w. of Cape Farquhar; 620 m; SS1/91/19. CSIRO H2573-16 (4,

TABLE 4. Comparison of selected measurements (in %HL) of *Caelorinchus argentatus*, *C. mayiae*, *C. gaesorhynchus*, and *C. pardus*.

	<i>C. argentatus</i>	<i>C. mayiae</i>	<i>C. gaesorhynchus</i>	<i>C. pardus</i>
Number of spec.	13	10	2	22
HL	42-93	47-83	70-76	36-56
Snout	36-44	40-46	49-50	43-49
Preoral	27-37	33-37	44-47	37-43
Postorb.	31-42	34-37	27-28	27-34
Orb.-preop.	35-42	38-42	31-34	33-38
Up.jaw	30-36	30-35	22-24	24-27
Barbel	6-14	11-16	7	9-16
Gill slit	13-18	14-18	10-11	10-18
P. len.	32-37	34-45	31- ?	34-46
V. len.	23-38	27-40	26-28	27-42

81.8-98 HL, 330-357+ TL); w. of Steep Point; 691 m; SS1/91/36. NTM S.12591-017 (60.0 HL, 168+ TL); NW Shelf; 17°35'S, 118°43'E; 445 m; coll. W. Houston; 3.XI.1985.

COUNTS AND MEASUREMENTS. — 1D. II,8-9; P. i17-i19; GR-I (inner) 2+6, GR-II (outer/inner) 0+(6-7)/(1-2)+(6-7), 7-9 total; scales 1D. 5-7, midbase 1D. 3.5-4.5 (5), 2D. (3.5)4.5-7.5, lat.line 30-42; caeca 24-28 (3 spec.).

Total length 168+ -370 mm; HL 51.7-103 mm. The following in percent of HL: snout 38-50; preoral 33-47; internasal 16-20; interorb. 19-25; orb. 24-30; suborb. 11-14; postorb. 25-34; orb.-preop. 29-36; up.jaw 21-29; barbel 6-12; gill slit 9-12; pre-A. 121-169; V.-A. 27-52; isth.-A. 47-79; body depth 41-62; 1D.-2D. 18-39; ht. 1D. 32-48; len. base 1D. 14-23; len. P. 28-49; len. V. 25-48; post. nostril 6-11.

DESCRIPTION. — General features of fish seen in Figure 9. Snout of moderate length in adults, decidedly longer (about twice orbit diameter) and more attenuated in young, sharply pointed and tipped with a diamond-shaped terminal scute. Orbits slightly less than postorbital length in adults, but slightly more in smallest specimens (51.7 mm and 63.1 mm HL). Mouth relatively small, rictus extending to below midorbit, restricted posteriorly by lip folds; maxillary extending to below hind margin of pupil; length upper jaw slightly less than postorbital length of head. Barbel short, about equal to or less than length posterior nostril. Posteroventral corner of preopercle produced into a moderate lobe; subopercle forming a short, slender, pointed ventral flap. Gill membranes broadly attached to isthmus, restricting gill openings.

Premaxillary teeth in broad, short bands; mandibular teeth in narrow bands; all teeth small.

Height of first dorsal fin much less than postrostral length of head; second dorsal fin poorly developed over most of length. No fin with notably elongated rays, but outer pelvic ray slightly produced.

Underside of head mostly covered with small scales, except for broad naked margin along upper jaws extending posteriorly to ventral and posterior margins of preopercle. Lower jaw sparsely scaled posteriorly; naked anteriorly. Nasal fossa sparsely scaled, mostly along ventral portions in adults, more broadly scaled in young. Scales on underside of snout small, relatively deciduous, and nonimbricate; each armed with tiny, small, erect, conical to bladelike spinules arranged in a small cluster or short rows. Spinules on body scales somewhat bladelike, overlapping along edges, and aligned in sharp, thin, saw-toothed rows that increase in height posteriorly; each spinule relatively erect, the most posterior on each row scarcely overlapping posterior margin of scale. In adults, midrow of spinules on each scale with 6-7 spinules; those in lateral rows similar in height but usually somewhat shorter, but all rows extend to margin of scale. Spinules on scales atop head and snout in

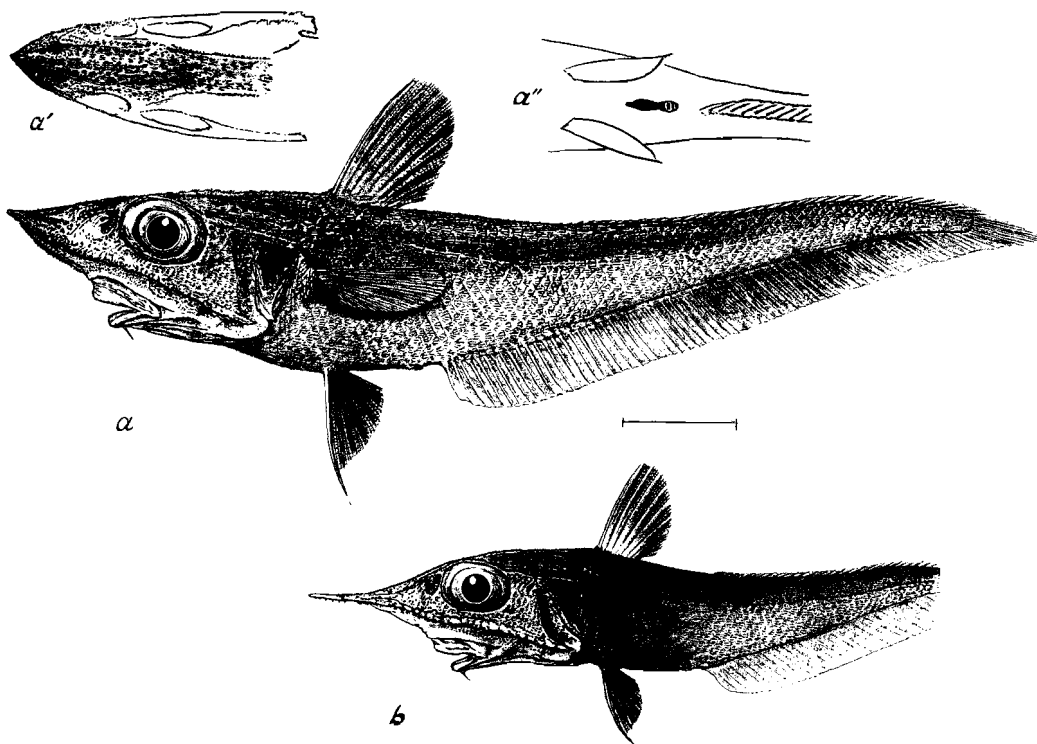


FIGURE 9. *Caelorinchus charius* n.sp. (a) Lateral view of holotype (AMS I.3166-005, 370+ mm TL) (scales and fins partially reconstructed) from off Shark Bay, WA, in 610–612 m; (a') dorsal view of snout of holotype; (a'') diagrammatic ventral view of periproct and light organ; (b) lateral view of small paratype (CSIRO H1514-34, 270+ mm TL) from North West Shelf in 582 m. Scale bar represents 25 mm.

divergent rows, scales over interorbital with bladeliike spinules; supraoccipital scute rather weakly developed.

Light organ short, but naked fossa anterior to anus prominent, its length usually shorter than greatest diameter of posterior nostril. Pyloric caeca long and slender, longest about 40 mm in 98.5 mm female from AMS I.31166-005.

Color overall light brownish gray dorsally; faintly bluish over abdomen; ventrally over most of body pale with ivory to silvery reflections. Underside of head whitish except anteriorly along snout margin slightly dusky. Median nasal bone dark in darker specimens. Lips, gums, barbel, anterior margin of mouth cavity cream colored, but otherwise dark; gullet and gill-cavity linings dark. Dorsal, pectoral, and anal fins lightly dusky; pelvic fins dark dusky but outer ray distally white. In smaller individuals from CSIRO H1514-34 and NTM S.12591-017, faint saddle bands noticeable on tail, these bands less distinct in darker, fully scaled specimens.

SIZE. — To more than 37 cm TL.

DISTRIBUTION. — Known only from off WA, from west of Steep Point (26°S) to the North West Shelf north of Port Hedland (18°S), and off Rowley Shoals (17°S). Depth range 420–691 m.

ETYMOLOGY. — From the Greek *charieis*, graceful.

COMPARISONS AND REMARKS. — This common new species shows considerable ontogenetic change in snout proportions, with the snout notably longer and sharper in the young than in the adults. These differences can be seen by comparison of the figures for young (Fig. 9b) and adult specimens (Fig. 9a). The snout appears to actually diminish in absolute length after a certain size, such that a



small individual may have a longer snout than another much larger individual. This difference affects most proportional values, as well as the lateral-line scale count.

Relationships of the new species seem to lie closest to *C. smithi*, but that species is distinctly darker in overall color than *C. charius*; it has a sharper, thinner snout in lateral profile and somewhat fewer pectoral fin rays (i16–i17 cf. i17–i19). Another closely similar species is *C. commutabilis* Smith and Radcliffe, 1912, but *C. commutabilis* has notably different spinulation on scales covering the underside of the head; they are broadly bladelike in ridged rows, whereas in *C. charius* they are needle-shaped (but usually 3-sided in cross section) and arranged in clusters.

*Caelorinchus charius* can be distinguished from most other members of the genus by the combination of anterolateral margin completely supported by bone, characteristic light organ and scale spinulation, mostly scaled underside of head, and sparsely scaled nasal fossa.

### *Caelorinchus gaesorhynchus* new species

Fig. 10

DIAGNOSIS. — Snout 49–50% of HL, anterolateral margin of snout not completely supported by bone; characteristic scales overlap onto anteroventral snout surface; orbit diameter 23–24% of HL; upper jaw short, 22–24% HL, extends to below posterior one-third of orbit; subopercle lacking a prolonged narrow flap; barbel short, about 7% of HL. Light organ extends from isthmus to anus. Underside of head completely naked (except as noted above); nasal fossa naked; body scales thin, spinules short, fine, in somewhat quincunx pattern. First dorsal fin dusky overall, but edges of base blackish; no bold body markings (at least in adults); median nasal process blackish; mouth cream colored, but lips and premaxillary processes blackish.

SPECIMENS EXAMINED. — WA: HOLOTYPE: CSIRO H2548-13 (76.3 mm HL, 245 mm TL); nw. of NW Cape; 290 m; SS1/91/08. PARATYPE: CSIRO H2548-16 (70.6 HL, 235 TL); same data as for holotype.

COUNTS AND MEASUREMENTS (holotype data first, followed by paratype data if different). — 1D. II,9; P. i15/i15, i15/i14; GR-I (inner) 2+6; GR-II (outer/inner) 0+6/2+6; scales 1D. 5, 6, midbase 1D. 4, 2D. 5, lat.line 46, 43.

Total lengths 245 mm, 235 mm; HL 76.3 mm, 70.6 mm. The following in percent of HL: snout 49, 50; preoral 44, 47; internasal 18; interorb. 23, 21; orb. 24, 23; suborb. 11; postorb. 28, 27; orb.-preop. 34, 31; up.jaw 24, 22; gill slit 10, 11; pre-A. 149, 139; V.-A. 41, 35; isth.-A. 69, 59; body depth 41, 45; 1D.-2D. 19, 14; len. P. 31, —; len. V. 26, 28; len. base 1D. 17, 16; post. nostril 6, 8.

DESCRIPTION. — General features of fish seen in Figure 10. Snout long and attenuated, with a sharply pointed tip. Orbits oblong, horizontal diameter about equal to postorbital length of head, much shorter than snout length. Mouth relatively small, upper jaw less than orbit diameter, the rictus extending posteriorly to below mid-orbit, the maxillary to below hind one-third of orbit. Suborbital shelf broad, with a series of strongly adherent, somewhat platelike scales covered with short spinules forming a sharp angular ridge separating upper and lower halves, scales above this ridge series thin and deciduous in region under nostrils and orbit; posterior end of ridge extends almost to posteroventral margin of preopercle bone. Preopercle somewhat prolonged posteriorly into a rather sharp lobe. Subopercle bone closely adhered to small opercle, posteroventral corner forming short nib, not prolonged into flap. Narrow naked cleftlike region along each side of median nasal ridge; nasal fossa completely naked. Underside of head completely naked except for characteristic overlapping scales along anterolateral margins. Barbel short, fine. Gill openings relatively wide, extending forward ventrally almost to hind end of orbits, gill membranes narrowly attached to isthmus.

Teeth small, in moderately-wide tapered bands in both jaws, premaxillary band extending almost to posterior end of rictus, mandibular band to or beyond end of rictus. No enlarged outer series of teeth.

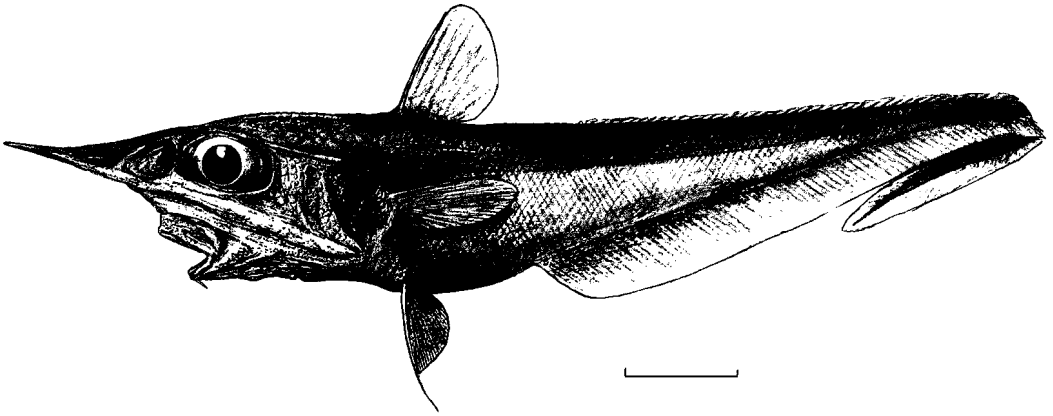


FIGURE 10. *Caelorinchus gaesorhynchus* n.sp. Holotype (CSIRO H2548-13, 245 mm TL) from northwest of North West Cape in 290 m. Fins and scales partially reconstructed. Scale bar represents 25 mm.

Fin size typical of other members of *C. argentatus* clade. Height of first dorsal fin less than postrostral length of head; second dorsal fin poorly developed; pectoral and pelvic fins of about equal length, outer pelvic ray slightly prolonged.

Light organ characteristic of Iwamoto's (1990) Group IV, externally characterized by a long median-ventral black streak extending from fossa just behind isthmus to immediately anterior to anus, the streak expanded at each end and entirely scale covered.

Body overall pale. Gums cream colored, upper jaws anteriorly blackish, lower lips black; lower jaw margins blackish; gill membranes dark. Opercle and subopercle dark. Gill cavity dark overall, but pale over hyoid bones. Pectoral fins dusky overall; pelvic fins densely covered with large melanophores; anal fin anteriorly dark, but dusky overall; medial surfaces of pectoral fin base black; base of first dorsal outlined with thin black margin.

SIZE. — Attains at least 25 cm TL.

DISTRIBUTION. — So far known only from off Northwest Cape and Northwest Shelf at 290 m depth.

ETYMOLOGY. — From the Greek, *gaison*, *gaisos*, a spear, javelin, and *rhynchos*, snout, in reference to the notably long, sharp snout.

COMPARISONS AND REMARKS. — We initially confused specimens of *C. gaesorhynchus* with *C. argentatus* and *C. mayiae*, but comparison with representatives of those species revealed notable differences in snout length, mouth size, and pigmentation patterns. In *C. argentatus* the snout equals about 40–44% of HL, in *C. mayiae* it equals 43–46%, but in *C. gaesorhynchus* it is 49–50% of HL. *Caelorinchus argentatus* also has small black punctations and hairlike papillae on the ventral surfaces of the head, and the spinules on scales posteriorly and ventrally on the trunk are triangular in shape along the leading margin of the exposed field. The upper jaw length in *C. argentatus* equals about 30–35% of HL, in *C. mayiae* 31–33%, whereas it is 22–24% in *C. gaesorhynchus* (this character also distinguishes the species from *C. pardus*). *Caelorinchus kamoharai* differs from the new species in its longer upper jaw, and in having more rays in the first dorsal fin and more gill rakers. *Caelorinchus gaesorhynchus* has pelvic fins heavily pigmented throughout, and the first dorsal fin is dusky. In contrast, the other species of this group have pelvic fins with scattered punctations at the base, tip, and sometimes the outer ray, but not in the middle; the black pigment on the first dorsal fin lies between the second spinous and first segmented rays, with the proximal portion completely pale.

*Caelorinchus goobala* new species

Fig. 11

DIAGNOSIS. — Snout long, slender and sharply pointed in young, shorter, blunter in adults, 36–49% HL; anterolateral margin fully supported by bone; orbit 23–31% HL, 1.2 to almost 2.0 into snout length. A short, poorly defined light organ in front of anus. Underside of head and nasal fossa completely naked; body scales with conical spinules, aligned in about 5–11 divergent rows, the individual spinules separate and not overlapping onto each other and without a transversely broadened base; spinules on scales of interorbital space small, fine, conical, in divergent rows; a relatively broad, translucent, unscaled area dorsally on each side of snout behind anterolateral margins. First dorsal fin with distal tip black; mouth pale.

SPECIMENS EXAMINED. — **WA:** HOLOTYPE: NTM S.12631-004 (85.4 HL, 260+ TL); NW Shelf off Rowley Shoals; 17°37'S, 118°40'E; 400 m; coll. W. Houston (WH85-21); 4.XI.1985. PARATYPES: AMS I.22808-042 (8, 63.7–94.0 mm HL, 183+–345 TL); NW Shelf, 220 km n. of Port Hedland; 420 m; SO2/82/17-18. CSIRO H1514-31 (6 of 11 spec., 59.7–77.2 HL, 206–290 TL); NW Shelf; 582 m; SO5/88/190. AMS I.23423-014 (63.5 HL, 211 TL); NW Shelf; 376 m; SO4/82/leg1. AMS I.23425-019 (54.8 HL, 200 TL) and CAS 200229 (61.4 HL, 200 TL); NW Shelf; 400 m; SO4/82/leg1. NTM S.12588-023 (98.5 HL, 380+ TL); NW Shelf off Rowley Shoals; 17°22'S, 118°38'E; 403 m; coll. W. Houston (WH85-15); 2.I.1985. NTM S.12614-023 (2, 57.4–82.9 HL, 180+–302 TL); NW Shelf off Rowley Shoals; 17°34'S, 118°38'E; 410 m; coll. W. Houston (WH85-33); 7.XI.1985. NTM S.13115-002 (57.5 HL, 150+ TL); n. of Cape Leveque; 14°07'S, 122°06'E; 423 m; coll. D. Evans; 24.I.1990. **NT:** Timor Sea: ZMMGU uncat. (72.5 HL, 291 TL); 9°07.5'S, 131°14.9'E; 340 m; *Akademik Berg*; 26.V.1967. ZMMGU uncat. (75.2 HL, 291 TL); 9°00.0'S, 130°39.8'E; 445–520 m; *Akademik Berg*; 30.X.1968.

COUNTS AND MEASUREMENTS (21 spec.). — 1D. II,(7)8–9; P. i14–i17; GR-I (inner) (1–2)+6; GR-II (outer/inner) 0+(5–6)/2+(5–6); scales 1D. 4.5–5.5, midbase 1D. 3.0–3.5, 2D. 4.0–5.5, lat.line 26–36 (38); caeca 30–44 (7 spec.).

Total length 180+–380+ mm; HL 57.4–98.5 mm. The following in percent of HL: preoral 25–44; internasal 16–19; interorb. 19–24; suborb. 10–15; postorb. 27–39; orb.-preop. 31–43; up.jaw 23–29; barbel 7–14; gill slit 8–15; pre-A. 136–164 (171); V.-A. 31–57; isth.-A. 47–90; body depth 32–56; 1D.-2D. 15–39; ht. 1D. 38–53; len. P. 32–52; len. V. 33–44; post. nostril 7–10.

DESCRIPTION. — General features of adult seen in Figure 11a. Snout of moderate length in adults, slightly longer than orbit diameter, but much longer and more attenuated in young (Fig. 11b) and almost twice orbit in some juveniles; tip sharply pointed and armed with a slender terminal scute. Orbit somewhat less than postorbital length of head. Mouth small, upper jaw length about equal to orbit diameter; maxillary extends about to below hind margin of pupil; rictus to about front margin of pupil. Barbel short, tapering to a fine tip; usually about equal to or less than suborbital width. Posteroventral corner of subopercle forming a slender flap. Nasal fossa and underside of head completely naked. A translucent naked area on each side of snout medial to anterolateral margins. Gill membranes broadly attached to isthmus, moderately restricting gill openings.

Premaxillary teeth in broad short bands not extending to end of rictus; mandibular teeth in long narrow band extending to end of rictus. No teeth enlarged.

Height of first dorsal fin less than postrostral length of head. Outer pelvic ray slightly prolonged. Other fins without produced rays. Second dorsal fin poorly developed over most of length, the interspace between first and second dorsal fins more than (1.2–1.7 times) length base of first dorsal fin.

Body scales (Fig. 8f) covered with slightly divergent rows of slender spinules that are sharp and narrow distally, but larger spinules often have bases broadened longitudinally in line with spinule row. Spinule rows on larger body scales number about 5–8 in specimens less than about 70 mm HL

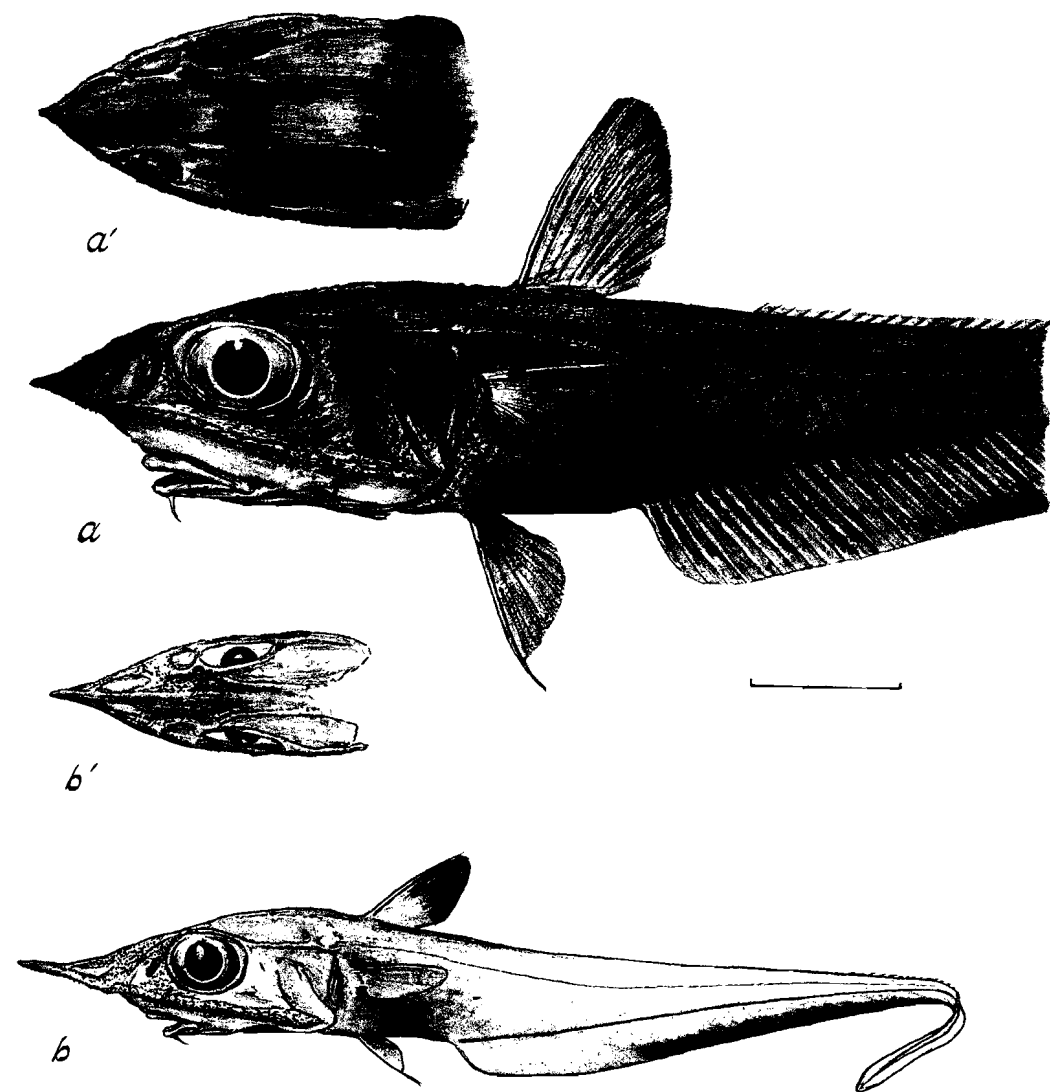


FIGURE 11. *Caelorinchus goobala* n.sp. (a and a') An adult paratype (ZMMGU uncat., 291 mm TL) from the Timor Sea, NT, in 445–520 m. (b and b') A juvenile paratype (AMS I.12808-42, 183+ mm TL) from the North West Shelf, WA, in 420 m. Fins and scales in figure a partially reconstructed. Scale bar represents 25 mm.

and about 8–11 in specimens larger than about 70 mm HL. Supraoccipital scute weakly developed. A slightly thickened, elongated scale at posterior end of occipital region above origin of lateral line.

Light organ short, slightly longer than posterior nostril, poorly defined and immediately preceding anus, which is slightly removed by 2 or 3 scales from anal fin origin.

Color in alcohol light brownish; underside of head mostly creamish, extending onto gill membranes; a light dusting of fine spots at tip of snout; mouth, lips and gums cream colored; inner wall of gill chamber light grayish, outer walls pale. Abdomen darker, somewhat violet tinged, the darker color extending posteriorly and ventrally onto tail. First dorsal fin dusky but tipped with black, the blackish color more extensive in some smaller specimens, base usually pale; pectorals overall dusky but with upper edge dark and base pale; pelvics creamy white with faint speckling in some

specimens, darker in others; anal fin creamy anteriorly but darker posteriorly along middle of fin, and paler near end.

SIZE. — To about 35 cm TL.

DISTRIBUTION. — Known from off northern Australia in the Timor Sea and the North West Shelf, in 300–582 m.

ETYMOLOGY. — From the Australian Bardi language *goobala*, meaning star, in reference to the spinules on scales of the median nasal ridge, which are, as in *C. asteroides*, arranged in rows radiating from a central point; to be used as a noun in apposition.

COMPARISONS AND REMARKS. — *Caelorinchus goobala* is closely similar to *C. asteroides* Okamura, 1970 and agrees rather well with the descriptions of that species provided by Okamura (1970) and Yatou (in Okamura and Kitajima 1984). Two paratypes of *C. asteroides* (FAKU 21513, 19115) were kindly loaned to us by Dr. Okamura for our comparisons. Some distinctive squamation features differentiate the two species, most notably the spinulation of body scales. In *C. asteroides* the spinules are wide-bladed, keellike structures, recumbent and overlapping onto one another, and forming sharp, narrow ridges, which are aligned in slightly divergent rows (see Okamura 1970, text-fig. 82 A, A'). In *C. goobala* the spinules are slender, conical, individually separated from each other and narrowly based in a transverse plane (but large spinules on or near midline of scales have longitudinally broadened bases), and in rather widely divergent rows. Furthermore, Okamura (1970:192) gave the ratio of the interspace between the dorsal fins and the length of the first dorsal base as between 1.6 and 2.2; in the new species the ratio is 1.2–1.6. The pyloric caeca counts in seven specimens were somewhat lower (30, 31, 36, 39, 41, 42, and 44) compared with the 40–50 given by Okamura (48 in two paratypes we examined). Okamura (1970:192) described the “lining of branchial [*sic*, probably meaning buccal] cavity greyish, that of branchial cavity blackish brown . . . .” In our specimens, the buccal cavity is pale, the branchial cavity somewhat dusky but paler along outer margins.

According to Okamura (1970:192), *C. asteroides* is most closely related to *C. radcliffei* Gilbert and Hubbs, 1920. The wide difference in the relative snout lengths of young and adults of that species (as discussed by Gilbert and Hubbs 1920: 499) compares with that seen in *C. goobala*. In this regard, we found that in our specimens, the snout of small specimens is proportionally elongated compared with that of large adults. This distorts the values of the proportional measurements given above because of our use of the head length for comparisons. Our largest specimen of 94 mm HL had head proportions that were generally greater than those of smaller specimens, and body and fin proportions that were shorter. *Caelorinchus radcliffei* differs from *C. goobala* chiefly in lacking a prolonged subopercular flap, having darkly pigmented branchial and buccal linings, and having coarser, bladellike scale spinules that broadly overlap each other.

### ***Caelorinchus innotabilis* McCulloch, 1907**

Fig. 12

*Caelorhynchus innotabilis* McCulloch, 1907:348, 349, pl. 63, figs. 2, 2a (e. of Sydney; 1,463 m).

*Caelorinchus innotabilis*: Last et al., 1983:241, fig. 21.14 (TAS, VIC, NSW). Gomon et al., 1994:352, fig. 312 (NSW to SA). Williams et al. 1996:148 (WA distr.).

DIAGNOSIS. — Snout long, sharply pointed, anterolateral margin completely supported by bone. Bony ridges of head generally narrow; bony scales of ridges with short, stout, posteriorly directed spines. Light organ small, indistinct, closer to pelvic fin bases than to anal fin origin. Underside of head mostly naked; scales moderately deciduous; scale pockets outlined by dark margins. Dark coloration of trunk restricted to an area ventral to pectoral fin bases and extending from isthmus to just beyond anal fin origin.

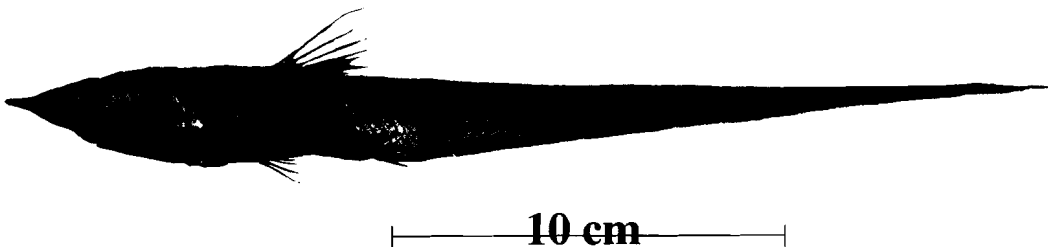


FIGURE 12. *Caelorinchus innotabilis* McCulloch. CSIRO H3007-10, from south of Albany, WA (35°26'S, 117°25'E), in 843 m.

**SPECIMENS EXAMINED.** — **WA:** CSIRO H3007-10 (4, 60.7–63.3 mm HL, 242–270 mm TL); 35°26'S, 117°25'E; 843 m; *Akebono Maru No. 3*, sta. 7; coll. A. Williams; 22.XII.1989.

**COUNTS AND MEASUREMENTS** (based on 4 spec.). — Total GR-I (inner) 6–7, GR-II (outer/inner) 7–8/5–7; scales 1D. 7.5, midbase 1D. 6.5, 2D. 6.5–8.5.

Total length 242–270 mm; HL 60.7–63.3 mm. The following in percent of HL: postrostral 57–59; snout 41–44; preoral 39–42; internasal 20–22; interorb. 19–20; orb. 29–30; suborb. 13–14; postorb. 28–29; orb.-preop. 27–29; up.jaw 21; barbel 7–10; pre-A. 145–155; pre-vent 136–142; V.-A. 47–57; isth.-A. 60–72; body depth 40–46; depth at A. 33–41; 1D.-2D. 13–14; ht. 1D. 43–49; len. P. 36–41; len. V. 34–39; post. nostril 9–10; rictus len. 9.

**DESCRIPTION.** — Snout 2.3–2.6 in HL, a well-developed, elongate, sharp scute at tip. Dorsal profile of snout shallowly concave. Mouth small, inferior.

Teeth small, in broad bands in both jaws.

Underside of head naked except for few scattered cycloid scales posterior to rictus. Body scales semi-deciduous, mostly missing in our specimens; scale pockets conspicuous.

Light organ small, oval, indistinct, connected to periproct region by faint median extension.

Body color pinkish brown; region from isthmus to pelvic fin bases intensely blue. Dorsal, pectoral, and anal fins dusky; pelvic fins dark; mouth and gill cavities black.

**SIZE.** — To at least 32 cm TL.

**DISTRIBUTION.** — Southern Australia and New Zealand, “common inclusion in trawl catches from depths between 600 and 1000 metres” (Last et al. 1983:241).

**COMPARISONS AND REMARKS.** — In Western Australia, *C. innotabilis* was taken only south of 30°S. In southern Australian waters it most closely resembles *C. kaiyomaru* Arai and Iwamoto, 1979. The two species may be readily separated in the field by the distribution of the dark bluish black abdominal tissue, which extends dorsally encircling the entire trunk in *C. kaiyomaru*, but only to the level of the pectoral fins in *C. innotabilis*.

### *Caelorinchus lasti* new species

Fig. 13, 14

*Caelorinchus* sp. G: Williams et al., 1996:149 (WA distr.).

**DIAGNOSIS.** — Snout moderately pointed, 1.4–1.6 times orbit diameter; anterolateral margin incompletely supported by bone; upper jaw slightly less than 1/3 HL; orbit 1.5–1.8 into postorbital length; subopercle produced into slender point ventrally, the tip protruding slightly beyond angle of preopercle. Color overall dark chocolate brown. Nasal fossa with small scales on anteroventral corner but otherwise naked. Spinules on body scales below dorsal interspace imbricate, broadly trihedral, with wide lateral buttresses, in 3–5 saw-toothed, divergent rows. Anus immediately anterior to anal fin; no external sign of light organ.

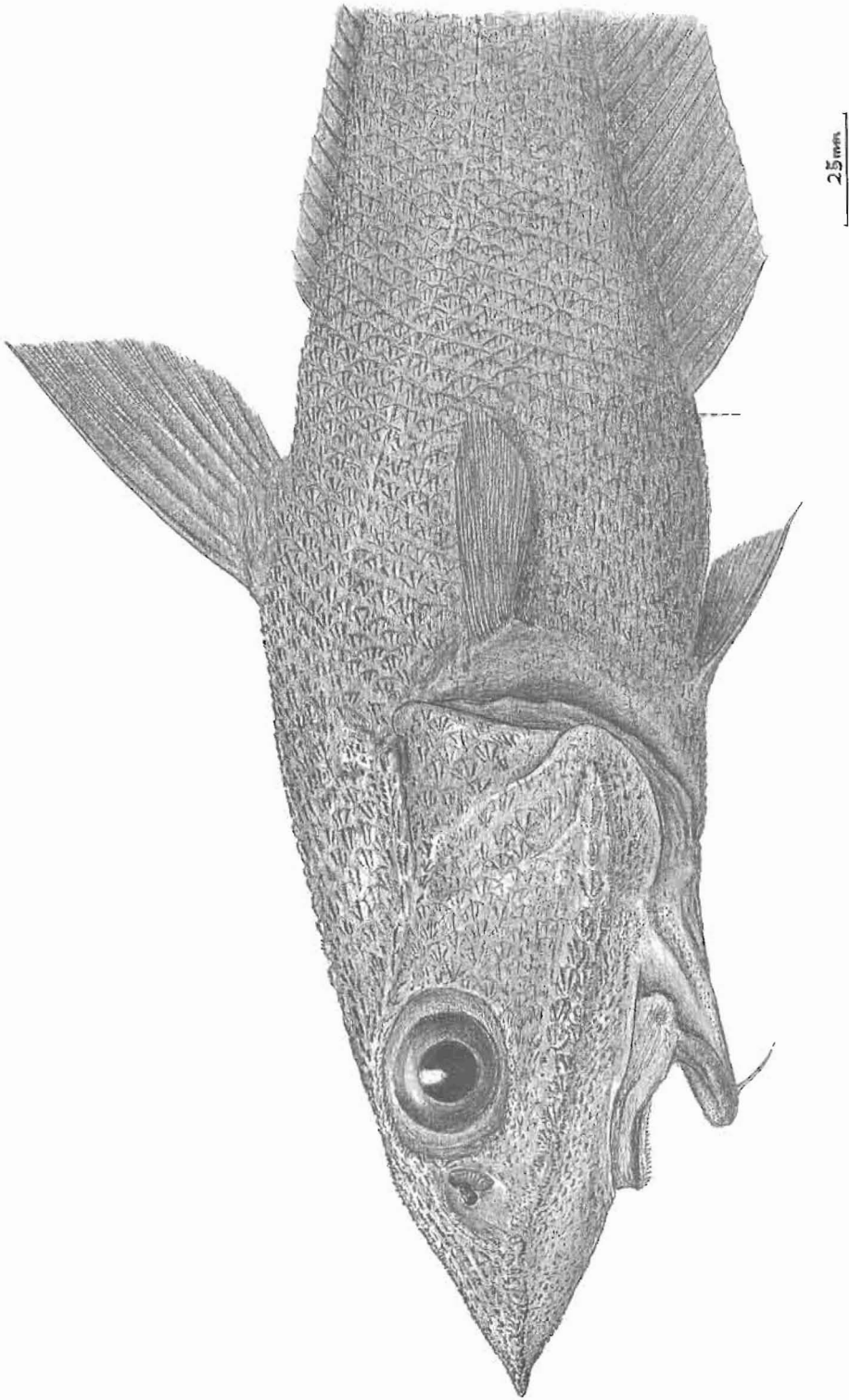


FIGURE 13. *Caelorinchus lasiti* n.sp. Holotype (CSIRO H2615-02, 620+ mm TL) from west of Mandurah, W.A. in 1,140 m. Fins and scales somewhat reconstructed. Scale bar represents 2.5 mm.

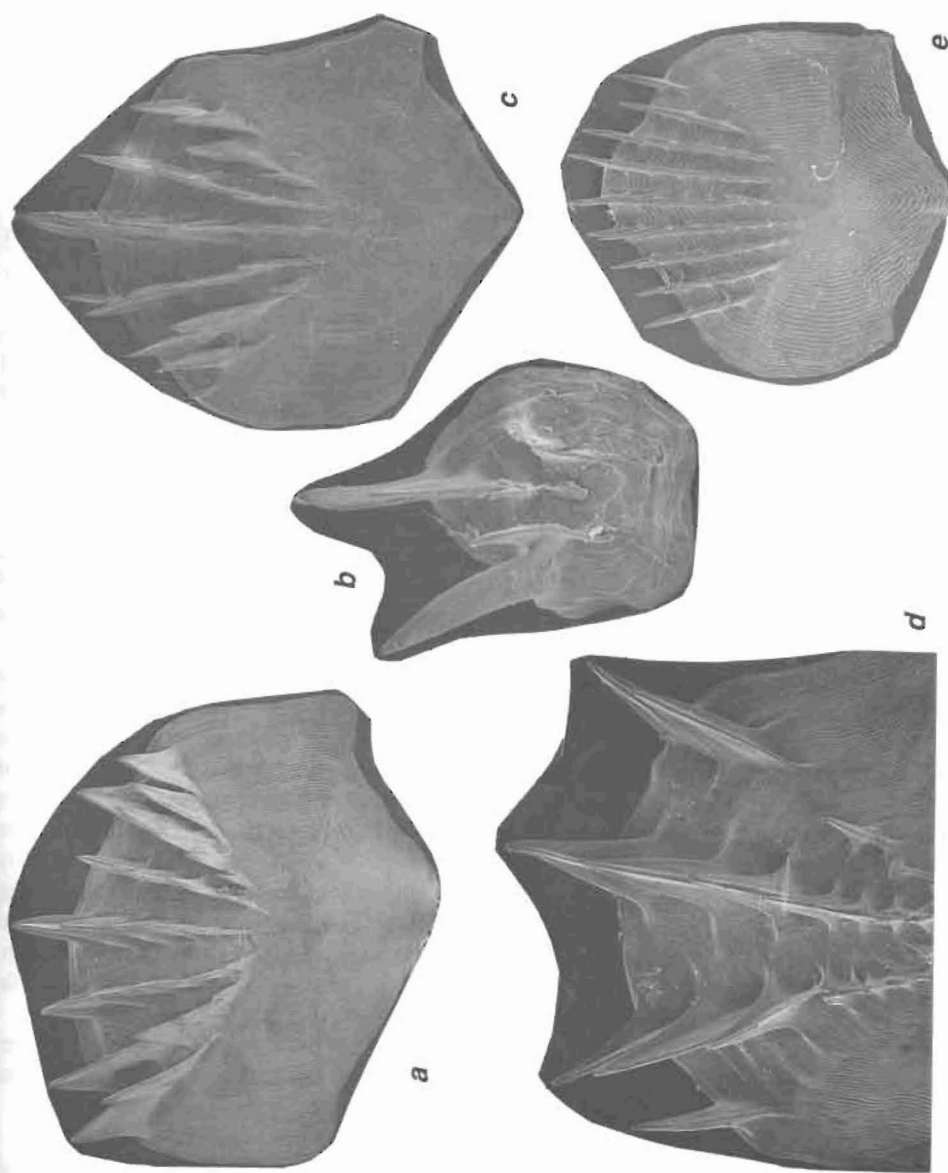


FIGURE 14. Scanning electron micrographs of four species of *Caetorhinchus*: (a) *C. macrorhynchus*; (b) and (c) *C. smithi*; (d) *C. lasti*; and (e) *C. thurta*. All scales except (b) are from the region below or near the interspace of the first and second dorsal fins; (b) is from the underside of the snout.



**SPECIMENS EXAMINED.** — **WA:** HOLOTYPE: CSIRO H2615-02 (163 mm HL, 620+ mm TL); w. of Mandurah; 1,140 m; SS1/91/83. **TAS:** PARATYPE: CSIRO H1925-01 (142 HL, 455+ TL); w. of Temma; 41°15'S, 143°58'E; 959–1,021 m; *Petuna Endeavour*; 18.II.1989.

**COUNTS AND MEASUREMENTS.** — 1D. II,8; P. i17; GR-I (inner) 2+6, GR-II (outer/inner) 0+6/2+6; scales 1D. 6–7, midbase 1D. 4.5–5.5, 2D. 5.5–6.0, lat.line 32–34. The following in mm, percent of HL in parentheses, holotype listed first: snout 52, 60 (37, 38); preoral 42, 52 (30, 32); internasal 28, 30 (20, 18); interorb. 40, 40 (28, 25); orb. 38, 38 (26, 32); suborb. 21, 24 (14, 15); postorb. 58, 67 (41, 41); orb.-preop. 60, 69 (42, 42); up.jaw 46, 52 (32, 32); barbel 14, 15 (10, 9); gill slit 20, 23 (14, 14); pre-A. 210, 247 (148, 152); body depth 89, 102 (63, 63); 1D.-2D. 31, 35 (22, 21); ht. 1D. 70, 59 (43, 42); 1D. base 24, 28 (17, 17); len. P. 64, 54 (39, 38); len. V. 61, 48 (37, 34); post. nostril 12, 11 (9, 7).

**DESCRIPTION.** — See Figure 13 for general shape and proportions. Head large, more than 3.5 into TL; greatest width about equal to or more than postorbital length of head. Mouth moderately large, rictus extends to midorbit, posterior edge of maxillary to below hind edge of orbit in holotype, to below hind edge of pupil in paratype. Barbel short, less than 1/2 orbit diameter, thin, hairfine distally. Body relatively deep, greatest depth below origin of first dorsal about equal to postrostral length of head. Free neuromasts on head numerous, black (but not particularly noticeable because of dark ground color).

Teeth in moderately broad bands in both jaws, about 3–6 teeth across widest part of premaxilla, 3–4 teeth wide across widest part of dentary; premaxillary band extending about 2/3 length of rictus, mandibular band to end of rictus.

Paired fins relatively short, none extending to vertical of anal fin origin; outer pelvic ray slightly prolonged but falling short of anus. Longest ray of first dorsal fin about equal to postorbital length of head; second dorsal fin poorly developed except near terminal end. Anal fin well developed to end of tail.

Scales (Fig. 14d) large, spinules on trunk scales in 3–5 divergent rows, the middle row slightly to notably higher than lateral rows; 6–7 broadly trihedral spinules per row, the erect spinules overlapping but free along most of their distal mesial edges; spinule rows complete in all trunk scales of paratype, but in holotype, many scales with only 3 rows complete and 1 or 2 small spinules at anterior edge of field in other rows. Scales on tail with more variable number of rows, the rows more parallel and often incomplete to edge, and middle row usually notably higher. Most of scale spinules on underside of head stoutly bladelike, aligned in high, narrow, crestlike or ridgelike rows, usually 1–2 rows per scale. Large broad scales of median nasal ridge row with short spinules in radiating rows, posterior rows longest; in scales running mesial to supranarial ridges, spinule rows aligned to some degree in wavy lines or striations. Occipital and cheek scales with widely divergent, sharp, spinule rows. Scales atop head between ridges with 1–3 widely divergent spinule rows, the middle row usually much longer than lateral rows.

Overall color dark brown; spinules on scales black; mouth, barbel, gill membranes, gill arches and rakers dark brownish to blackish; lips, jaws blackish; gums pale in holotype, blackish in paratype; all fins black.

**SIZE.** — To at least 62 cm TL.

**DISTRIBUTION.** — Known only from the holotype taken at about 33°S off WA, in 1,140 m, and the single paratype taken at about 43°S off the west coast of TAS.

**ETYMOLOGY.** — Named after Peter Last of CSIRO in tribute to his contributions to Australian ichthyology.

**COMPARISONS AND REMARKS.** — *Caelorinchus lasti* is distinctive among Iwamoto's (1990) Group I species of *Caelorinchus* that are characterized by having underside of head scaled and snout length less than twice orbit diameter (about 1.4–1.6 times orbit). It differs from other species of the group in having the combination of incomplete support of anterolateral margins of snout, a dark

chocolate brown color, nasal fossa naked or only sparsely scaled anteroventrally, divergent rows of spinules on scales of trunk and top of head, middle row of spinules on trunk scales higher than lateral rows with rows complete to edge of scale in most trunk scales, and moderate-sized mouth (almost one-third HL).

Of the Western Australian species, *C. lasti* appears most similar to *C. mycterismus*, with which it has been confused, but it can be distinguished by its darker color, shorter snout (37–38% HL cf. 45–51%), longer upper jaw (32% HL cf. 15–26%), usually fewer scales on nasal fossa, and fewer, more divergent and complete spinule rows on scales of trunk and tail. It can be distinguished from *C. acanthiger* by the complete spinule rows on most scales of trunk (in *C. acanthiger* all body scales with some rows incomplete, not reaching posterior edge of scale), and the very dark color of the head and body.

***Caelorinchus macrorhynchus* Smith and Radcliffe, 1912**

Fig. 15

*Coelorhynchus macrorhynchus* Smith and Radcliffe, 1912:127, 128, pl. 29, fig. 1 (holotype USNM 72944, 56 cm long, Verde I. Passage, Luzon, Philippines; 180 fm [329 m]; *Albatross* sta. 5367; 9 paratypes, Philippines and Indonesia, 432–759 m). Gilbert and Hubbs 1920:511, 512 (data on 5 paratypes).

*Caelorinchus* sp. D: Williams et al., 1996:148 (WA distr.).

DIAGNOSIS. — Snout about 2 times into HL, anterolateral margins completely supported by bone, orbit diameter 4–5 into HL; upper jaw 4–5 into HL, extends posteriorly to below hind 1/4 of orbit, rictus to below midorbit; barbel small, less than half orbit diameter. Light organ very short, less than greatest diameter of posterior nostril, externally a black streak extending forward from anus about midway to pelvic bases. Nasal fossa covered with small scales except immediately anterior to nostrils; underside of head uniformly scaled except for narrow margin above upper jaws; body scales with 5–8 divergent rows of broad-based, overlapping spinules; scales on top and underside of snout with few, relatively broad-bladed, adnate spinules in one or few serrated, crestlike rows. Overall body color swarthy to black; fins, mouth, and gill cavities blackish.

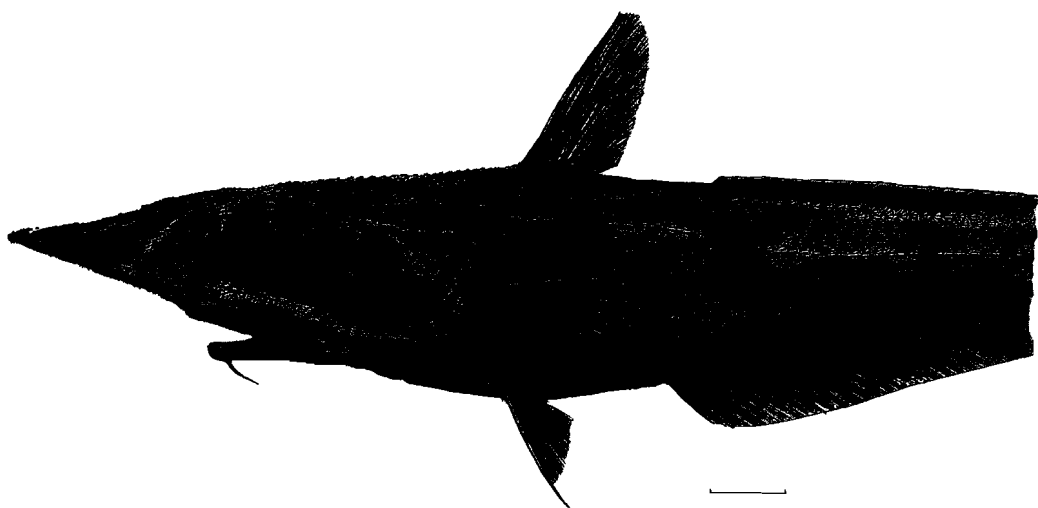


FIGURE 15. *Caelorinchus macrorhynchus* Smith and Radcliffe. AMS I.29600–01 (395+ mm TL) from off Sydney, NSW, in 785–975 m. Fins and scales partially reconstructed. Scale bar represents 25 mm.

SPECIMENS EXAMINED (9 spec.). — **WA:** CSIRO H2549-04 (112.5 mm HL, 365+ mm TL); w. of NW Cape; 650 m; SS1/91/10. AMS I.22810-041 (112 HL, 382 TL); NW Shelf; 736 m; SO2/82/22-24. **QLD:** AMS I.20967-016 (138 HL, 407+ TL); e. of Hinchinbrook I.; 17°56'S, 147°14'E; 878 m; 27.II.1979. **NSW:** AMS I.29738-01 (85.5 HL, 280 TL); e. of Harrington; 485–925 m; K87-24-05. AMS I.29825-01 (98.7 HL, 298 TL); off Terrigal; 741–768 m; K89-09-09. AMS I.24625-005 (440+ TL); off Broken Bay; 1,107 m; K84-06-06. AMS I.21722-07 (440+ TL); off Broken Bay; 822 m. AMS I.29600-01 (127 HL, 395+ TL); off Sydney; 785–975 m; K87-24-01. AMS I.27609-01 (55.6 HL, 162 TL); off Shoalhaven; K87-23-02.

COUNTS AND MEASUREMENTS. — 1D. II, 8–9; P. i16–i19; GR-I (inner) (1–2)+(6–8) 8–10 total, total GR-II (outer/inner) 6–8/9–10; scales 1D. 6–8, midbase 1D. 3.5–5.5 (usually 4.5), 2D. 5.5–6.5, lat.line 38–55.

Total length 162–440+ mm; HL 55.6–138 mm. The following in percent of HL: snout 47–54; preoral 39–52; internasal 15–17; interorb. 17–20; orb. 21–25; suborb. 9–12; postorb. 24–31; orb.-preop. 26–34; up.jaw 20–25; barbel 6–9; gill slit 9–13; pre-A. 131–143; V.-A. 24–36; isth.-A. 46–64; body depth 33–48; 1D.-2D. 16–21; ht. 1D. 33–37; len. P. 29–33; len. V. 23–31; post. nostril 6–7.

DESCRIPTION. — General features of fish seen in Figure 15. Snout long, forming in lateral view a slender pointed cone with shallow dorsal concavity, somewhat broader cone in dorsal view with gently convex sides; diamond-shaped scute at tip. Orbit broadly oblate, 2.0–2.3 into snout. Suborbital ridge stoutly developed along entire length, strongly spinulated along preopercular section. Preopercle forming lobelike extension posteriorly; subopercle posteroventrally angular, but not forming long slender flap. Chin barbel small and slender, length much shorter than least width of suborbital.

Premaxillary teeth in broad band extending almost 2/3 length of rictus; no enlarged teeth present. Mandibular teeth in long narrow band, scarcely more than 3 or 4 teeth wide anteriorly, narrowing to single row posteriorly; teeth extending to or beyond end of rictus.

Fins lacking any notably produced rays. First dorsal fin low, much less than postrostral length of head; second dorsal fin low and inconspicuous over most of length, but somewhat higher along posterior half. Outer pelvic ray slightly longer than mesial 6 rays.

Body scales (Fig. 14a) covered with ridgelike rows of broad, buttressed spinules, each spinule at a 45–60° angle from horizontal and closely adpressed to one another to form a saw-toothed ridge; every row complete to margin of scale. Scales cover entire underside of head except narrow margins above jaws, along ventral border of preopercle, and along lower jaw rami. Head scales highly variable in size and extent of spinulation; those over occipital, opercle, and along posterior margin of preopercle large, with many widely divergent spinule rows; most other head scales, aside from those on ridges, small, with few spinule rows. Scales atop snout between ridges small, essentially nonimbricate, each with one or few short rows of broad-bladed spinules forming high, serrated crest.

Anus immediately anterior to anal fin origin.

Gums, gill arches, and rakers dark or blackish, peritoneum black. Most spinules of head and body scales black.

SIZE. — To more than 44 cm TL.

DISTRIBUTION. — Known from the Philippines and Australia, including WA, NSW, and QLD; depth range in Australia 485–1,107 m.

COMPARISONS AND REMARKS. — *Caelorinchus macrorhynchus* was originally described from nine specimens taken in the Philippines in 329–750 m. Our Australian specimens agreed in most details with the holotype (USNM 72944), but differed slightly in having a longer preoral (39–52% HL cf. 37%), wider internasal (15–16% HL cf. 14%), larger orbit (21–25% HL cf. 19%), shorter postorbital (24–31% HL cf. 34%), shorter upper jaw (20–25% HL cf. 29%), and shorter barbel (6–9% HL cf. 11%). Furthermore, the snout-to-orbit ratios in the Australian specimens ranged 2.04–2.33, as compared with 2.47 in the holotype of *C. macrorhynchus* and 2.2–2.3 in five smaller paratypes (data

from Gilbert and Hubbs 1920:512). The substantially larger size of the holotype (179 mm HL) probably accounts for these proportional differences.

*Caelorinchus smithi* is similar to *C. macrorhynchus*, but there are numerous differences in proportions, including a shorter snout, larger orbit, and broader interorbital and internasal widths.

The dark, swarthy, overall color of *C. macrorhynchus*, the scaled nasal fossa, the 5–8 divergent rows of narrow-based spinules that are complete to the posterior margin of the scales, and the distinctive spinulation on the dorsal and ventral snout surfaces are diagnostic for this species among Iwamoto's (1990) Group I *Caelorinchus*, all of which have a long, fully scaled snout, two or more times orbit diameter, and a completely-supported, anterolateral snout margin.

*Caelorhynchus macrorhynchus* Weber, 1913 is a homonym, but Gilbert and Hubbs (1920:516) questionably identified Weber's species as representing their new species *C. spinifer*.

### ***Caelorinchus maculatus* Gilbert and Hubbs, 1920**

Fig. 16

*Caelorhynchus maculatus* Gilbert and Hubbs, 1920:446–452, fig. 9 (Moluccas between Gillolo and Makyan Is., 545 m; 10 paratypes from Moluccas and s. Luzon; 491–545 m). Arai in Gloerfelt-Tarp and Kailola 1984:83, fig.

DIAGNOSIS. — Snout relatively short, acutely pointed in lateral view, broadly convex sides in dorsal view, a small terminal scute; anterolateral margin completely supported by bone; orbits less than snout length and postorbital length of head in specimens larger than about 170 mm, more than in smaller specimens; mouth small, rictus extends to below midorbit, upper jaw to below hind one-third of orbit; subopercle forms a short protruding tip. Ventral light organ (externally seen as a black streak) extends forward from periproct to line connecting bases of outer pelvic fins or slightly beyond, the slightly expanded anterior end forms shallow scale-covered fossa; anus removed from anal fin origin by several scale rows. Underside of head completely naked; broad, naked translucent areas dorsally behind leading edges of snout; nasal fossa naked; body scales (Fig. 8g) large, thin, rather deciduous, exposed surfaces covered with small, sharp spinules aligned in 3–6 ridgelike rows, scale pockets on dorsal surfaces darkly marked along edges; scales of head ridges relatively weak and moderately spinulated (relatively coarser in juveniles). Ventral aspects of chest and abdomen dark, bluish black, but sides silvery to whitish; a small to moderately large, vertically elongated dark blotch above and immediately behind base of pectoral fin; numerous faint saddle marks posteriorly; most fins light dusky, but elongated spinous dorsal ray blackish, and pelvic fin dusky to blackish with outer ray paler; median nasal process dark. Anterior rays of second dorsal fin relatively well developed, length of rays 3–4 into orbit diameter.

SPECIMENS EXAMINED. — WA: CSIRO H1701-02 (63.4 HL, 210+ TL), H1701-06 (62.6 HL, 248+ TL), and H1701-07(69.6 HL, 260+ TL); Rowley Shoals area; 16°59'S, 120°10'E; 411 m; *Striker*; coll. S. Morris; 3.IV.1989. NTM S.12727-015 (52.2 HL, 215+ TL); sw. of Rowley Shoals; 17°52'S, 118°28'E; 410 m; coll. D. Evans; 9.II.1990. NTM S.12606-002 (36.1 HL, 125+ TL); off Rowley Shoals; 18°00'S, 118°16'E; 430 m; coll. W. Houston (WH85-28); 6.XI.1985. NTM S.12609-001 (33.6 HL, 132+ TL); off Rowley Shoals; 17°39'S, 118°40'E; 420 m; coll. W. Houston (WH85-31). NTM S.12716-007 (56.1 HL, 247+ TL); nw. of Montebello I.; 20°15'S, 114°50'E; 500–600 m; coll. D. Evans; 22.II.1990.

COUNTS AND MEASUREMENTS (6 WA spec.). — 1D. II,8–9; P. i14–i16; total GR-I (inner) 7–8, GR-II (outer/inner) 5–6/7–8; scales 1D. 6–7, midbase 1D. 3.5–4.5, lat.line 26–32.

Total length 125+–260+ mm; HL 33.6–69.6 mm. The following in percent of HL: snout 37–43; preoral 28–35; internasal 19–22; interorb. 21–25; orb. 28–29; suborb. 13–16; postorb. 30–37; orb.-preop. 35–43; up.jaw 26–30; barbel 6–12; gill slit 13–14; pre-A. 134–161; V.-A. 29–51; isth.-A.

57–80; body depth 47–62; 1D.-2D. 19–31; ht. 1D. 60–71; len. P. 43–56; len. V. 39–50; post. nostril 9–12.

SIZE. — To more than 26 cm TL.

DISTRIBUTION. — From southern Luzon (Philippines) in the South China Sea, to the Moluccas, and off northwestern Australia, in 390–600 m.

COMPARISONS AND REMARKS. — Our six specimens from Western Australia agree well with Gilbert and Hubbs's (1920) original description of *C. maculatus*. The overall whitish color of larger individuals is notable, particularly on the underside where the immaculate underside of head contrasts sharply with the dark bluish purple to black of the chest and abdomen. The sides of the trunk are generally whitish, with the dark color of the ventral surfaces not intruding onto these surfaces. These color features appear to distinguish the species from other related species (see Gilbert and Hubbs 1920). The relatively long, spinous dorsal fin ray (about two-thirds head length in our specimens) is somewhat shorter than that of other species in this group, where most have dorsal fin heights equal to or greater than the head length. The anterior dermal window extends farther forward in our specimens (to beyond the origin of the pelvic fins) than occurs in other species of the group, which may cause confusion when using the key to species of *Caelorinchus* in Iwamoto's (1990) FAO Catalogue. The species is normally assigned to Iwamoto's Group II based on the position of the dermal window at or behind the pelvic bases.

### ***Caelorinchus matamua* (McCann and McKnight, 1980)**

Fig. 17

*Mahia matamua* McCann and McKnight, 1980:53–56 (New Zealand).

*Coelorinchus matamua*: Sazonov and Shcherbachev, 1982a:42–47, figs. 1, 2 (se. Atlantic, s. Indian Ocean). Last et al. 1983:241–242, fig. 21.15 (Tasmania).

*Caelorinchus matamua*: Williams et al., 1996:148 (WA distr.).

DIAGNOSIS. — Snout short, blunt, anterolateral margin incompletely supported by bone; mouth large, upper jaw usually longer than snout; orbit diameter equal to or longer than snout length. Light organ small, indistinct. Underside of head including gular membranes scaled. Trunk completely encircled by prominent dark broad band; anterior one-third to one-half of anal fin black, becoming abruptly pale posteriorly.

SPECIMENS EXAMINED. — **WA**: CSIRO H3008-09 (93.5 mm HL, 380+ mm TL); sw of Albany; 35°25'S, 117°21'E; 842 m; *Akebono Maru No. 3*, shot 8; coll. A. Williams; 22.XII.1989.

COUNTS AND MEASUREMENTS (based on 1 spec.). — 1D. 11,9; P. 116; GR-I (inner) 12 total, GR-II (outer/inner) 12 total/12 total; scales 1D. 10.0–10.5, midbase 1D. 9.5–10.5.

Total length 380+ mm; HL 93.5 mm. The following in percent of HL: postrostral 73; snout 30; preoral 21; internasal 24; interorb. 25; orb. 37; suborb. 16; postorb. 37; orb.-preop. 44; up.jaw 29; barbel 16; outer gill slit 22; pre-A. 143; pre-vent 140; V-A. 47; isth.-A. 74; body depth 76; depth at A. 61; 1D.-2D. 33; ht. 1D. 66; len. P. 58; len. V. 51; post. nostril 7; rictus len. 33.

DESCRIPTION. — Head large, snout about 2.9–3.3 in HL, with well-developed terminal scute; dorsal profile gently rounded. Orbit very large, 34–37% HL, usually longer than snout. Subopercle forming narrow, tablike flap at ventral end.

Teeth small, forming long tapered bands in both jaws, premaxilla bearing outer row of enlarged, widely spaced teeth.

Dorsal fins well separated, second spinous ray of first dorsal fin not prolonged, its height about 50% HL; pectoral fin long, reaching to about 10th anal fin ray; anal fin well developed.

Scales of head mostly adherent; scales often missing on body. Suborbital ridge well developed; large, ornate, spinulated scales of lower margin forming thorny ridges. Head ridges well defined,

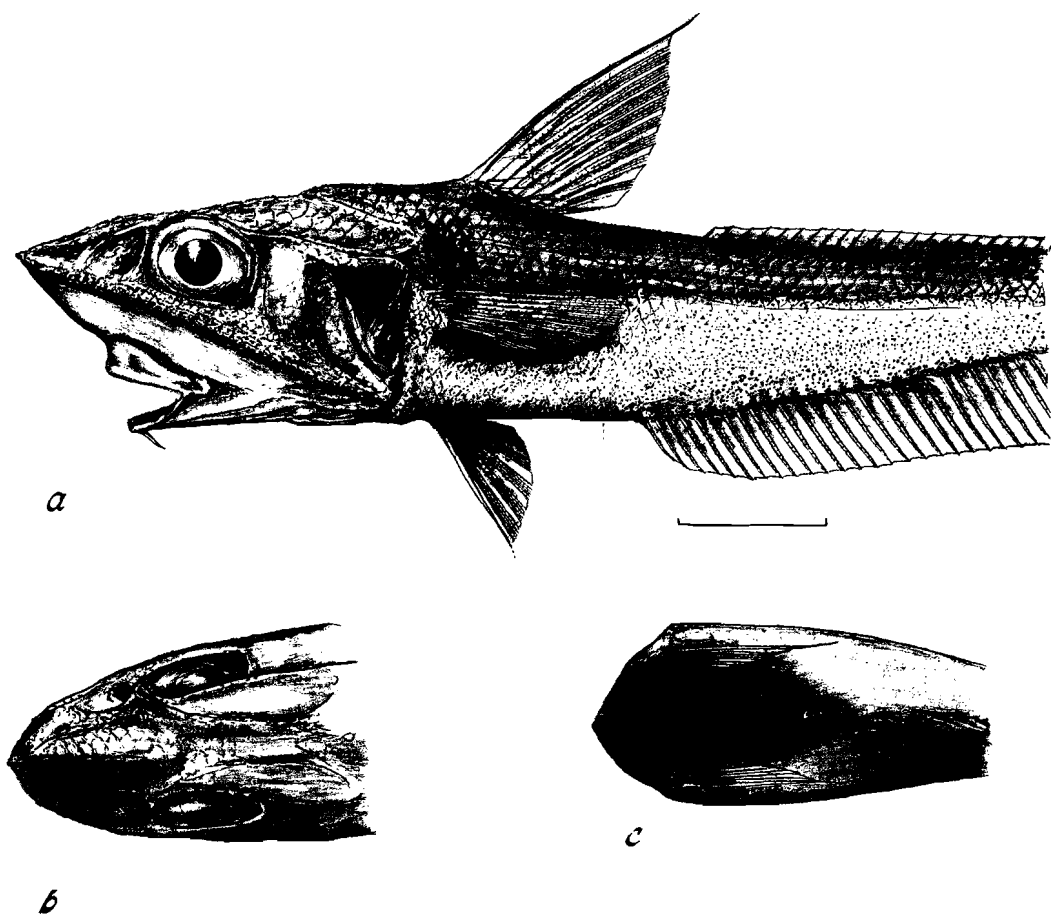


FIGURE 16. *Caelorinchus maculatus* Gilbert and Hubbs. CSIRO H1701-02 (210+ mm TL) from Western Australia. Fins and scales partially reconstructed. (a) lateral view; (b) dorsal view of head; (c) ventral view of abdomen to show extent of light organ and dark pigmentation. Scale bar represents 25 mm.

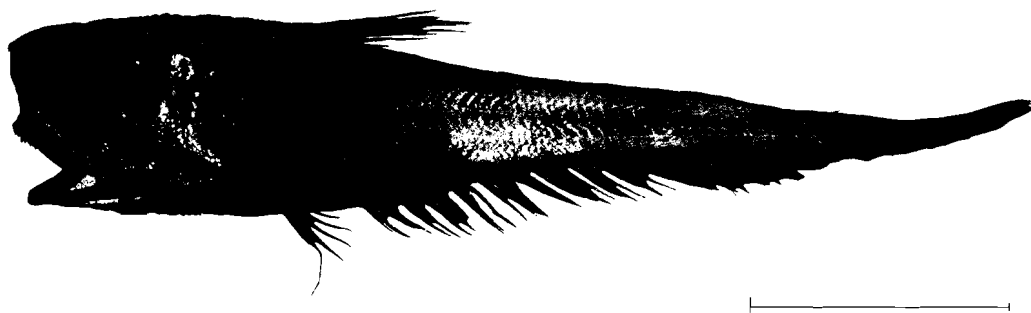


FIGURE 17. *Caelorinchus matamua* McCann and McKnight. CSIRO H3008-09, from south of Albany, WA (35°25'S, 117°21'E), in 842 m. Scale bar represents 10 cm.

scales enlarged but mostly lacking well-developed spinules; scales of anterior dorsal midline of head largest, with rows of low ridges radiating from centers; scales in adjacent rows also large, but with ridges forming a scalloped pattern.

Body color brown to grayish pink; head brown; distinct dark band around entire midsection of body, dark blue over abdomen to level of at least 12th anal fin ray and to level of pectoral fin base, less intense dorsally. All fins and branchiostegal membranes dark to black. Buccal cavity pale, lips distinctly black.

SIZE. — To at least 65 cm TL.

DISTRIBUTION. — Southern Australia, southern Africa, and New Zealand, in depths of 450–1085 m.

COMPARISONS AND REMARKS. — A distinctive species of *Caelorinchus* easily recognized in the field by its bulky body shape, darker pigmentation of the anterior part of the anal fin, dark trunk region, and the pockets of missing scales over the opercular region, which are reflective and clearly defined. A rare species off the Australian west coast but common in other parts of its range. Nakamura's (1986:132, 133) record from Chilean waters is apparently in error, as the specimen illustrated is not a member of this species.

***Caelorinchus maurofasciatus* McMillan and Paulin, 1993**

Fig. 18

*Caelorinchus maurofasciatus* McMillan and Paulin, 1993:826, 827, fig. 5 (holotype NMNZ P.23003; Challenger Plateau off New Zealand; 846–875 m; also n. and cent. NZ, 330–928 m; NSW, TAS, to GAB). Williams et al. 1996:148 (distr.)

*Caelorinchus* sp. 1: McMillan in Gomon et al., 1996:347, fig. 307 ("false banded whiptail"; descr.; NSW to GAB, TAS, and New Zealand, 400–800 m).

DIAGNOSIS. — Snout short, with broadly convex sides in dorsal view; terminal scute small, broad, blunt; anterolateral margins incompletely supported by bone; orbits longer than snout length and postorbital length of head; mouth small, maxillary extends to below about midorbit; subopercle weakly produced ventrally into a short flap. Lens-shaped naked fossa of light organ developed anterior to anus, about midway between anal and pelvic fins; anus immediately adjacent to origin of anal fin. Underside of head completely naked; nasal fossa usually partially scaled; no broad naked areas dorsally behind leading edge of snout; body scales covered with short, small spinules aligned in many (to 11 or more depending on size of fish) parallel to slightly divergent rows; weak median-dorsal ridge on nape from supraoccipital scute to origin of first dorsal, formed by modified scales with somewhat higher and stouter median spinule rows. About 9–11 prominent saddle bands on body, the third and fifth usually darker than others, the first beginning at about supraoccipital scute and terminating below spinous rays of first dorsal fin, pale interspaces between bands angled posteroventrally from dorsal median line; first dorsal fin blackish distally but pale near base; anal fin often with a dark distal stripe extending length of fin; oral and branchial cavities dark.

SPECIMENS EXAMINED. — **WA:** AMS I.31171-009 (45.3–51.6 HL, 197+210 TL); off Shark Bay; 500–508 m; SS1/91/37. NMV A9606 (6, 36.9–57.6 HL, 160–260 TL); 90 km sw. of Geraldton; 490–505 m; SS1/91/57. NMV A9660 (6, 38.9–63.3 HL, 168–282 TL); 50 km w. of Green Head; 480–490 m; SS1/91/65. CSIRO H2604-09 (2, 215–230 mm TL); sw. of Ledge Pt.; 512 m; SS1/91/70. NMV A9639 (5, 49.0–53.3 HL, 210–225 TL); 50 km w. of Rottnest I.; 640–670 m; SS1/91/72. **NSW:** AMS I.24854-003 (33.8 mm HL, 150 mm TL); Jervis Bay off Wattamolla; 505 m; K84-14-01. AMS I.23470-006 (5, 33.1–65.4 HL, 110–290 TL); off Sydney; 765 m; K83-17-01. NMV A2460 (32.2 HL, 147 TL); e. of Sydney; 33°04'S, 151°49'E; 421–494 m. **TAS:** NMV A2460 (46.6 HL, 197 TL); 70 km w. of Richardson; 41°13.4'S, 144°02.8'E; 528–600 m. NMV A4604 (58.6 HL, 252 TL); 21

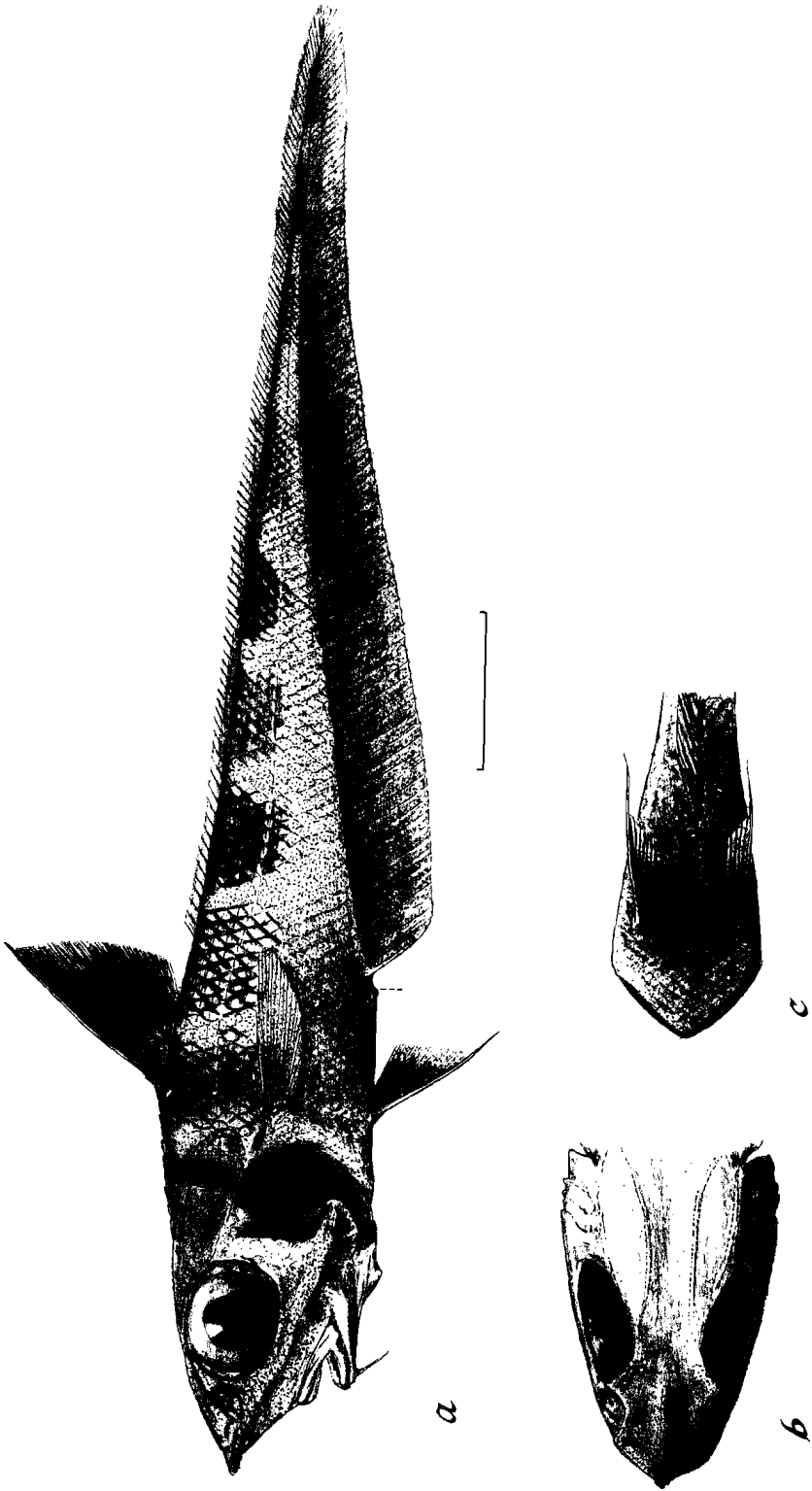


FIGURE 18. *Caelorinchus maurofasciatus* McMillan and Paulin, CSIRO H2604-09 (230 mm TL) from southwest of Ledge Point in 512 m. (a) lateral view, fins and scales partially reconstructed; (b) dorsal view of head to show shape and fully scaled dorsal surface of snout; (c) ventral view of abdomen to show shape and position of dermal window of light organ and anus. Scale bar represents 2.5 mm.



km e. of Maria I.; 42°41.7'S, 148°24.7'E; 428 m; *FRV Soela*. NMV A3831 (39.0 HL, 183 TL); 95 km ne. of Flinders I.; 39°02.9'S, 148°40.5'E; 636–660 m. NMV A8822 (69.7 HL, 302 TL); 80 km ne. of Flinders I.; 39°28.5'S, 148°18.4'E; 430 m. CSIRO T1261 (4, 68.2–85.0 HL, 285+–320 TL); South Tasman Rise; *Kaiyo Maru*; 22.XII.1975. VIC: NMV A768 (3, 69.8–83.5 HL, 285–310 TL); off Portland; 38°50'S, 141°46'E; 549 m; *Halycon*; field no. MFG-7; 6.II.1980. NMV A8836 (60.0 HL, 267 TL); Tasman Sea, 40 km ese. of Gabo I.; 37°44.1'S, 150°16.7'E; 650 m; 3.VII.1984. AMS I.18711-006 (2, 53.1–53.3 HL, 204+–206+ TL); “off southern Australia”; *Dmitry Mendeleev*; 28.II.1976.

COUNTS AND MEASUREMENTS. — 1D. II,9–10; P. (i16) i17–i20; GR-I (inner) (1–2)+(6–7), 7–9 total, GR-II (outer/inner) 0+(6–7)/(1–2)+(6–7); scales 1D. 4.5–6.0, midbase 1D. 3.5–4.5, 2D. 4.0–4.5 (5.5), lat.line 22–31; caeca 18–34.

Total length 110–320 mm; HL 32.0–83.5 mm. The following in percent of HL: snout 30–35; preoral 28–34; internasal 21–25; interorb. 18–23; orb. 37–46; suborb. 15–17 (18); postorb. 28–33; orb.-preop. 29–35; up.jaw 25–30; barbel 9–14 (16); gill slit 12–16; pre-A. 136–164; V.-A. 34–49; isth.-A. 62–84; body depth 59–73; 1D.-2D. (13) 15–25; ht. 1D. 57–80; len. P. 45–61; len. V. 48–59 (63); nostril 6–9; len. dermal window of light organ 6–13.

SIZE. — To at least 50 cm TL.

DISTRIBUTION. — From Shark Bay, WA, around Cape Leeuwin to VIC, TAS, and north to off Sydney, NSW. Also off northern and central coasts of New Zealand. Depth range 330–930 m.

COMPARISONS AND REMARKS. — *Caelorinchus maurofasciatus* is strikingly similar to *C. fasciatus* (Günther, 1878) and was confused with that species before McMillan and Paulin (1993) distinguished the two. They noted that the banding pattern is the same in the two species, but in *C. fasciatus* the scales on the midline of the nape have a higher, stouter central spinule row, especially the two or three nearest the dorsal fin; the body scales are generally more deciduous; the anal fin lacks a distinct dark stripe (more uniformly dusky to black); the first dorsal fin lacks the pale proximal portion that contrasts sharply with the blackish distal portion; and the pyloric caeca are generally fewer. Our specimens showed considerable variation in the extent of dark pigmentation on the first dorsal and anal fins; usually, we could not rely on those features alone to confidently identify our material but had to couple them with other characters. The more-deciduous nature of body scales in *C. fasciatus* was a useful clue, as representatives of that species in our collections were mostly denuded of scales. *Caelorinchus fasciatus* has a more southerly distribution than *C. maurofasciatus*; off New Zealand the latter species is abundant in northern waters, less so in central waters, and absent in southern waters. *Caelorinchus parvifasciatus* and *C. amydrozosterus* are readily distinguished from *C. maurofasciatus* by their fainter bands (which are oriented differently), usually paler body and fin pigmentation, and broad naked areas on dorsal snout surfaces behind the leading edges.

### *Caelorinchus mayiae* new species

Fig. 19b

DIAGNOSIS. — Snout 40–46% of HL, with a slight humplike rise in dorsal profile over nostril; anterolateral margins not fully supported by bone; scales anterolaterally overlap onto ventral surfaces; orbit diameter 22–25% of HL; upper jaw about 1/3 of HL, extends posteriorly to below hind margin of orbit; barbel 11–16% of HL; subopercle without a slender projection. Light organ extends from anus forward to just behind isthmus. Underside of head completely naked; nasal fossa naked. Spinous dorsal ray blackish distally; median nasal bone blackish. Body markings prominent in most specimens (see Description below). Head covering transparent; mouth lining white; lips and most of skin covering premaxilla blackish; maxilla darkly pigmented; belly and pelvic bases almost entirely without melanophores; vent and chest region densely pigmented.

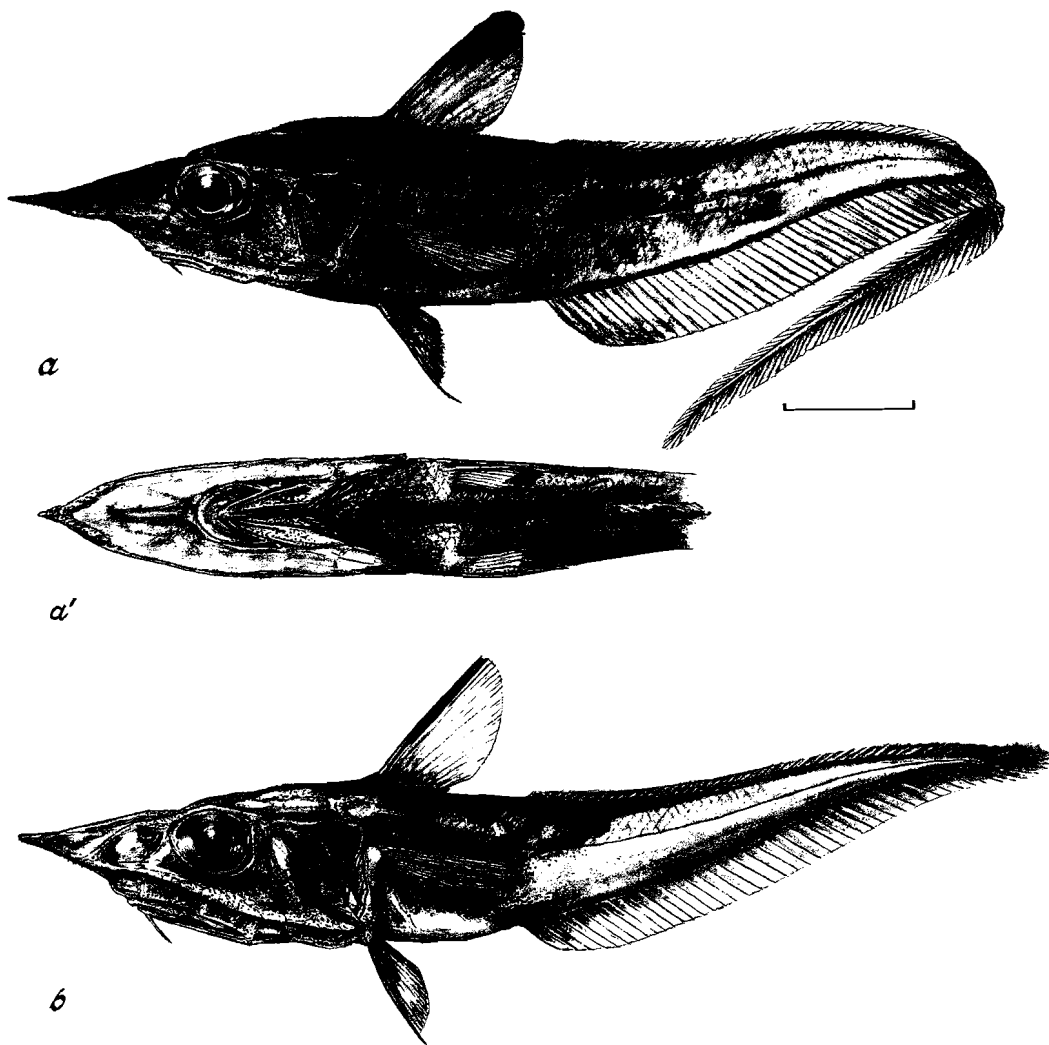


FIGURE 19. (a) *Caelorinchus pardus* n.sp. Paratype (NTM S.12902-027, 232 mm TL) from northeast of Cape Don, NT, in 143 m. (b) *Caelorinchus mayiae* n.sp. Holotype, NTM S.13580-001 (170+ mm TL) from Arafura Sea, NT, in 179–205 m. Fins and scales in (a) and (b) partially reconstructed. Scale bar represent 25 mm.

**SPECIMENS EXAMINED.** — **NT (Arafura Sea):** HOLOTYPE: NTM S.13577-001 (53.0 mm HL, 219 mm TL); 9°05.1'S, 133°39.7'E; 165–176 m; coll. R. Williams [RW92-66]; 20.X.1992. PARATYPES: NTM S.13580-001 (2, 53.0–71 HL, 171+–270 mm TL); 9°04.7'S, 133°04.7'E; 179–205 m; coll. R. Williams [RW92-68]; 20.X.1992. NTM S.13577-024 (6, 46.6–55.4 HL, 181–225 TL), QM I.31225 (52.7 HL, 170+ TL), and CAS 200226 (2, 47–50 HL, 184–196 TL); same data as for holotype. **OTHER SPECIMENS** (not paratypes): NTM S.13313-013 (3, 106–167 TL); Arafura Sea; 9°18'S, 133°12'E; 153 m; 6.XI.1990.

**COUNTS AND MEASUREMENTS** (see Table 2–4 for additional counts and measurements). — 1D. II,8–9; P. i14–i16; total GR-I (inner) 8–10, GR-II (outer/inner) 6–8/8–10; scales 1D. 6–8, midbase 1D. 3.5–4.5 (5.5), 2D. 4.5–5.5, lat.line 37–42; caeca 10–11.

Total length 153–275+ mm; HL 46.6–83.1 mm. The following in percent of HL: suborb. 12–14; pre-A. 145–159; V.-A. 43–58; isth.-A. 73–91; body depth 45–54; 1D.-2D. 16–27; base 1D. 18–23; ht. 1D. 40–53; len. P. 34–45; len. V. 27–40; post. nostril 6–8.

DESCRIPTION. — A complete description of *C. mayiae* would be redundant in that it is so similar in most respects to *C. argentatus* and *C. pardus*, the latter of which has been described in detail. Therefore, the following will emphasize only those features that differ between the species.

Body scales of *C. mayiae* (Fig. 8c) deciduous, most lost in all specimens examined. (This in contrast to *C. pardus*, where all individuals still retain most of their scales.) Scales dorsally below origin of first dorsal fin with spinules short, conical, little recurved, usually arranged in 4–6 somewhat irregularly divergent rows to somewhat quincunx pattern. Posteriormost spinules in each row scarcely or do not extend beyond edge of scale. Scales on chest with broader, flatter spinules, more triangular in shape. Scales over snout notably thin, head covering here thin and completely transparent; scales have few, short, weak spinules, even more reduced than in *C. pardus*, especially over median nasal ridge. Most scales between occipital ridges with single median row of erect spinules. Scales atop head sparse, spinulation thin, reduced (this contrasts with condition in *C. pardus* and *C. argentatus*, which have dense covering of short erect spinules in rather random pattern).

Underside of snout with scattered tiny black, usually paired, punctations (neuromasts) similar to those in *C. argentatus* and *C. kamoharai* but less dense; minute, black, hairlike papillae few or virtually absent over ventral head surfaces.

Body markings already described in part in description of *C. argentatus*. Markings rather similar to those of *C. pardus*, but generally not as spotty. Dorsally on nape and trunk, dark blotches fairly extensive and continuous. Anterior end of dorsal stripe (below origin of second dorsal fin) forming clublike or hockey-sticklike head directed anteroventrally and joining faint band that merges with dark periproct region. Lateral aspects of abdomen heavily punctate, but ventral surfaces almost completely devoid of pigmentation from periproct region to anterior end of pelvic fin bases, which are white with scattered black punctations along base of fins. Chest sharply demarcated from pale belly by dark pigmentation. Pelvic fins dark at base of rays, at tip, and along outer ray, but pale in middle. First dorsal fin with second spinous ray and membrane following black on distal two-thirds but completely pale proximally. Segmented rays with faint trace of broad darkish band across middle, but pale proximally. Base of dorsal rays rather prominently marked with black. Anal fin somewhat blackish on anterior few rays, but otherwise clear to light dusky posteriorly, with no blackened margin. Lips dark, barbel dusky to pale, maxillary densely pigmented; lower jaw with prominent dark pigment bands on inner surface of bones visible through transparent integument. Opercle and most of subopercle black except pale along posterior margin; branchiostegal membrane dark dusky but pale along posterior margin; gular membrane finely peppered posteriorly, with melanophores larger and fewer toward anterior end, and very sparse around chin barbel. Fresh specimens probably silvery over sides of head, ventral half of trunk, and midlaterally on tail.

SIZE. — To about 28 cm TL.

DISTRIBUTION. — Known only from the Arafura Sea, NT, in about 150–200 m.

ETYMOLOGY. — From the Australian Yindjibarndi language, *mayi*, meaning younger sister, in reference to the putative sister-species relationship with *C. argentatus*.

COMPARISONS AND REMARKS. — *Caelorinchus mayiae* is so similar to *C. argentatus* that no meristic or morphometric differences were found. The barbel appeared to be somewhat longer in *C. mayiae*, but there is considerable overlap (11–16% HL cf. 6–14%). Spinulation of scales (see Description) nonetheless distinguishes the two species. In *C. argentatus* the scales of the snout and head are densely spinulated, in contrast to *C. mayiae* where they are thin and sparsely spinulated, and the integument on the snout is not as thin and transparent in *C. argentatus* as in the new species. The spinulation on body scales is somewhat denser in *C. argentatus*, and spinules along the anterior edge of the scale field often have broadened bases aligned side by side on scales below the lateral line and

caudally on the dorsum beyond the trunk. Depth distribution shows some separation between the two species, with *C. mayiae* taken in somewhat shallower depths (150–200 m cf. 260–420 m). In this respect, *C. mayiae* and *C. pardus* show more overlap, and the two species have been taken in the same trawls.

*Caelorinchus denticulatus* Barnard, 1925 differs from *C. mayiae* in much the same way as the latter differs from *C. argentatus*. In addition, the blotched pattern on the body is more broken in the new species and there is no evidence of bands on the tail that we have noted in specimens of *C. denticulatus* smaller than about 50 mm HL. Dentition appears to be slightly larger in *C. mayiae*, and the scattered, paired punctations on the underside of the head in *C. mayiae* are not present in *C. denticulatus* specimens.

*Caelorinchus mayiae* is also close to *C. multispinulosus* and *C. pardus*, but those species have notably different pigmentation patterns, as well as a somewhat longer snout, proportionally shorter upper jaw, postorbital, and orbit-to-preopercle lengths. Other measurements of *C. pardus* are compared in Table 4. *Caelorinchus pardus* also has spinules on body scales in parallel rows. Differences between *C. mayiae* and other members of this species complex are discussed in the description of *C. argentatus*.

The surprising discovery of this new species, thought originally to be *C. argentatus*, serves to illustrate the distinctiveness of the Australian grenadier fauna compared with those from Indonesia and the Philippines. The small and subtle differences between *C. mayiae* and *C. argentatus* and between *C. multispinulosus* and *C. pardus*, however, suggest a fairly recent divergence between these species pairs.

### ***Caelorinchus mirus* McCulloch, 1926**

Fig. 20

*Coelorhynchus (Paramacrurus) mirus* McCulloch, 1926:178–180, pl. 46 (e. of Sydney off Montague I., NSW, and e. edge of Bass Strait; 128–402 m).

*Garichthys mirus*: Whitley, 1968:38.

*Coelorinchus mirus*: Last et al., 1983:242, 243, fig. 21.16 (TAS, VIC, NSW, SA, WA).

*Caelorinchus mirus*: McMillan in Gomon et al., 1994:354, fig. 314 (descr.; distr. QLD to TAS, GAB). Williams et al. 1996:148 (distr.).

DIAGNOSIS. — Snout pointed but short, much less than orbit diameter, tipped with a small spiny scute; anterolateral margin not fully supported by bone; orbit large, more than postorbital length of head; upper jaw extends to below posterior one-third of orbit, rictus to about below midorbits; suborbital forming a short, angular flap at posteroventral corner. Black scaleless fossa of ventral light organ large, extending forward from anus to line connecting origins of pelvic fins; anus removed from anal fin origin by 1 or 2 scales at the most. Underside of snout and most of suborbital naked, but lower jaw and underside of preopercle scaled posteriorly; nasal fossa and area immediately behind dorsal leading edges of snout on both sides naked; body scales with minute spinules closely aligned in numerous parallel rows (9–20 rows per scale in 37–57 mm HL specimens, larger individuals with more rows on each scale). Color overall light brownish to grayish dorsally, and whitish ventrally, with large, prominent, scattered peppering over gill membranes, posteriorly on underside of suborbital and preopercle, and ventral surfaces of abdomen; pelvic fin whitish with prominent black blotch in middle of fin; pectoral fin with small black spot at ventral corner; anal fin pale anteriorly, blackish distal margins posteriorly.

SPECIMENS EXAMINED. — WA: ZMMGU uncat. (54.1 HL, 237+ TL); 30°30'S, 114°33.6'E; 320–340 m; *Orlik*; trawl 33; 8.X.1962. CSIRO C.2011 (1 spec.); Great Australian Bight; 1951. CSIRO T1889-01(1 spec.); Great Australian Bight; III.1980 (no other data). NMV A9658 (5, 195–285

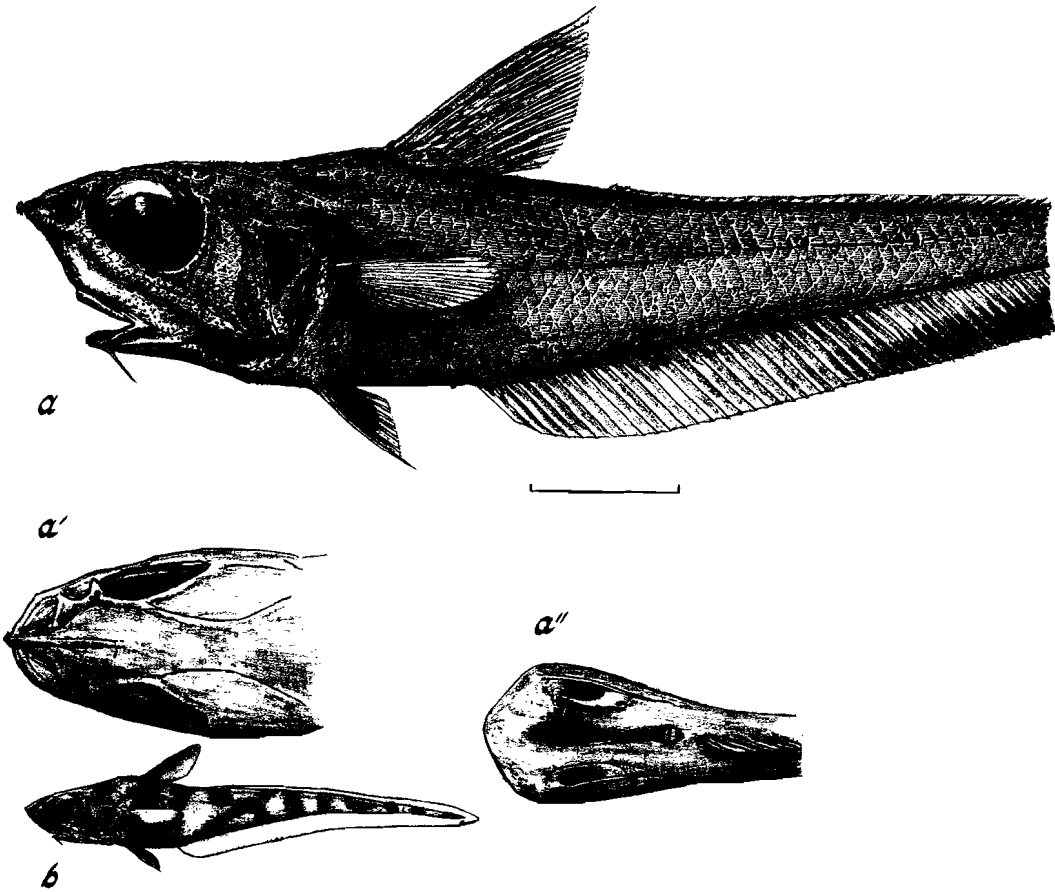


FIGURE 20. *Caelorinchus mirus* McCulloch. (a) Adult specimen (ZMMGU P.17226, 237+ mm TL) from off Perth, WA, in 320–340 m; (a') dorsal view of head to show naked regions behind leading edges of snout; (a'') ventral view of abdomen to show light organ and anus. (b) Juvenile (AMS IB.4360-2, 75 mm TL) from east of Tuggerah Lakes, NSW, in 260 m. Fins and scales in (a) partially reconstructed. Scale bar represents 25 mm.

TL); 50 km w. of Green Head; 30°00.1'S, 114°27.8'E; 380 m. NMV A10279 (3, 155–225 TL); 90 km sw. of Geraldton; 29°20.50'S, 113°56.80'E; 490–505 m. SA: CSIRO H1676-01 (1 spec.); 1980. CSIRO T1917-01 (1 spec.) and CSIRO T1917-02 (1 spec.); Great Australian Bight; 33°21'S, 128°35'E; 322–325 m; *Denebola*; 18.III.1980. VIC: NMV A3044 (1 spec.); Bass Strait, s. of Point Hicks; 38°14.89'S, 149°06.99'E; 212–240 m. NMV A8839 (6, 115–232 TL); Bass Strait, 40 km s. of Point Hicks; 38°13.5'S, 149°12.8'E; 232 m. TAS: AMS IA.1379 (1 spec.), IA.1380 (1 spec.); e. edge of Bass Strait; 39°S, 148°E. CSIRO CA3191 (1 spec.), CSIRO CA3192 (1 spec.), and CSIRO CA3193 (1 spec.); Bass Strait, s. of Gabo I.; 276 m; SO1/72/12. NMV A3676 (290 TL); South Tasman Rise; 47°32.00'S, 148°16.00'E. NMV A3715 (580 TL); South Tasman Rise, 47°29.00'S, 148°29.00'E. NSW: AMS I.15247 (holotype, 51.4 HL, 230+ TL); off Sydney; *Endeavour*. AMS I.15246 (paratype, 57 HL, 273 TL), AMS I.15037 (paratype, 52.5 HL, 245+ TL), AMS I.15038 (paratype, 52.3 HL, 240+ TL), AMS I.15248 (paratype, 37.6 HL, 191 TL); same data as for holotype. AMS I.15037 (1 spec.), I.15038 (1 spec.), I.15246 (1 spec.), I.15247 (1 spec.), I.15248 (1 spec.); e. of Sydney; 33°S, 151°E; 1920. CSIRO CA77 (1 spec.); se. Australia; 400 m; 1976. CSIRO CA95 (1

spec.) and CSIRO CA96 (1 spec.); e. of Broken Bay; 33°33'S, 151°57'E; 265–305 m; *FRV Courageous*; 2.II.1977. CSIRO CA495 (1 spec.); e. of Wollongong; 34°32'S, 151°16'E; 198–202 m; *FRV Courageous*; 17.X.1978. CSIRO C4799 (1 spec.); e. of Wollongong; 34°33'S, 151°15'E; 160–300 m; *FRV Courageous*; 8.VI.1976. AMS I.19205-004 (4, 90–235 TL); e. of Broken Bay; K76-07-01. AMS I.26221-002 (3, 230–250 TL); se. of Sugarloaf Point; K85-20-10. AMS I.25932-006 (180 TL); e. of Port Jackson; 1985. AMS IA.407 (1 spec.); off Montague I.; 36°S, 150°E. AMS IB.4336 (1 spec.), IB.4337 (1 spec.); IB.4338 (1 spec.), IB.4339 (1 spec.), IB.4340 (1 spec.); 35–40 miles ne. of Broken Bay; 33°S, 151°E; 258 m; 1959. AMS IB.4360 (3, 72–80 TL), IB.4361 (1 spec.), IB.4362 (1 spec.); e. of Tuggerah Lakes; 33°S, 151°E; 260 m; 1959. AMS IB.4391 (1 spec.), IB.4392 (1 spec.); e. of Newcastle; 32°S, 151°E; 293 m; 1959. AMS IB.8269 (5, 213–238 TL); 20 miles off Wollongong; 34°S, 151°E; 1968. NMV A2459 (3, 112–128 TL), e. of Sydney; 33°46'S, 151°49'E; 420 m. NMV A6912 (14, 98–150 TL); 52 km ene. of Nowra; 34°43.55'S, 151°13.16'E; 450–345 m. **QLD**: AMS I.15519-001 (2, 134–152 TL); off Brisbane; 26°17'S, 153°15'E; 188 m; 1968. AMS I.15528-003 (88 TL); off Brisbane; 26°31'S, 153°53'E; 373 m; 1968. AMS I.15550-004 (169 TL); off Brisbane, 26°31'S, 153°50'E; 329 m; 1968.

COUNTS AND MEASUREMENTS (6 spec.). — 1D. II,9–10; P. i17–i18; GR-I (inner) (1–2)+6, GR-II (outer/inner) 0+6/(2)+(6–7); scales 1D. 5.0–5.5, midbase 1D. 3.5, 2D. 4.0–5.5, lat.line 23–26; caeca about 40 in one spec.

Total length 191–273 mm; HL 37.6–57.0 mm. The following in percent of HL: snout 29–32; preoral 29–31; internasal 22–25; interorb. 22–26; orb. 36–40; suborb. 16–17; postorb. 32–38; orb.-preop. 37–40; up.jaw 28–33; barbel 15–20; gill slit 15–19; pre-A. 154–167; V.-A. 44–54; isth.-A. 74–96; body depth 69–86; 1D.-2D. 47–59; ht. 1D. 74–80; len. P. 51–58; len. V. 49–53; len. post. nostril 4.9–9.0.

SIZE. — To about 30 cm TL.

DISTRIBUTION. — Widespread and common across southern Australia, north on west coast to southwest of Geraldton, WA (about 30°S), and on east coast to off Brisbane, QLD (about 27°S), in about 200–500 m. Off WA, most numerous between 300 and 400 m.

COMPARISONS AND REMARKS. — *Caelorinchus mirus* is a common species along the southern part of the continent. It is easily distinguished from other similar species in the "*C. fasciatus*" group by the large ventral fossa that extends forward of the vent region to between the pelvic fin bases, the large black blotch on the pelvic fins, the small black spot ventrally at the base of the pectoral fin, the scaled underside of the head posteriorly from above the angle of the jaws, and the absence of saddle marks on the body of adults. Juveniles (Fig. 20b) as small as 72 mm TL (AMS IB.4360-2) were readily identified by the pectoral and pelvic spots; saddle bands on the body are prominent in juveniles but lost in adults.

### [?]*Caelorinchus mycterismus* McMillan and Paulin, 1993

Fig. 21

*Caelorinchus mycterismus* McMillan and Paulin, 1993:827–829, fig. 6 (New Zealand; 833–1,150 m).  
*Caelorinchus* sp. F: Williams et al., 1997:148 (WA distr.).

DIAGNOSIS.—Snout slender, sharply pointed and upturned, 1.7–2.4 times orbit diameter, antero-lateral margin incompletely supported by bone. Postorbital length of head 23–31% of HL, distance orbit to preopercle angle 26–32%; orbit into postorbital 0.9–1.3 times. Light organ short, not externally apparent; anus immediately before anal fin. Nasal fossa sparsely to (usually) extensively covered with tiny scales; body scales with 4–9 parallel rows of spinules, the median row larger, lateral rows often incomplete and not reaching posterior margin of scale.

SPECIMENS EXAMINED. — WA: AMS I.22810-009 (4, 71.4–77.7 HL, 225–236+ TL); NW Shelf, 250 km nw. of Port Hedland; 736 m; SO2/82/22-24. CSIRO H2549-03 (74.5 HL, 228+ TL); w. of NW Cape; 650 m; SS1/91/10. NSW: AMS I.29750-001 (90 HL, 278 TL); e. of Crowdy Bay; 1,024–1,052 m; K89-17-04.

COUNTS AND MEASUREMENTS (WA specimens only). — 1D. II,8–9; P. i16–i17; total GR-I (inner) 7–9, total GR-II (outer/inner) 6–7/7–9; scales 1D. 5–7, midbase 1D. 4.5, 2D. 4.5–5.5, lat.line 36–40; caeca 10 (2 spec.).

Total length 225–235 mm; HL 71.4–77.2 mm. The following in percent of HL: snout 45–48; preoral 43–46; internasal 17–18; interorb. 20–23; orb. 24–26; suborb. 13–15; postorb. 29–31; orb.-preop. 31–32; up.jaw 20–22; barbel 7–8; gill slit 10–11; pre-A. 132–145; V.-A. 30–38; isth.-A. 51–56; body depth 35–42; 1D.-2D. 13–17; ht. 1D. 32–36; len. P. 29–32; len. V. 31–33; post. nostril 6–7.

DESCRIPTION. — General features seen in Figure 21. Snout long, slender, slightly upturned with concave dorsal profile, tipped with a large, sharp, diamond-shaped terminal scute. Mouth gape restricted laterally by lip folds; rictus extends posteriorly to under midorbit. Barbel short, slightly longer than vertical diameter of posterior nostril. Preopercle forming a lobe posteroventrally; subopercle produced at ventral margin into a thin, narrow flap.

Premaxillary teeth in broad short band; mandibular teeth in narrow, more elongated band that extends to posterior end of rictus.

First dorsal fin relatively low, height about one-third of head length, slightly more than postorbital length; pectoral and pelvic fins similarly short, outer pelvic ray barely extends to vent; anal fin well developed, second dorsal fin low to end of tail.

Scales completely cover head and snout; nasal fossa with tiny, finely spinulated scales scattered only on ventral surfaces in most specimens, but over most of fossa in others. Underside of head completely covered with small, mostly nonimbricate scales (Fig. 8h) armed with 1–3 short rows of broad, bladeliike spinules, each spinule closely adjoined proximally to form a high, toothed crest, 2–5 spinules per row; spinules on scales dorsally atop snout and head similar, in 1–4 rows. Supraoccipital and occipital scutes not well differentiated; scales on head ridges thickened and armed with coarse, strong spinules. Body scales (Fig. 8i) with 4–7 parallel to slightly divergent rows of sharp spinules, the median row largest and highest, formed of 4–9 broad-based spinules, the spinules rapidly increase in height posteriorly to edge of scale; other scale rows shorter, those adjacent to median row often not complete to edge of scale and only one or two spinules long. Scales posterior to origin of second dorsal fin with more spinule rows than those on trunk.

Light organ short type, like those of Iwamoto's (1990) Group I, without visible external fossa.

Color in alcohol overall tawny to grayish brown; first dorsal fin dark dusky to blackish; paired fins and anal fin usually light dusky; abdomen with bluish tinge, but dark color not extending onto chest area, region surrounding anus somewhat darker than adjacent areas; mouth and gill cavities black, gums dusky to pale, upper and lower lips narrowly blackish, but usually pale laterally; barbel pale; branchiostegal membrane blackish posteriorly and dorsally, but paler ventrally and over gular membrane.

SIZE. — To about 50 cm TL.

DISTRIBUTION. — Known from WA only off the NW Shelf and NW Cape; also found off NSW; abundant off New Zealand in 833–1,150 m (McMillan and Paulin 1993:829).

COMPARISONS AND REMARKS. — We tentatively identify the small WA specimens with *C. mycterismus*, although scales on top and on the underside of the snout differ from one specimen we have examined from New South Wales and others from New Zealand. These scales (Fig. 21c) had broad spinules adjoined basally forming a short, high crest. Scales on the same areas of the head in other specimens had spinules that were more slender and not closely adjoined. We could find no other

difference, however, to support recognizing them as distinct, but examination of additional specimens covering a greater size range may change our view.

*Caelorinchus mycterismus* closely resembles *C. kermadecus* Jordan and Gilbert, 1904 and we initially confounded the two species. However, Peter McMillan (pers. comm., Nov. 1997) advised us as to characters that can be used to distinguish the two. According to McMillan and Paulin (1993), *C. mycterismus* has a longer, more slender and upturned snout (45–55% HL in *C. mycterismus* cf. 41–47% in *C. kermadecus*), a lower first dorsal fin (28–36% HL cf. 36–43%), slightly shorter pectoral fin (26–33% HL cf. 31–37%), shorter pelvic fin (21–31% HL cf. 29–39%), shorter upper jaw (15–26% HL cf. 25–30%), shorter postorbital (25–30% cf. 34–36% [our data]), shorter orbit-preopercle (25–30% cf. 34–36% [our data]). Additionally, the anal fin of *C. mycterismus* is pale posteriorly but dark dusky to blackish in *C. kermadecus*, and the spinule rows on body scales are more numerous, especially posteriorly on the tail (as many as 9 rows compared with about 7 as a maximum in *C. kermadecus*), and the spinules are broader based, especially those lateral to the median row.

The apparently disjunct distribution of this species on opposite sides of the continent is peculiar and unexpected. No collections of the species were made along the southern shores of Australia nor off Queensland, despite fairly extensive sampling at appropriate depths.

### *Caelorinchus pardus* new species

Fig. 19a

*Coelorinchus* sp. 4: Arai, in Gloerfelt-Tarp and Kailola, 1984:85, fig.

DIAGNOSIS. — Snout long, 43–49% of HL, anterolateral margin not completely supported by bone; characteristic scales overlap anterolaterally onto ventral snout surface; orbit diameter 22–25% of HL, 1.8–2.2 times into snout length; upper jaw 24–27% of HL; chin barbel short, about equal to length of first gill slit; subopercle lacking a prolonged narrow flap. Light organ extends from behind isthmus to front of anus. Underside of head naked; nasal fossa naked; body scales thin, spinules short, fine, aligned in close parallel rows. Conspicuous body markings consisting of blotches, spots and occasional ring on dorsum, becoming a narrow dorsal stripe to end of tail; belly between periproct and pelvic fin bases lacking melanophores; maxillary ramus immaculate (rarely with 2–3 melanophores). First dorsal fin with membrane between second spinous ray and first segmented ray black; anterior end of anal fin blackish distally. Pyloric caeca 8–11, usually 10 or 11; P. i14–i15, rarely i16.

SPECIMENS EXAMINED. — **NT (Arafura Sea):** HOLOTYPE: NTM S.13551-001 (57.0 mm HL, 213 mm TL); 9°39.3'S, 133°04.4'E; 123 m; coll. R. Williams (RW92-38); 3.X.1992. PARATYPES: NTM S.10774-001 (3, 170–185 TL); 9°32'S, 133°07'E; 126–130 m; *FRV Soela* sta. AS02/81/112; 2.VII.1981. NTM S.12902-027 (12, 32–58 HL, 136–232 TL); ne. of Cape Don; 9°19'S, 132°42'E; 143 m; coll. R. Williams (RW90-3); 7.XI.1990. NTM S.12903 (4, 180–200 TL); ne. of Cape Don; 9°19'S, 133°12'E; 152 m; coll. R. Williams (RW90-4); 7.XI.1990. NTM S.12923-003 (6, 36.4–44.1 HL, 145–165 TL) and QM I.31224 (3, 136–143 TL); Arafura Sea (no other locality given); 112 m; coll. R. Williams (RW90-24). NTM S.13313-013 (36.1 HL, 137 TL) and NTM S.13313-028 (12, 196–215 TL); 9°18'S, 133°12'E; 153 m; coll. R. Williams; 6.XI.1990. NTM S.13547-001 (11, 115–186 TL), AMS uncat. (2, 164–187 TL), BPBM 38460 (2, 161–172 TL), and BSKU uncat. (2, 116+–187 TL); 9°42.4'S, 133°23.2'E; 107 m; coll. R. Williams (RW92-34); 3.X.1992. NTM S.13548-001 (8, 128–195 TL) and CAS 200227 (4, 170–200 TL); 9°42.3'S, 133°17.2'E; 112–116 m; coll. R. Williams (RW92-35); 3.X.1992. NTM S.13550 (5, 46.2–50.4 HL, 146+–199 TL); 9°30.7'S, 132°56.3'E; 136 m; coll. R. Williams (RW92-37). NTM S.13551-001 (5, 43.1–59.2 HL, 161+–192 TL); same data as for holotype. NTM S.13577 (2, 51.3–52.8 HL, 200–200+ TL); 9°05.1'S,



133°39.7'E; 165–176 m; coll. R. Williams (RW92-65); 20.X.1992. NTM S.13578-001 (6, 178–208 TL); 8°55.3'S, 133°41.1'E; 179–187 m; coll. R. Williams (RW92-66); 20.X.1992.

COUNTS AND MEASUREMENTS (22 spec.). — 1D. II, 7–10, usually 8–9; total GR-I (inner) 8–9 total, GR-II (outer/inner) 6–7/8–9; scales 1D. 4.5–7.5, midbase 1D. 3.5–5.5, 2D. 4.5–5.5, lat.line 36–43.

Total length 145–203 mm; HL 36.4–56.4 mm. The following in percent of HL: preoral 37–43; internasal 18–23; interorb. 21–27; suborb. 11–14; postorb. 27–34; orb.-preop. 33–38%; barbel 9–16; gill slit 10–18; pre-A. 137–159; V.-A. 35–58; isth.-A. 66–91; body depth 45–55; 1D.-2D. 14–27; ht. 1D. 40–59; len. P. 34–46; len. V. 27–42; post. nostril 5.1–9.0.

DESCRIPTION. — General features of fish seen in Figure 19a. Snout attenuated, armed with a slender, sharp terminal scute. Orbit oblong, diameter about two or less in snout length, about equal to interorbital width. Rictus extends posteriorly to below middle of orbit, maxillary to end of orbit. Suborbital ridge forms a sharp edge separating upper and lower parts of head; ridge scales not especially coarse. Preopercle margin sharply angular, forming a moderate lobe. Broad, translucent naked areas dorsally behind leading edges of snout. Gill opening relatively wide, extending forward to level of angle of lower jaws; gill membranes form a narrow free fold across isthmus.

Teeth small, fine, in a moderately wide band in upper jaw and extending to end of rictus; in a narrow band in lower jaw extending slightly beyond end of rictus; none of teeth enlarged, although in largest specimens, teeth overall more prominent.

Fins rather typical of most members of genus. First dorsal fin height less than postrostral length of head; pectoral and pelvic fins of about equal length; outer pelvic ray barely reaching anal fin origin.

Body scales small (Fig. 8c), evenly covered with very small, conical, spinules. In smallest specimens examined (about 140 mm TL), spinule rows in largest scales below interspace of dorsal fins with 6–9 parallel rows, in larger specimens, number of rows ranged 8–12. Scales absent from nasal fossa and suborbital shelf below anterior half of orbit. Scales on head with small erect conical spinules, those on ridges not especially thickened nor coarsely spinulated; wide area behind anterolateral margin completely naked.

Light organ like those in Iwamoto's (1990) *Caelorinchus* Group IV, with ventral streak expanded at both ends.

Body markings prominent, characterized by series of blotches, vermiculations, and spots dorsally that become long, narrow, dark streak below the second dorsal fin base extending to end of tail. Usually, dusky color of postorbital region extends posteriorly as large, elongated blotch onto trunk above pectoral fin, connected dorsally to dark surround of first dorsal fin. A large, elongated blotch above midlateral septum about where lateral line levels off, beginning at or beyond level of depressed tip of first dorsal and ending well beyond that tip. Ventral half of head and trunk probably silvery in life. Chest region and broad area around vent darkly pigmented, but ventral surfaces of abdomen relatively pale; light organ long extending as blackish streak from vent almost to isthmus. Top of head and snout mostly pale; suborbital region and gill cover peppered with prominent melanophores. Median nasal bone black. Opercle mostly black, but outer margins pale. Mouth cavity entirely pale, lips darkly punctated. Lower jaw, gular membrane, and branchiostegal membrane generally dark; underside of head otherwise mostly pale. Second spinous ray of first dorsal fin and membrane behind black; base of fin with dark margin, especially noticeable at anterior edge. Pectoral fins pale to light dusky. Pelvic fin whitish at base, pale with scattered punctations proximally and medially, blackish along outer edge and distal tip. Anal fin with blackish distal margin at anterior end, becoming pale to light dusky posteriorly, dark margined near end of tail in some.

SIZE. — A small species probably not exceeding 30 cm TL.

DISTRIBUTION. — Confined to the Arafura Sea in NT, in 107–187 m.

ETYMOLOGY. — From the Greek *pardus*, the pard, leopard, in reference to the leopardlike spots characterizing the new species.

COMPARISONS AND REMARKS. — This species was recognized by Arai (in Gloerfelt-Tarp and Kailola 1984) as an undescribed species, which he labeled as "sp. 4." It appears to be a common species at the edge of the continental shelf and upper slope, and it is one of the shallowest-living grenadiers in Australian waters.

*Caelorinchus pardus* bears close resemblance to *C. multispinosus*, a species known from off Japan south to the Philippines and the Formosa Straits. The two are very similar in most characters, but *C. multispinosus* has generally more lateral line scales over a distance equal to predorsal length (41–46 cf. usually 33–41), smaller belly scales (usually 7–9 scale rows between inner bases of pelvic fins, cf. 5–6 rows); spinules on body scales in quincunx pattern at all sizes, and more pyloric caeca (11–14 cf. 8–11). Pigmentation pattern on the body also differs. In *C. multispinosus* the formation of three dark, lateral body stripes interspersed with three pale stripes is pronounced, although the dark stripes are variously broken and the upper two are often interdigitated. In *C. pardus* only the uppermost dark stripe is well developed, the second stripe being a series of elongate blotches or spots that end rather abruptly in an elongated blotch slightly beyond a point below the tip of the depressed first dorsal fin. Considerable variation is shown in these markings in both species, but on the whole, the development of multiple stripes in *C. multispinosus* is pronounced, whereas there is only a hint of multiple stripes in the *C. pardus*. Certain proportional measurements show some differences between the two species, but there is considerable overlap in ranges: for example, preoral length (somewhat shorter at 32–36% HL cf. 33–43, but complete overlap in specimens larger than 60 mm HL), and outer pelvic fin ray (slightly shorter, 30–33% cf. 27–42%).

*Caelorinchus argentatus* is also similar to *C. pardus* but has a somewhat shorter snout (40–44% of HL), longer upper jaw (30–36%), spinules on body scales in quincunx pattern, and different body markings. *Caelorinchus gaesorhynchus* lacks prominent body markings, lacks a black spinous dorsal fin ray and black distal edge of pelvic fin, has a slightly shorter chin barbel (7% of HL) and upper jaw (22–24%), and a longer preoral (44–47%). *Caelorinchus mayiae*, with which *C. pardus* has been taken in the same trawl, has a distinctly different color pattern and spinule arrangement on scales. Slight differences also exist in preoral and upper jaw lengths.

### *Caelorinchus smithi* Gilbert and Hubbs, 1920

Fig. 22

*Coelorhynchus smithi* Gilbert and Hubbs, 1920:493–498, fig. 20 (holotype: USNM 78212; Philippines between Gillolo and Makyán islands; 545 m; *Albatross* sta. 5621).

DIAGNOSIS. — Snout about 2.0–2.3 times into HL; anterolateral margin completely supported by bone; orbit diameter 1.47–1.68 into snout length in adults, 1.7–2.0 in young; upper jaw 3.5–4.0 into HL in adults, 4.8–5.1 in juveniles, extends posteriorly to below middle one-third of orbit; barbel short, less than 1/4 orbit diameter; subopercle produced into a short, angular flap directed posteriorly. Light organ short, less than greatest diameter of posterior nostril. Nasal fossa mostly naked or covered with small scales anteriorly and ventrally; underside of head uniformly scaled with small, nonimbricate scales; body scales with 5–8 divergent rows of bladelike, imbricate spinules; scales atop snout with spinules much like those on underside but in longer ridge-rows.

SPECIMENS EXAMINED (10 spec.). — **Java:** ZMMGU uncat. (89.6 mm HL, 300+ mm TL) and CAS 202083 (94.6 HL, 338+ TL); off s. coast; 8°39'S, 111°55'E; 560–600 m; *Prof. Mesiatzev* cr. 7, tr. 46; 27.IV.1979. **NT:** NTM S.12457-006 (95.7 HL, 312+ TL); Arafura Sea, se. of Tanimbar I.; 8°36'S, 132°00'E; 525–540 m; coll. M. Sachse; 1.VII.1988. ZMMGU uncat. (4, 94–102 HL, 278+–305+ TL); Timor Sea; 13°22'S, 128°38.3'E; 525 m; *Raduga* tr. 1; 27.VIII.1966. **QLD:** AMS I.32433-004 (2, 33.7–64.2 HL, 112–195+ TL); Papua Plateau, e. of Cape York; 10°29.8'S, 144°01.4'E; 596–603 m; R/V *Franklin*; 20.VIII.1993. QM I.23633 (88.6 HL, 270 TL); off Euston

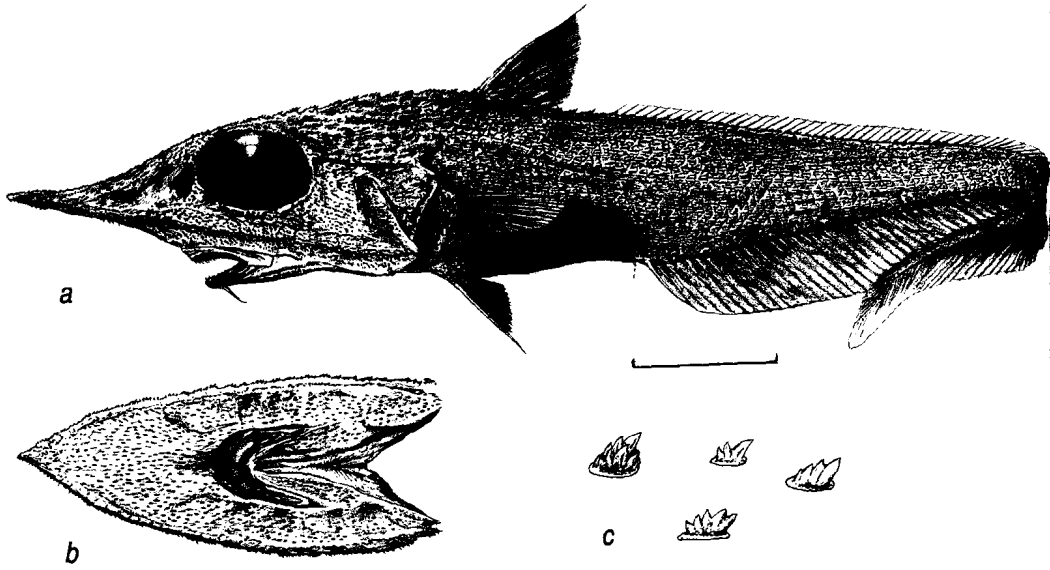


FIGURE 21. *Caelorinchus mycterismus* McMillan and Paulin. Juvenile (AMS 1.22810-009, 236+ mm TL) from 250 km northwest of Port Hedland, WA, in 736 m. (a) lateral view, fins and scales partially reconstructed; (b) ventral view of head; (c) scales from underside of head (not to scale). Scale bar represents 25 mm.

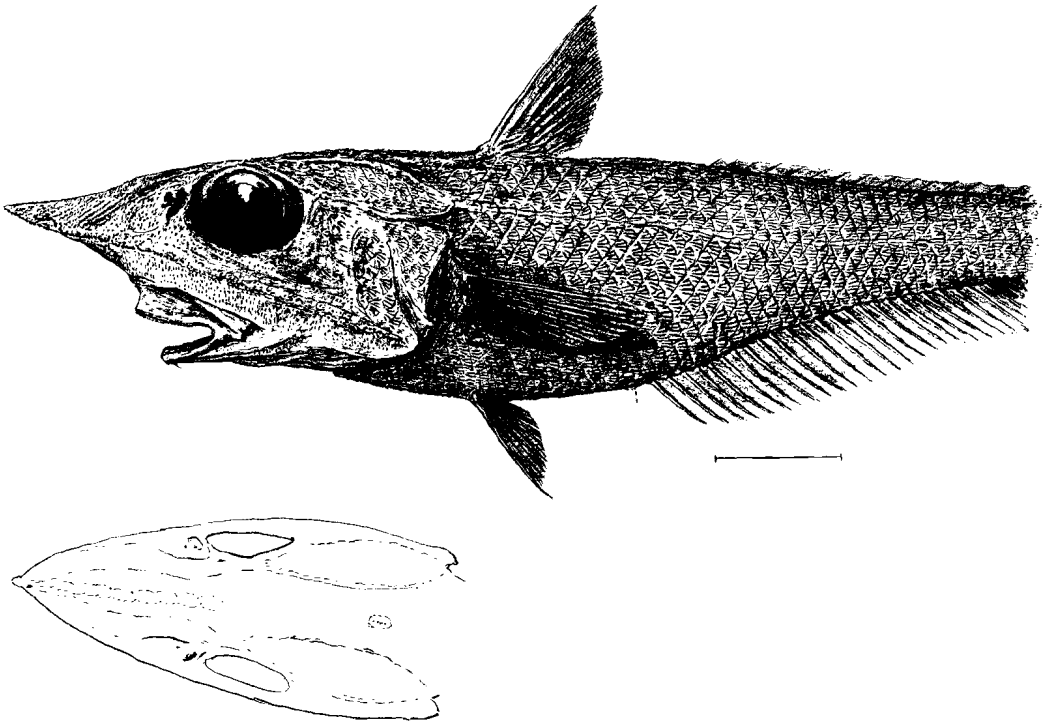


FIGURE 22. *Caelorinchus smithi* Gilbert and Smith. Adult (ZMMGU uncat., 300+ mm TL) from south coast of Java in 560–600 m. Scale bar represents 25 mm.

Reef; 16°40'S, 146°13'E; 600 m; 2.XII.1986. AMS I.21796-012 (58.5 HL, 176+ TL); ne. of Danger Pt.; 731 m; K78-23-08.

COUNTS AND MEASUREMENTS (10 spec.). — 1D. II,9; P. i16-i17; total GR-I (inner) 7-8, total GR-II (outer/ inner); 5-7/7-9; scale 1D. 5.5-6, midbase 1D. 3.5-4.5, 2D. 4.5-6, lat.line 29-37.

Total length 112-338+ mm; HL 89.6-102+ mm. The following in percent of HL: snout 41-52; preoral 35-49; internasal 17-19; interorbital 19-23; orb. 24-29; suborb. 10-14; postorb. 24-34; orb.-preop. 28-38; up.jaw 20-29; barbel 6-9; gill slit 9-14; pre-A. 131-154; V.-A. 22-51; isth.-A. 46-80; depth 36-59; 1D.-2D. 16-36; ht. 1D. 33-40 (5 spec.); base 1D. 15-19; len. P. 30-44 (7 spec.); len. V. 30-50; post. nostril 6-10.

DESCRIPTION. — General features of fish seen in Figure 22. Snout moderately long, more so in juveniles, sharply pointed in lateral view, dorsal profile slightly concave; viewed dorsally sides of snout gently convex; a sharp, slender, diamond-shaped scute at tip; anterolateral margin sharp. Orbits large, elliptic. Mouth relatively broad, slightly restricted at corners; chin barbel less than 10 percent of head length. Suborbital ridge sharp, armed with stoutly modified scales; preopercle somewhat lobelike at posteroventral corner; subopercle narrows to a short, pointed flap directed posteriorly to posteroventrally. Scales cover underside of head except along narrow ventral margin of preopercle, anteriorly on lower jaw, and over gill and gular membranes.

Premaxillary teeth in broad uniform band extending about three-fifths length of rictus; no enlarged teeth. Mandibular teeth all uniformly small, in long, narrow band extending to posterior end of rictus.

Dorsal and pectoral fins without produced rays; outer pelvic ray slightly produced, falling short of, or scarcely extending beyond, anal origin. First dorsal fin low, height much less than postrostral length, about equal to snout length. First dorsal and pelvic fins about on same vertical; pectoral fin origin slightly in advance of that vertical. Anal fin origin far posterior, below interspace of first and second dorsal fins, closer to origin of second. Base of first dorsal fin about 1.2-2.0 times into interspace between dorsals.

Body scales large, covered with sharp, bladelike spinules arranged in divergent ridge-rows, the rows complete to posterior margin of scale (Fig. 14c); posteriormost spinules in middle row often with broad lateral buttresses, producing trihedral cross-section with each leg almost equal in width; spinules in lateral rows often broadly triangular, and more or less aligned side by side, rather than back to front. Head scales large on opercle and posteriorly and dorsally on preopercle, covered with divergent ridge rows of low spinules; scales ventrally on head and above suborbital ridge and top of snout generally small; an abrupt change in scale size between upper and lower portions of preopercle. Scales atop snout and interorbital with 2-5 divergent rows of narrow, bladelike spinules of increasing height; those on underside of head nonimbricate, with erect rows of bladelike, slightly recurved spinules in one or two rows (Fig. 14b). Supraoccipital scute weakly developed.

Anus slightly removed by two or three scale rows from anal fin origin. A short, truncated light organ anterior to anus, its length less than greatest diameter of posterior nostril; a narrow black midventral streak anterior to periproct extending midway to pelvic bases, the light organ forming posterior end. In NTM S.12457-006, 26 long (to about 30 mm), slender, pyloric caeca.

Overall color dark brown to swarthy in adults, more grayish in young, belly with bluish to violet tinge; fins, mouth, gill cavities, and branchiostegal membrane black. Color of lips, external faces of premaxillary and maxillary white to dusky; gums pale; barbel pale to dusky.

SIZE. — To more than 35 cm TL.

DISTRIBUTION. — Philippines, South China Sea, Borneo, Arafura Sea, Timor Sea (NT), off south coast of Java, northern QLD, and northern NSW in 402-731 m.

COMPARISONS AND REMARKS. — The specimens from the Arafura Sea and Timor Sea represent the only records of *C. smithi* from Western Australian waters, although the species is apparently rather broadly distributed in tropical waters to the north. Our specimens agree well in all characters with the

original description of *C. smithi* and with numerous CAS paratypes. However, a slight difference in spinulation of the scales was noted. In NTM S.1247-006 the scale spinules are for the most part narrowly bladelike, without a broadly truncated posterior margin, and the posteriormost spinule in the middle row of body scales is not much different in size from the immediately anterior two or three, and the spinule is not broadly trihedral. In contrast, in two large paratypes (CAS-SU 23993) the posteriormost median spinule in most body scales is broadly trihedral, with a recurved, broad-bladed shape in lateral view, and a broad-leafed shape in dorsal view. Also, the snout shape in dorsal view is somewhat more convex in the Arafura Sea specimen. These are minor differences, however, and probably attributable to individual variation.

*Caelorinchus smithi* is closely similar to *C. charius* but the two are distinguishable primarily by the much paler overall color of *C. charius* and its slightly longer upper jaw, which ends below the posterior one-third of the orbits, whereas in *C. smithi* the upper jaw ends below the middle one-third. *Caelorinchus charius* also has a mostly pale mouth, whereas in *C. smithi* the mouth is wholly dark. In comparable-sized specimens, the scale spinules on scales below the first dorsal fin of *C. charius* are slightly more numerous in each row, more uniformly graduated in size posteriorly in each row, and the spinules lack strong, broad lateral buttresses.

*Caelorinchus smithi* resembles *C. macrorhynchus* in many features, but differs in its much shorter, somewhat broader snout (snout length 1.47–2.05 times orbit diameter cf. 2.04–2.47 in *C. macrorhynchus*), somewhat fewer gill rakers (inner GR-I 7–8 cf. 8–10, inner GR-II 6–7 cf. 9–10), fewer scale rows below the first dorsal (5–6 cf. 6–8), fewer lateral line scales over distance equal to predorsal length (29–45 cf. 38–55), and a number of proportional measurements including internasal width, interorbital width, and orbit diameter.

### *Caelorinchus thurla* new species

Fig. 23

*Coelorinchus* sp. 5: Arai, in Gloerfelt-Tarp and Kailola, 1984:85, fig.

DIAGNOSIS. — Snout 37–45% of HL, anterolateral margin of snout completely supported by bone; orbit diameter 26–29% of HL; upper jaw 22–26% of HL; subopercle prolonged into a short, narrow flap; barbel short, 6–10% of HL. Light organ a narrow black fossa extending forward from periproct region to point at same level as insertions of pelvic fins; anus slightly removed from anal fin origin. Underside of head completely naked; nasal fossa naked or with few tiny scales; body scales covered with short fine spinules arranged in 6–11 parallel rows. Prominent elongated black spot below first dorsal fin, subtending 4–8 scale rows horizontally, 4 or 5 rows vertically, and removed from pectoral fin base by about 4 scale rows; diagonal saddle mark below second dorsal fin.

SPECIMENS EXAMINED. — WA: HOLOTYPE: WAM P.21638-43 (49.0 mm HL, 210 mm TL); NW Shelf; 13°45'04"S, 123°30'00"E; *Umitaka-Maru*. PARATYPES: WAM P.21638-43 (4, 29.5 HL, 105+–187 TL); same data as for holotype. WAM P.26270-016 (2, 47.4–48.6 HL, 196–204 TL); 15°30'S, 120°58'E; 280–320 m; *Courageous* sta. 0751; 28.VI.1978. NT: NTM S.13147-003 (45.1 HL, 173+ TL); Arafura Sea; 9°47'S, 130°26'E; 255 m; coll. D. Evans; 9.XII.1990. NTMS S.13580-002 (4, 36.0–47.9 HL, 136+–206 TL); Arafura Sea; 9°04.7'S, 133°04.7'E; 179–205 m; coll. R. Williams; 20.X.1992.

COUNTS AND MEASUREMENTS. — ID. II, 8–9, 2D. 75–88; P. i14–i16; total GR-I (inner) 6–8, GR-II (outer/inner) 5–6/6–7; scales 1D. 5–7, midbase 1D. 4.5–5, 2D. 5.5–7, lat.line 30–37; 23 caeca (1 spec.).

Total length 105+–210 mm; HL 29.5–49.0 mm. The following in percent of HL: preoral 32–40; internasal 16–19; interorb. 18–21; suborb. 12–15; postorb. 29–35; orb.-preop. 33–38; gill slit 11–14;

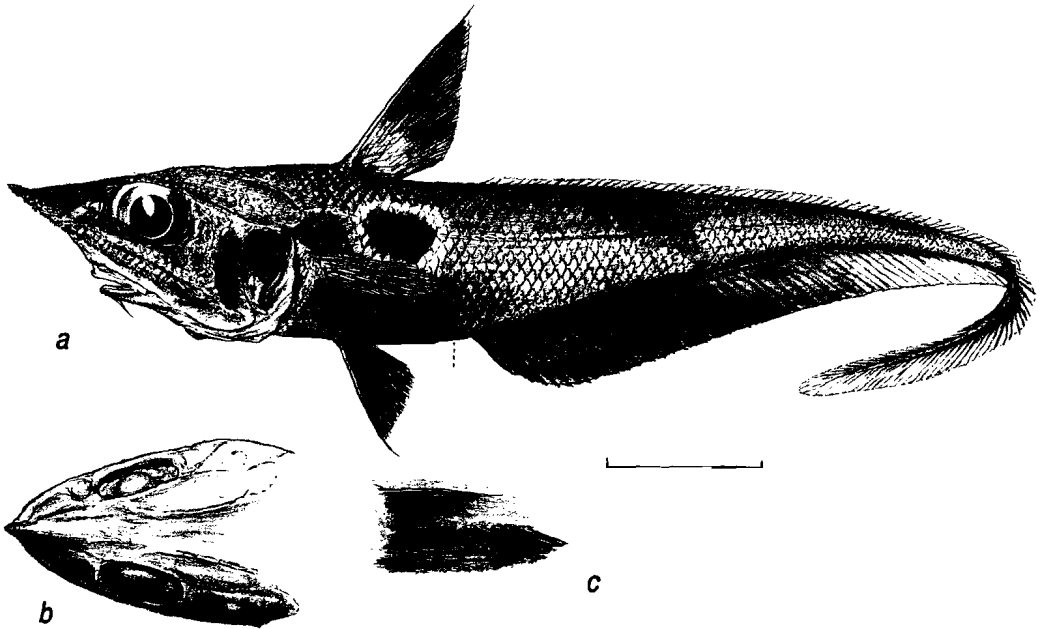


FIGURE 23. *Caelorinchus thurla* n.sp. Holotype (WAM P21638-43, 210 mm TL); off North West Shelf, WA: (a) lateral view, scales and fins partially reconstructed; (b) dorsal view of head; (c) paratype (187 mm TL), same locality as holotype, ventral view of abdomen showing shape and position of light organ and anus. Fins and scales in (a) partially reconstructed. Scale bar represents 25 mm.

pre-A. 140–161; V.-A. 29–41; isth.-A. 54–71; body depth 52–59; 1D.-2D. 24–34; ht. 1D. 58–70; len. P. 43–49; len. V. 41–49; len. base 1D. 18–25; post. nostril 8–11.

**DESCRIPTION.** — General features of fish seen in Figure 23. Snout of moderate length for genus, much longer than orbit diameter, which goes about 1.5–1.6 times into length of snout; snout sharply pointed in lateral profile, more broadly pointed in dorsal view, tipped with sharp spiny scute, which in smaller specimens more elongated than in larger representatives. Orbits oblong, about equal to postorbital length of head. Mouth small, upper jaw length less than orbit diameter, posterior margin of maxilla extending to below middle of orbit or slightly beyond. Barbel fairly thick proximally, rapidly tapering to fine tip. Suborbital ridge well developed, formed of series of stout spiny scales. Posteroventral corner of preopercle somewhat angular, not especially produced. Gill membranes rather broadly attached to isthmus, restricting opening of gill covers.

Premaxillary teeth in short broad band that falls well short of posterior end of rictus; mandibular teeth in narrow tapering band that extends to beyond rictus. No enlarged outer row of teeth.

Except for outer pelvic ray, none of fins with produced rays. Second dorsal fin poorly developed over most of length; other fins typical for genus.

Body scales (Fig. 14e) covered with needlelike spinules in parallel to slightly diverging rows. Supraoccipital scute elongated and relatively well developed, with strong median row of enlarged spinules. A weakly scutelike scale above origin of lateral line.

Light organ typical of Iwamoto's (1990) Group II, externally visible as short, narrow black fossa between pelvic fins (Fig. 23c). Anus removed from anal fin origin by three or four scale rows.

Body color brownish overall, somewhat creamy white on underside of head, lips, barbel, and gums. Gular and branchiostegal membranes all whitish except dorsally on branchiostegal somewhat blackish from underlying dark lining of gill cavity. Gill chamber linings dark, but paler along outer ventral walls; gill arches and rakers dusky, filaments paler. Mouth and gullet mostly dark but paler

near mouth opening; gums and lips cream colored. Abdomen with bluish tinge; dark area ventrally extends onto all of chest, but not much dorsally onto trunk. A prominent ocellated spot overlying anterior end of lateral line. Fainter, elongated saddle mark, shaped more like a diagonal band in some specimens, below second dorsal and separated from pectoral spot by distance about equal to snout length or length of snout and orbit. First dorsal fin dusky but darker distally; pectoral fin lightly dusky; pelvic fins blackish, densely covered with large melanophores; anal fin with larger melanophores anteriorly and distally, giving a dark appearance, but fin pales posteriorly to dusky, becoming completely pale near distal end.

SIZE. — To about 21 cm TL.

DISTRIBUTION. — So far known only from the Arafura Sea in Northern Territory and the North West Shelf of Western Australia, in 179–320 m.

ETYMOLOGY. — From the Australian Yindjibarndi word *thurla*, meaning eye, in reference to the characteristic shoulder spot and to the name of its sister species, *C. argus*. It is treated as a noun in apposition.

COMPARISONS AND REMARKS. — *Caelorinchus thurla* is similar to *C. argus* in most features, but differs in having a shallower and more posteriorly placed pectoral spot. In *C. argus* the spot is distinctly rounded, about 6 rows deep, and closely placed near the pectoral fin, being removed by only 2 or 3 scale rows from the pectoral fin base, with the anterior margin below the origin of the first dorsal fin. In *C. thurla* the spot is normally oblong, only 4 or 5 rows deep and removed from the pectoral fin base by 4 or 5 scale rows. Furthermore, the scales in *C. thurla* are somewhat smaller, about 4.5–5.0 rows below the midbase of the first dorsal (compared with 4.0–4.5 in *C. argus*) and 5.5–7.0 rows below the origin of the second dorsal fin (compared with 4.5–6.0). The preoral length is also somewhat shorter (34–39% cf. 37–45%), the internasal somewhat wider (16–19% cf. 14–17%), and the suborbital somewhat broader (13–15% cf. 11–13%).

***Caelorinchus trachycarus* Iwamoto, McMillan, and Shcherbachev, 1999**

Fig. 24

*Caelorinchus trachycarus* Iwamoto, McMillan, and Shcherbachev, 1999:49–54.

DIAGNOSIS.—A species of *Caelorinchus* in Iwamoto's (1990) Group I, with underside of head mostly scaled; anterolateral snout margin incompletely supported by bone; nasal fossa and triangular area bordered by fossa, orbit, and suborbital ridges naked; orbit 1.4–1.9 into snout length; head ridges especially spiny; broad margins of naked skin on preopercle and lower jaw; color dark swarthy with violet to purple tinge, fin rays black; body scales with usually 7–10 rows of spinules, the middle row highest; neuromasts on head prominently black; anus immediately before anal fin, without external trace of light organ; pyloric caeca 7–9.

SPECIMENS EXAMINED (10 WA specimens from type series).—WA: NMV A6189 (2 paratypes, 93.4–121 mm HL), NMV A6190 (1 paratype, 77.5 HL), sw. of Esperance, 1,015–1,030 m. AMS I.18712-015 (1 paratype, 99 HL), ZMMGU uncat. (6 paratypes, 96–117.7 HL), 1,080–1,100 m.

COUNTS AND MEASUREMENTS (from original description). — 1D. 11,7–9; P. i15–i18 (i20, i21); scales 1D. 4.5–7 (9), midbase 1D. 3.5–6, 2D. 4.5–6.5, lat.line 28–37 (42); caeca 7–9.

The following in percent of HL: snout length 39–49; preoral 36–48; internasal 18–23; interorb. 20–27; orb. 22–30; suborb. 14–17; postorb. 26–34; orb.-preop. 26–37; up.jaw 17–24; barbel 4–9; pre-A. 141–171; body depth 39–58; 1D.-2D. 18–33; ht. 1D. 37–59; len. P. 32–41; len. V. 28–46.

SIZE.—To about 51 cm TL.

DISTRIBUTION.—Southern Australia to New Zealand, in 1,015–1,234 m.

COMPARISONS AND REMARKS.—This recently described species is most similar to *C. acanthiger* but the two can be readily separated because *C. trachycarus* has relatively much coarser, more spiny

scales of the head, more extensive naked areas, especially on the preopercle and anteriorly on the suborbital shelf behind the nasal fossa, darker overall color, especially the black fins, and violet to purplish tinge on naked areas. Scales are somewhat smaller in *C. acanthiger*, although there is overlap in scale row counts (scale rows below 1D. usually 5.5–7 in *C. trachycarus* cf. 7–10 in *C. acanthiger*, below midbase 1D. 3.5–6 cf. 5.5–7, and lateral line scales 28–37 cf. 34–49).

### *Cetonurichthys* Sazonov and Shcherbachev, 1982

The generic diagnosis provided by Sazonov and Shcherbachev (1982) for *Cetonurichthys* is very similar to that for *Cetonurus*, as given in their later paper (Sazonov and Shcherbachev 1985). The following additional characters may be used to distinguish *Cetonurichthys*: pelvic fin distinctly posterior to line through first dorsal and pectoral fin bases; lateral line interdigitated, a series of elongate pores covered by a transparent membrane, each about 2.0–2.5 scales in length; pores separated by about 2.0–2.5 scales anteriorly, about 7 scales posteriorly; one pair of neuromasts located medially on border of each pore; margin of pore pigmented, about 6–7 rows of teeth at symphysis of upper and lower jaws; tooth patches broad, together forming crescent-shaped band in each jaw; lips fleshy, well developed at angles of mouth, with conspicuous development of branched papillae; mouth noticeably protrusible.

Only the single species known.

### *Cetonurichthys subinflatus* Sazonov and Shcherbachev, 1982

Fig. 25

*Cetonurichthys subinflatus* Sazonov and Shcherbachev, 1982b:8–11 (holotype ZMMGU P296, off nw. coast of Australia; 16°55'S, 114°53'E, 1,600–1,700 m). Williams et al. 1996:149 (WA). Grandperrin et al. 1997:117 (New Caledonia off Norfolk Ridge).

DIAGNOSIS. — Head broad, shallow, interorbital 31–34% of HL; snout 36–42% HL, with paired tubercular scales at tip; suborbital 17–20% HL, ridge lacking stout scutelike scales; jaws short, upper jaw 24–28% HL, inferior; tooth rows short, crescent-shaped, outer premaxillary series enlarged. Cephalic sensory canal moderately dilated, lacking open pores; lateral line canal with modified scales, interrupted in places. Trunk scales small (11–13 rows between origin of first dorsal fin and lateral line), bearing erect spinules in no particular arrangement; scales along dorsal fins larger than surrounding ones; head completely scaled, including patches on gular and branchiostegal membranes. Spinous second ray of first dorsal fin with small serrations; pelvic fins with 8–9 rays, outer ray elongated. Anus midway between bases of anal and pelvic fins; periproct narrow; no dermal window of light organ. Eleven trunk vertebrae. (After Sazonov and Shcherbachev 1982:8).

SPECIMENS EXAMINED. — WA: CSIRO H2551-16 (64.5 mm HL, 363+ mm TL) and CSIRO H2551-13 (79.0 HL, 395+ mm TL); off NW Cape; 1,460–1,500 m; SS1/91/12.

COUNTS AND MEASUREMENTS (based on 2 spec.). — 1D. 11.9–10; P. 11.5–11.7; V. 8; total GR-I (inner) 8–9, GR-II (outer/inner) 8/7–8; scales 1D. 11.5–13.0, midbase 1D. 8.5–12.0, 2D. 10.0–11.5.

Total length 363–395+ mm; HL 64.5–79.0. The following in percent of HL: postrostral 62–63; snout 39–40; preoral 29–31; internasal 27–30; interorb. 30; orb. 23; suborb. 18–19; postorb. 39–41; orb.-preop. 35–37; up.jaw 26–27; barbel 8; outer gill slit 10; pre-A. 154–160; body depth 76–83; pre-vent 141–151; isth.-A. 67–68; 1D.-2D. 33–37; ht. 1D. 91–94; len. V. 45–56; post. nostril 8–10.

SIZE. — To at least 40 cm TL.

DISTRIBUTION. — Known from only five specimens, including our two, from two locations north and east of the Exmouth Plateau, North West Cape, WA. Depth range 1,316–1,700 m.



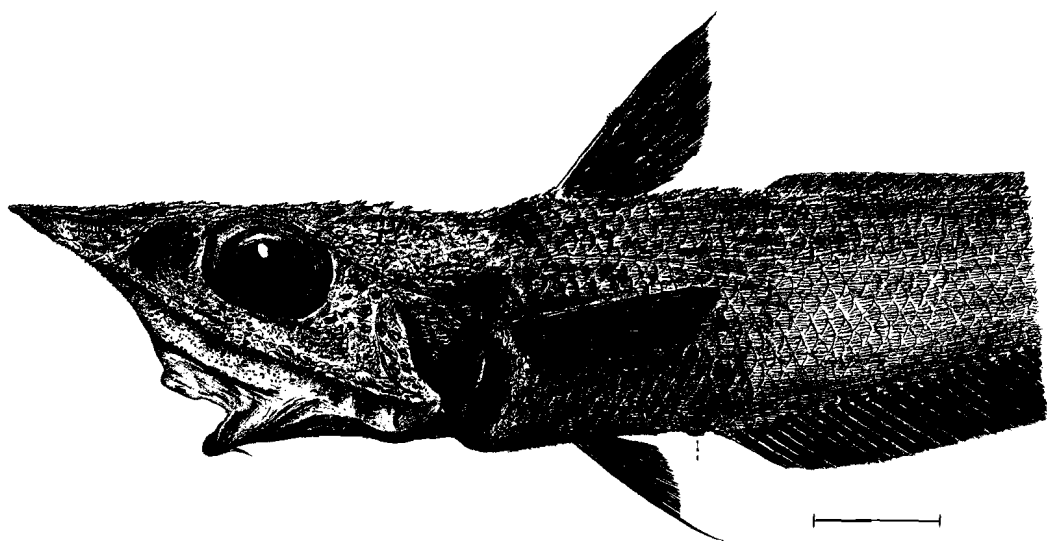


FIGURE 24. *Caelorinchus trachycarus* Iwamoto, McMillan, and Shcherbachev, 1999. Paratype (100 mm HL, 350+ mm TL), AMS I.18712-015, from off southern Australia. Fins and scales partially reconstructed. Scale bar equals 25 mm.

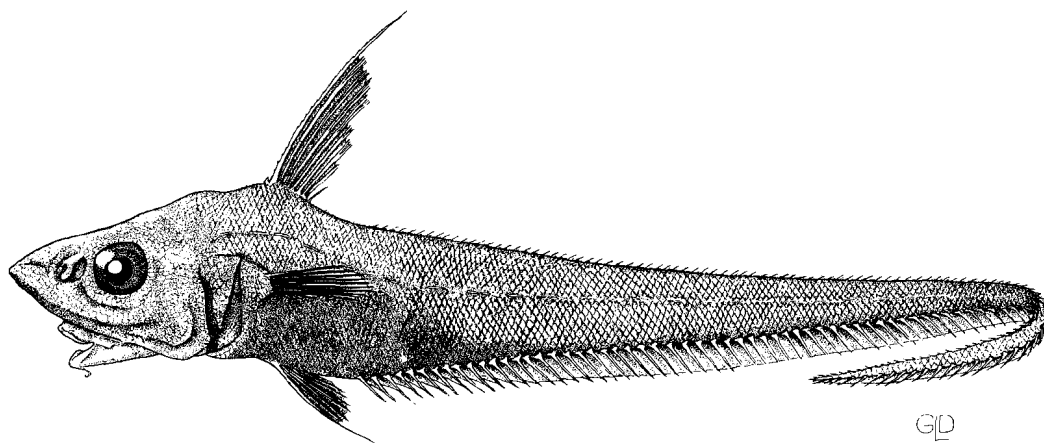


FIGURE 25. *Cetonurichthys subinflatus* Sazonov and Shcherbachev. CSIRO H2551-16 (395+ mm TL) from off North West Cape, WA, in 1,460–1,500 m. Drawn by Georgina L. Davis.

COMPARISONS AND REMARKS. — Our counts and proportional measurements slightly extended the ranges given by Sazonov and Shcherbachev (1982). This is not surprising considering that our specimens are the largest two of the five known. One noteworthy difference was the greater number of tooth rows in our specimens: six or seven rows at the symphysis of both jaws, compared to three reported in the type specimens.

In our specimens the pelvic fin origin was distinctly posterior to a vertical line through the posterior margin of the pectoral fin base. Sazonov and Shcherbachev (1982) described the position as “on the line or slightly posterior to it.” In the larger of our specimens, a well-developed elongate scale patch on the midline of the gular membrane extended posteriorly to a vertical through the

posterior margin of the orbit; on each side of the midline, a large oval scale patch (about 0.5 of orbit) was present on the anterior portion of the lower branchiostegal membranes; scattered scales linked these patches with the gular patch.

### *Cetonus* Günther, 1887

See Sazonov and Shcherbachev (1985) for diagnostic characters and a comprehensive discussion of this genus. Two species recognized, only one of which was found in our study material.

### *Cetonus globiceps* (Vaillant, 1884)

Fig. 26

*Macrurus globiceps* Vaillant in Filhol, 1884:183, fig. 2 (name and figure; name attributed to Vaillant).

*Cetonus globiceps*: McMillan in Gomon et al. 1994:345, fig. 306 (NSW, VIC, GAB, 950–1,200 m). Williams et al. 1996:149 (WA)

DIAGNOSIS. — Orbit 24–28% of HL; scale rows below origins of first and second dorsal fins, respectively, 16–18 and 10–19 (usually 14–15); 3–4 rows of closely spaced teeth on premaxilla.

SPECIMENS EXAMINED. — **WA**: CSIRO H2581-04 (77.0 mm HL, 366+ mm TL, CSIRO H2581-03 (84.0 HL, 375+ TL), CSIRO H2581-05 (79.5 HL, 364+ TL), and CSIRO H2581-08 (76.0 HL, 358+ TL); ssw. of Shark Bay; 996–1,009 m; SS1/91/44. CSIRO H2593-02 (84.0 HL, 275+ TL); w. of Leander Pt.; 942–970 m; SS1/91/58. CSIRO H3017-05 (68.1 HL, 298+ TL); off Cape Leeuwin; 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; coll. A. Williams; 24.XII.1989. **TAS**: CSIRO H1579-49 (12, 44.0–77.0 HL, 170+–310+ TL), w. coast; 792–830 m; SO3/86/37.

Also examined for comparison: holotype of *Cetonus crassiceps*, BMNH 87.12.7.108 (66.3 HL, 272 TL); n. of Kermadec Is.; 650 fathoms [1189 m]; *Challenger* sta. 170; 14.VII.1874.

COUNTS AND MEASUREMENTS (based on 10 spec.). — 1D. II,9; P. i15–i17; total GR-I (inner) 11–13, GR-II (outer/inner) 10–12/10–12; scales 1D. 18–19, midbase 1D. 15–17, 2D. 14–16.

Total length 275+–375+ mm; HL 68.8–84.0 mm. The following in percent of HL: snout 36–42; preoral 32–41; internasal 40–44; interorb. 41–45; suborb. 24–27; postorb. 43–50; orb.-preop. 42–53; up.jaw 28–33; pre-A. 129–142; pre-vent 128–133; V.-A. 46–52; isth.-A. 48–58; body depth 86–98; 1D.-2D. 28–39; ht. 1D. 47–53; len. P. 41; post. nostril 4–6.

SIZE. — To at least 38 cm TL.

DISTRIBUTION. — Circumglobal, recorded from the North and South Atlantic oceans, off the Indo-Malayan Archipelago, and Japan; western, central, and eastern Indian Ocean; southern Australia and New Zealand (Sazonov and Shcherbachev 1985). Widely distributed down the western coast of Australia in depth from 740 m to 1,500 m.

COMPARISONS AND REMARKS. — Some confusion exists regarding the distribution of *Cetonus* species in Australian waters. *Cetonus globiceps* was reported from southern Australia by Sazonov and Shcherbachev (1985), although only *C. crassiceps* is recorded by Paxton et al. (1989). More recently, Gomon, Glover, and Kuitert (1994) identified *C. globiceps* as the only species occurring in southern Australian waters, an observation consistent with the material examined during this study. The distribution of *C. crassiceps* appears to be disjunct, with populations in the central and southern Atlantic Ocean and the mid-central and southern Pacific Ocean.

Several characters may be used to differentiate *C. globiceps* from *C. crassiceps*. Comparison of data for *C. crassiceps* provided by Sazonov and Shcherbachev (1985) shows *C. globiceps* off WA have a distinctly larger orbit (24–28% HL cf. 18–23%) and smaller scales (18–19 rows below 1D. and 14–16 rows below 2D., cf. 11–14 and 9–13, respectively). Additionally, three to four rows of closely spaced teeth occur on the premaxilla, compared with two rows of sparse teeth in *C. crassiceps*.

Sazonov and Shcherbachev (1985) also use the presence of a band of naked skin adjacent to the anal fin in *C. crassiceps* and its absence in *C. globiceps* to differentiate the two species. However, this is a variable character in the BMNH type specimens of *C. crassiceps* and may not be definitive.

*Cetonus globiceps* was one of the most abundant grenadiers on the mid-continental slope region off Western Australia, representing about 21% of the total grenadier biomass (AW, personal data).

### *Coryphaenoides* Gunner, 1765

For more recent treatments and diagnoses of this genus see Iwamoto and Sazonov (1988), Iwamoto (1990), Iwamoto and Shcherbachev (1991), and Shcherbachev and Iwamoto (1995). Representatives of this diverse genus were relatively sparse in collections from Western Australia, probably because only a small percentage of trawls were made at depths exceeding 1,000 m. The primary vertical distribution of the genus appears to be at midslope to lower-slope depths, between roughly 800 and 2,000 m. Many of the species, especially of the subgenera *Chalinura* and *Lionurus*, are deeper living, commonly found at depths between 2,000 and 4,000 m. One species, *C. yaquinae* Iwamoto and Stein, 1974 of the North Pacific, is known from greater than 6,000 m. Undoubtedly, future work in deeper waters off WA will result in a much-expanded list of *Coryphaenoides* species. Notably absent from our list were the common, widespread abyssal species *C. armatus* Hector, 1875 and *C. filicaudus* (Günther, 1878). In addition, *C. mcmillani* Iwamoto and Shcherbachev, 1991 and *C. murrayi* Günther, 1878, both known from off VIC, should be expected off the southern coast of WA.

More than 60 species, only four so far known from Western Australia.

#### KEY TO SPECIES OF *CORYPHAENOIDES* FROM WESTERN AUSTRALIA

- 1a. Pelvic fin rays 7; large, conspicuous, tubercular scutes at tip and lateral angles of snout; spinules on body scales leaf-shaped or lanceolate . . . . . *C. serrulatus*
- 1b. Pelvic fin rays 8–12; snout tipped with rather inconspicuous tubercular scales; spinules on body scales conical . . . . . 2
- 2a. Pelvic rays 11–12 . . . . . *C. striatulus*
- 2b. Pelvic rays 8–10 . . . . . 3
- 3a. Outer gill slit greatly restricted, 6–9% of HL; outer gill rakers 3 or 4 . . . . . *C. rudis*
- 3b. Outer gill slit 17–24% of HL; outer gill rakers 7–9 . . . . . *C. sp.*

### *Coryphaenoides rudis* Günther, 1878

Fig. 27

*Coryphaenoides rudis* Günther, 1878:24 (n. of Kermadec Is., 1,152 m, *Challenger* sta. 170A). Williams et al. 1996:149 (WA).

*Macrurus (Macrurus) rudis*: Günther, 1887:131.

*Nematonurus macrocephalus* Maul, 1951:17 (Madeira).

*Macrourus paradoxus* Smith and Radcliffe in Radcliffe 1912:115–116, pl. 25, fig. 1 (Philippines).

*Coryphaenoides paradoxus*: Iwamoto and Sazonov, 1988:72–75, figs. 3c, 24, 28 (central and se. Pacific).

DIAGNOSIS. — Pelvic fin rays 9–10 (rarely 8 or 11); GR-I about 3 or 4 in outer, 9 or 10 in inner series; premaxillary teeth in narrow band, with an enlarged outer series; mandibular teeth in about 3 irregular series anteriorly, becoming uniserial posteriorly; orbit diameter 17–20% of HL, preoral length 10–12%, barbel length 15–20%, length outer gill slit 6–9%; body scales relatively adherent, densely covered with small, short, conical spinules in an irregularly quincunx or divergent-row pattern.

SPECIMENS EXAMINED. — **WA**: CSIRO H2551-14 (600 mm TL); w. of NW Cape; 1,460–1,500+ m; SS1/91/12. CSIRO H2552-13 (540 TL); nw. of Point Cloates; 1,305 m; SS1/91/13. CSIRO

H2561-03 (1 spec.); w. of Cape Cuvier; 1,320 m; SS1/91/23. NSW: AMS I.29340-001 (144 HL, 710 TL); off Sydney; 1,120–1,170 m; K89-13-02.

COUNTS AND MEASUREMENTS (data compiled mostly from Marshall and Iwamoto 1973; Iwamoto and Sazonov 1988; and Shcherbachev and Iwamoto 1995). — ID. II,9–11; P. i19–i21 (rarely i17 or i18); GR-II (outer/inner) 8–10 /9; scales 1D. 7–9, midbase 1D. 5.5–7.5, 2D. 5.5–6.5, lat.line 30–47; caeca 12–16.

The following in percent of HL: snout 23–29; preoral 10–12; internasal 17–19; interorb. 26–35; suborb. 14–15; postorb. 57–59; orb.-preop. 51–57; up.jaw 37–43; pre-A. 156–168; V.-A. 48–55; body depth 80–100; ht. 1D. 43–73; len. P. 45–63; len. V. 50–111 (usually 50–70).

SIZE. — A large species, to at least 120 cm TL.

DISTRIBUTION. — Widespread in Atlantic, Pacific, and Indian oceans. In Australia, known from NSW and WA (nw. coast), in 1,120–1,700 m.

COMPARISONS AND REMARKS. — *Coryphaenoides rudis* is unlikely to be confused with the other three species of the genus from WA because of its pelvic fin ray count and low gill raker numbers. The other three species have more and much better-developed gill rakers, especially on the outer series of the first arch. Iwamoto and Sazonov (1988) treated the species (as *C. paradoxus*) in detail; Shcherbachev and Iwamoto (1995) synonymized *C. paradoxus* and *C. macrocephalus* with *C. rudis*.

### *Coryphaenoides serrulatus* Günther, 1878

Fig. 28

*Coryphaenoides serrulatus* Günther, 1878:26 (ne. of New Zealand; 1,280 m). McMillan in Gomon et al. 1994:356, fig. 316 (descr.; NSW, VIC, TAS, and New Zealand; 600–1,000 m). Williams et al. 1996:149 (WA).

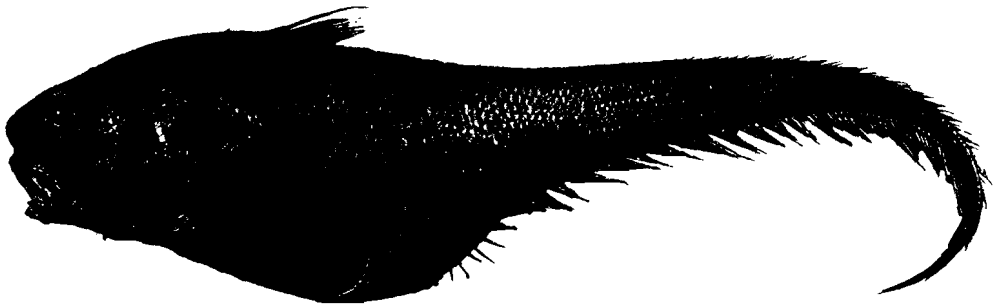
*Coryphaenoides s. serrulatus*: Iwamoto and Shcherbachev, 1991:218–221 (NSW, TAS, VIC, SA and New Zealand; 540–1,100 m).

DIAGNOSIS. — Pelvic fin rays 7; GR-I 7–9 in outer, 11–14 in inner series; premaxillary with moderately wide band of small inner teeth flanked by enlarged teeth with arrowhead-shaped tips; mandibular teeth in one row except about two at symphysis; orbit diameter 32–37% of HL, preoral length 12–18%, barbel 23–30%, outer gill slit 16–23%; body scales covered with small, greatly reclined, lanceolate spinules aligned in somewhat converging rows.

SPECIMENS EXAMINED. — WA: NMV A6192 (2, 405–425 mm TL); 95 km sw. of Esperance; 34°35.5'S, 121°19'E; 1,015–1,030 m. NSW: NMV A17 (285 TL) and NMV A9077 (2, 358–442 TL); 56 km ene. of Nowra; 34°43.95'S, 151°14.74'E; 1,009–817 m. NMV A5783 (336 TL); off Nowra; 35°00.0'S, 151°16.3'E; 1,100 m. VIC: NMV A3400 (5 spec.); 38 km sw. of Cape Bridgewater; 38°38'S, 141°04'E; 990–1,100 m. NMV A3412 (2 spec.); 45 km sw. of Cape Bridgewater; 38°36'S, 140°59'E; 1,040–1,170 m. NMV A6937 (2, 356–391 TL); s. of Point Hicks; 38°21.9'S, 149°20.0'E; 1,000 m. SA: NMV A5881 (2, 319–404 TL); 110 km w. of Robe; 37°19.04'S, 138°31.05'E; 990–1,000 m. CSIRO T1877-02 (1 spec.); w. of Cape Banks; 37°47'S, 139°39'E; 500–520 m; *Margaret Philippa*; 6.XII.1984. TAS: CSIRO T359 (1 spec.), T381 (1 spec.); e. of Bicheno; 41°48'S, 148°38'E; 950–1,099 m; *Challenger*; coll. M. Wilson; 21.IV.1982. CSIRO T362 (1 spec.); e. of Long Pt, 41°46'S, 148°37'E; 830–850 m; *Bluefin*; coll. R. Green; 18.V.1982. CSIRO T399 (1 spec.); nw. of Cape Sorell; 42°25'S, 144°43'E; 956–835 m; *Petuna Endeavour*; coll. K. Evans; 7.VI.1982. CSIRO T519 (476 TL); w. of Sandy Cape; 41°19'S, 144°03'E; 864–943 m; *Challenger*; coll. M. Wilson; 15.XII.1981. CSIRO T527 (1 spec.); sw. of King I.; 40°44'S, 143°30'E; 920–927 m; *Challenger*; coll. M. Wilson; 16.XII.1981. CSIRO T570 (360 TL), T578 (378 TL), T599 (343 TL), T601 (357 TL), T618 (321 TL), T807 (298 TL); sw. of King I.; 40°42'S, 143°29'E; 942–1,058 m;



FIGURE 26. *Cetonurus globiceps* (Vaillant). CSIRO H.2593-02 (275+ mm TL) from off Geraldton, WA, in 942–970 m.



20 cm

FIGURE 27. *Coryphaenoides rudis* Günther. CSIRO H2561-03, from west of Cape Cuvier, WA, in 1,320 m.

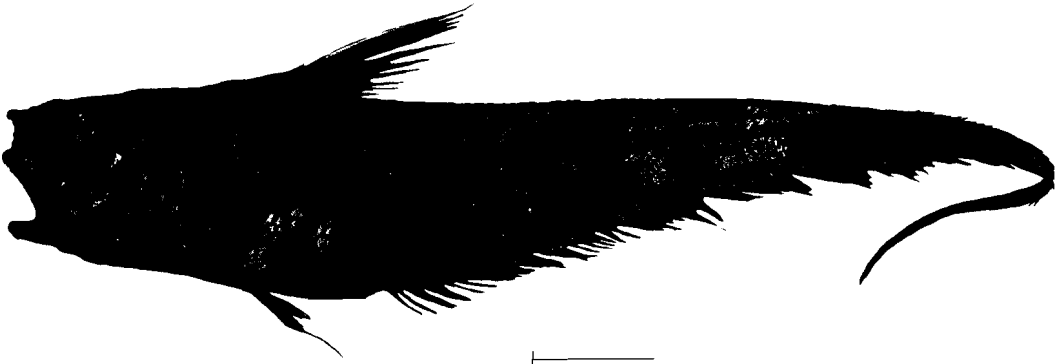


FIGURE 28. *Coryphaenoides serrulatus* Günther. CSIRO H3008-13, from southwest of Albany, WA, 842 m.

*Challenger*; coll. M. Wilson; 9.I.1982. CSIRO T591 (1 spec.); sw. of King I.; 40°44'S, 143°30'E; 920–927 m; *Challenger*; coll. M. Wilson; 16.XII.1981. CSIRO T658 (328 TL); ne. of Flinders I.; 39°05'S, 148°43'E; 947 m; 1983. **Southern Ocean, South Tasman Rise**: NMV A3689 (270 TL); 47°42.0'S, 148°10.0'E; 1,200 m. NMV A3711 (320 TL); 47°29.0'S, 148°29.0'E. NMV A3719 (310 TL) and NMV A3721 (230 TL); 47°29.0'S, 148°30.0'E.

COUNTS AND MEASUREMENTS. — 1D. II,9–11; P. i18–i24; (outer/inner) GR-II 10–14/10–14; scales 1D. 5.5–7.5, midbase 1D. 5.5–7.5, 2D. 7–10, lat.line 35–41; caeca 14–23.

The following in percent of HL: snout 26–31; internasal 16–19; interorb. 20–24; suborb. 11–14; postorb. 43–50; orb.-preop. 37–45; up.jaw 39–44; pre-A. 148–186; V.-A. 44–67; isth.-A. 86–116; body depth 74–108; 1D.-2D. 57–107; ht. 1D. 76–102; len. P. 50–74; len. V. 50–80.

SIZE. — To more than 48 cm TL.

DISTRIBUTION. — Off New Zealand, southern Australia (NSW, TAS, VIC, SA, and WA), and oceanic elevations of the Indian Ocean, in 540–1,255 m.

REMARKS. — Iwamoto and Shcherbachev (1991) found geographic differences in a number of characters and accordingly designated the oceanic population in the Indian Ocean as a distinct subspecies. Specimens from the Great Australian Bight differed slightly from those captured off New Zealand and in the Tasman Sea (including off the east coast of Tasmania), but the differences were insufficient to warrant recognition of another subspecies. Among the 4 species of the genus from WA, *C. serrulatus* can be easily distinguished by the presence of large terminal and lateral snout scutes, 7 pelvic fin rays, and lanceolate scale spinules. The closely similar *C. mcmillani* Iwamoto and Shcherbachev, 1991 has a smaller, more-upturned terminal snout scute, more pelvic fin rays (8 or 9), a rudimentary barbel, and needlelike scale spinules.

### *Coryphaenoides striaturus* Barnard, 1925

Fig. 29

*Coryphaenoides (Chalinura) striatura* Barnard, 1925:500, 501 (off Cape Point, South Africa, in 823–1,737 m). *Coryphaenoides striaturus*: Iwamoto and Shcherbachev, 1991:214–217 (s. hemisphere distr., from se. Atlantic to New Zealand; 823–2,010 m). Williams et al. 1996:149 (WA).

DIAGNOSIS. — Pelvic fin rays 11–12 (usually 12); GR-I 7–11 in outer, 12–16 in inner series; premaxillary teeth in broad cardiform band flanked by an outer row of enlarged, slender, widely spaced canines; mandibular teeth in one irregular row; orbit diameter 18–24% of HL, preoral length 10–16%; barbel length 18–26%, outer gill slit 16–23%; body scales rather deciduous, covered with short, slender spinules aligned in 9–14 low parallel rows. (Adapted from Iwamoto and Shcherbachev 1991.)

SPECIMENS EXAMINED. — **WA**: CSIRO H2617-09 (460 mm TL); w. of Bunbury; 33°15.8'S, 114°11.1'E; 982 m; SS1/91/85. CSIRO H3017-06 (1 spec.); nw. of Cape Leeuwin; 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; A. Williams; 24.XII.89. CSIRO T298 (1 spec.); Great Australian Bight; 33°27'S, 128°36'E; 1,027–1,044 m; *Margaret Philippa*; coll. K. Evans; 24.XI.1984. **VIC**: CSIRO H1519-06 (1 spec.); s. of Warrnambool; 39°12.3'S, 142°30.0'E; 1988. **TAS**: CSIRO H1260-19 (1 spec.); se. of St. Patricks Head; 1,195–1,185 m; SO2/88/87. CSIRO H1523-02 (1 spec.); w. of Low Rocky Point, 42°54.5'S, 144°45.9'E; 1,785 m; 1988.

COUNTS AND MEASUREMENTS (from Iwamoto and Shcherbachev 1991). — 1D. II,8–10; P. i18–i24; GR-I (outer/inner) 11–14/11–15; scales 1D. 7.5–10, midbase 1D. 5–7.5, 2D. 8–9, lat.line 30–36; caeca 9–12.

Total length 120–550 mm; HL 21–97 mm. The following in percent of HL: snout 26–30; internasal 20–28; interorb. 23–30; suborb. 11–15; postorb. 51–57; orb.-preop. 46–53; up.jaw 38–46;

pre-A. 152–180; V.-A. 42–74; body depth 81–103; ht. 1D. 81–109; len. P. 56–68; len. V. 65–97; post. nostril 3–7.

SIZE. — To about 55 cm TL.

DISTRIBUTION. — From the se. Atlantic, s. Africa, Indian Ocean between about 25°S to 35°S, s. Australia including WA, SA, VIC, TAS, NSW, Tasman Sea, and New Zealand, in 823–2,010 m (data mostly from Iwamoto and Shcherbachev 1991).

COMPARISONS AND REMARKS. — The completely scaled underside of snout, pelvic ray count, relatively numerous gill rakers, and features of the dentition and body scales together serve to distinguish *C. striaturus* from its congeners.

The species is widespread in southern temperate waters of the eastern hemisphere at depths usually between 1,000 m and 1,400 m. It appears to be relatively abundant in places, but off WA the species was uncommon and not captured north of Cape Leeuwin (about 35°S).

### *Coryphaenoides* sp.

Fig. 30

*Coryphaenoides* (*Coryphaenoides*) sp. indet. Iwamoto, 1986:355 (s. Africa, Mozambique; 696–960 m).

*Coryphaenoides* (*Coryphaenoides*) *rudis* (nec Günther, 1887): McCann and McKnight, 1980:35, figs. 16, 17, 18 (part) (New Zealand; 2,993 m).

*Coryphaenoides* sp.: Okamura in Amaoka et al., 1990:184, fig. 126 (New Zealand; 100–763 m). McMillan in Gomon et al. 1994:355, fig. 315 (“Humpback Whiptail”; descr.; NSW, VIC, TAS, and New Zealand; “in depths in excess of 800 m”).

*Coryphaenoides* sp. B: Paulin et al., 1989:129, fig. 56.30b (in key). Williams et al. 1996:149 (WA).

*Coryphaenoides* sp. 1: Shcherbachev and Iwamoto, 1995:309–312, fig. 8 (distr. New Zealand, Tasman Sea, Coral Sea, Indian Ocean, se. Atlantic; 696–1,600 m).

DIAGNOSIS. — Pelvic fin rays 8 (rarely 9); naked areas on underside of head confined to a median swath below snout tip, a narrow strip along ventral margins of snout and suborbital, and anterior end of mandible; snout low, barely protruding in adults; premaxillary teeth in a broad band flanked by a row of moderately enlarged and spaced conical teeth; mandibular teeth in 3 or 4 irregular rows; orbit diameter 19–23% of HL; preoral length 7–11%; barbel length 21–34%; outer gill slit 17–24%; body scales adherent, with numerous, small, reclined, closely packed spinules in subparallel to slightly convergent rows.

SPECIMENS EXAMINED. — (Numerous specimens including those listed by Shcherbachev and Iwamoto 1995).

COUNTS AND MEASUREMENTS (compiled mostly from Shcherbachev and Iwamoto 1995). — 1D. II, 9–10; P. i17–i21; GR-I (outer/inner) 7–9/11–13; GR-II 9–12/11–13; scales 1D. 9.5–11, midbase 1D. 7–10, 2D. 7–12, lat. line 38–48; caeca 10–18.

Total length 140–770 mm; HL 24–170 mm. The following in percent of HL: snout 25–29; interorb. 14–20; suborb. 9–13; postorb. 48–57; orb.-preop. 44–50; up.jaw 40–45; pre-A. 143–179; V.-A. 43–76; body depth 62–89; ht. 1D. 65–84; len. P. 43–57; len. V. 43–70; post. nostril 4–8.

SIZE. — To at least 77 cm TL.

DISTRIBUTION. — Widespread throughout southwestern Pacific Ocean, Indian Ocean, and se. Atlantic Ocean, in about 700–1,600 m (Okamura in Amaoka et al 1990:184, has recorded it from “100–763 m”). Found in Australia off NSW, TAS, VIC, SA, and WA.

COMPARISONS AND REMARKS. — This large species is extensively treated in Shcherbachev and Iwamoto (1995) and will be described soon by Peter McMillan of New Zealand (in litt. to TI, July 1998). It is unlikely to be confused with any other member of the genus currently known from Australia because of its peculiar physiognomy of low, scarcely protruding snout, shallow head, high

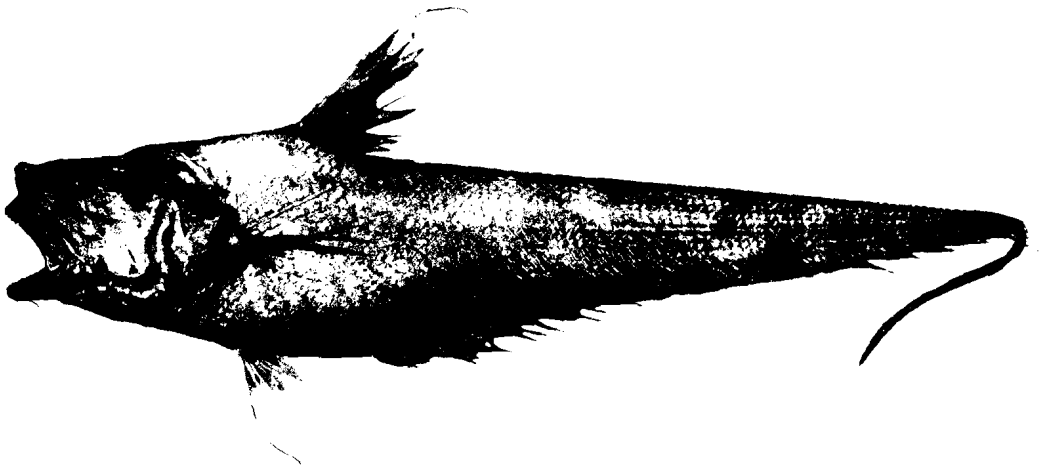


FIGURE 29. *Coryphaenides striaturus* Barnard. CSIRO H3017-06 from northwest of Cape Leeuwin, WA, 1,030 m.

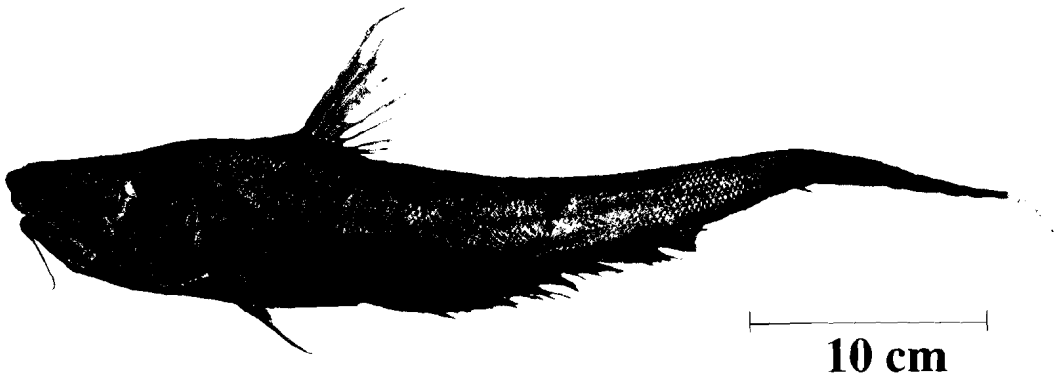


FIGURE 30. *Coryphaenides* sp. ("longbeard"). CSIRO H3010-09 from south of Cape Leeuwin, 945 m.

("hump-backed") nape, combined with usually eight pelvic fin rays and distinctive squamation of head and body.

***Hymenocephalus* Giglioli, 1884**

We use the generic name in the broadest sense to include *Hymenogadus* and *Spicomacrurus* as subgenera.

KEY TO SPECIES OF *HYMENOCEPHALUS* FROM WESTERN AUSTRALIA

- 1a. Pelvic fin rays 7-9 . . . . . 2
- 1b. Pelvic fin rays 11-14 . . . . . 5
- 2a. Inner gill rakers on first arch 19 or more; no broad, horizontal projections at snout tip . . . . . 3
- 2b. Inner gill rakers on first arch 11-12; three broad, horizontal projections forming tip and lateral angles of snout . . . . . *H. adelscottii*



- 3a. Chin barbel long, greater than least suborbital width; melanophores present to end of tail . . . . . *H. longibarbis*  
 3b. Chin barbel short, less than half suborbital width; melanophores absent posterior to belly region  
 . . . . . [?] *H. striatissimus aeger*  
 4a. Pelvic fin rays 12–14; orbits 23–29% of head length; interorbital greater than orbit diameter (about 0.8–0.9 into orbit); orbit about 1.7–2.1 into distance orbit-preopercle . . . . . *H. sp.*  
 4b. Pelvic fin rays 11–12; orbits 31–38% of head length; interorbital less than orbit diameter (1.2–1.4 into orbit), orbit 1.1–1.4 into distance orbit-preopercle . . . . . *H. nascens*

***Hymenocephalus adelscottii* Iwamoto and Merrett, 1997**

Fig. 31a

*Hymenocephalus adelscottii* Iwamoto and Merrett, 1997:514–516, fig. 19 (holotype MNHN 1994-882, 162 mm TL; n. of Fiji, 600 m).

DIAGNOSIS. — Pelvic fin rays 9, outer ray slightly expanded distally; nasal bones forming 3 horizontal platelike processes; gill rakers on outer arch 11; head bones relatively firm; barbel 3.8 into orbit.

SPECIMEN EXAMINED. — WA: CSIRO H2573-14 (37.0 mm HL, 166+ mm TL); w. of Shark Bay; 680–691 m; SS1/91/36.

COUNTS AND MEASUREMENTS. — 1D. II,11; P. i19–i20; V. 9; total GR-I (inner) 12, GR-II (outer/inner) 11/12; scales 1D. 3, 2D. 4.

Total length 166+ mm; 37.0 mm HL. The following in percent of HL: postrostral 74; snout 31; preoral 17; internasal 19; interorb. 18; orb. 32; suborb. 10; postorb. 44; orb.-preop. 36; up.jaw 36; barbel 8; gill slit 24; pre-A. 158; pre-vent 154; V.-A. 66; isth.-A. 104; body depth 50; depth at A. 45; 1D.-2D. 59; ht. 1D. 63; len. P. 62; len. V. 49; post. nostril 12.

DESCRIPTION. — Body slender, subcylindrical; head bones relatively firm (compared to most other *Hymenocephalus* species); crests on nasal, frontal, and occipital low; snout depressed, with median and lateral processes of nasal bones forming three blunt, horizontal platelike processes; lateral margins of snout concave posterior to processes. Underside of head flat; mouth moderately large, nearly horizontal. Teeth small, slender, conical. Gill rakers short, tubercular, bearing few spines. Scales large, deciduous (none remaining on our specimen). Second spine of first dorsal fin smooth. Elongate outer ray of pelvic fin slightly expanded and fleshy. Light organ long, luminous tissue joining a small lens anterior to vent, another lens just anterior to pelvic fin bases. Ventral striae well developed. Color dusky brown, paler on ventral surface. Abdominal region and isthmus black, underside of head dark. Lip of upper jaw black, surrounding tissue pale.

SIZE. — Our single specimen was about 17 cm TL, but had a damaged tail and developed pseudocaudal.

DISTRIBUTION. — Known only from the holotype captured north of Fiji and our single WA specimen; capture depths 600–691 m.

COMPARISONS AND REMARKS. — Our specimen showed great similarity to *Hymenocephalus kuronumai* (Kamohara, 1938), the only other species of the subgenus *Spicomacrurus*, in overall morphology, counts and proportional measurements. However, it differs in having longer platelike median and lateral processes of the nasal bone than figured for *H. kuronumai* by Okamura (1970). This accounts for the shorter snout-to-head ratio (3.3 cf. 3.6–4.5) in our specimen. The WA specimen also has a shorter barbel (3.8 into orbit diameter cf. 1.5–2.4) and smaller scales (4 rows from midbase of first dorsal fin to lateral line, cf. 3 rows, and 3 rows from the origin of second dorsal fin, cf. 2).

***Hymenocephalus longibarbis* (Günther, 1887)**

Fig. 31b

*Macrurus (Mystaconurus) longibarbis* Günther, 1887:139, 140, pl. 18, fig. C (Fiji Islands, *Challenger* sta. 173; 576 m).

*Hymenocephalus* sp.: Gomon et al., 1994:358, fig. 318 (GAB; 366 m).

*Hymenocephalus longibarbis*: Iwamoto and Merrett, 1997:520–521, fig. 21b (New Caledonia region).

DIAGNOSIS (for WA specimens only).—Pelvic fin rays 8; chin barbel long, 0.55–0.63 into orbit diameter; gillrakers 17–21 on inner series of first arch; interorbital narrow, 1.4–2.1 into orbit, 16–20% HL; suborbital narrow, 2.3–2.9 into orbit, 11–13% HL; midlateral stripe becoming faint or obscure posteriorly on tail, no prominent black marks on dorsal surfaces of trunk.

MATERIAL EXAMINED (9 spec.).—WA: AMS I.22808-029 (5, 23.5–35.2 mm HL, 142–192 mm TL); NW Shelf; SO2/82/17–18. AMS I.22826-006 (5, 29.4–40.9 HL, 167+–200+ TL); NW Shelf; 396–406 m; SO1/86/53.

SIZE. — To more than 23 cm TL.

DISTRIBUTION. — Australia (WA, NSW, QLD, ?SA), Fiji, and New Caledonia in 366–620 m.

COMPARISONS AND REMARKS. — This large member of the genus can be readily differentiated from its congeners by the combination of long barbel, slender body, low, non-protruding snout, relatively low gill raker counts, and eight pelvic fin rays. In having a notably long barbel, *H. longibarbis* is most similar to *H. longiceps* Smith and Radcliffe, 1912 from the Philippines, but the barbel in *H. longiceps* goes 1.0–1.4 times into the orbit diameter (cf. 0.55–0.63) and the suborbital width goes 2.0–2.3 (cf. 2.3–2.9) times into the orbit.

The Western Australian specimens differed slightly from specimens recorded by Iwamoto and Merrett (1997) from New Caledonia. The most striking differences were related to proportions of the barbel, interorbital, and suborbital. Thus, the WA specimens had for these characters, respectively, values of 0.55–0.63, 1.4–1.7, and 2.3–2.9 times into orbit diameter, in contrast to 0.7–1.0, 1.7–2.1, and 3.1–4.6 in the New Caledonian specimens. The WA specimens were also much paler overall, without bold body and head markings, but such differences are often attributable to differences in preservation techniques. The paucity of specimens and the lack of a more thorough examination of material from other areas prevents a decision as to whether or not they represent a new taxon.

That only two small WA collections were made of this species is somewhat surprising, in that it (or its sister taxon) is apparently rather abundant off New Caledonia and the east coast of Australia.

***Hymenocephalus nascens* Gilbert and Hubbs, 1920**

Fig. 32a

*Hymenocephalus nascens* Gilbert and Hubbs, 1920:535–539, fig. 30 (holotype USNM 78229; Borneo, vicinity of Sibuko Bay, 759 m). Iwamoto and Merrett, 1997:523–525, fig. 22b (New Caledonia region, 600–855 m).

DIAGNOSIS. — Chin barbel absent or rudimentary, much less than half suborbital width; V. 11–12; snout length 25–30% HL, orbit broadly oval, 31–37% HL, slightly greater than interorbital width, 25–28% HL; suborbital width 13–14% HL. Prominent midlateral stripe, ventrolateral surfaces of tail finely speckled. Scale margins dorsally well marked; preopercle mostly pale; dark areas of belly and chest with purplish tinge. Anterior lens of light organ small, about half size of posterior lens.

SPECIMENS EXAMINED. — WA: CSIRO H1492-19 (2, 23.5–28.6 mm HL, 120–120+ mm TL); w. of Barrow I.; 420 m; SO5/88/70. CSIRO H2573-24 (24.0 HL, 123 TL); w. of Steep Point; 691 m; SS1/91/36. CSIRO H2580-09 (25.5 HL, 120+ TL); sw. of Shark Bay; 491 m; SS1/91/43.

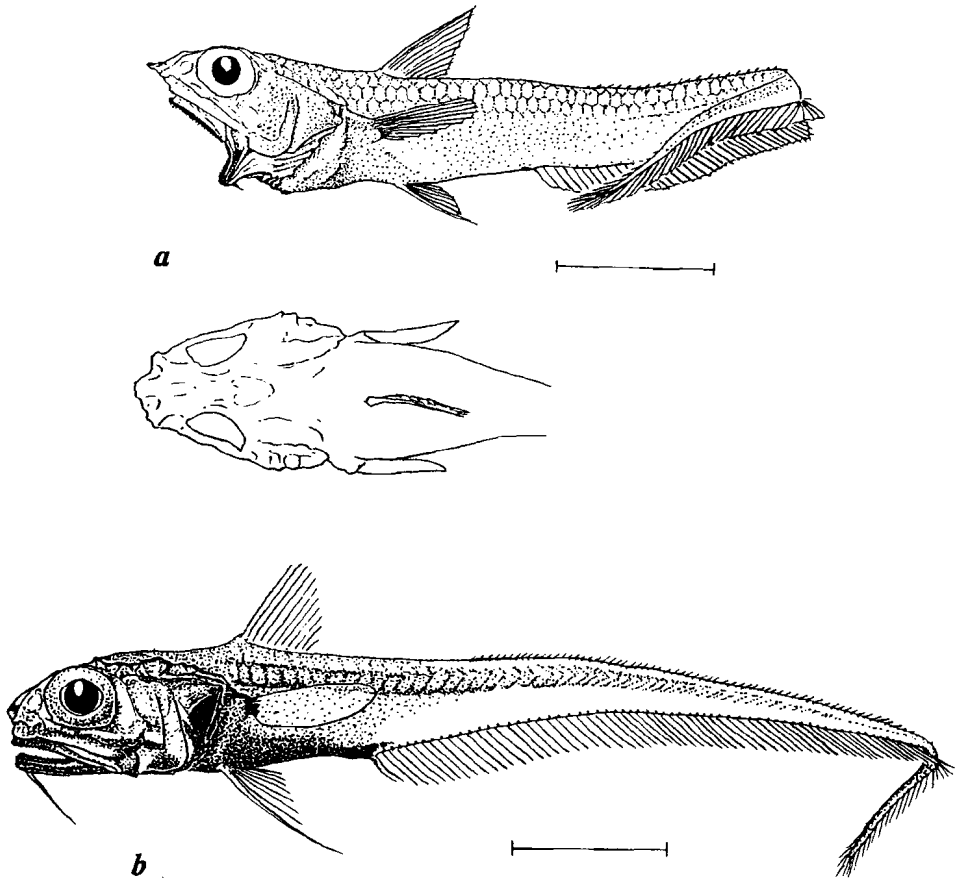


FIGURE 31. (a) *Hymenocephalus adelscottii* Iwamoto and Merrett. Holotype, MNHN 1994-882 (33 mm HL), from near Wallis and Futuna islands, south western Pacific, in 600 m. (From Iwamoto and Merrett 1997, fig. 19.) (b) *Hymenocephalus longibarbis* (Günther). NMNZ P.29239 (35.5 mm HL) from south of New Caledonia in 550–920 m. (From Iwamoto and Merrett 1997, fig. 21b.)

COUNTS AND MEASUREMENTS. — 1D. II,9; P. i14–i15; V. 11–12; GR-I (outer/inner) 17–18/24, GR-II 23–24/23–24. The following in percent of HL: postorb. 43–45; orb.-preop. 43–45; up.jaw 50–56; body depth 68–76; body width 44–47; head width 51–55; len. V. 82–86.

COMPARISONS AND REMARKS. — These four Western Australian specimens agree well with the detailed original description of the species by Gilbert and Hubbs (1920) and that of New Caledonian specimens by Iwamoto and Merrett (1997), with the exception of the pelvic fin ray count of 11–12, which agrees more with that of *H. lethonemus*. The rudimentary barbel in three of the four specimens is a bit disconcerting, but not especially surprising, in that a similar situation was recorded in specimens of *H. striatulus* Gilbert, 1905 from Hawaii and the Sala y Gomez Ridge (Sazonov and Iwamoto 1992).

[?]*Hymenocephalus striatissimus aeger* Gilbert and Hubbs, 1920

Fig. 32b

*Hymenocephalus striatissimus aeger* Gilbert and Hubbs, 1920:531–534, fig. 32 (holotype, USNM 78228, Molucca Sea off Halmahera, 545 m).

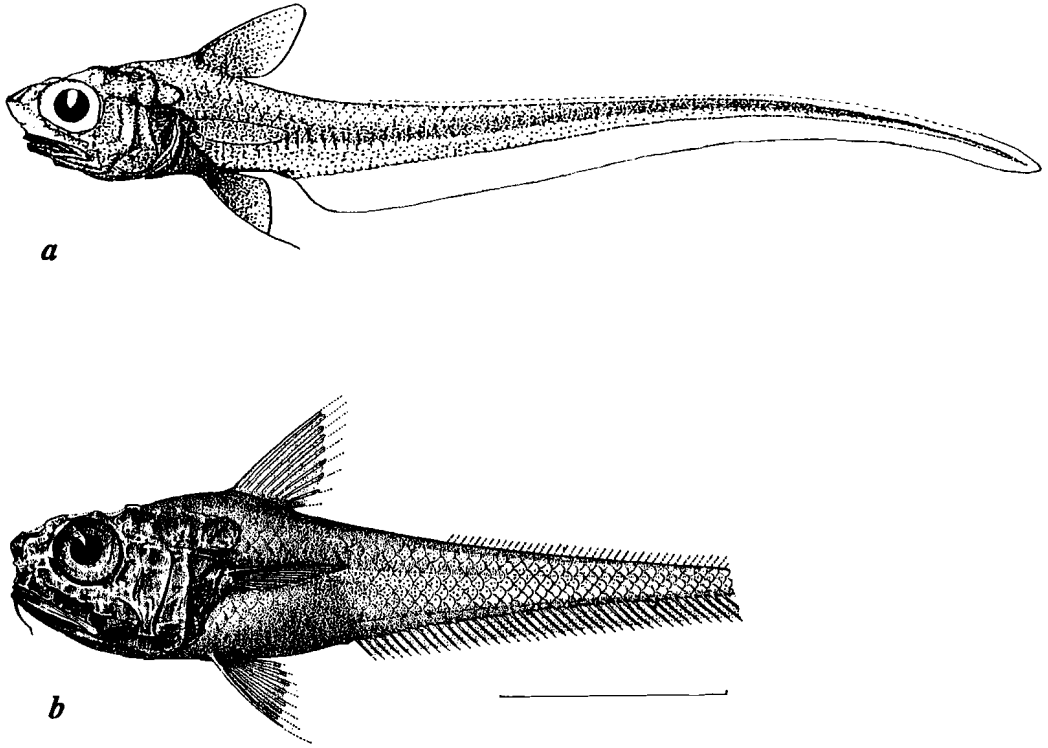


FIGURE 32. (a) *Hymenocephalus nascens* Gilbert and Hubbs. NMNZ P.29101 (26.2 mm HL), from south of New Caledonia in 550–690 m. (From Iwamoto and Merrett 1997, fig. 22b.) (b) *Hymenocephalus striatissimus aeger* Gilbert and Hubbs. Holotype (USNM 78228, 158 mm TL) from East Indies “between Gillolo and Makyan Islands” in 542 m. (From Gilbert and Hubbs 1920, fig. 32.)

DIAGNOSIS. — Pelvic fin rays 8 [7 rays in 1 of 15 spec.]; total gill rakers on first arch 12–18 (lateral series), 20–23 on inner series; barbel rudimentary 2–4% HL; orbits 33–45; dorsolateral stripe on trunk fades out completely on tail.

SPECIMENS EXAMINED. — WA: CSIRO H1514-35 (11, about 24–26 mm HL, 108+–153 mm TL); NW Shelf; 582 m; SO5/88/190. CSIRO H3144-07 (5, 24.5–28 HL, 95+–142+ TL); n. of Dampier Archipelago; 18°51'S, 116°02'E; 550 m; *Surefire*, shot 3; coll. D. Evans; 16.III.1992. AMS I.22816-003 (11, about 25.5–27 HL, 115+–262+ TL); NW Shelf, 220 km nw. of Port Hedland; 594–612 m; SO2/82/28–30.

COUNTS AND MEASUREMENTS. — 1D. II, 7–9; P. i10–i13; total GR-II (outer/inner) 19–23/19–21.

Total lengths 95–262+ mm, HL 24–28 mm. The following in percent HL: snout 26–29 (2 spec.); interorb. 35–40; suborb. 14–18; postorb. 41–50; orb.-preop. 45–54; up.jaw 48–59; body depth 64–82; body width 35–47; head width 48–55; ht. 1D. 68–92; len. P. 54–85; len. V. 48–69.

SIZE. — To at least 26 cm TL.

DISTRIBUTION. — Only three collections were made of the species off WA in 550–612 m.

COMPARISONS AND REMARKS. — This species is easily recognized among the Western Australian members of *Hymenocephalus* by the low pelvic and pectoral ray counts, rudimentary chin barbel, and the complete absence on the tail of a dorsolateral stripe or speckling of any sort.

Our Western Australian specimens (all of which are damaged and in poor condition) seem on the whole to agree with *H. striatissimus aeger*. The small, rudimentary barbel is much smaller, however, than that reported for the subspecies (much less than half pupil diameter, cf. 2/3 to more

than pupil diameter in *H. s. aeger*). The pigmentation on the flanks posterior to the abdominal cavity is wholly absent in our specimens, but appears to be present in *H. s. aeger*, as judged from the original illustration of the subspecies. Some badly faded type specimens (CAS-SU 25463) lack pigmentation posterior to the abdomen, but their absence may be an artifact of long preservation. Additionally, the orbits appear more round in outline and not as deeply oblique as in *H. s. aeger*.

Compared with *H. megalops* from the New Caledonia region and QLD, *H. s. aeger* has a shorter barbel (8–22% HL in *H. megalops*), fewer pectoral fin rays (i9–i13 cf. i13–i15), a somewhat longer orbit-to-preopercle distance (45–54% HL cf. 36–47%), a somewhat broader suborbital (14–18% HL cf. 8–16%), and a broader interorbital space (35–40% HL cf. 24–36%). The eight pelvic fin rays, the large orbit, and the absence of pigmentation on the tail are, however, characteristic of both species.

### *Hymenocephalus (Hymenocephalus) sp.*

DIAGNOSIS. — Pelvic fin rays 12–14; barbel absent; orbits about 23–29% HL, less than interorbital width; sides of trunk and tail heavily speckled; dorsolateral stripe prominent, extending posteriorly from behind head to end of tail; anterior lens of light organ tiny, inconspicuous.

SPECIMENS EXAMINED. — WA: CSIRO H2553-11 (33.5 mm HL, 153+ mm TL); w. of Pt. Cloates; 910 m; SS1/91/14. CSIRO H2583-13 (29.1 mm HL, 108+ mm TL); nw. of Shoal Pt.; 945–960 m; SS1/91/48. CSIRO H2584-14 (27.4 HL, 132+ TL) and CSIRO H2584-15 (29.6 HL, 140+ TL); w. of Shoal Pt.; 853 m; SS1/91/49.

COUNTS AND MEASUREMENTS. — 1D. II,9–11; P. i12–i15; V. 12–14; total GR-I (outer/inner) 17–19/24–26, GR-II 24–25/23–24.

Measurements in percent of HL: snout 33–39; orb. 23–29; suborb. 13–16; interorb. 27–31; postorb. 46–52; orb.-preop. 46–52; up.jaw 45–54; body depth 46–59; head width 42–46; ht. 1D. 64–69; len. P. 47–55; len. V. 81–82.

DESCRIPTION. — This species resembles *H. nascens* rather closely; thus, only major character differences will be described. Snout relatively high, the thin, slender, flexible tip elevated above mouth a distance of about two lens diameters. Suborbital region relatively broad, least width more than lens diameter, almost entirely black along inner walls. Opercular region behind and below preopercle ridge, chest, and gill membranes black.

COMPARISONS AND REMARKS. — These specimens do not readily key out to any species in the keys provided by Gilbert and Hubbs (1920) and Iwamoto (1990). They follow the description of *H. nascens* most closely, but the larger orbit diameter and higher pelvic fin ray count differentiate the specimens from *H. nascens*. They are also darker, with heavier pigmentation, especially on the opercular and suborbital bones, and ventrally on the tail below the dorsolateral stripe, where large melanophores are aligned in a V-shaped pattern (fine, more uniform arrangement of melanophores in *H. nascens*). There is some similarity to *H. striatulus*, but that species has a much more robust and thicker body, larger orbits, and stouter head bones.

We have not described this species as new because only five specimens, all in relatively poor condition, were present in our examined collections.

### *Kuronezumia* Iwamoto, 1974

See Sazonov and Iwamoto (1992) for a diagnosis of the genus. Seven species currently recognized (Shcherbachev et al. 1992); only two species found in WA, both rare in the area, but *K. leonis* is relatively common in TAS, SA, and NSW.

KEY TO SPECIES OF *KURONEZUMIA* FROM WESTERN AUSTRALIA

- 1a. Pelvic rays 8–9 (rarely 10); snout relatively pointed, tipped with a large tubercular scale; upper jaw 28–35% HL . . . . . *K. leonis*  
 1b. Pelvic rays 10–11; snout bluntly rounded, not tipped with large tubercular scale; upper jaw 36–42% HL . . . . . *K. pallida*

***Kuronezumia leonis* (Barnard, 1925)**

Fig. 33

*Lionurus leonis* Barnard, 1925:503 (off Cape Point, South Africa).*Macruroplus leonis*: Smith, 1949:134.*Nezumia leonis*: Krefft, 1969:36 (Uruguay).*Nezumia* sp. A: Okamura, in Amaoka et al., 1990:181 (New Zealand).*Kuronezumia leonis*: Shcherbachev et al., 1992:101, 102 (descr.; distr.; Indian Ocean).*Nezumia* sp.: McMillan, in Gomon et al., 1994:361, 362, fig. 322 ("snubnose whiptail"; Australia [VIC, TAS], New Zealand).

DIAGNOSIS. — Snout relatively pointed, tipped with enlarged, bony, tubercular scale; V. 8–10, usually 8 or 9.

SPECIMENS EXAMINED. — WA. CSIRO H3008-10 (1 spec.); sw. of Albany; 35°25'S, 117°21'E; 842 m; *Akebono Maru* No. 3, shot 8; coll. A. Williams; 22.XII.1989

COUNTS AND MEASUREMENTS (of 1 WA spec.).—1D. II,9; P. i20–i21; total GR-I (outer/inner) 9/10, GR-II 9/10; scales 1D. 15–15.5, 2D. 11–12.

Total length 317+ mm; HL 50.5 mm. The following in percent of HL: postrostral 73; snout 30; preoral 19; internasal 24; interorb. 29; orb. 29; suborb. 17; postorb. 45; orb.-preop. 37; up.jaw 28; barbel 26; gill slit 15; pre-A. 150; pre-vent 130; V.-A. 40; isth.-A. 81; body depth 80; depth at A. 72; 1D.-2D. 42; len. P. 65; len. V. 41; post. nostril 8.

SIZE. — Attains about 50 cm TL.

DISTRIBUTION. — Widely distributed in southern Africa, off Uruguay (not verified by current authors), southern Australia, New Zealand, and southern Indian Ocean on the Kerguelen Plateau.

COMPARISONS AND REMARKS. — This wide-ranging species has been adequately described in the recent works of Shcherbachev et al. (1992) and Iwamoto and Anderson (1994). The former work offers a key to the seven recognized species in the genus.

*Kuronezumia leonis* differs most obviously from *K. pallida*, the second species of the genus recorded off the west coast of Australia, in the presence of a large terminal scute on the snout. The pointed snout and relatively slender body of *K. leonis* also easily distinguished this species from *K. pallida*.

***Kuronezumia pallida* Sazonov and Iwamoto, 1992**

Fig. 34

*Kuronezumia pallida* Sazonov and Iwamoto, 1992:65–67 (Sala y Gomez Ridge, se. Pacific, 540–800 m).

DIAGNOSIS. — No large lateral line pores on head; length upper jaw 36–42% HL; inner GR-I 9–10; scales below 1D. 11–13; V. 10; light organ a small lenslike structure between pelvic fin bases, no bulbous swelling; color pale brown, slightly lighter on ventral surface; fins dark, abdominal area bluish.

SPECIMENS EXAMINED. — WA: CSIRO H3041-14 (106 mm HL, 495+ mm TL); wsw of Shark Bay; 26°36'S, 112°09'E; 760 m; *Akebono Maru* No. 3 sta. 41; coll. A. Williams; 28.XII.1989. CSIRO H3192-02 (66.9 HL, 340 TL); n. of Dampier Archipelago; 18°46'S, 116°13'E; 550 m; *Surefire*, shot

2; coll. V. Wadley; 10.II.1992. CSIRO H3086-01 (93.5 HL, 505+ TL); n. of Port Hedland; 17°49'S, 118°17'E; 725 m; *Courageous*; coll. D. Evans; 7.II.1990.

COUNTS AND MEASUREMENTS (based on 3 spec.).—1D. II,9–10; P. i19–i22; total GR-I (outer/inner) 7–8/9–10, GR-II 9/9–10; scales 1D. 11–13, 2D. 10, midbase 1D. 8–9.

Total length 340+–505+ mm, HL 66.9–106.0 mm. The following in percent of HL: postrostral 77–79; snout 26–27; preoral 16–19; internasal 18–19; interorb. 24–25; orb. 27–28; suborb. 17–18; postorb. 51–54; orb.-preop. 44–46; up.jaw 36–42; barbel 24–26; gill slit 17–20; pre-A. 141–149; pre-vent 105–122; V.-A. 43; isth.-A. 78–91; body depth 89–98; depth at A. 77–82; 1D.-2D. 34–46; len. P. 58–60; len. V. 50–59; post. nostril 4–8.

DESCRIPTION. — Large, deep-bodied species with deep, compressed head; snout high, blunt, with vertical anterior profile. Mouth large, jaws subterminal; lips and adjacent areas of buccal cavity with dense covering of fleshy, branched papillae that almost cover teeth. Suborbital region deep, vertical, without modified scales.

Body scales covered with radiating series of long, densely packed conical spinules.

Light organ manifested externally as a small, black, scaleless anterior dermal window between pelvic fin bases.

Color when fresh, light brown with slightly darker area on dorsal posterior region of head, lighter on ventral surface, abdominal area bluish; fins dark.

SIZE. — To about 51 cm TL.

DISTRIBUTION. — Only three specimens were taken from the west and northwestern coast of Australia. *Kuronezumia pallida* was known previously only from the Sala y Gomez Ridge in the subtropical South Pacific.

COMPARISONS AND REMARKS. — Our specimens closely agree with the original description of *K. pallida* in most counts and proportional measurements, and particularly in the physiognomy of the head, which is deep and compressed with a high, blunt snout. They match Sazonov and Iwamoto's (1992) diagnosis of that species precisely; however, compared to data from the large holotype, the orbit of the Australian material is larger (27–28% HL cf. 24%), the suborbital width narrower (17–18% HL cf. 20%), pectoral rays fewer (i19–i22 cf. i24–i25), and pelvic rays fewer (10, cf. 11). In addition, the scales appear more densely spinulated. We attribute these differences to natural variation among the few known specimens, and to geographical variation in a widely distributed species.

*Kuronezumia pallida* may be separated from *K. leonis* by the physiognomy of its head, which is deep and compressed, and its high blunt snout, which lacks a terminal bony scute. It differs from *K. dara* (Gilbert and Hubbs, 1916) from Japanese waters in having a humped dorsal profile over the posterior region of the head, a shorter snout (26–27% HL cf. 28–29%), and an overall paler color.

### *Lepidorhynchus* Richardson, 1846

A monotypic genus whose relationships are obscure.

#### *Lepidorhynchus denticulatus* Richardson, 1846.

Fig. 35

*Macrourus denticulatus* Richardson, 1846:53 (“coast of South Australia”).

*Coryphaenoides denticulatus*: Günther, 1862:396.

*Macrurus (Optonurus) denticulatus*: Günther, 1887:147.

“*Optonurus*” *denticulatus*: Gilbert and Hubbs, 1916:144. McCulloch, 1926:33.

*Lepidorhynchus denticulatus*: McCann and McKnight, 1980:50–52.

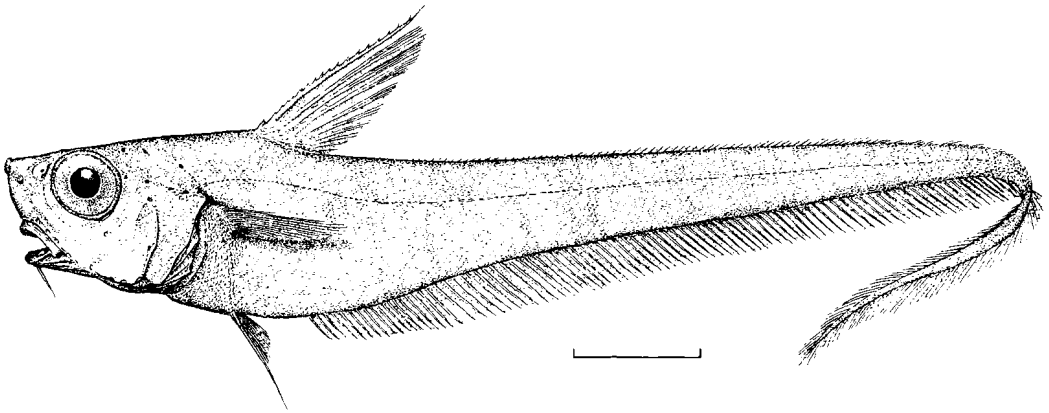


FIGURE 33. *Kuronezumia leonis* (Barnard). (From Shcherbachev et al. 1992, fig. 3)



FIGURE 34. *Kuronezumia pallida* Sazonov and Iwamoto. CSIRO H3041-14 (106 mm HL, 495 mm TL) from off Shark Bay, WA, in 760 m.



FIGURE 35. *Lepidorhynchus denticulatus* Richardson. CSIRO unregistered, from off southern coast of Australia.

DIAGNOSIS. — Bony ridges of head poorly developed and lacking modified scales. Mouth large, terminal; teeth of premaxilla in broad bands with large, widely spaced canines in outer row; teeth of mandible well developed, closer set than those of premaxilla. Ventral striae conspicuous over abdominal region from level of pectoral fin, extending along ventral region from isthmus to midpoint of anal fin.

SPECIMENS EXAMINED. — WA: CSIRO H2023-03 (86.5 mm HL, 527 mm TL); w. of Dongara and Leander Pt.; 29°14'S, 113°52'E; 556 m; *South Passage*; coll. D. Wright; 28.I.1989.



COUNTS AND MEASUREMENTS (based on 1 spec.).—1D. II,11; P. i16; V. 9; total GR-I (outer/inner 11/17, GR-II 16/16).

Total length 527 mm; HL 86.5 mm. The following in percent of HL: postrostral 75; snout 24; preoral 12; internasal 16; interorb. 22; orb. 34; suborb. 7; postorb. 42; orb.-preop. 43; up.jaw 49; barbel 9; gill slit 26; pre-A. 164; pre-vent 157; V.-A. 57; isth.-A. 112; body depth 84; depth at A. 71; 1D.-2D. 83; len. 42; post. nostril 6; len. rictus 40.

DESCRIPTION. — This species is quite distinctive and has been adequately described in recent works. McCann and McKnight (1980), Last et al. (1980), and Gomon et al. (1994) provide accounts of material from southern Australia.

SIZE. — To about 55 cm TL.

DISTRIBUTION. — Southern Australia and New Zealand. Reported from a wide depth range (60–1,000 m), but predominantly an upper-slope species in 270–450 m.

COMPARISONS AND REMARKS. — The well-developed teeth and distinctive reflective, silvery coloration of *L. denticulatus* make it easily recognizable. Extremely abundant off southeastern Australia, where it forms a substantial bycatch to the demersal trawl fishery for blue grenadier (or hoki, *Macruronus novaezelandiae*). It was caught only occasionally off the southern coast of Western Australia.

### *Lucigadus* Gilbert and Hubbs, 1920

Recent treatments of species of *Lucigadus* include Iwamoto and Anderson (1994) and Iwamoto and Merrett (1997). Only one species so far known from WA.

#### *Lucigadus ori* (Smith, 1968)

Fig. 36

*Macruropus ori* Smith, 1968:4–6, pl. 2 (off Durban, South Africa).

*Ventrifossa ori*: Iwamoto, 1979:153.

*Lucigadus ori*: Iwamoto and Anderson, 1994:16.

DIAGNOSIS. — Mouth small, upper jaw about 31% HL; pelvic fin rays 15–18; pectoral fin rays i18–i23; body and anal fin lacking banding pattern; branchiostegal membranes with two small scale patches.

SPECIMENS EXAMINED. — WA: CSIRO H2579-02 (31.1 mm HL, 230 mm TL); sw. of Shark Bay; 666–688 m; SS1/91/42.

Comparative material of *Lucigadus nigromaculatus*: NSW: AMS I.7894 (holotype, 32.1 HL, 222 TL) and AMS I.7895, I.7896, I.7897 (paratypes, 15.3–32.4 HL, 112–207 TL); off Sydney; 33°52'S, 151°48'E; 1,461 m. AMS I.15974-008 (32.3–36.7 HL); 55 n.mi. [102 km] off Newcastle; 366 m; K71-08-03. AMS I.15975-032 (32.3–38.3 HL); 35 n.mi. [65 km] se. of Newcastle; 567 m; K71-08-05. VIC: AMS E.5499 (28.4 HL); sse. of Genoa Point; 37°S, 149°E; 365 m; 1914. SA: AMS I.18711-005 (31.8–37.9 HL); Great Australian Bight; 33°29'S, 127°15'E; 1976. AMS IA.1367 (40.1 HL); Great Australian Bight, s. of Eucla; 31°S, 128°E; 730 m; 1913.

COUNTS AND MEASUREMENTS (1 WA spec.).—1D. II,10; P. i20–i21; V. 14–15; total GR-I (outer/inner) 9–10/13, GR-II 12/12; scales 1D. 17–18, midbase 1D. 13–14, 2D. 8–9.

Total length 230 mm; HL 31.1 mm. The following in percent of HL: postrostral 78; snout 28; preoral 23; internasal 20; interorb. 24; orb. 38; suborb. 16; postorb. 39; orb.-preop. 32; up.jaw 31; barbel 15; gill slit 18; pre-A. 163; pre-vent 137; V.-A. 46; isth.-A. 95; body depth 109; depth at A. 92; 1D.-2D. 65; len. 71; len. V. 47; post. nostril 6.

DESCRIPTION. — Body short, deep, and compressed, tapering from anal fin origin to end of long, compressed tail. Head short, compressed, lacking distinctive ridges; dorsal profile nearly straight (Madagascar specimens examined have a distinct hump), rising steeply to first dorsal fin origin. Snout short, rounded, barely protruding beyond level of mouth, about 1.4 into orbit. Mouth short, oblique; upper jaw extends posteriorly to vertical about one-third distance across orbit. Orbits relatively large, about 1.5 into interorbital width. Suborbital ridges flat, lacking enlarged or bony scales.

Teeth of premaxilla and mandible conical, forming broad, tapering bands; 4–5 rows of teeth at symphysis, outer row in each jaw slightly enlarged.

Gill rakers bearing clusters of elongate, straight to slightly curved spines; dorsal rakers on first arch well developed, ventral rakers a series of raised tubercles.

Upper surfaces of head completely scaled; branchiostegal membranes with a small scale patch on either side at level of isthmus; gular membranes and underside of lower jaw unscaled in WA specimen (but in specimens from Madagascar, area with a broad median patch, and posterior end of lower jaws scaled). Scales on body posterior of pectoral fin moderately deciduous; scales of dorsal flanks bearing small, slender spinules in 8–9 near-parallel rows.

Light organ keyhole-shaped; anterior dermal window situated between posterior margin of pelvic fin bases, connected to periproct by an isthmus of naked black skin; posterior dermal window relatively large, immediately anterior to vent.

First dorsal fin high, second spinous ray with numerous serrations along leading edge; pelvic fins broad, close together, outer ray only slightly produced; anal fin well developed along entire length. Pelvic fin origin at vertical through posterior margin of opercle; pectoral fin origin just posterior to pelvic fin origin; first dorsal fin origin set further back, posterior margin of base in line with origin of anal fin.

Body light brown, speckled with small melanophores; dense clusters of melanophores on gular membrane, on margin of branchiostegal membranes, and on pelvic fins; base of first dorsal, pectoral and pelvic fins, opercle, and ventral abdominal region dark; sides of abdomen to level of pectoral fin base with dark bluish pigmentation; periproct region black. Large dark patch over upper two-thirds of first dorsal fin between 2nd and 8th elements; anal fin with distinct dark distal margin over anterior 15–20% of its length; no evidence of banding over trunk or anal fin.

SIZE. — To about 23 cm TL.

DISTRIBUTION. — From Namibia to Natal coast (South Africa), off Madagascar, and at 28°S off west coast of Australia.

COMPARISONS AND REMARKS. — *Lucigadus ori* is very similar to *L. nigromaculatus* (McCulloch, 1907), which is widely distributed across temperate Australia and is also reported from New Zealand (McCann and McKnight 1980), the southeastern Pacific (Iwamoto 1979), and the southeastern Atlantic (Trunov and Konstantinov 1986). However, *L. ori* has a relatively small mouth (upper jaw 31% HL cf. 41–47%), a more restricted first gill slit (18% HL cf. 25–31%), a greater preoral length (23% HL cf. 17–21%), and a greater postorbital length (39% HL cf. 34–37%).

Our specimen of *L. ori* is most noticeably differentiated from *L. acrolophus* (Iwamoto and Merrett, 1997) by a higher pelvic fin ray count (14–15 cf. 9–11), shorter upper jaw (31% HL cf. 35–41%), and more inner gill rakers (GR-I 13 cf. 9–11; GR-II 12 cf. 8–11). It lacks the banded coloration over the body and anal fin of *L. microlepis* (Günther, 1878) and differs from *L. nigromarginatus* (Smith and Radcliffe, 1912) by its higher pelvic fin ray count (14–15 cf. 10–11) and several proportional measurements including, among others, orbit diameter (38% of HL cf. 33–36%) and barbel length (15% cf. 20–26%).

It is a bit curious to find a single representative of this predominantly southern African species in Western Australia but none of the other two members of the genus (*L. nigromaculatus* and *L. microlepis*) that have been recorded from Australia. The species has not been collected, so far as we know, in other parts of the Indian Ocean. That only a single specimen was collected suggests that its

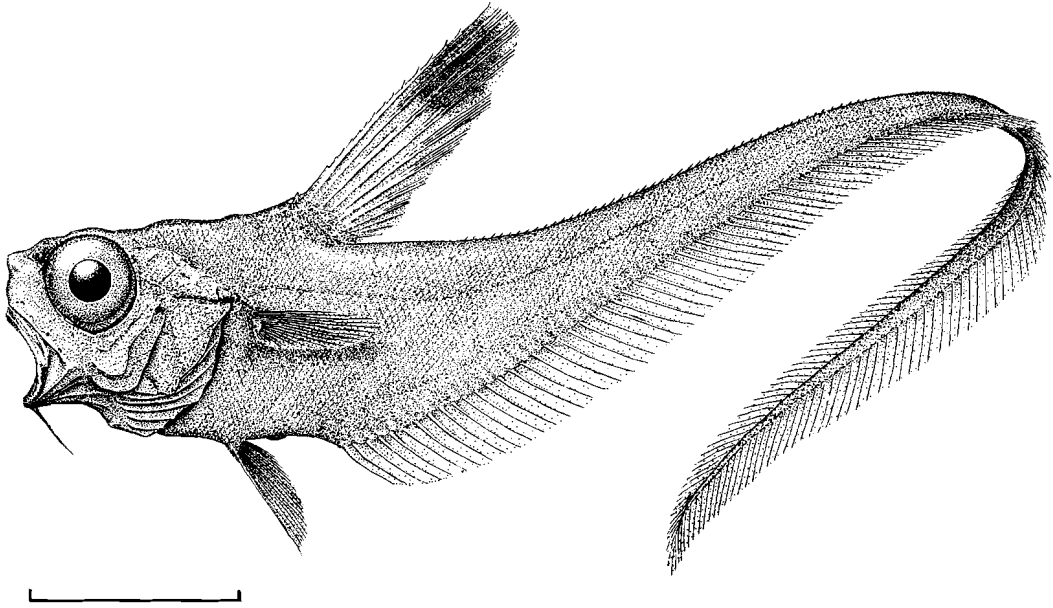


FIGURE 36. *Lucigadus ori* (Smith). RUSI 4323 (20 cm TL) from off Natal, South Africa. (From Iwamoto 1986, fig. 93.32.)

occurrence in Australia is rare. The more cool-temperate species *L. nigromaculatus* appears to be relatively common in waters off Tasmania, Victoria, and New South Wales, as well as off New Zealand. It will probably be found along the south coast of Western Australia with more extensive collecting.

### ***Malacocephalus* Günther, 1862**

See Iwamoto (1990) for generic diagnosis. Several nominal species, but probably only four or five valid. One wide-ranging, worldwide species found off Australia.

#### ***Malacocephalus laevis* (Lowe, 1843)**

Fig. 37

*Malacocephalus laevis*: Günther, 1862:397.

*Macrurus (Malacocephalus) laevis*: Günther, 1887:148, pl. 39, fig. B).

DIAGNOSIS (after Iwamoto 1990).—Snout 26–31% HL; distance from orbit to angle of preopercle 41–47% HL. Premaxillary teeth in 2 distinct rows; 1 row of widely spaced canine teeth on mandible. Dorsal fin spine smooth; first dorsal fin rays II,9–13; pectoral fin rays i15–i21; pelvic fin rays 8–9 (usually 9).

SPECIMENS EXAMINED. — WA: CSIRO H2573-18 (4, 56.5–82.4 mm HL, 298–450 mm TL) and CSIRO H2573 (72.5 HL, 380 TL); off Shark Bay; 690–691 m; SS1/91/36.

COUNTS AND MEASUREMENTS (based on 5 WA spec.).—1D. II,10–12; P. i18; V. 8–9; total GR-I (outer/inner) 6–9/10–13, GR-II 8–11/8–11; scales 1D. 15.5–18.5, midbase 1D. 13.5–16.5, 2D. 15.5–16.5.

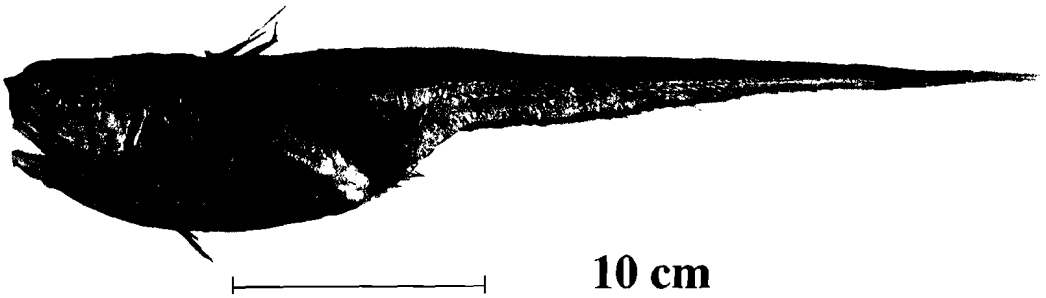


FIGURE 37. *Malacocephalus laevis* (Lowe). CSIRO unregistered, from southern Australia.

Total length 298–450 mm; HL 56.5–82.4 mm. The following in percent of HL: postrostral 75–78; snout 26–28; preoral 16–18; internasal 18–21; interorb. 26–32; orb. 32–37; suborb. 12–13; postorb. 42–45; orb.-preop. 41–43; up.jaw 46–48; barbel 16–20; gill slit 23–27; pre-A. 123–140; pre-vent 114–132; V.-A. 22–27; isth.-A. 55–62; body depth 79–88; depth at A. 75–87; 1D.-2D. 47–63; ht. 1D. 52–60; len. 46–59; len. V. 27–35; post. nostril 6–8; rictus len. 39–41.

DESCRIPTION. — Gomon, Glover, and Kuitert (1994) give a recent description of material collected from southern Australia.

SIZE. — To about 60 cm TL.

DISTRIBUTION. — Widespread, probably cosmopolitan in warm waters of the Atlantic Ocean, Indian Ocean, and Pacific Ocean. Reported off Australia from WA, NSW, and QLD, but probably distributed across entire southern coast.

COMPARISONS AND REMARKS. — *Malacocephalus laevis* is the only member of the genus thus far recorded from Australian waters. The genus comprises seven nominal species, although the close similarity of *M. hawaiiensis* Gilbert, 1905 and *M. luzonensis* Gilbert and Hubbs, 1920 to *M. laevis* casts some doubt on their validity. Small differences in scale counts between Atlantic and Indian Ocean populations and fish from the Pacific have been noted (Iwamoto 1990), but there appear to be no other reliable characters for differentiating the species. *Malacocephalus nipponensis* Gilbert and Hubbs, 1916 apparently lacks the scale patch on the gular membrane present in (well-preserved) specimens of *M. laevis*. The three remaining species, *M. occidentalis* Goode and Bean, 1885, *M. okamurai* Iwamoto and Arai, 1987, and *M. boretzi* Sazonov, 1985, are distinct. A key to species was provided by Iwamoto (1990:240, 241).

***Mataeocephalus* Berg, 1898**

The genus includes five nominal species, but two or more undescribed ones are known, including a species with six branchiostegal rays reported by Iwamoto and Merrett (1997) from New Caledonia and now recorded from Australia. A revision of the genus is planned by Y. I. Sazonov (ZMMGU) and Y. N. Shcherbachev (IOAN).

KEY TO SPECIES OF *MATAEOCEPHALUS* FROM WESTERN AUSTRALIA

- 1a. Branchiostegal rays 7; underside of head naked; pelvic fin rays usually 8; anus closer to anal fin than to pelvic insertions . . . . . *M. acipenserinus*
- 1b. Branchiostegal rays 6; underside of head mostly scaled; pelvic fin rays 7; anus closer to pelvic fin insertions than to anal fin . . . . . *M. sp.*

*Mataeocephalus acipenserinus* (Gilbert and Cramer, 1897)

Fig. 38

*Coelocephalus acipenserinus* Gilbert and Cramer, 1897:422, 423 (Hawaii).*Mataeocephalus acipenserinus*: Berg, 1898:41 (replacement name for *Coelocephalus*, preoccupied in Coleoptera). Sazonov and Iwamoto, 1992:70, 71 (Sala y Gomez Ridge). Iwamoto and Merrett, 1997:533, 534, fig. 26 (New Caledonian region).

DIAGNOSIS. — Underside of head mostly naked. Serrations on second dorsal fin spine developed and widely spaced. Jaw teeth in short bands. Anus at posterior end of broad periproct region situated close to anal fin. Pectoral fin rays i19–i25; pelvic fin rays 8.

SPECIMENS EXAMINED. — WA: CSIRO H2542-30 (3, 48.5–49.2 mm HL, 206–240 mm TL); Exmouth Plateau; 854–868 m; SS1/91/3. CSIRO H2549-14 (43.6 HL, 178 TL); w. of NW Cape; SS1/91/10; 650–685 m. CSIRO H2572-12 (3, 44.5–49.1 HL, 185–297 TL); w. of Dirk Hartog I.; 874–882 m; SS1/91/35. CSIRO H2580-08 (7, 39.2–46.0 HL, 170–190 TL) and CSIRO H2580-07 (44.2 HL, 175 TL); sw. of Shark Bay; 713–714 m; SS1/91/43.

COUNTS AND MEASUREMENTS (based on 12 spec.).—ID. II,7–9; P. i19–i24; V. 8; total GR-I (inner) 5–7, GR-II (outer/inner) 6–7 (usually 7)/6–8; scales 1D. 5–6, 2D. 4.5–6.

Total length 170–245 mm; HL 39.2–49.2 mm. The following in % HL: postrostral 59–69; snout 36–41; preoral 30–41; internasal 20–24; interorb. 20–23; orb. 25–32; suborb. 13–16; postorb. 31–36; orb.-preop. 29–34; up.jaw 18–23; barbel 4–5; pre-A. 126–147; pre-vent 116–137; body depth 53–59; depth at A. 41–57; 1D.-2D. 26–37; len. P. 40–46; len. V. 40–46; post. nostril 6–13; rictus len. 14–17.

DESCRIPTION. — Snout long, moderately depressed; suborbital ridge with a row of well-developed, coarsely spinulated scales; snout forming a broad, triangular leading edge with prominent bifid terminal scute. Mouth small, inferior, extending approximately between levels of anterior margin and midline of orbit. Upper jaw length less than orbit diameter.

Premaxillary teeth in short, broad, oval-shaped bands; mandibular teeth in crescent-shaped band. Teeth long, fine; none enlarged.

Opercular openings relatively small; gill filaments well developed; gill rakers on first arch blunt, tubercular, with a few small distal spines.

Serrations on second spinous ray of first dorsal fin poorly developed and widely spaced; second dorsal fin poorly developed. Pectoral and pelvic fins of similar length; outer rays in both fins moderately prolonged.

Body lacking prominent markings; overall coloration variable, ranging from pale to dusky. Mouth region bluish in dusky specimens, cream colored in pale specimens. Upper jaw blackish anteriorly, lower jaw dusky to dark; median nasal processes dusky to dark; buccal cavity dark; posterior region of opercular cavity blue-black. Fin color variable pale to dark; pelvic bases dark.

SIZE. — To about 25 cm TL.

DISTRIBUTION. — Recorded in the Pacific from the Hawaiian Islands (type locality) and Sala y Gomez Ridge (Sazonov and Iwamoto 1992), and believed to be widespread in Pacific and Indian Oceans (Y. I. Sazonov, pers. comm. with AW, 1995). We took numerous specimens off WA between 20°S and 29°S, in 650–945 m depth.

COMPARISONS AND REMARKS. — *Mataeocephalus* specimens collected off WA were nearly inseparable from *M. acipenserinus* based on comparison with type material and the accounts of Gilbert and Cramer (1897), Gilbert (1905), Iwamoto (1990), and Sazonov and Iwamoto (1992). The only notable difference was reduced development of the terminal scute on the snout in the WA specimens compared to the type material. Of note was the high degree of variation in color in our specimens. The pelvic and anal fins, branchiostegal membranes, and flanks ranged from darkly pigmented to pale or virtually unpigmented. Some color variation may be due to variable abrasion of skin and fins in the trawl, since *M. acipenserinus* has highly deciduous scales and rather delicate skin. This is borne

out by the absence of scale pockets in many light-colored fish. There were no differences in counts or measurements between dark and lightly pigmented fish and no correlation with depth, latitude, or station. Coloration differences were also noted by Gilbert (1905) in specimens from Hawaii.

***Mataeocephalus* sp.**

Fig. 39

*Mataeocephalus* sp. Sazonov and Shcherbachev MS: Iwamoto and Merrett, 1997:534, 535, fig. 27 (New Caledonian region).

DIAGNOSIS.— Branchiostegal rays 6; underside of head mostly scaled; pelvic rays 7; periproct removed from anal fin, anus closer to pelvic fin insertions than to anal fin origin.

SPECIMEN EXAMINED.— WA: CSIRO H2549-13 (1 spec.); w. of NW Cape; 650–685 m; SS1/91/10.

SIZE.— To at least 23 cm TL.

DISTRIBUTION.— WA and New Caledonian region, 412–970 m.

COMPARISONS AND REMARKS.— This specimen represents an undescribed species that has been recorded from the New Caledonian region by Iwamoto and Merrett (1997) and is known from other areas in Australia (personal records, TI). Its six branchiostegal rays, as opposed to seven in all other members of the genus, place it in a questionable position in the genus and obscures the differences between the genera *Mataeocephalus* and *Hyomacrurus* Gilbert and Hubbs, 1920.

***Mesobius* Hubbs and Iwamoto, 1977**

The two widely distributed species in the genus are known to be at least partially bathypelagic (based on trawls fished in midwaters) and have peculiar, distinctive squamation on the head. The scales there are elongate and aligned, each bearing 1–3 rows of spinules that form low, sharp ridges. For a complete diagnosis see the original description or Iwamoto (1979).

KEY TO SPECIES OF *MESOBIUS*

- 1a. Pelvic fin rays 6–7; inner gill rakers on second arch 12–16 . . . . . *M. antipodum*  
 1b. Pelvic fin rays 7–9; inner gill rakers on second arch 10–12 . . . . . *M. berryi*

***Mesobius antipodum* Hubbs and Iwamoto, 1977**

Fig. 40a

*Mesobius antipodum* Hubbs and Iwamoto, 1977:245, 246 (New Zealand, e. of South I.; 995–1,110 m). Arai, 1979:286–289 (12 spec., New Zealand off Chatham Rise and Pukaki Rise; 860–1,050 m). Shcherbachev et al., 1979:19–22 (Indian Ocean, Atlantic Ocean; comparison of *M. berryi* and *M. antipodum*).

DIAGNOSIS.— Posttemporal region with differentiated squamation extending posteriorly of vertical through origin of pectoral fin base. Outer margin of gill cover notably incised at subopercle. Total inner rakers on first gill arch 12–15, on second arch 12–16.

SPECIMENS EXAMINED.— WA: CSIRO H3010-03 (2, 107–110 mm HL, 510–580 mm TL); 35°07'S, 115°01'E, 945 m; *Akebono Maru* No. 3, shot 10, 23.12.1989, coll. A. Williams. CSIRO H3008-02 (131.6 HL, 670+ TL); sw. of Albany; 35°25'S, 117°21'E, 842 m, *Akebono Maru* No. 3, shot 8; coll. A. Williams; 22.12.1989.

COUNTS AND MEASUREMENTS (based on 3 spec.). — 1D. II,9–10; P. i13–i14; V. 7; total GR-I (outer/inner) 7–10/13, GR-II 13–14/13; scales 1D. 12–13, midbase 1D. 6–7, 2D. 9.5–10.5.

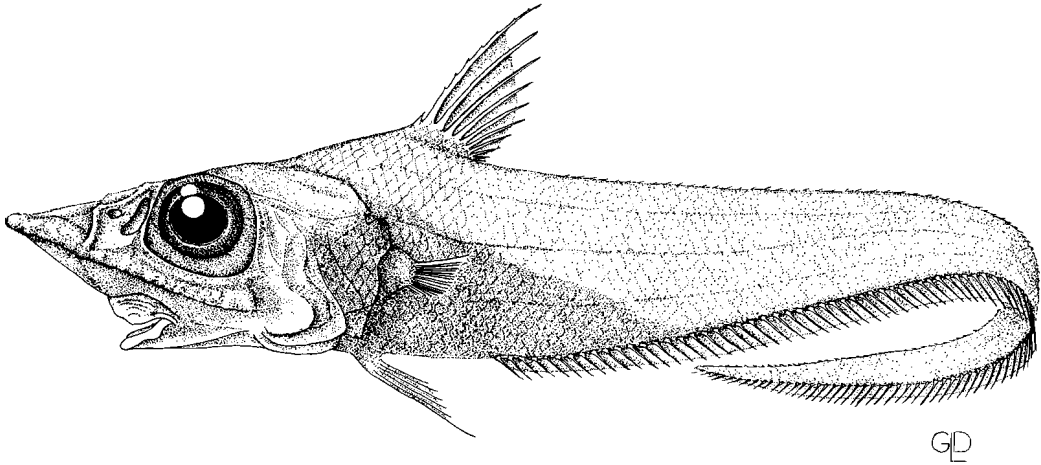


FIGURE 38. *Mataeocephalus acipenserinus* (Gilbert and Cramer). CSIRO H5272-12 (CSIRO H2572-12 (45 mm HL, 187 mm TL) from off Shark Bay, WA, in 874–882 m. Drawn by Georgina L. Davis.

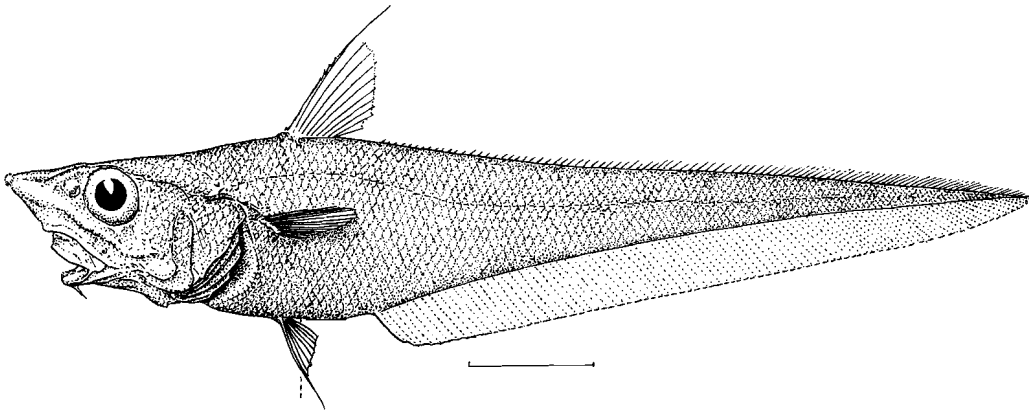


FIGURE 39. *Mataeocephalus* sp. (From Iwamoto and Merrett 1997, fig. 27.)

Total length 510–670 mm; HL 107.0–131.6 mm. The following in percent of HL: postrostral 74–77; snout 30–31; preoral 18–21; internasal 26–29; interorb. 33–34; orb. 26–30; suborb. 14–16; postorb. 48–49; orb.-preop. 47–49; up.jaw 44–47; gill slit 15–19; pre-A. 104–113; pre-vent 96–103; V.-A. 15–19; isth.-A. 32–37; body depth 79–87; depth at A. 78–87; 1D.-2D. 58–61; ht. 1D. 47 (1 spec.); post. nostril 4 (1 spec.); rictus len. 34–38.

DESCRIPTION. — Adequate descriptions are provided in the original description and the more recent accounts of Arai (1979), Shcherbachev et al. (1979), and Gomon et al. (1994).

SIZE. — To 67 cm TL.

DISTRIBUTION. — Widely distributed in the southern hemisphere: southern Atlantic Ocean off South Africa, Indian Ocean, Southern Ocean off southern Australia, southern Pacific Ocean off New Zealand.

COMPARISONS AND REMARKS. — The two species of *Mesobius* may be differentiated by counts of pelvic fin rays and gill rakers: for *M. antipodum* and *M. berryi*, respectively, pelvic fin rays 6–7

cf. 7–9, and inner rakers on second gill arch 12–16 vs. 10–12. Overall body size and development of the head may also be useful for field identifications. The largest reported size of *M. antipodum* (67 cm TL) is considerably greater than the size attained by *M. berryi* (42 cm TL); *M. antipodum* has a relatively well-developed and bulbous head, whereas the head of *M. berryi* is relatively slender.

*Mesobius antipodum* is possibly a pelagic species (see also comments under *M. berryi*), but thus far most specimens have been taken by demersal trawls.

***Mesobius berryi* Hubbs and Iwamoto, 1977**

Fig. 40b

DIAGNOSIS. — Posttemporal region with differentiated squamation not extending posteriorly of vertical through origin of pectoral fin base. Outer margin of gill cover not notably incised at subopercle. Total inner rakers on first gill arch 10–13; inner rakers on second arch 10–12.

SPECIMENS EXAMINED. — WA: CSIRO H2623-02 (76.0 mm HL, 375 mm TL); w. of Cape Freycinet; 1,225–1,240 m; SS1/91/92.

COUNTS AND MEASUREMENTS (based on 1 WA spec.). — 1D. II,10; P. i13; V. 8–9; total GR-I (outer/inner) 8/11, GR-II 10/10.

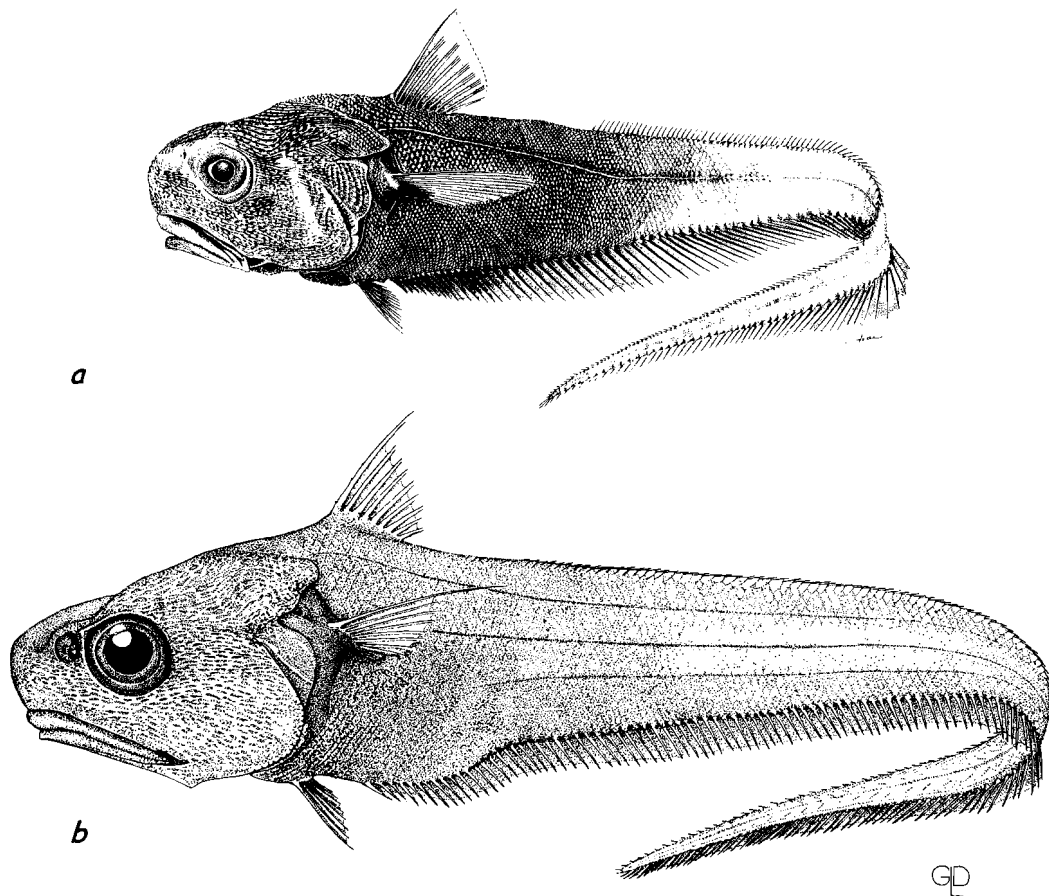


FIGURE 40. (a) *Mesobius antipodum* Hubbs and Iwamoto. CSIRO H3010-03, from south of Cape Leeuwin, WA, in 945 m. (b) *Mesobius berryi* Hubbs and Iwamoto. CSIRO H2623-02 (76 mm HL, 375 mm TL) from off Perth, WA, in 1225–1240 m. Drawn by Georgina L. Davis.



The following in percent of HL: postrostral 59; snout 20; preoral 12; internasal 17; interorb. 22; orb. 24; suborb. 10; postorb. 37; orb.-preop. 37; up.jaw 37; gill slit 14; pre-A. 75; pre-vent 72; V.-A. 10; isth.-A. 20; body depth 63; depth at A. 58; 1D.-2D. 34; len. V. 23; post. nostril 5; rictus len. 39.

DESCRIPTION. — Adequate descriptions are provided in the original description and by Iwamoto (1979).

SIZE. — To 41 cm TL.

DISTRIBUTION. — Indian Ocean, and central and northeastern Pacific Ocean.

COMPARISONS AND REMARKS. — Although our specimen and those of Shcherbachev et al. (1979) were taken by demersal trawling, the species is thought to be primarily bathypelagic (Hubbs and Iwamoto 1977). For comparison of *Mesobius* species, see remarks for *M. antipodum*.

### *Nezumia* Jordan, 1904

This genus includes more than 40 species, some of which when more closely studied are likely to be assigned to other genera. Shcherbachev et al. (1992) and Iwamoto and Sazonov (1994) recently revised, respectively, the genera *Kuronezumia* and *Kumba* to include several species previously considered as belonging to *Nezumia*. Many genera within this group of seven-branchiostegal-rayed grenadiers are inadequately diagnosed, and the distinctions between genera are often hazy and based on subjective or plesiomorphic characters. A thorough phylogenetic analysis of grenadiers with seven branchiostegal rays is needed to resolve the proper status of the included taxa.

The genus *Nezumia* is represented in waters off Western Australia by seven species. *Nezumia namatahi* McCann and McKnight, 1980 and *Nezumia coheni* Iwamoto and Merrett, 1997 are included in the key to species even though they have yet to be recorded from Western Australia. The former is a common species off New Zealand and the Australian east coast, but its farthest westward capture is the eastern part of South Australia. The latter species is common in New South Wales. The likelihood of the known ranges of these species extending into Western Australian waters and the possibility of specimens of the two species being confused with other species known from Western Australia prompt their inclusion in the key.

#### KEY TO AUSTRALIAN SPECIES OF *NEZUMIA*

- |  |                          |
|--|--------------------------|
| 1a. Pelvic fin rays 8 or 9, if 9, no dark band encircling trunk . . . . .  | 2                        |
| 1b. Pelvic fin rays 9–18, if 9, trunk encircled by a broad dark band . . . . .   | 3                        |
| 2a. Scale rows below origin of 1D. 10–13, below 2D. 7.5–11; pores on underside of head prominent; lip margins blackish anteriorly, pale towards jaw angle . . . . .  | <i>N. spinosa</i>        |
| 2b. Scale rows below origin of 1D. 7–7.5, below 2D. 6.5–7.5; pores on underside of head inconspicuous; lip margins black to jaw angles . . . . .   | <i>N. merretti</i> n.sp. |
| 3a. Pelvic fin rays 14–17 . . . . .  | <i>N. propinqua</i>      |
| 3b. Pelvic fin rays 9–12 . . . . .   | 4                        |
| 4a. Tip of tail posteriorly from about 90th anal fin ray completely pale; scales below origin of second dorsal fin 10–11 . . . . .   | <i>N. leucoura</i> n.sp. |
| 4b. Tail lacking prominent pale tip; scales below origin of second dorsal fin 5.5–9.5 . . . . .  | 5                        |
| 5a. Underside of snout completely scaled; orbit to preopercle distance 38–44% of HL . . . . .  | <i>N. wularnia</i> n.sp. |
| 5b. Underside of snout broadly naked; orbit to preopercle distance 33–44% of HL . . . . .  | 6                        |
| 6a. ADW about on line with pelvic fin insertions; dorsum rather uniformly pigmented, although area above abdomen often slightly darker . . . . .   | 7                        |
| 6b. ADW well posterior to line connecting pelvic fin insertions; dorsal aspects of trunk more darkly pigmented than comparable areas on tail (and usually nape), forming complete dark band around trunk . . . . . | 8                        |
| 7a. Total GR-I (outer/inner) 9–12/11–13; orbit to preopercle distance 33–38% of HL . . . . .   | <i>N. soela</i> n.sp.    |
| 7b. Total GR-I (outer/inner) 6–9/9–11; orbit to preopercle distance 38–44% of HL . . . . .   | <i>N. coheni</i>         |
| 8a. Pelvic fin rays 9–10; sensory pores on underside of head prominent . . . . .   | <i>N. namatahi</i>       |
| 8b. Pelvic fin rays 11–12; sensory pores on underside of head small . . . . .  | <i>N. kapala</i> n.sp.   |

*Nezumia kapala* new species

Fig. 41

No literature applies to this species.

DIAGNOSIS. — Pelvic fin rays 11–12; height first dorsal fin 86–109% of head length; underside of snout naked posteriorly to below about mid-orbit, pores of lateralis system small, inconspicuous; body scales covered with slender, conical to lanceolate spinules in slightly convergent rows; 7.5–9.5 scale rows below origin of second dorsal fin, 33–38 lateral line scales over distance equal to predorsal length; trunk encircled by broad dark band, sometimes poorly defined; first dorsal fin all black to black anteriorly and dusky posteriorly; anterior dermal window of light organ about on or well posterior to line connecting pelvic fin insertions; distance orbit to angle of preopercle 34–39% of head length; length upper jaw 26–33%; gill rakers on inner side of first arch 8–10.

SPECIMENS EXAMINED. — **NSW**: HOLOTYPE: AMS I.24993-008 (52.6 mm HL, 335 mm TL); off Broken Bay; 1,043–1,070 m; K84-16-14. PARATYPES: AMS I.24059-006 (4 of 6 spec., 48.1–54.2 HL, 318–358+ TL); off Broken Bay; 933–969 m; K8003-09-02. AMS I.24993-008 (57.1 HL, 367+ TL); same data as for holotype. CAS 200228 (formerly AMS I.24150-006) (51.1 HL, 343 TL); off Broken Bay; 988–1,020 m; K83-13-01. AMS I.25265-002 (4, 45.5–60.0 HL, 277+–402+ TL); se. of Broken Bay; 1,024–1,245 m; K84-19-04. AMS I.21724-005 (52.8 HL, 320 TL); e. of Broken Bay; 1,006 m; K79-20-15. AMS I.24060 (45.2 HL, 290+ TL); off Sydney; 942–960 m; K83-09-01. AMS I.24057-001 (4, 39.4–61.7 HL, 212+–394+ TL); se. of Kiama; 951–978 m; K83-09-04. **TAS**: CSIRO H2865-04 (43.7 HL, 255 TL); Pedra Branca area; 44°22.6'S, 147°08.6'E; 1,060–1,170 m; *Belinda*; 12.II.1992. **WA**: NMV A6195 (56.5 HL, 366 TL); 34°35.5'S, 121°14'S; 1,015–1,030 m; *Saxon Progress*; 17.VIII.1988. CSIRO H3008-11 (48.2 HL, 320 TL); sw. of Albany; 35°25'S, 117°21'E; 842 m; *Akebono Maru No. 3*, shot 8; 22.XII.1989. CSIRO H.2584-21 (30.9 HL, 148+ TL); w. of Shoal Point; 853 m; SS1/91/49.

COUNTS AND MEASUREMENTS (holotype first, followed by range in 24 paratypes). — 1D. II,9, II,8–10 (11); P. i20/i20, i18–i22; total GR-I (outer/inner) 9/10, 6–8/8–10, GR-II 9/11, 8–9/8–11; scales 1D. 10, 8–12, midbase 1D. 7.5, 5.5–7.5 8.5, 2D. 9.5, 7.5–9.5, lat.line 36, 33–38.

Total length 335 mm, 148+–410+ mm; HL 52.6 mm, 30.9–67.0 mm. The following in percent of HL: snout 33, 27–34; preoral 27, 23–31 (33); internasal 25, 21–25 (27); interorb. 22, 18–25; orb. 30, 29–33 (35); suborb. 15, 14–17; postorb. 41, 40–45; orb.-preop. 35, 34–39; up.jaw 27, 26–31 (33); barbel 14, 11–20; gill slit 12, 10–14; pre-A. 150, 146–167; V.-A. 44, 35–52; body depth 77, 69–92; 1D.-2D. 54, 28–60; ht. 1D. 87, 86–109; len. 1P. 55, 52–64; len. V. 51, 45–67; post. nostril 8, 4–9.

DESCRIPTION (of holotype, with comments on paratypes in parentheses). — General features of fish seen in Figure 41. A slender fish, head more than 6 times, greatest body depth more than 7 times, into total length. Snout conically pointed in lateral view; bluntly angular in dorsal view; about equal to orbit diameter; tip armed with a large, broad, bifid scutelike scale; lateral angles also studded with stout spiny scales. Mouth subinferior, jaws short, less than one-third head length; posterior end of maxilla falls about under mid-orbit. Chin barbel well developed but short, least width about half orbit diameter. Suborbital shelf formed of 2 rows of stoutly modified scales; the lower row forming a rather sharp angular ridge. A broad median swath of naked skin under snout, but almost all of suborbital, preopercle, and lower jaw scaled. Exposed posterior tip of subopercle scaled. Preopercle broadly rounded, chord of posterior margin vertical.

Exposed fields of body scales covered with sharp, slender, conical to narrowly lanceolate spinules aligned in 11–15 slightly convergent rows (number of rows size dependent).

Teeth in broad tapered bands in both jaws; upper jaw teeth somewhat larger than those of lower jaw, outer series enlarged.

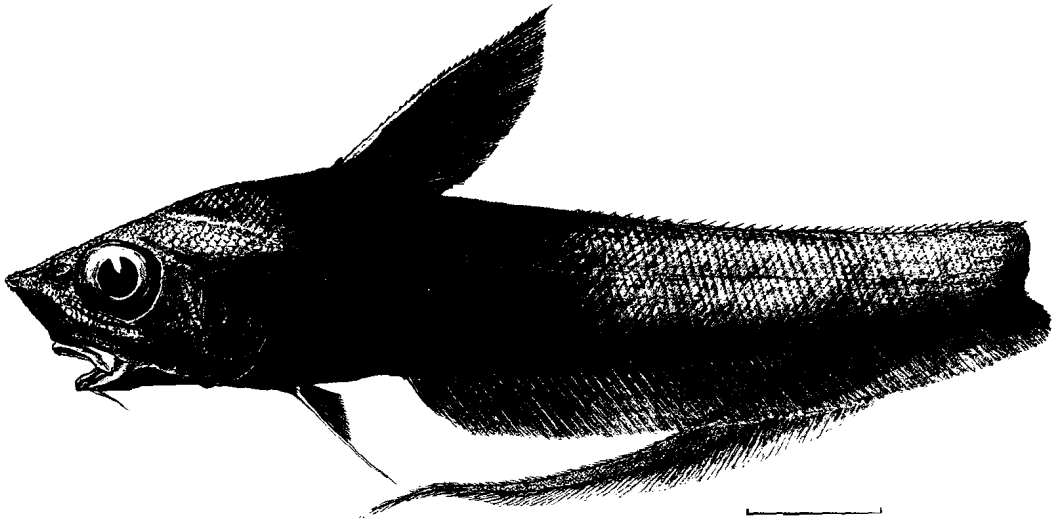


FIGURE 41. *Nezumia kapala* n.sp. Holotype, AMS I.24993-008 (335 mm TL), from off Broken Bay, NSW, in 1,043–1,070 m. Fins and scales partially reconstructed. Scale bar represents 25 mm.

First dorsal fin high, less than head length in holotype (more than head length in several paratypes); second spinous ray heavy, slightly recurved, leading edge armed with about 22 small sharp denticles. Second dorsal fin rudimentary over anterior half or so, rather low over posterior half. Outer pelvic fin ray slightly prolonged, extending posteriorly to about 4th or 5th anal ray. Pectoral and pelvic origins about on same vertical; origin of first dorsal behind that vertical. Anal fin well developed throughout.

Periproct region moderately developed; anus about midway between pelvic insertions and anal origin; ADW small, lying well posterior to line connecting pelvic insertions (in one paratype, AMS I.24060-023, ADW about at level of line).

Ground color pale to dark brown overall, with entire trunk region encircled by broad dark band. Ventral aspects of chest, opercle, and all of abdomen (to above 12th or so anal ray) black to bluish black; somewhat paler on dorsum and nape but still distinctly darker than head and posteriorly on tail. First dorsal fin all black (in most specimens, somewhat paler posteriorly in some). Pectoral, pelvic, and anteriormost rays of anal fins black; anal fin dark dusky posteriorly. Gular and branchiostegal membranes black; mouth and lips dark; gill chamber black; gill arches and rakers dark; barbel pale.

SIZE. — To about 41 cm TL.

DISTRIBUTION. — Australia, from NSW off Norah Head (33°32'S) south to TAS, and west to WA, west of Shoal Point (28°S) in 842–1,243 m.

ETYMOLOGY. — Named for the former New South Wales Fisheries research vessel, the *Kapala*, on which the holotype and many other grenadiers from New South Wales were collected.

COMPARISONS AND REMARKS. — *Nezumia kapala* is very similar in overall morphology to *N. namatahi*, a species formerly known only from off New Zealand but known from our records from off the southeast coast of Australia. The two species are sympatric, with individuals of both species having been captured together (and confused) in numerous trawls. The most readily apparent difference between the two lies in the pelvic fin ray count: 11 or 12 in the new species, 9 or 10 in *N.*

*namatahi* (see Table 5). Other differences include the broadly lanceolate to shield-shaped spinules in *N. namatahi* and the large pores on the underside of head, which are absent or small in the *N. kapala*.

*Nezumia kapala* is also closely similar to *N. soela*, but the two can be distinguished by the latter having a more anterior position of the periproct and ADW, absence of a completely encircling dark band on trunk, slightly higher gill raker counts on the first arch (9–12 cf. 6–8 in outer series, 11–13 cf. 8–10 in inner series), and slightly shorter postorbital length (37–40% HL cf. 40–45%). Another species from NSW and New Caledonia, *N. coheni* Iwamoto and Merrett, 1997, differs from *N. kapala* in lacking a complete, dark trunk girdle, ADW at or slightly anterior to line connecting pelvic insertions, and a somewhat greater orbit-preopercle distance (38–44% HL cf. 34–40%).

### *Nezumia leucoura* new species

Fig. 42a

DIAGNOSIS. — Pelvic fin rays 11–12; height first dorsal less than head length; underside of head including lower jaw naked, without prominent sensory pores; scales covered with tiny spinules in parallel to slightly convergent rows; 10–11 scale rows below origin of second dorsal fin, about 50 lateral line scale rows from anterior origin over distance equal to predorsal length; dark color of trunk confined to abdomen, not extending onto dorsum; first dorsal fin pale with blackish tip; anterior dermal window of light organ small, situated between pelvic fin bases; tip of tail distinctly pale over posterior 1/4–1/5th of fin, from about 90th (88th–110th) anal ray.

SPECIMENS EXAMINED. — **WA:** HOLOTYPE: AMS I.31181-012 (38.4 mm HL, 208+ mm TL); sw. of Shoal Point; 853–854 m; SS1/91/49. PARATYPES (32 spec.): AMS I.31181-012 (3, 33.0–42.0 HL, 163+–223+ TL), AMS I.31170-005 (4, 18.7–26.8 HL, 103+–170 TL) and CAS 200230 (35.3 HL, 210+ TL); same data as for holotype. NMV A9543 (7, 32.6–38.0 HL, 155–216 TL); CSIRO H2573-12 (170 TL), H2573-13 (6, 120–170 TL); w. of Steep Pt.; 691 m; SS1/91/36. CSIRO H2579-03 (190 TL); sw. of Shark Bay; 688 m; SS1/91/42. CSIRO H2596-05 (215 TL), H2596-06 (5, 200–220 TL); wnw. of Green Head; 760 m; SS1/91/62.

COUNTS AND MEASUREMENTS (holotype first, followed by range in 13 paratypes). — 1D. II, 13, II, 11–13; P. i21, i20–i23; V. 12, 11–12; total GR-I (outer/inner) 12/10, 8–12/9–11, GR-II 9/10, 8–10/9–11; scales 1D. 16, 14–15, midbase 1D. ?, 8.5–10.5, 2D. ?, 10–11, lat. line 51, 45–53.

Total length 208 mm, 103+–223+ mm; HL 38.4 mm, 18.7–42.0 mm. The following in percent of HL: snout 27, 25–32; preoral 22, 17–24; internasal 23, 21–28; interorb. 21, 20–25; orb. 34, 32–43; suborb. 14, 14–16; postorb. 42, 40–45; orb.-preop. 38, 33–40; up.jaw 36, 33–39; barbel 21, 19–26; gill slit 14, 13–20; pre-A. 156, 141–158; V.-A. 44, 36–52; body depth 94, 82–97; 1D.-2D. 40, 36–76; ht. 1D. 81, 80–97; len. P. 57, 52–58; len. V. 57, 52–69; post. nostril 3, 3–6.

DESCRIPTION. — General features of holotype shown in Figure 42a. Snout short, vertical profile relatively steep, length less than diameter of large orbits, protruding little beyond mouth. Jaws relatively large for genus, upper jaw usually more than one-third head length, extending posteriorly to below mid-orbit or slightly beyond. Suborbital shelf stout, formed of two series of modified scales, the lower series with notably stout and coarse scales, the upper series of small and rather weak scales; ventral edge of lower series forming a sharp ridge. Underside of snout, suborbital, and mandibular rami naked; sensory pores of head rather well developed. Preopercle broadly rounded, posterior margin almost vertical. Subopercle scaled and exposed only at posterior end. Chin barbel slender but well developed, length about equal to interorbital width. Gill arches restricted by membranes across lower extent.

Body scales small, rather deciduous; exposed fields covered with tiny conical spinules in 11–14 parallel to slightly convergent rows in holotype.

Teeth small, in moderately wide bands in both jaws; outer series in upper jaw slightly enlarged.

TABLE 5. Comparison of characters of nine species of *Nezumia* from Australia.

Species	V.	GR-1	ADW*	Dark trunk girdle	Len. upper jaw (%HL)	Orb. preop. len. (%HL)	ID. rays	Scales 2D.
<i>N. namatahi</i>	(9)10	5-8/(7)8-9	-	yes	(24)26-30	33-37	9-10(11)	7.5-9.5
<i>N. kapala</i>	(11)12	6-8/8-10	-	yes	26-31(33)	34-39	8-10(11)	7.5-9.5
<i>N. soela</i>	10-11	9-12/(10)11-13	-, +	no	29-33	33-38	10-11(12)	7.0-9.5
<i>N. coheni</i>	11	6-9/9-11	-, +	no	30-34	38-44	9-10(11)	(6.5)7.5-8.5
<i>N. wularnia</i>	11-12	6-8/9-10	-	no or faint	29-34	38-44	10-11(12)	5.5-7.5
<i>N. leucoura</i>	11-12	8-12/9-11	-, +	no	33-39	33-40	11-13	10-11
<i>N. propinqua</i>	14-17	8-10/8-10	+	no	31-35	30-39	10-12	8.5-10
<i>N. spinosa</i>	8-9	8-10/9-12	+	no	27-33	34-40	10-11	7.5-11
<i>N. merretti</i>	9	10/12	+	no	28-31	33-36	10	6.5-7.5

\* ADW behind (-) or before (+) V. insertion.

Height first dorsal fin less than head length, leading edge of second spinous ray armed with small, widely spaced denticulations; second dorsal fin rays rudimentary almost entire length of fin. Pectoral and pelvic fins in advance of first dorsal fin; pectoral fin slightly more than half head length; pelvic fin short, prolonged outer ray scarcely extends to origin of anal fin in holotype, to as far as 8th anal ray in paratypes.

Periproct region large, well removed from anal fin, close between pelvic fins; anterior dermal window small, between pelvic fin bases and anterior to line connecting insertions of fins. Pyloric caeca of four paratypes short (slightly longer than least suborbital width), mostly branched into pairs, 24, 28, 30, and 31 in number.

Ground color somewhat grayish to tawny, swarthy on underside of head but whitish under snout, blackish over operculum and ventrally around chest, pelvic fins, and anus; bluish over abdomen; no broad band of dark pigment encircling trunk; tip of tail posteriorly from about 90th anal ray (88th to 110th in paratypes) pale, lacking normal pigmentation of tail. First dorsal fin black on membrane between second spinous ray and first branched ray, the tips of next few rays black; pectoral fin dusky at base, pale over most of rays, lightly dusky towards tip, narrow dorsal edge dark; pelvic fins mostly black, but outer ray and distal tips paler; anal fin pale or faintly speckled anteriorly, becoming dusky posteriorly. A broad horizontal streak from upper lip onto membrane between premaxilla and maxilla. Chin barbel pale. Mouth lining dark except pale at angles of jaw; gums pale. Gill rakers and arches dark.

SIZE. — To about 23 cm TL.

DISTRIBUTION. — Known only from WA, from about 26°S to about 30°S, in 688–854 m.

ETYMOLOGY. — From the Greek, *leukos*, white, and *oura*, tail.

COMPARISONS AND REMARKS. — This small species appears to be confined to a short stretch of continental slope off Western Australia. In its morphology it is a fairly typical member of the genus, especially those found in shallow upper-slope waters of tropical seas. It is unique, however, in having a pale tail tip, which distinguishes it from all other known species of *Nezumia*. It is most likely to be confused with *N. propinqua* and *N. evides*, with which it shares a small adult size, black-tipped first dorsal fin, relatively high pelvic fin ray count, short snout, small scales covered with short, conical spinules, and the absence of a dark girdle around the trunk. The pale tail and counts of pelvic rays and scale rows below the first dorsal origin, however, readily distinguish *N. leucoura* from *N. propinqua* and *N. evides*.

### *Nezumia merretti* new species

Fig. 42b

*Nezumia* sp. B: Williams et al., 1996:149 (in part; WA list).

DIAGNOSIS. — Pelvic fin rays 9; underside of head almost completely naked, pocketed with prominent pores; body scales covered with moderately long, needlelike spinules in mostly parallel (to slightly convergent) rows, spinules overlap posterior scale margin slightly; 6.5–7.5 scale rows below origin of second dorsal fin; lower jaw teeth in broad, short band; abdomen light bluish, dorsally on trunk dirty straw-colored or tawny; first dorsal fin dusky overall; anterior dermal window of light organ between pelvic fin bases.

SPECIMENS EXAMINED. — WA: HOLOTYPE: CSIRO H2584-20 (54.2 mm HL, 245+ mm TL); w. of Shoal Point; 853 m; SS1/91/49. QLD: PARATYPE: CSIRO H1966-01 (39.9 HL, 202+ TL); Marian Plateau, e. of Townsville; 879–886 m; SO6/85/36.

COUNTS AND MEASUREMENTS (holotype first, followed by paratype). — 1D. II,10, II,10; P. i22/i21, i22/i21; total GR-I (outer/inner) 10/12, 11/12; total GR-II 11, 11/13, 11/12; scales 1D. 7.5, 7.0, midbase 1D. 5.5, 6.5, 2D. 7.5, 6.5, lat.line 35, 39.



FIGURE 42. (a) *Nezumia leucoura* n.sp. Holotype, AMS I.311181-012 (208+ mm TL), from southwest of Shoal Point, WA, in 853-854 m. Fins and scales partially reconstructed.  
(b) *Nezumia merretti* n.sp. Holotype, CSIRO H2584-20 (245+ mm TL) from west of Shoal Point, WA, in 853 m. Fins and scales partially reconstructed. Scale bars represent 25 mm.

The following in percent of HL: snout 33, 36; preoral 24, 31; internasal 19, —; interorb. 21, —; orb. 30, 30; suborb. 13, 13; postorb. 40, 38; orb.-preop. 36, 33; up.jaw 31, 28; barbel 15, 8; gill slit 16, 14; pre-A. 157, 145; V.-A. 41, 30; body depth 81, 73; 1D.-2D. 39, 30; len. 1P. 54, 53; len. V. 76, 55; post. nostril 7, 11.

**DESCRIPTION.** — General features shown in Figure 42b. Body and head laterally compressed; dorsal profile rises smoothly from snout tip to first dorsal fin. Snout broadly triangular in dorsal view, tipped with large, blunt bifid scute, tubercular scales at lateral angles not prominent. Suborbital shelf composed of two rows of stout, coarsely spinulated, modified scales. Underside of snout, most of suborbital, and mandible naked; lower margin of preopercle narrowly naked; interopercle scaled at exposed posterior end; pores on underside of head relatively large. Upper jaw extends to below posterior one-third of orbit. Preopercle broadly rounded, although somewhat angular at posteroventral corner.

Body scales relatively large, densely covered with small, needlelike spinules aligned in 16–18 parallel to slightly convergent rows in holotype (fewer rows in smaller paratype). Spinules reclined at about 35–45° angle, those along posterior margin of scale slightly overlapping edge.

Teeth in both jaws in broad bands, lower jaw band broader, shorter, and more abruptly tapered laterally. Outer teeth series in upper jaw slightly enlarged; lower jaw teeth uniformly small.

Tips of first dorsal fin rays in holotype and paratype broken off; leading edge of second spinous ray armed with small, widely spaced denticles. Most pelvic fin rays fall short of, but outer ray prolonged well beyond, anal fin origin.

Anterior dermal window of light organ prominently developed, situated between pelvic fin bases. Periproct region large, far removed from anal fin origin.

Color in alcohol dirty-straw overall, abdomen light bluish, but blackish in vicinity of periproct and ADW. Gill cover and gill membranes blackish. Lips and membrane connecting maxilla and premaxilla blackish; gill and oral cavities dark gray to blackish. First dorsal fin dusky overall; pectoral fin light dusky with black basal segment; pelvic fin black; anal fin dark dusky anteriorly, paler posteriorly. Chin barbel pale.

**SIZE.** — To about 25 cm TL.

**DISTRIBUTION.** — Known only from two specimens from WA and QLD, in 853–860 m.

**ETYMOLOGY.** — Named in honor of our friend and colleague, Nigel R. Merrett, in recognition of his contributions to deep-sea biology.

**COMPARISONS AND REMARKS.** — *Nezumia merretti* is closely similar in most features to *Nezumia spinosa*. They can be separated by the larger scales of the new species, color of the first dorsal (overall dusky in the new species, blackish anteriorly in *N. spinosa*), spinules on body scales (shorter and do not overlap posterior margin as extensively and in more tightly parallel rows in the new species), and head pores (more prominent in *N. spinosa*). Characters given in the key readily separate the new species from other congeners from WA. *Nezumia holocentra* (Gilbert and Cramer, 1897) and *N. burragei* (Gilbert, 1905) from Hawaiian waters also share many characters with the new species and *N. spinosa*, including similar teeth bands, scale spinulation, terminal snout scute, naked underside of head, and high first dorsal fin. The two Hawaiian species, however, have a shorter, blunter snout; in *N. holocentra* the barbel is shorter, and in *N. burragei* the scales are smaller (about 15 below 1D., 13 below 2D., 46 lateral line scales over predorsal distance).

### *Nezumia propinqua* (Gilbert and Cramer, 1897)

Fig. 43a

*Macrourus propinquus* Gilbert and Cramer, 1897:424, 425, pl. XLII, fig. 2 (Hawaii).

*Nezumia propinqua*: Sazonov and Iwamoto, 1992:72–74, figs. 27, 28a (Sala y Gomez Ridge; extended synonymy). Iwamoto and Merrett, 1997:541, 542, fig. 29a (New Caledonia region).



DIAGNOSIS. — Pelvic fin rays 13–17; height first dorsal fin 97–113% of head length; underside of snout, suborbital, and lower jaw naked; sensory pores in naked areas small but readily discernible; body scales covered with needlelike spinules in as many as 10–12 parallel to slightly convergent rows; 8.5–10 scale rows below origin of second dorsal fin, 36–42 lateral line scales over distance equal to predorsal length; no dark band encircling trunk; distal 1/3 to 3/4 of first dorsal black; anterior dermal window of light organ slightly in advance of line connecting pelvic fin insertions.

SPECIMENS EXAMINED. — WA: CSIRO H2541-14 (31.4 mm HL, 160+ mm TL); Exmouth Plateau; 914 m; SS1/91/02. CSIRO H2549-17 (2, 30.0–31.5 HL, 160+–190 TL); w. of NW Cape; 650–685 m; SS1/91/10. CSIRO H2553-14 (2, 28–32.8 HL, 120+–173+ TL); w. of Pt. Cloates; 910 m; SS1/91/14. CSIRO H2563-02 (7, 21.5–19.6 HL, 94+–170 TL); w. of Quobba Pt.; 901 m; SS1/91/25. CSIRO H2572-10 (2, 29.6–32.7 HL, 158+–164+ TL); w. of Dirk Hartog I.; 874–882 m; SS1/91/35. ZMMSU uncat. (27.6–27.7 HL, 150–160 TL); off Cape Cuvier; 23°57.9'S, 112°14.2'E; 831–834 m; *Vityaz*' sta. 4564; 1.XII.1959.

COUNTS AND MEASUREMENTS (14 WA specimens). — 1D. II, 10–12; P. i19–i22; total GR-I (outer/inner) 8–10/8–10, GR-II 7–9/9–10; scales 1D. (9.5) 11–13, midbase 1D. 6.5–8.5; caeca 21, 28 (2 spec.).

Total length 128+–190 mm; HL 21.3–32.8 mm. The following in percent of HL: snout 29–34; preoral 18–24; internasal 19–26; interorb. 20–25; orb. 30–34; suborb. 14–18; postorb. 41–45; orb.-preop. 30–39; up.jaw 31–35; barbel 15–23; gill-slit 13–17; pre-A. 134–166; V.-A. 38–61; anus-A. 13–26; body depth 79–98; 1D.-2D. 23–40; len. 1P. 54–67; len. V. 76–105; nostril 5.4–10.0.

DESCRIPTION. — General features of fish seen in Figure 43a. Snout short, blunt, length about equal to greatest orbit diameter, tipped with small but prominent, usually bifid, tubercular scales. Mouth rather short, about one-third of head length; upper jaw extends to below midorbit. Suborbital shelf formed by 2 rows of stoutly modified scales, ventral row larger with relatively sharp ventral edge. Underside of snout, suborbital, ventral edge of preopercle, and mandibular rami naked; pores of sensory system small but readily discernible. Preopercle broadly rounded, posterior margin almost vertical. Interopercle exposed only along posteroventral margin. Chin barbel well developed, rather stout throughout, not forming filamentous tip. Gill arches restricted ventrally by narrow fold of skin.

Body scales small, exposed fields covered with slender, needlelike spinules arranged in 10–12 parallel to slightly convergent rows in largest specimens examined. Spinules greatly reclined on body scales, posteriormost ones extend well beyond posterior margin of exposed field.

Teeth small in both jaws, arrayed in short, narrow, tapered bands; those in lower jaw in bands 3 or 4 teeth wide; in upper jaw outer series slightly enlarged.

Height first dorsal fin about equal to or more than head length; second spinous ray armed along leading edge with 6–12 wide-spaced, slender spikes. Outer pelvic fin ray thickened and elongated, extending well beyond anal fin origin to base of 10th to 16th anal ray in some specimens. Pelvic fin origin below opening of operculum, well anterior to origin of pectoral fin, which is anterior to that of first dorsal fin.

Periproct region large, situated within middle one-third of distance between pelvic fin insertions and anal fin origin, usually somewhat closer to pelvic fin insertions. Anterior dermal window of light organ small, often inconspicuous between pelvic fin bases, well removed from periproct. Pyloric caeca of 2 specimens well developed, rather thick, some bifidly branched from near base.

Ground color dark brown to swarthy overall, with abdominal region somewhat violet; gill cover, gill membranes, and region around periproct black. All of head, including snout and underside, swarthy. First dorsal fin blackish over distal 2/3 to 3/4 but paler near base. Pectoral fin dusky; pelvic fin black; anal fin blackish anteriorly to dark dusky posteriorly. Proximal 1/2 of barbel dark; distal half pale. Oral and gill cavity black, although latter ventrally pale; gill arches and rakers dark. Lips blackish; skin connecting maxillary and premaxillary dark except near jaw angle.

SIZE. — To about 19 cm TL.

DISTRIBUTION. — Hawaii, southeastern Pacific (Sala y Gomez Ridge), Kyushu-Palau Ridge, New Caledonia, Western Australia, and across Indian Ocean to southern Africa, in 523–914 m.

COMPARISONS AND REMARKS. — *Nezumia propinqua* shares in common with *N. evides* Gilbert and Hubbs, 1920, and *N. condylura* Jordan and Gilbert, 1904, an unusually high (13–19) pelvic fin ray count. The upper range of these counts, from 16 to 19, is higher than in any other species of Macrouridae. The three species also share in common a relatively blunt snout, naked underside of head, black-tipped first dorsal fin, and similar scale spinulation (needlelike, in 4–12 parallel to slightly convergent rows). The species in this clade have not been adequately characterized, although representatives have been recorded from the Indian Ocean, throughout the tropical western Pacific, Hawaii, and the southeastern Pacific. Most characters used to distinguish the three species show overlap, leading to the question of whether they are valid species. A more thorough study of this clade using specimens from the entire distributional range will be necessary to resolve this question.

### *Nezumia soela* new species

Fig. 44b

*Nezumia* sp. C: Williams et al., 1996:1949 (WA list).

DIAGNOSIS. — Pelvic fin rays 10–11; first dorsal fin with 10 or 11 segmented rays (rarely 12); underside of snout with broad naked median swath, pores of lateralis system small, inconspicuous; body scales covered with narrow, lanceolate spinules in slightly convergent rows; 7–9.5 scale rows below origin of second dorsal fin, 36–41 lateral line scales over distance equal to predorsal length; trunk lacking prominent broad dark girdle; first dorsal fin all black; anterior dermal window of light organ more or less on transverse line connecting pelvic fin insertions; upper jaws 29–33% of HL; orbit to preopercle distance 33–38% of HL; inner gill rakers on first arch 10–13.

SPECIMENS EXAMINED. — WA: HOLOTYPE: CSIRO H3017-04 (65.3 mm HL, 350+ mm TL); nw. of Cape Leeuwin; 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; coll. A. Williams; 24.XII.1989. PARATYPES (17 spec.): CSIRO H2551-17 (46.6 HL, 250+ TL); w. of NW Cape; 1,500+ m; SS1/91/12. CSIRO H3002-04 (54.5 HL, 290+ TL); se. of Albany; 35°23.5'S, 118°27'E; 1,030 m; *Akebono Maru No. 3*, shot 2; coll. A. Williams; 21.XII.1989. CSIRO T292 (51.1 HL, 293+ TL), CSIRO T297 (53.0 HL, 388+ TL), T299 (51.4 HL, 285+ TL); GAB, s. of Eucla; 33°27'S, 128°36'E; 1,027–1,044 m; *Margaret Philippa*; coll. K. Evans; 24.XI.1984. AMS I.18712.-014 (51.6 HL, 290+ TL); GAB, s. of Maduras; 33°49'S, 127°00.9'E; 1,080–1,100 m; *Dmitry Mendeleev*; coll. J. R. Paxton; 28.I.1976. SA: CSIRO H2877-06 (50.9 HL, 290+ TL); 33°59'S, 131°07'E; 1,062 m; 1992. TAS: CSIRO H1579-48 (5 of 19 spec., 27.9–55.1 HL, 124+–296 TL); w. coast; 830 m; SO3/86/37. CSIRO T831 (56.6 HL, 315+ TL); sw. of King I.; 40°33'S, 143°18'E; 1,250–1,290 m; *Margaret Philippa*; coll. K. Evans; 18.X.1983. CSIRO T358 (45.0 HL, 240+ TL); sw. of King I.; 40°33'S, 143°18'E; 1,250–1,290 m; *Margaret Philippa*; coll. K. Evans; 18.X.1983.

COUNTS AND MEASUREMENTS (holotype first, followed by range in 19 paratypes). — 1D. II, 12, II, 10–12; P. i20/i20, i18–i22; total GR-I (outer/inner) 9/13, 9–12/11–13, GR-II 11/12, 9–11/10–13; scales 1D. 10, 8–11, midbase 1D. 7, 5.5–7.5(8.5), 2D. 8.5, 7.0–9.5, lat. line 40, 36–41.

Total length 350+ mm, 148+–410+ mm; HL 65.3 mm, 30.0–65.3 mm. The following in percent of HL: snout 33, 30–36; preoral 25, 24–31; internasal 22, 21–26; interorb. 21, 20–26; orb. 33, 31–36; suborb. 15, 14–17; postorb. 39, 37–40; orb.-preop. 38, 33–38; up.jaw 32, 29–33; barbel 17, 11–17(21); gill slit 14, 11–16; pre-A. 156, 137–159; V.-A. 47, 31–47; body depth 84, 63–81; 1D.-2D. 49, 29–62; ht. 1D. 93, 75–102; len. 1P. 51, 44–61; len. V. 46, 46–66; post. nostril 8, 6–12.

DESCRIPTION. — General features of fish seen in Figure 44b. Head 5–6.5 times into total length, greatest body depth more than six times into total length. Snout conically pointed in lateral view;

angular in dorsal view; about equal to orbit diameter; tip armed with two large, closely adjoined, tubercular scales; lateral angles also studded with stout spiny scales. Mouth subinferior, upper jaws about one-third or less of head length; posterior end of maxilla falls about under midorbit or slightly beyond. Chin barbel short, length less than half orbit diameter. Lower row of modified scales on suborbital shelf forming a rather sharp angular ridge. Preopercle broadly rounded, chord of posterior margin inclined slightly forward.

Exposed fields of body scales covered with sharp, slender, lanceolate spinules aligned in 10–17 convergent rows (number of rows size dependent).

Teeth in broad tapered bands in both jaws; upper jaw teeth larger than those of lower jaw, outer series slender, slightly enlarged.

First dorsal fin high, less than head length in holotype, but more than head in a few paratypes; second spinous ray heavy, slightly recurved, leading edge armed with about 33 small, low, spaced, non-overlapping denticles. Outer pelvic fin ray slightly produced into hair-fine filament, extending posteriorly to just beyond anal fin origin.

Periproct region moderately developed; ADW small.

Ground color medium brown, with trunk dorsally slightly darker but without a prominent dark encircling band (in contrast to *N. kapala* and *N. namatahi*). Ventral aspects of chest, all of abdomen (to above 10th or so anal ray), and opercle black to bluish black; medium brown on dorsum and nape. First dorsal, pectoral, pelvic, and anteriormost rays of anal fins black; anal fin dark dusky posteriorly. Gular and branchiostegal membranes black; mouth and lips dark; gill cavity black except over hyoid bones and isthmus, which are pale; gill arches and rakers dark; barbel dusky near base, pale distally.

SIZE. — To more than 35 cm TL.

DISTRIBUTION. — Australia, from west coast TAS to North West Cape, WA; in 830 to about 1,500 m.

ETYMOLOGY. — Named for the former CSIRO fisheries research vessel *Soela*, on which were collected many of the specimens used in this report.

COMPARISONS AND REMARKS. — Specimens from the west coast of Australia north of Cape Leeuwin appeared to be slightly paler and more brownish over the tail than those from southern Australia. Furthermore, their snout appeared somewhat more pointed and angular, and the underside of the snout had a slightly broader naked area. These differences were too slight to consider recognizing two separate populations.

*Nezumia soela* is very similar in overall morphology to *N. coheni* in having a tiny anterior dermal window lying at, or about on a line with, the pelvic fin insertions, 11 pelvic fin rays, no prominent dark girdle encircling trunk, and generally similar proportions. The two species differ, however, in gill raker counts of the first arch (9–12 inner rakers, 11–13, rarely 10, rakers on outer arch in *N. soela* cf. 6–9 and 9–11, respectively, in *N. coheni*), distance orbit to preopercle angle (33–38% HL in *N. soela* cf. 38–44%), and size of outer series of premaxillary teeth (larger, thicker in *N. soela*). Pores of the lateralis system on the lower jaw are larger with raised rims in *N. soela* (cf. smaller, no rims), the sensory papillae on the underside of the snout are more prominent and numerous in *N. soela*, and the snout is blunter and narrower. Several features of the two species are compared in Table 5.

The higher gill raker counts, the absence of a prominent dark trunk girdle, and the more anteriorly placed anterior dermal window distinguish the species from *N. namatahi* and *N. kapala*. *Nezumia kapala* and *N. soela* appear to be sympatric, although *N. kapala* occurs farther to the east and north (to NSW).

### *Nezumia spinosa* (Gilbert and Hubbs, 1916)

Fig. 43b

*Lionurus spinosus* Gilbert and Hubbs, 1916:199, pl. 10, fig. 2 (Japan); 1920:554 (4 spec., off Luzon, Philippines).

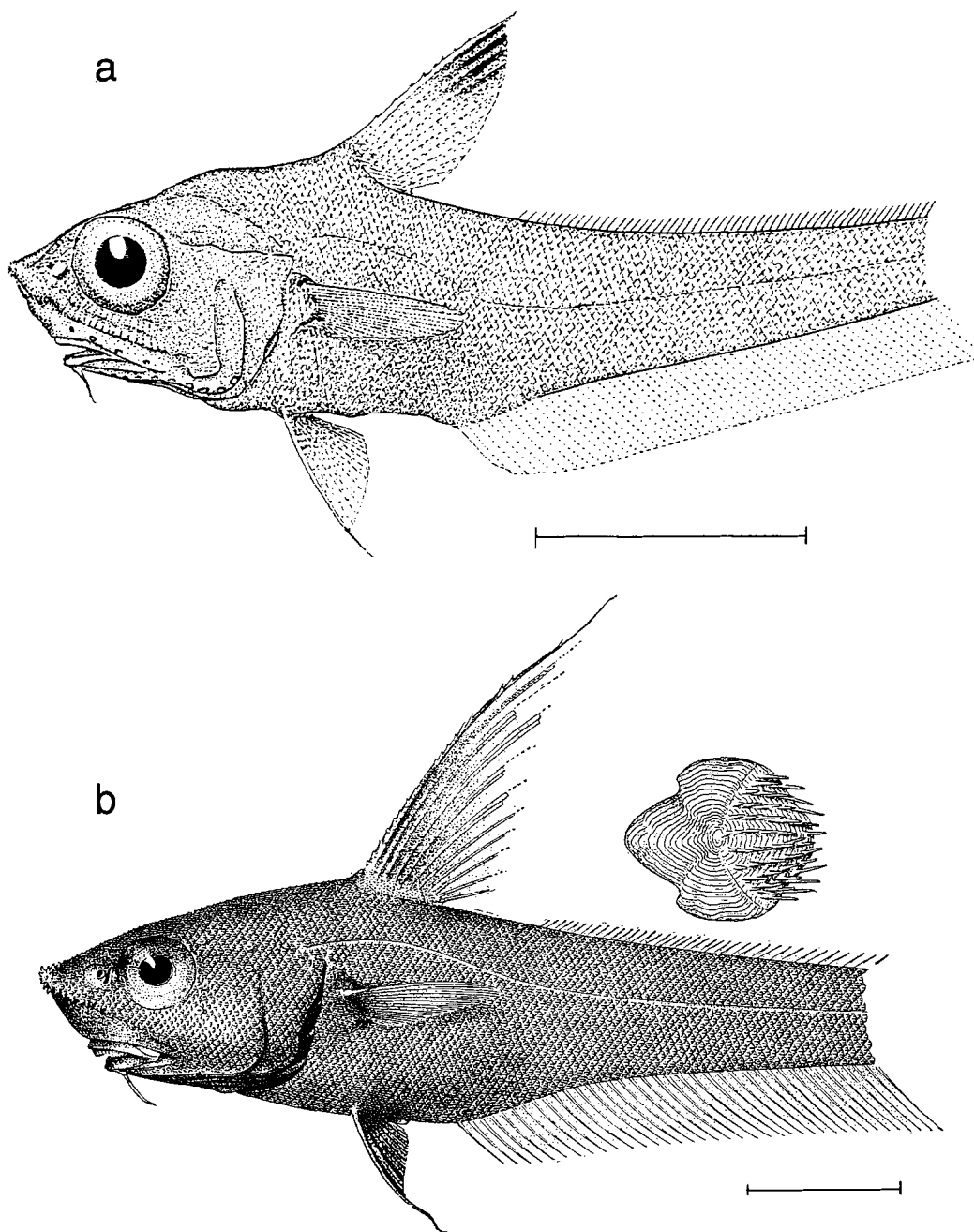


FIGURE 43. (a) *Nezumia propinqua* (Gilbert and Cramer). (From Iwamoto and Merrett 1997, fig. 29a.) (b) *Nezumia spinosa* (Gilbert and Hubbs). Holotype, USNM 76868 (280 mm TL), from off Japan in 777 m. From Gilbert and Hubbs 1916, pl. 10, fig. 2.) Scale bars represent 25 mm.

*Nezumia spinosa*: Iwamoto and Anderson, 1994:18, 19 (22 spec., Natal, South Africa and Mozambique).  
Williams et al., 1996:149 (WA list). Iwamoto and Merrett, 1997:542–545, fig. 29b (New Caledonia region).

DIAGNOSIS. — Pelvic rays 8 or 9; height first dorsal fin usually much greater than head length; underside of head almost completely naked, pocketed with rather prominent pores along mandible and ventral margin of suborbital region; scales densely covered with long needlelike spinules in parallel to convergent rows, posteriormost spinules on scales extend most of their length beyond scale margin; 7.5 to 11 scale rows below origin of second dorsal fin; teeth in lower jaw in notably broad bands, 6 or more teeth wide across anterior end; dark color of trunk confined to abdomen, not extending onto dorsum; first dorsal fin blackish anteriorly and proximally, paler near distal tips and posterior margin; anterior dermal window of light organ prominent, situated between pelvic fin bases.

SPECIMENS EXAMINED. — WA: AMS I.22809-046 [formerly 014] (33.4 mm HL, 260+ mm TL); NW Shelf, 250 km nw. of Port Hedland; 584–592 m; SO2/82/19-21. AMS I.22810-045 (36.4 HL, 140+ TL); NW Shelf, 250 km nw. of Port Hedland; 694–736 m; SO2/82/22-24. CSIRO H1492-25 (33.3 HL, 155+ TL); NW Shelf; 420 m; SO5/88/70. CSIRO H2542-29 (38.5 HL, 185 TL); Exmouth Plateau; 854–868 m; SS1/91/03. CSIRO H2549-10 (49.1 HL, 255+ TL); w. of NW Cape; 650–685 m; SS1/91/10. CSIRO H2557-09 (33.3 HL, 165+ TL); w. of Cape Farquhar; 620 m; SS1/91/19. CSIRO H2580-04 (47.7 HL, 245+ TL); sw. of Shark Point; 713–714 m; SS1/91/43. CSIRO H2584-03 (51.1 HL, 220+ TL); w. of Shoal Point; 853 m; SS1/91/49. (Also material listed by Iwamoto and Anderson (1994) from southern Africa and Iwamoto and Merrett (1997) from New Caledonia, East China Sea, and South China Sea.)

COUNTS AND MEASUREMENTS (of Australian material only; see Tables 5 and 6). — P. i18–i22; total GR-II (outer/inner) 9–11/9–12; scales 1D. 10–13, midbase 1D. 6.5–9; 2D. 7.5–11; lat.line 35–42.

Total lengths 155+–255+ mm; HL 32.0–51.1 mm. The following in percent of HL: snout 28–32; preoral 18–29; internasal 17–21; interorb. 18–24; orb. 28–31; suborb. 12–14; postorb. 43–46; orb.-preop. 34–40; up.jaw 27–33; barbel 9–18; gill slit 11–14; pre-A. 141–155; V.-A. 34–47; body depth 78–81; 1D.-2D. 34–52; ht. 1D. 93–156; len. 1P. 48–57; len. V. 61–84; post. nostril 7–11.

SIZE. — To at least 26 cm TL.

DISTRIBUTION. — Japan, South and East China seas, Philippines, Australia (QLD, WA), southern Africa, in 420–900 m (and possibly to 1,258 m, based on field data of AW).

COMPARISONS AND REMARKS. — *Nezumia spinosa* is a distinctive species of the genus owing to its low pelvic fin ray count, high first dorsal fin with leading edge of prolonged second spinous ray beset with widely spaced teeth, almost completely naked underside of head pocketed with pores of sensory lateralis system, notably broad band of dentary teeth, and small body scales covered with long, needlelike, greatly reclined spinules arranged in somewhat convergent rows. *Nezumia spinosa* is likely to be confused only with *N. merretti*, which it closely resembles but differs in having longer scale spinules that greatly overlap the posterior scale margin (overlap slightly in *N. merretti*), smaller body scales (rows below 1D. 7–7.5 in *N. merretti*, compared with 10–13 in *N. spinosa*), and darker first dorsal fin (overall dusky in *N. merretti*).

Comparison of Australian specimens of *N. spinosa* with those reported by Iwamoto and Anderson (1994) from southern Africa revealed some notable differences in frequency distributions of first dorsal rays, preoral length, postorbital length and upper jaw length. These are compared in Table 6. These differences and the disjunct distribution of the species suggest that isolation has resulted in significant divergence between the populations on each side of the Indian Ocean. The extent to which the African population has diverged from the eastern population may argue for the recognition of a second species. Continental drift may have accounted for the disjunct distribution. This species is one of few Western Australian grenadiers also found off Queensland.

*Nezumia wularnia* new species

Fig. 44a

*Nezumia* sp. D: Williams et al., 1996:149 (WA).

DIAGNOSIS. — Pelvic fin rays 11–12; height first dorsal fin about equal to or more than head length; underside of head scaled, but lacking prominent pores of sensory lateralis system; body scales with dense covering of broadly shield-shaped spinules; 5.5–7.5 scale rows below origin of second dorsal fin, 36–42 lateral line scales over distance equal to predorsal length; trunk completely encircled by broad dark band, although sometimes rather faint; first dorsal fin uniformly blackish; anterior dermal window of light organ scarcely developed, usually apparent only as triangular anterior protrusion of naked periproct, situated behind line connecting insertions of pelvic fins; orbit to preopercle distance 38–44% of head length; upper jaw 29–34%; gill rakers on inner side of first arch 9–10.

SPECIMENS EXAMINED (all from WA). — HOLOTYPE: AMS I.31157-011 (53.0 mm HL, 245+ mm TL); off Cape Cuvier; 1,293–1,320 m; SS1/91/23. PARATYPES: AMS I.31157-011 (4, 48.2–55.0 HL, 215+–263+ TL); same data as for holotype. NTM S.12716-007 (76.1 HL, 247+ TL); nw. of Monte Bello I.; 20°15'S, 114°50'E; 500–600 m; coll. D. Evans; 22.II.1990. CSIRO H2545-01 (2, 53.6–55.2 HL, 240+–280 TL); over Exmouth Plateau; 1,023 m; SS1/91/05. CSIRO H2544-14 (68.8 HL, 340+ TL) and H.2544-12 (64.1 HL, 330+ TL); over Exmouth Plateau; 1,128 m; SS1/91/04. CSIRO H2553-09 (205+ TL); w. of Point Cloates; 910 m; SS1/91/14. AMS I.31159-005 (6, 57.0–73.4 HL, 234–370+ TL); off Cape Cuvier; 1,293–1,320; SS1/91/23. CSIRO H2581-15 (4, 49.4–55.2 HL, 230+–276+ TL); sw. of Shark Bay; 996 m; SS1/91/44. NMV A9583 (3, 50.0–56.0 HL, 240–265 TL); 95 km sw. of Geraldton; 29°21.8'S, 113°46.6'E; 942–970 m. CSIRO H2615-07 (61.8 HL, 315+ TL), H2615-08 (40.8 HL, 240 TL); and NMV A9523 (67.2 HL, 365 TL); w. of Mandurah; 1,030–1,140 m; SS1/91/83. CSIRO H2616-07, H2616-08, H2616-09; w. of Mandurah; 960 m; SS1/91/84. CSIRO H3017-03 (370 TL); nw. of Cape Leeuwin, 34°10'S, 114°16'E; 1,030 m; *Akebono Maru No. 3*, shot 17; coll. A. Williams; 22.XII.1989. CSIRO H3022-03 (2 spec.); w. of Bunbury; 33°17'S, 114°13'E; 976 m; *Akebono Maru No. 3*, shot 22; coll. A. Williams; 25.XII.1989.

COUNTS AND MEASUREMENTS (holotype first, followed by range in 19 paratypes). — 1D. II, 11, II, 10–12; P. i23/i21, i18–i23; total GR-I (outer/inner) ? / ? , 6–8/9–10, GR-II ? / ? . 8–9/9–10; scales 1D. 8, 7–7, midbase 1D. 5.5, 4.5–6.5, 2D. 6.5, 5.5–7.5, lat.line 37, 36–42.

Total length 215+–370+ mm; HL 40.8–73.4 mm. The following in percent of HL: snout 32, 27–32; preoral 24, 19–24; internasal 24, 20–25; interorb. 21, 18–23; orb. 30, 28–35; suborb. 16, 15–17; postorb. 44, 40–46; orb.-preop. 39, 38–44; up.jaw 34, 29–34; barbel 15, 11–18; gill slit ? , 12–17; pre-A. 168, 148–168; V.-A. 45, 28–46; body depth 84, 74–89; 1D.-2D. 41, 35–59; ht. 1D. 82, 82–113; len. P. 58, 46–60; len. V. 65, 43–70; post. nostril 5, 3–7.

DESCRIPTION. — General features shown in Figure 44a. Snout conical in lateral profile, tipped with large, but rather inconspicuous, tubercular scale; scales at lateral angles similarly large and inconspicuous. Suborbital shelf strong, composed of two distinct rows of modified scales; ridge formed by ventral margin of lower row not sharply angular, ventral aspects of suborbital rather smoothly blend in with shelf dorsally. Ventral surfaces of snout, suborbital, preopercle, and mandible completely and uniformly scaled; scales on underside of snout fairly deciduous and often lost. Free neuromast of cephalic lateralis system prominent in pale specimens. Body scales densely covered with broadly lanceolate to shield-shaped spinules.

Small fine teeth in bands in both jaws; outer premaxillary teeth slightly enlarged.

Long spinous ray of first dorsal fin relatively slender, especially prolonged distal portion; serrations along leading edge fine and widely spaced. Other fins without notably prolonged rays; outer pelvic fin ray slightly prolonged, extending at best to bases of first few anal fin rays.

TABLE 6. Comparison of six characters of *Nezumia spinosa* by area: southern Africa and Australia.

	Segmented 1D rays										N	x
	8	9	10	11	12							
S. Africa	—	—	8	14	1	23	10.70					
Australia	1	4	3	—	—	8	9.25					

	Pelvic fin rays			
	8	9	N	x
S. Africa	46	—	46	46.00
Australia	12	4	16	8.25

	Preoral length (%HL)										N	x
	18–19	20–21	22–23	24–25	26–27	28–29	30–31	32–33	34–35			
S. Africa	—	—	—	—	—	5	12	3	3	23	30.91	
Australia	2	2	2	—	1	1	—	—	—	8	22.38	

	Postorbital length (%HL)						N	x
	37–38	39–40	41–42	43–44	45–46			
S. Africa	2	8	13	—	—	23	40.65	
Australia	—	—	—	4	4	8	44.50	

	Length Outer Gill Slit (%HL)							N	x
	9	10	11	12	13	14			
S. Africa	1	3	3	6	4	2	19	11.89	
Australia	—	—	1	2	2	2	7	12.71	

	Length Upper Jaw (%HL)											N	x
	23	24	25	26	27	28	29	30	31	32	33		
S. Africa	1	—	2	3	6	6	2	1	—	—	—	21	27.10
Australia	—	—	—	—	1	1	—	2	—	3	1	8	30.50

Periproct region large, far removed from anal fin origin and closer to pelvic fin bases; minute, inconspicuous anterior dermal window anterior to periproct and situated posterior to line connecting insertions of pelvic fins.

Ground color of variable intensity; some specimens very dark brown, with nape, top of head, and tail faintly paler; in others these areas distinctly paler. A broad, dark trunk girdle of variable intensity (sometimes faint) present on all specimens. Abdomen bluish to black. Gular and branchiostegal membranes and operculum, including hind margin of preopercle, black. Lips blackish, but premax-

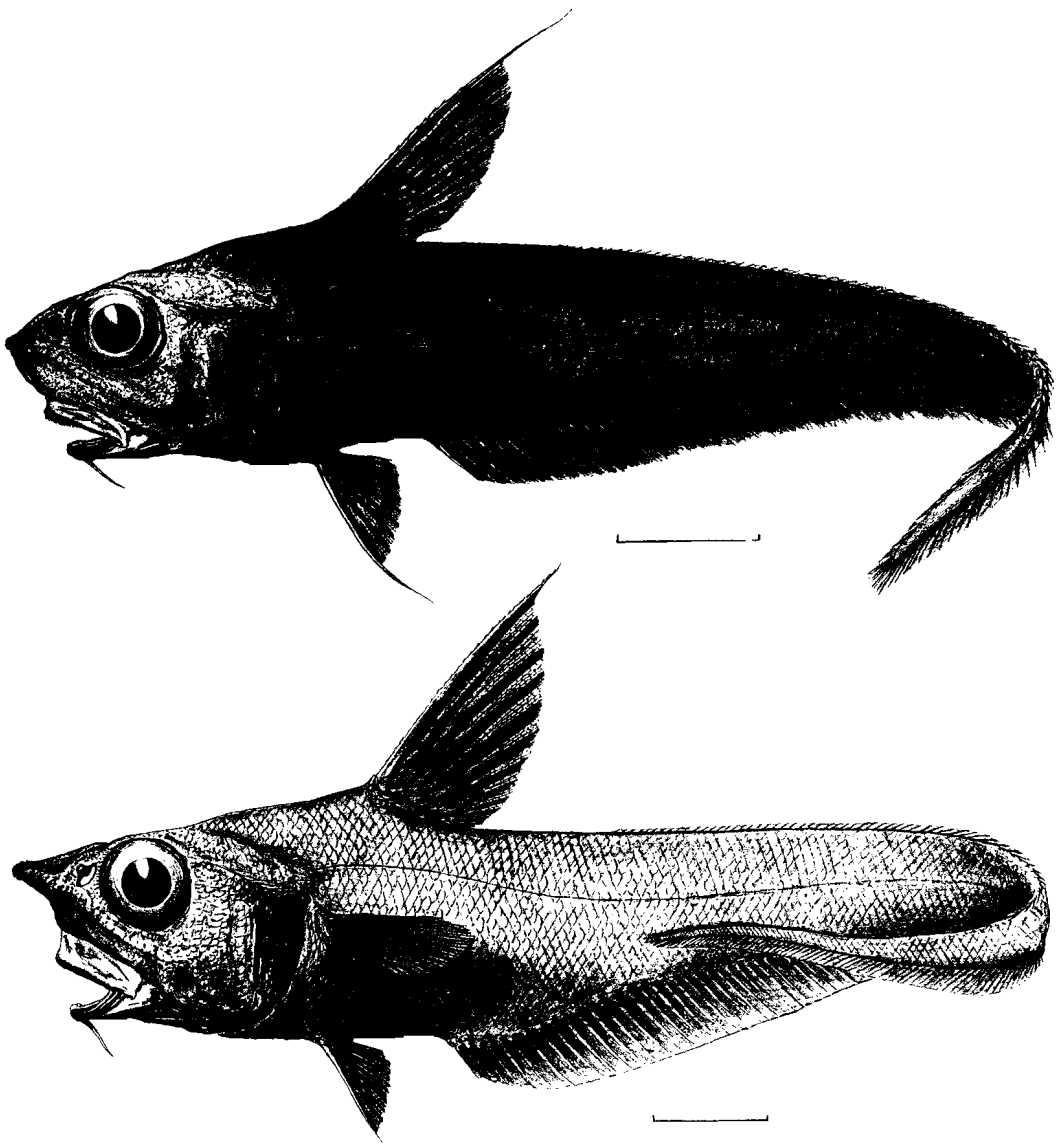


FIGURE 44. (a) *Nezumia wularnia* n.sp. Holotype, AMS I.31157-011 (245+ mm TL), from off Cape Cuvier, WA, in 1,293–1,320 m. (b) *Nezumia soela* n.sp. Holotype, CSIRO H3017-04 (350+ mm TL), from northwest of Cape Leeuwin, WA, in 1030 m. Fins and scales partially reconstructed. Scale bars represent 25 mm.

illary anteriorly (over ascending limbs) and angle of jaws pale. Barbel dark at base, pale distally. Paired and first dorsal fins black; anal fin blackish throughout in darker specimens, but in paler specimens only anterior end of anal fin blackish, with dusky rays posteriorly over remainder of fin.

SIZE. — To more than 37 cm TL.

DISTRIBUTION. — Known only from off WA, from Exmouth Plateau (ca. 21°S) to west of Mandurah (ca. 32°S), in 685–1,320 m.

ETYMOLOGY. — From the Yindjibarndi, *wularni*, from the west.



COMPARISONS AND REMARKS. — *Nezumia wularnia* differs from most other members of *Nezumia* in having the underside of the head completely scaled. (A few specimens of *N. wularnia* had a medium swath of naked skin ventrally on the snout, but the scales in that area appeared to have been sloughed off during capture or subsequent handling.) In other species of *Nezumia* from the region, the underside of head is almost completely naked, or at the least, most of the underside of snout is naked. Additionally, body scales in the new species are slightly larger, with scale-row counts below the dorsal fins somewhat lower. *Nezumia wularnia* agrees in many respects with *N. kapala* but differs in having slightly more first dorsal fin rays, a longer distance orbit to preopercle, and somewhat longer upper jaw (see Tables 5 and 7).

### *Pseudonezumia* Okamura, 1970

*Pseudonezumia* Okamura, 1970:38 (type species *Pseudonezumia japonicus* Okamura, 1970, by original designation).

*Paracetonus* Marshall, 1973:615 (type species *Macrourus parvipes* Smith and Radcliffe, 1912, by original designation).

See Iwamoto and Anderson (1994:21, 22) and Sazonov and Shcherbachev (1982b:11) for diagnosis (as *Paracetonus*). At least five species, including *Pseudonezumia cetonuropsis* (Gilbert and Hubbs, 1920), *P. flagellicauda* (Koefoed, 1927), *P. japonicus*, *P. parvipes*, and *P. pusilla* Sazonov and Shcherbachev, 1982b. Sazonov and Shcherbachev (1982b:11) included all of the above except *P. japonicus* in the genus *Paracetonus*.

### *Pseudonezumia pusilla* (Sazonov and Shcherbachev, 1982)

Fig. 45

*Paracetonus pusillus* Sazonov and Shcherbachev, 1982b:12–14, fig. 4 (Ninety East Ridge, central Indian Ocean and Bismarck Sea off New Guinea; 1,380–2,000 m).

*Pseudonezumia puscilla* [sic]; Williams et al., 1996:149 (WA list).

*Pseudonezumia pusilla*: Iwamoto and Merrett, 1997:547, 548, fig. 30b (New Caledonia off Loyalties).

DIAGNOSIS. — Chin barbel usually 14–23% HL, interorbital width 29–35%, upper jaw 30–39%, body 59–87% (usually <75%). Adult size relatively small, about 250 mm TL or less.

SPECIMENS EXAMINED. — CSIRO H2551-20 (30.5 mm HL, 186+ mm TL); off WA, w. of NW Cape; 1,460–1,500+ m; SS1/91/12.

COUNTS AND MEASUREMENTS (based on 1 WA spec.). — 1D. II,10; P. i15–i16; V. 6; total GR-I (outer/inner) 9/11, GR-II 10/11; scales midbase 1D. 13.

The following in percent of HL: postrostral 74; snout 31; preoral 22; internasal 26; interorb. 34; orb. 33; suborb. 15; postorb. 43; orb.-preop. 36; isth.-A. 65; body depth 73; depth at A. 72; 1D.-2D. 41; post. nostril 19; up.jaw 35.

DESCRIPTION. — Body slender, compressed, tapering gradually. Head relatively large, dorsal profile more or less flat; snout broad and high; orbits relatively large, the anterior margin adjacent to posterior nostril developed as thin lateral flange; perimeter of nostril distinctly large, circular; mouth long, narrow, subterminal. Gill rakers on outer side of first gill arch a series of rounded tubercles lacking spination; those of inner side of first arch and all other arches well developed and armed with series of dorsally directed, long, narrow, pointed spines.

Suborbital ridge and ridges of head poorly defined, their scales lacking enlargement or bony development; head and underside of jaw scaled; branchiostegal and gular membranes naked. Scales on head adherent, armed with long, slender, erect, and widely spaced spinules; body scales mostly deciduous.

TABLE 7. Comparison of first dorsal fin ray counts, upper jaw length, and distance orbit to preopercle in *Nezumia wularnia* and *N. kapala*.

	Segmented First Dorsal Rays										x
	8	9	10	11	12						
<i>N. wularnia</i>	—	—	11	12	1						10.17
<i>N. kapala</i>	3	18	3	1	—						9.08

	Upper Jaw length (%HL)										x
	26	27	28	29	30	31	32	33	34		
<i>N. wularnia</i>	—	—	—	1	5	5	5	4	4		31.75
<i>N. kapala</i>	1	5	6	6	3	2	—	1	—		28.67

	Orbit to Preopercle distance (%HL)										x	
	34	35	36	37	38	39	40	41	42	43		44
<i>N. wularnia</i>	—	—	—	—	3	3	7	8	1	1	1	40.33
<i>N. kapala</i>	2	7	7	3	2	3	—	—	—	—	—	36.21

Teeth slender, conical, forming tapering bands in both jaws; 2–3 indistinct rows at symphysis of each jaw, those of outer row slightly enlarged.

Second bony element of first dorsal fin long, with numerous spinulations; pelvic fin bases close together, situated well in advance of pectoral fin bases; all fins rather poorly developed.

Periproct region adjacent to anal fin origin, well developed, broadly oval in shape with a short anterior extension; no external evidence of an accessory light organ.

Body color yellowish brown; head dark brown; operculum, branchiostegal membranes, mouth and branchial cavities black; anterior section of anal fin base and dorsal midline darkish brown; fins pale to dusky; periproct region black.

SIZE. — Sazonov and Shcherbachev (1982) reported sexually mature adult specimens reaching a maximum length of around 25 cm TL—a relatively small size among members of the genus.

DISTRIBUTION. — Widespread in the tropical Indian Ocean and the western Pacific. Off Western Australia, known from a single specimen taken in the deepest sample from which material was examined (1,460 m to about 1,500 m).

COMPARISONS AND REMARKS. — Our specimen agreed well with *P. pusilla*, although it has a well developed, broadly oval periproct with a short anterior extension (not “comparatively narrow,” as described by Sazonov and Shcherbachev, 1982b). Those authors differentiated *P. pusilla* from the two other Indo-West Pacific species of the genus, *P. parvipes* and *P. cetonuropsis*, on its greater orbit diameter and longer barbel. Comparing their data with those of Gilbert and Hubbs (1916), the respective differences of the three species are: orbit (29–38% of HL cf. 20–25% and 27%), and barbel (14–20% HL cf. 4–9% and 6%). Additionally, the anal opening of *P. pusilla* is adjacent to the anal fin origin, whereas in *P. cetonuropsis* it is separated by a distance about one-third distance between anal and pelvic fins.

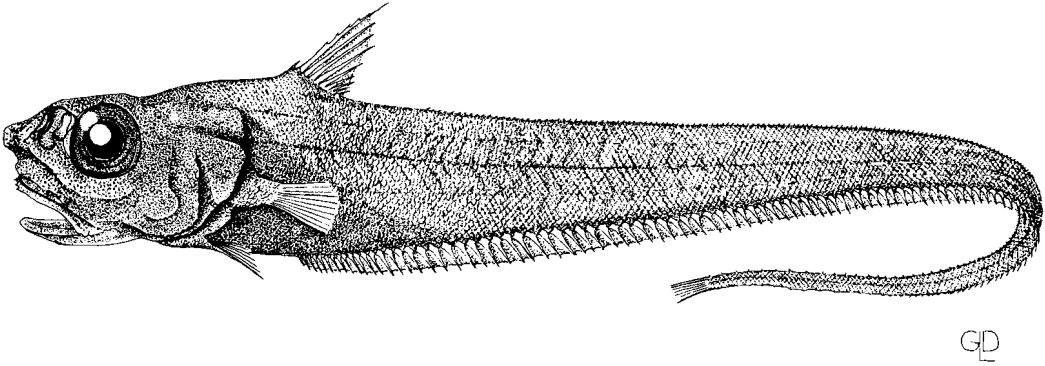


FIGURE 45. *Pseudonezumia pusilla* (Sazonov and Shcherbachev). Specimen CSIRO H2551-20 (30.5 mm HL, 186+ mm TL) from off North West Cape, WA, in 1460–1500 m. Drawn by Georgina L. Davis.

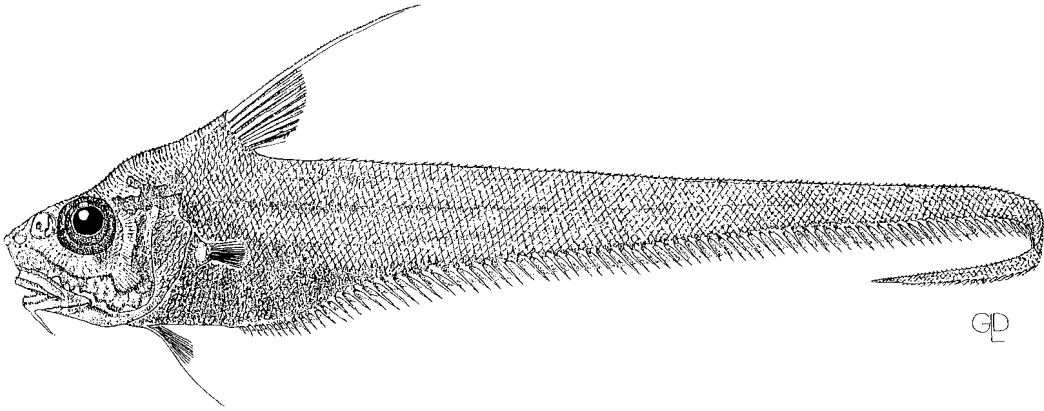


FIGURE 46. *Sphagemacrurus pumiliceps* (Alcock). Specimen CSIRO H2551-22 (35.7 mm HL, 253 mm TL) from off North West Cape, WA, in 1460–1500 m. Drawn by Georgina L. Davis.

### *Sphagemacrurus* Fowler, 1925

The forward shift of the ventral aspects of the trunk, coupled with a blunt snout are convergent developments in morphology with members of the genus *Lucigadus*. The location of the anus and urogenital opening in a broad naked area extending about 2/3 distance between pelvic and anal fins differs markedly from the condition in *Lucigadus*. Only one species of the genus was taken in WA, but *Sphagemacrurus richardi* (Weber, 1913) should be expected in the tropical regions, as it has been taken off Queensland and Indonesia.

#### *Sphagemacrurus pumiliceps* (Alcock, 1894)

Fig. 46

*Macrurus pumiliceps* Alcock, 1894:125–127 (Laccadive Sea; 1,315 m)

*Lionurus pumiliceps*: Gilbert and Hubbs, 1920:559, 560 (Philippine and East Indies; 732–1,646 m).

*Sphagemacrurus pumiliceps*: Marshall and Iwamoto *in* Marshall, 1973:627 (list; lectotype designation); Iwamoto, 1986:339 (Mozambique; 1,510–1,600 m); Shcherbachev, 1987:41 (Indian Ocean distr.; 880–1,880 m).

**DIAGNOSIS.** — Orbit longer than snout, about 1.0–1.2 times into distance from orbit to angle of preopercle, 33–37% of HL; underside of snout mostly covered with small, irregularly shaped scales; a pale, naked area anterior to margin of upper lip; scales mostly deciduous except on nape and head; teeth small, slender, with curved tips, 4–5 rows at symphysis of premaxilla, 2–3 rows at symphysis of mandible; pelvic fin rays 11–13; total inner gill rakers on first arch 8–11; body color variously pale to dusky brown on nape and flanks, darker grayish brown on head.

**SPECIMENS EXAMINED.** — **WA:** CSIRO H2617-03 (34.5 mm HL, 231 mm TL); off Bunbury; 982 m; SS1/91/85. CSIRO H2551-22 (35.7 HL, 253 TL) and H2551-23 (6, 170–240 TL); off NW Cape; 1,460–1,500+ m; SS1/91/12. CSIRO H2581-16 (2, 27.2–28.4 HL, 160–213 TL); 996–1,009 m; SS1/91/44. **Madagascar:** CAS 66504 (4, 18.0–32.3 HL, 147+–205 TL); off Cape St. Vincent; 22°27'S, 43°00'E; 940–960 m; *Vityaz'* sta. 2652; coll. M. E. Anderson; 3.XII.1988.

**COUNTS AND MEASUREMENTS.** — 1D. II,9–11; P. i19–i22; total GR-II (outer/inner)9–10/10–11; scales 1D. 12–14, midbase 1D. 10–12, 2D. 7–10, lat.line 36–38.

Total length 160–253 mm; HL 27.2–38.0 mm. The following in percent of HL: snout 30–34; preoral 16–21; internasal 24–29; interorb. 24–28; orb. 33–37; suborb. 15–18; postorb. 40–42; orb.-preop. 34–38; up.jaw 34–38; barbel 16–21; gill silt 18–21; pre-A. 113–150; body depth 93–121; 1D.-2D. 41–56; ht. 1D. 95 (1 spec.); len. P. 60–65; len. V. 52–71; post. nostril 6–12.

**DESCRIPTION.** — Body deep and strongly compressed; snout blunt, broad, with well-developed bony scutes at tip and lateral angles; bony scutes with a crown of short, blunt, conical spinules. Underside of snout mostly covered with small, irregularly shaped scales; naked area around margin of upper lip. Scales easily lost through abrasion. Suborbital ridge well developed with short, blunt, conical spinules present on lateral margins of ridge and lower margin of orbit; ridge extending beyond midline of orbit. Jaws small, subterminal, oblique; upper jaw extending posteriorly to below midorbit. Short fleshy barbel present. Gill rakers moderately developed, tubercular with stout spines on tip; gill filaments well developed.

Body scales with about 5 near-parallel rows of short, sharp, slightly raised spinules; scales mostly deciduous except on head and nape. Anus and urogenital opening in a broad naked periproct extending about 2/3 distance between pelvic and anal fins.

Teeth small, slender, with curved tips; 4–5 rows at symphysis of premaxilla, 2–3 rows at symphysis of mandible.

Base of first dorsal fin elevated, angled at about 45 degrees to long axis of body; second spine long, slightly curved, leading edge with series of well-developed serrations becoming progressively finer and more widely spaced towards tip; height of fin about equal to head. Pectoral fin poorly developed; leading ray not prolonged; pelvic fin origin below gill cover, well in advance of pectoral fin in, leading ray with moderately developed filamentous extension reaching to at least 10th anal fin ray.

Body lacking prominent markings; nape and flanks variously pale to dusky brown; head darker grayish brown. Buccal cavity and jaws black; lips dusky; margin of orbit dark. Underside of snout brown, naked area anterior to margin of upper jaw pale; dark free neuromasts irregularly spaced over head; opercle and preopercle, branchiostegal membranes, and abdomen black. Pelvic fins black at base; pectoral, dorsal, and anal fins variable in color from pale to dusky to blackish.

**SIZE.** — A small species attaining about 26 cm TL.

**DISTRIBUTION.** — Widely distributed in the Indo-West Pacific. Taken off WA between 882 m and about 1,880 m.

**COMPARISONS AND REMARKS.** — Our specimens generally agreed well with published data on *S. pumiliceps*, however, they varied in having a relatively short postorbital distance (34–38% HL cf. 38–45%) and in being scaled on the underside of the snout. They also differed in several other characters compared to *S. pumiliceps* from Madagascar, which have fewer pelvic fin rays (9–11 cf. 11–13) and a wider interorbital (30–37% HL cf. 24–28%). Scale spinulation was also markedly

coarser in the Madagascan specimens, particularly the degree of development on scales of the suborbital ridge and those of the anterolateral margin of the snout. Body color in preserved material was a uniform dark brown in Madagascan specimens compared to a variously pale to dusky brown nape and flanks, with darker grayish brown head in the WA specimens. There may, therefore, be unresolved problems with identification of *Sphagemacrurus* species in the Indian Ocean and west Pacific regions, which will only be resolved by examination of material from a wide range of localities.

*Sphagemacrurus pumiliceps* is most similar to *S. richardi* from Indonesia, but can be differentiated from that species by its higher pelvic fin ray count (11–13 cf. 8–10). It is also similar in many counts and proportional measurements to *S. hirundo* (Collett, 1896) and *S. grenadae* (Parr, 1946), known respectively from the northeastern and western Atlantic. However, in *S. hirundo* the snout and interorbital dimensions are about equal (Marshall 1973), whereas in *S. pumiliceps*, the snout is relatively long (30–34% HL cf. 24–27%). Marshall reported *S. grenadae* as being dark brown to black, whereas *S. pumiliceps* is variously pale to dusky brown.

### *Trachonurus* Günther, 1887

See Sazonov and Iwamoto (1992:77) for diagnosis of genus. The number of species in this genus is still uncertain. Two species have been recently described (*Trachonurus gagates* Iwamoto and McMillan, 1997, and *T. robinsi* Iwamoto, 1997). *Trachonurus sentipellis* Gilbert and Cramer, 1897, which had been synonymized with *T. villosus*, was recognized by Iwamoto and McMillan (1997). Three species are so far known from Western Australia, including a new species herein described.

#### KEY TO WESTERN AUSTRALIAN SPECIES OF *TRACHONURUS*

- 1a. Grooved lateral line completely absent . . . . . *T. gagates*
- 1b. Grooved lateral line present . . . . . 2
- 2a. Teeth all small, outer premaxillary series scarcely or not at all enlarged; 26–34 lateral line scales counted from anterior end over distance equal to predorsal length; body scales large, 8 or 9 between pelvic fin base and gill cavity, about 8 from pelvic fin base to lower edge of pectoral fin base . . . . . *T. sentipellis*
- 2b. Outer series of premaxillary teeth distinctly enlarged, inner series of dentary teeth usually slightly enlarged; 39–50 lateral line scales over distance equal to predorsal length; body scales relatively small, 10 or 11 between pelvic fin base and gill cavity, 12 or more between pelvic fin base and pectoral fin base . . . . . *T. yiwardaus* n.sp.

### *Trachonurus gagates* Iwamoto and McMillan, 1997

Fig. 47

*Trachonurus* sp. A: Williams et al., 1996:149 (WA).

*Trachonurus gagates* Iwamoto and McMillan, 1997:255–259, fig. 1 (holotype AMS I.24059-009; Australia, NSW off Norah Head, 978 m; paratypes from Australia [NSW, QLD, SA, TAS, VIC, WA], and New Zealand; 435–1,240 m).

DIAGNOSIS. — Grooved lateral line absent; chin barbel 4–8%, suborbital width 13–15%, postorbital 50–55% of head length; total gill rakers on second arch (outer/inner) 10–13/10–12; scale rows from origin of second dorsal fin to anal fin 20–25; lateral scales over distance equal to predorsal length usually 35–42; outer premaxillary teeth slightly enlarged; gular and branchiostegal membranes usually heavily covered with scales.

SPECIMENS EXAMINED. — Type specimens listed in Iwamoto and McMillan (1997).

SIZE. — To about 48 cm TL.

DISTRIBUTION. — Widespread in Australia (NSW, QLD, SA, TAS, VIC, WA) and New Zealand in 435–1,200 m.

COMPARISONS AND REMARKS. — *Trachonurus gagates* is closely similar to *T. villosus* (Günther, 1877) with the primary difference being the absence of a grooved lateral line in *T. gagates* compared with a well-developed one in *T. villosus*. The two species are similar in having small scales, compressed head, bluntly rounded snout profile, and relatively small outer premaxillary teeth.

***Trachonurus sentipellis* Gilbert and Cramer, 1897**

Fig. 48

*Trachonurus sentipellis* Gilbert and Cramer, 1897:429, 430, pl. XLV, fig. 1 (Hawaiian Islands). Iwamoto and Merrett, 1997:79, 80, fig. 31b (New Caledonia region; 760–980 m).

*Trachonurus* sp. B: Williams et al., 1996:149 (WA).

DIAGNOSIS. — Grooved lateral line well developed; body scales relatively large, coarsely covered with stout, erect spinules, 26–34 lateral-line scales over distance equal to predorsal length, 4–6 below midbase 1D., 5–7 below 2D. origin; small scale patch or none on gular membrane, few or no scales at base of ventral-most branchiostegal rays. Teeth in both jaws all small, outer premaxillary series scarcely enlarged. Total GR-II (outer) 10–14. Pyloric caeca short, thick, 9–13.

SPECIMENS EXAMINED. — WA: CSIRO H2541-15 (2, 53.1–59.5 mm HL, 258+–294+ mm TL); Exmouth Plateau; 914 m; SS1/91/02. AMS I.31159-006 (6, 39.9–62.8 HL, 200–300+ TL); off Cape Cuvier; 1,060–1,064 m; SS1/91/21. CSIRO H2592-09 (2, 57.2–59.3 HL, 300+–290+ TL); w. of Leander Pt.; 942–970 m; SS1/91/58. NMV A9653 (65.7 HL, 325 TL); w. of Leander Pt.; 1,132–1,136 m; SS1/91/61. NMV A9640 (2, 53.7–57.4 HL, 270–315 TL); ssw. of Geraldton; 770–760 m; SS1/91/62. CSIRO H3041-13 (44.5 HL, 223+ TL); sw. of Shark Bay; 26°36'S, 112°09'E; 760 m; *Akebono Maru* No. 3, shot 41; coll. A. Williams; 28.XII.1989. NSW: AMS I.28100-003 (44.9 HL, 258 TL); e. of Taree; K88-08-06. AMS I.24462-003 (51.3 HL, 248+ TL); off Cape Hawke; 980 m; K83-15-02.

UNCERTAIN VARIANTS.—NSW: AMS I.27718-010 (51.9 HL, 295+ TL); NSW, off Brush I.; 1,190 m; 1988. AMS I.20920-005 (47.6 HL, 263+ TL); QLD, ne. of Raine I.; 11°32'S, 144°10'E; 0–900 m; field no. FNQ79–33; 12.II.1979. WA: NTM S.12716-010 (43.1 HL, 247+ TL); nw. of Monte Bello I.; 20°15'S, 114°50'E; 500–600 m; coll. D. Evans; 22.II.1990. NMV A11386 (54.6 HL, 312 TL); w. of Leander Pt.; 1,132–1,136 m; SS1/91/61.

COUNTS AND MEASUREMENTS (15 WA and 2 NSW specimens).—1D. II, 7–8(9); P. (i11)i12–i15; V (6)7; total GR-I (outer/inner) 2–8/(11)12–14, GR-II 10–14/12–14; scales 1D. 6–7, midbase 1D. 4–6 [total to A. 20–25], total 2D.-A. 14–21.

Total length 223+–325 mm; HL 44.5–67.5 mm. The following in percent of HL: snout 24–30; preoral 14–19; internasal 18–22; interorb. 31–36; orb. 26–34; suborb. 10–12; postorb. 45–50; orb.-preop. 31–37; up.jaw 30–36; barbel 9–14; gill-slit 12–17; pre-A. 134–165; body depth 69–87; 1D.-2D. 17–52; ht. 1D. 49–61; len. P. 40–51 len. V. 30–47; nostril 5–11.

DESCRIPTION. — General features of fish seen in Figure 48. Head 5–6 times into total length; greatest head width 1.7–1.8 into its length. Snout gently conical and protruding in lateral view, blunt in dorsal view. Orbits relatively large, about equal to snout length and about 0.7 into broad, slightly depressed interorbital space. Preopercle gently rounded, the chord of margin vertical. Jaws large, extending posteriorly to below midorbit or slightly beyond. Chin barbel small, slender, length about equal to least suborbital width.

Teeth fine, short, in narrow bands in both jaws, extending almost to end of rictus. Premaxillary band about 4 or 5 teeth wide, tapering to 2 irregular series, then to 1 row near posterior end; outer series scarcely, if at all, larger than inner teeth. Mandibular teeth about 3 or 4 teeth wide anteriorly, becoming 2 irregular series, then 1 series near posterior end; inner teeth very slightly larger than outer.

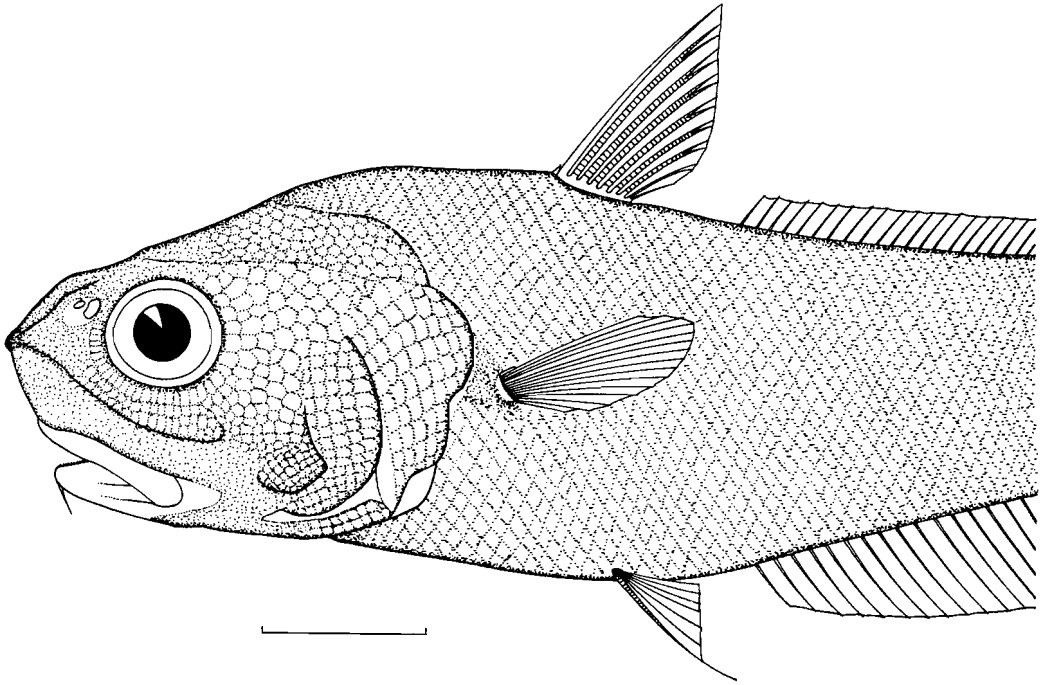


FIGURE 47. *Trachonurus gagates* Iwamoto and McMillan. (From Iwamoto and McMillan 1997, fig. 2).

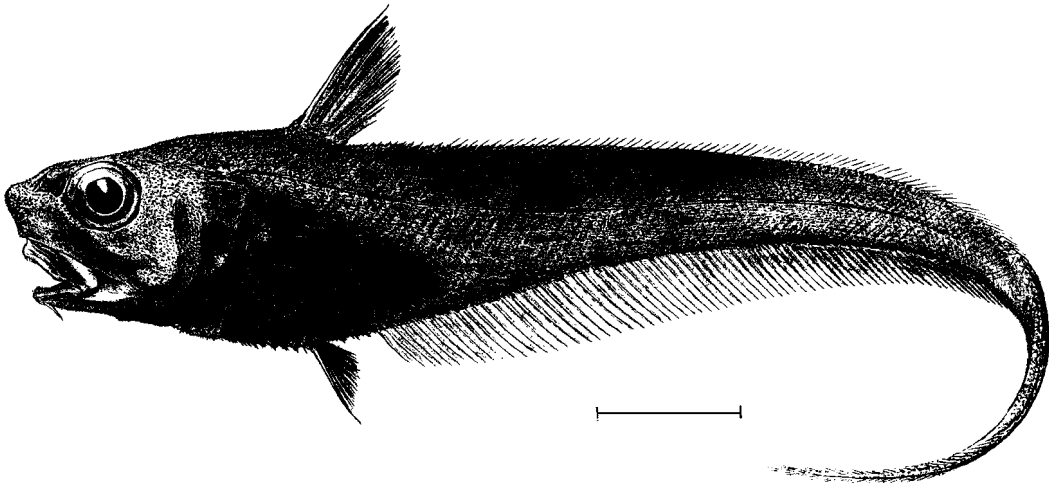


FIGURE 48. *Trachonurus sentipellis* Gilbert and Cramer. (From Iwamoto and Merrett 1997, fig. 31b.) Scale bar represents 25 mm.

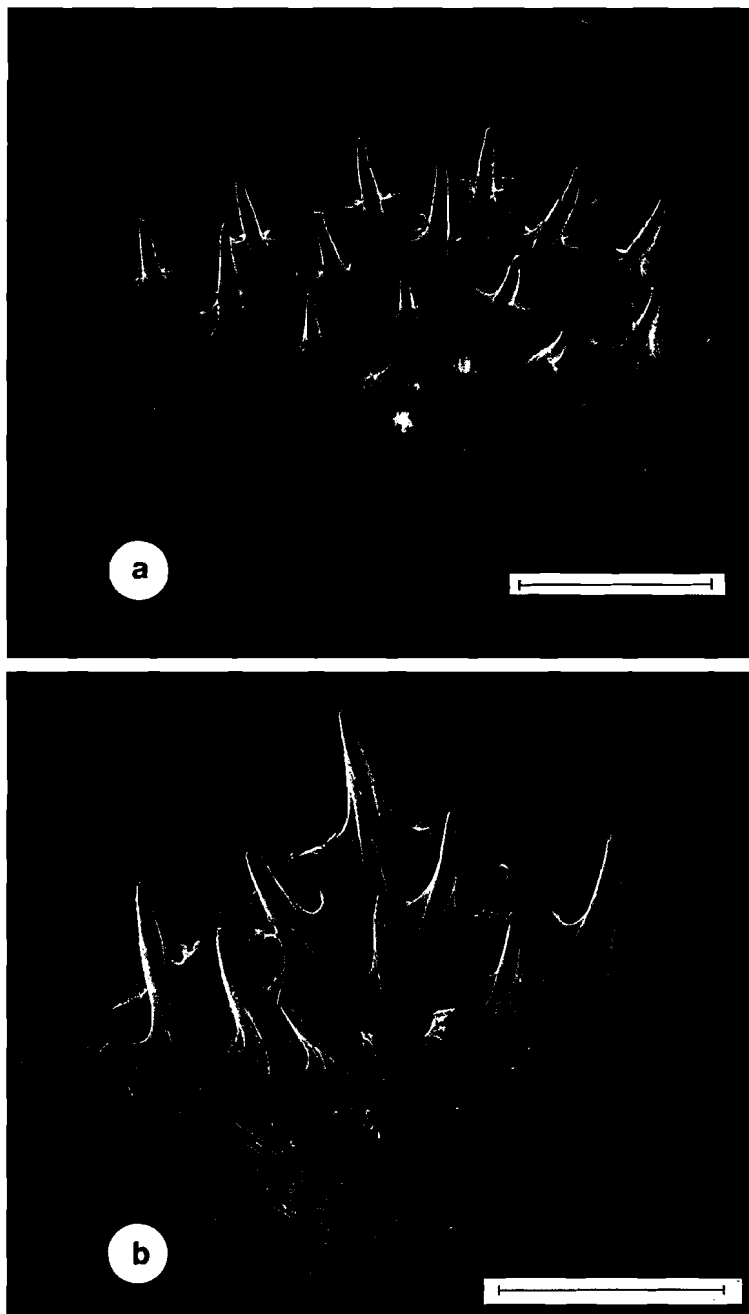


FIGURE 49. Body scales from dorsum below origin of second dorsal fin of (a) *Trachonurus sentipellis* and (b) *T. yiwardaus*. Scale bars represent 1.0 mm.



Body scales large, coarsely covered with short, erect conical spinules (Fig. 49a). Enlarged, vertically elongated scales along anal fin base; these armed with stouter spinules and interconnected buttresses. Scales along each side of second dorsal also somewhat enlarged, with larger spinules recurved and somewhat reclined. Scales over dorsal surfaces of preopercle and opercle platelike and enlarged; those along posterior margin of orbit somewhat elongated, other scales of head much smaller. Gular and branchiostegal membranes usually sparsely scaled or almost naked, but most with small median patch of scales on gular membrane and isolated patches (or narrow files) of scales at base of anteriormost branchiostegal rays. Scales over abdominal region large with spinule fields sharply defined and with little overlap in scale margins. Scales over chest also large, usually 9 or fewer rows between pelvic base and gill cavity, about 8 rows from pelvic base to lower edge of pectoral base. Lateral line scales with prominent groove throughout and few or no interruptions.

Periproct region large, round to somewhat oval, with posterior margin abutting anal fin; entire span between anal origin and inner rays of pelvic fins naked; anus about midway between or slightly closer to anal fin.

Color in alcohol medium brown to gray overall; swarthy over abdomen, operculum, and laterally and ventrally on head. Branchiostegal and gular membranes dark gray to blackish; branchial cavity black, mouth, lips, jaws dark gray to black; barbel dark brown; peritoneal membranes black. Rays of first and second dorsal fins dusky, pectoral and anal usually darker, pelvic fins blackish.

SIZE. — To at least 31 cm TL.

DISTRIBUTION. — So far known from the Hawaiian Islands, Australia (WA and NSW), and the New Caledonian region, but probably more widespread. Capture depths off Australia varied from 500 m to 1,132 m.

COMPARISONS AND REMARKS. — Our Western Australian specimens agree well, for the most part, with Hawaiian and New Caledonian specimens of *Trachonurus sentipellis*. We were troubled by four specimens, however, which we list as uncertain variants: one is from the North West Shelf, another from southwest of Geraldton, WA, and two from NSW (off Brush Island and northeast of Raine Island). The North West Shelf specimen (NTMS.127165-010) agreed well in almost all features of the species except for the scale spinules, which were notably fine with flexible tips that gave a velvety feel to the body surface. In contrast, all other specimens of the species had stout spinules that gave a rough feel to the surface. The specimen from off Geraldton (NMV A11386) had low gill raker counts (9 on inner series of first arch and 9 and 10, respectively, on the outer and inner series of the second arch), low lateral line scale count (24), relatively greater snout length (30% HL), preoral length (19%), internasal width (24%), interorbital width (37%), and height first dorsal (71%). Scales on the branchiostegal rays were more extensive than on the other specimens. The Brush Island (AMS I.27718-010) and Raine Island (AMS I.20920-005) specimens had relatively high lateral line scale counts of 39 and 36, respectively. In addition, the Brush Island specimen had low gill raker counts (8 total on inner series of first arch, 8 and 9 on outer and inner series of second arch) and a slightly wider internasal distance (23% HL cf. 18–22%) than we found in the other specimens of *T. sentipellis*. Compared with a specimen of *T. sentipellis* of almost identical size (AMS I.27718-010) from Cape Hawke, NSW, there was a notable difference in appearance. The Brush Island specimen appeared slimmer, the snout more pointed, the head shallower and wider, the body scales larger, and the scale spinules were somewhat coarser and more deciduous. The Raine Island specimen had low gill raker counts (11 on inner side of first and second arches, but the counts were within the range found in other specimens of *T. sentipellis*), and a lateral line that was interrupted into long dashes behind the abdominal cavity. Aside from the high lateral-line scale count, other meristic and morphometric features fell well within the range of the species. A more thorough study of additional specimens is needed to determine if these specimens are simply variants of *T. sentipellis* or representatives of different taxonomic entities.

*Trachonurus yiwardaus* new species

Fig. 50

*Trachonurus* sp. C: Williams et al., 1996:49 (WA).

DIAGNOSIS. — Grooved lateral line present; body scales relatively small, lateral line scales over distance equal to predorsal length 39–50, scale rows between pelvic fin base and operculum 11–12, below midbase of first dorsal fin to anal fin 26–30, below origin of second dorsal fin 6–9; scale covering on gular and branchiostegal membranes extensive. Teeth in both jaws relatively small, but with a distinctly enlarged outer series on premaxillary and a slightly enlarged inner series on dentary. Total gill rakers on inner series of first arch 9–13, on inner and outer series of second arch 9–12.

SPECIMENS EXAMINED. — WA: HOLOTYPE: NMV A9643 (72.8 mm HL, 422 mm TL); w. of Leander Pt.; 1,132–1,136 m; SS1/91/61. PARATYPES: NMV 19782 (formerly A9643) (3, 36.4–40.3 HL, 218–238 TL) and CAS 200231 (73.1 HL, 390+ TL); same data as for holotype. AMS I.3157-007 (2, 35.0–53.8 HL, 190–350 TL); off Cape Cuvier; 1,060–1,064 m; SS1/91/21. AMS I.31180-010 (57.5 HL, 310+ TL); sw. of Shoal Pt.; 945–960 m; SS1/91/48. CSIRO H2592-10 (2, 55.5–64.5 HL, 270+–367+ TL); w. of Leander Pt.; 942–970 m; SS1/91/58. CSIRO H4783-01 (2, 50.4–60.8 HL, 265+–237+ TL); Western Australia; SS1/91 (no other data). NMV A11385 (78.5 HL, 383 TL) and NMV A11386 (54.6 HL, 312 TL); 95 km sw. of Geraldton; 942–970 m; SS1/91/61. SA: CSIRO T321 (84.0 HL, 500+ TL); 33°58'S, 131°49'E; 930 m; *Margaret Phillipa* sta. 6/3; 10.XI.1984. CSIRO T317 (62.6 HL, 387+ TL); 34°28'S, 132°03'E; 1,175 m; *Margaret Phillipa* sta. 6/19; 14.II.1984. CSIRO T320 (61.8 HL, 380+ TL); 34°10'S, 131°37'E; 1,115 m; *Margaret Phillipa* sta. 10/5; 14.VI.1985.

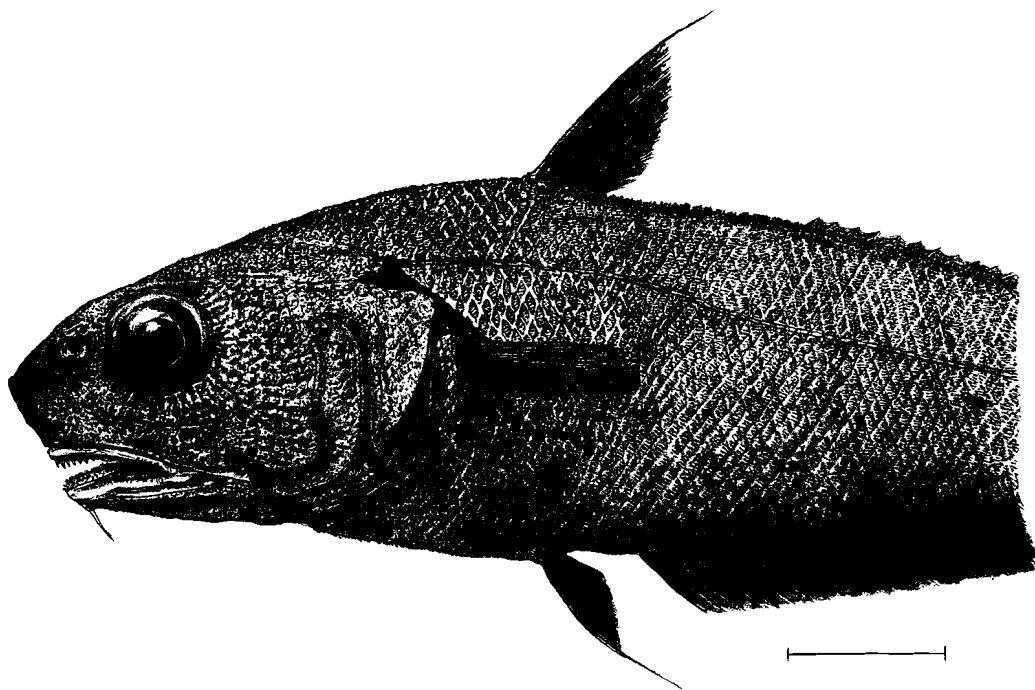


FIGURE 50. *Trachonurus yiwardaus* n.sp. Holotype, NMV A9643 (72.8 mm HL, 422 mm TL), from 115 km southwest of Geraldton, WA, in 1,132–1,136 m. Fins partially reconstructed. Scale bar equals 25 mm.

UNCERTAIN VARIANT.—WA: CSIRO H3002-05 (55.9 HL, 280+ TL); se. of Albany; 35°23'S, 118°27'E; 1,030 m; *Akebono Maru No. 3*, shot 2; coll. A. Williams; 21.XII.1989. NTM S.12716-010 (71.5 HL, 350+ TL); nw. of Monte Bello I.; 20°15'S, 114°50'E; 500–600 m; coll. D. Evans; 22.II.1990.

COUNTS AND MEASUREMENTS (exceptional values are in parentheses).—1D. II, 6–9; P. i12–i18; V. (6) 7; total GR-I (outer/inner) 3–8/9–13, GR-II 9–12/9–12; scales 1D. 7–10, midbase 1D. 4–7, midbase 1D.-A. 26–30, 2D. 6–9, 2D.-A. 17–23, lat.line 39–50; caeca 9–13.

Total length 238–500+ mm; HL 35.0–84.0 mm. The following in percent of HL: snout 25–31; preoral 14–19; internasal 20–25; interorb. 33–37(39); orb. 24–31; suborb. 12–15; postorb. 46–52; orb.-preop. 32–38; up.jaw 33–39; barbel 6–14; gill slit 13–17; pre-A. 139–162; V.-A. 28–42; body depth 73–92; 1D.-2D. 21–30; len. 1D. 41–72; len. P. 37–67; len. V. 30–43; post. nostril 4–10.

DESCRIPTION. — General features of fish seen in Figure 50. Head about 6 in total length. Snout rounded to bluntly pointed in profile, relatively high and not much protruding beyond mouth, length less than interorbital width. Internasal about 1.6–1.7 into least interorbital width. Orbits round, greatest diameter much less than snout and interorbital. Upper jaw extends posteriorly to below posterior 1/3 to 1/4 of orbit.

Body scales relatively small, spinules short, slender, erect (Fig. 49b); scales dorsally along median line with strongly recurved spinules, scales along second dorsal and anal fins somewhat larger than adjacent scales.

Gular and branchiostegal membranes liberally covered with small scales forming a Y-shaped patch, with the arms of the Y over the anteriormost branchiostegal rays. In some specimens, scale patch broken up. Area between pelvic fins and periproct usually scaled, but completely naked in a few specimens.

Premaxillary teeth short, slender, in moderately wide tapered band about 4 to 6 teeth across widest portion near symphysis, tapering posteriorly to 1 or 2 rows; outer series slightly enlarged. Mandibular teeth also in band slightly narrower than that of premaxillary, narrowing to 2 or 3 rows posteriorly, with inner series slightly larger than outer.

Pyloric caeca variable from short and stubby to long and fingerlike, length from much less than suborbital width to almost twice suborbital; 11–13 counted in 5 specimens.

Color in alcohol apparently variable, but holotype and most of paratypes uniformly dark gray to brownish gray. Smaller paratypes (formerly NMV A9643) from same collection as holotype had blackish abdomen, snout, opercle, and subopercle; CSIRO T316 similarly colored, but most of head pale gray, with free neuromasts on head prominently marked (no other specimen had such prominent free neuromasts). CSIRO T320 exceptional in more brownish than grayish coloration.

SIZE. — Attains at least 50 cm TL.

DISTRIBUTION. — Known only from WA and SA, from off Cape Cuvier, WA, south and east to GAB (longitude 132°E), in 930–1,175 m (but 770–1,293 m based on field data of AW).

ETYMOLOGY.—From the Yindjibarndi word *yiwarda*, meaning ashes, in reference to the grayish color of the species.

COMPARISONS AND REMARKS. — *Trachonurus yiwardaus* is readily distinguished from other Western Australian *Trachonurus* by its relatively small scales, heavily scaled gular and branchiostegal regions, bluntly rounded snout profile, enlarged outer premaxillary teeth, presence of a grooved lateral line, and a gray overall color. The first four characters separate the species from *T. sentipellis*, the last two separate it from *T. gages*.

In the smaller of two specimens from off Cape Cuvier (AMS I.31157-007), the flexible spinous dorsal fin ray had about nine small serrations along the leading edge. This is a most unusual occurrence, as one of the primary diagnostic characters of the genus is the presence of a smooth spinous dorsal fin ray. There is no question in our minds, however, that the specimen represents *T. yiwardaus*.

One specimen (CSIRO H3002-05) listed as an uncertain variant had only a small gular scale patch and no scales on the branchiostegals, relatively high gill raker counts (13 on inner series of first arch, 12 on both sides of second arch), narrow bands of jaw teeth (about three teeth wide at symphysis in premaxillary and dentary), short barbel (6% of HL), and was quite dark (swarthy to blackish). It was captured along with a specimen of *T. gagates*, a species with which it agrees closely except for its grooved lateral line. Another questionable specimen (from northwest of Monte Bello Point, NTM S.12716-010) had finer spinules with flexible tips on body scales, fewer scales on the gular membrane, slightly wider head (width equal to postorbital length plus half orbit diameter cf. slightly more than postorbital length in *T. yiwardaus*), posterior margin of preopercle inclined anteroventrally (cf. chord of margin essentially vertical), and only seven nublke pyloric caeca.

### *Ventrifossa* Gilbert and Hubbs, 1920

See Iwamoto and Merrett (1997), Sazonov and Iwamoto (1992), and Iwamoto (1990) for a diagnosis of genus. The 20 or so species in the genus are readily allocated to this taxon, but circumscribing the genus has been difficult because of the absence of any recognized synapomorphy. A good field character that is not usually apparent in formalin-preserved specimens is the silvery reflections along the sides of head, trunk, and tail in most species. This silvery pigmentation obscures much of the black markings on the head (notably on suborbital and operculum) and trunk in fresh specimens. The blackish dorsal leading margin of the snout coupled with the relatively thin head covering are distinctive to *Ventrifossa* and *Hymenocephalus*.

All six Australian species of the genus are found in Western Australia. *Ventrifossa nigrodorsalis* is widespread in the central western Pacific and appears to be common off the northern and eastern shores of Australia, including Queensland and New South Wales. *Ventrifossa johnboborum* is found off the east and west coasts of Australia and has been reported from the southeastern Pacific (Sazonov and Iwamoto 1992). *Ventrifossa macropogon* Marshall, 1973 was first recorded from Australian waters, although it has been recently reported from the New Caledonian region (Iwamoto and Merrett 1997). *Ventrifossa sazonomi* n.sp. is recorded from WA, QLD, and the South China Sea; *V. paxtoni* n.sp. from NSW, QLD, WA, New Caledonia, and the Chesterfield and Bellona Plateau; and *V. gomoni* n.sp. appears to be confined to WA.

### KEY TO THE AUSTRALIAN SPECIES OF *VENTRIFOSSA*

- 1a. Second spinous ray of first dorsal fin smooth . . . . . *V. sazonomi* n.sp.
- 1b. Second spinous ray of first dorsal fin with finely serrated leading edge . . . . . 2
- 2a. Lateral line scales over distance equal to predorsal length of head 65–75; suborbital shelf narrowly constricted anteriorly; a small but distinct tubercle-like scale at apex of snout . . . . . *V. johnboborum*
- 2b. Lateral line scales less than 51 over distance equal to predorsal length; suborbital shelf not especially narrow at anterior end; no distinct terminal snout tubercle . . . . . 3
- 3a. A prominent black blotch or streak across first dorsal fin; pelvic fin rays 8 or 9, usually 8; no dark longitudinal streak over median nasal ridge; chin barbel moderate, 16–27% of head length . . . . . *V. nigrodorsalis*
- 3b. No prominent blotch or streak on first dorsal fin, but fin may be dark proximally, paler distally; pelvic fin rays 8–10; dark streak over median nasal ridge present or absent; chin barbel 22–45% of head length . . . . . 4
- 4a. Outer premaxillary teeth notably enlarged, distinctly larger than teeth of inner band; first dorsal fin pale to light dusky, darker proximally; a prominent dark median nasal streak; snout low, preoral length 9–14% of head length; preserved specimens generally pale, with some blackish or dark regions on body and head, suborbital shelf with thin dark margin, dark blotches on gill cover limited; pelvic fin rays 8–9, usually 8 . . . . . *V. gomoni* n.sp.
- 4b. Outer premaxillary teeth scarcely larger than teeth of inner band; first dorsal fin pale to blackish; dark median nasal streak present or absent; preoral length 11–19% of head length; overall color usually dark with substantial blackish areas, entire suborbital shelf blackish, gill cover extensively covered with dark markings; pelvic fin rays 8–10 . . . . . 5

- 5a. Chin barbel notably long, often thick, 34–45% of head length; first dorsal fin pale or dusky, sometimes proximal 1/2 to 2/3 of anterior four rays and spines dark . . . . . *V. macropogon*
- 5b. Chin barbel moderate length, usually thin, 25–38% of head length; first dorsal fin uniformly blackish, paler on base in some . . . . . *V. paxtoni* n.sp.

***Ventrifossa gomoni* new species**

Fig. 51

No literature applies to this species.

DIAGNOSIS. — Pelvic fin rays 8–9; first dorsal fin dusky proximally, paler distally, no distinct black blotch or streak; a dark streak along leading edge of snout, with a median extension atop snout; barbel 22–35% of head length, about 75–130% of orbit diameter; orbit diameter 1.3–2.1 into postorbital length of head; outer premaxillary teeth distinctly enlarged, mandibular teeth in two irregular rows; ground color of body in preserved specimens light brown, dorsum of trunk and tail not strongly demarcated from lateral and ventral surfaces; suborbital shelf broad, not constricted anteriorly, blackish streak covers shelf broadly or narrowly, but confined along dorsal portions.

SPECIMENS EXAMINED. — HOLOTYPE: AMS I.23425-003 (61.1 HL, 300+ TL); WA, NW Shelf; 400 m; SO4/82/leg1. PARATYPES: WA: AMS I.23423-012 (5, 34.1–50.1 mm HL, 130+–260+ mm TL); NW Shelf; 376 m; SO4/82/leg1. AMS I.23425-003 (4, 26.2–46.9 HL, 145+–222+ TL); same data as for holotype. AMS I.24449-001 (4, 45.1–about 53 HL, 245+–270 TL); NW Shelf; 450 m; SO1/84/12. CAS 200225 (formerly NTM S.12588-016)(54.8 HL, 260+ TL); NW Shelf off Rowley Shoals; 17°22'S, 118°38'E; 430 m; coll. W. Houston, WH-85-15; 2.XI.1985. NTM S.12590-010 (4, 44.3–48.6 HL, 226+–253+ TL); NW Shelf off Rowley Shoals; 17°23'E, 118°57'E; 430 m; coll. W. Houston; WH-85-17; 3.XI.1985. NTM S.12614-016 (3, 25.4–52.4 HL, 135–260+ TL); NW Shelf off Rowley Shoals; 17°39'S, 118°38'E; 410 m; coll. W. Houston; WH 85-33; 7.XI.1985. NTM S.12727-022 (2, 46.0–53.0 HL, 197+–260 TL); sw. of Rowley Shoals; 17°52'S, 118°28'E; 410 m; 9.II.1990. CSIRO H1514-37 (5 spec.); nw. of Port Hedland; 18°08.8'S, 117°54.5'E; 582 m; SO5/88/190; 1988.

COUNTS AND MEASUREMENTS (24 spec.).—1D. II,9–11; P. (i15) i18–i21; GR-I (outer/inner) 9–11/(13)14–15, GR-II 13–15/13–14.

Total length 150+–270; HL 26.2–61.1 mm. The following in percent of HL: snout 25–31; preoral 9–14; internasal 17–23; interorb. 23–28; orb. 24–34; suborb. 11–13; postorb. (43) 45–54; orb-preop. 38–47% (usually 40–44%); up.jaw 42–48; gill slit 21–28; pre-A. 124–156; V.-A. 27–42; body depth 76–89; 1D.-2D. 45–79; ht. 1D. 68–78; len. P. 49–61; len. V. 34–41; post. nostril 3–6.

DESCRIPTION. — General features of holotype shown in Figure 51. Snout low, short, pointed in lateral view; blunt in dorsal view, width across lateral angles about equal to or slightly more than interorbital width. Mouth large, upper jaw extends posteriorly to about vertical through hind margin of orbit; barbel relatively thin and long.

Body scales highly deciduous, thin, covered with small, erect conical spinules in more or less quincunx pattern. Spinuleless scales numerous (about 10–12) behind base of first dorsal fin, behind pectoral fin, and along margin of gill cover.

Premaxillary teeth in broad band, with outer series large, recurved, and relatively widely spaced; inner band teeth small. Mandibular teeth small, in about 2 irregular rows.

First dorsal fin origin well behind vertical through pectoral fin base, which in turn, lies behind pelvic fin origin. Anal fin origin below about midbase of first dorsal fin. Outer pelvic fin ray scarcely produced beyond other rays; barely extends to anal fin origin in some, to as much as 6th anal fin ray in others.

Ground color in preserved specimens light to medium brown dorsally, tawny laterally and ventrally; dark, somewhat violet colored over abdomen and chest; opercle and subopercle, lower

portion of preopercle, margins of ramus of lower jaw, gill and gular membranes dark; upper lips black, lower lips generally dark but pale near angle of mouth; leading edge of snout with black margin, the pigmentation extending onto suborbital shelf, but not as intensely black as in other species (e.g., *V. nigrodorsalis*, *V. macropogon*) and in some specimens confined to upper part of shelf; fainter blackish margin along supranarial ridges and median nasal ridge (darker and more prominent in some paratypes); a spear-shaped darker area on nape pointing forward from origin of first dorsal and narrowly connected to a pair of small, dark projections at anterior end of nape; a faint dusky band across anterior end of interorbital region. Mouth cavity immaculate except blackish along edge of upper oral valve and small patch behind symphysis of lower jaw teeth; most ventral surfaces of gill cavity, gill filaments, arches, and rakers pale, outer and upper margins blackish, but narrow edge of branchial membranes pale; chin barbel dark only on base, remainder pale. First dorsal fin dusky proximally, pale distally; second dorsal and anal fins pale throughout; pectoral fin pale to lightly dusky, but sometimes darker near base; pectoral fin base, small area over axil, and lunate naked area immediately behind fin blackish; pelvic fin black proximally, pale distally.

SIZE. — Attains at least 27 cm TL.

DISTRIBUTION. — The species is known only from the North West Shelf of WA, in 376–450 m.

ETYMOLOGY. — Named for our ichthyological friend and colleague Martin F. Gomon, curator in the Museum of Victoria, Melbourne.

COMPARISONS AND REMARKS. — This pale-colored species and the dark-colored *V. sazonovi* are easily distinguished from other Australian congeners by their relatively large outer series of premaxillary teeth. In the other four Australian species, the outer series is scarcely larger than the inner band of teeth. *Ventrifossa gomoni* can be distinguished from *V. sazonovi* by its serrated (as opposed to smooth) spinous dorsal ray, among other characters. In addition to the teeth character, *V. gomoni* differs from: *V. nigrodorsalis* in lacking the distinct black streak or spot on the first dorsal fin, and having a well-marked median nasal streak, and a lower snout (preoral length 9–14% HL compared with 14–23%); *V. macropogon* in having a lower snout (preoral length 9–14% HL cf. 13–17%), a shorter barbel (22–35% HL cf. 34–45%), a somewhat narrower internasal width (17–22% HL cf. 21–25%), and a paler overall color; from *V. paxtoni* in having a narrower suborbital (11–13% HL cf. 13–17%), lower gill raker counts on second arch (13–14 total on inner side cf. 15–18), and a long, well-marked median nasal streak (cf. short and faint, or lacking). Three fairly recently described species differ from *V. gomoni* in the following: *V. longibarbata* has a distinct black blotch on the first dorsal fin, a higher snout, a somewhat larger orbit (31–38% HL cf. 24–34%), a shorter postorbital length (39–44% HL cf. 43–54%), and more pectoral fin rays (“23–25” *vide* Okamura, 1982:157, cf. i18–i21); *V. rhipidodorsalis* has a distinct black blotch on first dorsal fin, a black distal margin on anal fin, no median nasal snout streak, and slightly higher gill-raker counts (inner GR-II 15–16 total cf. 13–14 in the new species); *V. saikaiensis* has an overall dark first dorsal fin, lacks markedly enlarged outer premaxillary teeth, lacks a blackish leading snout margin and median snout streak, has a somewhat broader interorbital (27–31% HL cf. 23–28%), somewhat longer upper jaw (46–52% HL cf. 42–48%), and prominently marked scale pockets on body.

### *Ventrifossa johnborum* Iwamoto, 1982

Fig. 52

*Ventrifossa johnborum* Iwamoto, 1982:55–61, fig. 1 (Bismarck Sea). Williams et al., 1996:149 (WA list).

DIAGNOSIS. — Head broad, interorbital width 28–33% HL, less than orbit diameter; upper jaw 39–45% HL; barbel 13–19% HL; scales small, 65–71 lateral line scales from origin over distance equal to predorsal length; spinous ray of first dorsal fin weakly serrated; V. 8–10; suborbital shelf narrowly constricted at anterior end; mouth blackish.

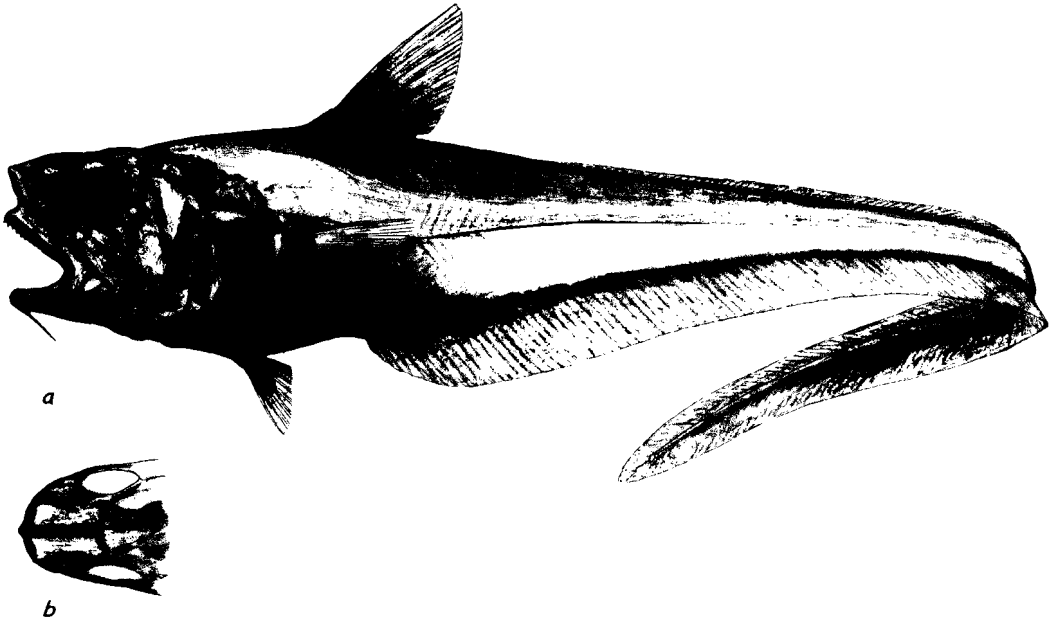


FIGURE 51. *Ventrifossa gomoni* n.sp. Holotype, AMSI.23425-003 (61.1 mm HL, 300+ mm TL), off North West Shelf, WA, in 400 m. Scale bar represents 25 mm. (a) Lateral view. Fins partially reconstructed. (b) Dorsal view of snout showing extent of dark pigmentation along ridges. Scale bar represents 25 mm.

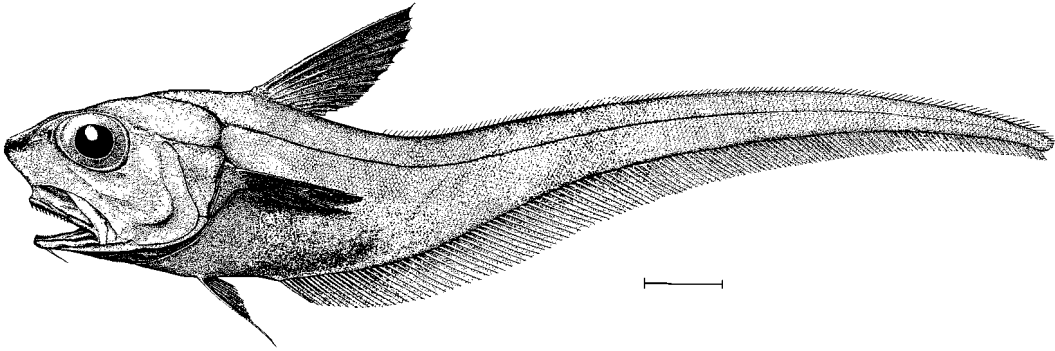


FIGURE 52. *Ventrifossa johnborum* Iwamoto. (From Sazonov and Iwamoto 1992, fig. 30.)

SPECIMENS EXAMINED. — WA: CSIRO H1492-11 (1 spec.); NW Shelf, w. of Barrow I.; 420 m; SO5/88/70. CSIRO H2542-23 (1 spec.); Exmouth Plateau; 854–868 m; SS1/91/03. CSIRO H2553-07 (1 spec.); w. of Point Cloates; 910 m; SS1/91/14. CSIRO H2572-09 (1 spec.); w. of Dirk Hartog I.; 874 m; SS1/91/35. CSIRO H2573-22 (2, 140–185 mm TL); off Shark Bay; 690–691 m; SS1/91/36. CSIRO H2580-[11 through 16]; NW Shelf, sw. of Shark Point; 420 m; SS1/91/43. CSIRO H2584-[9 through 13]; w. of Shoal Point; 853 m; SS1/91/49.

SIZE. — Attains about 48 cm TL.

**DISTRIBUTION.** — Widely distributed in tropical waters of the southern hemisphere, from the Indian Ocean coast of southern Africa, east to Australia and into the Pacific, from Australia (WA, TAS, NSW, QLD) and New Caledonia in the west, to the Sala y Gomez Ridge in the east. Off WA, it has been taken between longitudes 21°49'S and 28°06'S. Depth range 540–850 m (Iwamoto and Merrett 1997).

**COMPARISONS AND REMARKS.** — *Ventrifossa johnboborum* is a well-marked species that is unlikely to be mistaken for any other grenadier in the West Australian region except as juveniles. *Ventrifossa fusca* Okamura, 1982 and *V. misakia* (Jordan and Gilbert, 1904) are closely related, but can be differentiated by characters provided in Iwamoto (1990:305) and Sazonov and Iwamoto (1992: 78–81). Iwamoto and Merrett (1997:85) noted differences in specimens from New Caledonia compared with the holotype and material from the Sala y Gomez Ridge.

### *Ventrifossa macropogon* Marshall, 1973

Fig. 53

*Ventrifossa macropogon* Marshall, 1973:658–660, fig. 5 (holotype, USNM 198187, nw. Caribbean, 576 m). Williams et al., 1996:149 (WA list). Iwamoto and Merrett, 1997:85–87, fig. 35 (New Caledonia region; 675–833 m).

**DIAGNOSIS.** — Pelvic fin rays 8–10 (usually 8 or 9); first dorsal fin lacking distinct black blotch; a faint to prominent dark median nasal streak; chin barbel usually thick, long, 34–45% of head length; preoral length 13–17% of head length; dorsal parts of trunk and tail darkly contrasted and sharply demarcated from paler lateral and ventral parts of body; suborbital shelf broad with no anterior constriction, entirely pigmented in black.

**SPECIMENS EXAMINED.** — WA: CSIRO H2549-09 (46.2 HL, 242+ TL); w. of NW Cape; 650 m; SS1/91/10. AMSI.1.31166-009 (5 of 6, 26.8–39.1 HL, 150+–223+ mm TL); off Shark Bay; 610–612 m; SS1/91/31. AMSI.1.31170-006 (5, 44.4–50.0 mm HL, 210–240 mm TL) and CSIRO H2573 (1 of 5, 48.5 HL, 240+ TL); off Shark Bay; 690–691 m; SS1/91/36. CSIRO H3034-03 (39.8 HL, 195+ TL) and H3034-11 (46.6 HL, 247+ TL); w. of Shoal Point; 28°06'S, 113°27'E; 649 m; *Akebono Maru* No. 3, shot 34; coll. A. Williams; 27.XII.1989.

**COUNTS AND MEASUREMENTS** (15 WA spec.).—1D. II,9–11; P. i18–i24 (usually i20–i21); total GR-I (outer/inner) 9–12/13–15, GR-II 13–14(16)/12–15; scales 1D. about 8.5–11, midbase 1D. 6–8.5, 2D. 7.5–9.5, lat.line about 40–44.

Total length 150+–253+ mm; HL 26.8–50.0 mm. The following in percent of HL: snout 28–32; internasal 21–25; interorb. 25–28; orb. 30–36; suborb. 12–15; postorb. 41–46; orb.-preop. 39–45; up.jaw 43–46; gill-slit 22–28; pre-A. 126–155; V.-A. 26–40; body depth 74–95; 1D.-2D. 23–58; ht. 1D. 62–87; len. P. 52–61; len. V. 36–45; post. nostril 3–7.

**DESCRIPTION.** — General features seen in Figure 53. Snout barely protruding beyond mouth, broadly rounded in dorsal view; width across lateral angles more than interorbital width, about equal to orbit diameter and snout length. Upper jaw extends to below posterior 1/4th of orbit; barbel usually longer than orbit diameter.

Body scales densely covered with small, erect, conical spinules in more or less quincunx pattern; spinules black. Spinuleless scales under margin of gill cover, beneath pectoral and pelvic fins, and a small patch behind first dorsal fin.

Jaw teeth all small, in broad band 6–7 teeth wide in premaxilla with outer series slightly larger than teeth of inner band; mandibular teeth small, conical in 2–4 rows (usually 3 irregular rows), none enlarged.



Fin positions as shown in Figure 53. Leading edge of spinous second ray of first dorsal fin finely serrated, the ray not produced beyond adjacent segmented rays. Outer pelvic fin ray slightly prolonged, extending to 6th or 7th anal fin ray.

Specimens variable in overall darkness, some with swarthy or dark areas more extensive than in others. Dark dorsum of trunk and tail sharply demarcated from paler lateral and ventral surfaces, the division being stronger posteriorly toward dark-dusky tail tip, but sometimes faint in midbody region. Dorsum of trunk often darker than adjacent anterior and posterior regions; abdomen dark with bluish tinge. Ventral surfaces of chest and abdomen blackish; gular and gill membranes black; operculum mostly black; a broad, diagonal, blackish streak from posteroventral corner of orbit to angle of preopercle; leading edge of snout with blackish margin extending broadly onto entire suborbital shelf, with dark streaks over median nasal and lateral nasal ridges. Lips sharply delineated in black; lower jaw black along margins, dark along ramus; barbel with base narrowly black but overall pale. Mouth cavity immaculate except for dusky dorsal oral valve and dusky to blackish ventral oral valve and gum; roof of gullet dark. Gill chamber blackish except for pale hyoid regions and outer margins; gill rakers and arches pale except for light peppering on rakers. First dorsal fin pale in smaller specimens (less than ca. 40 mm HL) but dusky to dark in larger specimens; fin often paler over distal and posterior margins. Pectoral fin with narrow black basal margin, and pale to dark dusky overall; pectoral axil coal black, a lunate black margin behind base. Pelvic fin black at base and proximally, but distally dusky or pale. Anal fin pale in smaller specimens, dusky to blackish (especially anteriorly) in larger specimens.

**SIZE.** — The largest specimen examined from Australian waters was 25 cm; from New Caledonian waters 32 cm. In the western Atlantic, the species is known to exceed 45 cm (personal observations, TI).

**DISTRIBUTION.** — In Australia known only from WA west of North West Cape (ca. 21° S) south to about 33°30'S, in 320–760 m. Specimens have also been examined from off New Caledonia (see Iwamoto and Merrett 1997). Otherwise known only from waters of temperate and tropical western North Atlantic.

**COMPARISONS AND REMARKS.** — The seemingly disjunct distribution of *V. macropogon* is perplexing, although the presence of the species in Australian waters is in itself not surprising. Merrett and Haedrich (1997) cite examples of several deep-demersal fishes found in North Atlantic and Australian waters, but their distributions are continuously through the South Atlantic and Indian Ocean. (The orange roughy, *Hoplostethus atlanticus* Collett, 1889 is an example.)

Based on distribution patterns and morphological variability in material collected from New Caledonia (Iwamoto and Merrett 1997), it is conceivable that more than one species is involved, as several recognized species of *Ventrifossa* appear extremely similar, and it is possible that we were unable to detect differences that actually exist between our specimens. On the other hand, we may be dealing with a single, widespread, highly variable species that frustrates our attempts at circumscription.

### ***Ventrifossa nigrodorsalis* Gilbert and Hubbs, 1920**

Fig. 54

*Ventrifossa nigrodorsalis* Gilbert and Hubbs, 1920:546–549, fig. 36 (holotype, USNM 83627, off n. coast of Mindanao, Philippines, 391 m; paratypes from Formosa, Philippines, and East Indies [Borneo, Celebes] in 290–686 m). Williams et al., 1996:149 (WA list) Iwamoto and Merrett, 1997:87–90, fig. 36, 37a (New Caledonia region; 545–855 m).

**DIAGNOSIS.** — Pelvic fin rays 8–9 (usually 8), color black with distal and mesial margins paler; first dorsal fin with distinct black blotch or streak across anterior part of fin; no dark streak over

median nasal ridge; barbel 16–27% of head length, less than orbit diameter, pale with dark base; orbit diameter 1.1–1.6 into postorbital length of head; outer premaxillary teeth slightly enlarged; dark dorsal parts of trunk and tail strongly contrast the pale or silvery lateral and ventral parts of body; suborbital shelf broad with no anterior constriction.

**SPECIMENS EXAMINED.** — **WA:** AMS I.31154-013 (3, 49.7–56.2 mm HL, 246+–295+ mm TL), CSIRO H2554-09 (42.2 HL, 220 TL), and CSIRO H2554-11 (4, 48.8–54.3 HL, 230–260+ TL); sw. of Point Cloates; 482–554 m; SS1/91/15. AMS I.22817-012 (6, 30.7–43.6 HL, 168–231+ TL); NW Shelf; 520 m; SO2/82/31–35. CSIRO H1492-13 (1 of 12 spec., 31.5 HL, 169 TL) and CSIRO H1492-21 (2 of 12 spec., 38.7–48.4 HL, 206+–245+ TL); NW Shelf, s. of Barrow I.; 420 m; SO5/88/70. CSIRO H1514-11 (38.4 HL, 205+ TL); NW Shelf; 582 m; SO5/88/190. **QLD:** AMS I.23613 (50.6 HL, 180+ TL); off Marion Reef; 19°06'S, 152°30'E; 650 m; 1987. AMS I.20661 (3 of 8, 34.8–38.7 HL, 202+–223+ TL); e. of Murray Isles; 9°53'S, 144°23'E; 480 m; Queensland Fishery Survey; 28.V.1983. AMS I.20518-018 (2, 41.5–45.4 HL, 235+–250 TL); e. of Gold Coast; 548 m; K78-09-05. AMS I.21795-005 (2, 36.0–43.1 HL, 201+–240+ TL); ne. of Danger Point; 731 m; K78-23-08. AMS I.20459-027 (4, 37.9–45.0 HL, 20+–228+ TL); e. of Danger Point; 548 m; K78-17-10. AMS I.32433-007 (46.9 HL, 251 TL); Papua Plateau, e. of tip of Cape York; 10°29.8'S, 144°01.4'E; 596–603 m; *Franklin* site 2; 20.VIII.1992. **NSW:** AMS I.15987-014 (31.1 HL, 203 TL); 30 miles ne. of Jervis Bay; 549 m; K71-11-09. AMS I.21805-002 (5 of 25 spec., 28.0–38.8 HL, 175–238 TL); se. of Newcastle; 586 m; K77-23-09. AMS I.21669-004 (3, 35.9–37.0 HL, 167+–235+ TL); e. of Broken Bay; 603 m; K77-16-16. AMS I.24852-009 (25.5 HL, 128+ TL); off Broken Bay; 512–530 m; K84-15-03. AMS I.29535-005 (24.9 HL, 160 TL); e. of Sydney; 540 m; K79-15-01.

**COUNTS AND MEASUREMENTS** (41 spec.).—1D. II,9–11; P. i18–i22 (i23); GR-I (outer/inner) 8–12/13–16, total GR-II 13–15(16)/12–14; scales 1D. 7–10, midbase 1D. 5.5–7.5, 2D. 7.5–10, lat.line 39–42.

Total length 128+–295+ mm; HL 24.9–56.2 mm. The following in percent of HL: snout 26–33; preoral 14–22; internasal 19–25; interorb. 24–30; orb. 29–35; orb.-preop. 38–45; suborb. 11–15; postorb. 40–46; up.jaw 37–45; gill slit 20–27; pre-A. 125–162; V.-A. 27–40; body depth 75–95; 1D.-2D. 45–72; ht. 1D. 64–96; len. P. 46–77; len. V. 37–48; post. nostril 4–8.

**DESCRIPTION.** — General features shown in Figure 54. Snout short, conical in lateral profile, barely protruding beyond large mouth; width across lateral angles more than interorbital width. Upper jaw extends posteriorly to below middle of pupil or beyond; barbel moderately long and thin, length less than orbit diameter.

Body scales thin, densely covered with small, erect, conical spinules in more or less quincunx pattern; spinules often densely pigmented and blackish. Spinuleless scales under margin of gill cover, beneath pectoral and pelvic fins, and behind first dorsal fin.

Small fine teeth in bands in both jaws; outer premaxillary teeth very slightly enlarged and not prominent. Lower jaw band usually 3 or 4 teeth wide; premaxillary band 4–6 teeth wide.

Fin positions as shown in figure. Pectoral and pelvic fins originate about on same vertical; first dorsal fin slightly behind that vertical; second dorsal fin beginning far behind first dorsal fin and poorly developed throughout. Outer pelvic fin ray slightly prolonged, extending at most to bases of first few anal fin rays.

Formalin-fixed specimens generally lack silvery guanine layer; dorsum dark, strongly contrasted with pale lateral and ventral surfaces of body; color darkens, punctations increase toward tip of tail. Leading edge of snout with broad black margin that joins black suborbital shelf; supranasal ridges with some blackish margins, but only a trace over midorbit, a faint trace of a dark median nasal streak in a few specimens, but absent in others. In fresh specimens silvery reflections obscure underlying black pigmentation; silvery layer covers suborbital, gill covers, and lower 2/3 of trunk and tail. Lips black; skin covering premaxillary and maxillary bones generally pale or lightly punctate; mouth lining white; upper oral valve lightly peppered; gums of dentary dusky, that of premaxillary pale to dusky;

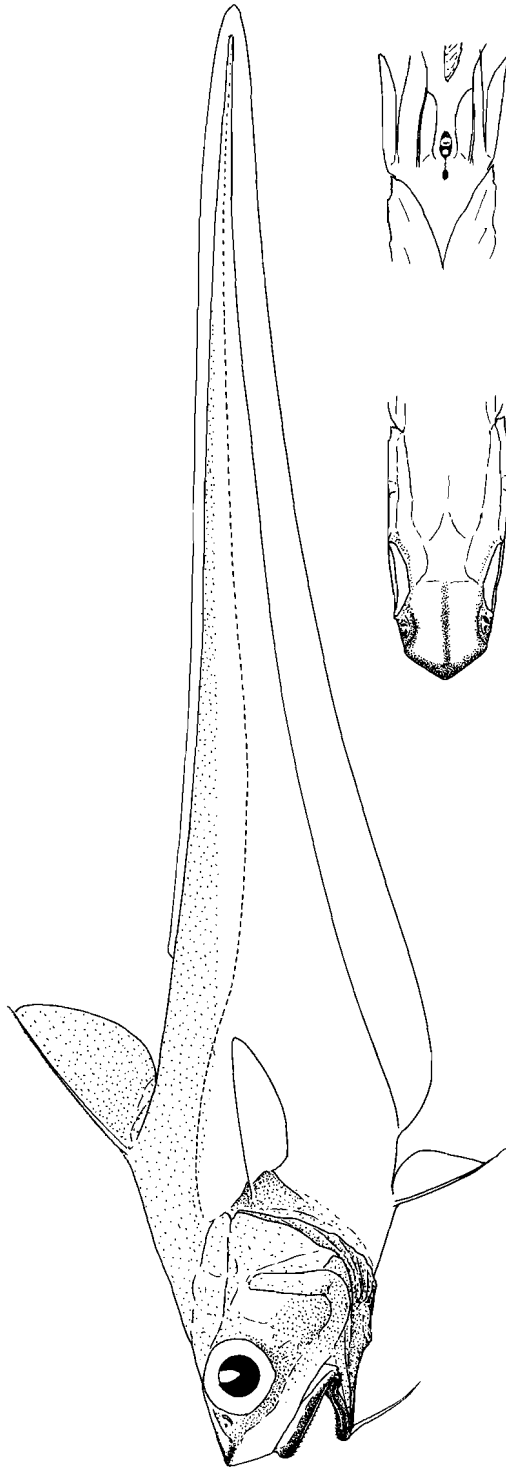


FIGURE 53. *Ventrifossa macropogon* Marshall. From Iwamoto 1990, fig. 680.

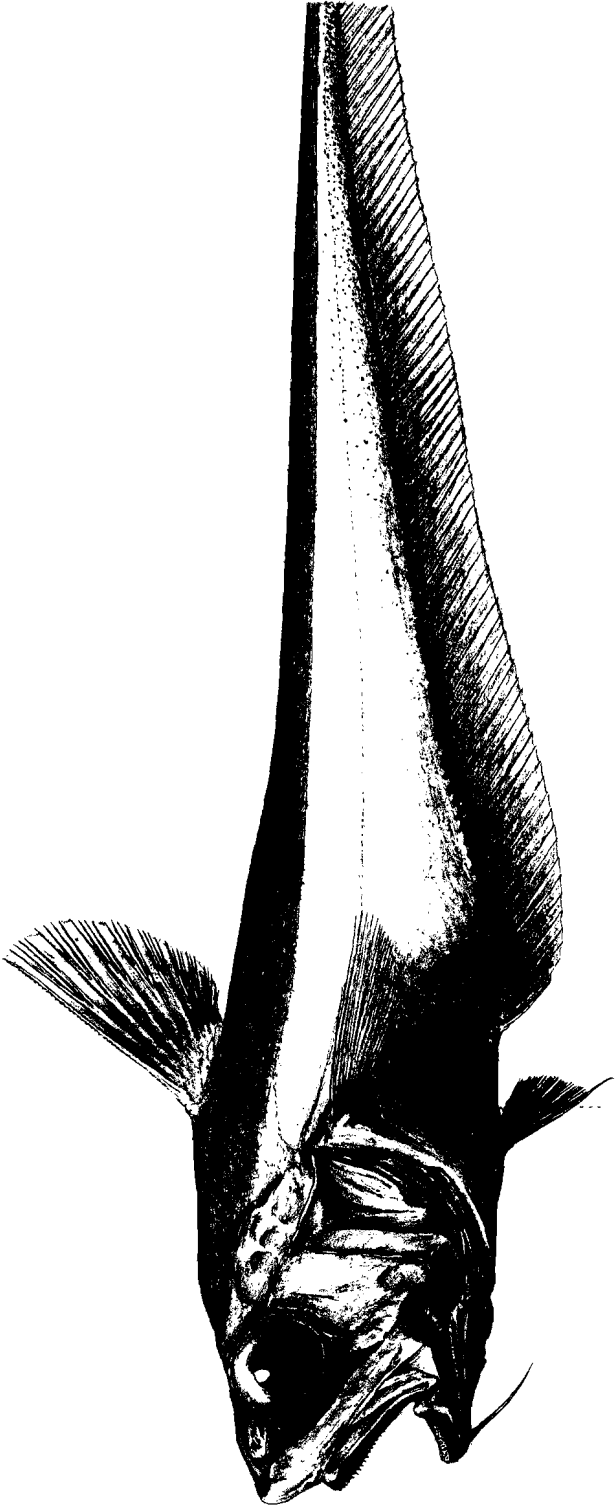


FIGURE 54. *Ventrifossa nigrodorsalis* Gilbert and Hubbs. AMS I.3114-013 (49.7 mm HL, 246+ mm TL), off Point Cloates, W.A. in 482-554 m. Scale bar represents 25 mm.

gill arches and filaments generally pale, but rakers dark; chin barbel dark at immediate base but pale distally. First dorsal fin spot or streak usually coal black and distinctive; spot extended as a broad streak in many specimens, beginning on serrated spinous ray and fading beyond 5th or 6th ray. Pelvic fins with inner distal portion pale or lightly dusky, with other parts black. Pectoral fin pale to dark dusky overall, darker on base; a lunate area of naked black skin behind base. Anal fin clear to lightly dusky but darker near anterior end.

SIZE. — To about 30 cm TL.

DISTRIBUTION. — Known from off Australia (WA, QLD, NSW), New Caledonian region, and Indonesia north to the Philippines and South China Sea, in 290–759 m. Distribution in WA confined to NW Shelf (about 18°S, 117°E) and coasts south to off Point Cloates (about 23°S).

COMPARISONS AND REMARKS. — *Ventrifossa nigrodorsalis* is one of five closely related species that have a distinct black blotch in the middle of the first dorsal fin; these include *V. petersoni* (Alcock, 1891), *V. longibarbata* (Okamura, 1982), *V. rhipidodorsalis* Okamura, 1984, and *V. ctenomelas* (Gilbert and Cramer, 1897). *Ventrifossa petersoni* appears to be most similar to *V. nigrodorsalis* but differs in having a somewhat shorter preoral length (11–15% of HL cf. 14–22%), a smaller orbit (25–28% HL cf. 29–35%), and a longer postorbital length (orbit 1.7–2.0 into postorbital). *Ventrifossa rhipidodorsalis* differs in having an anteriorly black-edged anal fin and on average more pelvic fin rays (9 or 10). *Ventrifossa longibarbata* has a longer barbel (more than orbit diameter) and smaller body scales (9 or 10 below midbase of first dorsal fin, compared with about 5.5–7.5 in *V. nigrodorsalis*). *Ventrifossa ctenomelas* from Hawaii is readily distinguished by its larger outer premaxillary teeth, more rays in first dorsal fin (II, 12–13), and smaller scales (11–12 scale rows below first dorsal fin origin, 50–53 lateral line scales over distance equal to predorsal length).

This species complex deserves closer study, owing to the close similarity of the species and the subtle characters that are used to differentiate one from another. Color patterns often differ among individuals of the same species, and reliance on such characters to distinguish species may prove unreliable. Variation in the relative intensity and the shape of the dark blotch on the first dorsal fin in members of *V. nigrodorsalis* and *V. rhipidodorsalis* (see Okamura in Okamura and Kitajima, 1984) lend an air of uncertainty in using such characters for species determinations.

### *Ventrifossa paxtoni* new species

Fig. 55

*Ventrifossa* species (NSW) Iwamoto and Merrett, 1997:92, 93, fig. 33b (New Caledonia region; 760–970 m).  
*Ventrifossa* sp. B: Williams et al., 1996:149 (WA).

DIAGNOSIS. — Pelvic fin rays 9–10 (usually 9), fins all black; median nasal streak faint or absent; chin barbel slender, moderately long, 24–35% (rarely to 38%) of head length; outer premaxillary teeth small, scarcely enlarged; darker dorsum not strongly demarcated from paler lateral and ventral parts of trunk and tail; suborbital shelf broad, without anterior constriction, almost entirely black.

SPECIMENS EXAMINED. — HOLOTYPE: AMS I.27647-002 (58.4 mm HL, 317+ mm TL); NSW off Sugarloaf Point; 880–950 m; K87-16-02. PARATYPES: NSW: AMS I.27647-002 (57.3 HL, 306+ TL); same data as for holotype. AMS I.28189-005 (2, 49.2–59.0 HL, 232+–235+ TL); e. of Newcastle; 960 m; K87-24-03. AMS I.24990-001 (52.4 HL, 294+ TL); off Sydney; 927–955 m; K84-16-13. AMS I.29753-008 (4, 26.7–47.4 HL, 145+–255+ TL); e. of Crowdy Head; 878–933 m; K89-17-06. AMS I.29805-001 (55.2 HL, 259+ TL); e. of Hawks Nest; 885–950 m; K87-24-04. AMS I.26981-005 (5 of 6, 54.9–57.7 HL, 252–310 TL); e. of Wallis Lake; 900–960 m; K87-02-01. QLD: AMS I.15822 (2, 62.8–68.6 HL, 295+–370+ TL); 10–11 miles ne. of Raine Island; 900 m; 12.II.1979. **New Caledonia**: CAS 86476 (56.4 HL, 305+ TL); 23°07.26'S, 166°50.45'E; 850 m; BIOCAL exped., st. CP31; R/V *Jean-Charcot*; 29.VIII.1985. **Chesterfield and Bellona Plateau**: MNHN 1994-1010 (6,

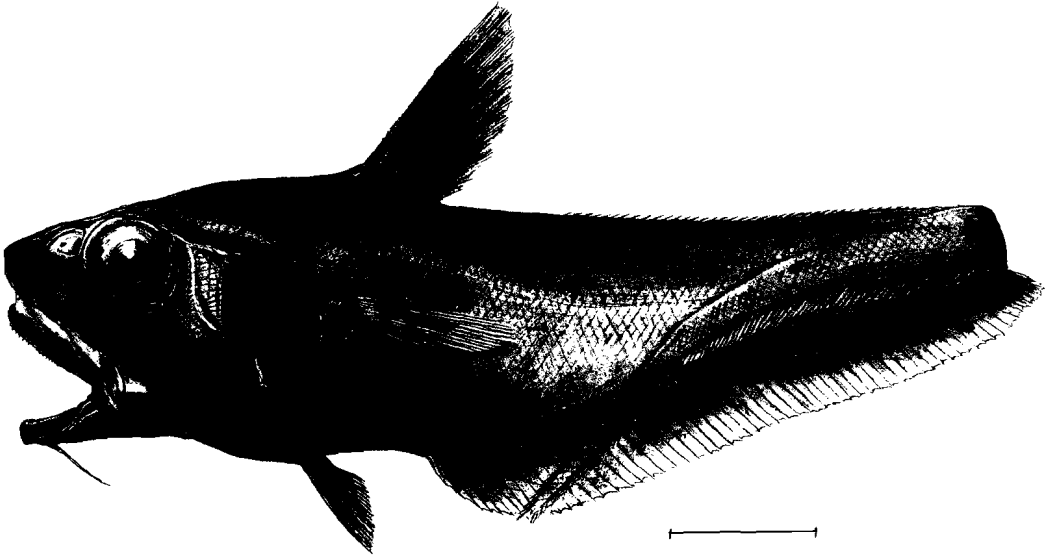


FIGURE 55. *Ventrifossa paxtoni* n.sp. Paratype, CAS 86476 (305+ mm TL) from off New Caledonia in 850 m. From Iwamoto and Merrett 1997, fig. 33b. Scale bar represents 25 mm.

64.8–82.1 HL, 325+–380+ TL); MUSORSTOM 5 exped., st. CP384; 19°42.40'S, 158°50.80'E; 772–756 m; R/V *Coriolis*; 21.X.1986. BMNH 1996.7.19:38, 46–58 (4 spec.) and MNHN 1997-668 (33.2 HL, 164+ TL); MUSORSTOM 5 exped., st. CC337; 19°53.80'S, 158°38.00'E; 412–430 m; R/V *Coriolis*; 15.X.1986. OTHER SPECIMENS (not paratypes): WA: CSIRO H2621-01 (480 TL); w. of Bunbury; 780 m; SS1/91/90. CSIRO H2549-09 (43.3 HL, 245 TL) and H2549-16 (305 TL); w. of NW Cape; 650 m; SS1/91/10. CSIRO H3145-26 (4, 170–220 TL); Rowley Shoals area; 17°52'S, 118°16'E; 550 m; 1992.

COUNTS AND MEASUREMENTS (24 spec.; see also Diagnosis).—1D. II,9–11 (usually II,10 or 11); P. i20–i25 (usually i20–i23); total GR-I (outer/inner) 10–13/15–18, GR-II 14–18/15–18; scales 1D. 8–12, midbase 1D. 5.5–8.5, 2D. 7.5–9.0, lat.line 37–50.

Total length 145+–380+ mm; HL 26.5–87.5 mm. The following in percent of HL (exceptional measurements enclosed in parentheses): snout (24) 26–31; preoral 10–19; internasal 20–26 (29); interorb. 24–30; orb. 27–34 (38); suborb. 13–17; orb.-preop. 42–48; postorb. 43–52; up.jaw 43–50; gill slit 24–30; pre-A. 122–164; V.-A. 27–45; body depth 77–96; 1D.-2D. 38–61; ht. 1D. about 63–73; len. P. about 50–65; len. V. about 40; post. nostril 3–6.

DESCRIPTION (of holotype, paratypes in parentheses unless otherwise stated).—Head and trunk moderately compressed; head about 5 times in total length; body depth about 0.8 into head length, more than postrostral length. Snout blunt in holotype, almost rounded in a few larger paratypes, relatively lower in larger than in smaller specimens, especially those 60 mm or more in head length, slightly extending beyond large subterminal mouth. Upper jaw extends posteriorly to below hind margin of orbits. Orbit circular (to slightly oval), diameter slightly more than (about equal to) snout length and interorbital width, 3.4 (2.7–3.7) into head length (size dependent, largest specimens have proportionally smallest orbit). Suborbital region almost vertical, without strong or sharp ridge; suborbital shelf broad, not narrowly constricted under anterior end of orbit. Opercular bones as for most others of genus, as described for *V. saxonovi*.

Teeth all small, rather blunt with low flanges below tip; in broad band in premaxillary with outer series scarcely enlarged; in 2 or 3 irregular series in mandible.

Body scales covered with small, conical, sharp, reclined, slightly recurved spinules arranged in subparallel (somewhat divergent or convergent) rows (about 15 or 16 rows, with posteriormost spinules on exposed field somewhat larger than those preceding), rows short, about 4 to 6 spinules per row. Spinules dorsally on trunk and tail, nape, and especially those remaining on chest all black or black at base.

Height first dorsal fin less than postrostral length of head, spinous second ray finely serrated, not prolonged beyond adjacent segmented rays. Second dorsal fin poorly developed throughout length; anal fin well developed. Pelvic fin short, outer ray scarcely produced, barely, if at all, reaching anal fin. First dorsal fin origin behind vertical through pectoral fin origin; origin pectoral fin slightly behind that of pelvic fins. Anal fin origin below midbase of first dorsal fin.

Color in alcohol overall rather dark, swarthy in NSW and QLD specimens, but much paler in WA specimens. In holotype and NSW specimens, entire head, chest, and abdomen swarthy, but WA specimens more pale. Blackish margins of snout, supranarial ridges, suborbital shelf prominently black in NSW specimens, much paler in WA specimens. Barbel blackish at and near base, pale distally. Lips black, mouth cavity almost entirely pale but upper oral valves lightly peppered (blackish), and gums dusky; roof of gullet dark. Gill chamber walls black, with contrasting white areas over hyoids, gill filaments, and to some extent, isthmus. Gular and branchiostegal membranes dark to black. First dorsal and pelvic fins black, pectoral fin black at base, blackish to dark dusky more distally. Anal fin intensely blackish anteriorly at base, dark dusky over most of length, becoming swarthy to blackish near end of tail (paler in these features in WA specimens).

SIZE. — To at least 43 cm TL.

DISTRIBUTION. — So far known only from Australia (NSW, QLD, WA), New Caledonia, and the Chesterfield and Bellona Plateau, in 878–1,053 m.

ETYMOLOGY. — Named in honor of John R. Paxton, former curator at the Australian Museum, Sydney, for his many contributions to ichthyology.

COMPARISONS AND REMARKS. — Of the Australian species, *V. paxtoni* appears most closely similar to *V. macropogon*, but that species has a distinctly longer and thicker barbel (34–45% HL) and its median nasal dark streak is much more prominent. In addition, gill-raker counts are notably higher in *V. paxtoni*. *Ventrifossa gomoni* bears some resemblance to *V. paxtoni*, but it has a somewhat narrower internasal (17–23% HL cf. 20–26%, exceptionally 29% in *V. paxtoni*), a narrower suborbital (11–13% cf. 13–17%), generally fewer gill rakers, and a more prominent median nasal streak.

Among western North Pacific species, *V. paxtoni* appears to be most similar to *V. saikaiensis* Okamura, 1984 in having a completely dark first dorsal fin, large mouth, small premaxillary teeth, relatively numerous gill rakers, and similar proportions and counts. The chin barbel of *V. saikaiensis*, which, according to Okamura (*in* Okamura and Kitajima 1984:209) is always more than orbit diameter, appears to be somewhat longer than in *V. paxtoni*, in which the barbel is usually shorter than the orbit, but varies from 0.84 to 1.29 into orbit. Four paratypes of *V. saikaiensis* were made available to us by Dr. Okamura. In three of these four (BSKU 28005, 28007, 28008), the pelvic fin ray counts were 8 on each fin, but in the fourth (BSKU 28006), the left side had 8, the right 9. Okamura recorded 8 and 9 in the holotype, with a range of 8–9 in the paratypes. *Ventrifossa paxtoni* has 9 or 10 pelvic rays, usually 9. The outer gill raker counts on the first arch were slightly higher in *V. saikaiensis* (12–15 cf. 10–13), and the count of scale rows below the second dorsal were slightly lower (7.0–7.5 cf. 7.5–10). One notable pigmentation difference between the two species was the absence in *V. saikaiensis* of dark border markings on the leading edge of the snout, over the supranarial ridges, and on the median nasal ridge. These markings are prominent in *V. paxtoni*.

The Western Australian specimens are tentatively assigned to this species, although their overall paleness and certain count and measurement differences suggest that they might not be conspecific with *V. paxtoni*. In general, there was good overlap in most counts and measurements, but the WA specimens often were at one end or another of the ranges and occasionally extended them marginally.

It is apparent that additional specimens from WA must be compared with material from other areas of its range to confirm their identification.

*Ventrifossa sazonovi* new species

Fig. 56

*Ventrifossa* species 1: Iwamoto, 1990:293 (in key).

*Ventrifossa* species: Sazonov and Iwamoto, 1992:83, fig. 33 (in key and scatter diagram.)

*Ventrifossa* sp. A: Williams et al., 1996:149 (WA).

**DIAGNOSIS.** — Pelvic fin rays 9–10; second spinous ray of first dorsal fin with smooth leading edge; a well-marked median nasal streak; chin barbel dark, length 17–24% of head length; outer premaxillary teeth notably larger than teeth of inner band; dorsum not strongly demarcated in color from rest of body in preserved specimens; suborbital shelf narrows anteriorly, somewhat constricted at anterior end.

**SPECIMENS EXAMINED.** — **HOLOTYPE:** CAS 13564 (male, 63.6 mm HL, 297+ mm TL); South China Sea off Vietnam; 15°48'N, 109°47'E; 479 m; *MV Stranger* sta. 60–63 (Naga 60–216; GVF 2079); 28.II.1960. **PARATYPES:** **WA:** AMS I.31166-006 (6, 38.2–71.5 mm HL, 200–330 mm TL); off Shark Bay; 610–612 m; SS1/91/31. **NT:** NTM S.12457-003 (47.9 HL, 240+ TL); Arafura Sea, se. of Tanimbar I.; 8°36'S, 132°00'E; 525–540 m; coll. M. Sachse; 1.VII.1988. **QLD:** CSIRO H1973-01 (44.2 HL, 220+ TL); Marian Plateau, e. of Townsville; 879–886 m; SO6/85/36. **SOUTH CHINA SEA:** CAS 99817 (7, 25.4–57.7 HL, 136–274+ TL); data as for holotype.

**COUNTS AND MEASUREMENTS** (21 spec.).—**ID.** II,9–10; P. i19–125; total GR-I (outer/inner) 10–15/15–20, GR-II 14–18/15–19; scales midbase **1D.** 7–8, **2D.** ca. 7.5–8.5.

Total length 132+–340+ mm; HL 21.9–71.5 mm. The following in percent of HL: snout 26–29; preoral 6–12; internasal 19–25; interorb. 22–28; orb. 25–35; suborb. 11–14; postorb. 45–51; orb.-preop. 43–46%; up.jaw 45–50; gill slit 23–29; pre-A. 128–157; V.-A. 26–44; body depth 71–83; **1D.**-**2D.** 41–60; ht. **1D.** 56–74; len. P. 42–65; len. V. 32–39; post. nostril 2–6.

**DESCRIPTION** (of holotype, paratype data as for holotype or in parentheses).—Head and trunk compressed, width over pectoral fin bases about 0.6, head about 0.7 greatest body depth. Greatest depth somewhat less than postrostral length of head, 6.5 (6.0–6.5) in total length. Snout low, blunt, scarcely protruding beyond large subterminal mouth, about equal to (slightly shorter than) interorbital width. Orbit almost circular, diameter greater than snout length and interorbital width, 3.3 (2.8–3.6) in head. Mouth large, upper jaw extends about to vertical through hind margin of orbit, length 2.1 (2.0–2.2) in head length. Barbel slender, tapering to fine tip, 0.58 (0.56–0.73) orbit diameter. Interorbital region essentially flat. Suborbital region vertical, gently rounded, without strong or sharp ridges; suborbital shelf slightly narrowed anteriorly. Preopercular ridge distinctly delineated; hind margin of preopercle inclined slightly forward. Posterior and ventral margins of interopercle exposed beyond preopercle. Ridges of gill cover distinctly incised at junction of opercle and subopercle; subopercle terminating in a blunt, triangular point. Gill membranes unite under hind one-third of orbit, narrowly attached to isthmus; a narrow free posterior fold.

Teeth in upper jaws in long, moderately broad band that tapers posteriorly to a narrow point at end of rictus; outer series of enlarged wide-spaced recurved teeth with slightly flanged tips (arrow-head-shaped); inner teeth minute. Mandibular teeth short, stoutly conical, in 2 irregular series, outer series smaller than inner series, scarcely exposed above gum papillae.

Body scales deciduous, mostly missing in specimens examined. In holotype, those on dorsum below second dorsal fin progressively beset with increasingly stout, long spinules (Fig. 56a'). Near origin of second dorsal fin, spinules fine, conical, slightly reclined, and bespeckled with large melanophores, an occasional midlateral spinule being larger than the remainder. Enlarged spinules



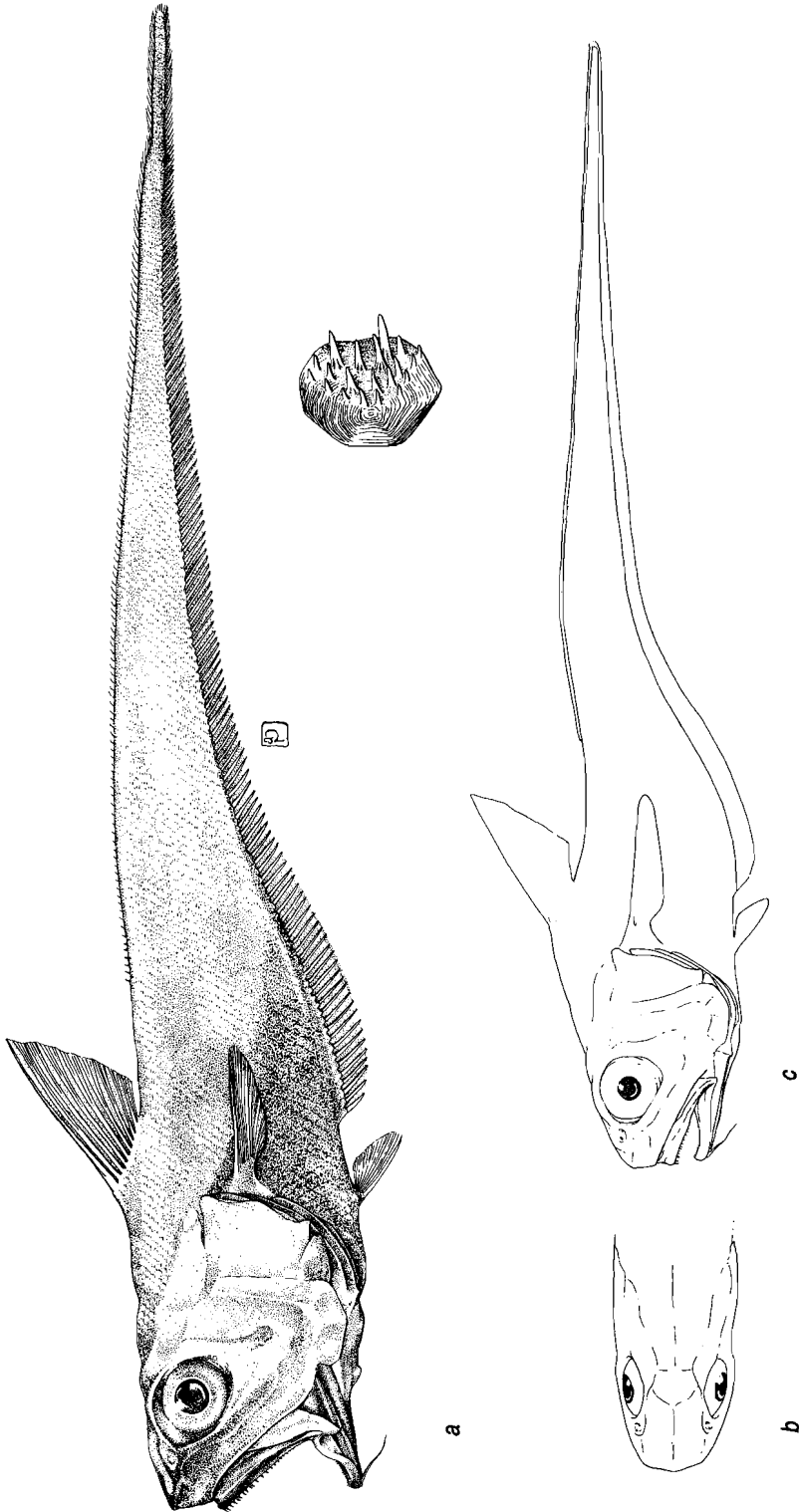


FIGURE 56. *Ventrifossa sazonovi* n.sp. (a) Lateral view of holotype, CAS 13564 (63.6 mm HL, 297+ mm TL); South China Sea off Vietnam, 479 m. Fins and scales partially reconstructed. Scale bar represents 25 mm. (b) Outline drawing of dorsal view of head of paratype (CAS 99817). (c) Outline drawing of lateral view of paratype. (d) Enlarged view of scale taken from first row below origin of second dorsal fin. Drawings by Amy Pertschuk.

increase in size and number on more posterior scales. No scales remain on flanks. Nape scales covered with uniformly small, conical, relatively erect spinules in typical (for genus) irregularly quincunx or widely (and irregularly) divergent, V-shaped rows. Chest scales densely covered with spinules similar to those on nape except that they are longer and more erect. No terminal or enlarged scutelike scales on snout. Scales below second dorsal fin missing in paratypes smaller than about 40 mm HL; spinules on these scales may not have been as enlarged as in larger individuals.

First dorsal fin relatively low, height much shorter than postrostral length of head, about equal to or (usually) slightly longer than length pectoral fin. Second dorsal fin rudimentary to poorly developed over most of length; 146 rays counted in 162 mm paratype with small rudimentary tail tip. Anal fin of moderate height, well developed throughout; 140 rays counted in 162 mm paratype. Pelvic fin short, outer ray barely, if at all, reaches anal fin. Origin of first dorsal fin behind vertical through pectoral fin origin, which is behind that of pelvic fin. Anal fin origin below midbase of first dorsal fin.

Color in alcohol light brownish overall, dark over most of head, abdomen, and chest. (South China Sea specimens pale, possibly because they have been in alcohol for more than 30 years. Fresher Australian paratypes generally darker.) Dorsum of trunk and tail slightly darker than surfaces ventrally, but without sharp demarcation. Ridges of head mostly dark (notably so in Australian specimens); leading margin of snout, suborbital shelf, median and lateral nasal ridges marked with faint (prominent in many paratypes) blackish pigmentation. Lips, underside of head, operculum mostly blackish; barbel pale (to dark); a faint (dark) oblique bar extending from posterior margin of orbit towards angle of preopercle, but falling short of preopercle ridge. Distal surfaces of medial walls of infraorbital bones blackish (visible through translucent skin). Mouth cavity white, roof of gullet blackish; gums dark, upper oral valve blackish. Gill cavities dark with pale inner areas (as in other species of genus); gill rakers and arches generally pale with tiny punctations (or dusky). First dorsal fin dusky (darker proximally); pectoral fin dusky, axil blackish; pelvic fins black, with slight fading near tips; anal fin dusky (anterior 1/5th or more dark dusky, turning paler posteriorly).

Periproct region as for others of subgenus. Anterior dermal window a small, circular, shallow black fossa between pelvic fin bases, separated by a scaly bridge from periproct. Posterior dermal window a black naked area immediately anterior to vent and forming anterior end of oval- to teardrop-shaped periproct. About 74 slender, densely packed pyloric caeca, longest about equal to length of barbel in 57.7 mm HL female paratype from South China Sea. Gonads in this specimen large; eggs of various sizes, up to 1.3 mm in diameter.

SIZE. — To at least 34 cm TL.

DISTRIBUTION. — So far known only from WA, NT, and QLD in Australia, and the South China Sea off Vietnam, in 420–612 m. Off WA it has been taken only off the NW Shelf (about 21°S) and off Shark Bay (about 25°S).

ETYMOLOGY. — Named for our Russian colleague and fellow student of grenadiers, Yuri I. Sazonov, curator of ichthyology in the Zoological Museum, Moscow State University.

COMPARISONS AND REMARKS. — *Ventrifossa sazonomi* is one of four members of the genus having a smooth, second, spinous dorsal fin ray. The four species also share in common the character of mandibular teeth in 1 or 2 irregular series, snout relatively low, gill raker counts relatively high, and mouth large. The new species differs from the others in having enlarged spinules on scales below the second dorsal fin in adults. In addition, *V. atherodon* (Gilbert and Cramer, 1897) from the Hawaiian Islands differs in having somewhat larger orbits (32–40% HL cf. 25–35%); *V. macrodon* Sazonov and Iwamoto, 1992 has a longer barbel (23–34% HL cf. 17–24%) and a somewhat shorter postorbital length (39–47% cf. 45–51%); and *V. macroptera* Okamura, 1982 has longer pectoral fins (1.3–1.5 in HL cf. 1.5–2.2).

## SUBFAMILY MACROUROIDINAE

*Squalogadus* and *Macrouroides* Smith and Radcliffe, 1912, each with a single species, are the only members of this peculiar group of grenadiers. There is some controversy as to whether or not the group should be treated at the subfamily level or at the family level (see Cohen 1989), and it is possible that the two species do not even belong within the Macrouroidei. Although *Macrouroides* was not represented in WA, its presence there would not be surprising as it has a broad, generally worldwide distribution (Philippines, Indian Ocean, South Atlantic, central western Atlantic).

***Squalogadus* Gilbert and Hubbs, 1916**

Only one species, found circumglobal, except eastern Pacific.

***Squalogadus modificatus* Gilbert and Hubbs, 1916**

Fig. 57

*Squalogadus modificatus* Gilbert and Hubbs, 1916:156 (Japan). Shcherbachev and Piotrovskiy, 1982:47 (world-wide distr. plotted; 600–1,740 m). Shcherbachev, 1987:41 (Indian Ocean distr. including Mascarene Ridge, West Australian Ridge, Exmouth Plateau; 800–1,740 m).

*Squalogadus intermedius* Grey, 1959:330 (Gulf of Mexico).

DIAGNOSIS. — Head massive, inflated, with rounded contours. Opercular cavity large, operculum extending well beyond gills; first gill slit unrestricted. Gill rakers on outer margin of first gill arch numerous (20), styliiform. Jaws relatively short; markedly inferior. One continuous dorsal fin, anterior section not elevated. Pelvic fins small, with five rays.

SPECIMENS EXAMINED. — WA: CSIRO H2614-03 (110 mm HL, 322+ mm TL); 1280 m; SS1/91/82. CSIRO H2544-01 (113 HL, 304+ TL); 1,128–1,139 m; SS1/91/04. CSIRO H2570 (77 HL, 198+ TL); 1,254–1,277 m; SS1/91/33.

COUNTS AND MEASUREMENTS (based on 3 spec.).—P. i22–i29; V. 5; total GR-I (outer/inner) 28–31/17–22, GR-II 16–19/17–19; scales 1D. 12–13.

Total length 198–322+ mm; HL 77–113 mm. The following in percent HL: postrostral 74–80; snout 31–33; preoral 42–44; internasal 37–40; interorb. 38–46; orb. 11; suborb. 29–30; postorb. 64–68; orb.-preop. 62–64; up.jaw 26–33; premaxillary 24–27; pre-A. 121–125; pre-vent 119–122; V.-A. 28–31; isth.-A. 41–43; body depth 64–67; depth over A. origin 42–50; post. nostril 3; rictus 23–30.

SIZE. — To at least 35 cm TL.

DISTRIBUTION. — Widespread in tropical and southern temperate seas, but absent in eastern Pacific.

COMPARISONS AND REMARKS. — An easily recognizable grenadier, separated from *Macrouroides inflaticeps*, the only other representative of the subfamily, by the presence of pelvic fins (absent in *Macrouroides*).

## SUBFAMILY TRACHYRINCINAE

Two genera, *Trachyrincus* and *Idioloophorhynchus*. Only the latter has been found off WA, but the former can also be expected as Gomon and others (1994) have recorded *T. longirostris* from off Portland, VIC.

*Idiolorhynchus* Sazonov, 1981

Only one distinctive species, so far known only from off Australia and New Zealand.

*Idiolorhynchus andriashevi* Sazonov, 1981

Fig. 58

*Idiolorhynchus andriashevi* Sazonov, 1981:1,360–1,363, figs. 1, 2 (holotype ZMMSU P-15341; WA, e. of Cape Leeuwin; 33°22'S, 113°59'E; 1,190–1,230 m). McMillan, 1995:84, 85, fig. 1 (descr.; 17 New Zealand spec.; 1,030–1,484 m).

**DIAGNOSIS.** — Snout long, pointed, flattened dorsoventrally; mouth inferior; small teeth in bands in both jaws; barbel absent. Gill rakers numerous; outer rakers on first arch long, tapering to fine tip; remaining rakers relatively short, with broad rounded tips. Pelvic fin with 3–4 rays. Four longitudinal rows of scutelike scales on each side; 1 dorsolaterally, 2 ventrolaterally, and 1 midlaterally; intervening areas with weak, unspined scales or naked. Bony ridges of head smooth or with small posteriorly directed spines. No temporal pit.

**SPECIMENS EXAMINED.** — **WA:** CSIRO H2623-01 (79.2 mm HL, 263 mm TL); off Cape Leeuwin; 1,040–1,045 m; SS1/91/92.

**COUNTS AND MEASUREMENTS** (based on 1 spec.).—1D. 10; P. i17–i19; V. 3; total GR-I (outer/inner) 26/17, GR-II 17/16; scales 1D. 8, 2D. 6.

Total length 263 mm; HL 79.2 mm. The following in percent of HL: snout 47; preoral 46; internasal 26; interorb. 31; orb. 21; suborb. 14; postorb. 35; orb.-preop. 29–30; up.jaw 15; outer gill slit 9; pre-A. 150; pre-vent. 145; body depth 48; V.-A. 49; isth.-A. 67; len. P. 46; len. V. 53; post. nostril 7.

**DESCRIPTION.** — Body elongate, tapering posteriorly to a point; greatest body depth at operculum. Snout long, sharply pointed, lacking terminal scute, flattened dorsoventrally; anterolateral margins completely supported by bone; bony ridges of head smooth or with small, posteriorly directed spines. Orbits small, more than twice into snout length; oblique, with notch in posteroventral margin. Mouth small, inferior, rictus 2.3 times into preoral length, posterior margin of maxilla in line with posterior margin of orbit. Barbel absent. Suborbital ridge poorly developed, narrow, bearing no spinulated scales; a small cluster of scutelike scales where ridge extends to posterior margin of operculum. Opercle and subopercle poorly developed; preopercle bearing a small, central bony keel.

Gill opening relatively wide, extending forward almost to posterior margin of orbit. Gill rakers numerous; outer rakers on first arch long, flattened, and closely spaced, tapering to fine tip with fine teeth on posterior margins; inner rakers on first arch and those on remaining arches relatively short, stout, with broad, rounded tips bearing short, fine teeth.

Teeth small, in narrow bands in both jaws; tooth bands tapering gently to single row of teeth posteriorly. Two dorsal fins of similar height separated by indistinct notch; second dorsal fin long, rays more developed than those of anal fin. Pectoral fin moderately long, leading ray not prolonged. Leading ray of pelvic fin fine, prolonged to origin of anal fin, inner ray fine and short.

Scales of 2 types: enlarged, adherent, scutelike with single, curved, central spine or small, deciduous, weak, and unspined. Scutelike scales forming 4 longitudinal rows on each side; 1 dorsolaterally, 2 ventrolaterally, and 1 midlaterally; additional row of scutelike scales curves between pectoral fin base and isthmus; dorsolateral row extends from nape for about 50% TL; midlateral row originates dorsal to pectoral fin base and about equal to postrostral length; long ventrolateral row intersects pectoral/isthmus row just posterior to pelvic fin base and extends just posterior to dorsolateral row; short ventrolateral row extends from midpoint of isthmus and vent to anal fin origin; 1–2 scutes on inner margin of pelvic fin base. Areas between primary scale rows and entire head covered

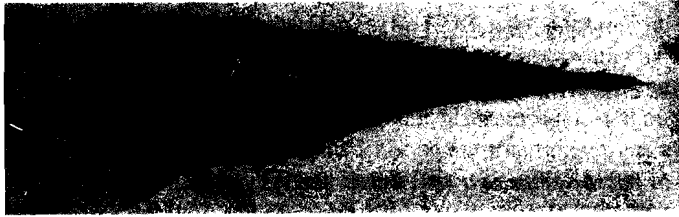


FIGURE 57. *Squalogadus modificatus* Gilbert and Hubbs. CSIRO H2614-03 (320 mm TL), from west of Rockingham, in 1,310 m.

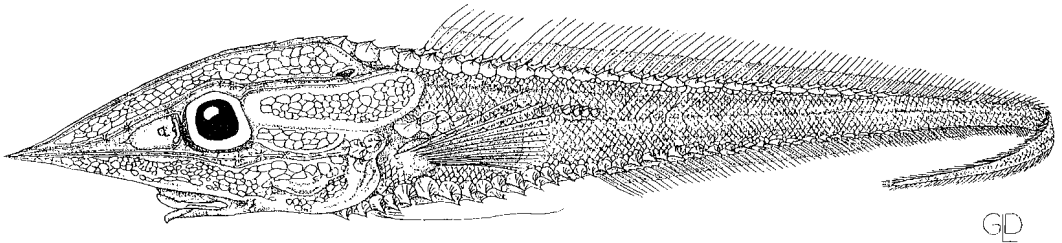


FIGURE 58. *Idiolophorhynchus andriashevi* Sazonov. CSIRO H2623-01 (79.2 mm HL, 263 mm TL) from off Cape Leeuwin, WA, in 1040 m. Drawn by Georgina Davis.

with weak, unspiculated scales; these larger on head than on body; lost scales leave conspicuous and distinctive pattern of scale-pocket margins on head and body; narrow naked margins adjacent to bony head ridges.

Body color brown; skin in scale pockets pale; branchiostegal membranes dark brown; branchial cavity and buccal cavity blackish brown. All fins light dusky brown.

SIZE. — To at least 26 cm TL.

DISTRIBUTION. — Southern Australia and New Zealand; 1,030–1,484 m.

COMPARISONS AND REMARKS. — *Idiolophorhynchus andriashevi* is a distinctive grenadier and is unlikely to be confused with other species. The species has been treated in a recent review of trachyrincine grenadiers from New Zealand by McMillan (1995).

APPENDIX 1. Station data for vessels *Southern Surveyor*, *Kapala*, and *Soela*.**FRV SOUTHERN SURVEYOR stations**

- SS1/91/02 [H2541] – WA: Exmouth Plateau; 20°17.8'S, 113°12.3'E; 914 m; 1991.  
 SS1/91/03 [H2542] – WA: Exmouth Plateau; 20°07.8'S, 112°56.3'E; 854–868 m; 1991.  
 SS1/91/04 [H2544] – WA: Exmouth Plateau; 20°55.4'S, 112°51.5'E; 1128–1139 m; 23.I.1991.  
 SS1/91/05 [H2545] – WA: Exmouth Plateau; 21°28.2'S, 113°38.6'E; 1022–1023 m; 24.I.1991.  
 SS1/91/08 [H2548] – WA: w. of North West Cape; 21°44.7'S, 113°52.3'E; 320–290 m; 24.I.1991.  
 SS1/91/10 [H2549] – WA: w. of North West Cape; 21°49.1'S, 113°47.6'E; 650–685 m; 24.I.1991.  
 SS1/91/11 [H2550] – WA: w. of NW Cape; 21°54.1'S, 113°40.7'E; 1,158–1,100 m; 24.I.1991.  
 SS1/91/12 [H2551] – WA: w. of NW Cape; 21°58.7'S, 113°08.7'E; 1,460–1,500+ m; 1991.  
 SS1/91/13 [H2552] – WA: nw. of Point Cloates; 22°26.2'S, 113°12.3'E; 1,305 m; 1991.  
 SS1/91/14 [H2553] – WA: w. of Point Cloates; 22°45.8'S, 113°13.6'E; 910 m; 1991.  
 SS1/91/15 [H2554] – WA: off Point Cloates; 22°57.6'S, 113°14.4'E; 482–554 m; 26.I.1991.  
 SS1/91/19 [H2557] – WA: w. of Cape Farquhar; 23°42.9'S, 112°35.9'E; 620 m; 1991.  
 SS1/91/21 [H2559] – WA: off Cape Cuvier; 24°00.4'S, 111°54.1'E; 1,060–1,064 m; 27.I.1991.  
 SS1/91/23 [H2561] – WA: w. of Cape Cuvier; 24°07.5'S, 111°39.4'E; 1,320 m; 1991.  
 SS1/91/25 [H2563] – WA: w. of Quobba Point; 24°30.6'S, 111°50.4'E; 895–901 m; 18.I.1991.  
 SS1/91/31 [H2568] – WA: off Shark Bay; 25°19.1'S, 111°56.6'E; 610–612 m; 29.I.1991.  
 SS1/91/33 [H2570] – WA: off Shark Bay; 25°52.1'S, 111°27.2'E; 1,254–1,277 m; 29.I.1991.  
 SS1/91/35 [H2572] – WA: w. of Dirk Hartog I.; 26°04.4'S, 111°47.1'E; 874–882 m; 1991.  
 SS1/91/36 [H2573] – WA: w. of Steep Point; 26°14.5'S, 112°03.2'E; 690–691 m; 30.I.1991.  
 SS1/91/37 [H2574] – WA: off Shark Bay; 26°35.7'S, 112°29.0'E; 508–500 m; 30.I.1991.  
 SS1/91/41 [H2578] – WA: sw. of Shoal Point; 28°04.1'S, 112°42.6'E; 853–854 m; 1.II.1991.  
 SS1/91/42 [H2579] – WA: sw. of Shark Bay; 26°58.2'S, 112°21.4'E; 666–688 m; #1991.  
 SS1/91/43 [H2580] – WA: NW Shelf, sw. of Shark Point; 20°40.8'S, 114°43.4'E; 713–714 m; 1991.  
 SS1/91/44 [H2581] – WA: off Shark Bay; 27°22.1'S, 112°10.8'E; 996–1,009 m; 31.I.1991.  
 SS1/91/48 [H2583] – WA: nw. of Shoal Point; 28°00'S, 112°41.0'E; 945–960 m; 1.II.1991.  
 SS1/91/49 [H2584] – WA: w. of Shoal Point; 28°00.6'S, 112°41.9'E; 853–854 m; 1991.  
 SS1/91/57 [H2591] – WA: 90 km sw. of Geraldton; 29°20.5'S, 113°58.3'E; 490–505 m; 6.II.1991.  
 SS1/91/58 [H2592] – WA: w. of Leander Pt; 29°21.8'S, 113°46.6'E; 942–970 m; 6.II.1991.  
 SS1/91/61 [H2595] – WA: w. of Leander Pt.; 29°21.8'S, 113°46.6'E; 1,132–1,136 m; 6.II.1991.  
 SS1/91/62 [H2596] – WA: wnw. of Green Head; 29°50.3'S, 114°10.9'E; 770–760 m; 7.II.1991.  
 SS1/91/65 [H2599] – WA: 50 km w. of Green Head; 30°00.0'S, 114°27.1'E; 480–490 m; 8.II.1991.  
 SS1/91/70 [H2604] – WA: sw. of Ledge Point; 31°14.9'S, 114°52.3'E; 512 m; 1991.  
 SS1/91/71 [H2605] – WA: nw. of Rottnest I.; 31°43.0'S, 114°58.7'E; 485 m; 1991.  
 SS1/91/72 [H2606] – WA: Rottnest Canyon; 32°02.3'S, 114°54.5'E; 670–640 m; 10.2.1991.  
 SS1/91/73 [H2607] – WA: Rottnest Canyon; 31°54.1'S, 115°04.6'E; 550 m; 1991.  
 SS1/91/82 [H2614] – WA: 32°19.8'S, 114°28.6'E; 1280 m; 1991.  
 SS1/91/83 [H2615] – WA: w. of Mandurah, 32°33.0'S, 114°25.8'E; 1,140 m; 1991.  
 SS1/91/84 [H2616] – WA: w. of Mandurah, 32°40.4'S, 114°28.2'E; 880–960 m; 14.II.1991.  
 SS1/91/85 [H2617] – WA: 33°17.9'S, 114°12.6'E; 982 m; 14.II.1991.  
 SS1/91/87 [H2618] – WA: 33°17.9'S, 114°30.8'E; 468–430 m; 15.II.1991.  
 SS1/91/90 [H2621] – WA: 33°25.5'S, 114°21.0'E; 817–780 m; 16.II.1991.  
 SS1/91/92 [H2623] – WA: w. of Cape Freycinet; 34°12.8'S, 114°07.7'E; 1,225–1,240 m; 1991.  
 SS1/91/96 [H2626] – WA: s. of Cape Leeuwin, 35°04.9'S, 114°59.7'E; 870–920 m; 18.II.1991.

**FRV KAPALA stations**

- K71-11-09 – NSW: 30 miles ne. of Jervis Bay; 34°50'S, 151°09'E; 549 m; 7.VII.1971.  
 K77-16-16 – NSW: e. of Broken Bay; 33°31'S, 152°04'E; 548–603 m; 28.IX.1977.  
 K78-09-05 – QLD: e. of Gold Coast; 28°02'S, 153°59'E; 548 m; 2.VI.1978.  
 K78-17-10 – QLD: e. of Danger Point; 28°01'S, 154°00'E; 548 m; 17.VIII.1978.  
 K78-23-08 – QLD: ne. of Danger Point; 28°03'S, 154°04'E; 731 m; 6.XI.1978.

- K79-15-01 – NSW: e. of Sydney; 33°48'S, 151°49'E; 440 m; 2.VII.1979.  
 K79-20-15 – NSW: e. of Broken Bay; 33°39'S, 152°06'E; 1,006 m; 6.XII.1979.  
 K83-09-01 – NSW: off Sydney; 33°48'S, 151°27'E; 942-960 m; 22.VIII.1983.  
 K83-09-02 – NSW: off Broken Bay; 33°32'S, 152°09'E; 933-969 m; 23.VIII.1983.  
 K83-09-04 – NSW: se. of Kiama; 34°55'S, 151°13'E; 951-978 m; 24.VIII.1983.  
 K83-13-01 – NSW: off Broken Bay; 33°40'S, 152°04'E; 988-1,020 m; 17.X.1983.  
 K83-15-02 – NSW: off Cape Hawke; 32°02'S, 153°09'E; 980 m; 2.XI.1983.  
 K83-17-01 – NSW: off Sydney; 33°42'S, 151°54'E, 765 m; 12.X.1983.  
 K84-06-06 – NSW: off Broken Bay; 33°28'S, 152°13'E; 1,107 m; 1984.  
 K84-08-04 – NSW: off Broken Bay; 33°31'S, 152°08'E; 915 m; 1984.  
 K84-14-01 – NSW: Jervis Bay off Wattamolla; 34°19'S, 151°24'E; 505 m; 1984.  
 K84-15-03 – NSW: off Broken Bay; 33°32'S, 152°03'E; 512-530 m; 11.IX.1984.  
 K84-16-04 – NSW: e. of Broken Bay; 33°32'S, 152°05'E; 759 m; 25.IX.1984.  
 K84-16-13 – NSW: off Sydney; 33°45'S, 152°00'E; 927-955 m; 1984.  
 K84-16-14 – NSW: off Broken Bay; 33°43'S, 152°03'E; 1,043-1,070 m; 27.IX.1984.  
 K84-16-15 – NSW: off Broken Bay; 33°43'S, 152°03'E; 957-993 m; 27.IX.1984.  
 K84-18-06 – NSW: ne. of Sydney; 33°48'S, 151°56'E; 914-924 m; 11.X.1984.  
 K84-19-04 – NSW: e. of Broken Bay; 33°36'S, 152°07'E; 1,024-1,245 m; 16.X.1984.  
 K87-02-01 – NSW: e. of Wallis Lake; 32°24'S, 153°00'E; 900-960 m; 19.II.1987.  
 K87-16-02 – NSW: off Sugarloaf Point; 32°25'S, 153°01'E; 880-950 m; 27.VIII.1987.  
 K87-24-01 – NSW: off Sydney; 33°54'S, 151°48'E; 785-975 m; 7.XII.1987.  
 K87-24-03 – NSW: e. of Newcastle; 32°55'S, 152°44'E; 960 m; 8.XII.1987.  
 K87-24-04 – NSW: e. of Hawks Nest; 32°41'S, 152°53'E; 885-950 m; 8.XII.1987.  
 K87-24-05 – NSW: e. of Harrington; 31°56'S, 153°08'E; 485-925 m; 9.XII.1987.  
 K89-06-05 – NSW: e. of Budgewoi; 33°13'S, 152°22'E; 722-768 m; 12.IV.1989.  
 K89-09-09 – NSW: off Terrigal; 33°28'S, 152°09'E; 741-768 m; 18.V.1989.  
 K89-13-02 – NSW: off Sydney; 33°45'S, 152°03'E; 1,120-1,170 m; 30.VI.1989.  
 K89-17-04 – NSW: e. of Crowdy Bay; 31°47'S, 153°18'E; 1,024-1,052 m; 16.VIII.1989.  
 K89-17-06 – NSW: e. of Crowdy Head; 31°53'S, 153°16'E; 878-933 m; 16.VIII.1989.

#### FRV SOELA stations

- SO1/82/12 – TAS: 38°06'S, 149°55'E; 250-276 m; 18.I.1982.  
 SO5/84/70 – TAS: 42°41.7'S, 148°24.9'E; 444-448 m; 24.X.1984.  
 SO6/85/36 – QLD: Marian Plateau, e. of Townsville; 17°59'S, 150°32'E; 879-886 m; 25.XI.1985.  
 SO6/85/47 – QLD: Queensland Trough, e. of Hinchinbrook I.; 17°55'S, 147°00'E; 402 m; 29.XI.1985.  
 SO6/85/86 – Townsville Trough; 18°58.1'S, 150°29.6'E; 420 m; 1985.  
 SO3/86/37 – TAS: w. coast; 42°25.8'S, 144°47.7'E; 792-830 m; 16.V.1986.  
 SO3/87/13 – TAS: e. of St. Helens; 41°21.2'S, 148°48.9'E; 1,060-1,260 m; 9.V.1987.  
 SO2/88/87 – VIC: Bass Strait, s. of Gabo I.; 38°06'S, 149°55'E; 250-276 m; 18.I.1982.  
 SO3/88/09 – VIC: s. of Warrnambool; 39°12.29'S, 142°29.99'E; 1,175 m; 1988.  
 SO5/88/70 – WA: NW Shelf, s. of Barrow I.; 20°40.8'S, 114°43.4'E; 420 m; 1988.  
 SO5/88/190 – WA: NW Shelf; 18°08.8'S, 117°54.5'E; 582 m; 12.X.1988.

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