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A REVIEW OF THE SOUTHEASTERN PACIFIC *CORYPHAENOIDES* (SENSU LATO) (PISCES, GADIFORMES, MACROURIDAE)

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ABSTRACT: The grenadier genus *Coryphaenoides* is represented by 14 species in the southeastern Pacific, including two new ones: *C. oreinos* (5 specimens from off Mexico) is closest related to *M. bucephalus*, differing primarily in having a more rounded and naked snout, different squamation, and broader head; *C. myersi* (known only from the holotype taken in the Galapagos) is closely related to *C. capito* and *C. boops*, but differs in having a shorter, stubbier snout and more pelvic rays. Small individuals of these two last species were difficult to distinguish; Garman in fact included two specimens of *C. capito* in the type series of *C. boops*. *Macrurus latinasutus* Garman, 1899, and *M. liraticeps* Garman, 1899, are considered synonyms of *M. anguliceps* Garman, 1899. *Macrurus leucophaeus* Garman, 1899, is questionably placed in the synonymy of *C. capito*. Other species treated are: *C. ariommus*, *C. armatus*, *C. bucephalus*, *C. bulbiceps*, *C. carminifer*, *C. delsolari*, *C. fernandezianus* (no new material), *C. filicauda*, and *C. paradoxus*. Provisional diagnoses are provided for subgenera *Chalinura*, *Coryphaenoides*, *Lionurus*, and *Nematonurus*, and a preliminary hypothetical phylogeny of macrourids with six branchiostegal rays is presented.

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Introduction

This paper continues a series treating the Macrouridae of the eastern Pacific begun with Iwamoto and Stein's (1974) review of northeastern Pacific grenadiers followed by articles by Chirichigno and Iwamoto (1977), Hubbs and Iwamoto (1977), and Iwamoto (1978, 1979).

The genus *Coryphaenoides* is represented by 20 species in the eastern Pacific and is well represented in several other parts of the world where sufficient deep-water sampling has shown them to be present. Iwamoto and Stein (1974) reported on seven *Coryphaenoides* species (excluding *Albatrossia pectoralis* (Gilbert, 1892), included in *Coryphaenoides*) from the boreal eastern North Pacific. In this paper we treat the 13 remaining eastern Pacific members of the genus, including two new species. We report again on the wide-ranging *C. armatus* Hector, 1875, which was treated by Iwamoto and Stein (1974), but for which additional pertinent information has been recently published.

Materials and Methods

Most of the specimens used in compiling this review are from collections of the California Academy of Sciences (CAS and CAS-SU), Museum of Comparative Zoology, Harvard (MCZ), and the National Museum of Natural History (USNM), but important additions were obtained from the recent Soviet collections housed at the Zoological Museum of Moscow State University (MMSU), the P. P. Shirshov Institute of Oceanology, Moscow (IOAN), and the collections of the Instituto del Mar, Callao, Peru (IMARPE), the Los Angeles County Museum of Natural History (LACM), and Scripps Institution of Oceanography (SIO). Abbreviations for institutions follow the Standard Symbolic Code for Institutional Research Collections in Herpetology and Ichthyology (Leviton et al. 1985).

Garman's (1899) valuable work, in which he described 6 of the 14 species here treated, was based on an ALBATROSS collection made during a cruise to the eastern tropical Pacific in 1891. Garman apparently did not examine collections from an 1888 ALBATROSS cruise around the tip of South America, north along the Pacific coasts of South and Central America, and out to the Galapagos, although many of the species he described were collected during that voyage. Gilbert and Thompson (1916) later reported on that portion of the collection procured between Montevideo, Uruguay, and Tome, Chile, but it was not until recently that some of the macrourids collected from low-latitude waters were treated (see Iwamoto 1978, 1979). Most material from that 1888 voyage was poorly preserved, and the macrourid specimens have deteriorated badly.

A subsequent ALBATROSS cruise to the tropical eastern Pacific in 1904 resulted in the collection of additional macrourid specimens, some of which are here reported (others were treated by Iwamoto 1979). Carl L. Hubbs told one of us (Iwamoto, pers. comm., ca. 1976) of having examined the 1888 and 1904 collections in preparing with C. H. Gilbert their two monumental works on macrourids (Gilbert and Hubbs 1916, 1920), but other commitments diverted him from completing his studies on them.

Most recent CAS macrourids used here were collected by the ANTON BRUUN in 1966 during the Southeastern Pacific Biological Oceanography Program (SEPBOP), and by Margaret G. Bradbury in 1968 on a cruise of the former Stanford University vessel TE VEGA. The LACM macrourids utilized were chiefly procured by the VELERO IV and other vessels through the efforts of Curator Robert J. Lavenberg and his colleagues at the LACM. The LACM's extensive ELTANIN collections from the Southern Ocean were used for comparison of some species and for the description of *Coryphaenoides filicauda.* The IOAN macrourids are from recent Soviet fisheries surveys in the southeastern Pacific, including the Nazca and Sala-y-Gomez ridges off Peru and Chile (see Parin et al. 1980). The entire macrourid fauna of these ridges will be reported by us in a separate publication.

Methods for making counts and measurements generally follow Gilbert and Hubbs (1916) and Iwamoto (1970). Definitions and abbreviations are explained below. In the Diagnosis sections, the numbers within parentheses refer to exceptional counts and measurements, at least in our material.

Counts

1D. and 2D.—Counts of the first and second dorsal fin rays. The Roman numerals "II" refer to the two spinous rays of the first dorsal, the first ray is usually rudimentary and closely appressed to the elongated and serrated second spinous ray; the Arabic numbers that follow refer to the segmented rays.

1P.—Pectoral fin ray count. The lowercase "i" refers to the rudimentary or short uppermost ray that is frequently closely appressed to the larger second ray.

V.—Pelvic fin ray count.

A.—Anal fin ray count.

GR-1 and GR-2—Gill raker counts of the first and second arches. Both inner and outer series are given. In the following, "(2–5) / (1–2) + (0–1) + (6–7) [7–9 total]," the outer and inner series are separated by a slash mark; the first figures within parentheses indicate the presence of 2–5 rakers on the outer series; in the inner series there are 1–2 rakers on the dorsal arm, 0 or 1 raker at the angle, 6–7 rakers on the lower arm, and 7–9 total rakers. When it could not be determined if a raker at the angle resided on the upper or lower arm, it was included in the lower-arm count.

Scales 1D., 2D., mid-1D., lat.l.—Scale row counts, respectively, below the origin of the first dorsal fin, second dorsal fin, mid-base of first dorsal fin, and lateral line scales counted from the anterior origin over a distance equal to the predorsal length. Lateral line scales are not included in the first three counts, and half-scale (0.5) counts are given when the uppermost scale is considerably smaller than others of the series.

Precaud. vert.—Precaudal vertebrae count.

Caeca—Pyloric caeca count; includes all distal tips.

Measurements

Measurements of fins and trunk parts are often imprecise because of distortion caused by preservation and are rounded to the nearest 1.0 mm. Head parts are measured to the nearest 0.1 mm.

Postrostral—Distance from anteriormost edge of orbit to posteriormost extent of operculum.

TL—Total length, snout tip to posteriormost extent of tail. A plus sign (+) indicates that a portion of the tail tip was missing or that a pseudocaudal was present.

HL—Head length, taken from snout tip to upper posterior angle of opercle.

Snout—Snout length, taken from tip of snout to anterior edge of orbit.

Preoral—Median ventral measurement from snout tip to (but not including) upper lip.

Internasal—Least distance between supranarial ridges.

Interorbital—Least distance between bony orbits.

Orbit—Greatest orbital diameter, often oblique.

Suborbital—Least width of suborbital space.

Postorbital—Horizontal measurement along midorbital axis from posterior rim of orbit to posteriormost extent of operculum.

Orbit–preop.—Oblique measurement from posteroventral edge of orbit to posteroventral angle of preoperculum.

Upper jaw—Length from anteriormost tip of premaxilla to posterior edge of maxilla.

Rictus—Length from symphysis of upper jaw to posteriormost extent of mouth opening.

Nostril—Greatest diameter of posterior nostril.

Barbel—Length from base (posterior insertion) to tip.

Gill slit—Greatest length of opening between gill cover and first gill arch.

Pre-D., pre-A., pre-V.—Predorsal, preanal, and prepelvic lengths, taken from snout tip to origin of first dorsal, anal, and pelvic fins, respectively.

V.–A.—Measurement from base of outer pelvic ray to origin of anal fin.

Isth.–A.—Measurement from anterior end of scaled area of chest to origin of anal fin.

Body depth—Greatest body depth taken below origin of first dorsal fin.

1D.–2D.—Distance from posterior base of first dorsal to origin of second dorsal fin; the latter point often difficult to discern because of the rudimentary anteriormost rays.

1D., 1P., V.—Height of first dorsal, lengths of pectoral and pelvic fins, respectively.

Genus **Coryphaenoides** Gunnerus, 1765

Coryphaenoides Gunnerus, 1765 (type species *Coryphaenoides rupestris* Gunnerus, 1765, by monotypy).
(See Iwamoto and Stein [1974] for synonymy.)

Diagnosis.—Branchiostegal rays 6. Anus immediately in advance of anal fin or slightly anterior to it; no light organ. Barbel present. Dentition variable among species, from broad bands to 1 or 2 rows, but teeth never few and fanglike. Snout shape variable, from pointed to bluntly rounded, but never greatly produced beyond mouth. Suborbital ridge extends from lateral angle of snout to below hind edge of orbit; not connected to preopercular ridge. Second spinous ray of first dorsal fin usually slightly prolonged and serrated along leading edge, rarely completely smooth. Anterior rays of second dorsal fin never as well developed as opposite of anal fin. A distinct interspace between dorsal fins, usually more than half length base of first dorsal. Gill rakers tubercular to short and tablike (or spatulate); those of outer series on first arch often few and rudimentary. Precaudal vertebrae 11–16. Pyloric caeca simple, unbranched, stublike to long and slender; usually fewer than 20. Retia and gas glands 4–7 each. (Modified from Iwamoto and Stein [1974]. See also Okamura [1970*a*, *b*] for additional characters.)

Discussion and Relationships.—The species of *Coryphaenoides* are among the deepest-living members of the family, most being found deeper than about 500 m, with species of subgenera *Nematonurus, Chalinura,* and *Lionurus* generally found well below 2,000 m to as much as 6,160 m (the last figure reported by Horibe [1983] for specimens that are probably *C. yaquinae* from the North Pacific).

Coryphaenoides as here defined represents a diverse array of species whose interrelationships are poorly understood. Based on our ideas, we present a phylogeny in Figure 1. Though very tentative and not based on a rigorous evaluation of characters, it is presented to allow future workers to test our ideas. It will undoubtedly face much alteration when more synapomorphies are found to establish monophyletic groups. The subgenera and species groups have not been adequately established, accounting for the many unresolved nodes. We recognize that the use of as plastic a character as rete mirabile numbers may erroneously infer relationships that do not exist, but we have used it lacking anything better. Rete numbers in *Lepidorhynchus,* for example, may be as high as 9 (Marshall 1965), and in *Coelorinchus canus* they vary between 6 and 11, although most others of the genus have only 4 retia. It is difficult to reconcile in our minds that *Coelorinchus* and *Macrourus* are closer relatives of *Coryphaenoides* than are *Albatrossia, Hyomacrurus, Coryphaenoides serrulatus,* and *C. subserrulatus.* Yet using rete numbers forces this assumption as the most parsimonious.

We follow Iwamoto and Stein's (1974) use of the subgeneric categories *Coryphaenoides, Nematonurus, Lionurus,* and *Chalinura,* although others (Parr 1946; Nybelin 1957; Marshall 1973) feel they deserve full generic standing. From the diversity seen, it is apparent to us that other genera or subgenera will eventually be recognized, as species groups within the genus become better known and synapomorphies are identified. Two genera have recently been removed from

Coryphaenoides: *Albatrossia* Jordan and Evermann, 1898 (because of its peculiar otolith, squamation, two retia, and reduced swim bladder) and *Hyomacrurus* Gilbert and Hubbs, 1920 (two retia, anus far removed from anal fin). Other candidates for separate recognition are *Macrurus longifilis* Günther, 1877 (in *Bogoslovia*); *Coryphaenoides serrulatus* Günther, 1878, and *C. subserrulatus* Makushok, 1976; and *Macrurus zaniophorus* Vaillant, 1888 (and its several close relatives including *Macrourus carminifer, M. boops, M. capito,* and *Coryphaenoides paramarshalli,* among others). The type species of *Coryphaenoides, C. rupestris,* differs so much from most members of the genus as here used that it too is a distinct candidate for separation from the group. (The genus name *Hemimacrurus* Fraser-Brunner, 1935 [type species *Macrurus acrolepis* Bean, 1884] is available for the remaining species in the event that should happen.)

We recognize approximately 61 species (see List) of *Coryphaenoides* (sensu lato). Seven other genera share the derived feature of six branchiostegal rays: *Albatrossia, Coelorinchus, Cynomacrurus, Hyomacrurus, Lepidorhynchus, Macrourus,* and *Odontomacrurus.* Of these, the monotypic *Odontomacrurus* (*murrayi* Norman, 1939) and *Cynomacrurus* (*piriei* Dollo, 1909) are so bizarre, with their bathypelagic habit, terminal mouth, no projecting rostrum, and fanglike teeth, that their relationship with the remaining genera must be very distant. Similarly, *Lepidorhynchus* (*denticulatus* Richardson, 1846) is notably different in having a luminescent organ with ventral striae, a character shared only with the seven-branchiostegal-rayed *Hymenocephalus* and a few distant gadiforms and higher teleosts. *Coelorinchus* and *Macrourus* represent a well-defined monophyletic line characterized by the sharply pointed and heavily scuted posteroventral angle of the preopercular ridge; strong, modified scutelike scales on head ridges; and absence of gill rakers on the outer side of the first gill arch. All members of *Coelorinchus* have a ventral light organ, some highly developed. A small structure has been observed in the body wall immediately anterior to the anus in *Macrourus*; it may very well represent a rudimentary or primitive state of light organ, which, if so, would be another synapomorphy for this line.

The number of known species within *Coryphaenoides* will undoubtedly increase with ad-

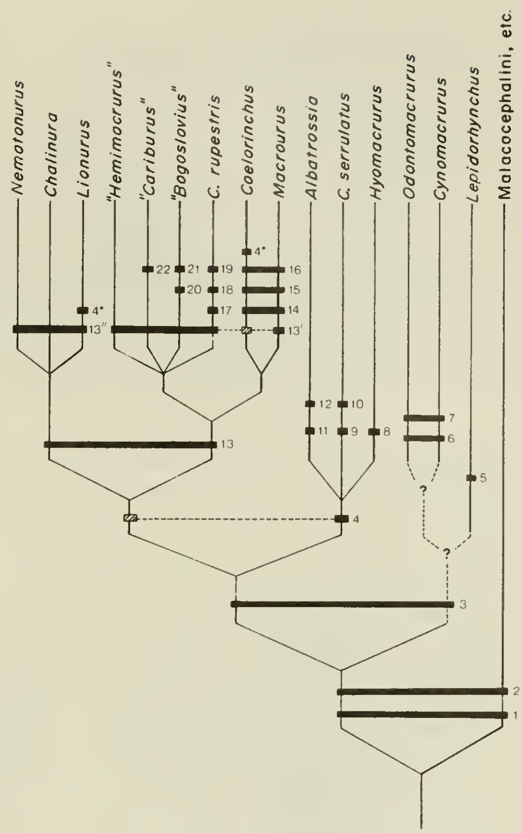


FIGURE 1. Tentative phylogeny of macrourines with six branchiostegal rays. Apomorphic character states indicated by numerals as follows [plesiomorphic states in square brackets]: (1) A. better developed than 2D. [2D. larger than A.]; (2) dorsal fins separated by a distinct gap [no gap]; (3) branchiostegal rays 6 [7]; (4) serrated 1D. spinous ray [smooth]; (5) ventral striae [none]; (6) reductions related to bathypelagic habit [none]; (7) fanglike teeth [small teeth]; (8) anus remote from A. [immediately in advance of A.]; (9) lanceolate scale spinules [conical]; (10) outer gill rakers on first arch tablike or spatulate [lathlike or tubercular]; (11) swim bladder reduced [normally developed]; (12) saccular otolith elongated [oval]; (13) retia numbers more than 2 [2]; (13′) retia 4 [2]; (13″) retia 5–7 [2]; (14) angle of preopercle ridge sharp, reinforced with stout scutelike scales [rounded, scales normal]; (15) outer gill rakers on first arch absent [present]; (16) light organ present [absent]; (17) inflated head [normal]; (18) high number of gill rakers, more than 17 [fewer than 17]; (19) scale patches on gular membrane [absent]; (20) reduced scale size [normal]; (21) premaxillary teeth in 2 widely separated rows [in bands or closely spaced rows]; (22) jaws short, with mouth opening restricted posterolaterally by lip folds [jaws moderate to large, mouth opening unrestricted]. Asterisk (*) indicates plesiomorphic condition found in some species within lineage; hatched boxes indicate some species within lineage may have either a more derived or a plesiomorphic condition.

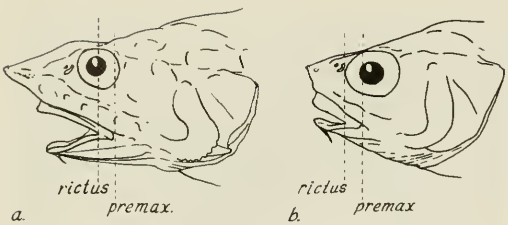


FIGURE 2. Diagrammatic illustrations of two species of grenadiers showing posterior extent of mouth opening (the rictus) and upper jaw (more specifically, the maxillary bone): (a) upper jaw extends to below posterior ⅓ of orbits, rictus to vertical through midorbit; (b) upper jaw ends short of level of midorbit, rictus extends to vertical through anterior ⅓ of orbit.

ditional collecting in the poorly known waters of the mid-Pacific, the western South Pacific, the Indo-Australian region, and the entire Indian Ocean. We think that relatively few currently recognized species of the genus will be synonymized as almost all are well defined and most appear to be confined to broadly restricted zoogeographical areas. Notable exceptions in their distributions are *Coryphaenoides armatus, C. leptolepis* Günther, 1887, and perhaps, *C. paradoxus* (Smith and Radcliffe, 1912) (if *C. macrocephalus* Maul, 1951, is a synonym). The first species has been thought to have a cosmopolitan distribution; Wilson and Waples (1983, 1984) have recently added significant insights into its zoogeography and taxonomy. They reported that *C. armatus* is generally confined in the Pacific to continental rise and slope areas between 2,000 and 4,300 m and is replaced in deeper waters by *C. yaquinae* Iwamoto and Stein, 1974. They recognized the North Pacific population as a distinct subspecies, *C. armatus variabilis*; populations from other areas represent the subspecies *C. a. armatus*. A few of the southernmost species of the genus, such as *C. subserrulatus* Makushok, 1976, *C. rudis* Günther, 1877, *C. filicauda* (Günther, 1878), and members of the subgenus *Nematonurus* are found in two or more ocean basins, but this is not surprising in that there is little to restrict their distributions in high-latitude southern waters. The apparent disjunction in the distribution of *C. rudis* between the western Indian Ocean and New Zealand is probably attributable to inadequate collecting off Australia and in the eastern Indian Ocean.

The *Coryphaenoides* species in this report are known for the most part only from adults and large juveniles. Collections of macrourid eggs, larvae, and prejuveniles remain scarce and unrepresentative of the diversity of this group. Mead et al. (1964) and Marshall (1965) summarized much of what was known to that time about reproductive and early stages of macrourid life. Recently, Merrett (1978), Stein (1980), and Stein and Pearcy (1982) reported on larval and prejuvenile stages of several species of *Coryphaenoides,* and Fahay and Markle (1985) provided a comprehensive summary of the little known about macrourid early life history. Much remains to be learned about the early life history of macrourids in general.

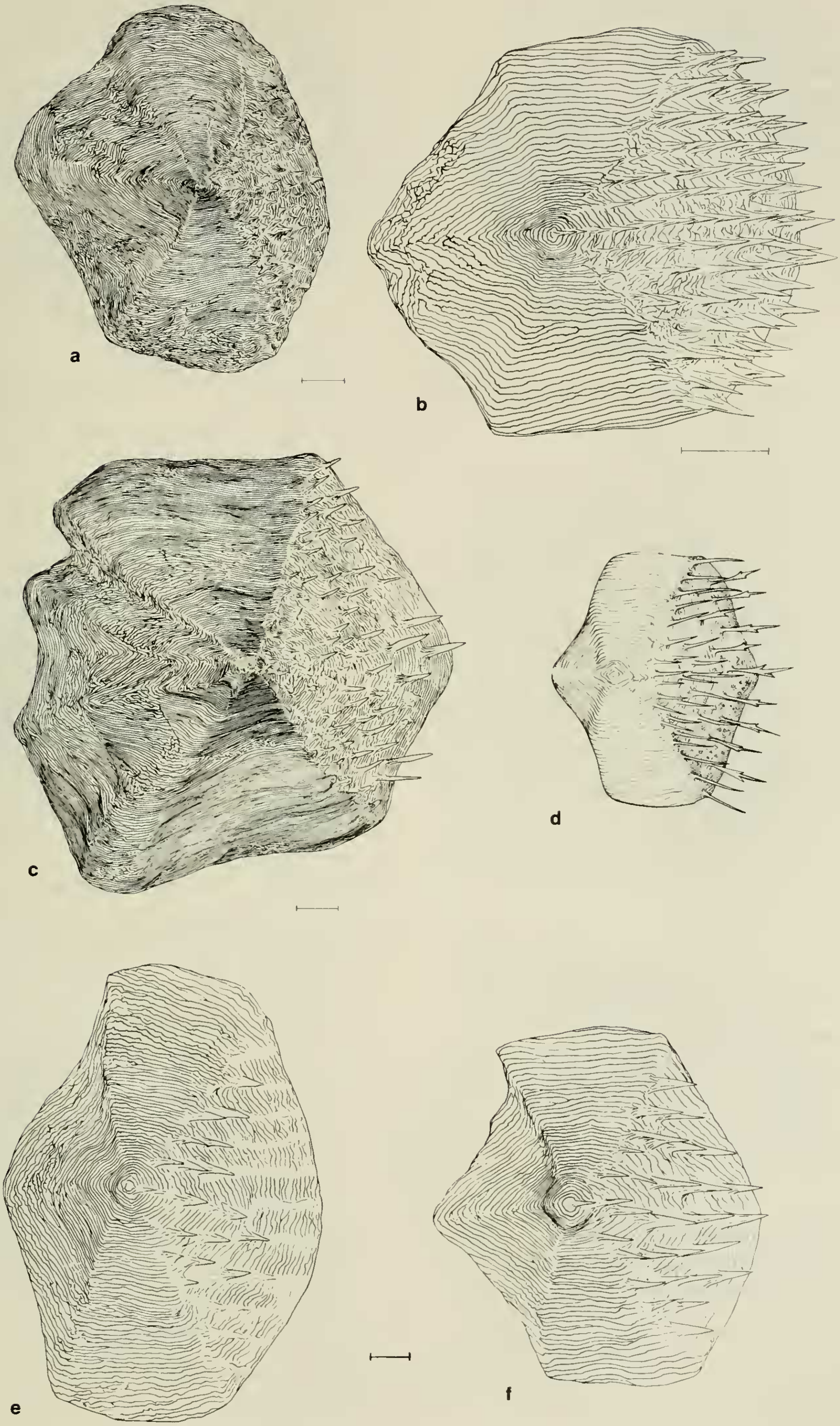
LIST OF *CORYPHAENOIDES* SPECIES
(Southeastern Pacific species indicated by an asterisk*)

Subgenus *Coryphaenoides* Gunnerus, 1765

1. *C. acrolepis* (Bean, 1884)
2. *C. aequatoris* (Smith and Radcliffe, 1912)
3. *C. alateralis* Marshall and Iwamoto, 1973
4. *C. altipinnis* Günther, 1877
5. *C. anguliceps* (Garman, 1899)*
6. *C. ariommus* Gilbert and Thompson, 1916*
7. *C. asper* Günther, 1877
8. *C. asprellus* (Smith and Radcliffe, 1912)
9. *C. boops* (Garman, 1899)*
10. *C. bucephalus* (Garman, 1899)*
11. *C. bulbiceps* (Garman, 1899)*
12. *C. camurus* (Smith and Radcliffe, 1912)
13. *C. capito* (Garman, 1899)*
14. *C. carminifer* (Garman, 1899)*
15. *C. cinereus* (Gilbert, 1895)
16. *C. delsolari* Chirichigno and Iwamoto, 1977*
17. *C. dubius* (Smith and Radcliffe, 1912)
18. *C. filamentosus* Okamura, 1970
19. *C. filifer* (Gilbert, 1895)
20. *C. guentheri* (Vaillant, 1888)
21. *C. hextii* (Alcock, 1890b)
22. *C. hoskynii* (Alcock, 1890a)

⟶

FIGURE 3. Body scales of *Coryphaenoides* spp. taken from region below interspace of dorsal fins, second to fourth row down: (a) *C. bulbiceps*; (b) *C. carminifer*; (c) *C. paradoxus*; (d) *C. delsolari* (from Chirichigno and Iwamoto 1977, fig. 2); (e, f) *C. oreinos*. Scale bars equal 1 mm.


a
b
c
d
e
f

23. *C. longicirrhus* Gilbert, 1905
24. *C. longifilis* (Günther, 1887)
25. *C. macrocephalus* (Maul, 1951)
26. *C. macrolophus* (Alcock, 1889)
27. *C. marginatus* Steindachner and Döderlein, 1887
28. *C. marshalli* Iwamoto, 1970
29. *C. mexicanus* (Parr, 1946)
30. *C. microps* (Smith and Radcliffe, 1912)
31. *C. myersi* Iwamoto and Sazonov, n. sp.*
32. *C. nasutus* Günther, 1877
33. *C. oreinos* Iwamoto and Sazonov, n. sp.*
34. *C. orthogrammus* (Smith and Radcliffe, 1912)
35. *C. paradoxus* (Smith and Radcliffe, 1912)*
36. *C. paramarshalli* Merrett, 1983
37. *C. rudis* Günther, 1878
38. *C. rupestris* Gunnerus, 1765
39. *C. semiscaber* Gilbert and Hubbs, 1920
40. *C. serrulatus* Günther, 1878
41. *C. sibogae* Weber and de Beaufort, 1929
42. *C. subserrulatus* Makushok, 1976
43. *C. thelestomus* Maul, 1951
44. *C. tydemani* (Weber, 1913)
45. *C. woodmasoni* Alcock, 1890b
46. *C. zaniophorus* (Vaillant, 1888)

Subgenus *Nematonurus* Günther, 1887

47. *C. armatus* (Hector, 1875)*
48. *C. ferrieri* (Regan, 1913)
49. *C. lecointei* (Dollo, 1900)
50. *C. yaquinae* Iwamoto and Stein, 1974
51. *C. affinis* (Günther, 1878)

Subgenus *Chalinura* Goode and Bean, 1883

52. *C. brevibarbis* (Goode and Bean, 1896)
53. *C. fernandezianus* (Günther, 1887)*
54. *C. leptolepis* Günther, 1877
55. *C. liocephalus* (Günther, 1887)
56. *C. mediterranea* (Giglioli, 1893)
57. *C. murrayi* Günther, 1878
58. *C. profundicola* (Nybelin, 1957)
59. *C. striatura* Barnard, 1925

Subgenus *Lionurus* Günther, 1887

60. *C. carapinus* (Goode and Bean, 1883)
61. *C. filicauda* Günther, 1887*

Key to Adults of *Coryphaenoides* Species from the Southeastern Pacific

1a. Upper jaw extends to or beyond posterior ⅓ of orbits, length 35–45% HL; rictus extends to or beyond vertical through midorbit (Fig. 2a) 2

1b. Upper jaw ends at or short of level of midorbit, length usually 36% HL or less; rictus extends to or short of vertical through anterior ⅓ of orbit (Fig. 2b) 9

2a. Underside of snout fully scaled (ventral edge may be narrowly naked) 3

2b. Underside of snout naked 5

3a. V. 8 (rarely 9). Premaxillary teeth all small, in 1 row .... *C. bulbiceps* (p. 59)

3b. V. 9–11. Premaxillary teeth in bands, with an enlarged outer series 4

4a. Orbit about 17% HL; barbel about equal to or greater than suborbital width; distance isthmus to A. equal to or more than HL. Body scales densely covered with short, fine, needlelike spinules (Fig. 3c) .... *C. paradoxus* (p. 72)

4b. Orbit 23–34% HL; barbel length much less than suborbital width; distance isthmus to A. less than HL. Body scales with tridentate spinules (Fig. 3d) in specimens greater than 50 mm HL .... *C. delsolari* (p. 66)

5a. Premaxillary teeth in 1 or 2 distinct rows .... *C. armatus* (p. 75)

5b. Premaxillary teeth in bands 6

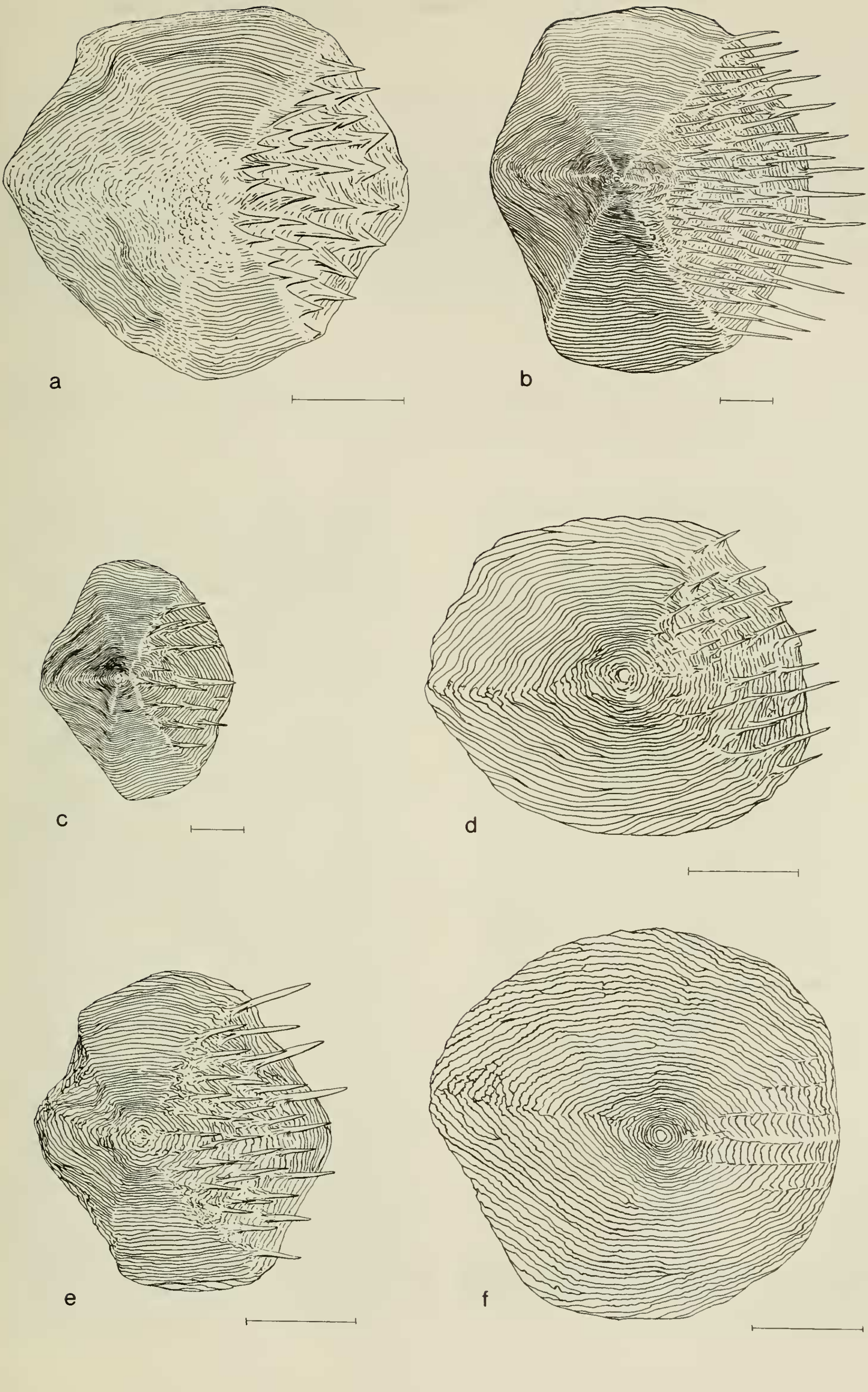
6a. Snout low, pointed, produced well beyond mouth. Mandibular teeth in narrow tapered band. 1D. spine smooth except for a few low denticulations distally. Spinulations on scales weak or absent, the few dispersed along 1–3 low ridges .... *C. filicauda* (p. 77)

6b. Snout high, blunt, little produced beyond mouth. Mandibular teeth in 1 or 2 rows. Denticulations along entire leading edge of 1D. spine. Spinulations on scales well developed, in several parallel rows (Fig. 4c) 7

7a. Barbel 17–23% HL. Snout narrow, bluntly pointed. Outer premaxillary teeth notably large .... *C. bucephalus* (p. 57)

→

FIGURE 4. Body scales of *Coryphaenoides* spp. taken from region below interspace of dorsal fins, second to fourth row down: (a) *C. ariommus*; (b) *C. boops*; (c) *C. bucephalus*; (d) *C. capito*; (e) *C. myersi*; (f) *C. anguliceps*. Scale bars equal 1 mm.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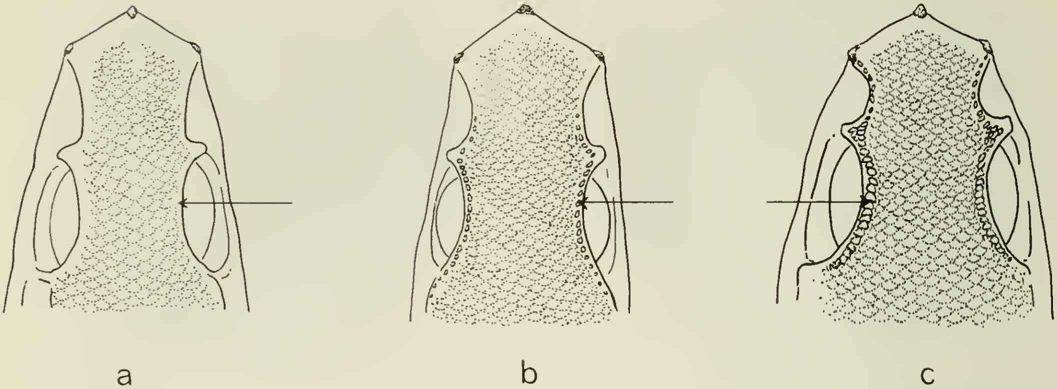

FIGURE 5. Squamation over dorsal surfaces of snout and interorbital region in (a) *C. anguliceps* (CAS 55832, 111 mm HL); (b) *C. ariommus* from off Peru (CAS 55835, 55.7 mm HL); and (c) *C. ariommus* from off Chile (CAS 55833, 82.5 m HL). Note larger scales over interorbital and absence of coarse scales along dorsal rim of orbit in *C. anguliceps*.

7b. Barbel 8–11% HL. Snout broad, rounded. Outer premaxillary teeth moderate in size 8

8a. Orbits 4–5 in HL. Mandibular teeth in narrow band 2–5 teeth wide .... *C. oreinos*[1] (p. 68)

8b. Orbits 5.5 in HL. Mandibular teeth in single row .... *C. fernandezianus* (p. 77)

9a. Barbel thick, stout, 14–23% HL; underside of snout scaled *C. carminifer* (p. 64)

9b. Barbel moderately thick to relatively thin and small, usually 11% HL or less; underside of snout mostly or entirely naked 10

10a. Body scales coarsely spinulated, adherent, those of suborbital shelf strongly adherent, in 2 or more rows and forming a distinct scaled edge to ventral rim of orbits. Snout low, scarcely protruding, preoral length less than 13% HL, 2.5–4 or more into greatest orbit diameter (which is 29–35% HL) 11

10b. Body scales thin and highly deciduous or heavily spinulated and moderately adherent; suborbital shelf mostly naked or with small scales in 1 or 2 rows that do not cover most of shelf and do not form a scaled ventral orbital edge. Snout variously produced and moderately high, preoral length 10–24% HL, 2.5 or less into orbit (which is 21–36% HL) 12

11a. V. 10, outer ray relatively thick and prolonged beyond 7th to 8th A. fin ray .... *C. myersi* (p. 71)

11b. V. 7–8, outer ray thin, scarcely if at all reaching A. origin .... *C. boops* (p. 53)

12a. Total gill rakers on inner series of first arch 11–14. Snout blunt, relatively short, 22–28% HL; suborbital narrow, 7–11% HL; interorbital narrow, 14–21% HL, 1.35–2.15 into orbit. Pyloric caeca short, stubby, 6–8 .... *C. capito* (p. 62)

12b. Total inner gill rakers on first arch 7–10. Snout blunt or pointed, short to moderate in length, 26–35% HL; suborbital 11–16% HL; interorbital 17–29% HL, 0.95–1.59 into orbit. Pyloric caeca slender, 9–14 (in *C. ariommus* and *C. anguliceps*, unknown in *C. oreinos*) 13

13a. Snout high, bluntly rounded, length 25–28% HL. Mouth moderate 36–39% HL, rictus extends posteriad below anterior ⅓ orbit .... *C. oreinos*[1] (p. 68)

13b. Snout low, pointed, length 28–35% HL. Mouth rather small, 26–35% HL, rictus extends to or slightly beyond anterior edge of orbits 14

14a. V. usually 9 (rarely 7, 8, or 10). Scales relatively adherent, coarsely spinulated (Fig. 4a), 12–15 rows across interorbital space (Fig. 5b, c); dorsal rim of orbits demarcated by a row of small, coarse,

[1] *Coryphaenoides oreinos* appears twice in the key (see also couplet 13a) in the event the jaw and rictus length characters of the first couplet are misinterpreted.

FIGURE 6. *Coryphaenoides anguliceps.* Composite drawing of CAS-SU 25227 (76 mm HL, 330+ mm TL) and CAS 55832 (76.3 mm HL, 352+ mm TL). Scale bar equals 25 mm.

adherent scales. Oral cavity blackish. Orbit 1.09–1.66 into distance orbit to angle of preopercle ..... *C. ariommus* (p. 50)

14b. V. usually 8 (rarely 7 or 9). Scales highly deciduous, sparsely spinulated (Fig. 4f), 6–8 rows across interorbital space (Fig. 5a); no scales along dorsal rim of orbits. Oral cavity grayish. Orbit 1.60–2.22 into distance orbit to angle of preopercle. .... *C. anguliceps* (p. 45)

Subgenus **Coryphaenoides** Gunnerus, 1765

DIAGNOSIS.—A subgenus of *Coryphaenoides* with 4 retia mirabilia. Origin of A. below or forward of 1D.–2D. interspace. Drumming muscles developed on swim bladder. Dentition pattern and size variable, usually in narrow to broad bands on premaxillary, with an enlarged outer series; mandibular teeth in 1–2 irregular rows or a band. Flesh generally firm; bones stout. Scales deciduous to adherent; spinules sometimes reduced or obsolescent. Snout acute to bluntly rounded; orbits small to large, diameter more than 20% HL in most species, usually about equal to or greater than interorbital width in small species (less than 40 cm TL). Upper jaw usually less than 45% HL; mouth opening greatly restricted in some species; upper jaw rarely extends beyond vertical through posterior ⅔ of orbit. Isthmus to A. distance in most species less than HL. Gill membranes usually broadly connected to isthmus with a narrow or no posterior free fold. Outer gill slit greatly restricted, less than 15% HL. GR usually fewer than 14 on inner series of first arch.

REMARKS.—The subgenus as here defined is a catchbasket for those species that do not readily fit into the other subgeneric categories. *Coryphaenoides serrulatus, C. subserrulatus,* and *C. longifilis* will not, in fact, fall into the circumscription of any of the subgenera here used—their placement will be considered in another paper. Much work still remains before the species groups are adequately sorted out, and the subgeneric diagnoses given here are highly provisional.

Coryphaenoides anguliceps (Garman, 1899)

(Figures 4f, 5a, 6–8, 11)

Macrurus anguliceps Garman, 1899:212–214, pl. G, fig. 1; pl. L; pl. 83, fig. 2 (type locality: Cocos Ridge between Panama and Galapagos; 5°56′N, 85°10.5′W; ALBATROSS sta. 3362 in 1,175 fm [2,149 m]; 26 Feb. 1891).

Coryphaenoides anguliceps: Gilbert and Hubbs 1916:144 (list).

Macrurus liraticeps Garman, 1899:196–197, pl. XLV, fig. 1–1b (type locality: Galapagos; 0°04′N, 90°24′30″W; ALBATROSS sta. 3407 in 885 fm [1,618 m]; 3 Apr. 1891). NEW SYNONYMY.

Coryphaenoides liraticeps: Gilbert and Hubbs 1916:144 (list).

Macrurus latinasutus Garman, 1899:214–215 (type locality: Gulf of California, ALBATROSS sta. 3431 in 1,820 m). NEW SYNONYMY.

Coryphaenoides latinasutus: Gilbert and Hubbs 1916:144 (list).

Lionurus latinasutus: Marshall 1973:596 (list).

Coryphaenoides anguliceps (?): Parin and Makushok 1973:180 (one adult, 340 mm TL; 2°S, 82°37′W, 2,150 m).

Macrouridae Gen. sp.: Parin and Makushok 1973:180 (juv., 63+ mm TL; 2°S, 82°37′W, 2,150 m).

MATERIAL EXAMINED.—Lectotype of *Macrurus anguliceps* Garman (here designated): MCZ 28558 (70.8 mm HL, 341 mm TL); ALBATROSS sta. 3362. Paralectotypes of *M. anguliceps*: MCZ 63000 (3: 58.5–69.8 HL, about 147–326 TL; all damaged; mixed, ALBATROSS sta. 3366, 3392, 3400).—MCZ 28562 (2: 64.3–70.2 HL, 307–354 TL); Gulf of California, 26°48′N, 110°45′20″W; 859 fm (1,571 m); ALBATROSS sta. 3435; 22 Apr. 1891.—MCZ 28567 (1: 87 HL, 405+ TL) and MCZ 28588 (1: 58.4 HL); off Cocos I.; 5°30′N, 86°45′W; 1,067 fm (1,951 m); ALBATROSS sta. 3366; 27 Feb. 1891.—MCZ 28568 (1: 94 HL, 400+ TL) and USNM 57858 (2: 70.0–81.2 HL, 350+–340+ TL); off Cocos I.; 5°26′20″N, 86°55′W; 770 fm (1,408 m); ALBATROSS sta. 3371; 1 Mar. 1891.—MCZ 28563 (1: 74.0 HL, 334+ TL); Gulf of Panama; 7°06′15″N, 80°34′W; 695 fm (1,271 m); ALBATROSS sta. 3353; 23 Feb. 1891.—MCZ 28560 (4: 54.3–84.1 HL, 283+–412+ TL) and MCZ 28566 (1: 84.1 HL, 375+ TL); Gulf of Panama; 7°05′30″N, 79°40′W; 1,270 fm (2,323 m); ALBATROSS sta. 3392; 10 Mar. 1891.—MCZ 28565 (1: 75.8 HL, 365 TL); Gulf of Panama; 3°09′N, 82°08′W; 1,132 fm (2,070 m); ALBATROSS sta. 3376; 4 Mar. 1891.—MCZ 28559 (3: 72.2–76.6 HL, 337+–395+ TL); Cocos I.; 5°26′20″N, 86°55′W; 770 fm (1,408 m); ALBATROSS sta. 3371; 1 Mar. 1891.—MCZ 28569 (1: 85.3 HL, 400+ TL); Galapagos; 0°59′S, 88°58′30″W; 395 fm (722 m); ALBATROSS sta. 3400; 28 Mar. 1891.

Lectotype of *Macrurus liraticeps* (here designated): MCZ 28598 (112 HL, 500+ TL); Galapagos; ALBATROSS sta. 3407. Paralectotype: MCZ 63301 (1: 105 HL, 430 TL; same data as for lectotype).

Holotype of *Macrurus latinasutus*: MCZ 28557 (46.3 HL, 225+ TL); off mouth of Gulf of California; 23°59′N, 106°40′W; 995 fm (1,820 m); ALBATROSS sta. 3431; 20 Apr. 1891.

Other material.—MEXICO.—SIO 59-265 (13: 38.2–97.7 HL, 135+–422+ TL); Gulf of California, off Rio Glata; 23°40.5′N, 107°38.5′W, 747–757 fm (1,366–1,384 m); 11 May 1959.—SIO 65-233 (4: 67.7–91.4 HL, 328–401+ TL); SW of Cape region; 22°42.5′N, 110°21.0′W; 1,035–1,070 fm (1,893–1,957 m); HORIZON field no. MV-65-I-50; 28 June 1965.—LACM 31124-4 (4: 72.7–91.7 HL, 317+–416+ TL); Middle American Trench; 21°52′30″N, 106°46′36″W; 1,554 m; VELERO IV. sta. 13770; 21 Jan. 1970. COSTA RICA.—LACM 33588 (17: 67–94.0 HL, 285+–415 TL); 9°45′18″N, 85°52′24″W; 1,866 m; VELERO IV sta. 18932; 12–13 May 1973.—LACM 33643 (1: 67.4 HL, 330 TL); 8°36′N, 84°17′36″W; 2,240 m; VELERO IV sta. 19037; 27 May 1973. COCOS ISLAND (96 km S of).—AMNH 7504 (3: 41.6–76.0 HL, 210+–340+ TL); ARCTURUS sta. 74; May 1925. ECUADOR.—USNM 135342 (1: 63.5 HL, 295+ TL) and USNM 148997 (1: 69.1 HL, 330+ TL); 1°03′N, 80°15′W; 741 fm (1,355 m); ALBATROSS sta. 2793, 3 Mar. 1888.—MMSU P-16520 (2: 17+–68 HL, 63+–340 TL); AKADEMIK KURCHATOV sta. 308 ("Proba" 253); 2°S, 82°37′W; 2,150 m. GALAPAGOS.—USNM 135343 (3: 46–101 HL, 188+–400+ TL); 0°24′S, 89°06′W; 812 fm (1,485 m); ALBATROSS sta. 2807; 4 Apr. 1888. PERU.—CAS 55832 (10 [of about 100]: 48.5–111 HL, 180+–466+ TL) and MMSU P-16514 (3 spec.); 4°10′S, 81°27′W; 1,815–1,860 m; ANTON BRUUN cr. 18B, sta. 766 (field no. LWK66-115); 9 Sep. 1966.

Diagnosis.—A species of *Coryphaenoides*, subgenus *Coryphaenoides*, with tiny chin barbel, about 3–4 into orbit. V. usually 8 (rarely 7 or 9). Mouth opening slightly restricted, rictus extends beyond vertical through anterior orbit margin, upper jaw extends to below midorbit. Small teeth in bands in both jaws. Snout pointed, protruding well beyond mouth. Body and head scales weak and highly deciduous; ventral and leading surfaces of snout naked; dorsal shelf region of suborbital mostly naked; suborbital ridge scales small, weak if present. Transverse scale rows across interorbital space 6–8. Oral cavity pale to grayish.

Counts and Measurements (83 spec.) (see also Table 1, and Fig. 6).—1D. II,8–10 (rarely 7); 1P. i18–i23 (usually i19–i21); V. 8 (rarely 7 or 9); 2D. about 100–118; A. 110–125; GR-1 (2–5) / (1–2) + (0–1) + (6–7) [7–9 total], GR-2 (1–2) + (0–1) + (5–7) [7–9 total] / (1–2) + (0–1) + (5–7) [7–9 total]; scales 1D. 6–8, 2D. 5.5–8.5, mid-1D. 3.5–5.5, lat.l. 39–46; caeca 9–14.

Total length 144+–460+ mm; HL 28.6–101 mm. The following in percent HL: postrostral 67.7–75.6; snout 27.8–34.0; preoral 15.7–22.9; internasal 16.5–22.5; interorbital 16.9–23.5; orbit 21.0–29.3; suborbital 11.7–15.0; postorbital 43.0–50.0; orbit–preop. 40.3–47.7; upper jaw 26.7–34.6; rictus 20.8–27.3; nostril 2.5–7.7; barbel 3.4–8.7; gill slit 5.3–8.7; pre-D. 107–117; pre-A. 135–174; pre-V. 104–125; V.–A. 34–57; isth.–A. 68–94; body depth 56–82; 1D.–2D. 15.5–48.7; 1D. 47–82; 1P. 36–57; V. 34–67.

Description.—Head large, fairly broad, greatest width about equal to postorbital length; length about 4.5–5.0 in TL. Nape prominently humped from behind orbits. Body long, slender, gradually tapered from level of first dorsal fin to end of tail. Orbits of moderate size, length 1.2–1.4 into snout length, about 4.2 in HL. Interorbital space narrow, slightly concave 1.1–1.4 into orbit. Snout pointed with a high median ridge; broad, width across lateral angles slightly more than orbit diameter, least width across supranarial ridges about equal to or more than interorbital space; snout tipped at terminal and lateral angles with stout, blunt scutes. Mouth relatively large; gape posterolaterally slightly restricted by lip folds; rictus extends to below anterior ¼ of orbits, end of maxillary to below midorbit, distance end of rictus to posterior end of maxillary about equal to barbel, which is very small, little longer than the small posterior nostril. Suborbital with a broad shelf and sharply angular (in cross section) longitudinal ridge which extends from tip of snout to anterior end of preopercle (the ridge not supported by bone between terminal and lateral angles of snout and for a short distance behind lateral angle). Preopercle broadly rounded, posterior margin inclined forward; preopercular ridge with a prominent lobelike prolongation at posteroventral angle. Interopercle almost entirely covered by preopercle, posterior edge barely exposed beyond preopercle margin.

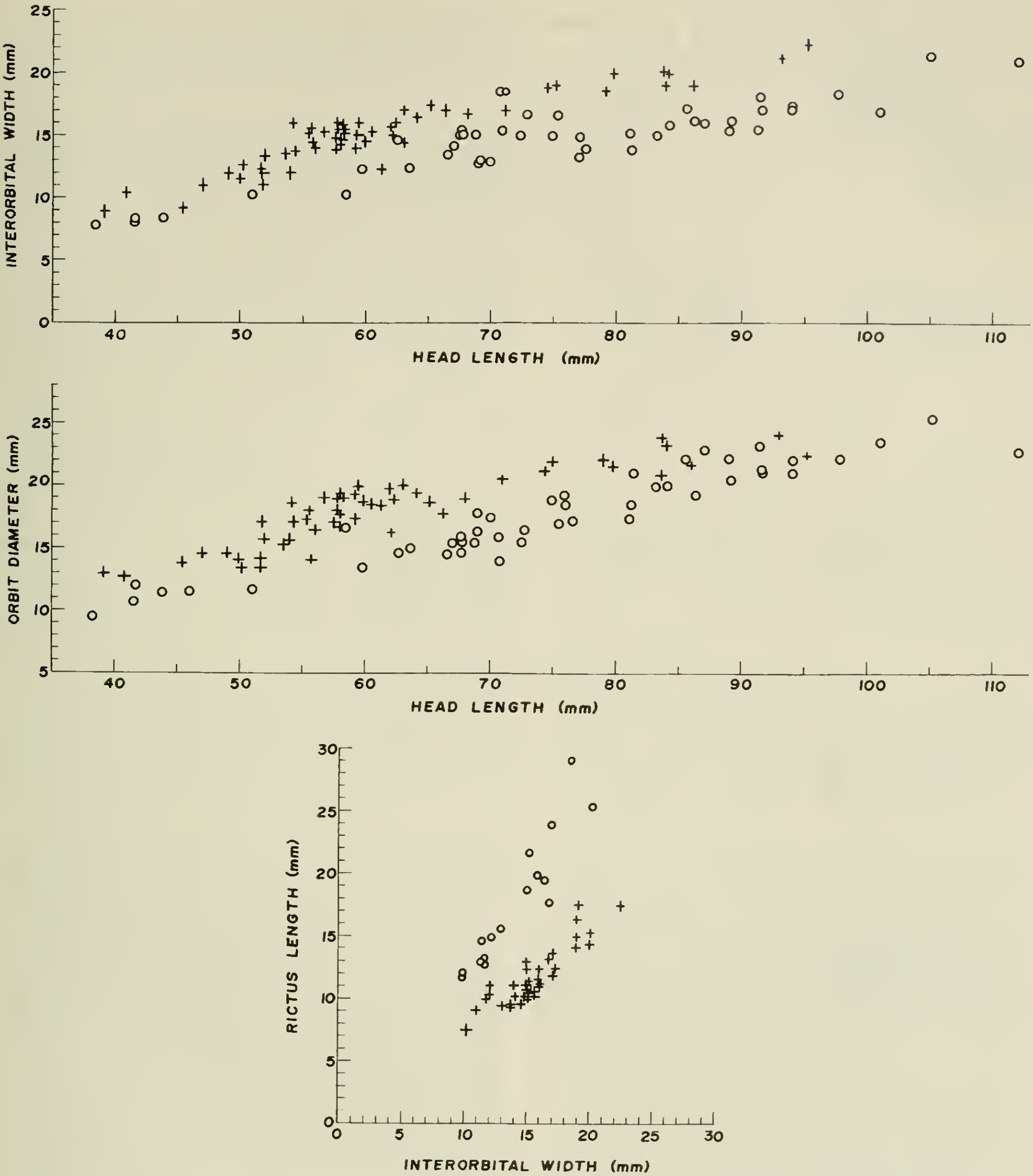

FIGURE 7. Scatter diagrams comparing interorbital width, orbit diameter, and rictus length of *Coryphaenoides anguliceps* (+) and *C. ariommus* (O).

Gill membranes broadly attached to isthmus, without a free posterior fold; opercular opening extends forward to below vertical arm of preopercular ridge. Gill slits, rakers, and filaments otherwise as described for *C. ariommus* (wh. see).

Scales highly deciduous, few remain in study material, although scale pockets prominently marked. Ventral surfaces and leading upper margin of snout naked except for terminal and lateral scutes. Dorsal surfaces of suborbital almost entirely naked, although a row of small, deeply embedded scales remain in the best-preserved specimens; lower surfaces of suborbital with a broad wedge of small scales. Nostril membranes and orbital margins naked. Anterior ⅓ or so of mandibular rami, all gill membranes, and ex-

TABLE 1. COMPARISONS OF FINRAY AND GILL RAKER COUNTS OF *CORYPHAENOIDES ARIOMMUS* AND *C. ANGULICEPS*.

	1D. rays (segmented)											
	7	8	9	10	$\bar{x}$	SD	*n*					
C. ariommus	1	25	31	4	8.62	0.637	61					
C. anguliceps	1	17	29	8	8.80	0.704	55					
	V. rays											
	7	8	9	10	$\bar{x}$	SD	*n*					
C. ariommus	—	3	106	6	9.02	0.280	115					
C. anguliceps	3	106	4	—	8.01	0.250	113					
	1P. rays											
	19	20	21	22	23	24	25	26	27	$\bar{x}$	SD	*n*
C. ariommus	—	4	15	49	28	5	2	1	1	22.28	1.11	105
C. anguliceps	6	18	33	31	7	1	—	—	—	21.14	1.09	97
	GR-1 (total inner series)											
	7	8	9	10	$\bar{x}$	SD	*n*					
C. ariommus	—	2	27	31	9.48	0.567	60					
C. anguliceps	1	29	27	—	8.47	0.537	57					
	GR-2 (total inner series)											
	7	8	9	10	$\bar{x}$	SD	*n*					
C. ariommus	2	24	31	3	8.58	0.645	60					
C. anguliceps	3	48	6	—	8.05	0.397	57					

posed tip of interopercle naked. All of trunk, tail, and most of head otherwise covered with thin deciduous scales. Scales over dorsal aspects of trunk covered with few small fine greatly reclined spinules arranged in low, more or less parallel longitudinal rows (8–12 rows in a specimen 67.5 mm HL, LACM 33588; 6–8 rows in a paralectotype 69.8 mm HL, MCZ 63300); spinules often absent in scales of largest specimen (Fig. 3f); scales near lateral line in MCZ 28558 lack spinules and have fewer ridges than those more dorsad; those on nape and interorbital space covered with short, erect, slender conical spinules. Terminal snout scute stout, somewhat conical with many rows of low stout spinules radiating from apex. In a 38-mm-HL specimen (SIO 59-265), scales below 1D. with 3–6 rows of slender, conical, sharp, much reclined spinules, the rows sharply defined, but because the spinules in a series overlap little, the rows do not appear ridge-like.

Teeth small, in bands in both jaws; the lower jaw band about 5–6 teeth wide, that of upper about 7–8 teeth wide. Outer series in upper jaw very slightly enlarged.

Fins moderately developed but rays generally weak. Height of second spinous ray of first dorsal about equal to postrostral length of head in most (somewhat longer in a few); serrations along leading edge small, sharp, but reduced or obsolete near base and filamentous tip (more reduced in largest specimens). Pectoral fins broad but short, scarcely reaching level of vent. Pelvics small, all rays falling well short of vent in most specimens, although in a 76-mm-HL paralectotype (MCZ 28559), outer ray extends to fifth anal ray; outer ray slightly prolonged into a hairfine tip. Second dorsal rudimentary throughout; anal fin well developed, but tips of rays broken off in all examined specimens.

Swim bladder large, fat-filled. Retia and gas gland bundle very small. Retia 4, long, slender, coiled; gas glands 4, peltate. Intestines complexly coiled, amount and complexity of loops variable among different individuals (see Fig. 8). Pyloric caeca long and slender, in an adherent mass, 9–

14 caeca, length of longest about equal to or longer than width interorbital space; caeca directed ventrally and posteroventrally around pyloric portion of stomach.

Color in alcohol varies from gray-brown in specimens from Peru (CAS 55832) to chocolate-brown in specimens from off Mexico and Cocos I., with descaled areas white. Naked areas of head, fins, and gill membranes generally dark brown. Oral lining grayish to dusky, lining of gill cavity grayish along shoulder girdle but blackish along branchiostegal rays. Gill arches and filaments pale. Mental barbel gray-brown. Peritoneum blackish.

Distribution (Fig. 11).—Gulf of California to northern Peru, 722–2,418 m.

Remarks and Comparisons.—Garman (1899: 215) described *Macrurus latinasutus* from a single, relatively small (46.3 mm HL) specimen collected at the mouth of the Gulf of California. As with most of his descriptions, Garman gave no comparative diagnosis, so it is difficult to ascertain the reasons for his recognition of one taxon over another. Examination (by TI) of the holotype (MCZ 28557) showed nothing except a slightly lower pectoral fin ray count (i17 on both fins) that would suggest that it is other than conspecific with *C. anguliceps*.

The type specimens of *Macrurus liraticeps* (Garman) are large individuals of *C. anguliceps* that show pronounced reduction of serrations on the leading edge of the second spinous dorsal ray and reduction of spinulation on body scales. Garman (1889:197) was aware of the possibility that these features probably represented size-related changes, but he failed to connect the large specimens with the smaller type specimens of *Macrurus anguliceps* that he described on a subsequent page.

Specimens reported by Parin and Makushok (1973) as "*Coryphaenoides anguliceps* (?)" and "Gen. sp." were examined (by YIS) and confirmed as belonging to this species. The larger specimen (340 mm TL) has 9/9 pelvic fin rays, and two small scales remain at the upper margin of the orbit, but it otherwise agrees with the diagnosis of the species.

Relationships of *C. anguliceps* are closest to *C. ariommus*, and the ranges of the two overlap in northern Peru where they have been captured together (ANTON BRUNN sta. 766). The two species share a similar physiognomy, as well as

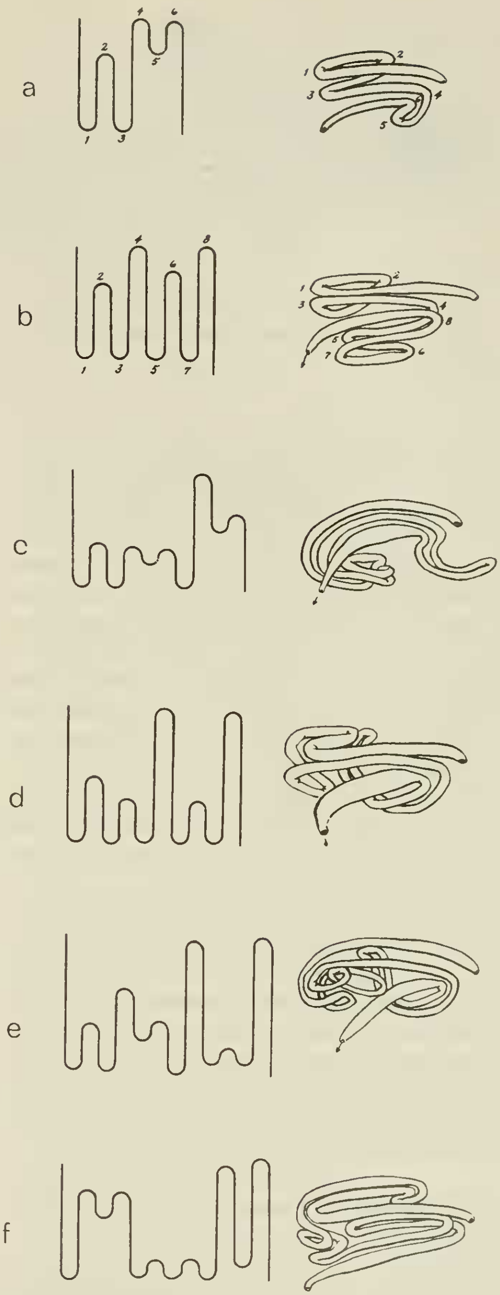

Figure 8. Diagrammatic exploded view of intestines of *Coryphaenoides anguliceps* showing bending patterns at left (note that bending numbers do not correspond with those of Okamura 1970*b*): (a) CAS 55832 (54.0 mm HL); (b) CAS 55832 (61.5 mm HL); (c) LACM 33588 (67.0 mm HL); (d) SIO 59-265 (43.8 mm HL); (e) SIO 59-265 (59.7 mm HL); (f) CAS 55182 (111 mm HL).

FIGURE 9. *Coryphaenoides ariommus.* CAS 55834, 55.3 mm HL, 270 mm TL, from off Chile in 1,170–1,480 m. Scale bar equals 25 mm.

numerous anatomical and mensural features. The shape of the head bones, the gills and associated structures, the mouth, barbel, dentition, and fins show obvious similarities. The two species can be readily distinguished by differences in squamation on the interorbital region (fewer, larger scales in *C. anguliceps*; see Fig. 5); extent of naked areas on the snout and suborbital region (more extensive in *C. anguliceps*); scales along the orbital rim and suborbital ridge (weak and deciduous in *C. anguliceps,* relatively strong and adherent in *C. ariommus*); modal differences in pelvic fin ray counts (mode = 8 in *C. anguliceps,* 9 in *C. ariommus*); spinulation of scales; and several morphometric measurements (see Table 1 and Fig. 7).

Coryphaenoides anguliceps is easily distinguished from *C. carminifer* by (among other features) the particularly stout mental barbel in the latter species and its coarser, more adherent scales. The group of species including *C. capito, C. myersi,* and *C. boops* differ considerably from *C. anguliceps* in its members having a shorter blunter snout, smaller gape, larger orbits, and a generally much different physiognomy.

Coryphaenoides ariommus Gilbert and Thompson, 1916

(Figures 4a, 5b, c, 9–11)

Coryphaenoides ariommus Gilbert and Thompson, 1916:471–472, pl. 5, fig. 1 (off Lota, Chile). Pequeño 1971:287–288, fig. 12 (descr. after Gilbert and Thompson 1916).

MATERIAL EXAMINED.—Holotype: USNM 76859 (58.5 mm HL, 250+ mm TL); 38°08′S, 75°53′W; 677 fm (1,238 m); ALBATROSS sta. 2791; 14 Feb. 1888. Paratypes: USNM 76891 (4: 58.5–79.3 HL, 235–340+ TL) and CAS-SU 22728 (7: 54.2–79.0 HL, 160+–300+ TL); same collection data as for holotype.

Other material.—PERU.—CAS 55835 (15 of 44: 35.0–77.9 HL, 135+–311+ TL) and MMSU P-16516 (6 spec.); 4°10′S, 81°27′W; 1,815–1,860 m, ANTON BRUUN, cr. 18B, sta. 766 (field no. LWK66-115); 9 Sep. 1966.—MMSU P-16521 (1: 32.3 HL, 133 TL); 7°50.5′S, 80°58.2′W; 2,400–2,600 m; AKADEMIK KURCHATOV sta. 1471, 3 Mar. 1971.—MMSU P-16522 (1: 71 HL, 297 TL); 9°56′S, 79°26.6′W; 891 m; DMITRY MENDELEEV sta. 544; 30 July 1972.—CAS 51798 (2: 56.0–62.1 HL, 233+–275+ TL) and MMSU P-16529 (4: 53.9–86.0 HL, 214+–356+ TL); 14°44′S, 76°12′W; 1,495 m; DMITRY MENDELEEV sta. 1654; 19–20 Mar. 1978.—IMARPE uncat. (1: 58 HL, 239 TL); 17°05.0′S, 72°16.9′W, 1,000 m; coll. L. Flores & L. Curotto, cr. 7201, sta. 7; 27 Jan. 1972.—SIO 72-184 (1: 53.7 HL, 216+ TL); 18°40′30″S, 70°36.0′W, 420–529 fm (768–967 m); THOMAS WASHINGTON field no. MV72-II-27.—SIO 72-183 (3 of 8: 27.3–64.1 HL, 100+–275 TL); 18°42.6′S, 70°37.9′W, 600–630 fm (1,907–1,152 m); field no. MV72-II-26; 7 May 1972. CHILE.—CAS 55833 (14: 54.1–84.0 HL, 250+–380+ TL), MMSU P-16515 (2 spec.), and USNM uncat. (2: 51–83 HL; 222+–370+ TL); 24°29.5′S, 70°40′W; 950 m; 72-ft otter trawl; ANTON BRUUN cr. 18A, sta. 714 (field no. LWK66-60); 16 Aug. 1966.—CAS 55834 (16: 40.8–75.0 HL, 188+–320+ TL); 33°39′S, 72°09.5′W; 1,170–1,480 m; 72-ft otter trawl; ANTON BRUUN cr. 18A, sta. 699 (field no. LWK6-41); 10 Aug. 1966.

DIAGNOSIS.—A species of *Coryphaenoides,* subgenus *Coryphaenoides,* with 1D. II,8–9 (rarely 7 or 10); 1P. i19–i26 (usually i20–i22); V. usually 9 (rarely 8 or 10); scales generally absent on lower portion of snout, most of interopercle, and leading margin of snout; 12–15 rows of scales across interorbital space; spinules on body scales short, conical in young, more triangular and flattened in adults, arranged in generally parallel, longitudinal rows; spinules obsolescent along posterior margin of exposed field in larger individuals; pyloric caeca slender, well developed, 9–13, directed anteroventrally for the most part; preopercular ridge forms an inverted clublike projection.

COUNTS AND MEASUREMENTS (75 spec.) (see

Table 1 for other counts).—A. and 2D. about 100–105; GR-1 (2–5) / (1–2) + (0–1) + (7–8) [8–10 total], GR-2 1 + (0–1) + (6–8) [7–10 total] / (1–2) + (0–1) + (5–8) [7–9 total]; scales 1D. 7–9 (18 spec.), 2D. 5–7.5 (8 spec.), mid-1D. 4.5–6.5 (15 spec.), lat.l. 41–55 (23 spec.); precaud. vert. 12 (one spec.); caeca 9–13 (22 spec.).

Total length 100+–380+ mm; HL 27.3–84.0 mm. The following in percent of head length: postrostral 69.0–75.7; snout 28.0–35.2; preoral 15.0–23.7; internasal 19.4–26.7; interorbital 20.1–29.4; orbit 25.1–36.1; suborbital 11.1–15.1; postorbital 36.8–46.8; orbit–preop. 35.9–43.4; upper jaw 24.8–30.9; rictus 16.8–21.4; barbel 4.1–8.6; gill slit 3.9–8.1; pre-D. 109–123; pre-A. 137–167; pre-V. 103–124; V.–A. 32–54; isth.–A. 61–93; 1D.–2D. about 20–50; 1D. 48–64; 1P. 40–51; V. 31–54.

Description.—Head robust, about as broad across preopercle as depth at hind edge of orbits, length 4.3–5.1 into TL. Orbits large, diameter 3–4 into HL, usually about equal to snout length, but orbit : snout ratio variable (0.75–1.24); dorsal rim forms part of head profile. Snout broad, tipped with a small spiny tubercle and flanked by similar but blunter tubercles at lateral angles, width across supranarial ridges slightly less than that of broad, slightly concave interorbital space. Mouth moderate in size and inferior, lateral opening restricted by lip folds, rictus extends to below anterior edge of orbits, maxillary extends to about middle of orbit; distance end of rictus to posterior end of maxillary usually more than barbel length. Barbel small, slender, length less than twice posterior nostril length. Suborbital region divided into upper and lower halves by a well-developed longitudinal shelf, but shelf ridge not sharply edged with spiny, scutelike scales. A series of prominent neuromasts parallel lower anteroventral edge of orbits, with a series branching off below nostrils. Preopercle margin broadly rounded; vertical and horizontal ridges of bone meet posteroventrally in a club-shaped projection. Posterior edge of interopercle narrowly exposed beyond preopercle margin and smoothly joined with subopercle and opercle to form posterior edge of gill cover.

Gill membranes thick, closely attached along entire length of isthmus, without a free posterior fold; point of attachment with isthmus under vertical ridge of preopercle. Slits between gill arches restricted dorsally and ventrally; outer gill slit greatly restricted, length about the same as barbel length (but much variation in both measurements). Outer gill rakers of first arch few (2–5), rudimentary, and scarcely visible; others tubercular with several projecting, recurved, needlelike spinules. Gill filaments short, longest on first arch about equal to length of outer gill slit.

In a 55-mm-HL specimen from Chile (CAS 55834) close in size to the holotype, dorsal snout and interorbital surfaces almost completely covered with small scales, each with 1–6 slightly divergent rows of small, erect, slender, needlelike spinules. Anteriormost leading dorsal edge and almost all of ventral snout surface naked (except for a few small, thin, isolated scales). Tubercular scutes at tip and lateral angles of snout prominent but rather blunt. A distinct series of small, adherent, scutelike scales along dorsal edge of orbit, connecting to similar series over supranarial ridge. A series of similar but smaller and widely spaced scales deeply embedded in thick, fleshy skin along suborbital shelf, aligned above and not forming part of ridge. Suborbital shelf otherwise naked below anterior ⅔ of orbit; more posteriorly, shelf covered with small scales blending in with those on preopercle. On ventral portion of suborbital, squamation extends in a broad wedge from preopercle anteriorly to level of posterior nostril. Ventral margin of suborbital naked. Area surrounding nostrils, including adjacent rim of orbit, naked. Mandibular rami covered along posterior ⅔ by small thin scales, but naked anteriorly. Nape scales with spinule rows slightly more divergent than those on head scales, and spinules somewhat more flattened and reclined. Scales on trunk thin, deciduous, with brittle, needlelike spinules arranged in 5–10 subparallel rows. Those immediately below dorsals with spinules mainly on anterior part of exposed field and only low ridges on broad posterior margin.

In a somewhat larger specimen (CAS 55834, 71 mm HL), squamation on head much the same as on smaller individuals but more scales below nostril region, and ventral snout surface and anterodorsal edge of snout covered with short, blackish, hairlike papillae. Larger scales below dorsals have 12–13 rows of short spinules that are either more angular in cross section than those of smaller individuals or are more flattened and leaflike (Fig. 4a).

In an even larger specimen (CAS 55833; 79

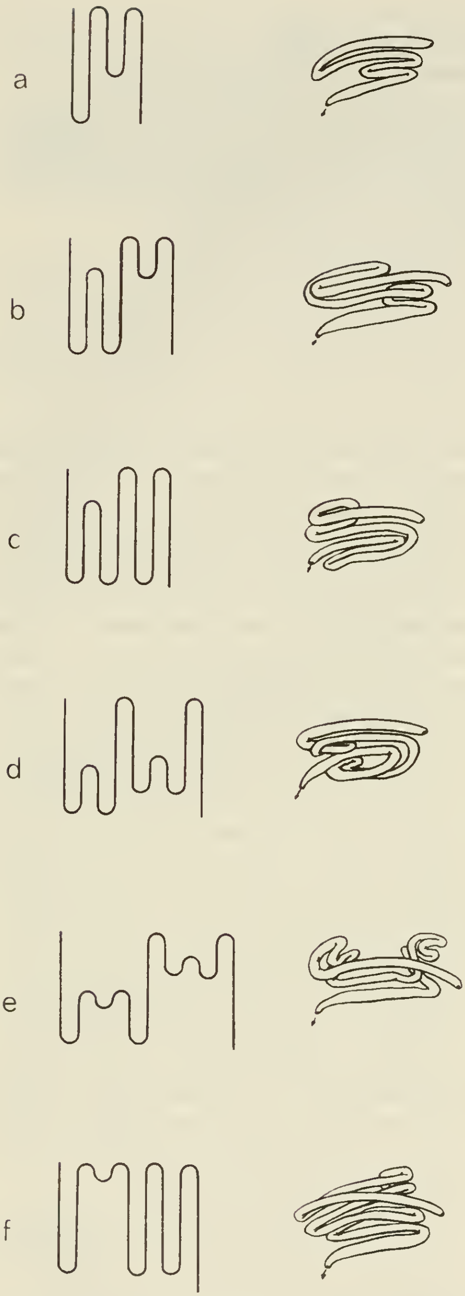

FIGURE 10. Diagrammatic exploded view of intestines of *Coryphaenoides ariommus* showing bending patterns at left: (a) CAS 55833 (58.0 mm HL); (b) CAS 55833 (59.0 mm HL); (c) CAS 55835 (76.4 mm HL); (d) CAS 55835 (47.0 mm HL); (e) CAS 55835 (77.9 mm HL); (f) CAS uncat. (98 mm HL).

mm HL), head even more scaled, including leading snout edge and almost all of ventral suborbital region to below anterior nostril.

Dentition in both jaws composed of small conical, recurved teeth set in cardiform bands, none of teeth notably enlarged, although outer ones tend to be larger than inner ones. Premaxillary band about 5–6 rows wide, abruptly narrowing at posterior end, which coincides with end of rictus. Dentary band narrow, 2–3 teeth wide; individual teeth generally smaller than corresponding premaxillary teeth; band extends slightly farther back into mouth than premaxillary band.

First dorsal fin ray a small spike protruding at base of second ray, which is relatively short (greatest length much less than postrostral length of head), triangular in cross section, and armed along its leading edge with small serrations that become obsolescent basally in large specimens. Second dorsal fin rudimentary throughout; anteriormost rays in larger individuals often obsolescent. Pectorals broad but short, barely reaching vertical through anal fin origin. Pelvics short, small, outermost ray extended into hair-fine tip that barely reaches past anal fin origin; all other rays of fin fall well short of anus. Pectoral and pelvic origins about on same vertical, that of first dorsal slightly posterior.

Intestinal coiling variable among specimens examined; pattern ranged from simple (see in CAS 55833, 58 mm HL; Fig. 10a) to the more commonly encountered pattern in another specimen (59.0 mm HL; Fig. 10b) from the same collection, to more convoluted (Fig. 10c–f). These intraspecific differences transcend Okamura's (1970*b*, fig. 68) different stages of intestinal coiling within the *Coryphaenoides* and *Coelorinchus* lines, and take the extreme of *Coelorinchus* (Okamura's fig. 68J) a step or more further.

Pyloric caeca slender, unbranched, usually directed anteriorly at base but distally sweeping down and around anterior end of pyloric portion of stomach; length about half orbit diameter. Swim bladder large; drumming muscles well developed in males examined, but not in females. Retia 4, long, slender, convoluted, terminating in 4 gas glands that are paired into 2 flattened, bean-shaped masses, each gas gland closely adhered to its fellow.

Color in alcohol light brown to tawny over scaled regions in Nazca Ridge specimens, but darker in other specimens. In areas with missing scales, integument whitish to flesh colored and scale pockets outlined in brown. Normally scaleless parts of head dirty brownish. Lips and barbel dark brown. Branchial and peritoneal membranes blackish, oral membrane dark gray to blackish. Gill arches and rakers dusky to blackish, gill filaments pale. Fins dusky to blackish.

DISTRIBUTION (Fig. 11).—Northern Peru (4°10′S) to southern Chile (38°08′S) in 768–1,860 m.

REMARKS AND COMPARISONS.—Of the eastern Pacific species, *Coryphaenoides ariommus* is most likely to be confused with *C. anguliceps*, a species with which it is sympatric off northern Peru (ANTON BRUUN cr. 18B, sta. 115), although the primary distribution of *C. ariommus* is south of that area and that of *C. anguliceps* is to the north. The two species share in common a generally similar physiognomy, a closeness in morphometric proportions and meristic counts, and similarities in such features as dentition, restriction of gill membranes, gill raker shape, alimentary canal coiling, and various squamation features. They are readily distinguished by a combination of characters including: pelvic fin ray count (usually 9 in *C. ariommus*, 8 in *C. anguliceps*); color of mouth (blackish or dark gray in *C. ariommus*, pale or light gray in *C. anguliceps*); scale rows across interorbital space (11–14 in *C. ariommus*, versus 6–8); coarse, adherent row of scales over supranarial and supraorbital ridges in *C. ariommus* (lacking in *C. anguliceps*, or at least none in specimens examined); length of rictus (16.9–20.9 percent HL in *C. ariommus* versus 22.7–26.2); a somewhat broader interorbital space and larger orbits in *C. ariommus* (see scatter diagrams, Fig. 6). In addition to these characters, *C. ariommus* has smaller body scales than does *C. anguliceps*, but because of the denuded and often damaged condition of most specimens, the differences could not be enumerated. *Coryphaenoides ariommus* also has a wider head than does *C. anguliceps*; spinules on body scales in adults are flattened or more angular in cross section than the smoothly conical spinules of *C. anguliceps*; and none of the premaxillary teeth are enlarged, in contrast to the slightly enlarged outer teeth series in *C. anguliceps*.

Coryphaenoides ariommus is probably more distantly related to *C. boops* and *C. capito* than to *C. anguliceps*. Differences in counts, squamation on the head, shape and relative sizes of opercular bones and pyloric caeca, and shape of snout and suborbital regions are notable.

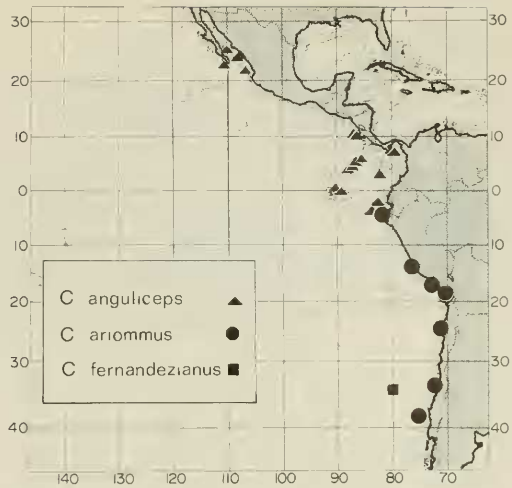

FIGURE 11. Map showing distributions of *Coryphaenoides anguliceps*, *C. ariommus*, and *C. fernandezianus*.

Coryphaenoides boops (Garman, 1899)

(Figures 4b, 12–15)

Macrurus boops Garman, 1899:202–203 (type locality off Panama, ALBATROSS sta. 3356 in 511 fm [935 m] and sta. 3394 in 546 fm [999 m]).

Coryphaenoides boops: Gilbert and Hubbs 1916:143 (list).

MATERIAL EXAMINED.—Lectotype (here designated): MCZ 28588 (male, 47.2 mm HL, 203 mm TL); Gulf of Panama, 7°21′N, 79°35′W; 511 fm (935 m); ALBATROSS sta. 3394; 10 Mar. 1891. Paralectotypes: MCZ 61093 (2: 41.9–46.7 HL, 172–192 TL) (smaller spec. is a *C. capito*); same local. data as for lectotype.—Paralectotype: MCZ 28587 (1: 57.9 HL, 245+ TL) (this is a spec. of *C. capito*); SW of Punta Mala, Panama; 7°09′30″N, 81°08′30″W; 322 fm (999 m); ALBATROSS sta. 3356; 23 Feb. 1891.

Other material.—ECUADOR.—USNM 148996 (4: 52.8–73.7 HL, 248–300+ TL); 00°37′N, 81°00′W; 401 fm (750 m); ALBATROSS sta. 2792; 2 Mar. 1888.—CAS 38350 (3: 84.2–97.2 HL, 400–425+ TL); 3°15′S, 80°55′W; 945–960 m; ANTON BRUUN cr. 18B, sta. 770; 10 Sep. 1966. PERU.—IMARPE uncat. (1: 83.5 HL, 360+ TL); 3°39′S, 81°22′W: 720 m.—IMARPE uncat. (1: 55.9 HL, 272 TL); 3°48.2′S, 81°22′W; 700–750 m.—LACM uncat. (1: 81.5 HL, 350+ TL); 6°42′S, 80°59′05″W; 780 m; beam trawl; sta. SNP1-25; 22 Jan. 1974.—MMSU P-16530 (1: 62.2 HL, 253+ TL) and CAS 50955 (1: 64.1 HL, 302 TL); 7°41′S, 80°40′W; 900–1,000 m. IKMT on bottom at 900 m; AKADEMIK KURCHATOV sta. 1472; 4 Mar. 1972.—CAS 55836 (3: 29.6–57.2 HL, 158–250+ TL); 7°49′S, 80°38′W; 605–735 m; ANTON BRUUN cr. 18B, sta. 754 (field no. LWK66-93); 5 Sep. 1966.

DIAGNOSIS.—A species of *Coryphaenoides*, subgenus *Coryphaenoides*, with 1D. II,8–9, 1P. 21–25; V. 7–8; chin barbel short but relatively thick; scales generally absent on lower portion of snout, ventral margin of preopercle, most of interopercle, and anteriorly on lower jaw; leading

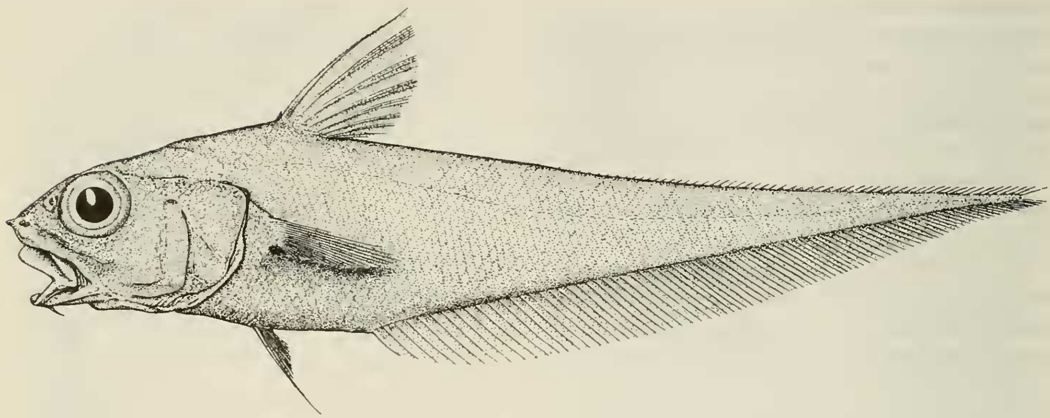

FIGURE 12. *Coryphaenoides boops.* MMSU P-16530 (62.2 mm HL, 253+ mm TL) from off Peru, 900 m.

dorsal margin of snout narrowly naked; scales on suborbital shelf in 2–3 rows, scales not modified into heavy scutes nor elongated in a longitudinal line; all scales rather strongly adherent; spinules on scales dense, long, slender, reclined, arranged in irregular quincunx or widely divergent or convergent pattern; pyloric caeca stublike, 6–7, directed anteriorly.

COUNTS AND MEASUREMENTS (13 specimens).—D. II,8–9 + about 116; 1P. i20–i24; V. 7 (sometimes 8); GR-1 (3–6)/(1–2) + (0–1) + (9–10) [10–12 total], GR-2 1 + (0–1) + (8–10) [9–11 total] / (1–2) + (0–1) + (7–8) [9–11 total]; scales 1D. 6.5–8, 2D. 4.5–6.5, mid-1D. 3.5–6.5, lat.l. 31–38; caeca 6–7.

Total length 158–360+ mm; HL 29.6–83.5 mm. The following in percent HL: postrostral 75.4–77.6; snout 25.1–27.2; preoral 8.3–12.8; internasal 12.6–14.9; interorbital 14.0–16.9; orbit 29.4–34.5; suborbital 7.8–9.8; postorbital 40.8–49.2; orbit-preop. 31.5–35.6; upper jaw 29.7–34.0; nostril 4.7–7.5; barbel 5.9–10.0; gill slit 7.2–

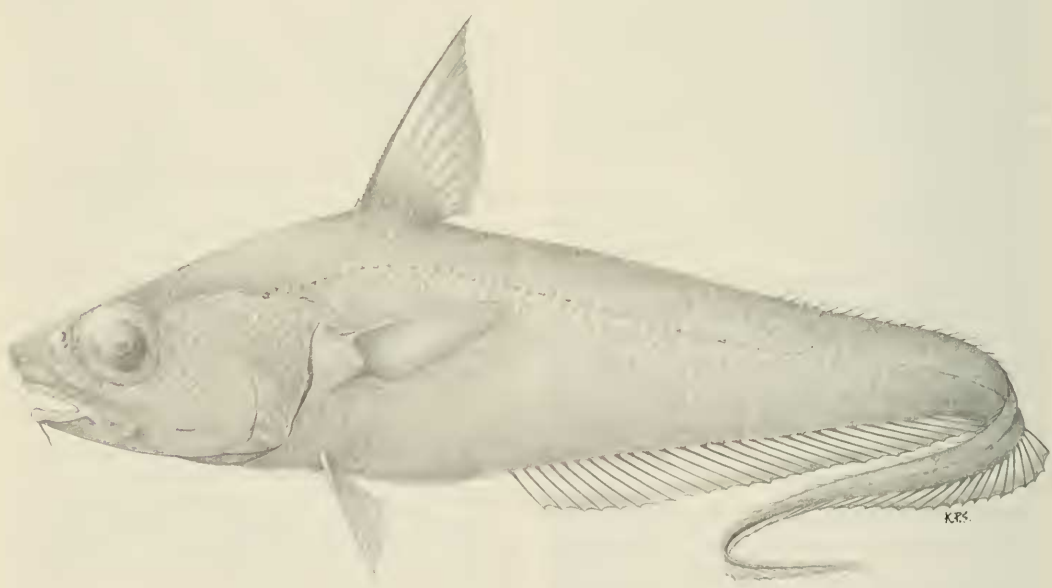

FIGURE 13. *Coryphaenoides boops.* CAS 38350 (84.2 mm HL, 400 mm TL) from off Gulf of Guayaquil, Ecuador, in 945–960 m. Scale bar equals 25 mm. Drawn by Katherine P. Smith.

10.5; pre-D. 109–127; pre-A. 138–178; pre-V. 102–131; V.–A. 34–70; isth.–A. 69–109; body depth 66–89; 1D.–2D. 28–48; 1D. 58–76 (5 spec.); 1P. 52–62; V. 33–47.

DESCRIPTION.—Body stout, greatest depth at dorsal origin about equal to postrostral length of head, tapers rapidly behind vent to end of tail; head about 4.0–4.5 into TL. Head stout, rather conical in shape, about as high as wide at posterior orbit margin. Orbits large, basically round in outline, about 3.0–3.2 into HL, greater than snout length, deeply incised into top of skull, resulting in narrow interorbital space, which goes about 2.0–2.2 into orbit diameter. Snout low, barely protruding beyond mouth; tip armed with a single stout, spinous, conical scute; lateral snout angles with 1 or 2 stout but blunt scutes. Mouth opening restricted laterally; rictus barely extended posteriorly to anterior edge of orbits. Barbel short, stout at base, tapering rapidly to fine tip. Suborbital region narrow, demarcation into upper and lower parts distinct but not especially sharp. Preopercle broadly rounded; chord of posterior margin nearly vertical; vertical and horizontal ridges meet at a near right angle without a lobelike projection at angle. Opercle and subopercle broadly exposed, their posterior margins smoothly continuous with posterior margin of broadly exposed interopercle.

Gill membranes thick, broadly attached to isthmus; gill openings on each side restricted, completely separated from each other. Gill rakers small, tubercular; filaments long; longest on first arch almost half orbit diameter. Openings between gill arches much restricted. Spines on rakers of third and fourth arches notably long.

Body scales rather large, densely covered with greatly reclined, sharp, slender, conical spinules arranged variably in essentially parallel rows (12–14 rows in one syntype 45.7 mm HL) to irregularly quincunx to widely divergent "V" pattern, the spinules giving a coarse texture to surfaces. Head scales generally similar to those of body, but spinules shorter and more erect. Scales along head ridges somewhat stouter and more adherent, but not especially enlarged or scutelike except at tip and lateral angles of snout where stout, tuberclelike scutes obtain. Scales on suborbital shelf strongly adherent, small but stout, in 2–3 irregular rows below anterior half of orbits and forming a well-defined dorsal border. Spinous scales uniformly cover most of dorsal surfaces of head. Snout essentially naked ventrally and along leading upper margin (a few small isolated scales in some specimens), the naked area extending posteriorly along ventral portion of suborbital. Small scales intrude from posteriorly onto ventral surface of suborbital, and a patch of small scales below and behind lateral snout angle in some specimens. Mandibular rami almost entirely naked except near posterior end where scattered small scales prevail. A series of small pores along middle of each ramus, in addition to scattered papillae of free neuromasts. Ventral margin of preopercle and ventral arm of preopercular ridge naked. Naked surfaces of snout and suborbital covered with small papillaelike free neuromasts; these also scattered over scaled portions of suborbital, snout, and interorbital space. Broad circular area around nostrils naked, including rim of orbits adjacent to posterior nostril; adjoining suborbital shelf area broadly scaled.

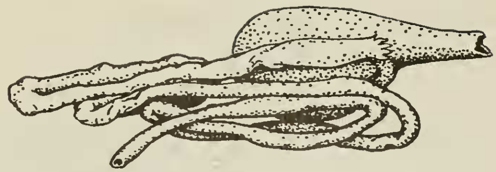

FIGURE 14. Slightly exploded right lateral view of alimentary canal of *Coryphaenoides boops* drawn from a paratype, MCZ 18588 (46.7 mm HL). Proportions and relationship of intestines to stomach altered for clarity.

Teeth in both jaws small, slender, conical, slightly recurved, arranged in bands that gradually taper posteriorly. Premaxillary band about 7–8 teeth wide anteriorly, dentary band about 4 teeth wide. Both upper and lower teeth bands extend posteriorly into mouth slightly beyond rictus. No teeth enlarged.

First dorsal fin relatively low and short; first spinous ray a short spike closely adhered to long second spinous ray, which is triangular in cross section near base with a weakly serrated leading edge. Interspace between dorsals wide, about equal to postrostral length of head; second dorsal poorly developed throughout. Pectoral and pelvic origins about on same vertical; that of first dorsal slightly behind. Pectorals broad but short, extending posteriorly to above first 1 or 2 anal rays. Pelvics small, outermost ray hairfine distally, barely reaching vent.

Alimentary canal (Fig. 14) multiply looped, similar to that illustrated by Okamura (1970b: 120, fig. 63D) for *C. marginatus* except that loop

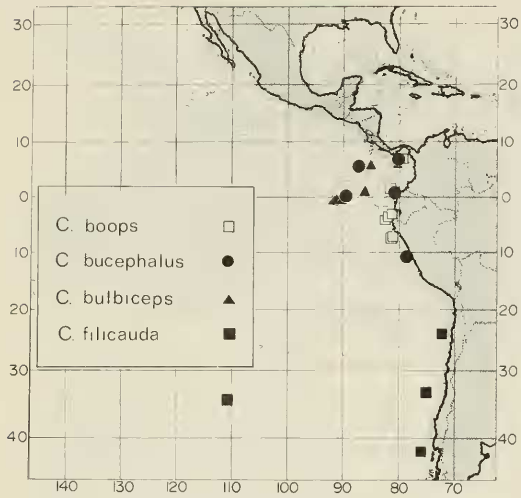

FIGURE 15. Map showing eastern Pacific distributions of *Coryphaenoides boops, C. bucephalus, C. bulbiceps,* and *C. filicauda.*

formed by Okamura's "bend 2" (folding around front and left side of stomach) much longer in *C. boops.* Pyloric caeca rudimentary, stublike, 6 or 7 directed anteriorly. Swim bladder well developed, with 4 small gas glands, each connected to a long slender rete. Anus immediately anterior to anal fin, without intervening scales.

Color in alcohol overall dark brownish to swarthy, fins blackish to swarthy. Gill cavity black; oral cavity dark gray. Branchiostegal membranes and naked areas on head grayish with violet tinge, paler on gular membrane. Barbel blackish on base, abruptly paler on distal half.

DISTRIBUTION (Fig. 15).—Panama to northern Peru, at depths of 605–1,000 m.

REMARKS AND COMPARISONS.—*Coryphaenoides boops* and its eastern Pacific congeners *C. capito* (Garman, 1899) and *C. myersi* n. sp. form a closely related group having in common: (1) relatively low, broad head; (2) protrusible jaws with long ascending premaxillary process, coupled with laterally restricted mouth opening, the rictus not extending much behind anterior edge of orbits; (3) a short barbel; (4) gill membranes closely attached to isthmus greatly restricting opercular openings; (5) surfaces of head with prominently developed cephalic sensory canal system; (6) broadly rounded preopercle, posterior margin nearly vertical, preopercle ridge not lobelike or much produced at angle; (7) snout bluntly pointed, extending little beyond mouth; (8) suborbital region smoothly rounded, lacking stout, enlarged, scutelike scales along ridge; (9) jaw teeth all small, in narrow bands; and (10) first gill slit greatly restricted, almost porelike, diameter much less than half orbit diameter.

Many of these features are shared with the species group including *C. semiscaber* Gilbert and Hubbs, 1920, *C. marginatus* Steindachner and Döderlein, 1887, *C. microps* (Smith and Radcliffe, 1912), *C. macrolophus* (Alcock, 1889), and *C. tydemani* (Weber, 1913) which Gilbert and Hubbs (1920:413) characterized as ". . . a well-marked group of species which agree in possessing a produced dorsal spine, a deep and sharply compressed body, and a dorsal contour horizontal behind the first dorsal fin."

Coryphaenoides boops appears most closely related to *C. capito,* with which it is apparently sympatric. The difficulty in distinguishing between these two very similar species led to Garman's mixing individuals of both species in the type series for *C. boops.* Thus, at ALBATROSS station 3394 in the Gulf of Panama, one of three syntypes of *C. boops* was actually a specimen of *C. capito,* as was the single syntype (MCZ 28587) from station 3356. We here designate the 47.2 mm HL male from sta. 3394 as the lectotype of *C. boops.*

The main features distinguishing *C. boops* from *C. capito* are: (1) scales more adherent in *C. boops*; (2) suborbital shelf scales round or oval, in three or four rows, versus. somewhat elongated, in one deeply embedded row in *C. capito*; (3) spinules long, needlelike, curved, moderately reclined, and densely packed, versus in *C. capito,* spinules short, very slender and weak, erect, and widely spaced (in larger specimens, spinules either mostly broken off or obsolescent, and in some, scales without spinulation, with only low ridges on exposed fields); (4) scales on first dorsal base scarcely extend up onto fin (although sometimes a single row of tiny scales basally on shank of second spinous ray, as in *C. capito*), versus small deciduous scales that extend notably up fin in *C. capito*; (5) pelvic rays usually seven, sometimes eight, versus eight or nine in *C. capito*; and (6) orbits at all sizes essentially circular, with anteroventral corner well defined, versus orbit shape more ellipsoid in larger specimens of *C. capito* with longest axis anteroventral-to-posterodorsal, the anteroventral corner extended, fleshy, the margin ill-defined.

The larger specimens we examined clearly show

FIGURE 16. *Coryphaenoides bucephalus.* MMSU P-16531 (83.7 mm HL, 345+ mm TL) from off Peru in 2,290–2,230 m. Scale bar equals 22 mm.

the strongly different physiognomy of the two species. Particularly notable are the distinctly humpbacked appearance of *C. capito,* its elongate orbits, smaller terminal and lateral snout scutes, single row of suborbital scales, and the generally denuded state of preserved specimens. Smaller *C. capito* (e.g., MCZ 61093, 41.9 mm HL; CAS 43981, 33.5 and 35.6 mm HL, from Costa Rica; and CAS 55839, 45.8 mm HL, from Ecuador) are not so distinct, especially if the *C. capito* specimens are denuded of scales. General proportions do not differ significantly (in fact proportional measurements and all but the pelvic fin ray counts are essentially identical in the two species); the orbits are circular in small *C. capito* as in *C. boops*; the scales on the suborbital appear to be almost the same size; the terminal and lateral snout scutes are of similar size; the humpback is not developed; and the scales on the suborbital of small *C. capito* are more numerous and denser than those of larger individuals, approaching the condition found in *C. boops.*

Coryphaenoides boops is closely similar to *C. carminifer,* and the distributions of the two species broadly overlap, although they have not been captured together. Similarities lie in the general structure of the head, snout, jaws, gill cover, gills, and fins. Like *C. boops, C. carminifer* has a blunt snout that protrudes little beyond the mouth and is armed with a heavy terminal scute; the rictus is restricted posteriorly and extends to below the anterior orbital margin; the preopercle is broadly rounded as in *C. boops,* but its ridge has a lobular prolongation at the angle; the interopercle is exposed and scaled posteriorly; and papillae of the cephalic sensory canal system are numerous and well developed, especially on the snout. Numerous other similarities exist that show a fundamental relationship between the two species. *Coryphaenoides carminifer* differs from *C. boops* in having an overall much thicker barbel; no naked areas on snout; a thick, greatly prolonged outer pelvic ray; spinules on scales in parallel rows; and long slender pyloric caeca.

Coryphaenoides boops shows relationships with *C. myersi* in general features, but the two are readily distinguished by differences in pelvic ray counts and the extent of development of the outer pelvic ray. Other differentiating features are given in the description of *C. myersi.* Relationships of *C. boops* to other eastern Pacific members of the genus are remote, and its ties (as with *C. myersi* and *C. capito*) are probably closer to Indo-Pacific species of the *C. semiscaber* species group.

Coryphaenoides bucephalus (Garman, 1899)

(Figures 4c, 15, 16)

Macrurus bucephalus Garman, 1899:195–196 (type locality off Panama, Cocos, and Ecuador).

Coryphaenoides bucephalus: Gilbert and Hubbs 1916:143 (list).

TYPE SPECIMENS.—Lectotype (here designated): MCZ 28599, 94.8 mm HL, 350+ mm TL; Gulf of Panama, 7°15′N, 79°36′W; 1,020 fm (1,865 m); ALBATROSS sta. 3393; 10 Mar. 1891. Paralectotypes: MCZ 28590 (1: 124 HL, 590+ TL); Cocos Ridge, 5°36′40″N, 86°56′50″W; 134 fm (245 m); ALBATROSS sta. 3370; 28 Feb. 1891; by tangles [see Remarks].—MCZ 28601 (2: 65.0–75 HL, ?–330+ TL); Ecuador, 1°07′N, 80°21′W; 1,573 fm (2,877 m); ALBATROSS sta. 3398; 23 Mar. 1891.—MCZ

28600 (1: 46.4 HL, about 220 TL); off Mazatlan, Mexico; 23°16'N, 107°31'W; 852 fm (1,558 m); ALBATROSS sta. 3430; 19 Apr. 1891 (paratype of *Coryphaenoides oreinos* Iwamoto and Sazonov, n. sp.).

Other material.—GALAPAGOS.—USNM 150192 (2: 106–124 HL, 430+–570+ TL); 0°24'S, 89°06'W; 812 fm (1,485 m); ALBATROSS sta. 2807; 4 Apr. 1888. PERU.—MMSU P-16531 (1: 83.7 HL, 345+ TL); 10°53'S, 78°46'W; 2,290–2,230 m; DMITRY MENDELEEV cr. 20, sta. 1648; 15 Mar. 1978.

Diagnosis.—A species of *Coryphaenoides*, subgenus *Coryphaenoides*, with 1D. II,8–9; 1P. i19–i23; V. 9; teeth prominent, those on premaxillary in a band with outermost series notably large, mandibular teeth in a single row except at symphysis; ventromedian area below snout tip naked, head otherwise without naked areas; terminal and lateral snout scutes weak or not developed; suborbital region and other head ridges without modified scutelike scales.

Counts and Measurements (7 specimens).—1D. II,8–9; 1P. i19–i23; V. 9 (1 spec. had 8 on left fin and 9 on right, but left fin appeared somewhat abnormal); GR-1 (1–2) + (0–1) + (7–9) [9–10 total], GR-2 (1–2) + (0–1) + (7–8) [9–10 total]; scales 1D. 7.5–9, 2D. 5.5–7, mid-1D. 4.5–5.5, lat.l. 34–38 (4 spec.).

Total length 330+–590+ mm; HL 65.0–124 mm. The following in percent HL: postrostral 72–75; snout 26–30; preoral 11–16; internasal 20–21; interorbital 23–28; orbit 23–26; suborbital 12–15; postorbital 47–53; orbit–preop. 44–49; upper jaw 38–44; nostril 5.1–5.9; barbel 17–23; gill slit 8–9; pre-D. 106–111; pre-A. 152–164; pre-V. 102–115; V.–A. 48–62; isth.–A. 87–106; body depth 75–78; 1D.–2D. 15–30; 1D. 53–60; 1P. about 50; V. 40–53.

Description.—Head broad, greatest width more than depth behind orbit; HL about 3.7–4.8 into TL. Orbits round, relatively small, horizontal diameter less than snout length and interorbital space, about 4.5 in HL. Interorbital region flat to slightly depressed in preserved specimens, but probably slightly convex in life. Snout low, bluntly pointed with a single weakly spined terminal scute; lateral angles rounded and lacking scutes. Mouth large, unrestricted laterally; with jaws closed, rictus extends posteriorly almost to or below middle of orbits; hind end of maxilla extends to below posterior ⅓ of orbit. Barbel slender, of moderate length (about 1.0–1.4 into least suborbital width). Suborbital region vertical, gently rounded, without a pronounced longitudinal ridge separating upper and lower portions in well-preserved specimens; squamation differences delineate the 2 regions, however. Preopercle large, somewhat produced posteroventrally into a slight lobe; preopercle ridge forms a prominent lobe. Opercle and subopercle of moderate size; their posterior margins smoothly blended and forming an almost straight or steeply declined edge before rounding off at interopercle, of which only the posterior tip is exposed.

Gill membranes rather narrowly attached to isthmus (compared with *C. ariommus*, for example), without a free posterior fold. Outer gill arch greatly restricted by folds of skin connecting upper and lower arms to gill cover; the outer slit less than width of suborbital, about equal to length of longest gill filaments. Gill rakers blunt, tubercular, weakly spined.

Head and body almost completely and uniformly scaled except on fins and gill membranes. A small ventromedian area on snout, region immediately surrounding nostrils, and interopercle bone naked. Scales of head generally smaller than those of body and densely covered with minute, relatively erect slender spinules arranged in divergent rows. Scales on suborbital shelf slightly larger than those ventrally and with fewer, coarser spinules. Scales along median nasal, supranarial, and supraorbital ridges similarly different from surrounding scales, but generally poorly defined and not scutelike. Body scales (Fig. 4c) large, covered with relatively long, slender, erect, slightly recurved, conical spinules arranged in ill-defined longitudinal rows. Body surfaces coarsely textured.

Premaxillary teeth in a long, broad, gradually tapered band, widest part of band about 6–7 teeth deep. Inner teeth small, bordered externally by large, wide-spaced conical canines, the anteriormost being notably long (length of longest about equal to length of posterior nostril) and slightly recurved. Dentary teeth moderate sized, widely spaced, erect canines only slightly recurved and arranged in a single row except near symphysis where teeth scattered in 2 or 3 series. In smaller individuals (e.g., 65-mm and 75-mm HL specimens from MCZ 28601) dentary teeth smaller, in 2–3 irregular rows laterally and in a band 3–4 teeth wide near symphysis. Teeth in both jaws extend posteriorly well beyond rictus.

Generally poor condition of specimens examined precluded accurate assessment of fin sizes, but fins generally small to moderate in size. Spinous second ray of first dorsal slightly prolonged into a fine tip, length slightly more than postorbital length; denticulations on leading edge weak, obsolescent basally. Second dorsal rudimentary throughout; anal well developed. Outer pelvic ray elongate, the long, hairfine tip extends slightly beyond anal fin origin; other rays of fin reach about halfway between origins of pelvic and anal fins, if that far. Origin of first dorsal slightly behind that of pectoral, which in turn is slightly behind that of pelvics; origin of second dorsal slightly before or behind that of anal.

Anus immediately before anal fin. Pyloric caeca in MCZ 28601 (75 mm HL) long (length about equal to least width between supranarial ridges), slender, about 14 total. Other alimentary canal features not determined because of poor condition of specimens.

Coloration in alcohol of MMSU specimen overall grayish brown, darker on abdomen, operculum and gill membranes. Fins and barbel dusky to gray-brown. Lips edged in black. Branchiostegal membrane, lining of branchial cavity, and peritoneum black. Oral cavity dark gray.

Distribution (Fig. 15).—Gulf of Panama to Galapagos and northern Peru; 1,485–2,877 m.

Remarks and Comparisons.—Collection data for paralectotype MCZ 28590, reportedly taken by tangles in 134 fm (245 m), are suspect in that the depth is far too shallow and the gear somewhat questionable. The small paralectotype (MCZ 28600, 46.4 mm HL) from the Gulf of California off Mazatlan, Mexico, represents *C. oreinos* new species, described below.

Coryphaenoides bucephalus is readily distinguished from other congeners in the eastern Pacific by characters given in the Key and Diagnosis. The species differs from the presumably sympatric *C. bulbiceps* in (among other characters) having a naked ventral snout strip (none in *C. bulbiceps*); orbit diameter shorter than snout and interorbital (versus about equal to); large prominent canines on premaxilla (teeth all small in *C. bulbiceps*); coarsely spinulated scales (versus spinules very short, greatly reclined, giving a rather smooth surface texture in *C. bulbiceps*); and V. 9 (versus 8).

Relationships among the genus are inadequately known and little can be said about those of *C. bucephalus*. The species shows similarities in physiognomy to *C. filifer* (Gilbert, 1890) from the eastern North Pacific, but squamation features are quite different between the two. There are similarities in dentition and general shape to species of the subgenus *Chalinura*, but again, squamation features, especially that on the snout, differ. *Coryphaenoides longicirrhus* (Gilbert, 1905) from Hawaii is superficially similar but lacks the naked ventromedian area on the snout and has a broader band of mandibular teeth.

Coryphaenoides bulbiceps (Garman, 1899)

(Figures 3a, 15, 17)

Macrourus bulbiceps Garman, 1899:194–195, pl. XLIV, fig. 1, 1a (type locality off Cocos Ridge).

Nematonurus bulbiceps: Gilbert and Hubbs 1916:143 (list).

Coryphaenoides bulbiceps: MacDonald and Mudie 1974 (collected at surface after seismic disturbances fide Cohen and Haedrich 1983; ref. not seen).—Cohen and Haedrich 1983: 375 (photographic observations on Galapagos thermal vent region).

Material Examined.—Holotype: MCZ 28602 (112 mm HL, 550+ mm TL); Cocos Ridge, 5°43′N, 85°50′W; 978 fm (1,789 m); ALBATROSS sta. 3363; 26 Feb. 1891.

Other material.—GULF OF PANAMA.—UMML uncat. (2: 63.0–68.8 HL, 295+–311+ TL); 6°53′N, 79°27′W; 3,193 m; PILLSBURY sta. 526; 5 May 1967. GALAPAGOS.—SIO 74-44 (133 HL, 660+ TL), off James I., 0°10.5′S, 90°55′W; 2,000 m; free-vehicle setline; ALPHA HELIX: fall, 1970.—SIO 72-108 (137 HL, most of tail missing); 0°48′N, 86°09.0′W; dipnetted on surface ("20–40 fishes floating near area of high seismic activity"); ALPHA HELIX; 26 June 1972.—CAS 42518 (15: 107.5–183.5 HL, 559+–810+ TL); 0°41′S, 91°35.5′W; 2,490 m; free-vehicle bottom setline; ANTON BRUUN cr. 16, sta. 618B; 26 May 1966.—CAS 55837 (12: 127–154 HL, 580+–732 TL); MMSU P-16517 (1: 131 HL, 650 TL), and USNM uncat. (2: 131–144 HL, 625+–645+ TL); 0°11.3′S, 91°27.2′W; 1,710 m; free-vehicle bottom setline; ANTON BRUUN cr. 16, sta. 618A; 25 May 1966.

Diagnosis.—A large species (probably more than 100 cm) of *Coryphaenoides*, subgenus *Coryphaenoides*, with 1D. II,9–11, 1P. i18–i22, V. 8 (rarely 9). Teeth small, inconspicuous, bluntly pointed, in a single row in premaxillary, in one or two irregular rows on mandible. Snout blunt and completely scaled; terminal and lateral snout scutes weak or not developed. Suborbital region completely scaled, head ridges without enlarged modified scutelike scales.

Counts and Measurements (33 specimens).—D. II,9–11 + 95–111; 1P. i18–i22; V. 8 (9 in left fin of one spec.); GR-1 3–5 / (1–2) + 1 + (7–9) [9–11 total], GR-2 (0–1) + (0–1) + (2–8) [8–10 total] / (1–2) + (0–1) + (6–8) [8–11 total]; scales 1D. 8.5–11, 2D. 6.5–9.5, mid-1D. 5–7.5, lat.l. 34–44.

Total length 295+–810 mm; HL 63.0–183.5 mm. The following in percent HL: postrostral 73.3–79.4; snout 23.9–29.5; preoral 11.7–16.7;

FIGURE 17. *Coryphaenoides bulbiceps.* CAS 42518 (107.5 mm HL, 565 mm TL) from off Galapagos in 2,490 m.

internasal 16.5–20.5; interorbital 25.2–31.7; orbit 19.7–25.3; suborbital 12.1–16.6; postorbital 50.5–57.5; orbit–preop. 47.4–56.5; upper jaw 37.6–44.9; nostril 4.9–8.8; barbel 13.0–19.4; gill slit 9.9–15.4; pre-D. 106–125; pre-A. 163–187; pre-V. 96–116; V.–A. 58–89; isth.–A. 97–134; body depth 71–87; 1D.–2D. 13.4–55.3; 1D. 58–77; 1P. 48–80; V. 49–80.

DESCRIPTION.—Head broad, width about equal to depth behind orbits; length about 4.4–5.2 into TL. Body rather deep, greatest depth about equal to postrostral length of head, trunk long, distance isthmus to anal origin longer than HL, gradually tapering beyond vent; depth over anal origin about 0.6 of HL. Orbits moderate sized, about equal to snout and interorbital, about 2 into postorbital length. In adults, snout low, rather narrow, distance across lateral angles less than least interorbital width, bluntly rounded, scarcely protruding beyond large mouth; snout in young (UMML uncat.) more pointed and protruding. Scales on tip and lateral angles of snout not especially enlarged or scutelike. Interorbital space gently convex; orbits do not form part of dorsal profile. Mouth large, unrestricted at angles, rictus extends to below midorbit, maxilla to below hind ⅓ of orbit; lips thick, fleshy, papillaceous near teeth. Chin barbel slender distally, although rather stout at base; length about equal to least suborbital width. Suborbital region vertical in adults, smoothly rounded, without a sharp longitudinal ridge; in young, ridge forms a pronounced angle cross-sectionally. Preopercle large, slightly lobelike ventrally, hind margin almost vertical; preopercle ridge forms a slight lobe at posteroventral angle. Opercle-subopercle posterior margin smoothly curved; interopercle barely exposed as a naked tab at posterior tip.

Gill membranes attached to isthmus with no free fold, point of attachment slightly behind angle of lower jaw. Outer gill arch greatly restricted with a small outer slit, the length of which is less than least suborbital width. Gill rakers tubercular and weakly spined.

Sensory papillae on head numerous, distinctly dark colored, in contrast to paler ground.

Body and head covered with scales except for usual naked areas on lips, eyes, fins, nostrils, and gill membranes. No enlarged scutelike scales on head, although in large specimens (greater than

80 mm HL), scales on head ridges often stout and strongly adherent. Suborbital region divided into dorsal and ventral parts by differences in scales; those dorsally being slightly larger and coarser spinulated. Body scales covered with numerous rows of minute spinules that barely rise above horizontal; surface texture thus appears relatively smooth.

Teeth very small, tips barely protrude above thick gum matrix. Premaxillary teeth in 1 row; mandible teeth in 2 irregular rows, but 1 row laterally. Dentition in both jaws not occurring to posterior extent of rictus.

First dorsal fin moderately large; length second spinous ray about equal to postorbital length, denticulations along leading edge obsolescent or almost so, most of edge smooth; in small UMML specimens denticulations few, slender, weak, confined to distal half of ray. Second dorsal rudimentary throughout. Pectoral fin length about equal to postorbital length, posterior extent of fin well short of vertical through vent. Outer pelvic ray produced into a hairfine filament that just reaches vent, but falls short of anal origin. Anal well developed; origin behind that of second dorsal; vent region immediately in advance of fin without intervening scales.

Pyloric caeca of seven specimens long and slender, 9–16 total, longest caecum in one specimen (130 mm HL, CAS 42518) longer than postorbital length. Bends of intestine complex and variable (see Fig. 18). Swim bladder with tough external tunic, retia 4, long and slender; gas glands probably 4, but not accurately determined in few specimens examined for this.

Coloration in alcohol overall medium to light brown. Oral cavity pale to light gray; outer wall of gill cavity black, but inner wall medium brown; peritoneum black. Fins and nostril membranes dark brown to black; tips of anterior anal rays and first dorsal blackish. Lips, barbel, gular and most of branchiostegal membranes brownish gray; outer edge of branchiostegal membrane blackish.

Distribution (Fig. 15).—Gulf of Panama, Cocos Ridge, Galapagos, in 1,710–3,193 m.

Remarks and Comparisons.—*Coryphaenoides bulbiceps* appears to be most closely related to *C. paradoxus* from the Pacific (and possibly also the Atlantic as *C. macrocephalus*—see Remarks in description of *C. paradoxus*), *C. thelostomus* Maul, 1951, and *C. longicirrhus* (Gilbert, 1905) from Hawaii. These four species attain a large size (more than 80 cm) and have the same general head physiognomy (low blunt snout, large subterminal mouth, suborbital region essentially vertical, without a distinct ridge, etc.). The minute teeth (uniserial [in adults, extra rows in young] in premaxilla, biserial in mandible) immediately distinguish the species from its closest congeners, and *C. paradoxus* and *C. longicirrhus* have more pelvic finrays (9–10 and 11, respectively). *Coryphaenoides thelostomus* further differs from *C. bulbiceps* in having smaller orbits (about 15% HL), shorter upper jaw (about 36–38%), longer pectoral fins (64–98%), longer pelvic fins (123–189%), and longer chin barbel (about 30–33%) (*C. thelostomus* data from Dooley 1979:541–542).

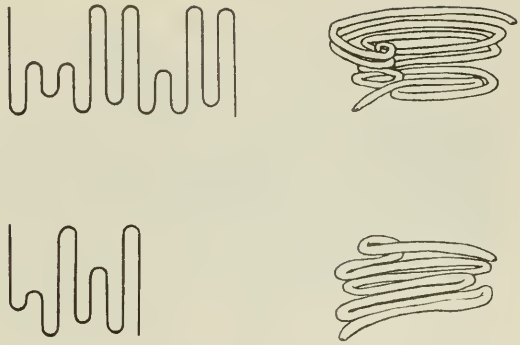

Figure 18. Diagrammatic exploded views of intestines of *Coryphaenoides bulbiceps*. (a) CAS 42518 (117 mm HL); (b) MMSU P-16518 (131 mm HL).

Coryphaenoides armatus, which has been captured at slightly greater depths in the same general region, differs notably in having a more pointed snout, smaller orbits, more pelvic fin rays (9–12), more retia (5–7), and extensive naked ventral areas on the snout and suborbital. Dentition and squamation features, among several other characters, readily distinguish *C. bulbiceps* from *C. bucephalus.*

Coryphaenoides bulbiceps has been taken and observed around thermal vent areas in the eastern Pacific (see Cohen and Haedrich 1983) and may very well be confined to areas harboring these geological features. Where found, adults of this large species appear to be numerous and have been noted to congregate around baited traps and cans within relatively short periods. They are susceptible to deep-set bottom longlines; 29 were captured on a pair of longline sets made by the research vessel ANTON BRUUN off the Ga-

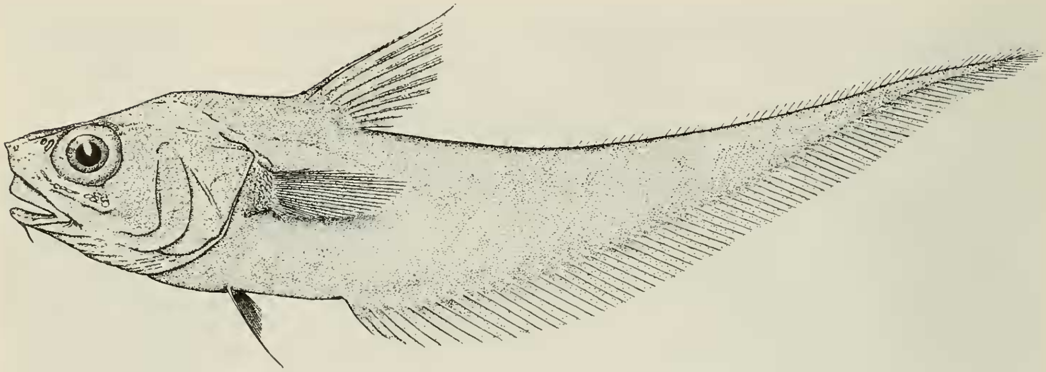

FIGURE 19. *Coryphaenoides capito.* CAS 55839 (57.1 mm HL) from off Ecuador in 945–960 m.

lapagos in 1966 (stations 618A, 618B). Cohen and Haedrich (1983) found the species to be the most abundant macrourid in their observations of Galapagos thermal vent communities (made from manned submersibles and time-lapse photography).

Coryphaenoides capito (Garman, 1899)

(Figures 4d, 19, 20)

Macrurus capito Garman, 1899:200–201 (type locality off Panama and Mexico).

?*Macrurus leucophaeus* Garman, 1899:201–202 (type locality off Panama). NEW SYNONYMY.

Macrurus vagrans Garman, 1899:201. NEW SYNONYMY.

MATERIAL EXAMINED.—Lectotype (here designated): MCZ 28591 (female: 37.0 mm HL, 140+ mm TL); 7°31′30″N, 79°14′W; 458 fm (935 m); ALBATROSS sta. 3384; 8 Mar. 1891. Paralectotypes: MCZ 63331 (1: 34.4 HL, 153+ TL); same data as for lectotype.—MCZ 28592 (5 paralectotypes, too deteriorated to measure) and USNM 12043 (1: ca. 30 HL, 114+ TL); 16°32′N, 99°48′W, 493 fm (902 m); ALBATROSS sta. 3417; 11 Apr. 1891.—MCZ 61093 (paralectotype of *Macrurus boops* Garman, 1899: 41.9 HL, 172+ TL); 7°21′N, 79°35′W; 511 fm (935 m); ALBATROSS sta. 3394; 10 Mar. 1891.—MCZ 28587 (paralectotype of *Macrurus boops*: 57.9 HL, 245+ TL); 7°09′30″N, 81°08′30″W, 546 fm (999 m); ALBATROSS sta. 3356; 23 Feb. 1891.—MCZ 28589 (holotype of *Macrurus leucophaeus* Garman, 1899; 47.2 HL, 185+ TL); 7°09′45″N, 80°50′W; 322 fm (589 m); ALBATROSS sta. 3354; 23 Feb. 1891.

Other material.—GULF OF CALIFORNIA.—SIO 68-83 (9: 36.3–77.4 HL, 152+–324+ TL); 27°40.0′N, 111°22.6′W; 40-ft otter trawl; THOMAS WASHINGTON, field no. MV68-I-50; 16 Jan. 1968. MEXICO.—CAS 55840 (6 of 29: 48.8–62.1 HL, 165+–245+ TL); 19°43.5′N, 105°35.5′W; 700–900 m; TE VEGA sta. 17; 10 July 1968.—CAS 55838 (1: 75.1 HL, 322 TL); 17°24′N, 101°31′W; 940–1,000 m; TE VEGA sta. 19; 12 July 1968. COSTA RICA.—CAS 43981 (2: 33.5–35.6 HL, 145+–135+ TL); off Cabo Blanco; 325–334 m; 14 Dec. 1975. PANAMA.—GCRL 14257 (1: 58.4 HL, 257+ TL); 7°13′00″N. 79°18′00″W; 305–841 m; M/V CANOPUS sta. 1291; 5 Mar. 1974. ECUADOR.—CAS 55839 (7: 45.8–68.0 HL, 175+–313+ TL) and ZMMU P-16518 (2 spec.); 3°15′S, 80°55′W; 945–960 m; ANTON BRUUN cr. 18B, sta. 770 (field no. LWK66-120); 10 Sep. 1966. PERU.—USNM 118019 (1: 66.1 HL, 304 TL); 5°47′S, 81°24′W; 536 fm (980 m); ALBATROSS sta. 4653; 12 Nov. 1904. NO LOCALITY.—MCZ 28583 (3: 24.9–31.1 HL, 87+–136+ TL); ALBATROSS 1888 Expedition.

DIAGNOSIS.—A species of *Coryphaenoides,* subgenus *Coryphaenoides,* with 1D. II,8–9; 1P. i19–i26; V. 8–9. Scales generally absent on lower portion of head including snout, anteriorly on suborbital, ventral margin of preopercle, most of interopercle, and most of lower jaw. Scales dorsally along suborbital ridge small but scutelike, slightly elongate, and in a single file; other more normal scales sometimes dorsal to this series in 1 or 2 rows and separated by a naked line of the sensory lateralis system. Leading margin of snout narrowly naked. All scales rather deciduous; spinules on scales weak, slender, short, arranged in irregularly parallel, longitudinal rows. Pyloric caeca stublike, 6–8, directed anteriorly. Vertical and horizontal arms of preopercular ridge form a right angle without a lobelike extension.

COUNTS AND MEASUREMENTS (34 specimens).—D. II,8–9 + about 95; 1P. i19–i26; V. 8–9; GR-1 5–9 / (1–2) + (0–1) + (10–12) [11–14 total]; GR-2 1 + (0–1) + (10–12) [total 11–13] / (1–2) + (0–1) + (7–10) [9–12 total]; scales 1D. 7–8 (17 spec.), 2D. 4.5–6.5 (14 spec.), mid-1D. 3.5–6.5 (15 spec.), lat.l. 31–38 (14 spec.); caeca 6–8 (8 spec.).

Total length 87+–324 mm; HL 24.9–77.4 mm. The following in percent of HL: postrostral 75.1–79.3; snout 22.3–28.4; preoral 10.0–17.1; internasal 11.4–15.7; interorbital 13.6–20.7; orbit 27.5–31.8; suborbital 7.1–11.3; postorbital 40.2–

49.9; orbit–preop. 31.0–35.6; upper jaw 26.9–32.2; nostril 4.1–6.9; barbel 5.4–10.2; gill slit 10.5–14.8; pre-D. 106–119; pre-A. 127–151; pre-V. 94–114; V.–A. 30–52; isth.–A. 60–86; body depth 60–89 (usually between 65 and 75); 1D.–2D. 18–59; 1D. 46–63; 1P. 47–60; V. 33–47.

Description.—Body and head relatively compressed, greatest head width in most adults about 0.6–0.7 greatest body depth, which in turn about equals postrostral length of head; HL 4.5–5.0 into TL. Supraoccipital crest high, forming pronounced hump in nape in all specimens and a dip in dorsal profile above orbits. Orbits large, 3.2–3.7 into HL, much longer than snout length; deeply incised into skull, resulting in narrow interorbital space (1.5–1.8 into orbit); orbit shape basically elliptical in young, becoming more ovoid in adults with narrow end anteroventral. Orbit margin anteroventrally fleshy in adults, not well defined by bony elements. Snout low, rather blunt, but armed with a single, small, conical scute at tip and 1 or 2 blunt scutes at lateral angles. Mouth opening restricted, rictus extends posteriorly to below anterior ¼ of orbits, premaxillary almost extends to vertical through midorbit. Barbel short, stout at base, but tapering to a fine tip. Suborbital ridge low, rounded, not sharply demarcated. Preopercle broadly rounded; chord of posterior margin essentially vertical; preopercular ridge low, no lobelike extension of ridge at posteroventral angle (as in *C. anguliceps* and *C. ariommus*). Opercle, subopercle, and interopercle broadly exposed, their free margins smoothly adjoined without deep incisions or lobes.

Gill membranes thick, broadly attached to isthmus, without a free posterior fold; gill openings on each side completely separate. Gill rakers tubercular, those on second and third arches armed with several long sharp spines.

Scales cover most of dorsal surfaces of head, but broad naked areas on ventral surfaces of snout and suborbital, mandibular rami, and lower margins of opercle and interopercle. Naked ventral surfaces of snout extend onto leading upper edge (except for terminal and lateral scutes) of snout. Boundaries of postorbital sensory canals and most edges of opercular bones narrowly naked. Interopercle sparsely scaled in middle portion of exposed surfaces. Areas around nostrils, orbital rim between nostrils and eye, suborbital ridge, and lower (horizontal) preopercle ridge naked. Only a single row of small, elongated, deeply embedded scales along anterior half of suborbital shelf. A cluster of small scales present below nostrils. Gill membranes naked. Body scales (Fig. 4d) rather large, highly deciduous (as are most head scales), covered with short, sharp, conical spinules arranged in generally parallel longitudinal rows (5–8 rows in larger scales below 1D.–2D. interspace). A row of small scales proximally on shank of second spinous ray; other small scales proximally on membranes of first dorsal fin rays.

Jaw teeth very small, slender, sharp, conical, deeply embedded within fleshy gum matrix; arranged in narrow, gradually tapered bands (2–4 teeth wide at broadest point) on mandibles, in moderately broad bands (6–7 teeth wide) on premaxillaries; no teeth significantly enlarged.

First dorsal relatively low, greatest height much less than postrostral length of head, base rather steeply inclined; first spinous ray a short splint closely appressed to base of stout, tapered second spinous ray, which has a finely serrated leading edge and filamentous tip. Second dorsal poorly developed throughout; origin poorly defined in larger individuals where anteriormost rays not developed, although pterygiophores present. Pectorals broad, well developed, extend to above sixth to eighth anal ray. Pelvic fins small, origin far forward below opercle; outermost ray thin, hairfine at tip, barely reaches vent. Anal origin below, or slightly behind vertical of, posterior edge of first dorsal.

Coloration in alcohol, SIO 68-83 specimens from Mexico swarthy; faint violet tinge on head; fin rays of first dorsal, pectoral, and pelvics swarthy to black. Other specimens examined paler, brownish; scaleless and abraded surfaces whitish. Oral and gill cavities blackish.

Distribution (Fig. 20).—Mainland Mexico into Gulf of California and south to northern Peru, 305–1,000 m.

Remarks and Comparisons.—Relationships of *C. capito* to *C. boops* have been discussed under the latter species. Specimens larger than about 50 mm HL are most likely to be confused with the sympatric *C. anguliceps,* but the two are immediately distinguishable by the shape of their preopercular ridge, which forms a right angle with no lobe in *C. capito* versus an acute angle with a pronounced lobe in *C. anguliceps.* Counts of gill rakers, pyloric caeca, and lateral line scale rows (over distance equal to predorsal length) also differ notably between the two species.

The five syntypes (MCZ 28592) from ALBATROSS sta. 3417 are all in such poor con-

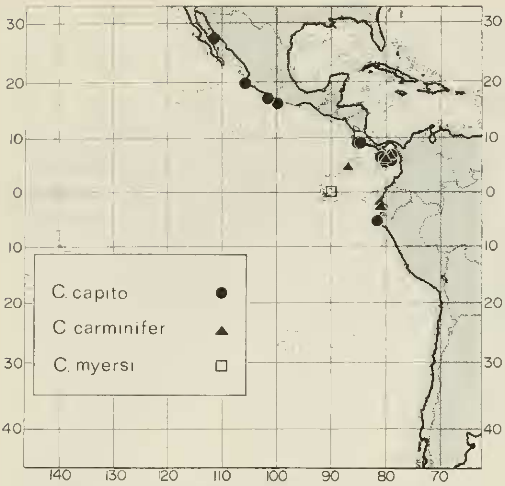

FIGURE 20. Map showing distributions of *Coryphaenoides capito, C. carminifer,* and *C. myersi.*

dition that counts and measurements could not be made. These syntypes were called *Macrurus vagrans* by Garman in his original description of *C. capito*: "The specimens from Station 3417 are hardly identical in variety with those from Station 3384; they are closely allied but differ in that the former (*M. vagrans*) is darker in color, and has less of the silver tint." (Garman 1899:201). This brief passage could be construed as an original description of the variety "*vagrans*" of *Macrurus capito,* and the International Code of Zoological Nomenclature (1985 ed., Art. 45(g)(ii)) states that "a new name published expressly for a "variety" or "form" . . . is: . . . subspecific if published before 1961." Thus, based on the Code, the name *vagrans* is to be treated as a subspecific taxon of *M. capito.* One of us (TI) examined the specimens and found them somewhat different in scale features from that of the other type series. In general, the scales had fewer spinules, and in some areas (behind 1D.; over pelvic fins; on belly) the scales entirely lacked spinules. Most spinuleless scales had about three low ridges, although those on the belly had none. These slight differences between "*Macrurus vagrans*" and *Macrurus capito* do not seem sufficient to warrant recognition of *M. vagrans* as either a distinct species or a subspecies, although more material from the type locality may suggest otherwise.

We have questionably placed *Macrurus leucophaeus* Garman, 1899, into the synonymy of *C. capito* because there appeared to be no significant feature that would differentiate the holotype (and only specimen) from *C. capito.* Minor differences in squamation were, however, found. The holotype had a row of elongate, thickened nonimbricate scales along the suborbital ridge similar to that found in *C. capito,* but there were also two additional rows of more normal scales dorsally separated from the first row by the cephalic lateral line system. These rows of more normal scales extend forward to cover most of the area below the suborbital ridge, the scales extend forward in a narrow line to below the anterior rim of the orbits, but the snout ventrally is naked.

Coryphaenoides carminifer (Garman, 1899)

(Figures 3b, 20–22)

Macrurus carminifer (Garman, 1899:204–206, pl. 46, fig. 2 (type locality: Gulf of Panama, 1,020 fm [1,865 m], ALBATROSS sta. 2393; other type specimens from ALBATROSS sta. 3353, 3354, 3395, in 584–1,335 m).

Coryphaenoides carminatus: Gilbert and Hubbs 1916:143 (misspelling of *C. carminifer;* list).

Coryphaenoides carminifer: Makushok 1967:221 (table).

MATERIAL EXAMINED.—Holotype: MCZ 28582 (53.7 mm HL, 295 mm TL); Gulf of Panama, 7°15′N, 79°36′W; 1,020 fm (1,865 m); ALBATROSS sta. 3393; 10 Mar. 1891. Paratype: USNM 57860 (1: 55.8 HL, 290+ TL); 7°06′15″N, 80°34′W; 695 fm (1,271 m); ALBATROSS sta. 3353; 23 Feb. 1891.

Other material.—COCOS I. (96 km S of).—AMNH 7513 (1: 63.7 HL, 325+ TL); ARCTURUS sta. 74. ECUADOR.—CAS 42519 (3: 47.5–55.5 HL, 248+–298+ TL); 2°20′S, 81°16′W; 850–1,400 m; TE VEGA cr. 19, sta. 84; 4 Aug. 1968.—CAS 56109 (2: 47.5–52.1 HL, 258+–260+ TL); 2°25′S, 81°10′W; 700–1,000 m; TE VEGA cr. 19, sta. 148; 1 Sep. 1968.—CAS 56101 (5: 28.6–72.9 HL, 144+–355+ TL) and MMSU P-16519 (2: 46.0–51.0 HL, 247+–262+ TL); 3°15′S, 80°55′W, 945–960 m; ANTON BRUUN cr. 18B, sta. 770 (field no. LWK66-120; 10 Sep. 1966.

DIAGNOSIS.—A species of *Coryphaenoides,* subgenus *Coryphaenoides,* with chin barbel thick, about 0.5–0.8 orbit diameter; 1D. II,8–10; 1P. i18–i21; V. 8–9 (usually 8); mouth opening restricted, rictus scarcely extending to vertical through anterior orbit margin; teeth uniformly small on both jaws, in narrow bands; snout short, blunt, protruding little beyond mouth; body and head uniformly scaled, without naked areas on snout, suborbital, or preopercle, and mandibles mostly scaled; scales densely covered with sharp, reclined, spikelike to somewhat lanceolate spinules in discrete parallel rows; outer pelvic ray thick and prolonged; second spinous ray of 1D. heavy and triangular in cross section basally, rap-

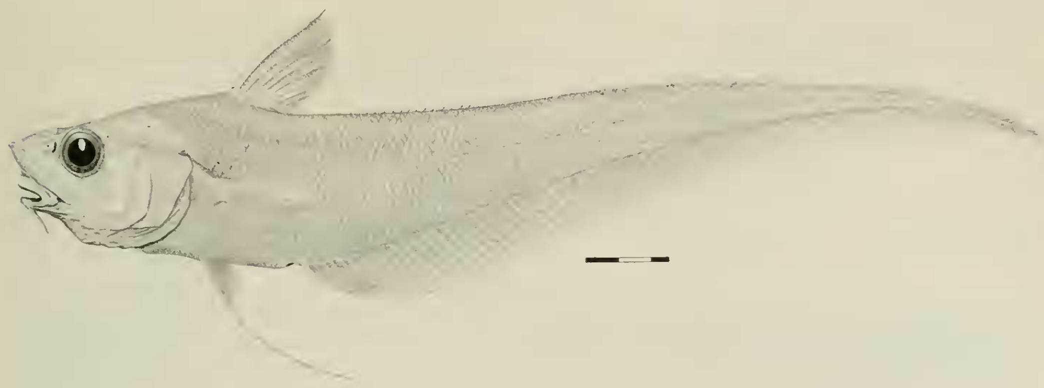

FIGURE 21. *Coryphaenoides carminifer*. CAS 42519 (47.5 mm HL) from off Ecuador in 850–1,400 m.

idly tapering to filamentous tip, leading edge serrated distally, but serrations become obsolete basally; preopercle broadly rounded, not lobed; preopercle ridge not forming lobes at angle; posterior tip of interopercle exposed and scaled.

COUNTS AND MEASUREMENTS (17 specimens).—1D. II,8–10, 1P. i16–i22 (usually i19–i21); V. 8–9; A. and 2D. about 100–110; GR-1 (3–6) / (1–2) + (0–1) + (8–9) [8–10 total], GR-2 (1–2) + (0–1) + (6–7) [total 8–10] / (1–2) + (0–1) + (6–7) [8–9 total]; scales 1D. 9–12, 2D. 7–9.5, mid-1D. 5.5–8.5, lat.l. 37–44; caeca 8 or 9.

Total length 144+–355+ mm; HL 28.6–72.9 mm. The following in percent of HL: postrostral 72.8–76.8; snout 26.1–30.6; preoral 13.6–17.5; internasal 21.7–24.8; interorbital 26.1–31.3; orbit 25.9–31.1; suborbital 11.9–14.7; postorbital 42.3–46.9; orbit–preop. 34.4–38.1 (41.3); upper jaw 26.7–32.0; nostril 5.1–9.3; rictus 18.6–20.4; barbel 13.7–23.4; gill slit 4.1–8.1; pre-D. 108–124; pre-A. 139–171; pre-V. 105–124; V.–A. 40–60; isth.–A. 78–94; body depth 80–93; 1D.–2D. 23.4–48.0; 1D. 72–84; 1P. 51–66; V. 78–117.

DESCRIPTION.—Head and body moderately compressed, greatest width over pectoral bases about half greatest body depth, HL 4.0–5.0 into TL. Orbits round, about equal to interorbital width and to snout length. Interorbital space slightly depressed to almost level. Snout short, bluntly pointed, extending little beyond mouth. Mouth opening restricted posterolaterally by lip folds; rictus about ⅔ length upper jaw, end of rictus below anterior edge of orbit; maxilla terminates below anterior ⅓ of orbits. Barbel notably stout, thickened over most of length; abruptly tapered to a fine tip, length 0.52–0.80 orbit diameter. Suborbital region smoothly rounded in well-preserved specimens, the shelf region broad, not sharply narrowed anteriorly. Preopercle broadly rounded, not lobed, posterior margin nearly vertical; preopercle ridge forming a moderate lobe at angle. Posterior margin of gill cover steeply inclined from posterodorsal angle, gently curved at ventral edge of subopercle, where interopercle protrudes broadly beyond preopercle.

Gill membranes thick, broadly attached to isthmus, without a free posterior fold. First gill arch broadly attached to gill cover by folds of skin. Outermost gill slit greatly restricted, length less than that of longest gill filament. Second slit unrestricted; third and fourth restricted at ventral end by folds of skin; fifth slit restricted dorsally and ventrally but wider than first slit. Ceratobranchial gill rakers tubercular, tipped with small spines; epibranchial rakers platelike, broadly triangular, with tufts of spines of various lengths. Gill filaments of moderate length, but substantially less than least suborbital width.

Scales evenly cover all of body and head except for fins, gill membranes, nostril membranes and adjoining orbital rim, and anterior end of mandibular rami. Scales (Fig. 3b) large, adherent, densely covered with parallel longitudinal rows of slender, lanceolate, reclined spinules, about 13–14 rows in large scales below dorsal fins in a specimen 72.9 mm HL, 8–9 rows in a specimen 48 mm HL. Small scales at base of rays of first dorsal and pelvic fins. A few small scales on exposed tip of interopercle. A stout, spiny, tubercular scale at snout tip, and one or more blunter ones at lateral angles. Scales on suborbital shelf

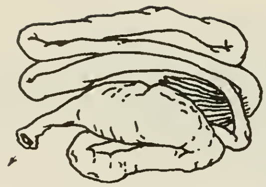

FIGURE 22. Right lateral view of intestines of *Coryphaenoides carminifer*, CAS 56101 (46.3 mm HL).

not notably different from adjacent scales. Head ridges not armed with stout scutelike scales.

Narrow bands of small, sharp, strongly recurved teeth on both upper and lower jaws; the dentary bands about 3 teeth wide near symphysis, the premaxillary bands about 4 teeth wide. No teeth enlarged. Bands extend posteriorly to end of rictus, but not much, if at all, beyond.

Height of first dorsal about equal to postrostral length of head. Second spinous ray stout and triangular in cross section at base, tapering rapidly to a fine tip; sharp leading edge with small sawtooth serrations distally, but obsolescent proximally, even in smallest specimens examined. Second dorsal rudimentary throughout. Pectorals broad, extend to above anal fin origin. Pelvics small except for thick, greatly elongated outer ray, which extends to about the 9th–13th anal ray; other rays fall well short of anal origin. Anal fin well developed, origin behind vertical through hind edge of first dorsal fin. Pectoral origin slightly in advance of pelvic origin, which in turn slightly precedes that of first dorsal.

Cephalic sensory canal system well developed, particularly on ventral surfaces of head and dorsally on snout and interorbital region. System represented by series of low papillae, but no large open pores.

Alimentary canal long, multiply looped (see Fig. 22); pyloric caeca long, slender, longest caecum about equal to interorbital width, 8 and 9 in 2 specimens. Swim bladder large, filled with fatty tissue; 4 globular gas glands connected to 4 slender retia in CAS 42519 (55.5 mm HL), but gas glands in CAS 56101 (46.3 mm HL) in flattened coalesced mass without distinct separations. Males have large drumming muscles anteroventrally on swim bladder.

Coloration in alcohol dark brown overall; fins blackish, although elongated pelvic ray white. Gill membranes pale brown in some, blackish in others. Oral cavity light grayish to pale. Lips dark brown around mouth opening; other skin folds around mouth pale brown. Chin barbel light brown. Gill chamber dark gray to blackish; peritoneum blackish or dark brown.

DISTRIBUTION (Fig. 20).—Gulf of Panama (Panama) to Gulf of Guayaquil (Ecuador) in 589–1,865 m.

REMARKS AND COMPARISONS.—*Coryphaenoides carminifer* appears to be in the *C. boops-capito-myersi* species complex discussed in the description of *C. boops. Coryphaenoides carminifer* differs from the other three in having a much thicker chin barbel, a posteriorly prolonged preopercle-ridge angle, and a somewhat higher, more protruding snout. It further differs from *C. capito* and *C. boops* (but not *C. myersi*) in having a thick, elongated outer pelvic ray and long slender pyloric caeca. In its thick barbel, *C. carminifer* resembles *C. zaniophorus* Vaillant, 1888, from the Atlantic, but it differs from that species in having gill openings less far forward (under posterior margin of orbit in *C. zaniophorus*); more pointed, protruding snout; fewer pelvic rays (usually 10, sometimes 9 in *C. zaniophorus*); and fewer gill rakers (11–12 total on second arch in *C. zaniophorus*).

Coryphaenoides delsolari Chirichigno and Iwamoto, 1977

(Figures 3d, 23, 24)

Coryphaenoides delsolari Chirichigno and Iwamoto, 1977:519–528 (type locality: Ecuador, ANTON BRUUN sta. 770 in 945–960 m). Parin and Sazonov 1983:86 (7 spec.; 3 localities off Peru; 600–610 m).

Nematonurus sp. aff. *altipinnis:* Chirichigno 1968:418–421, fig. 13 (descr., illus.); 1969:37, fig. 81 (list).

Coryphaenoides nov. sp. Chirichigno, 1974:315, fig. 622–624 (in key).

The description given here is an abridgement of the extensive original by Chirichigno and Iwamoto (1977).

MATERIAL EXAMINED.—Type specimens (examined by TI); others from off Peru (examined by VIS): MMSU P-16523 (6: 32.5–81 HL, 158–365 TL); 7°41′S, 80°40′W; 900–1,000 m; IKMT on bottom at 900 m; AKADEMIK KURCHATOV sta. 1472; 4 Mar. 1972.—MMSU P-16524 (3 spec.); PROF. MESIATZEV trawl 44.—MMSU P-16525 (3 spec.); PROF. MESIATZEV trawl 45.—MMSU P-16526 (1 spec.); PROF. MESIATZEV trawl 66.

DIAGNOSIS.—A species of *Coryphaenoides* with head and body scales densely covered with fine, relatively erect spinules, most with multipronged, usually tridentate tips in adult specimens larger than 50 mm HL. Head and body completely and uniformly scaled except for naked exposed tip of interopercle. 1D. II,8–11 (usually II,8–9); V. 9–10 (rarely 11). Inner gill rakers

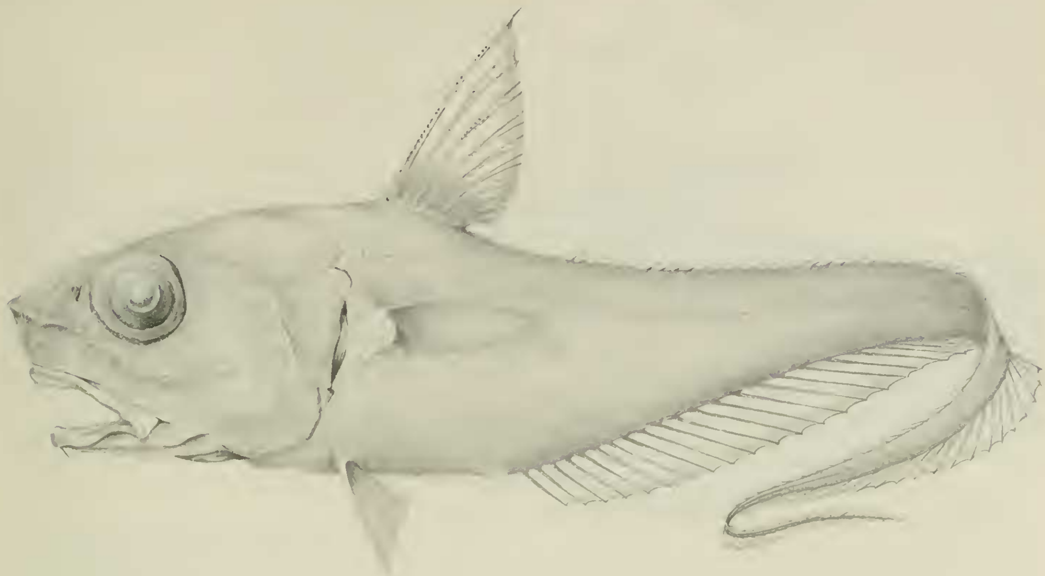

FIGURE 23. *Coryphaenoides delsolari.* Drawing of holotype (USNM 215278) from Chirichigno and Iwamoto (1977, fig. 1).

on first arch 1–2 + 9–11 (10–13 total); inner rakers on second arch 1–2 + 9–11 (10–13 total). Snout blunt, high, scarcely protruding. Upper jaw 2.4–2.9 in head; orbits 2.9–3.4. Barbel short and thin, usually 4 or more into orbit. Teeth small, in moderately broad band in upper jaw with outer series slightly enlarged; in narrow band on lower jaw.

COUNTS AND MEASUREMENTS.—1D. II,8–10 (rarely 11); 1P. (i18)i19–i23; V. 9–10(11); GR-1 (5–7) / (1–2) + (9–12) [total 11–14], GR-2 ? / (1–2) + (9–11) [10–13 total]; scales 1D. 8–12, 2D. 6–9, mid-1D. 4.5–8, lat.l. 30–34; vert. 12; caeca 11–14.

Measurements in percent of HL: postrostral 70–79; snout 26–32; preoral 13–24; internasal 20–25; interorbital 23–32; orbit 23–34; suborbital 12–17; postorbital 38–50; orbit-preop. 42–50; upper jaw 35–41; barbel 3–10; gill slit 11–17; pre-A. 128–164; V.–A. 28–53; isth.–A. 60–91; body depth 58–87; 1D.–2D. 13–45; 1D. 50–66; 1P. 53–67; V. 38–57.

DESCRIPTION.—Head large, deep, broad in juveniles, more compressed in adults. Snout pointed in juveniles, blunt in adults; lateral profile arched. Interorbital space somewhat concave, width less than orbit diameter in young, but more in large adults. Suborbital region broad, with a stout dorsal shelf of scutelike scales. Preopercle ridge produced into a narrow lobe posteroventrally; preopercle margin forms a broad lobe. Interopercle exposed as a narrow triangle posteriorly. Mouth large, maxillary extends to below posterior half of orbit; rictus little restricted. Barbel short, thin, only slightly longer than diameter of posterior nostril. Opercular openings wide, but membranes rather broadly attached to isthmus.

Height 1D. less than postrostral length of head; the second spinous ray finely serrated, slightly produced. Outer pelvic ray slightly produced, its filamentous tip extends little beyond anal origin. Origins of 1D. and 1P. about on same vertical, that of V. a bit anterior.

Dentition generally small, teeth in upper jaw arranged in a broad band with a slightly enlarged outer series, those in lower jaw in a narrow band.

Almost all of head and body uniformly scaled including most of ventral aspects of snout and suborbital (ventral margin narrowly naked, however), and lower jaw rami. Scales of trunk and tail densely covered with slender, relatively erect spinules arranged in irregularly divergent rows.

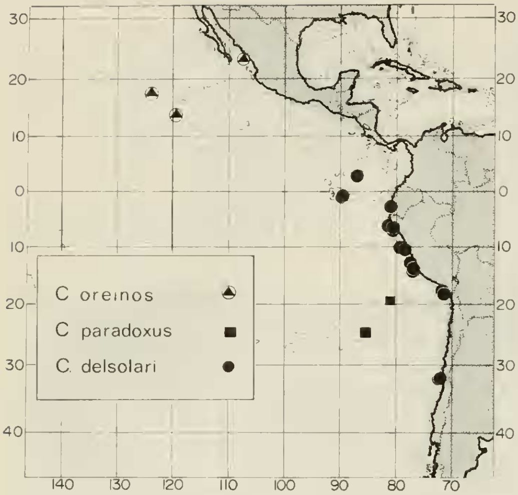

FIGURE 24. Map showing eastern Pacific distributions of *Coryphaenoides delsolari, C. paradoxus,* and *C. oreinos.*

In specimens larger than about 80 mm HL, most scales have narrow lanceolate spinules with tridentate or multipronged tips. In specimens 50–80 mm HL, tridentate spinules variously developed. In smaller specimens, spinules few, conical, and with slender recurved tips.

Large swim bladder with 4 long slender retia, each connected to a small peltate gas gland. Pyloric caeca short, rather thick, simple.

Color in alcohol generally dark brown in adults, paler in young, with brownish black fins, gill membranes, and lips. Linings of mouth, gill, and abdominal cavities blackish.

DISTRIBUTION (Fig. 24).—Cocos Ridge, Galapagos, Ecuador, Peru, to central Chile (32°S), in 580–1,200 m.

REMARKS AND COMPARISONS.—*Coryphaenoides delsolari* is apparently closest to the western Pacific *C. altipinnis* Günther, 1877, but the latter species has a longer barbel, narrower suborbital, larger posterior nostril, and different scales. Of the eastern Pacific species, *C. delsolari* is readily distinguished from *C. bucephalus* by its much smaller teeth, higher gill raker count (9–10 in *bucephalus*), shorter barbel, longer outer gill slit, and different scale spinules. It differs from *C. bulbiceps* in its fewer pelvic fin rays; narrower internasal; somewhat smaller orbits; a longer postorbital length; longer barbel; longer preanal, outer V. to A., and isthmus to A. distances; and scale spinulation. The combination of scale spinules, mouth size, length outer gill slit, pelvic fin ray count, barbel size, and dentition distinguish *C. delsolari* from all other congeners.

Coryphaenoides oreinos n. sp.

(Figures 3e, 24–26)

Macrurus bucephalus Garman, 1899 (partim; specimen from ALBATROSS sta. 3430).

HOLOTYPE. NSMT P44088 (formerly FSFL NA-280) (80.5 mm HL, 413 mm TL); Dowd Tablemount off Mexico; 13°27.5′N, 119°54.8′W; 1,200–1,626 m; KAIYO MARU sta. LL7; multiple-hook setline; 9 Feb. 1979.

PARATYPES. FSFL NA-281 (1: 93.5 HL, 444+ TL) and NSMT P44080 (formerly FSFL NA-282) (1: 85.5 HL, 405 TL), same data as for holotype.—FSFL NA-349 (1: 132 HL, 650+ TL); Seamount 375 off Mexico, 17°40.9′N, 124°02.5′W; 990–1,100 m; KAIYO MARU sta. LL12; multiple-hook setline; 18 Feb. 1979.—MCZ 28600 (1: 46.4 HL, about 220 TL); Mexico off Mazatlan; 23°16′N, 107°31′W; 852 fm [1,558 m]; ALBATROSS sta. 3430; 19 Apr. 1891 (paralectotype of *Macrurus bucephalus* Garman, 1899).

DIAGNOSIS.—A species of *Coryphaenoides,* subgenus *Coryphaenoides,* with 1D. II,8–10, V. 9–10. Snout broad, rounded, naked except for 2 spiny tubercular scales at lateral angles, a series of small coarse scales along posterior portion of median nasal ridge, and a wedge of small scales intruding forward from interorbital region on each side of median ridge. Naked margins on head bones prominent. Spinules on scales reduced, lacking along outer scale margins, about 8–12 subparallel ridges, few with sharp spinules. Teeth small in broad bands in both jaws. Internasal width about 5 in head, interorbital about 4, slightly greater than orbit diameter; barbel small, about 0.5 or less into orbit; upper jaw 36–39% HL.

COUNTS AND MEASUREMENTS (5 specimens; see also Table 2).—1D. II,8–10; 1P. i19–i26; V. 9–10; GR-1 0–4 / (1–2) + (7–9) [9–11 total], GR-2 (1–2) + (7–8) [8–10 total] / 2 + (7–8) [9–10 total]; scales 1D. 6.5–8, 2D. 6.5–9.5, mid-D. 6.5–8, lat.l. 45–49.

Total length about 220–650+ mm; HL 46.4–132 mm. The following in percent HL; postrostral 75.0–77.4; snout 25.0–27.8; preoral 12.9–19.6; internasal 19.4–21.7; interorbital 23.4–26.4; orbit 21.6–24.7; suborbital 13.2–15.9; postorbital 50.6–56.4; orbit–preop. 47.7–50.1; upper jaw 36.0–39.0; nostril 3.2–6.1; barbel 8.8–10.8; gill slit 8.5–10.3; pre-D. 105–116; pre-V. 109–119; pre-A. 142–159; V.–A. 35–52; isth.–A. 69–89; body depth 74–86; 1D.–2D. 21–32; 1D. 53–67; 1P. 48–55; V. 43–60.

DESCRIPTION OF HOLOTYPE.—Head laterally

FIGURE 25. *Coryphaenoides oreinos* Iwamoto and Sazonov, new species. Holotype, NSMT P44088 (80.5 mm HL, 413 mm TL) off 950 Dowd Tablemount off Mexico in 1,200–1,626 m.

compressed, width about equal to greatest depth of opercular region; length more than 5 in TL. Trunk moderate, distance isthmus to anal almost as long as HL. Anus immediately adjacent to anal fin origin. Snout blunt, high, scarcely protruding beyond mouth; dorsal profile little elevated. Orbits round, relatively small, diameter much less than snout length, slightly less than interorbital space. Interorbital relatively flat, about 4 into HL. Mouth of moderate size, rictus extends posteriorly to below anterior ¼ of orbits; maxillary to below midorbit (or slightly beyond). Barbel

FIGURE 26. *Coryphaenoides oreinos* Iwamoto and Sazonov, new species. Paratype, MCZ 28600 (46.4 mm HL) from off Mazatlan, Mexico in 1,558 m (fins, scales, and parts of trunk and tail reconstructed). Scale bar equals 25 mm.

short and thin. Suborbital region broad, not sharply angular, the upper shelf area gently rounded, without strong spiny ridges. Preopercle large, posterior margin slightly inclined from vertical, with a broad rounded angle; the preopercle ridges form a pronounced lobe at angle. Opercle and subopercle moderate sized, forming a smooth posterior gill-cover margin. Interopercle naked, exposed only at extreme tip, which blends in smoothly with subopercle. Nostrils small, about 3 into suborbital width. Sensory papillae of head well developed, especially on snout, suborbital, and mandible.

Gill membranes narrowly attached to isthmus, opposite sides joined below vertical arm of preopercular ridge. Outer gill arch broadly restricted to operculum by folds of skin, leaving a small outer gill slit. Gill rakers small, tubercular, none on outer side of first arch (but present in paratypes); filaments of moderate length, longest on first arch about equal in length to outer gill slit.

Scales (Fig. 4e, f) small, uniformly cover all of trunk and tail except fins. Head mostly covered except on snout, suborbital, lower jaw, interopercle, margins and ridges of preopercle, and margins of opercle, parietal, and orbits. Scales on suborbital confined to a narrow wedge of small scales intruding forward from preopercle to below anterior edge of orbits; those on mandible limited to a medial row or 2 on posterior half of ramus. All ventral surfaces of snout naked except for small scutes at lateral snout angles; these scutes armed with stout conical posteriorly directed spinules. Terminal scute absent. A series of 6 small but relatively stout scales on posterior half of median nasal ridge; similar scales along dorsal border of orbits (these extend forward to over posterior end of supranarial ridges in larger paratypes). A patch of apparently regenerated scales between 2D. origin and lateral line having a single series of spinules along posterior edge (Fig. 4f). These aberrant scales have small conical to narrowly triangular spinules aligned along 8–12 subparallel rows of low ridges. Spinules on body scales generally fall short of posterior margin. (In large paratypes, posterior margin broadly spinuleless, the spinules confined to anterior part of exposed field.) A broad naked area around 1D. base; thin spinuleless scales behind 1D., pectoral, and pelvic fins. Belly between pelvic fins and margin of isthmus and gill chamber edged with similar scales.

Teeth on premaxillary small, in moderately broad tapered bands about 7–8 teeth wide, the bands extending almost to end of rictus; outer series of stout, enlarged, conical, slightly recurved teeth. Mandibular teeth small, in narrow band 2–5 teeth wide, broadest along posterior half; band extends well beyond posterior extent of rictus. (Teeth in larger paratypes generally deeply embedded in thick layer of gum papillae.)

First dorsal fin rather short, length about equal to postrostral length; second spinous ray serrated, filamentous at tip but not produced beyond first 2 segmented rays; a low keellike process developed at base on spine (not present in paratypes; in larger paratypes distal teeth on spine long and tightly appressed, almost coalesced). Second dorsal fin rudimentary anteriorly, becoming moderately well developed towards end of tail. Pectoral fins broad, longest rays extend to beyond level of anus (slightly short of anus in some paratypes). Pelvic fins moderate sized, outermost ray much thicker than others and prolonged into a hairfine tip that extends to base of fourth anal ray; other rays fall well short of anus. First dorsal and pectoral fins about on same vertical; pelvic fin origin slightly anterior to that vertical.

Color in alcohol dark chocolate brown overall, fins black. Oral cavity gray, gill cavity lining and peritoneum blackish. Barbel pale. Branchiostegal membranes black. Gill arches, rakers, and filaments pale.

Distribution (Fig. 24).—Seamounts off central Mexico in 990–1,626 m.

Etymology.—From the Greek *oreinos* (from the mountains, mountain dwelling), in reference to the habitat of the new species on seamounts and guyots of the eastern Pacific.

Remarks and Comparisons.—The extensive naked areas on the head and the absence of a terminal snout scute distinguish *C. oreinos* from all congeners including *C. bucephalus, C. bulbiceps,* and *C. paradoxus,* the eastern Pacific species most similar in overall appearance. The new species further differs from *C. anguliceps* and *C. ariommus* in having a blunter snout profile and less restricted rictus; from *C. myersi* in a higher snout, fewer pelvic fin rays, more deciduous scales, and weaker scale spinulation. The species bears some resemblance to *Coryphaenoides* (*Chalinura*) *fernandezianus* in its blunt snout, naked regions on head, and thin, deciduous scales, but it differs in having larger orbits, mandibular teeth in a band (versus in one row), shorter upper

FIGURE 27. *Coryphaenoides myersi* Iwamoto and Sazonov, new species. Holotype, CAS 56103 (55.0 mm HL) from Galapagos in 457 m.

jaws, narrower suborbital region, and several other features. In many squamation features it resembles members of the subgenus *Chalinura,* but differs in lacking scales along the leading edge of the snout, and has different mandibular dentition and interopercle shape. Other eastern Pacific *Coryphaenoides* differ widely from the new species, and possibly its closest relationships lie with western Pacific or Indian Ocean species.

Coryphaenoides myersi n. sp.

(Figures 4e, 20, 27)

HOLOTYPE.—CAS 56103 (55.0 mm HL, 262+ mm TL, incomplete, a small pseudocaudal developed); 1°09′S, 90°35′W; 250 fm [457 m]; collector G. S. Myers, VELERO sta. 802-38; 23 Jan. 1938.

DIAGNOSIS.—A species of *Coryphaenoides,* subgenus *Coryphaenoides,* with 1D. II,9, 1P. i24, V. 10; outer pelvic ray elongated and thick. Snout low, scarcely protruding, preoral length 8% HL. Underside of snout, most of mandibular rami naked, scales otherwise uniformly cover head and body; spinules long, conical, densely packed in parallel to convergent rows. Orbits large, 3 into HL, twice interorbital space. Teeth small, in bands in both jaws; none in premaxillary enlarged. Mouth small, upper jaws about 3 in HL; rictus does not extend beyond level of posterior nostril. Barbel small, more than 3 into orbit.

COUNTS AND MEASUREMENTS.—D. II,9 + 70+; A. 81+; 1P. i24/i24; V. 10/10; GR-1 5 / 2 + 1 + 8, GR-2 1 + 0 + 8 / 1 + 1 + 7; scales 1D. 10.5, 2D. 8.5, mid-1D. 8 (excluding those on fin), lat.l. 38; vert. 11; anal pterygiophores before first haemal spine 7.

Measurements in mm followed by percent HL in parentheses; postrostral 42.1 (76.6); snout 14.7 (26.7); preoral 4.3 (7.8); internasal 7.7 (14.0); interorbital 9.7 (17.6); orbit 19.0 (34.5); suborbital 7.0 (12.7); postorbital 22.9 (41.6); orbit–preop. 17.5 (31.8); upper jaw 17.7 (32.2); rictus 12.8 (23.3); nostril 3.9 (7.1); barbel 5.1 (9.3); gill slit 5.8 (10.5); pre-D. 62 (113); pre-A. 86 (156); pre-V. 67.5 (123); isth.–A. 40 (72.7); V.–A. 20.8 (37.8); body depth 52 (95); depth over A. origin 47 (86); 1D.–2D. 29 (53); 1P. 34.5 (63); V. 34 (62); 1D. base 13 (24).

DESCRIPTION.—Body compressed, deep, greatest depth under first dorsal origin about equal to head length; body tapers rapidly from anal origin to tip of tail. Head 4.7 in TL, but tail incomplete, probably about 5 in TL in complete specimens. Mouth relatively small, subterminal; rictus restricted, does not extend beyond vertical of posterior nostril; maxillary extends to slightly beyond level of anterior orbit margin. Lips thick, papillaceous. Snout low, narrow, scarcely protruding beyond mouth; terminal and lateral angles tipped with stout tubercular scutes. Orbits large, much longer than snout, 1.2 into postorbital length; twice interorbital width. Barbel short, slender; length about 1.5 length of posterior nostril, less than suborbital width, about 3 into orbits. Suborbital region vertical, without a ridge. Underside of snout and suborbital heavily studded with large tubercular sensory papillae. Leading anterior edge of snout scaleless, but densely covered with papillae. Pores of cephalic sensory canals fairly prominent along ventral edges of snout, suborbital, preopercle, and mandible. Preopercle broadly rounded, posterior edge inclined slightly backwards and almost forming a right angle with ventral margin. Preopercle ridge rather inconspicuous, ventral arm stout but low, joining vertical arm at a slightly acute or almost right angle. Posterior edge of interopercle exposed as a prominent scaled tab closely adjoined to ventral edge of broad subopercle.

Gill membranes broadly attached to isthmus below or slightly behind level of posterior preopercle margin, without a free posterior fold. Gill filaments long, equal to suborbital; rakers tubercular, armed with slender curved spines; first and fifth slits greatly restricted by folds of skin.

Spinous second dorsal fin ray strongly serrated along sharp leading edge; tip of first dorsal broken off, but length probably about equal to postrostral length. Second dorsal rudimentary; anal well developed. Pectoral fins broad, extend to about over fourth anal ray. Pelvic fins well developed, most rays extend to anus or beyond; outer ray thick, prolonged, extends to about seventh or eighth anal ray. First dorsal and pelvic origins about on same vertical, pectoral origin slightly in advance of this. Anal origin about below posterior margin of first dorsal. Interspace between first and second dorsals about 1.5 length base of first dorsal; anteriormost 4 or so rays of second dorsal mere stubs.

Scales strongly adherent, spinulose, uniformly covering almost all of head and body. Naked areas limited to: small areas on lower snout surface and leading upper edge; a narrow margin below front portion of suborbital; most of mandibular rami (few scattered scales posteriorly); all of branchiostegal and gular membranes. Base of first dorsal heavily covered with small scales that rise part way up fin. Scales heavily covered with relatively long, conical, moderately reclined, closely spaced spinules arranged in parallel to somewhat convergent rows; 1 or more spinules along posterior margin longer than remainder.

Teeth all small, slender, deeply embedded in papillose gum matrix, those in upper jaw in broad bands, about 7–8 rows wide, none enlarged; those in lower jaw in narrow bands 3–4 teeth wide. Upper jaw band short, not extending beyond rictus; those in lower jaw somewhat longer, extending slightly beyond rictus. Lips and oral valves strongly papillose.

Color in alcohol tawny to light brown ground; ventral surface of head pale; fin membranes dark brown. Lining of gill chamber dark brown; gills pallid. Peritoneal lining dark brown. Oral cavity pale.

Holotype a male, its testes large and well developed. Pyloric caeca slender, fairly long (to about 10 mm), 7 counted, but possibly more (stomach everted into gullet, other caeca may have been hidden from view). Coiling of alimentary canal could not be determined because of disturbed condition of internal organs. Swim bladder features not observed to avoid further damage to specimen.

Distribution (Fig. 20).—Known only from the Galapagos in 457 m.

Etymology.—The species is named after the collector, the late George S. Myers, distinguished ichthyologist and former professor at Stanford University.

Remarks.—*Coryphaenoides myersi* is readily distinguished from its close relatives *C. boops* and *C. capito* by the elongated outer pelvic ray; high pelvic ray count; short abdomen; low, nonprotruding snout; small mouth; rictus not extending to below orbits; squamation; and short broad premaxillary teeth band. The general configuration of the snout and head also differs, although there is a distinct resemblance. All three species have a short low snout and similar naked areas ventrally on the head. Squamation pattern (spinulation, extent of naked area, etc.) probably more closely resembles that of *C. boops,* although there are subtle differences. *Coryphaenoides capito* has much more deciduous scales, its spinules are more erect and needlelike and in more discrete parallel to subparallel rows. *Coryphaenoides carminifer* also shows similarity in general shape, but its higher snout and greatly thickened barbel are distinguishing.

Coryphaenoides paradoxus (Smith and Radcliffe, 1912)

(Figures 3c, 24, 28)

Macrourus paradoxus Smith and Radcliffe *in* Radcliffe 1912: 115–116, pl. 25, fig. 1 (type locality off eastern Palawan, Philippines, 2,021 m).

Coryphaenoides (*Nematonurus*) *paradoxus:* Gilbert and Hubbs 1916:143 (list), 1920:409 (compiled).

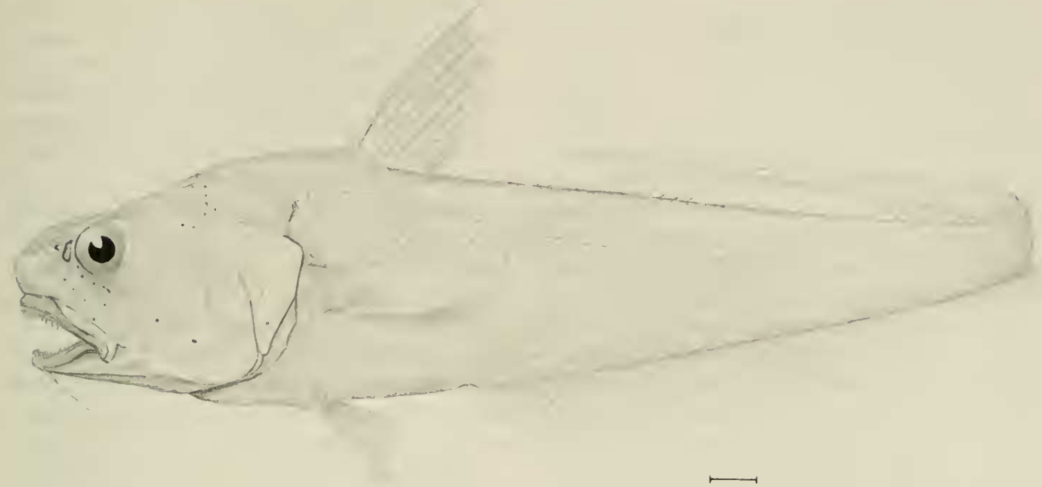

FIGURE 28. *Coryphaenoides paradoxus*. MMSU P-16528 (155 mm HL) from Nazca Ridge in 980 m. Scale bar equals 25 mm.

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

?*Coryphaenoides macrocephalus:* Marshall and Iwamoto *in* Marshall 1973:575–578 (14 spec., Gulf of Mexico, Caribbean Sea, Guyana; 1,006–2,734 m); Merrett and Marshall 1981:241 (215 mm HL spec. from off NW Africa; 2,344–2,406 m); Anderson et al. 1985:797 (table 2) (listed from Caribbean; 3,459–3,508 m).

Coryphaenoides sp.: Parin et al. 1980:11 (765 mm TL spec. from Nazca Ridge, ICHTHYANDR sta. 1 [reported below]).

Coryphaenoides paradoxus: Wilson et al. 1985:1246 (1 spec., SIO 68-479, Darwin Guyot; about 1,600 m).

MATERIAL EXAMINED.—Holotype: USNM 72932 (116 mm HL, 585+ mm TL); Philippines, 9°13′00″N, 118°51′15″E, 1,105 fm (2,021 m); ALBATROSS sta. 5428; 3 Apr. 1909.—MMSU P-16528 (1: 155 HL, 765 TL); off Nazca Ridge, 19°40′S, 80°18′W; 980 m; R/V ICHTHYANDR sta. 1.—MMSU P-16527 (1: 166 HL, 820 TL); off Sala-y-Gomez Ridge, 25°34.4′S, 85°20.7′W; 1,070–1,100 m; R/V PROFESSOR MESIATZEV trawl 10.—SIO 68-479 (1: 268 HL, 1,200 TL); central Pacific, Darwin Seamount, 22°07.7′N, 171°36.0′E; free-vehicle setline; 16 Sep. 1968.

DIAGNOSIS.—A large species (120+ cm) of *Coryphaenoides*, subgenus *Coryphaenoides*, with 1D. II,9–11, 1P. i16–i21, V. 9–11 (rarely 8). Mouth large, almost terminal, upper jaw extends to below posterior orbit margin. Teeth prominent, an outer enlarged series on premaxillary behind which a narrow villiform band; mandibular teeth in about 3 irregular series near symphysis, becoming uniserial posteriorly. Snout low, scarcely protruding; head fully scaled except lips, gill membranes, interopercle. Orbits relatively small, about 1.5 into snout, 1.8–1.9 into interorbital space, 5.0–6.0 into HL. Interopercle barely exposed as broad fleshy tab without scales. Suborbital region vertical; no strong sharp ridges on head.

COUNTS AND MEASUREMENTS (MMSU P-16528, MMSU P-16527, SIO 68-479).—D. II, 10 + 74+, II,9 + ?, II,10 + ?; 1P. i21/i20, i21/i20, i20/i20; V. 10/10, 10/8, 10/10; GR-1 3 / 1 + 1 + 8, 3 / 1 + 1 + 8, 4 / 1 + 9; on second arch 1 + 7 / 1 + 1 + 7, ?/ 1 + 1 + 7, 2 + 8 / 1 + 8; scales 1D. 7, 8, ca. 10; 2D. 5.5, 6, 5.5; mid-1D. 5.5, 6.5, 6.5; lat.l. 36, ?, 47.

Total length 765, 820, 1,200 mm; HL 155, 166, 268 mm. Measurements in mm followed by percentage of HL in parentheses: postrostral 122, 123, 204 (74.1–77.2); snout 40.3, 46.8, 71.0 (25.5–28.2); preoral 18.4, 19.9, 27.0 (10.1–12.0); internasal 35.3, —, 46.0 (17.2–19.3); interorbital 50.1, 58.1, 71.0 (26.5–35.0); orbit 26.9, 32.5, 45.0 (16.8–19.6); suborbital 21.8, 24.1, 37 (13.8–14.5); postorbital 92.5, 95.1, 158 (57.3–59.0); orbit–preop. 89.8, 91.1, 138 (51.5–56.8); upper jaw 64.7, 71.0, 109 (40.7–42.8); barbel 26.0, 33.0, 39.0 (14.6–19.9); gill slit 10.1, 11.5, 23.0 (6.4–8.6); pre-D. 188, 193, 310 (116–119); pre-A. 248, 259, 450 (156–168); pre-V. 170, 186, 340 (108–127); V.–A. 85, 80.0, 148 (48.2–55.2); isth.–A. 158, —, 350 (100–131); body depth 133, 150, 231 (84–90); depth over A. origin 112, —, 204

(71–76); 1D.–2D. 48, 64.1, 62 (23.1–38.6); 1D. 88, 111, 148 (55.2–66.8); 1P. 78, 105, 130 (48.5–63.3); V. 100, 100, 139 (51.9–65.7).

Description (based primarily on 765 mm southeastern Pacific specimen, MMSU P-16528).—Head broad, greatest width about 1.7 into length; HL about 5.0 into TL. Orbits oval, longest axis vertical, horizontal diameter 5.9 into HL. Interorbital space broad, flattened in cross section. Snout low, blunt, with inconspicuous scutes at terminal and lateral angles. Mouth large, unrestricted laterally; upper jaw extends to below hind margin of orbits. Barbel well developed, slightly shorter than horizontal orbit diameter; base stout, narrows abruptly to a slender filament. Suborbital region vertical, gently rounded, without a sharp longitudinal ridge; scales covering upper half of region somewhat stouter and larger than those on lower half. Preopercle large; posterior margin slightly tilted forward from vertical; joining ventral margin in smooth curve. Preopercle ridge low, forming a slight backward extension at angle. Opercle and subopercle closely joined, forming a narrow "V." Interopercle almost entirely covered by preopercle; posterior end narrowly exposed as a broad naked, fleshy tab.

Gill membranes thick, fleshy, closely attached to isthmus without a free posterior fold. Membranes of each side join at point below posterior angle of lower jaw. First and fourth gill arches closely attached to sides of gill chamber; first and fifth gill slits consequently greatly restricted; length first (outermost) slit less than suborbital width. Gill rakers tubercular, rounded, weakly spined. Portion of shoulder girdle under gill cover heavily scaled with small spinuleless scales.

Head and body almost completely and uniformly scaled except for gill membranes and interopercle. Fins naked except at very base. Body scales large, fairly adherent, densely covered with small, short, fine, needlelike spinules in somewhat quincunx pattern or in widely divergent rows (Fig. 3c). Spinules absent along posterior margin in large specimens, most of those in large specimens with highly recurved tips. Head scales adherent and more variable in size and spinulation; some scales along head ridges somewhat larger than those surrounding, and rather coarsely spinulated and strongly adherent.

Premaxillary dentition a narrow inner band of small teeth about 3 rows wide and an outer 1 or 2 series of enlarged conical, recurved canines. Mandibular teeth clustered anteriorly, becoming 1 or 2 irregular rows posteriorly; both large and small canines at symphysis. All teeth prominent and exposed, not embedded in a thick layer of gum papillae (as in *C. bulbiceps*), extending in both jaws to posterior end of rictus.

Fins well developed. Pectoral and pelvic fin origins about on same vertical, first dorsal origin slightly behind; anal origin below that of second dorsal. Interspace between first and second dorsals about 30% HL. Second dorsal poorly developed except at tip of tail. Height of first dorsal more than half head length but less than postrostral length of head; when laid back, longest rays extend to second dorsal origin. Outer pelvic ray prolonged into filamentous tip that extends slightly beyond anal origin.

Coloration in alcohol overall dark brown with scale pockets prominently outlined in brownish black. Fins blackish to dark brown. Lips and barbel black. Gill chamber lining black; oral cavity lining blackish to dirty gray; peritoneum brownish black; gular and branchiostegal membranes dark dirty gray to blackish.

Distribution (Fig. 24).—Philippines, mid-Pacific north of Hawaii, and Nazca Ridge in the Pacific (980–2,021 m); if *C. macrocephalus* is a synonym of *C. paradoxus*: Madeira, off NW coast of Africa, Gulf of Mexico, and Caribbean Sea in the Atlantic (1,006–3,508 m).

Remarks and Comparisons.—The surprising find of *Coryphaenoides paradoxus* in the southeastern Pacific reveals an even wider distribution than previously known. Marshall and Iwamoto (1973:578) listed several slight meristic differences between *C. paradoxus* and *C. macrocephalus* from the Gulf of Mexico and Caribbean Sea. Our comparisons of photographs of *C. macrocephalus* from the North Atlantic (Museu Municipal do Funchal no. 898 [holotype]; MCZ uncat.; UMML uncat.) with the MMSU specimens showed no definable difference. Meristic and morphometric features similarly showed no substantive differences, and in fact, the MMSU specimens agree closer in those features with the Atlantic material than with the holotype of *C. paradoxus* (USNM 72932), taken off the Philippines in 2,021 m. If the two are synonyms, then *C. paradoxus* (as *C. macrocephalus*) is known from 19 specimens from the Atlantic (see Marshall and Iwamoto 1973:575–578; Merrett and

Marshall 1981:241; Anderson et al. 1985:797). In the Pacific, only the holotype and the three specimens herein reported are known.

As with other *Coryphaenoides* species, the relationships of *C. paradoxus* are poorly known. *Coryphaenoides rudis* Günther, 1878 (reported from north of the Kermadec Islands and off New Zealand) seems very similar, as does *C. bulbiceps* from the eastern Pacific and *C. longicirrhus* (Gilbert, 1905) from Hawaii. All have similar dentition; a relatively blunt, unproduced snout; a large, almost terminal mouth; an almost flat, vertical suborbital region; an interopercle that protrudes from behind preopercle as a small fleshy naked tab; and finely spinulated scales.

Coryphaenoides paradoxus is readily distinguished from its eastern Pacific counterpart, *C. bulbiceps,* in having stronger, larger outer premaxillary teeth; smaller orbit; larger barbel; lower snout (preoral length more than 2 into interorbital space versus less than 2); and V. 9–11 versus 8.

Subgenus **Nematonurus** Günther, 1887

Nematonurus Günther, 1887:124 (as subgenus of *Macrurus*) (type species *Macrurus armatus* Hector, 1875, by subsequent designation of Jordan 1920).

Diagnosis.—A subgenus of *Coryphaenoides* with usually 6 (sometimes 5 or 7) retia mirabilia. Origin of 2D. behind vertical through anus. No drumming muscles on swim bladder. Premaxillary teeth with a distinct outer row and 0–3 much smaller inner rows; mandibular teeth uniserial. Flesh relatively firm; bones stout. Scales deciduous to adherent, exposed fields with many parallel longitudinal rows of small spinules (sometimes reduced or obsolescent distally on exposed field in large individuals). Snout pointed, rather narrow, least width across supranarial ridges less than interorbital width; orbits small, less than 25% HL in adults, equal to or smaller than interorbital space and snout length. Mouth large, upper jaw more than 3 into HL, unrestricted at angles; premaxillary extends to below posterior ¼ of orbits or beyond. Abdomen long, isth.–A. greater than HL.

Remarks.—The subgenus as here diagnosed restricts the group to four species: *C. armatus, C. lecointei, C. ferrieri,* and *C. yaquinae.* Its members are closest to species of subgenus *Chalinura,* especially in terms of squamation, dentition, and retia numbers, but they differ in having generally fewer premaxillary teeth rows, more pointed snout, longer trunk, and generally firmer bodies.

Albatrossia pectoralis has a similar dentition pattern but has a softer body, different body coloration (olive gray-brown fresh, whitish defoliated versus brown to swarthy to whitish), elongated comblike saggita otoliths, much reduced swim bladder with only two retia and gas glands, and different scales (rather elongated with much reduced spinulation).

Coryphaenoides longifilis Günther, 1887, placed in the genus *Bogoslovia* (as *B. clarki*) by Gilbert (*in* Jordan and Evermann 1898), and in genus or subgenus *Nematonurus* or *Chalinura* by most recent authors, shares similarities with *Nematonurus* spp. in dentition pattern, but other features including coloration, snout shape, fins, squamation on head and body, barbel, retia/gas gland numbers, etc., are quite different. The species probably deserves separate subgeneric or generic recognition.

Coryphaenoides armatus armatus (Hector, 1875)

Macrurus armatus Hector, 1875:81 (type locality 200 miles E of Cape Farewell, New Zealand, 400 fm [732 m]).
Macrurus (*Nematonurus*) *armatus:* Günther 1887:150, pl. 40, fig. A. (S Indian Ocean, South Pacific, Mid-Pacific).
Nematonurus armatus: Goode and Bean 1896:416 (list).
Coryphaenoides (*Nematonurus*) *armatus:* Gilbert and Hubbs 1916:143 (list).
Coryphaenoides armatus armatus: Wilson and Waples 1984: 227–237.

Material Examined.—GALAPAGOS.—CAS 56589 (1: 122 mm HL, 670 mm TL); 1°48′S, 90°19′W; 3,225 m; ANTON BRUUN cr. 16, sta. 619A; bottom longline; 26–27 May 1966.—CAS 56590 (1: 131 HL, 690 TL); same data as previous except sta. 619B.—CAS 38332 (1: 95 HL, 520 TL); 2°12′S, 88°42′W; 3,160 m; ANTON BRUUN cr. 16, sta. 620B; bottom longline; 28 May 1966.

Diagnosis.—A species of *Coryphaenoides,* subgenus *Nematonurus,* with bluntly pointed snout. Premaxillary teeth generally in 2 distinct rows, the outer series enlarged, the inner much smaller and sometimes lost in large individuals; mandibular teeth in 1 row, the tips rather blunt and flanged. Head pores well developed. Most ventral surfaces of head naked. Scales rather deciduous, spinules small, low, absent from posterior margin of exposed field, often reduced to low horizontal ridges in adults. 1D. II,8–9; 1P. i17–i21 (usually i20); orbit 18–27% HL; interorbital 22.0–29.9; 1D.–2D. 45.1–95.1

Counts and Measurements (from 3 SE Pacific specimens only, CAS 38332 first, CAS 56589 second, CAS 56590 third).—D. II,8 + 105, II,9 + 96, II,8 + 94; 1P. i19/i20, i20/i20, i18/i20; V. 10/10, 10/10, 7/10 (left fin probably abnormal); A. 105, 110, 104; GR-1 7 / 2 + 1 + 9, ca. 10 / 2 + 1 + 10, 6 / 2 + 9, GR-2 2 + 11 / 2 + 10, 1 + 10 / 1 + 1 + 9, 1 + 1 + 7 / 2 + 1 + 8; scales 1D. 9, 9, 9.5; 2D. 10, 9, 9; mid-1D. 7.5, 7.5, 6.5; lat.l. 34, 30, 30.

Total length 520, 670, 690 mm; HL 95, 122, 131 mm. The following in percent of HL: postrostral 77.9, 80.4, 80.2; snout 26.4, 21.8, 22.9; preoral 13.4, 12.8, 11.5; internasal 17.5, 16.4, 16.0; interorbital 26.9, 24.4, 25.2; orbit 21.6, 20.5, 19.8; suborbital 11.0, 10.6, 8.9; postorbital 56.4, 58.9, 56.5; orbit–preop. 45.9, 49.9, 49.2; upper jaw 39.0, 38.3, 38.4; barbel 14.9, 15.9, 9.0; gill slit 16.3, 15.7, 15.8; pre-D. 124, 131, 130; pre-A. 196, 198, 196; pre-V. 120, 115, 111; V.–A. 81, 90, 90; isth.–A. 129, 151, 151; body depth 93, 93, 96; 1D.–2D. 54, 83, 81; 1D. 68, 77, 67; 1P. 50, 66, 63; V. 65, 66, 69.

Remarks.—This species has been adequately described and illustrated by several authors, including Iwamoto and Stein (1974), Marshall (1973), Nybelin (1957), and Parr (1946). Extensive synonymies are provided by Parr (1946), Grey (1956), and Marshall (1973). Wilson and Waples (1983) recently described characters to better distinguish the species from *C. yaquinae* Iwamoto and Stein, 1974, and designated a lectotype for *C. variabilis* Günther, 1878, from a type series that included both *C. yaquinae* and *C. armatus*, as well as *C. leptolepis* Günther, 1878.

Wilson and Waples (1984) subsequently recognized two subspecies of *C. armatus*: *C. a. variabilis* (Günther, 1878) from the North Pacific and *C. a. armatus* (Hector, 1875) from all other areas. In the eastern Pacific, the Gulf of Panama separates the two subspecies. The two authors found the North Pacific subspecies to have a narrower interorbital space, shorter dorsal interspace, more 1D. rays (II,9–10 versus II,8–9) and more 1P. rays (21–23 total of both sides, versus 18–21) than in *C. a. armatus*. In addition to these differences, our *C. a. armatus* from the southeastern Pacific are paler in overall color (light brown to tawny in alcohol compared with dark brown to almost swarthy in *C. a. variabilis*) as well as in fin color (blackish in *C. a. variabilis* cf. pale with blackish edges on serrated dorsal spine, uppermost pectoral ray, outer pelvic ray, and distal edges of anal fin in *C. a. armatus*), and the serrations on the 1D. spine are much better developed in our three southeastern Pacific specimens than in our *C. a. variabilis* specimens from the northeastern Pacific.

For references to much of the recent published information on biochemical, physiological, morphological, ecological, and life history aspects of this, the best known, most extensively studied abyssal macrourid, see Wilson and Waples (1983, 1984), and Wilson and Smith (1984).

Subgenus **Chalinura** Goode and Bean, 1883

Chalinura Goode and Bean, 1883:24 (type species *Chalinura simula* Goode and Bean, 1883, by original designation).

Goode and Bean (1883) provided a good diagnosis for their new genus *Chalinura,* which Parr (1946) expanded based on his experience with western Atlantic species. Parr, however, included *C. carapinus,* which Nybelin (1957) subsequently relegated to the genus *Lionurus,* and failed to consider in his diagnosis characters of other *Chalinura.* We believe the following combination of characters distinguishes the eight or so members of this subgenus from other *Coryphaenoides.*

Diagnosis.—A subgenus of *Coryphaenoides* with 5–6 retia mirabilia. Origin of A. below or forward of 1D.–2D. interspace. No drumming muscles on swim bladder. Premaxillary teeth in moderately wide band of small teeth with an outer row of enlarged spaced canines; mandibular teeth moderate in size, in 1 row (sometimes irregular double row). Flesh and bones rather soft. Scales deciduous; small sharp conical spinules arranged in parallel longitudinal rows, spinules sometimes greatly reduced. Snout usually bluntly pointed or somewhat rounded, width between supranarial ridges usually less than interorbital width; orbits small, about 25% HL or less, less than interorbital. Mouth large, upper jaw usually more than 40% HL; mouth opening not restricted; upper jaw extends to or beyond vertical through posterior ¼ of orbit. Abdomen moderate to short, isth.–A. usually less than HL. Gill membranes narrowly connected to isthmus with a broad posterior free fold. Outer gill slit moderately restricted, 14–30% HL. Gill rakers usually 12–17 on inner series of first arch.

Coryphaenoides fernandezianus (Günther, 1878)
(Figure 11)

Macrurus (*Chalinurus*) *fernandezianus* Günther, 1887:145, pl. 38, fig. B (type locality S of Juan Fernandez Is.; CHALLENGER sta. 300; 1,375 fm [2,515 m]).
Chalinura fernandezianus: Goode and Bean 1896:412.
Coryphaenoides fernandezianus: Gilbert and Hubbs 1920:143.

Remarks.—We examined no representative of this species and none has been recorded since the capture of the holotype off Juan Fernandez Island. Its relationship to other members of the subgenus *Chalinura* must be examined. The notably high snout resembles that of *C. brevibarbis* Goode and Bean, 1883, but its barbel is much longer than in that species and its head is not as broad. *Coryphaenoides fernandezianus* appears to differ from *C. leptolepis* (Günther, 1877) in its higher snout, shorter barbel, and less humpbacked dorsal profile, and from *C. murrayi* Günther, 1878, in its fewer pelvic rays (10 versus 11–12 in *C. murrayi*). (See also comparison with *C. oreinos.*)

Subgenus **Lionurus** Günther, 1887

Lionurus Günther, 1887:124 (as subgenus of *Macrurus*) (type species *Coryphaenoides filicauda* Günther, 1878, by subsequent designation of Goode and Bean 1896).

Diagnosis.—A subgenus of *Coryphaenoides* with 6 retia mirabilia. Origin of 2D. behind vertical through anus. No drumming muscles on swim bladder. Premaxillary teeth small, in narrow band, outer teeth somewhat larger than those more medial; mandibular teeth in narrow band (about 4 rows wide at symphysis) that tapers rapidly to a single row laterally. Flesh rather soft; bones of head weak and thin. Scales highly deciduous, exposed fields with few (1–5) low ridges sometimes armed with a few greatly reclined spinules; 1 or 2 adjacent parallel ridges on either side of medial row; many scales completely smooth. Snout pointed, broad across supranarial ridges, width about equal to interorbital width; orbits small, less than 25% HL in adults, much less than broad interorbital space. Mouth moderate sized, unrestricted at posterior angles; upper jaw about 3 into HL, extends to below posterior ¼ of orbits or beyond. Abdomen moderate in length, distance isth.–A. about equal to or less than HL.

Remarks.—This subgenus includes only two known species: *C. filicauda* and *C. carapinus* (but see Remarks in description of the former species). Its relationships are probably closest to subgenus *Chalinura.* Members of the two subgenera share: relatively soft flesh; small eyes; unrestricted, relatively large mouth; extensive naked areas on underside of head; generally weak scale spinulation; six retia mirabilia; and similar premaxillary dentition.

Lionurus species are among the deepest-living grenadiers; the soft flesh, weak bones, small eyes, pale coloration, and reduced spinulation on scales are probably responses to living conditions at abyssal depths.

Larval and juvenile stages of *Lionurus carapinus* and *Lionurus* (?) sp. from the eastern North Atlantic were described by Merrett (1978).

Coryphaenoides filicauda Günther, 1878
(Figures 15, 29)

Coryphaenoides filicauda Günther, 1878:27 (type locality: "both sides of the South American continent; Antarctic Ocean. [Stations 157, 299, 325.] 1,800–2,650 fathoms.").
Macrurus (*Lionurus*) *filicauda:* Günther 1887:141, pl. 34, fig. B. (CHALLENGER sta. 146, 157, 299, 323, 325; 2,515–4,846 m).
Lionurus filicauda: Goode and Bean 1896:409, fig. 342 (compiled).
Lionurus (?) [sic.]: Parin and Makushok 1973:80 (one spec., 215 mm TL, sta. 239A, "Proba" 137, presumed lost, but subsequently found by Y. N. Shcherbachev; see Material Examined below).

Material Examined.—Lectotype: BMNH 1887. 12.7:96 (65.3 mm HL, 372 mm TL); off Valparaiso, Chile, 33°32′S, 74°43′W; 3,951 m; CHALLENGER sta. 299. Paralectotype: BMNH 1887.12.7:95 (49.1 HL, 287 TL); S Atlantic off Rio de La Plata, 36°44′S, 46°16′W; 4,846 m; 2 Mar. 1876.

Other material.—CHILE.—MMSU P-16540 (1: 40.3 mm HL, 215 mm TL); 23°51′S, 71°01′W; 4,550 m; AKADEMIK KURCHATOV sta. 239a ("Proba" 137).—LACM 10189-1 (1: 25 HL, 145 TL); off Chiloe I., 42°57′S, 75°33′W; 3,651 m; ELTANIN sta. 334; 27 Nov. 1962. NEW ZEALAND.—LACM 11333-2 (1: 62.5 HL, 265+ TL); SW of South Is., 46°40′S, 165°18′E; 2,470 m; ELTANIN sta. 1844; 15 Feb. 1966. ANTARCTIC.—LACM 11436-2 (1: 70.5 HL, 405+ TL); SW Pacific sector, 57°55′S, 153°58′E; 3,422 m; ELTANIN sta. 1969; 13 Feb. 1967.—LACM 10862-1 (1: 43.4 HL, 270 TL); SW Pacific sector, 51°50′S, 159°50′W; 4,667 m; ELTANIN sta. 1184; 3–4 Aug. 1964.—LACM 11761-1 (1: 62.2 HL, 295 TL); SE Pacific sector, 50°51′S, 104°53′W; 3,923 m; ELTANIN cr. 20, sta. 26; 25 Oct. 1965.—LACM 10747-3 (2: 73.0–73.0 HL,

FIGURE 29. *Coryphaenoides filicauda.* Composite drawing of LACM 11436-2 (70.5 mm HL, 405+ mm TL) and LACM 10747-3 (73.0 mm HL, 355 mm TL) from Antarctic waters. Scale bar equals 25 mm.

299–355 TL); SW Atlantic sector, 58°54′S, 53°51′W; 3,931 m; ELTANIN sta. 1509; 25–26 Jan. 1966.—LACM 10749-1 (1: 70.0 HL, 378 TL); SW Atlantic sector, 59°01′S, 52°00′W; 3,510 m; ELTANIN sta. 1511; 26 Jan. 1966. AUSTRALIA.—MMSU P-16539 (1: 41 HL, 230 TL); off SW coast Tasmania, 43°37′S, 144°04′E; 4,464 m; DMITRY MENDELEEV sta. 1349.—MMSU P-16538 (1: 27 HL, 120 TL); Great Australian Bight, 35°21′S, 128°42′E; 5,070 m; DMITRY MENDELEEV sta. 1358.

DIAGNOSIS.—A species of subgenus *Lionurus* with GR-1 3–6 total outer / 8–10 total inner; outer gill rakers reduced to minute prickles; orbits 15.6–18.7% HL; barbel 4.1–11.9% HL; leading edge of spinous 1D. ray smooth except for a few low denticles distally. Overall coloration pale whitish gray.

COUNTS AND MEASUREMENTS (13 specimens).—1D. II,8–10; 1P. i16–i19; V. 9–10. GR-1 (3–6)/(1–2) + 1 + (7–9) [8–10 total], GR-2 (1–2) + 1 + (7–8) [8–9 total]/(1–2) + 1 + (7–8) [9–10 total]. Total length 120–405+ mm; HL 25.0–73.0 mm. The following in percent HL: postrostral 66.6–69.2; snout 32.6–38.0; preoral 16.1–23.0; internasal 21.1–28.1; interorbital 30.7–33.1; orbit 15.6–20.0; suborbital 11.6–16.6; postorbital 46.7–53.6; orbit–preop. 45.7–50.0; upper jaw 32.5–36.8; barbel 3.8–8.8; gill slit 10.0–17.5; pre-D. 113–127; pre-V. 108–133; pre-A. 140–177; V.–A. 33–53; isth.–A. 76–106; body depth 62–87 (100); 1D.–2D. 53.8–83.4; 1D. 56–70; 1P. 51–69; V. 43–60; nostril 4.6–6.0.

DESCRIPTION.—Head somewhat depressed, broad, bones rather soft; width across opercles about equal to depth at beginning of nape. Body notably soft fleshed, long and slender. Trunk rather long, distance isth.–A. about equal to HL in larger specimens (+60 mm HL). Head about 6 in TL, greatest depth about 7 in TL in larger specimens. Snout pointed, protruding well beyond jaws a distance more than ⅔ length of orbits. Orbits small, about 2 into broad interorbital space in larger specimens; shape oval, longest axis horizontal. Jaws long, extending to below hind ¼ of orbit; rictus to below or beyond midorbit. Barbel minute, length about equal to diameter of posterior nostril. Preopercle large, posterior margin inclined, free posteroventral margin crenulated. Interopercle exposed posteriorly as thin, slender pointed flap adjoined to subopercle.

Gill membranes narrowly attached to isthmus; opercular opening wide, little restricted, extends forward to below posterior end of lower jaw. Outer gill slit fairly wide, slightly smaller than orbit diameter. Gill rakers of outer series few rudimentary prickles on low ridges; inner series tubercular, spiny. Gill filaments short, slightly longer than ½ orbit diameter.

Scales large, thin; the few remaining on some specimens have either a single median ridge of 1–3 greatly reclined spinules or surface entirely smooth. About 7 transverse rows across interorbital space; 5–6.5 rows below midbase 1D., about 26–33 over distance equal to predorsal length. No stout scutelike scales on head ridges; leading edge of snout with a few small, deeply embedded spiny scales. Underside of snout mostly naked; a few large cycloid scales on suborbital and mandibular rami.

Jaw teeth small, slender, in narrow bands. Premaxillary band 4–5 teeth wide near symphysis; band gradually tapers to 2 irregular rows posteriorly; outer teeth somewhat larger than those more medial. Mandibular teeth band about 4 rows wide anteriorly tapering rapidly to a single row posterolaterally.

Fins fairly well developed. Height 1D. somewhat more than postorbital length; leading edge of second spinous ray smooth except for a few small low denticles distally. Pectoral fin and filamentous outer pelvic ray extend to level of vent. First dorsal and V. origins about on same vertical, pectoral origin well in advance of this. Interspace between dorsals wide, about equal to postrostral length; 2D. rudimentary throughout, origin over 7th–11th A. ray. Flesh over anal pterygiophores jellylike, translucent.

Coloration in alcohol whitish gray overall. Fins pale except for uppermost 1P. ray, tip of spinous second 1D. ray, and outer V. ray, which are blackish. Branchiostegal membranes, barbel, and rim of vent brownish gray to dark brown. Branchial and peritoneal linings black; oral lining and gill arches dark gray to gray-brown.

Distribution (Fig. 15).—High latitudes of southern hemisphere; known from Atlantic, Indian, and Pacific oceans. Collected in abyssal waters off Chile, Argentina, South Shetland Islands, New Zealand, and southern Australia. Depth range 2,470–5,070 m; primary range around 3,500–5,000 m.

Remarks and Comparisons.—This abyssal species has a broad distribution in the Southern Ocean and was previously recorded from the southern part of the Pacific coast of Chile from CHALLENGER sta. 299 (lectotype). Two additional specimens from Chile are herein recorded.

Material from outside the southeastern Pacific examined at MMSU and LACM revealed the presence of another species of the subgenus *Lionurus* in the southern hemisphere. These specimens were indistinguishable from *C.* (*L.*) *carapinus* (Goode and Bean, 1883). These southern hemisphere "*C. carapinus*" were captured at somewhat shallower depths (1,700–3,064 m) than our *C. filicauda* specimens.

Among these additional specimens was a 259-mm specimen (ZIL 11720, formerly deposited in the Zoological Institute in Leningrad) labeled as "*C. filicauda*" and trawled at CHALLENGER sta. 146 in the southwestern Atlantic. The station (in 2,515 m) is one of those listed by Günther (1887:141) at which representatives of *C. filicauda* were procured. This particular specimen, however, is indistinguishable from *C. carapinus.*

The type specimen of *C. filicauda* from Chile (CHALLENGER sta. 299), taken at a depth of 3,951 m, was designated as the lectotype by Grey (1956:184). Our concept of *C. filicauda* conforms to that specimen, which was examined (by TI) through the courtesy of A. Wheeler (BMNH). Nybelin's (1957) specimens of *Lionurus carapinus euabyssalis,* trawled from depths between 4,255 and 5,610 m in the northeastern Atlantic, are problematic. Their vertical distribution (much deeper than in *C. carapinus*) suggests *C. filicauda,* but Nybelin's specimens are in such poor condition that we cannot determine their identity based on his description.

As we see it, *Coryphaenoides filicauda* is distinguished from *C. carapinus* by its having fewer outer gill rakers on the first arch (3–6 versus 6–11), these being rudimentary prickles compared with the tablike rakers in *C. carapinus*; a softer, more translucent body; fewer spinations on the spinous dorsal ray; a shorter outer gill slit (11.9–14.6% HL versus 14.6–18.5%); and a narrower interorbital (29.3–32.2% HL versus 30.8–40.1%).

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