OCCASIONAL PAPERS

OF THE

California Academy of Sciences

No. 111, 79 pages, 25 figures, 1 table.

A SYSTEMATIC REVIEW OF THE RATTAIL FISHES (MACROURIDAE:GADIFORMES) FROM OREGON AND ADJACENT WATERS

By

Tomio Iwamoto
California Academy of Sciences
San Francisco, California 94118

and

David L. Stein
School of Oceanography, Oregon State University
Corvallis, Oregon 97331

Introduction

During the past decade, Oregon State University research vessels have conducted a number of cruises to sample the deep-water fauna off the coast of Oregon. Fishes of the family Macrouridae comprised the bulk of benthic catches below approximately 600 meters. Macrourids collected revealed few species, but allocating correct names to the different forms proved extremely perplexing because of inadequate published descriptions, the lack of keys, and the profusion and confusion of names previously given to the various species.

It was the intent of this study to resolve some of these problems and particularly to: (1) give adequate descriptions

and illustrations of the species found off Oregon and adjacent waters; (2) establish proper scientific names; (3) provide lists of synonyms for each species; and, finally, (4) provide a key to the species. We have also discussed the generic problems involving *Coryphaenoides* and related genera and offered our views for handling them.

The macrourid fauna in the boreal western Pacific has been recently reviewed by Rass (1963) for the Okhotsk Sea, and Okamura (1970; 1971) for the rich fauna off the coast of Japan, but no recent review is available for eastern North Pacific macrourid fishes. Earlier works on this region with important descriptive information include those by Gilbert (1891; 1892; 1895; 1915), Gilbert and Burke (1912), Jordan and Evermann (1898), Gill and Townsend (1897), Jordan and Gilbert (1899), Townsend and Nichols (1925), and Clemens and Wilby (1946). Macrourid fishes from the Pacific off Central and South America are very poorly known. Garman (1899) worked on the extensive *Albatross* collections and gave descriptions of 22 species, 20 of which he described as new. The status of many of his species (most treated as species of *Macrurus*) is presently uncertain, although Marshall (1973) allocated them to different genera. Günther (1878; 1887) and Gilbert and Thompson (1916) described a number of species from off the west coast of South America. Chirichigno F. (1968; 1969) recently treated the species off Peru, and Pequeño (1971) treated the species from off Chile, three of which he described as new.

We limited the scope of this study to the macrourid fishes found in eastern Pacific waters from northern California to the Bering Sea. Two species, *Nezumia liolepis* (Gilbert) and *Coelorinchus scaphopsis* Gilbert, have been recorded from central California and may occasionally stray into waters north of San Francisco Bay. These are included in the key, but are not described in detail. Macrourid fishes south of San Francisco are poorly known, and a comprehensive study of all eastern Pacific species is needed.

Material and Methods

Collections by the Oregon State University research vessels *Yaquina* and *Cayuse*, comprised the principal source of materials for this study. Depths from 637-4100 meters were sampled in four major areas off the Washington-Oregon coast: (1) the continental slope 44-833 km. off Oregon; (2) Cascadia Abyssal Plain; (3) Tufts Abyssal Plain; and (4) 185 km. west of the Strait of Juan de Fuca. Gear used was a 3-meter beam trawl (see Carey and Heyamoto, 1972) and a 22-foot Gulf semi-balloon shrimp trawl (see Day and Pearcy, 1968), both towed at 2-3 knots. Duration of drags varied from two hours on the abyssal plain to 15 minutes on the continental slope. Specimens deposited at Oregon State University are housed either in the Department of Oceanography

(OSUO), or in the Department of Fisheries and Wildlife (OSUFW). Representative specimens now listed as OSUO uncataloged will be deposited at the California Academy of Sciences after other studies have been completed on them. Other collections used to supplement Oregon State University material are those of the College of Fisheries, University of Washington (UW); University of British Columbia (UBC); California Academy of Sciences (CAS), Ichthyological Collections, Stanford University (SU) (now housed at CAS); Scripps Institution of Oceanography (SIO); U. S. National Museum of Natural History (USNM); Museum of Comparative Zoology, Harvard University (MCZ); and Humboldt State College.

Methods for taking meristic and morphometric data follow general procedures described by Gilbert and Hubbs (1916), Hubbs and Lagler (1958), and modified by Iwamoto (1970). The measurement 'internasal width' refers to the least distance between the supranarial ridges. In the descriptions, the information given pertains only to specimens we examined, unless otherwise stated. In the 'Specimens Examined' sections, the depository is listed first, followed by the catalog number (if available), the number of specimens and the ranges of head and total lengths (in parentheses), and pertinent capture data.

Acknowledgments

We are indebted to many persons for their help in the preparation of this paper. The following curators and staff members assisted us in the examination of specimens under their care: Dr. Miles Alton, National Marine Fisheries Service, Seattle; Mr. Robert Behrstock, Humboldt State University; Dr. William N. Eschmeyer, Mrs. Lillian J. Dempster, and Miss Pearl Sonoda, California Academy of Sciences; Mr. Thomas McClain, Department of Fisheries and Wildlife, Oregon State University; Dr. Richard H. Rosenblatt and Mr. Joseph Copp, Scripps Institution of Oceanography; Dr. Victor G. Springer, United States National Museum of Natural History; Dr. Norman J. Wilimovsky, Mr. Tony Kluge, and Mr. Don E. Wilson, University of British Columbia.

Mr. Richard A. Grinols, Peninsula Junior College, Port Angeles, Washington, kindly furnished us with data, photographs, and radiographs of specimens he had studied while employed by the U. S. Fish and Wildlife Service, Seattle, Washington. Dr. Daniel M. Cohen, National Center for Systematics, Washington, D.C., advised and assisted us in numerous ways. Dr. Carl L. Hubbs, Scripps Institution of Oceanography, gave advice and kindly allowed us to examine and describe the new species of *Coryphaenoides* he had previously planned to study. Mr. S. Jurgen Westrheim, Fisheries Research Board of Canada, made possible the collection of a specimen of *Nezumia stelgidolepis* off British Columbia. Larry Hanna, Julie Ambler, and Martha Casteel, Oregon State

University, assisted in the examination of specimens. Dr. Lo-Chai Chen, California State University, San Diego, helped in the loan of specimens.

We gratefully acknowledge the aid of Dr. William G. Pearcy, School of Oceanography, Oregon State University, who initiated and encouraged this study. Financial support was provided through a grant to Dr. Pearcy from the U. S. Atomic Energy Commission (RLO 227-T12-35, "Ecological and radioecological studies of the Columbia River estuary and adjacent Pacific Ocean").

Drs. D. M. Cohen, W. N. Eschmeyer, and W. G. Pearcy critically reviewed and gave useful advice on improving the manuscript.

Key to adult macrourids of the eastern North Pacific north of San Francisco, California

1a. A stout spinous ridge midlaterally on head, passing continuously from tip of snout to preopercle angle (fig. 1A). A large, black, naked fossa midventrally on chest; anus at origin of anal fin (fig. 2A). Second dorsal spine smooth at all sizes (fig. 3A). Pelvic fin rays invariably 7.....*Coelorinchus scaphopsis* (p.50)

1b. Not as above combination of characters..... 2

2a. Anus far removed from origin of anal fin; usually a small black naked fossa (sometimes obscure) located anterior to anus (fig. 2B). Branchiostegal rays 7..... 3

2b. Anus immediately anterior to anal fin; no black naked fossa on abdomen (fig. 2C). Branchiostegal rays 6..... 4

3a. Second dorsal spine strongly serrate (fig. 3C). Scales along suborbital shelf very stout, coarse, strongly adherent. Black naked fossa of light organ, when present, between bases of pelvic fins (fig. 2B). Pelvic fin rays 9-10 (usually 10).....*Nezumia stelgidolepis* (p.47)

3b. Second dorsal spine weakly serrate (fig. 3B). Scales along suborbital shelf, if present, weak and deciduous. Naked fossa on abdomen very small, situated notably posterior to a line connecting bases of pelvic fins. Pelvic fin rays 10-11 (usually 11)..... .....*Nezumia liolepis* (p.46)

4a. Pelvic fin rays 7, rarely 6 or 8 (if 8, upper jaw long, extending past vertical through posterior margin of orbits and with no stout spinous

scutes on snout tip).....
.....*Coryphaenoides pectoralis* (p.37)

4b. Pelvic fin rays 8 or more (if 8, upper jaw shorter, not extending past vertical through posterior margin of orbits and with stout scute-like scales on snout tip)..... 5

5a. Teeth in upper jaws in one or two (widely separated) distinct rows, the teeth in the outer row much larger than those of inner row..... 6

5b. Teeth in upper jaws in two irregular rows (rows not distinct and not widely separated), or more than two rows, or teeth in bands..... 8

6a[1]. Pores on ventral surfaces of lower jaws and suborbital region large and prominent (figs. 12, 15B)..... 7

6b[1]. Pores on ventral surfaces of lower jaws and suborbital region small, inconspicuous (fig. 15A) 8

7a. Outer ray of pelvic fin extremely long, 136-192 peroent of H.L. First dorsal fin rays II, 12-14.....*Coryphaenoides longifilis* (p.24)

7b. Outer ray of pelvic fin not notably long, less than 90 percent of H.L. First dorsal fin rays II,8-10.....*Coryphaenoides armatus* (p.27)

8a. Orbits small, horizontal diameter 15-21 percent of H.L. Ventral surfaces of snout, suborbital area, preopercle, and lower jaws naked. Interopercle slender (fig. 24)..... 9

8b. Orbits moderate to large, 23-34 percent of H.L. Naked areas on head usually confined to ventral surfaces of snout; suborbital area, preopercle, and lower jaws usually completely covered with scales. Interopercle broad, not shaped as in figure 24..... 10

9a. Snout pointed, protruding well beyond mouth. Scales stout, coarse, strongly spinulated; spinules aligned in 3-6 sharp, ridge-like rows. Length outer gill-slit 18-20 percent H.L. .....*Coryphaenoides yaquinae* (p.34)

---

[1]Couplet 6 comprises a second set of characters that will serve in the event of questionable interpretation of teeth patterns (from couplet 5) in specimens of *C. acrolepis, C. filifer,* and *C. yaquinae.* Teeth in upper jaws in *C. leptolepis* are always in a broad band.

9b. Snout bluntly rounded, scarcely protruding beyond mouth. Scales thin, deciduous; spinulation on scales reduced, present as greatly reclined points along low divergent ridges. Length outer gill-slit 23-28 percent H.L. .. ..*Coryphaenoides leptolepis* (p.42)

10a. Pelvic fin rays 8, rarely 9. First dorsal fin rays II,9-11. Entire orbital circumference black. Outer pelvic ray relatively short, 50-70 percent H.L. Entire leading edge of snout with series of enlarged tubercular scales.....*Coryphaenoides acrolepis* (p.12)

10b. Pelvic fin rays usually 9-10, rarely 8. First dorsal fin rays II,10-14. Orbital rim black anteroventrally only. Outer pelvic fin ray usually greater than 70 percent H.L. Leading edge of snout with enlarged tubercular scales only at tip and at lateral angles.. 11

11a. First dorsal fin rays usually II,10-12 (one with II,14). Internasal width broad, 20-25 percent H.L. Suborbital shelf very narrow anteriorly with small thorn-like branch on anteroventral margin (fig. 5B)..... .....*Coryphaenoides cinereus* (p.20)

11b. First dorsal fin rays usually II,12-14, rarely II,11. Internasal width narrower, 16-20 percent H.L. Suborbital shelf not especially narrow anteriorly, no thorn-like branch on ventral edge of shelf (fig. 5A).... .....*Coryphaenoides filifer* (p.17)

Genus *Coryphaenoides* Gunner, 1765

Coryphaenoides Gunner, 1765 (type-species *Coryphaenoides rupestris* Gunner, 1765, by monotypy).

Chalinura Goode and Bean, 1883, p. 198 (type-species *Chalinura simula* Goode and Bean, 1883, by monotypy).

Nematonurus Günther, 1887, p. 150 (as subgenus, type-species *Macrurus armatus* Hector, 1875, by subsequent designation).

Lionurus Günther, 1887, p. 141 (as subgenus, type-species *Coryphaenoides filicauda* Günther, 1878, by subsequent designation).

Moseleya Goode and Bean, 1896, p. 417 (type-species *Coryphaenoides longifilis* Günther, 1877, by original designation).

Albatrossia Jordan and Evermann, 1898, p. 2573 (type-species *Macrurus pectoralis* Gilbert, 1892, by original designation).

Bogoslovius Jordan and Evermann, 1898, p. 2574 (type-species

Bogoslovius clarki Jordan and Gilbert, *in* Jordan and Evermann, 1898, by original designation).
Dolloa Jordan, 1900, p. 897 (replacement for *Moseleya* Goode and Bean, preoccupied).
Hyomacrurus Gilbert and Hubbs, 1920, p. 422 (as subgenus, type-species *Macrourus hyostomus* Smith and Radcliffe, *in* Radcliffe, 1912, by original designation).
Hemimacrurus Fraser-Brunner, 1935, p. 322 (type-species *Macrurus acrolepis* Bean, 1884, by original designation).
Cariburus Parr, 1946, p. 57 (type-species *Macrurus zaniophorus* Vaillant, 1888, by original designation).

DIAGNOSIS. Branchiostegal rays 6. Anus situated immediately in advance of anal fin or slightly anterior to it, but never associated with a light organ. No light organs present. Dentition highly variable in size and arrangement between species, in broad bands to one or two distinct rows on premaxilla; in broad bands to a single row on mandible; teeth never very few and fanglike. Snout shape variable, from sharply pointed to bluntly rounded. Scaling on snout from completely and uniformly scaled to entirely naked; snout frequently armed with stout, tubercle-like buttons at tip and lateral angles. Suborbital ridge variable, from prominent, sharp, and stout, to faint and smoothly rounded; suborbital ridge never extends continuously to preopercle ridge. Pelvic fin highly variable in length and in ray count (which varies from 6-14). Second spinous ray of dorsal fin usually slightly prolonged and serrated along leading edge; rarely completely smooth. Anterior rays of second dorsal fin never well developed. Precaudal vertebrae 12-16 (judging from the few species we examined for this character). Pyloric caeca relatively few, simple, unbranched, usually slender and relatively long, usually fewer than 20. Retia and gas glands 2-6 each. Exposed fields of scales invariably covered with spinules or radial ridges at some stage of life; spinulation usually reduced in number and size in very young and in very deep dwelling, soft-bodied species (particularly in subgenus *Lionurus*); spinulation sometimes reduced in large specimens of some species.

REMARKS. We follow the Gilbert and Hubbs' (1916) concept of the genus, further clarified by the detailed works of Okamura (1970; 1971). We do not follow Parr's (1946) recognition of *Nematonurus*, *Cariburus*, *Coryphaenoides*, and *Chalinura*. Although Parr's structuring of this complex suits the western Atlantic species reasonably well, species from other parts of the world break down his generic framework. We do agree with Parr, however, that *Macrourus berglax* Lacépède, 1802, and *Coryphaenoides rupestris* represent opposite extremes. We have not examined in detail members of the genus *Macrourus* and, therefore, cannot comment fur-

ther on the genus. Marshall (1973) recognized only three species of *Macrourus: M. berglax, M. holotrachys* Günther, 1878, and *M. whitsoni* Regan, 1913.

Parr appreciated the distinctness of *C. rupestris* and Marshall and Iwamoto (1973) further added that "in its combination of a relatively high snout, scaling on the anterior gular membrane, a high number of gill rakers on the second arch, reduced mandibular dentition and short abdominal region, *C. rupestris* is not closely related to any known species of the genus." In fact, in its head and body shape, *C. rupestris* is remarkably similar to members of *Cetonurus*, a macrourine genus with seven branchiostegal rays. If we followed Parr's definition of *Coryphaenoides*, the only species included would be *C. rupestris*.

Parr's diagnosis for *Nematonurus* is untenable. He used proportional measurements to differentiate *Nematonurus* from *Cariburus, Chalinura*, and *Coryphaenoides*. His diagnostic characters, however, show considerable individual as well as size-related variation. For example, he used the length of the trunk, as reflected in the measurement snout to anal origin, as a key character distinguishing *Nematonurus* from the other three genera. *Nematonurus* supposedly has a snout-to-anal-origin length nearly twice that of the head compared with less than two-thirds longer than head in *Cariburus, Chalinura*, and *Coryphaenoides*. A brief survey of that measurement in other species shows how unacceptable it is a generic character. *Coryphaenoides armatus*[2] has an exceptionally long trunk and its great snout-to-anal measurement (160-210 percent of head length) reflects this. But some specimens of *C. macrocephalus* Maul, 1951, have trunks almost as long (150-190 percent) but with the lower part of the range well below the "less than 2/3 longer than head" figure. Other species that fall on either side of the supposed dividing line include: *'pectoralis'* (144-182), *'yaqinae'* (163-178), *'guentheri'* (Vaillant, 1888) (159-179), *'colon'* Marshall and Iwamoto, 1973, (158-178), *'filifer'* (129-174), and *'acrolepis'* (142-167). Thus, based on that character, different individuals of one species may fall in either key category.

The same sort of situation applies with Parr's other character for *Nematonurus*, "ventrals well behind pectorals, but distance from base of outer ventral rays to anal fin more than 2/3 length of head." Small individuals of *'arma-*

---

[2]It should be noted that Parr (1946, p. 18) used *Nematonurus goodei* in his discussion of the subfamily, yet he later placed that name in the synonymy of *N. armatus*. Furthermore, he failed to realize that Gilbert and Hubbs (1916, p. 162) did not retain *Nematonurus* as a genus but rather relegated it to subgeneric status.

tus' (see fig. 13) and *'macrocephalus'* and most specimens of *'pectoralis'*, *'longifilis'*, and *'yaquinae'* have their ventrals directly under the pectorals, but their outer ventral to anal measurements fall at or beyond the supposed "2/3 length of head" limit. A few examples of this measurement (expressed as percent of head length) serve to illustrate its variability within a species and its wide overlap between distantly related species: *'cinereus'* 43-57; *'filifer'* 41-77; *'acrolepis'* 49-67; *'pectoralis'* 51-76; *'yaquinae'* 61-77.

Parr's *Cariburus* and *Chalinura* represent two relatively distinct but closely related groups. However, using his definitions would necessitate including in *Cariburus* most species that we consider as belonging in subgenus *Coryphaenoides*. If we accept Parr's concepts of both *Coryphaenoides* and *Cariburus*, then *Cariburus* must be relegated to the status of a junior synonym of *Hemimacrurus* Fraser-Brunner with *Macrurus acrolepis* Bean as type-species.

Marshall (1973) used other characters to redefine the several natural groups within the *Coryphaenoides* complex. However, his key to the genera breaks down, in places, when dealing with this complex. For example, in one couplet he used the extent of scaling on the head and snout to differentiate *Coryphaenoides* from *Macrourus*, *Nematonurus*, *Chalinura*, and *Lionurus*, but our experience has been that this character is too variable between and within species of *Coryphaenoides* to be consistently useful at the generic level. One of Marshall's key characters for distinguishing *Coryphaenoides* is "Head fully scaled except for the gular and branchiostegal membranes." Marshall and Iwamoto (1973) on the other hand reported scales on the anterior part of the gular membrane in *C. rupestris*, and we have found small loose scales on some specimens of *C. acrolepis* and *C. filifer*. Marshall's use of retia mirabilia numbers appear good for distinguishing *Coryphaenoides* (4) and *Macrourus* (4) from *Nematonurus* (5?), *Chalinura* (6), *Lionurus* (6), and *Hyomacrurus* (2). This character lends support for recognizing a subgenus *Albatrossia* to include *'pectoralis'*, a species Marshall and Iwamoto (1973) included in *Coryphaenoides*, but which has only two retia. The high retia counts in *Nematonurus* (5 *fide* Marshall, but we counted 6 in *'yaquinae'* and *'armatus'* and only 4 in *'longifilis'*), *Chalinura* and *Lionurus* probably indicates a close relationship of the three. (See also comments under 'Remarks', p. 80, in description of subgenus *Chalinura*.) Marshall's figures for abdominal vertebrae numbers is inconsistent with our limited findings. He gives 11 or 12 as the number in *Coryphaenoides*, but our data show *'acrolepis'* with 14-16, *'filifer'* with 13-14, *'cinereus'* with 13-14, and an undescribed species from the Eastern Pacific with 12. *Nematonurus*, according to Marshall, has 15, but we found 13-15 in *'armatus'*, 13-14 in *'pectoralis'*, and 14-15 in *'longifilis'*.

Although we agree that Marshall's genera do generally represent natural groups, we feel that they are best considered as subgenera. It is apparent that *Chalinura, Coryphaenoides, Lionurus, Nematonurus,* and *Hyomacrurus* are more closely related to each other than to any genus outside this group. Treating *Coryphaenoides* as a broadly encompassing genus and using subgeneric designations for the groups within *Coryphaenoides* conveys our ideas of relationships best. Bolin (1947) and Rosen and Bailey (1963, pp. 5-7) gave useful discussions of the pragmatic and philosophic needs of taxonomy in the delimitation of genera. We have given their comments much consideration in our treatment of the *Coryphaenoides* complex.

The diagnoses given below for the three subgenera of *Coryphaenoides* from the eastern North Pacific are preliminary and subject to alteration when examination of other specimens adds additional information. It is apparent that much work remains before a good understanding of the phylogeny of this diverse genus is realized.

VARIATION OF DENTITION PATTERNS IN GENUS *CORYPHAENOIDES*

Patterns of dentition have long been used to support generic recognition of groups of species related to *Coryphaenoides.* Dentition patterns were initially used by Günther (1887, p. 124) to distinguish the genera *Coryphaenoides, Nematonurus,* and *Chalinura.* Goode and Bean (1896) and Jordan and Evermann (1898) used them in distinguishing even more genera. Gilbert and Hubbs (1916), however, after examining most of the known species of macrourids, found species with intermediate dentition. They consequently placed *Albatrossia* and *Bogoslovia* in the synonymy of *Nematonurus,* relegated *Nematonurus* to subgeneric status under *Coryphaenoides,* and placed *Chalinura* in the synonymy of subgenus *Coryphaenoides.* Okamura (1970; 1971) concluded after detailed study of many different characters, including dentition patterns, that *Nematonurus* is best treated as a subgenus of *Coryphaenoides.* Marshall (1973) used dentition patterns in his key to the macrourine genera to separate *Nematonurus, Chalinura,* and *Lionurus.* Our examination of large series of specimens of some of the species treated here revealed much variation in dentition patterns within and between species, such that they cannot generally be used as primary characters to distinguish genera. Nevertheless, enough differences do exist between certain groups in the *Coryphaenoides* complex that the character may be of some use at the subgeneric level. The dentition patterns of species belonging to three subgenera of *Coryphaenoides* are, therefore, here described in detail.

1. Subgenus *Coryphaenoides.* Members of subgenus *Coryphaenoides* characteristically have teeth in bands on both

jaws. Unlike *Chalinura*, with no variation in premaxillary dentition, in *Coryphaenoides* the teeth vary considerably making it difficult to utilize dentitional characters to differentiate between this subgenus, *Nematonurus*, and the three members of subgenus *Coryphaenoides* considered here. In *C. (C.) acrolepis*, the pattern of premaxillary teeth is variable at all sizes; variation does not appear to be associated with age or growth. Teeth are arranged in either two irregular rows or in a narrow band; in the latter case, the outer series of teeth is often much enlarged. Mandibular teeth are smaller than those on the premaxilla, although similarly arranged. *Coryphaenoides (C.) cinereus* is unlike either *C. acrolepis* or *C. filifer* in having both jaws with narrow bands of uniformly small teeth which do not seem to vary extensively. The dentition of *C. filifer* resembles that of *C. acrolepis* in type of variation but shows a lesser degree. Most individuals of *C. filifer* have premaxillary teeth in bands with enlarged outer series. The pattern of the mandibular teeth is usually irregularly biserial but is occasionally narrowly banded.

2. Subgenus *Nematonurus*. Members of subgenus *Nematonurus* usually have premaxillary teeth in two distinct rows, the inner row well separated from the outer one and much reduced. Mandibular teeth are usually uniserial but sometimes irregularly biserial in arrangement. Three out of four northeast Pacific species of *Nematonurus (C. yaquinae* the exception) exhibit these dentition characteristics in specimens smaller than about 700 mm. total length, but not in larger ones. Premaxillary teeth of large specimens of *C. pectoralis* are in bands that consist of very large, strong, slightly recurved teeth that decrease in size inwardly. Mandibular teeth are in two irregular rows or very narrow bands in larger individuals. The premaxillary dentition pattern of *C. longifilis* does not change with size of the fish, but remains in essentially two rows. Mandibular teeth in *C. longifilis* are in one or two rows; when in two rows, teeth in the outer row are much reduced while those in the inner are enlarged. In *C. armatus*, the inner series of the premaxilla regresses with increase in size, with the result that, in large specimens, the premaxillary dentition consists of only a single row. Mandibular dentition is uniserial at all sizes. In *C. yaquinae*, teeth in the upper jaws are arranged in three irregular rows or in a widely scattered band. Teeth in the lower jaws are in about two irregular series near the symphysis and in a single row posteriorly.

3. Subgenus *Chalinura*. The dentition pattern of *Coryphaenoides (Chalinura) leptolepis* is generally consistent with that of other members of the subgenus. The premaxillary dentition invariably consists of a wide band of uniformly small teeth, the band narrowing posteriorly, with an

outer series of much enlarged wide-spaced teeth. The arrangement of mandibular teeth varies, however, both with size and between individuals. Small (shorter than 200 mm. total length) individuals have teeth of uniform size, biserial or in bands, but irregularly arranged. Larger specimens tend to have a uniserial (although often irregular) arrangement of teeth. Most large (longer than 400 mm. total length) members of *C. leptolepis* have spaced, uniform, uniserially arranged mandibular teeth, as characteristic for the subgenus.

Subgenus *Coryphaenoides* Gunner

DIAGNOSIS. Arrangement of teeth variable but usually in a narrow to broad band on both jaws and never in (1) two distinct rows above and one row below, or (2) a broad cardiform band of minute teeth with distinctly enlarged, spaced outer series above and a distinct single row of slightly enlarged teeth below. Anus immediately in front of anal fin. Scales usually adherent and coarse with well developed spinules; scales at tip and lateral angles of snout and along suborbital ridge often stoutly enlarged and deeply embedded. Opercular openings usually somewhat restricted ventrally and broadly connected to isthmus, with rather narrow free fold or none over isthmus. Outer (first) gill-slit moderately to greatly restricted. Precaudal vertebrae 12-16. Retia and gas glands 2-4 each.

Coryphaenoides (Coryphaenoides) acrolepis (Bean). (Figures 6, 7.)

Macrurus acrolepis Bean, 1884, pp. 362-363 (original description; holotype, USNM 32496, from stomach of a fur-seal, Juan de Fuca Strait off Neah Bay, Washington); Gilbert, 1895, p. 457 (*Albatross* collections records off Washington and Oregon, 345-786 fathoms (631-1437 meters)); Jordan and Gilbert, 1899, p. 487, pl. 82 (1 juvenile specimen; illustration; Bering Sea off Bogoslof Island, *Albatross* station 3634 in 664 fathoms (1214 meters)); Evermann and Goldsborough, 1907, p. 350, fig. 131 (records; illustration of juvenile after Jordan and Gilbert, 1899); Gilbert and Burke, 1912, p. 91 (8 *Albatross* collections off Aleutian Islands and east of Kamchatka, in 344-1217 fathoms (629-2226 meters)); Gilbert, 1915, p. 376 (records off California between San Diego and Monterey Bay, in 331-1350 fathoms (605-2469 meters)); Townsend and Nichols, 1925, p. 16, pl. 4 (numerous specimens between 29°N. and 36°N., in 534-1090 fathoms (976-1993 meters)); Johnsen, 1927, p. 241 (considered *Ateleobrachium pterotum* Gilbert and Burke to be a larva of *"Macrurus* sp., possibly *acrolepis"*); Schultz and DeLacy, 1936, p. 15 (range, records).

Macrurus firmisquamis Gill and Townsend, 1897, p. 234 (original description; holotype, USNM no. 48779, 31 inches long, Bering Sea, SW. of Pribilof Island, *Albatross* collections).

Bogoslovius firmisquamis, Jordan and Evermann, 1898, pp. 2575-2576 (description); Evermann and Goldsborough, 1907, p. 349 (1 specimen; Bering Sea).

Coryphaenoides bona-nox Jordan and Thompson, 1914, p. 305, pl. 38, figs. 1, 1a (original description; illustrations; Japan); Gilbert and Hubbs, 1916, pp. 162-163 (2 specimens, Enoshima, Japan; species synonomized with *Macrurus acrolepis* Bean).

Hemimacrurus acrolepis, Fraser-Brunner, 1935, p. 322 (*Macrurus acrolepis* Bean designated type species for new genus *Hemimacrurus*); Grey, 1956, pp. 181-182 (distribution; records; extensive synonymy); Rass, 1963, p. 219, fig. 4, table 7 (description; illustration; 28 specimens, 51-87 cm.; Okhotsk Sea SW. of Bussol Strait and Kurile-Kamchatka Trench, over waters 3420-8100 meters in depth using midwater nets).

Coryphaenoides acrolepis, Gilbert and Hubbs, 1916, p. 162 (name in footnote; placed in subgenus *Nematonurus*); Makushok, 1967, pp. 201, 203 (comments on bathypelagic life habits, mass concentrations, feeding; compiled); Okamura, 1970, pp. 125-129, pl. 27, text fig. 51 (good description; illustration; 11 specimens, 380-748 mm. total length, off Japan, in 620-2200 meters).

Nematonurus acrolepis, Okada and Matsubara, 1938, p. 448 (not seen); Okada, 1955, pp. 424-425, text fig. (description; illustration).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers: outer series of first arch 5-7; inner series first arch 11-13 total (usually 2 + 10-11); inner series second arch 12-14 total (usually 2 + 10). Scales below origin of first dorsal fin 9-13; below origin of second dorsal fin 7-9.

MORPHOMETRY. Measurements based on 20 specimens ranging from 26-159 mm. in head length, 140-783 mm. in total length. The following in percent of head length: snout length 25-30; preoral length 13-19; horizontal diameter of orbits 24-31; interorbital width 18-24; orbit to angle of preopercle 38-43; suborbital width 11-13; length upper jaw 36-44; length barbel 11-19; (usually 15-19); length outer gill-slit 14-22 (usually 15-16); preanal length 142-167; distance isthmus to anal origin 82-100; greatest body depth 57-82 (usually about 65-75); height first dorsal fin 72-93; length pectoral fin about 50-55; length pelvic fin about 50-70; interspace between first and second dorsal fins 8-15.

DESCRIPTION. Figures 6 and 7 show general features of

the fish at both small and large sizes. The head is relatively shallow, broad, and the surface contours are generally rounded. Relatively stout ridged scutes cover the tip and lateral angles of the snout. Ridges on the snout and suborbital are rounded and not particularly conspicuous in larger specimens. The ridges, however, appear somewhat more angular in smaller specimens (smaller than about 100 mm. head length). The interopercle is broadly exposed and scaled posteriorly beyond the preopercle. Gill openings are moderately wide; they extend forward to a point slightly behind a vertical through the posterior edge of the orbits. The gill membranes are restricted over the isthmus with only a narrow free fold, if any.

Some distinct size-related changes were noted in the morphometry of certain head characters. The snout appears more slender and less bluntly pointed in specimens larger than about 70 mm. head length. The head also seems much more robust in comparison to the body in the small specimens. The orbits are relatively smaller in the larger specimens. In specimens under 25 mm. head length, the orbits go approximately 0.7-0.9 times into the snout and about 1.1-1.3 into the postorbital length. In specimens 40-50 mm. head length, the orbits go about 0.9-1.1 times into the snout and 1.2-1.6 into the postorbital length. In the largest specimens, 100 mm. head length or larger, the orbits go about 1.2-1.3 times into the snout and about 1.8-2.0 into the postorbital length.

Scales are adherent and uniformly cover all surfaces of the head and body with the exception of the fins and a ventromedian area on the snout. This scaleless area on the snout continues posteriad as a narrow margin along the ventral edge of the snout and suborbital. In some specimens, the naked area extends dorsally over the leading edges of the snout on both sides of the midline. Patches of small scales are sometimes present on the branchiostegal and gular membranes of large specimens. Mucous pores, sometimes fairly prominent, liberally pocket the naked areas on the snout and suborbital. Scales along the suborbital are comparatively small, but resemble most scales on the head in being strongly adherent. Small, strong, close-set spinules form three sharp, divergent, ridge-like rows on most scales of the suborbital region. Scales on other parts of the head and body usually have spinules arranged in more than three rows, and the spinules are finer. In the largest specimens examined, five divergent rows of spinules were present on large scales of the trunk. The number of spinule rows varied from 3-5 in smaller specimens, but the rows were nevertheless well developed at all body sizes.

The paired, first dorsal, and anal fins are well developed, but no rays are particularly long. The first spinous ray of the dorsal fin protrudes as a sharp stout spike at the base of the long serrated second spine. Serrations on

the spine are large and strongly developed in all specimens, regardless of size. They are, however, more numerous and more closely spaced in individuals up to about 130 mm. head length; in larger specimens, serrations tend to be less prominent and reduced in size near the base. The outer ray of the pelvic fin is slender and slightly prolonged. The filamentous tip of that ray barely extends posteriad beyond the anal-fin origin in all specimens.

Four slender retia were each connected to four small gas glands in two specimens examined. Pyloric caeca were long and slender, 12, 12, and 14 in three specimens. Okamura (1970, p. 126) counted 13 in three specimens.

Coloration is generally grayish brown to dark chocolate brown overall, the darker color most common in the largest specimens. Specimens smaller than about 70 mm. in head length frequently tend to be tawny overall, with a silvery gray sheen about the abdomen and gill cover. Fins are pale to dusky in smaller specimens, but blackish in larger specimens. The orbital rim is conspicuously black in all fresh and most preserved specimens; this feature serves as a useful diagnostic character, particularly under field conditions.

COMPARISONS AND RELATIONSHIPS. *Coryphaenoides acrolepis* seems closest to *C. filamentosus* Okamura from Japan. It bears many superficial resemblances to that species, especially in squamation and head configuration. *Coryphaenoides filamentosus*, however, has a blunter, higher, and shorter snout, a deeper body, broader interorbital space, longer pectoral fins, higher first dorsal fin, and the gill membranes forming a broad, free fold over the isthmus.

Coryphaenoides acrolepis is not likely to be confused with any boreal eastern Pacific species of Macrouridae. The species is readily distinguished from *C. armatus* by its fewer pelvic finrays, its dentition, the absence of large naked areas below the suborbital, preopercle, and mandible (that are so conspicuous in *C. armatus*), the shorter interspace between the dorsal fins (8-15 percent head length compared with 39-77 percent), the larger orbits (24-28 percent head length vs. 18-24), and numerous other features.

Coryphaenoides acrolepis can be distinguished from *C. filifer* by its fewer dorsal rays (II, 8-11 versus usually II, 12-13), fewer pelvic rays (usually 8 versus usually 10-11), its shorter paired and first dorsal fins, more adherent scales armed with stouter spinules arranged in sharper more divergent rows, black orbital rims, and numerous other characters.

REMARKS. This well known, widely distributed fish has been reported many times. It was the first known macrourid fish from the eastern Pacific, and it is now probably the best known rattail in the entire North Pacific. Although the holotype (the only type specimen), is in poor condition (having come from the stomach of a seal), there is little doubt that specimens reported subsequent to the original

description under the name *C. acrolepis* all refer to the same species.

We have examined the holotype (USNM no. 48779) of *Macrurus firmisquamis* Gill and Townsend and found no difference between that specimen and others identified by various workers as *C. acrolepis*.

SIZE. The holotype of *M. firmisquamis*, at 159 mm. head length and 783 mm. total length, is the largest specimen we have examined. Rass (1963, p. 220) reported specimens as large as +87 cm. in length taken over the Kurile-Kamchatka Trench.

DISTRIBUTION. The species is broadly distributed and abundant in boreal slope waters of the North Pacific basin. It ranges from southern California to Alaska in the eastern Pacific and from Japan to the Okhotsk and Bering Seas in the western Pacific. Its primary depth range appears to be about 600 to 2500 meters, but the species is recorded from drags made at even greater depths. Rass (1963, table 7) reported 25 specimens captured over the Kurile-Kamchatka Trench with a conical net fished from 8000 meters to the surface over a bottom depth of 8100 meters. It is doubtful, however, that the fish were actually captured at the 8000-meter level. They were more likely taken in the mid-waters where they apparently lead a partially bathypelagic life. Rass (1963, p. 221) gave an example of a large specimen of *C. acrolepis* taken in a fish-plankton net in waters more than 1250 meters above the bottom (which was 3250 meters below the surface). Makushok (1967, p. 201) stated that the species is not infrequently taken several thousand meters above bottom, and that based on stomach contents, Birshteyn and Vinogradov (1955, as cited by Makushok) considered the species bathypelagic. The R/V *Yaquina* captured a 610-mm. specimen of *C. acrolepis* (OSUO no. 1718) in a 6-foot midwater trawl fishing at a depth of 0-1000 meters over a bottom depth of 2800 meters (44°42.2'N., 125°44.8'W.).

SPECIMENS EXAMINED. USNM no. 48779 (holotype of *Macrurus firmisquamis* Gill and Townsend, 159 mm. H.L., 783 mm. T.L.) Bering Sea, SW. of Pribilof Island, *Albatross* collections; USNM no. 188140 (1, 67 mm. H.L.), off Oregon, 45°49' N., 124°52'W., R/V *Cobb*, in 415-427 fathoms (759-780 meters); UW no. 19293 (1, 153 mm. H.L., 655 mm. T.L.), SW. of Columbia River, 46°N., 125°W., 750 fathoms (1372 meters); UW no. 19308 (4, 80-141 mm. H.L., 400-630 mm. T.L.), SW. of Columbia River, 46° N., 125° W., 750 fathoms (1372 meters); USNM uncataloged (1, 99 mm. H.L.), off Washington, 47°22'N., 125°48'30"W., *Albatross* station 3074, 877 fathoms (1604 meters); OSUO uncataloged (6, 74-144 mm. H.L., +340-700 mm. T.L.), 48°38.0'N., 127°00.0'W., *Yaquina* trawl no. BMT 9 DWD, in 2189 meters; OSUO no. 377 (1, 121 mm. H.L., 540 mm. T.L.),

48°38.5'N., 126°58.0'W., *Yaquina* trawl no. BMT 10 DWD, in 1998 meters; OSUO no. 393 (1, 74 mm. H.L., 345 mm. T.L.), 44°34.4'N., 124°58.4'W., *Yaquina* trawl no. OTB 22, in 800 meters; OSUO no. 402 (1, 113 mm. H.L., 500 mm. T.L.), 44°21.7'N., 125°07.9'W., *Yaquina* trawl no. OT 27, in 1000 meters; OSUO no. 401 (1, 132 mm. H.L., 610 mm. T.L.), 44° 27.6'N., 125°14.2'W., *Yaquina* trawl no. OT 28, in 1150 meters; OSUO no. 394 (1, 77 mm. H.L., 326 mm. T.L.), 44°20.7' N., 125°05.9'W., *Yaquina* trawl no. OT 42, in 823-914 meters; OSUO no. 395-397 (3, 26-77 mm. H.L., 140-352 mm. T.L.), 44° 20.8'N., 124°59.9'W., *Yaquina* trawl no. OT 43, in 640-732 meters; OSUO no. 398-399 (2, 139-121 mm. H.L., 630-564 mm. T.L.), 44°27.2'N., 125°13.3'W., *Yaquina* trawl no. OT 52, in 1372-1394 meters; OSUO uncataloged (1, 137 mm. H.L., about 578 mm. T.L.), 44°36.0'N., 125°17.0'W., *Yaquina* trawl no. OTB 63, in 1600 meters.

Coryphaenoides (Coryphaenoides) filifer (Gilbert). (Figures 4B, 5A, 8, 10, 11.)

Chalinura filifera Gilbert, 1895, pp. 458-459 (original description; types, 3 specimens, 520-550 mm. long; British Columbia off Queen Charlotte Island, *Albatross* station 3342, in 1588 fathoms (2904 meters)); Clemens and Wilby, 1946, pp. 135-136, fig. 77 (description; illustration).

Macrurus lepturus Gill and Townsend, 1897, p. 233 (original description; holotype USNM no. 48767, 22 inches long, Bering Sea, SW. of Pribilof Island, *Albatross* station 3604, in 1401 fathoms (2562 meters)); Jordan and Evermann, 1898, pp. 2584-2585 (description; *Macrurus dorsalis* Gill and Townsend synonymized with *M. lepturus*); Gilbert and Burke, 1912, pp. 91-92, fig. 35 (description; illustration of holotype; 2 specimens, 375-550 mm., off Yunaska Island, Aleutian chain, *Albatross* stations 4764, 4765, in 1130 fathoms (2065 meters) and in 1217 fathoms (2226 meters), respectively).

Macrurus dorsalis Gill and Townsend, 1897, p. 233 (original description; holotype USNM no. 48768, 22 inches long, Bering Sea, SW. of Pribilof Island, *Albatross* station 3604, in 1401 fathoms (2562 meters)); Jordan and Evermann, 1898, p. 2585, footnote, (description from Gill and Townsend; species synonymized with *Macrurus lepturus* Gill and Townsend).

Coryphaenoides filifer, Gilbert and Hubbs, 1916, p. 143 (name only).

Coryphaenoides lepturus, Gilbert and Hubbs, 1916, p. 144 (name only).

Coryphaenoides (Nematonurus) lepturus, Gilbert and Hubbs, 1916, p. 162, footnote (name only).

Nematonurus lepturus, Grey, 1956, p. 167 (distribution).

Coryphaenoides filifera, Clemens and Wilby, 1961, pp. 169-170, fig. 87 (description; illustration).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers: outer series of first arch 8-10 total; inner series first arch 12-14 total; inner series second arch 11-14 total (usually 1-2 + 10-12). Scale rows below origin of first dorsal fin 10-11; below origin of second dorsal fin 7-10.

MORPHOMETRY. Measurements from 45 specimens ranging 54-125 mm. in head length, 264-662 mm. in total length. The following in percent of head length; snout length 24-29; preoral length 5-18 (usually 10-15); internasal width 17-20; horizontal diameter of orbits 22-30 (usually 24-28); interorbital width 22-27; orbit to angle of preopercle 41-48; suborbital width 9-13; length upper jaw 36-42; length barbel 6-13 (usually 9-12); length outer gill-slit 18-26 (usually 20-22); preanal length 129-174; distance isthmus to anus 68-108; greatest body depth 68-92 (usually about 70-80); height first dorsal fin 79-118; length pectoral fin 56-69; length pelvic fin 74-135; interspace between first and second dorsal fins 9-29.

DESCRIPTION. General features of the fish are best seen in the illustration (fig. 8). *Coryphaenoides filifer* has a moderately broad head with large orbits that are round to oval. Small specimens tend to have proportionately larger orbits than larger specimens (fig. 10). Head contours are gently rounded in well preserved specimens. The interopercle is broad and slightly exposed along its posteriormost end where it has small, loose scales. The chin barbel is short, stout at the base but tapering into a thin tip. Gill openings are broad and extend forward to a vertical about a pupil's length behind the orbits. The gill membranes are closely joined to the isthmus with no free fold present. Pores of the sensory lateralis system are small and scarcely developed.

The tip of the snout is armed with a stout, conical scute, which is generally stouter and proportionately larger in *C. filifer* than in any other species treated in this paper. It normally has between four and seven usually serrated ridges that radiate out from the apex; the horizontal (mid-lateral) ridges are usually markedly larger than the others, resulting in the scute being broader than high.

Scales are moderate in size with about three to seven parallel to slightly divergent ridge-like rows of very small, greatly reclined spinules. Scales uniformly cover almost all of the head and body. A small area along the anteroventral snout surface is naked. The medioventral surface of the gular membrane has small, loose scales in a few specimens, but they are apparently rubbed off in most others. Ventral surfaces of the lower jaws are broadly covered with scales. The lateral angles of the snout have a few deeply embedded, stout, but small scute-like scales. These

are not prominent in well preserved specimens. The broad suborbital shelf has a double row of stout, deeply embedded scales (except in an occasional specimen with one row of embedded scales, see figs. 4B and 8). Again, these stout scales are not prominent in well preserved specimens, but they stand out in specimens having most other scales removed. No other ridges on the head have similar deeply embedded scale rows.

Paired fins and the first dorsal fin are large and long. The first spinous ray of the dorsal fin is short and closely appressed to the long, serrated second spinous ray. The outer pelvic ray is elongate with a broad membranous mesial border.

Coloration is dark brown to swarthy, especially over the head. Membranes of the upper and lower jaws and the gular region are whitish with a bluish to blackish tinge. A thin black margin of the upper lip overlies the teeth. Fins and gill membranes are black. The peritoneum is brownish black; the buccal membrane is grayish to blackish.

Ten long, slender pyloric caeca were found in a *Yaquina* specimen from station BMT 190. Four retia and four small gas glands were found in the swimbladder of a specimen from British Columbia (UBC64-444).

COMPARISONS AND RELATIONSHIPS. *Coryphaenoides filifer* appears most closely related to *C. cinereus* with which it shares many general features such as head, body, and fin configurations, squamation, dentition, barbel shape and size, and many meristic and morphometric features. *Coryphaenoides filifer* is distinguishable from *C. cinereus* chiefly by: (1) its broader suborbital shelf (fig. 5A) with no anteroventral process; (2) its more adherent, stouter scales on the suborbital shelf (fig. 4B); (3) its generally more segmented first dorsal rays (usually 12-13 compared with usually 10-11 in *C. cinereus*); and (4) its narrower internasal space (17-20 percent of head length compared with 21-25 percent in *C. cinereus*).

Coryphaenoides filifer also appears fairly close to *C. acrolepis* but is easily distinguished from that species in having more first dorsal (usually II,12-13 versus II,9-11) and pelvic (9-10 versus usually 8) fin rays, longer pelvic fins (74-135 percent head length versus 50-70), and a somewhat shorter barbel (6-12 percent head length versus 11-19).

REMARKS. A search through the type collection at the U. S. National Museum of Natural History in April, 1971, failed to reveal any of the three syntypes of *C. filifer*. Böhlke (1953) did not list any paratype for the species in the Stanford University collections, and our visit to that collection in March 1972 revealed no specimen of *C. filifer*. The distinctive features of the species, as noted above, and the excellent original description leave little doubt that the name *'filifer'* truly applies to the specimens herein considered.

Although we have not examined the type specimens of *Macrurus lepturus* Gill and Townsend and *M. dorsalis* Gill and Townsend, the descriptions of these two species and the illustration of the holotype of the first (given by Gilbert and Burke, 1912, fig. 35) suggest that the names *'filifer'*, *'dorsalis'*, and *'lepturus'* all refer to a single species. The high first dorsal fin ray counts, the head physiognomy, the fin sizes, the strong terminal snout scute, the suborbital shelf, the barbel size, and scale features support our view that they are one and the same. The descriptions of *'lepturus'* and *'dorsalis'* also leave open the possibility that the species are synonyms of *C. cinereus*. The absence of prior records of *'filifer'* from the Bering Sea, where *'cinereus'* is apparently abundant, lends credence to this idea. But the high first dorsal fin ray counts and the shape of the suborbital shelf (illustrated for *'lepturus'* by Gilbert and Burke, 1912) weigh heavier towards *'filifer'* as the correct identification.

DISTRIBUTION. Eastern North Pacific from the Bering Sea to southern California. Depth range 2065-2904 meters.

SPECIMENS EXAMINED. OSUO uncataloged (1, 64 mm. H.L., 321 mm. T.L.), 47°51.1'N., 127°02.3'W., *Yaquina* trawl no. DWD 5, in 2519 meters; OSUO uncataloged (2, about 90-93 mm. H.L., 465-575 mm. T.L.), 48°39.6'N., 126°55.3'W., *Yaquina* trawl no. DWD 9, in 2189 meters; OSUO uncataloged (2, 45-83 mm. H.L., 235-585 mm. T.L.), 44°40.5'N., 125°46.0'W., *Yaquina* trawl no. OTB 49, in 2800 meters; OSUO uncataloged (2, 72-119 mm. H.L., 357-638 mm. T.L.), 44°34.0'N., 125°32.0'W., *Yaquina* trawl no. BMT 186, in 2816 meters; OSUO no. 406 (1, 114.5 mm. H.L.), 44°58.8'N., 125°40.4'W., *Yaquina* trawl no. BMT 188, in 2792 meters; OSUO uncataloged (5, 108-114 mm. H.L., 570-630 mm. T.L.), 45°19.8'N., 125°44.3'W., *Yaquina* trawl no. BMT 190, in 2597 meters; OSUO uncataloged (1, 67.6 mm. H.L., +263 mm. T.L.), 45°39.2'N., 125°44.6'W., *Yaquina* trawl no. BMT 192, in 2450 meters; OSUO no. 333 through 339, 354 (8, 92-125 mm. H.L., 467-662 mm. T.L.), 46°00.7'N., 126° 42.4'W., *Yaquina* trawl no. BMT 256, in 2743 meters; OSUO no. 313 through 317 (5, 80-119 mm. H.L., 364-630 mm. T.L.), 45° 55.5'N., 126°39.4'W., *Yaquina* trawl no. BMT 258, in 2670 meters; OSUO uncataloged (1, 54 mm. H.L., 264 mm. T.L.), 45° 57.2'N., 127°40.7'W., *Yaquina* trawl no. BMT 276, in 2761 meters; SIO 66-53-62 (1, 100 mm. H.L., +520 mm. T.L.), off California, 38°01.8'N., 124°10.8'W., UBC64-444 (12, 30-116 mm. H.L., +150-610 mm. T.L.), off Triangle Island, British Columbia; UBC64-446 (1, 109 mm. H.L., 570 mm. T.L.), off Triangle Island, British Columbia.

Coryphaenoides (Coryphaenoides) cinereus (Gilbert). (Figures 4A, 5B, 9, 10, 11.)

Macrourus cinereus Gilbert, 1895, p. 457 (original descrip-

tion; numerous specimens, N. of Unalaska Island and North Pacific, S. of Ookamok Island, *Albatross* stations 3307, 3329, 3340, in 399-1033 fathoms (730-1889 meters)); Jordan and Evermann, 1896, p. 497 (records; distribution); 1898, pp. 2586-2587 (description after Gilbert; "Bering Sea; excessively abundant," many specimens near Bogoslof Island, 664 fathoms (1214 meters)); Jordan and Gilbert, 1899, p. 487 (record off Bogoslof Island, *Albatross* station 3634); Evermann and Goldsborough, 1907, p. 350 (records, Bering Sea and Cape Edgecumbe, *Albatross* station 3634, 4267, in 660-922 fathoms (1207-2048 meters)); Gilbert and Burke, 1912, p. 92 (7 Bering Sea localities, 344-771 fathoms (629-1410 meters)).

Coryphaenoides cinereus, Gilbert and Hubbs, 1916, p. 167 (characters; 2 specimens from off Sakhalin Island, *Albatross* station 5015, in 510 fathoms (933 meters)); 1920, p. 371 (sexual dimorphism); Schmidt, 1950, pp. 61-62, table 6 (description; 1 specimen, 245 mm. T.L., Sakhalin, in 1643 meters); Okamura, 1970, pp. 129-133, pl. 28, text-fig. 52 (description; illustration; geographic variation).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers: outer side of first arch 0-1 + 9-10; inner side of second arch 1-2 + 10-13 (total 12-14). Scales below origin of second dorsal fin 7-10 in 16 Bering Sea and Okhotsk Sea specimens, 9-10 1/2 in 4 eastern Pacific specimens.

MORPHOMETRY. Measurements based on 20 specimens ranging 39-94 mm. in head length, 217-560 mm. in total length. Measurements for 16 specimens from the Bering Sea and Okhotsk Sea are given first followed in parentheses by measurements for 4 specimens from off Oregon and British Columbia. Where a measurement of one specimen deviated considerably from the range of the others, that measurement is enclosed in brackets. The following in percent of head length: snout length 25-29, (28-29); preoral length [8]11-18,(16-19); internasal width 21-24,(23-25); horizontal diameter of orbit 27-34,(23-28); interorbital width 24-30,(27-30); orbit to angle of preopercle 42-48,(46-49); suborbital width 11-16,(13-14); length upper jaw 35-38[41], (38-39); length barbel 2-8, (6-7); length outer gill-slit [16]18-20,(20-23); preanal length 130-150,(135-156); greatest body depth 65-81,(79-87); height first dorsal fin 85-105; length pectoral fin 62-84; length pelvic fin 67-116, (83-141); interspace between first and second dorsal fins [9.5]15-22[24],(13-20).

DESCRIPTION. The head is broad, the orbits are large and slightly longer than the interorbital width in immature specimens, but becomes smaller relative to the interorbital width in mature individuals (fig.10). The snout is moderately acute and tipped with a broad spinous scute which has 4-10 finely

serrated radiating ridges. This spinous terminal snout scute is similar to that of *C. filifer* although normally smaller. The suborbital region has a prominent shelf that becomes very constricted anteriorly (figs. 4A, 5B). A small spike or prong juts ventrally from the lower anterior edge of the shelf (fig. 5B). The ascending limb of the preopercular ridge is slightly inclined from the vertical and usually extends dorsad to meet, at a tangent, the postorbital ridge. The interopercle is partially exposed beyond the preopercle; its posterior end is naked and broadly rounded. Upper jaws are moderate in size but fail to reach a vertical through the posterior margin of the orbits; the gill openings, however, are wide and extend forward to slightly behind that vertical. The mental barbel is very short and small; its length is less than the length of the posterior nostril.

Scales are moderate in size and relatively deciduous. Exposed fields of body and most head scales have numerous (5-9) rows of low, fine, parallel to slightly divergent, ridge-like rows of spinules. The number of spinule rows increases with size. The smallest specimens (39-40 mm. H.L.) examined had only 3 rows on large body scales while a larger (60 mm. H.L.) specimen had 6-7 rows and those larger than about 70 mm. in head length had 7-10 rows. Scales are apparently lacking in this species over the leading edge and most of the ventral surfaces of the snout. The head and body are uniformly scaled everywhere else, however, except for the gular and branchiostegal membranes and the interopercle. Scales along the suborbital shelf are thin and deciduous except for a few stout scales at the anteriormost end. In no specimen were stout, deeply embedded scales present along the entire course of the suborbital region (as in *C. filifer*). Grooved scales of the lateral line series are discontinuously arranged. The path of the lateral line appears as long broken dashes. Grooving of the lateral line scales is shallow and faint.

Dentition in both jaws is composed of very small and fine teeth in narrow bands. There is no distinct enlargement of the outer series of teeth in either jaw.

Pyloric caeca are short, much shorter than the orbit diameter and number 5-7 (Gilbert and Hubbs, 1916, p. 167). The gas bladder is large and filled with spongy white material. Four long, slender retia were connected to four small, globular gas glands in two large male specimens from the eastern Pacific. Gonads in these specimens were slightly developed; those in a large female specimen (UBC64-444) were moderately developed. Precaudal vertebrae based on X-ray photographs 13 (2 specimens) and 14 (1 specimen).

Coloration of denuded specimens is a dirty white with margins of scale pockets brownish. Paired and first dorsal fins are black in adult specimens, but dusky or pale in the young; the second dorsal fin and anal fin are dusky or grayish. Gill membranes are blackish. The oral cavity is dark

gray to black; branchial cavity walls and the peritoneum are black. The ventral edge of the orbits are black, but the remainder is grayish. The barbel is blackish. The species name *'cinereus'* is derived from its generally grayish color.

COMPARISONS AND RELATIONSHIPS. *Coryphaenoides cinereus* is closest to *C. filifer* and the two are often difficult to tell apart. Chief distinguishing characters are given under the comparisons section for *C. filifer*. In addition to those characters, other more variable, but often useful, ones were found. Thus *C. cinereus* tends to have a paler color, a slightly wider interorbital region (fig. 11), broader naked areas on the snout, and its lateral line grooves are fainter and more interrupted than in *C. filifer*.

Coryphaenoides cinereus is apparently also closely related to *C. filamentosus* Okamura from Japan, but it can be distinguished from that species in having softer head bones, scale spinules arranged in parallel, rather than divergent ridges, a larger orbit, and a shorter barbel (Okamura, 1970).

REMARKS. Gilbert and Hubbs (1916, p. 167) and Okamura (1970, p. 132) noted variations in meristic and morphometric characters exhibited by this species. Some of these variations are seen in the above section on morphometry where populations from different regions are compared. Overlap is seen in all compared characters, however, and there is no reason to suspect specific divergence.

Gilbert and Hubbs (1916) noted a particularly large variation in the length of the filamentous outer pelvic ray. A later reinvestigation (Gilbert and Hubbs, 1920, p. 371) showed this variation to be attributable to sexual dimorphism. The outer pelvic ray is notably larger in the male than in the female. Our specimens from Oregon and British Columbia confirm their observations. Three of our four large specimens were males with pelvic fin lengths of between 125-141 percent head length. The fourth specimen from British Columbia was a female with a pelvic fin length of only 83 percent head length.

DISTRIBUTION. The range of this species seems to be centered in the northwestern Pacific around the Bering Sea, Kamchatka, and the Okhotsk Sea where it is most abundant. The specimens reported here represent not only the first record of the species from the eastern Pacific outside the Bering Sea, but the Oregon specimen is also the largest and from the greatest depth (2832 meters compared with the previous depth record of 1890 meters). The paucity of material from this area, despite relatively extensive coverage by research vessels of the Scripps Institution of Oceanography, Oregon State University, and National Marine Fisheries Service (Seattle), indicates that the eastern Pacific is marginal to the normal range of the species.

Depth range approximately 630-2832 meters.

SPECIMENS EXAMINED. USNM no. 48577 (1 syntype, 75 mm. H.L., 408 mm. T.L.), *Albatross* collection; USNM no. 70849 (2, 61-63 mm. H.L., 345-333 mm. T.L.), Bering Sea, *Albatross* collection, 426 fathoms (779 meters); USNM no. 70908 (1, 39 mm. H.L., 217 mm. T.L.), *Albatross* collection, 682 fathoms (1247 meters); USNM no. 77249 (1, 62.5 mm. H.L., 381 mm. T.L.), S. of Sakhalin, *Albatross* collection, 426 fathoms (779 meters); MCZ no. 28211 (1, 81 mm. H.L., 430 mm. T.L.), *Albatross* collection; SU no. 22976 (1, 61 mm. H.L., 364 mm. T.L.), Okhotsk Sea off Sakhalin, 46°44'N., 144°02'E., 510 fathoms (932 meters), *Albatross* station 5015; SU no. 5742 (3, 59-73 mm. H.L.), Bering Sea, 54°51'N., 167°27'W., *Albatross* station 3634, 664 fathoms (1214 meters); SU no. 14229 (1, 87.5 mm. H.L., 494 mm. T.L.), *Albatross* collection, ?1904-05?; SU no. 11191 (1, 75 mm. H.L., 444 mm. T.L.), Bering Sea, *Albatross* collection, 1890; SU no. 5493 (4, 40-75 mm. H.L., +195-438 mm. T.L.) off Alaska Peninsula near Shumagin Island, 54°19'N., 159°40'W., 625 fathoms (1143 meters), *Albatross* station 3338; UBC64-444 (3, 84-97 mm. H.L., 488-520 mm. T.L.), British Columbia off Triangle Island area, 11 Sept. 1964; OSUO uncataloged (1, 94 mm. H.L., 560 mm. T.L.), 44°39.1'N., 126°40.1'W., *Yaquina* trawl no. CP-2-6, haul 271, 2832 meters.

Subgenus *Nematonurus* Günther

DIAGNOSIS. Teeth in upper jaws in two distinct series with outer series enlarged; mandibular teeth usually in a single series, when in two series, the outer much reduced. Retia 2-6, gas glands 2-6. Precaudal vertebrae 13-16.

REMARKS. Dentition appears to be the only useable character that will diagnose the subgenus as we have defined it. Based on this character, *Nematonurus* must include *C. armatus* (Hector), *C. pectoralis* (Gilbert), and *C. longifilis* (Günther) in addition to one or more other species not here considered. But, as indicated in our descriptions, *C. pectoralis* is widely divergent from *C. armatus* and *C. longifilis* by what seem to be several fundamental characters, such as swimbladder size and ossification of the skeleton. *Coryphaenoides (Nematonurus) longifilis* also appears superficially very different from *C. armatus*, but our material does not allow critical examination of important characters of *C. longifilis*. The only other species of macrourine rattail whose status in *Nematonurus* we are reasonably sure of is *C. lecointei* Dollo, 1900.

Coryphaenoides (Nematonurus) longifilis Günther.
(Figure 12.)

Coryphaenoides longifilis Günther, 1877, p. 439 (original

description; S. of Yeddo (Tokyo), Japan).
Macrourus (Nematonurus) longifilis, Günther, 1887, p. 151, pl. 35 (description, illustration; one specimen (holotype), 28 inches long, S. of Yeddo (Tokyo), Japan, *Challenger* station 235, in 565 fathoms (1033 meters)).
Moseleya longifilis, Goode and Bean, 1896, p. 417, pl. 100, fig. 349a (illustration after Günther; *Macrurus longifilis* Günther designated type species of new genus *Moseleya*).
Bogoslovius clarki Jordan and Gilbert, *in* Jordan and Evermann, 1898, p. 2575 (original description; 4 specimens, 24-41 cm. long, Bering Sea off Bogoslof Island, *Albatross* station 3634, in 664 fathoms (1216 meters)) (this description predates that of Jordan and Gilbert, 1899)); Jordan and Gilbert, 1899, pp. 487-488, pl. 83 (description, illustration; supposedly original description but described in an earlier publication by Jordan and Evermann, 1898).
Dolloa longifilis, Jordan, 1900, p. 897 (*Macrurus longifilis* designated type species of new genus *Dolloa*, erected to replace *Moseleya* Goode and Bean, preoccupied).
Coryphaenoides (Nematonurus) longifilis, Gilbert and Hubbs, 1916, pp. 159-161 (description; 3 specimens, off Japan, *Albatross* station 4956, in 720 fathoms (1317 meters) and station 4980, 507 fathoms (927 meters); Okamura, 1970, pp. 121-124, pl. 26, text fig. 50 (good description; illustration; southern Japan, in 850-1700 meters); 1971, figs. 5B, 63B (scale, alimentary canal).
Nematonurus longifilis, Kamohara, 1952, p. 96 (listed).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers on first arch 2-3 + 12-13 (total 14-16); on second arch 2-3 + 11-13 (total 13-15). Scales below origin of first dorsal fin 16; below origin of second dorsal fin 14 (one specimen). Precaudal vertebrae 14-15. Retia 4; gas glands 4.

MORPHOMETRY. Measurements from 7 specimens ranging +240-360 mm. in total length, 44-68.5 mm. in head length. The following in percent of head length: snout length 25-31; horizontal orbit diameter 20-25; interorbital width 23-24; orbit to angle of preopercle 38-45; suborbital width 10-13; length upper jaws 43-47; length barbel 2-3.5; length outer gill-slit 21-23; preanal length 130-147; distance isthmus to anal origin 74-87; greatest body depth about 64-72; height first dorsal fin 72-87; length pectoral fin 77-114; length pelvic fin 136-192; interspace between first and second dorsal fins 11-15.

DESCRIPTION. The head is large and compressed with the snout profile low and smoothly rounded; the scarcely developed rostrum results in the mouth being essentially terminal. The suborbital region is almost flat, but a low, smooth ridge traverses the region midlaterally. The inter-

opercle is broadly exposed posteriorly beyond the preopercle. The barbel is rudimentary. Sensory pores on the head are well developed.

The first dorsal, pectoral, and pelvic fins are all long and well developed. The second spinous dorsal ray is finely serrated and slightly prolonged into a filamentous tip. The dorsalmost pectoral ray is
to the long second ray. The third ray of the pectoral fin is longest. The fourth, fifth, and sixth rays of that fin are about as long as the second ray, all of these being about equal in length to the postrostral length of the head. The outermost pelvic ray is thick and greatly prolonged; the length is normally more than 1.5 of length of the head.

Scales are thin, small, and appear to cover almost all of the head and body. Gill membranes are entirely naked. The lower jaw is finely scaled. No apparent naked areas are present on the snout or suborbital area of specimens we have examined, but fresh specimens may indicate otherwise.

Teeth in the upper jaws are in two distinct and widely separated series, between which very small teeth are sometimes scattered. Teeth on the outer series of the premaxillae are enlarged and slightly recurved; the spacing between each tooth is comparatively wide and even. The inner series of premaxillary teeth is very small and arranged in a dense, single row; the teeth are directed almost horizontally. Mandibular teeth occur either in a single row or in two somewhat irregular rows. Teeth of the inner row are moderately enlarged but smaller and more closely spaced than the outer premaxillary series. The outer mandibular teeth, when present, are much smaller than those on the inner row. Very small teeth are occasionally interspersed between the larger mandibular teeth.

Coloration in 70 percent ethanol is tawny overall to almost whitish over surfaces of the head. Lips, branchiostegal membranes, and oral and branchial cavities are dark brown. Fins are probably dusky in life.

REMARKS. This species was ably described and illustrated by Okamura (1970, p. 121, pl. 26), and Günther's illustration (1887, pl. 38) is excellent, showing the trenchant features of this distinctive fish. Makushok (1964, p. 138), in a lengthy discussion comparing descriptive information from the literature of *C. longifilis* and *C. clarki*, gave abundant evidence for considering the two nominal species as conspecific.

No specimens of this species were found in the collections made by Oregon State University vessels. *Coryphaenoides longifilis* is known only from the western North Pacific off southern Japan and in the Bering Sea. Rass (1965) did not report it from the Okhotsk Sea, and there are no records of its having been captured in the eastern Pacific south of the Aleutian Islands. Its depth distribution ranges from 850 to 1700 meters (Okamura, 1970, p. 124).

SPECIMENS EXAMINED. USNM no. 70987, (7,44-69 mm. H.L., +240-360 mm. T.L.), Bering Sea on Bowers Bank, 54°33'30"N., 178°44'E., *Albatross* station, 4775, 585 fathoms (1070 meters); USNM no. 149479 (1, 130 mm. H.L.), Japan, off Yokohama, *Albatross* collection.

Coryphaenoides (Nematonurus) armatus (Hector).
(Figures 13, 14, 15B.)

Macrurus armatus Hector, 1875, p. 81 (original description; off Cape Farewell, New Zealand, *Challenger* collection, in 400 fathoms (731 meters)).

Coryphaenoides variabilis Günther, 1878, p. 27 (original description; between Cape of Good Hope and Kerguelen Island, S. of Australia, mid-Pacific, and SW. of Juan Fernandez, *Challenger* collection, in 135-2425 fathoms (247-4435 meters)).

Macrurus asper Goode and Bean, 1883 (*nec Coryphaenoides asper* Günther, 1877), pp. 196-197 (original description; holotype 322 mm. T.L.; *Blake* stations 308 and 309, in 1242 and 304 fathoms (2271 and 556 meters)).

Macrurus goodii Günther, 1887, p. 136 (substitute for *Macrurus asper* Goode and Bean, preoccupied).

Macrurus (Nematonurus) armatus, Günther, 1887, p. 150, pl. 40, fig. A (description; illustration; synonymized *Coryphaenoides variabilis* Günther with *Macrurus armatus* Hector; corrects Hector's count of pelvic fin rays in holotype).

Coryphaenoides gigas Vaillant, 1888, pp. 232-233, pl. 20, figs. 2, 2a-c. (original description; holotype MNHN no. 86-117, 116 mm. H.L., 730 mm. T.L., *Talisman* station 136, in 4255 meters).

Macrurus cyclolepis Gilbert, 1895, p. 458 (original description; 2 specimens, off Queen Charlotte Island, British Columbia, *Albatross* station 3342, in 1588 fathoms (2904 meters)).

Hymenocephalus goodei, Goode and Bean, 1896, p. 407, fig. 340 (description; illustration; many western North Atlantic localities).

Nematonurus armatus, Goode and Bean, 1896, p. 416 (name; distribution).

Nematonurus gigas, Goode and Bean, 1896, p. 416 (description after Vaillant).

Macrurus (Nematonurus) suborbitalis Gill and Townsend, 1897, p. 234 (original description; holotype 20 inches long; Bering Sea, SW. of Pribilof Island, *Albatross* station 3603, in 1771 fathoms (3239 meters)).

Macrurus (Hymenocephalus) goodei, Lütken, 1898, p. 26 (specimens from Denmark and Davis Straits, in 1300-1715 fathoms (2378-3137 meters)).

Moseleya cyclolepis, Jordan and Evermann, 1898, pp. 2570-2571 (description after Gilbert).

Nematonurus goodei, Jordan and Evermann, 1898, pp. 2571-2572 (description after Goode and Bean).
Nematonurus suborbitalis, Jordan and Evermann, 1898, pp. 2572-2573 (description after Gill and Townsend).
Nematonurus abyssorum Gilbert, 1915, p. 374, pl. 21, fig. 23 (holotype, USNM no. 75827, off Santa Catalina Island, 33°02'15"N., 120°42'W., *Albatross* station, 4390, in 1350-2182 fathoms (2469-3991 meters)).
Coryphaenoides abyssorum, Barnhart, 1936, p. 24, fig. 81 (brief description; illustration from Gilbert, 1915).
Dolloa cyclolepis, Jordan, Evermann, and Clark, 1930, p. 203 (listed).
Nematonurus cyclolepis, Böhlke, 1953, p. 59 (listed).
Coryphaenoides cyclolepis, Clemens and Wilby, 1961, pp. 168-169, fig. 86 (description; illustration).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers on outer series of first arch 0-1 + 6-9 (usually 0 + 8) (total 7-9); inner series of first arch 1-3 + 10-12 (11-14 total); inner series of second arch 1-3 + 9-12 (11-13 total). Scales below origin of second dorsal fin 8-10.

MORPHOMETRY. Measurements from 40 specimens ranging 23.5-165 mm. in head lengths. The following in percent of head length: snout length 20-31; preoral length 6-17; horizontal diameter of orbits 18-27; interorbital width [18.5] 21-26; orbit to angle of preopercle 35-49; suborbital width 9-13; length upper jaw 34-40 (usually 36-38); length barbel 11-19; length outer gill-slit 12-18; length snout to anus 156-202; distance isthmus to anus 89-135; greatest body depth 66-113; height first dorsal fin 53-75; length pectoral fin 31-74 (usually 50-60); length pelvic fin 39-88; interspace between first and second dorsal fins 39-77.

DESCRIPTION. General features of this species are best seen in figs. 13 and 14. The snout protrudes prominently beyond the mouth in small specimens, but tends to become lower, blunter, and less prominent in specimens larger than about 100 mm. in head length (note leveling of growth curve at larger sizes in fig. 16). Proportional measurements of the snout varied accordingly over a wide range. The orbits are small; the horizontal diameter is less than the interorbital width in most specimens (fig. 17) and usually much shorter than the snout length (fig. 18). The abdomen is very long, the distance from the isthmus to the anus being greater than the head length in specimens larger than 40 mm. in head length (fig. 19). The gill openings are wide and extend far forward to beneath the orbits. The gill membranes form, at most, a narrow free fold across the isthmus. The barbel is stout at the base but tapers sharply into a thin filamentous tip; its length is less than the suborbital width. The lips are thick and bear many papillae. Ventral

aspects of the snout and suborbital are covered with fleshy, naked skin and liberally pocketed with enlarged pores of the sensory lateralis system. In large specimens (larger than about 150 mm. in head length) the leading edge and ventral aspects of the snout have an especially dense covering of papillae giving an almost fur-like texture to the surface. Lower jaw rami on the largest specimens are usually entirely naked, but small scales are present posteriorly along the midline of each ramus in the smaller specimens. Mucous pores along the lower jaw are especially prominent. In small specimens (under about 80 mm. head length), a prominent naked area is present on each side, just behind the leading edge of the snout. The condition is similar to that found in specimens of subgenus *Chalinura*. The outer (posterior and ventral) margins of the gill covers are naked in the largest specimen examined, but generally covered with scales in all other specimens. The ventral surface of the preopercle is naked below the preopercular ridge, and the interopercle is exposed posteriorly as a narrow, fleshy, naked tab. There are no scales on the gular or branchiostegal membranes.

Scales uniformly cover most surfaces of the head and body, other than for the areas noted above. The trunk and tail are completely covered with large, thin scales. Scale spinules are thin and sharp and arranged in discrete parallel rows with the median row in each scale slightly larger than the lateral rows. The spinule rows on large trunk scales numbered as few as three in the smallest specimen examined, to as many as 8-10 in the largest specimen. Spinules are relatively coarser on scales of small specimens, where they overlap the hind margin of the scales. Spinules in large specimens are arranged in low, narrow, horizontal rows on the exposed fields of trunk scales; they do not overlap the hind margin of the scales. In very large specimens (larger than 100 mm. head length), the scales tend to become deeply embedded and the spinules greatly reduced. Exposed fields become relatively much smaller, in these large specimens, and the fields widely separated from each other by broad naked margins. Head scales are generally smaller, coarser, and more adherent than body scales. Scales over the suborbital shelf in the largest specimen (165 mm. head length) are small and appear no different from other head scales. There are approximately four scale rows over the narrowest part of the shelf in this specimen. There are no enlarged or stoutly modified scales on the snout.

Pores of the sensory lateralis system are particularly well developed in specimens of *C. armatus* larger than about 80 mm. in head length. In addition to the usual complement of enlarged pores on the head found in many other species of macrourid fishes, additional smaller pores are found in *C. armatus* on the dorsal surfaces of the head and trunk. These dorsally situated pores are black rimmed and prominently contrasted in large specimens against the brown

ground color of the fish. They originate just behind the first dorsal fin and follow a line forward on each side of the first dorsal fin to an area over the supraoccipital area. A less well defined row of pores is present one scale row above the anterior portion of the lateral line. A transverse series over the hind end of the frontal bones meets an ill defined postorbital series on each side of the head. The two postorbital series run anteromedially over the interorbital space and onto the snout.

Fins have no ray prolonged except the outer pelvic ray which extends posteriorly to slightly beyond the vent in small specimens, but falls well short of the vent in larger ones. The second dorsal spine is strongly triangular in cross section near the base, but becomes laterally compressed distally; serrations along its leading edge are sharp and prominent in small specimens but become progressively reduced in larger specimens where they remain evident only near the distal end.

There are six long, slender retia and six small, peltate gas glands in a 93 mm. head length specimen from off Oregon (*Yaquina* station no. BMT 253). Radiographs (kindly made available to us by Richard A. Grinols) of 22 specimens revealed 13 (3 specimens), 14 (16 specimens), and 15 (3 specimens) precaudal vertebrae.

Overall coloration is dark brown to blackish. All fins are blackish in large specimens but tend to be dusky to pale in the smallest specimens. Ventral surfaces of the head, including the gill membranes, barbel, lips, suborbital region, and lower snout surfaces, are black. The oral, branchial, and peritoneal linings are black.

COMPARISONS. *Coryphaenoides armatus* is most closely related to *C. yaquinae* but differs primarily in teeth characters, in the presence of large pores of the sensory lateralis system on the head, and in a number of scale features including relatively finer scale spinulation; and small, irregularly arranged scales about 4-5 rows wide on the suborbital (see description of *C. yaquinae* for a more detailed comparison).

C. armatus is not likely to be confused with any other species found in the North Pacific except *C. leptolepis* in the smaller sizes. The broad band of very small and fine teeth on the premaxillae of *C. leptolepis*, however, immediately distinguishes that species from *C. armatus* (which has its premaxillary teeth in one or two distinct rows).

SIZE. *Coryphaenoides armatus* is one of the largest known members of the family. The maximum size of specimens we examined was 165 mm. in head length and over 870 mm. in total length.

DISTRIBUTION. The species apparently occurs in all oceans except the Arctic. Its depth range is extremely great

(according to published records) ranging 282-4700 meters (Grey, 1956, p. 169), but most specimens have been captured in depths of approximately 2500-3500 meters. Eastern North Pacific specimens were taken in abundance at depths of between 2000 and 4000 meters. Large collections are presently housed at Scripps Institution of Oceanography, Oregon State University, and the University of Washington.

The presence of *C. armatus* in the eastern North Pacific is not surprising, when the localities of past captures of the species are considered. *Coryphaenoides armatus* was originally described by Hector (1875) from a specimen taken by the *Challenger* off New Zealand. Günther (1878 and 1887) later reported several other specimens (reported in 1878 under the name *Coryphaenoides variabilis*) taken in the southern Indian Ocean, the South Pacific, the mid-equatorial Pacific, and in the central North Pacific. Many subsequent workers, summarized by Parr (1946), reported the species from the North Atlantic. The cosmopolitan distribution of *C. armatus* was discussed by Nybelin (1957) who plotted the world-wide distribution of the species.

REMARKS. We feel that the statuses of many species closely related to *Coryphaenoides armatus* still remain undetermined. The problem cannot, however, be adequately resolved without a thorough examination of all type specimens concerned, and examination of additional material from representative areas throughout the supposed range of *C. armatus*.

Our cursory study indicates that there are some differences between Atlantic and Pacific populations of what is now recognized as *C. armatus*. These differences, as enumerated below, are slight, but probably meaningful. If the populations are indeed conspecific, as we believe they are, the cause of geographical variation may be some degree of isolation in the North Atlantic and Pacific cul-de-sacs. Perhaps, as Günther (1887, p. 150) stated, the species is widely variable, even within a given area. However, we encountered little variability in specimens from either the North Atlantic or the North Pacific.

Günther (1887, p. 150) described a pallid, albino-like form that is not present in our study material. The great variability he speaks of may have resulted from his having two closely related species. The very similar looking *Coryphaenoides yaquinae*, for example, could very easily be mistaken for a *C. armatus*. The closely related *C. lecointei* (Dollo) ranges in the southern hemisphere where most of Günther's specimens were taken. His study material may have contained members of that species.

Most notable differences in meristic features of Atlantic and Pacific specimens of *C. armatus* were the counts for pelvic fin rays and scales below the origin of the second dorsal fin (table 1). Nybelin (1957, p. 261) summarized, in a table, all previous records of pelvic fin ray counts for

C. armatus; they were 9 or 10. Scale row counts below the origin of the second dorsal fin were slightly lower in Pacific specimens, ranging 8-10, with a mode at 8. Our Atlantic specimens had a range of 9-10 with a strong mode at 10. Koefoed (1927, p. 111) tabulated the scale row counts of 17 Atlantic specimens; these showed a range of 8-11 with a mode at 10.

Marshall (1973) used the ratio of snout length to orbit diameter to distinguish *C. armatus* from *'abyssorum'*, but a plot of these measurements (fig. 18) showed complete overlap in this character between specimens from the Atlantic and the Pacific. The distance from the isthmus to the anus (fig. 19) was slightly longer in North Atlantic material of moderate to large sizes, but the difference appeared negligible.

DISCUSSION OF SYNONYMY. We follow Makushok (1967) in placing *Nematonurus abyssorum* Gilbert, *N. cyclolepis* Gilbert, and *Macrurus (Nematonurus) suborbitalis* Gill and Townsend into the synonymy of *C. armatus* (Hector). We have examined and compared the holotypes of *'abyssorum'* and *'suborbitalis'* and the two syntypes of *'cyclolepis'*, in addition to many specimens previously referred to *'abyssorum'* taken in the eastern Pacific off Oregon, Washington, and off southern California (type locality for *'abyssorum'* off Santa Catalina Island). We found no significant differences between any of these specimens.

There is some confusion regarding the type specimens of *N. cyclolepis*. Gilbert (1895) described the species from two small specimens, the largest of which was only 150 mm. long. Two specimens catalogued under USNM no. 48585 are designated as types in the United States National Museum of Natural History, but one of these is a large specimen of *Coryphaenoides ariommus* Gilbert and Thompson, 1916, measuring 230 mm. in total length. (That species is only known from off Chile.) The other specimen in the 'type' lot is a small specimen too badly decomposed to properly examine. A specimen deposited in the Stanford University collections (now housed at the California Academy of Sciences) was listed by Böhlke (1953) as a paratype of *'cyclolepis'*. We examined that specimen and found it to closely fit Gilbert's description of *'cyclolepis'*. The specimen measured slightly over 115 mm. in total length and is not likely to have been longer. Because the Stanford syntype is in good condition and the USNM specimens are of questionable status, we have designated the former (SU no. 3090) as the lectotype. We have examined many small Pacific specimens of what we have called *C. armatus* and found them no different from the lectotype of *'cyclolepis'*.

We do not agree with Makushok (1967) in his placing of *Macrourus albatrossus* Townsend and Nichols, 1925, into the synonymy of *C. armatus*. We have not examined the holotype and only specimen of *'albatrossus'*, and the description for

that species is inadequate. The original illustration, however, indicates a species with a much blunter and higher snout than that found in *C. armatus;* the orbits also appear much larger and the abdomen appears shorter. The general physiognomy, in fact, appears much closer to that of *C. cinereus* and quite unlike that of *C. armatus.*

SPECIMENS EXAMINED. Western Atlantic: MCZ no. 25815A (2, 34-55 mm. H.L., 176-+300 mm. T.L.) (cotypes of *Macrurus asper* Goode and Bean, *non M. asper* Günther); USNM no. 38161 (1, 133 mm. H.L., 660 mm. T.L.); USNM no. 38169 (1, 68 mm. H.L., +310 mm. T.L.), 36°35'N., 74°03'30"W., *Albatross* station 2727, in 1289 fathoms (2357 meters), 24 Oct. 1886; USNM no. 38104 (1, 78 mm. H.L., 455 mm. T.L.), 38°59'N., 70'07' W., *Albatross* station 2711, in 1544 fathoms (2824 meters), 16 Sept. 1886; USNM no. 33392 (3, 58-64 mm. H.L., +240-340 mm. T.L.), 41°43'N., 65°21'50"W., *Albatross* station 2074, in 1309 fathoms (2394 meters), 3 Sept. 1883; USNM 132234 (1, 76 mm. H.L., 410 mm. T.L.); USNM no. 143199 (3, 52-65 mm. H.L.), off Cape Sable, Nova Scotia, *Albatross* collection; USNM 38102 (1, 50 mm. H.L., 260 mm. T.L.), 38°20'N., 70°68'30"W., *Albatross* station 2713, in 1859 fathoms (3400 meters), 17 Sept. 1886; USNM no. 92829 (1, 85 mm. H.L., +400 mm. T.L.), 39°15'N., 68°08'W., *Albatross* station 2568, in 1781 fathoms (3257 meters), 31 Aug. 1885.

Eastern Pacific: USNM no. 75827 (1, 152 mm. H.L., +803 mm. T.L.), California, off Santa Catalina Island, 1350-2182 fathoms (2470-4500 meters) (holotype of *Nematonurus abyssorum* Gilbert); USNM no. 48773 (1, 96 mm. H.L., 468 mm. T.L.) (holotype of *Nematonurus suborbitalis* Gill and Townsend); USNM no. 48585 (one small specimen, badly decomposed, possibly one of two syntypes of *Nematonurus cyclolepis* Gilbert); SU no. 3090 (1, 26.7 mm. H.L., +115.5 mm. T.L.), off British Columbia, in 1588 fathoms (2920 meters) (we designate this specimen as lectotype of *Nematonurus cyclolepis* Gilbert); OSUO uncataloged (3, 45-105 mm. H.L.), 44°39.8'N., 125°33.3'W., *Yaquina* trawl no. OTB 50, in 2800 meters; OSUO no. 405 (1, 155 mm. H.L., 843 mm. T.L.), *Yaquina* trawl no. OTB 331; OSUO uncataloged (1, 110 mm. H.L., 555 mm. T.L.), 44°58.8'N., 125°40.4'W., *Yaquina* trawl no. BMT 188, in 2792 meters; OSUO uncataloged (2, 93-165 mm. H.L.), 44°39.0'N., 126°44.8'W., *Yaquina* trawl no. BMT 253, in 2816 meters; OSUO uncataloged (1, 78 mm. H.L.), 45°55.5'N., 126°39.4'W., *Yaquina* trawl no. BMT 258, in 2670 meters; OSUO uncataloged (1, 60 mm. H.L., 330 mm. T.L.), 45°38.4'N., 126°43.7'W., *Yaquina* trawl no. BMT 262, in 2721 meters; OSUO uncataloged (1, 116 mm. H.L., 670 mm. T.L.), 45°36.5'N., 126°46.1'W., *Yaquina* trawl no. BMT 263, in 2730 meters; OSUO uncataloged (1, 31 mm. H.L., 161 mm. T.L.), 45°24.7'N., 127°41.1'W., *Yaquina* trawl no. BMT 278, in 2811 meters; SIO no. 66-54-62 (2, *ca.*486-586 mm. T.L.), off California, 38°23.0'N., 124° 06.5'W., 24-25 May 1966; SIO no. H53-338 (1, 176 mm. T.L.), off Kamchatka and Aleutian Islands, 46°16.5'N., 168°52.0'E.,

6-7 Sept. 1953; UBC no. 64-444 (3 small specimens) off British Columbia, Triangle Island area, 11 September 1964.

Coryphaenoides (Nematonurus) yaquinae, Iwamoto and Stein, new species.
(Figures 15A, 20.)

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers on inner series of first arch 11-12 total; inner series of second arch 11. Scales below origin of first dorsal fin 8; below origin of second dorsal fin 8.

MORPHOMETRY. Measurements from the type specimens which ranged 53-79 mm. in head length, and +255-400 mm. in total length. The following in percent of head length: snout length 26-30; preoral length 12-16.5; horizontal orbit diameter 19-21; interorbital width 25-26; distance orbit to angle of preopercle 47; suborbital width 10-11; length upper jaw 39-40; length barbel 16-18; length outer gill-slit 18-20; length snout to anal origin 163-178; outer pelvic ray to anal origin 61-77; distance isthmus to anus 100-122; greatest body depth 77-92; height over anal origin 61-68; length first dorsal fin 65-74; length pectoral fin 55-57; length pelvic fin 72; interspace between first and second dorsal fins 44-51.

DESCRIPTION. The head is broad and somewhat depressed; the dorsal profile takes a notable dip above the orbits before rising over the strongly arched nape. The interorbital region is broad and relatively level, there being no distinct troughs or ridges across most of its breadth. The suborbital region has a low but distinct ridge traversing its entire length. Small scales are present on the shelf above the crest of the ridge. Gill openings are wide and extend forward ventrally to a vertical approximately a pupil's length behind the orbits. The gill membranes connect over the isthmus and form a moderately broad free fold in the holotype but a rather narrow free fold in the paratypes. The interopercle is narrow and barely exposed posterior to the preopercle angle. Lips are rather fleshy and papillose. The barbel has a relatively short base but tapers rapidly into a thin filament. Mucous pores are outlined in black and fairly prominently cover large areas of the head, especially in the interorbital region back to the base of the nape and ventrally on the snout and suborbital surfaces. The blackish pores do not extend onto the body as they do in large specimens of *C. armatus*. Pores of the sensory lateralis system that are so large and prominent in *C. armatus* and *C. leptolepis* are not well developed in *C. yaquinae*.

Almost all surfaces of the body and the dorsal surfaces of the head are coarsely scaled. A prominent, broad,

swarthy, naked area lies dorsally behind the leading edges of the snout on either side of the median nasal ridge. The ventral surfaces of the snout, suborbital, preopercle, and lower jaws are naked. The interopercle and the branchiostegal and gular membranes are also naked. Almost all scales on the head and body have strong sharp ridges comprised of close-set sharp spinules. Spinules on body scales tend to be more reclined and larger than those on head scales. Spinules on body scales are arranged in about 3-5 more-or-less parallel rows with the middle spinule row longer and slightly higher. The posteriormost spinules extend beyond the margin of the scale. Compared with the body scales, those on the head have much smaller, more erect and more closely appressed spinules. The spinule rows on these scales are widely divergent and number 1-3 on small scales and as many as 5-7 on the large scales of the operculum.

Dentition of the upper jaw of the holotype consists of a band of very small, widely scattered teeth with a distinctly enlarged outer series of sharp conical teeth. In the paratypes, the inner teeth are better described as in two irregular series. Lower jaw teeth in all type specimens were moderate-sized, conical teeth arranged in two irregular rows near the symphysis but narrowing to a single series posteriorly. The lower jaw teeth are smaller than the enlarged outer premaxillary series but larger than the inner premaxillary teeth.

The spinous second ray of the first dorsal fin is distinctly serrated along its leading edge; it tapers to a fine, thin, but scarcely produced tip. The outer pelvic ray is produced well beyond the other rays of the fin and extends a short distance posterior to the anal-fin origin.

The swimbladder of the 53 mm. head length paratype measures about 32 mm. in greatest length and is covered with a thin, translucent external tunica. There is little fatty tissue within the lumen. Six slender retia, each about 30 mm. long, form coiled loops terminating in six small peltate gas glands each approximately 3-4 mm. in diameter and about 1 mm. thick. The alimentary canal is similar in its coiling pattern to that illustrated for *C.(N.) pectoralis* by Okamura (1971, fig. 63A). There are ten simple, slender pyloric caeca, each about 15 mm. long.

Coloration overall is a grayish brown with the snout, lips, orbits, barbel, opercle, and posterior margins of the gill membranes swarthy to blackish. Fin membranes are all dusky except for those bordering the outer pelvic rays and the distal half of the serrated spinous dorsal ray; these last membranes are black. The oral cavity is dark gray; the linings of the gill and abdominal cavities are black.

COMPARISONS AND RELATIONSHIPS. *Coryphaenoides yaquinae* appears most closely related to *C. armatus;* the two differ mainly in dentition and squamation. The inner premaxillary series of teeth in *C. yaquinae* are either in two irregular

series or in a widely scattered band, whereas those in *C. armatus*, if present, are always in a distinct single row (the inner premaxillary series is essentially lost in very large specimens of *C. armatus*). Mandibular teeth in *C. yaquinae* are arranged in two irregular series near the symphysis but in a single row posteriorly. *Coryphaenoides armatus*, in contrast, has mandibular teeth in a continuous, single row, both at the symphysis and posteriorly. Scales in *C. yaquinae* are notably coarser than in *C. armatus*. Scale spinules in *C. yaquinae* are more erect and the spinule ridges are higher and fewer than those found in comparable-sized *C. armatus*. Scales on the suborbital shelf (fig. 15) are in fewer rows (usually only two rows along the narrowest portion) in *C. yaquinae* compared with *C. armatus*, which has suborbital scales in more than two rows. Coloration shows slight differences between the two species, but the differences are not readily apparent unless specimens of both are compared directly. Generally, *C. yaquinae* is more pallid with a grayish cast while *C. armatus* tends to be darker with a brownish black coloration. Pores of the sensory lateralis system are comparatively much larger and more prominent on the head of *C. armatus* than in *C. yaquinae* (fig. 15).

Chalinura ferrieri Regan (1903, p. 236) from the Antarctic Ocean appears to be close to *C. yaquinae*. We had no specimens of *Chalinura ferrieri* for comparison, and the description for that species is inadequate; however, the two species appear to differ mainly in that *C. ferrieri* has a more pointed snout, more extensive naked areas on the preopercle, larger pores on the suborbital region, a longer barbel, fewer spinule rows on body scales, and more pelvic fin rays (11 versus 10). When more adequate comparative material becomes available, the species may be shown to be conspecific. Until such comparisons are made, however, it seems best to treat the specimens reported here as representing a distinct species.

REMARKS. We are indebted to Dr. Carl L. Hubbs who first recognized this fish as representing an undescribed species. Dr. Hubbs had a manuscript name for the species and intended to describe the two Scripps specimens, but, learning of our study, he graciously relinquished his specimens and allowed us to use them in our description.

The presence of an undescribed species in our collections was surprising in view of the many nominal, but few valid species we found from the eastern North Pacific. It is remotely possible that the species was reported previously under one of the synonyms of *C. armatus*. As indicated in our comparisons, the two species are very close and could easily be confused. The possibility of *C. yaquinae* being conspecific with an Antarctic species, *C. ferrieri*, has already been suggested. If this proves true, *C. ferrieri* should be expected throughout most of the Pacific.

The few known specimens and the great depths at which they were taken may indicate that *C. yaquinae* is either very rare in the eastern North Pacific or that it is normally an inhabitant of greater depths than have been adequately sampled.

SPECIMENS EXAMINED. Holotype: USNM uncataloged, (75 mm. H.L., 376 mm. T.L.) Tufts Abyssal Plain, 44°39.9'N., 133°37.2'W., *Yaquina* station TP-3, haul 232, in 3724 meters, 3 June 1970. Paratypes: SIO no. 67-115-62, (2, 53-79 mm. H.L., 255-400 mm. T.L.) California, SW. of Farallon Islands, 37°22'16"N., 123°54'53"W., collected by C. L. Hubbs, *et al.*, 31 July 1967.

Coryphaenoides (Nematonurus) pectoralis (Gilbert).
(Figures 21, 22.)

Macrurus (Malacocephalus) pectoralis Gilbert, 1892, pp. 563-564 (original description; off Oregon, *Albatross* stations 3071, 3074, and 3075, in 685-877 fathoms (1253-1604 meters)).

Macrurus (Nematonurus) magnus Gill and Townsend, 1897, p. 234 (original description; holotype 43 inches long, Bering Sea, SW. of Pribilof Islands, *Albatross* collection).

Albatrossia pectoralis, Jordan and Evermann, 1898, pp. 2573-2574 (description after Gilbert; synonymized *Macrurus magnus* Gill and Townsend with this species; designated type-species of new genus *Albatrossia* Jordan and Evermann); Jordan and Gilbert, 1899, p. 487 (2 specimens; Bering Sea off Bogoslof Island, *Albatross* station 3634; in 1214 meters); Taranetz, 1933, p. 77 (Bering Sea, Olyutorskiy Gulf).

Coryphaenoides (Nematonurus) pectoralis, Gilbert and Hubbs, 1916, pp. 161-162 (description; specimens from off E. and SE. coasts of Sagkalin and S. coast Hokkaido, in 309-510 fathoms (565-933 meters)); Okamura, 1970, pp. 118-121, text fig. 49, pl. 25 (description; illustration; 14 specimens, 620-1050 mm. total length; off Japan, in 550-1200 meters); 1971, figs. 5A, 14H, 17D, 22A, 27B, 31B, 34G, 42A, 45A, 47B, 55F, 63A, tables 1, 11 (osteological and internal characters).

Coryphaenoides pectoralis, Taranetz, 1937, p. 169 (listed); Schmidt, 1950, p. 62 (Bering Sea near Bering Island).

Nematonurus pectoralis, Andriashev, 1937, p. 346, fig. (description; illustration; 2 specimens, Bering Sea off Bering Island, in 200 meters); Matsubara, 1955, p. 1308 (in key).

Chalinura pectoralis, Rass, 1963, pp. 217-219, fig. 3, table 5 (description; illustration; 5 specimens, 552-965 mm. total length, Okhotsk Sea, *Vityaz* station 103, 116, 132, in 1500, 1030, and 890 meters); Novikov, 1970, pp. 304-331 (extensive life history information).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers on inner series of first arch 12-14 total (usually 2 + 10-11); inner series of second arch 11-14 (usually 2 + 10-11). Scale rows below origin of first dorsal fin 13-15, below origin of second dorsal fin 9-13 (usually 10-12).

MORPHOMETRY. Measurements from 15 specimens ranging 94-228 mm. in head length, +350-+970 mm. in total length. The following in percent of head length: snout length 24-28; preoral length 8-12, horizontal diameter of orbit 19-23; interorbital width 23-28; orbit to angle of preopercle 40-45; suborbital width 9-12; length upper jaw 35-47 (usually 42-44); length barbel 6-13; length outer gill-slit 18-20; preanal length 144-182; distance isthmus to anal origin 88-123; greatest body depth 65-86; depth over anal origin 63-72; height first dorsal fin about 35-50; length pectoral fin 43-56; length pelvic fin 36-52; interspace between first and second dorsal fins 10-21.

DESCRIPTION. General features of the fish are best shown in figure 21. (See also Okamura, 1970, pp. 118-121, pl. 25, for a detailed description and good illustration.) Body musculature is soft and the neurocranium appears poorly ossified. The head is broad with the greatest width more than 50 percent of the length. Ridges of the head are rounded; they are neither sharp nor strongly set off by rows of deeply embedded scales. The terminal and lateral angles of the snout are prominent but lack enlarged, deeply embedded, scute-like scales. In fact, most specimens are partially naked at these points. The suborbital region is gently convex in cross-section and completely covered with small, unmodified scales. The interorbital region is broad, its width about equaling the snout length and considerably longer than the orbit diameter. The interopercle is broadly exposed along its posteroventral border and along its anterior articulation with the lower jaw. The barbel is very fine and small. Gill openings are wide and extend forward to a point just behind a plane through the posterior end of the upper jaw. Gill membranes adhere closely to the isthmus and lack a free fold. Head pores of the sensory lateralis system are small and inconspicuous. The lateral line, however, is very large and strongly marked.

All fins are relatively small and weakly developed. The first dorsal and pelvic fins are notably small and the rays relatively slender and weak. The first spinous ray of the dorsal fin is very small, closely adhered to the second ray,

and completely embedded within the integument. The second spinous ray is weak, slender, and either entirely smooth or with minute denticles distally. Smaller specimens tend to have the prickles best developed. The narrow and short pelvic fins have a single outer ray slightly prolonged. This prolonged ray falls short of, or barely reaches, the anus.

Scales are comparatively small, thin, and deciduous. Some size-related variation is seen in both the number of longitudinal ridges on the exposed fields and the amount of spinulation on these ridges. The smallest specimens we have examined have 3-5 divergent ridge-like rows of small, sharp spinules. Larger specimens have correspondingly fewer ridge-rows and spinules on the ridges are less developed. The largest specimens have a single non-spinulated ridge running longitudinally across the middle of the exposed field. Scales uniformly cover most of the head and body. Naked areas include most of the anterior portion of the snout, a thin margin along the ventral edge of the suborbital region, lips, gill membranes, small areas behind the bases of the paired fins, and all fins. The exposed portions of the interopercle and the lower jaws are finely scaled. The suborbital region is uniformly covered with small, unmodified scales, except along the extreme dorsal and ventral margins where the skin is naked.

Variation in the dentition of this species is discussed under the description of the genus. Dentition in the upper jaw consists of moderately large teeth, usually in two irregular series with the outer series slightly enlarged. Teeth laterally on the premaxilla are sometimes in a single row. Mandibular teeth are usually in a single row and moderately enlarged; the teeth are not crowded together but are usually evenly and well spaced. All teeth have distinctly arrowhead-shaped tips.

Coloration of specimens with scales completely intact (we had no perfect specimens) is probably uniformly medium brown with the fins, gill membranes, lips, and lower surface of the snout somewhat blackish. Specimens denuded of scales (most of our study material) were pale with a slight pinkish to violet tinge.

The swimbladder is much reduced in size. A female specimen (UW no. 19304) 188 mm. in head length has a swimbladder about 22 mm. in length. Two very slender retia, each measuring about 15 mm. in length, terminates in two small, flat gas glands. The reduced condition of the swimbladder gives further indication of the wide separation of *C. pectoralis* from other members of the genus. Pyloric caeca in two specimens are long, slender, and number 13 and 15. Okamura (1970, p. 121) gave a count of 12-15 for the species, while Andriashev (1937) counted 12 and Gilbert and Hubbs (1916, p. 161) counted 16. Radiographs of 16 specimens showed 13 (4 specimens) or 14 (12 specimens) precaudal vertebrae.

DISTRIBUTION. This large boreal North Pacific species ranges along the North American coast from off Northern California to the Bering Sea. It is abundant in the Bering and Okhotsk Seas (Rass, 1963, p. 219) and extends southward along the western side of the Pacific to southern Hokkaido. Capture depths range from about 200 meters (Andriyashev, 1937, p. 346) to 2170 meters (Novikov, 1970).

REMARKS. Although Jordan and Evermann (1898, p. 2574) stated that this is a firm-fleshed species, the consistency of the flesh is quite soft when compared with all other species considered here. The reduced condition of the gas bladder, the relatively soft flesh, and the scarcely ossified bones of the head are features not found in any other species of *Coryphaenoides* of which we know. The comparatively reduced fins and the peculiar dentition are additional features that set this species apart. A more detailed examination of the internal structure may reveal other characters that could justify a subgeneric or generic separation of this species. *Albatrossia* Jordan and Evermann is available.

Mr. Robert N. Lea of the California Department of Fish and Game informs us that commercial fishermen operating out of Trinidad and San Francisco, California, occasionally capture and market large specimens of *C. pectoralis*. Novikov (1970) states that the species is "especially common" in the North Pacific, often "being more abundant than ... halibuts and rockfishes" with catches amounting "to 4-6 tons per trawling" "in several cases." He considers the fish as "a valuable food" and "promising commercial species."

Novikov (1970) has reported on aspects of the life history of *C. pectoralis*. From catch data, he speculates that the young are pelagic, descending to demersal layers after reaching a length of 50-60 cm. Females are usually larger than males and normally maintain a shallower depth regime (300-700 m. compared with deeper than 700 m. for males). The largest specimen Novikov examined measured 116 cm. and weighed 758 g. (or about 16.5 lbs.). From his data, the fish at this size would be over 17 years old.

SIZE. This species attains the largest size of any macrourid fish known. The largest specimen we have examined weighed 17.5 lbs. and measured 1031 mm. in total length with a large section of the tail missing. A specimen which may have been even larger was captured by the R/V *Cobb* of the National Marine Fisheries Service off the Columbia River. The specimen shown in the photograph (fig. 22) was brought to our attention by Mr. Richard B. Grinols, formerly a fishery biologist with the National Marine Fisheries Service. A rough estimate of the size of the specimen based on the photograph would be approximately 5 feet or about 150 cm.

SPECIMENS EXAMINED. UW no. 19279 (1, 181 mm. H.L., about

920 mm. T.L.), off mouth of Columbia River, AEC station 39A, 1000 fathoms (1829 meters), 28 May 1964; UW no. 19289 (5, 105-181 mm. H.L., 604-708 mm. T.L.), approximately 46°N., 125°W., AEC station 35A, 900 fathoms (1646 meters), 29 May 1964; UW no. 19290 (1, 206 mm. H.L., + 970 mm. T.L.), approximately 46°N., 125°W., AEC station, 10A, 275 fathoms (503 meters), 10 April 1967; OSUFW uncat. (1, 115 mm. H.L., + 520 mm. T.L.), off Coos Bay, Oregon, 310-320 fathoms (567-585 meters), 26-27 Dec. 1970; OSUO no. 376 (1, 228 mm. H.L.), 48°38.4'N., 126°58.0'W., *Yaquina* station DWD 5, 1998 meters.

Other specimens examined but from which no data were taken: OSUO uncataloged (1, 1031 mm. T.L.), off Trinidad, Calif.; SIO no. H51-367 (1, 710 mm. T.L.), 56°20'N., 145°20'W., 330 fathoms (603 meters), 25 Aug. 1951; UBC no. 64-443 (3 specimens), British Columbia, SW. of Baja Reef, 9 Sept. 1964; UBC no. 62-465 (1 specimen), 54°26'30"N., 159°13'20"W., *Morning Star* haul 212, station 24P, 10 July 1961; UBC no. 62-478 (1 specimen), 54°18'40"N., 160°01'40"W., haul 183, station 21-N., 250 fathoms (457 meters), 30 June 1961; UBC no. 62-464 (1 specimen), 53°39'N., 165°00'W., haul 6, station 1-E, 14 May 1961; CAS 20521 (2, 110-123 mm. H.L., about 450-530 mm. T.L.), Calif., off Ft. Bragg; CAS 20598 (1, 129 mm. H.L., 700 mm. T.L.), Calif., off Crescent City, 19 May 1952; CAS 25908 (3, 115-128 mm. H.L., 640-650 mm. T.L.), Calif., off Point St. George, 25 May 1952; CAS 26333 (1, 121 mm. H.L., 500 mm. T.L.), Calif., off Humboldt Co.; CAS 26337 (1, 117 mm. H.L., 610 mm. T.L.), Calif., off Trinidad Head, 4 May 1958; CAS 26343 (1, 136 mm. H.L., 680 mm. T.L.), Calif., off Trinidad Head, 14 May 1958; CAS uncat., acc. 1965-II:23 (1, 133 mm. H.L., 715 mm. T.L.), Calif., off Sonoma Co., 24 miles W. by S. of Bodega, S. side of Bodega Canyon, between 270-320 fathoms, 23 Feb. 1965; CAS uncat., acc. 1965-IX:9 (1, 121 mm. H.L., 600 mm. T.L.), Calif., probably off Eureka.

Subgenus *Chalinura* Goode and Bean

DIAGNOSIS. Dentition in upper jaws a broad cardiform band of minute teeth with a distinctly enlarged, spaced outer series; dentition in lower jaw usually a distinct single row of slightly enlarged teeth (occasionally in narrow bands in young individuals). Precaudal vertebrae 12. Retia and gas glands 6 each. Scales usually relatively small and loose; spinules on exposed fields short, but sharp, arranged in discrete, usually parallel, ridge-like rows; a characteristic single row of small scales along leading edge of snout, passing over supranarial ridges, and usually over median nasal ridge. Broad naked areas behind scale row along leading snout edge; also broad naked areas over ventral aspects of snout, suborbital, and preopercle. Opercular opening wide with a broad free fold over isthmus. Outer gill-slit moderately wide. Interopercle slender, naked. Orbits small, usually about 20 percent of head length;

interorbital broad, width greater than orbit length. Head pores of sensory lateralis system large.

REMARKS. Subgenus *Chalinura* appears to comprise a well marked group of species containing *C. leptolepis* Günther, 1877, *C. brevibaris* Goode and Bean, 1896, *C. profundicola* Nybelin, 1957, *C. murrayi* (Günther, 1878), *C. mediterraneus* Giglioli, 1893, *C. liocephalus* (Günther, 1887), *C. affinis* (Günther, 1878), and *C. fernandezianus* (Günther, 1887). The dentition appears to be the only character that definitely distinguishes it from other subgenera as here defined. That character breaks down to some degree, however, when the mandibular dentition of *C. leptolepis* is compared with that of members of subgenus *Lionurus*. Our examination of many specimens of *C. leptolepis* indicates considerable variability in this character, with many specimens (particularly the smaller ones) having teeth arranged in a narrow band (the condition in subgenus *Lionurus*) rather than in a distinct single row (as is characteristic of subgenus *Chalinura*). The premaxillary dentition in *Chalinura* characteristically has a broad band of very small cardiform or villiform teeth with a distinct enlarged outer series. The teeth on the premaxilla of *Lionurus* are identical except that the outer enlarged series is generally less well developed.

The broad naked areas on the ventral surfaces of the head are features shared in common with the subgenus *Lionurus*. A number of species belonging to subgenera *Coryphaenoides* and *Nematonurus* also have similar naked areas. *Coryphaenoides (Nematonurus) armatus* has broad naked areas on the ventral surfaces of the snout, suborbital region, preopercle, and lower jaws and, in the smaller specimens, even on the anterior dorsal surfaces of the snout, behind the leading edge. The squamation along the leading edge of the snout in small specimens of *C. armatus* very closely resembles that found in all members of subgenus *Chalinura*.

Coryphaenoides (Chalinura) leptolepis Günther.
(Figures 23, 24.)

Coryphaenoides leptolepis Günther, 1877, p. 441 (original description; "off the coasts of Brazil and Japan, Mid-Pacific").

Chalinura simula Goode and Bean, 1883, pp. 199-200 (original description; holotype MCZ no. 25824, 458 mm. total length, 41°24'45"N., 65°35'30"W., *Blake* station 308, in 1242 fathoms (2271 meters); 3 other specimens, "probably belonging to [this] species"); Goode and Bean, 1896, pp. 412-413, fig. 345 (description; illustration; *Blake* and *Albatross* records from western North Atlantic); Roule, 1919, p. 86 (2 specimens; Azores, 1919-2102 meters); Parr, 1946, pp. 65-68, fig. 20 (description; illustration).

Macrurus (Chalinurus) leptolepis, Günther, 1887, p. 144, pl. 31 (description; illustration; one specimen, the holotype, 18 inches long, off Pernambuco, Brazil, *Challenger* station 122, 350 fathoms (640 meters); other specimens of original type series from Japan and mid-Pacific redescribed and designated types for new species, *Macrurus liocephalus*).

Macrurus (Chalinurus) simulus, Günther, 1887, p. 145 (description; compiled).

Chalinura serrula Bean, 1891, p. 37 (original description; off Prince of Wales Island, about 55°N., 136°W., in 1569 fathoms (2870 meters)).

Chalinura leptolepis, Goode and Bean, 1896, p. 414 (description after Günther); Nybelin, 1957, p. 264 (in key), pp. 267-268 (characters; comparison with *'simula'*).

Macrurus (Chalinura) simulus, Lütken, 1898, pp. 28-29 (description; 4 specimens Denmark Strait, in 912-1236 fathoms (1668-2260 meters)); Koefoed, 1927, pp. 100-103 (description; 7 specimens, eastern North Atlantic, in 2615-3120 meters).

Coryphaenoides serrulus, Gilbert and Hubbs, 1916, p. 144 (listed).

Macrurus (Chalinura) leptolepis, Koefoed, 1927, p. 102 (comparison with *'simula'*).

Coryphaenoides simulus, Fowler, 1936, p. 457 (description after Goode and Bean).

COUNTS. Frequency distributions of selected counts are given in table 1. Gillrakers on outer series of first arch 8-11 total (0-1 + 8-10); inner series of second arch 10-14 total (1-2 + 8-19).

MORPHOMETRY. Measurements based on 21 specimens ranging 31-103 mm. in head length, and 160 to over 460 mm. in total length. The following in percent of head length: snout length 24-31 (usually 25-28); preoral length 4-16 (usually 4-10); horizontal orbit diameter 15-20; interorbital width 23-27 (usually 23-25); orbit to angle of preopercle 48-51; suborbital width 10-16; length upper jaw 41-47; length barbel 16-23; length outer gill-slit 23-28; length snout to anus 134-154; predorsal length 107-122; distance isthmus to anus 65-88; greatest body depth 65-78; length pectoral fin 52-62; length pelvic fin 70-102; interspace between first and second dorsal fins 27-50 (usually about 35-45).

DESCRIPTION. General features of *C. leptolepis* are shown in figure 23. Gill openings are wide and the gill membranes form a broad free fold across the isthmus. The preopercle forms a prominent, broad, posteriorly projecting lobe at its lower angle. The posterior end of the interopercle is exposed as a slender naked sliver. Pores of the sensory lateralis system are extremely large and prominent on the head. Their locations are best seen in the illus-

tration (fig. 24).

Scales of *C. leptolepis* are very thin and deciduous. Spinulation is poorly developed on all scales, but, when present, they occur as small, greatly reclined points along low divergent ridges. A single row of small, adherent scales is present along the dorsal leading edge of the snout. This row of scales connects laterally, on each side, with a similar row of adherent scales that passes over the supranarial ridge onto the dorsal edge of the orbits. A row of scales is also sometimes present on the dorsomedian snout ridge. A broad area behind the leading edge of the snout, on either side of the dorsomedian ridge, is naked. The ventral surfaces of the snout, suborbital, preopercle, and lower jaws are naked. Serrations along the leading edge of the second dorsal spine are low and generally reclined, and well developed in individuals of all sizes. The spine tapers to a thin filamentous tip but is little prolonged. The outer pelvic ray is relatively much thicker than other rays of the fin and is much prolonged, extending well past the anal-fin origin.

Coloration in denuded specimens is whitish overall with a pinkish tinge. The gill cover has a violet tinge resulting from the black lining of the branchial chamber showing through the opercular bones. The lips, gular and branchiostegal membranes, the barbel, most of the orbit margin, and the edge of the urogenital orifice are blackish. The oral, branchial, and peritoneal linings are black. All fins are dusky to pale.

Six long thin retia were connected to six small peltate gas glands in a 95-mm. head length female specimen. Radiographs of nine specimens showed a consistent count of 12 precaudal vertebrae.

REMARKS. *C. leptolepis* was originally described by Günther (1877) from a single specimen taken off the coast of Brazil. Goode and Bean (1883) later described *Chalinura simula* from specimens taken by the *Blake* off the east coast of the United States. The two nominal species were compared by Koefoed (1927, p. 102) who found differences between the two "extremely small and uncertain." He noted that his seven specimens, which he identified as *C. simula*, had longer barbels, longer outer pelvic fin rays, and a slightly shorter distance between the isthmus and anus compared with what was given in the description of *C. leptolepis*. Nybelin (1957, p. 268) re-examined the type of *C. leptolepis* and compared it with two specimens of *'simula.'* He found differences only in proportional values of the distance isthmus to anus, distance pelvic base to anal, predorsal length, and barbel length. These very slight differences, between only the three specimens, in characters that normally exhibit considerable variability, scarcely seem valid as specific differences. Our findings using many more specimens from the eastern North Pacific and the western North Atlantic

show even greater variability for these characters.

Chalinura serrula Bean was originally described from three individuals taken in the Pacific off the coast of southeastern Alaska. Koefoed (1927, p. 103) recognized its closeness to *C. simula* but noted that the eye diameter was slightly smaller in *C. serrula*. Our data show complete overlap in that character for specimens from the eastern North Pacific and the western North Atlantic. Comparisons of other features showed no significant differences.

The only differences of possible significance that we were able to detect between Atlantic and Pacific specimens of *C. leptolepis* were the fin ray counts of the first dorsal fin and pelvic fins. Table 1 shows the slight differences in modes of the two characters between populations.

DISTRIBUTION. *Coryphaenoides (Chalinura) leptolepis* thus appears to be a widely distributed species inhabiting relatively deep waters of the Pacific and Atlantic Oceans. The distribution of *C. leptolepis* in the southern hemisphere is unknown. It is plausible to assume that its distribution is continuous around the southern tip of South America, but we know of no records that would verify this.

COMPARISONS. The only other species of *Chalinura (fernadezianus* Günther) from the eastern Pacific seems quite distinct; it is only known from the holotype taken by the *Challenger* south of Juan Fernandez Island in 1375 fathoms (2515 meters). *Coryphaenoides liocephalus* (Günther) appears extremely close to, and may be conspecific with, *C. leptolepis*. Günther gave no good characters that would distinguish the two species except that *C. liocephalus* was blackish and *C. leptolepis* a dirty whitish. *C. liocephalus* is known only from the type series, one taken near Yokohama, Japan in 1875 fathoms (3429 meters) and two taken in the mid-Pacific (about 36°N., 178°W.) in 2050 fathoms (3749 meters). A fourth Pacific species of the subgenus *Chalinura* is *C. murrayi* (Günther) described from five specimens taken off New Zealand. That species, which was once thought to have occurred also in the Atlantic, differs from *C. leptolepis* in having slightly more pelvic fin rays (11-12 compared with 9-11 in *leptolepis*), broader interorbital space, longer interspace between the dorsal fins, and a distinctly darker coloration.

SPECIMENS EXAMINED. Pacific: OSUO no. 404 (1, 103 mm. H.L.), 45°59.6'N., 125°44'W., cruise 6507, trawl no. 78 in 2500 meters; OSUO no. 384 (1, 61 mm. H.L., +295 mm. T.L.), 48°18.4'N., 127°42.4'W., trawl no. DWD 1, in 2560 meters; OSUO uncataloged (2, 81-89 mm. H.L., 410-457 mm. T.L.), 44°58.8'N., 125°40.4'W., *Yaquina* trawl no. BMT 188, in 2792 meters; OSUO uncataloged (2, 35-58 mm. H.L., 187-268 mm. T.L.), 45°19.8'N., 125°44.3'W., *Yaquina* trawl no. BMT 190, in 2597 meters; OSUO uncataloged (1, 58 mm. H.L., 283 mm.

T.L.), 45°39.2'N., 125°44.6'W., *Yaquina* trawl no. BMT 192, in 2450 meters; OSUO uncataloged (3, 42-83 mm. H.L., 207-404 mm. T.L.), 45°55.3'N., 125°53.7'W., *Yaquina* trawl no. BMT 251, in 2377 meters; OSUO no. 2089-2090 and uncataloged (4, 37-78 mm. H.L., 200-406 mm. T.L.), 45°45.7'N., 126°33.1' W., *Yaquina* trawl no. BMT 259, in 2665 meters; OSUO no. 2073 (1, 35 mm. H.L., 168 mm. T.L.), 45°38.9'N., 126°46.1'W., *Yaquina* trawl no. CP2-B, in 2669 meters; OSUO no. 2100 (1, 31 mm. H.L., 160 mm. T.L.), 45°38.4'N., 126°43.7'W., *Yaquina* trawl no. BMT 262, in 2721 meters.

Atlantic: USNM no. 38081 (1, +460 mm. T.L.), 38°29'30" N., 70°54'30"W., *Albatross* station 2715, in 1753 fathoms (3408 meters); USNM no. 38103 (1, 74 mm. H.L., +320 mm. T.L.), 38°20'N., 70°68'30"W., *Albatross* station 2713, in 1859 fathoms (3400 meters); USNM no. 38138 (1, 83 mm. H.L., 435 mm. T.L.), 36°47'N., 73°09'W., *Albatross* station 2723, in 1685 fathoms (3082 meters); USNM no. 39152 (1, 71 mm. H.L.), 39° 29'N., 70°58'40"W., *Albatross* station 2095, in 1342 fathoms (2454 meters); USNM no. 143225 (1, 64 mm. H.L., 332 mm. T.L.), 40°34'18"N., 66°09'W., *Albatross* station 2573.

Specimens examined but from which no data were taken: SIO 67-115-62 (12, 282-368 mm. T.L.), 37°22'N., 123°54'W., 14 June 1967; UBC 64-444 (8 specimens), Canada, British Columbia, off Triangle Island area, 11 Sept. 1964.

Genus *Nezumia* Jordan, 1904

Nezumia Jordan, *in* Jordan and Gilbert, 1904, p. 620 (type-species *Nezumia condylura* Jordan and Gilbert, by original designation).

Nezumia liolepis (Gilbert).
(Figure 1B.)

Macrurus (Lionurus) liolepis Gilbert, 1891, p. 117 (original description; off southern California, *Albatross* station 2980, in 603 fathoms (1103 meters)).

Lionurus liolepis, Goode and Bean, 1896, p. 409 (listed); Gilbert, 1915, p. 376 (characters; numerous records from off California between San Diego and Monterey Bay, in 161-110 fathoms (294-201 meters)); Townsend and Nichols, 1925, p. 17 (numerous specimens, N. of Pt. Conception to Cape San Lucas, Lower California, in 284-645 fathoms (519-1180 meters)).

Macrurus liolepis, Garman, 1899, pp. 199-200 (description; records from off Baja California, *Albatross* stations, in 660-905 fathoms (1207-1655 meters)); Gilbert, 1896, p. 473 (record from off Monterey Bay, Calif., *Albatross* station 3126, in 456 fathoms (834 meters)).

Lionurus (Lionurus) liolepis, Gilbert and Hubbs, 1916, p. 146 (listed).

Nezumia liolepis, Fitch and Lavenberg, 1968, p. 142 (listed).

REMARKS. *Nezumia liolepis* is a divergent member of its genus, marked by few spinules on the scales, few serrations on the second dorsal ray, and small ventral light organ. The only other species of the genus with comparable reductions in these features is *N. barbiger* (Garman), an eastern Pacific species found in waters off Central America.

DISTRIBUTION. The species is known from Cape San Lucas, Baja California to off Monterey Bay, California. Capture depths range 201-1655 m.

SPECIMENS EXAMINED. CAS no. 26638 (4, 41-56 mm. H.L., 185-272 mm. T.L.), Calif., off San Mateo Pt., 23 June 1953; SU no. 21402 (5, 51-64 mm. H.L., 242-295 mm. T.L.), Calif., off Santa Cruz Island, *Albatross* station 4428, in 764-891 fathoms (1397-1629 meters).

Nezumia stelgidolepis (Gilbert).
(Figures 2B, 3C, 25.)

Macrurus stelgidolepis Gilbert, 1891, p. 116 (original description; off Pt. Conception, California, 34°10'45"N., 120°16'45"W., *Albatross* station 2960, in 267 fathoms (488 meters)); Goode and Bean, 1896, p. 391 (listed); Gilbert, 1915, p. 376 (recorded from off San Diego, *Albatross* station 4306, in 207-497 fathoms (378-910 meters)).

Macrurus gracillicauda Garman, 1899, pp. 206-207, pl. H., fig. 1 (original description; illustration; specimens from off Pacific Panama, *Albatross* stations 3384 and 3385, in 458 and 286 fathoms (837 and 523 meters)).

Lionurus (Nezumia) stelgidolepis, Gilbert and Hubbs, 1916, p. 145 (listed).

Lionurus stelgidolepis, Barnhart, 1936, p. 24 (brief description).

Nezumia stelgidolepis, Roedel, 1951, p. 509, fig. 183 (16 records from off California); Fitch and Lavenberg, 1968, pp. 73-74, fig. 37 (illustration; characters; otoliths and life history notes).

COUNTS. First dorsal fin rays II, 8-10; pectoral fin rays 23-24; pelvic fin rays 10 (rarely 9). Outer gillrakers on first arch 2 + 9-10 (10-12 total); on second arch usually 2 + 9 (9-11 total). Scales below origin of first dorsal fin 9-10; below origin of second dorsal fin 7-8.

MORPHOMETRY. Measurements from 7 specimens ranging 49-96 mm. in head length, +200-+380 mm. in total length. The following in percent of head length: snout length 24-26; preoral length 12-15; horizontal orbit diameter 26-28;

interorbital width 24-26; orbit to angle of preopercle 40-45; suborbital width 12-14; length upper jaws 34-37; length barbel 15-23; length outer gill-slit 16-18; distance snout to anal origin 126-157; greatest body depth 75-89; body depth over anal origin 62-83; height first dorsal fin 59-68; length pectoral fin 52-55; length pelvic fin 43-50; interspace between first and second dorsal fins 27-44.

The head is moderately compressed and contours are generally rounded; head ridges are not strongly angular. The interopercle is broadly exposed and scaled. Gill openings are wide, the branchiostegal membranes unite over the isthmus at a point below the hind margin of the orbits or slightly posteriad, and a moderately broad free fold is formed. Pores of the sensory lateralis system on the head are large and prominent. The vent is located below the middle of the first dorsal fin, behind the bases of the pelvic fins, but well ahead of the anal fin. The distance between the vent and the anal-fin origin is greater than the orbit diameter. A small black fossa lies between the medial margins of the pelvic-fin bases (fig. 2B). A relatively much larger area of scaleless black skin lies anterior to the vent -- these black areas represent parts of the light organ.

Fins lack enlarged or greatly prolonged rays. The outer pelvic ray is thin, the tip filamentous and extending slightly beyond other rays but falling well short of the anal-fin origin. Serrations on the second spinous dorsal ray are stout, well developed at all sizes, and sharp.

Scales are densely covered with slender, lanceolate to conical spinules arranged in an irregularly quincuncial pattern. Scales over the dorsal portion of the suborbital region are large, stout, and in two discrete longitudinal rows along the narrowest portion. Spinules on these scales are erect and arranged in 3-5 sharp, divergent, ridge-like rows. The tip and lateral angles of the snout are armed with stout, heavily spined, tubercle-like scales. Ventral surfaces of the snout and almost all of the suborbital region are naked. The anterior half to two-thirds of the lower jaw rami are naked; sensory pores are very large and prominent here. The third to fifth branchiostegal rays are usually heavily scaled along their bases.

Premaxillary dentition consists of a broad band of villiform teeth with a series of somewhat enlarged, spaced, outer teeth. Broad bands of irregular-sized teeth are present on the mandible; the inner teeth are generally larger. The mandibular band tapers to one to two rows posteriorly.

Coloration is dark brown to swarthy overall and bluish over the abdomen. Gill membranes, lips, gular membranes, lower surfaces of the snout and suborbital, and fins are blackish. The oral cavity is rather pale or dusky, except for blackish oral valves. Gill chambers are black along the outer margins but pale along the anteroventral outer walls and ventralmost and dorsalmost portions of the inner wall.

Peritoneal linings are pale. Gillrakers are darkish, but gill arches and filaments are pale.

SIZE. A 445-mm. specimen reported by Roedel (1951, p. 509) as taken off Point Vicente, California, is the largest known.

COMPARISONS. *Nezumia stelgidolepis* appears most closely related to *N. atlantica* (Parr, 1946) from the western Atlantic. It is readily distinguished from that species by the presence of heavy scales on the branchiostegal rays, the posteriorly produced upper opercular angle and the extensive naked areas on the lower jaw. The relationships of these two species with *N. burragei* (Gilbert, 1905) and *N. tomiyamai* (Okamura, 1963) are briefly discussed by Iwamoto (1970). *Nezumia liolepis* is the only other member of the genus normally found in eastern Pacific waters north of southern California. That species differs markedly from *N. stelgidolepis*, particularly in its thinner, less spinulated, more deciduous scales, its lower first dorsal fin, its more numerous pelvic fin rays (usually 11), its weaker serrations on the second dorsal spine, and its more posteriorly located vent.

DISTRIBUTION. The species is known from off Vancouver Island, British Columbia, south to Panama where it has been reported as *Macrurus gracillicauda* Garman (a synonym *fide* Gilbert and Hubbs, 1916, p. 145). We found no specimens from off Oregon or Washington and suspect that the species is rare north of California.

SPECIMENS EXAMINED. SU no. 102 (1, 49 mm. H.L., +200 mm. T.L.), off Lower California, 26°24'N., 113°49'W., *Albatross* station 3045, in 184 fathoms (336 meters), 10 April 1889; SU no. 17168, (1, 68.5 mm. H.L., + 330 mm. T.L.), off Trinidad Head, Calif., 235 fathoms (430 meters), 14 Aug. 1950; SU no. 22931, off Pt. Loma, Calif. (1, 50 mm. H.L., + 215 mm. T.L.), *Albatross* station 4306, 207-497 fathoms (379-909 meters), 2 March 1904; CAS no. 25992, (2, 85-96 mm. H.L., +380-+405 mm. T.L.), off Pescadero Pt., Calif., 15 April 1954; CAS no. 26072, (1, 81 mm. H.L., 400 mm. T.L.), off Ft. Bragg, Calif., April 1954; CAS no. 15384, (1, 48 mm. H.L., 240 mm. T.L.), *G. B. Reed* cruise 72-3, station 17, off Vancouver Island, British Columbia, 48°45.4'N., 126°21.5'W., in 257 fathoms (470 meters).

Additional specimens from which no meristic or morphometric data were taken: CAS no. 14276, (10, 54-71 mm. H.L.), off Santa Cruz Island, Calif., 19 Feb. 1951; CAS no. 17166, (1, 67 mm. H.L.), off Eureka, Calif., 0-200 fathoms (0-366 meters), Jan.-April, 1950; CAS no. 20558, (1, 69 mm. H.L.), SW. of St. George Light, Calif., *Clara G*, 200 fathoms (366 meters), 3 Sept. 1951; CAS no. 26347, (1, 90 mm. H.L.), off Ft. Bragg, Calif., 10 June 1958; CAS uncataloged, (1, 63 mm.

H.L.), off Pigeon Pt., Calif., 200 fathoms (366 meters), 22 Dec. 1963.

Genus *Coelorinchus*[3] Giorna, 1805

Coelorinchus Giorna, 1809, p. 179 (type-species *Lepidoleprus coelorhincus* Risso, 1810, by tautonymy).

Coelorinchus scaphopsis (Gilbert).
(Figures 1A, 2A, 3A.)

Macrurus (Coelorhynchus) scaphopsis Gilbert, 1890, p. 115 (original description; many specimens, Gulf of California, 29°19'N., 112°50'W., *Albatross* station 3015, in 145 fathoms (265 meters)); Böhlke, 1953, p. 58 (12 syntypes, SU no. 179, listed).
Coelorhynchus scaphopsis, Goode and Bean, 1896, p. 397 (listed).
Coelorhynchus (Coelorhynchus) scaphopsis, Gilbert and Hubbs, 1916, p. 144 (listed).

DISTINGUISHING FEATURES. This species is readily distinguished from all other macrourid fishes treated here by the following combination of characters: a large, black, naked fossa on midventral line just anterior to pelvic fins; snout pointed, produced, and stoutly supported by sharp lateral ridges that pass continuously from tip of snout to the preopercle angles; pelvic fin rays 7; second spinous dorsal ray smooth at all sizes.

REMARKS. *Coelorinchus scaphopsis* is the only member of the genus *Coelorinchus* known to inhabit eastern Pacific waters north of Baja California.

Mr. Joseph Copp of Scripps Institution of Oceanography informs us that this species is rather commonly taken by commercial trawlers fishing out of Santa Barbara. Three specimens we examined come from that general area, but we know of none from north of Point Conception.

---

[3]Lillian J. Dempster and William I. Follett of the California Academy of Sciences point out that Giorna's original spelling of the generic name, *Coelorinchus*, was improperly emended to *Coelorhynchus* by most later authors. There is no justification for this according to Article 32(a)(ii) of the International Code of Zoological Nomenclature. The spelling should remain *Coelorinchus*. The different spellings of *Coelorinchus (Coelorhincus, Coelorhynchus, Caelorhynchus,* etc.) are homonyms according to Article 58 (1 and 4) of the Code.

SPECIMENS EXAMINED. SU no. 179 (5 paratypes, 41-59 mm. H.L., 261-240 mm. T.L., Gulf of California, 29°19'N., 112° 50'W., *Albatross* station 3015, in 145 fathoms (265 meters), 24 March 1889; CAS no. 14555, (1, 54 mm. H.L., 245 mm. T.L.), Calif., Santa Cruz Island, Pelican Bay, in 110-150 fathoms (201-274 meters); SIO no. 61-194-62A (1, 80 mm. H.L., 340 mm. T.L., Calif., off Pt. Conception, in 145-150 fathoms (265-274 meters); SIO no. 67-267-62 (1, 58 mm. H.L., 230 mm. T.L.), Calif., Santa Cruz Island, Pelican Bay, in 135 fathoms (247 meters); SIO no. 68-93-62, (32, 83-206 mm. T.L.), Mexico, Gulf of California, SE. of San Felipe, 19 June 1968.

Literature Cited

ANDRIASHEV, ANATOLY P.
1937. A contribution to the knowledge of the fishes from the Bering and Chukchi Seas. Issledovaniia morei SSSR, Gosudarstrennyi gidrologicheskii institut, Leningrad, no. 25, pp. 292-355, figs. 1-27. (In Russian with English summary) (Also United States Fish and Wildlife Service, Special Scientific Report, Fisheries, no. 145, 1955 (English translation)).

BARNHART, PERCY S.
1936. Marine fishes of southern California. University of California Press, Berkeley, 209 pp.

BEAN, TARLETON H.
1884. Notes on some fishes collected in Washington Territory, including a new species of *Macrurus*. Proceedings of the United States National Museum, vol. 6 (for 1883), pp. 362-364.
1891. New fishes collected off the coast of Alaska and the adjacent region southward. Proceedings of the United States National Museum, vol. 13 (for 1890), pp. 37-45.

BIRSHTEYN, YA. A., and M. YE. VINOGRADOV
1955. Zametki o pitanii glubokovodnykh ryb Kurilo-Kamchatskoy Vpadiny. [Notes on the feeding of deep-sea fishes in the Kurile-Kamchatka Trench.] Zoologicheskij Zhurnal, Moscow, vol. 34, no. 4. (In Russian) (not seen).

BÖHLKE, JAMES E.
1953. A catalogue of the type specimens of recent fishes in the Natural History Museum of Stanford University. Stanford Ichthyological Bulletin, vol. 5, no. 1, pp. 1-168.

BOLIN, ROLF L.
1947. The evolution of the marine Cottidae of California with a discussion of the genus as a systematic category. Stanford Ichthyological Bulletin, vol. 3, no. 3, pp. 153-168.

1957. Deep-water biological provinces of the Indo-Pacific. Proceedings of the 8th Pacific Science Congress, vol. 3 (Oceanography), pp. 373-378.

BRAUER, AUGUST
1906. Die Tiefsee-Fische. Wissenschaftlische Ergebnisse der deutschen Tiefsu-Expedition auf dem Dampfer "Valdivia" 1898-1899. Systematischer Teil, vol. 15, pp. 3-432.

CAREY, ANDREW G., JR., and H. HEYAMOTO
1972. Techniques and equipment for sampling benthic organisms. Chapter 18. *In*, A. T. Pruter and D. L. Alverson (editors), The Columbia River estuary and adjacent ocean waters. Bioenvironmental Studies. University of Washington Press, XIII + 868 pp.

CHIRICHIGNO F., NORMA
1968. Nuevos registros para la ictiofauna marine del Peru. Boletin Instituto del Mar del Peru, vol. 1, no. 8, pp. 377-504.
1969. Lista sistematica de los peces marinos comunes para Ecuador-Peru-Chile. Conferencia sobre explotacion y conservacion de las riquezas maritimas del Pacifico sur Chile-Ecuador-Peru. 108 pp.

CLEMENS, W. A., and G. V. WILBY
1946. Fishes of the Pacific coast of Canada. Bulletin of the Fisheries Research Board of Canada, no. 68, 368 pp. (Also 1949 and 1961 (revised) editions).
1961. Fishes of the Pacific coast of Canada. Bulletin of the Fisheries Research Board of Canada, no. 68 (revised edition), 443 pp.

DAY, DONALD S., and WILLIAM G. PEARCY
1968. Species associations of benthic fishes on the Continental Shelf and Slope off Oregon. Journal of the Fisheries Research Board of Canada, vol. 25, no. 12, pp. 2665-2675, figs. 1-3, tables 1-3.

DOLLO, LOUIS
1900. *Macrurus lecointei*, poisson abyssal nouveau recueilli par cette expédition. Expédition Antarctique Belge. Bulletins de l'Académie Royal de Belgique (Classe de Sciences), no. 6, pp. 1-20.

EVERMANN, BARTON W., and EDMUND L. GOLDSBOROUGH
1907. The fishes of Alaska. Bulletin of the United States Bureau of Fisheries (for 1906), vol. 26, pp. 219-360.

FITCH, JOHN E., and ROBERT J. LAVENBERG
1968. Deep-water teleostean fishes of California. University of California Press, Berkeley, 155 pp.

FOWLER, HENRY W.
1936. The marine fishes of West Africa. Bulletin of the American Museum of Natural History, vol. 70, no. 1, pp. 1-605, no. 2, pp. 606-1493.

FRASER-BRUNNER, A.
1935. New or rare fishes from the Irish Atlantic Slope. Proceedings of the Royal Irish Academy, vol. 42, section B, no. 8, pp. 319-326.

GARMAN, SAMUEL
1899. Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands, in charge of Alexander Agassiz, by the U. S. Fish Commission steamer "Albatross" during 1891. Lieut.-Commander Z. L. Tanner, U.S.N., commanding. Part 26, The fishes. Memoirs of the Museum of Comparative Zoology of Harvard College, vol. 26, pp. 1-431, pls. 1-84, A-N.

GIGLIOLI, ENRICO H.
1893. Di una nuova specie di Macrurid appartenente alla fauna abissale del Mediterraneo. Zoolgischer Anzeiger, vol. 16, no. 428, pp. 343-345.

GILBERT, CHARLES H.
1891. A preliminary report on the fishes collected by the steamer "Albatross" on the Pacific coast of North America during the year 1889, with descriptions of twelve new genera and ninety-two new species. Proceedings of the United States National Museum (for 1890), vol. 13, no. 797, pp. 49-126.
1892. Scientific results of explorations by the U. S. Fish Commission steamer "Albatross." No. 22. Descriptions of thirty-four new species of fishes collected in 1888 and 1889, principally among the Santa Barbara Islands and in the Gulf of California. Proceedings of the United States National Museum (for 1891), vol. 14, no. 880, pp. 539-566.
1895. The ichthyological collections of the steamer "Albatross" during the years 1890 and 1891. Report of the United States Commissioner of Fish and Fisheries for 1893, vol. 19, pp. 393-476, pls. 20-35.
1905. The deep-sea fishes of the Hawaiian Islands. *In*, The Aquatic Resources of the Hawaiian Islands. Bulletin of the United States Fish Commission (for 1903), vol. 23, part 2, pp. 575-713, figs. 230-276, pls. 66-101.
1915. Fishes collected by the United States fisheries steamer "Albatross" in southern California in 1904. Proceedings of the United States National Museum, vol. 48, no. 2075, pp. 305-380, pls. 14-22.

GILBERT, CHARLES H., and CHARLES V. BURKE
1912. Fishes from Bering Sea and Kamchatka. Bulletin of the United States Bureau of Fisheries (for 1910), vol. 30, pp. 31-96.

GILBERT, CHARLES H., and CARL L. HUBBS
1916. Report on the Japanese macrouroid fishes collected by the United States fisheries steamer "Albatross" in 1906, with a synopsis of the genera. Proceedings of the United States National Museum, vol. 51, no. 2149, pp. 135-214, pls. 8-11.
1920. The macrouroid fishes of the Philippine Islands and the East Indies. United States National Museum Bulletin 100, vol. 1, part 7, pp. 369-588.

GILBERT, CHARLES H., and WILL F. THOMPSON
1916. Family Macrouridae, pp. 471-476. *In*, Will F. Thompson, Fishes collected by the United States Bureau of Fisheries steamer "Albatross" during 1888, between Montevideo, Uruguay, and Tome, Chile, on the voyage through the Straits of Magellan. Proceedings of the United States National Museum, vol. 50, no. 2133, pp. 401-476, pls. 2-6.

GILL, THEODORE, and CHARLES H. TOWNSEND
1897. Diagnoses of new species of fishes found in Bering Sea. Proceedings of the Biological Society of Washington, vol. 11, pp. 231-234.

GIORNA, MICHEL E.
1809. Mémoire sur des poissons d'espèces nouvelles et du genres nouveaux. Memoires de l'Académie Impériale des Sciences, Turin, pour les annees 1805-1808, Sciences, Physiques et Mathématiques, vol. 2, pp. 177-180.

GOODE, G. BROWN, and TARLETON H. BEAN
1883. Reports on the results of dredging under the supervision of Alexander Agassiz, on the east coast of the U. S. XIX--Report on the fishes. Bulletin of the Museum of Comparative Zoology, Harvard College, vol. 10, no. 5, pp. 183-226.
1896. Oceanic ichthyology, a treatise on the deep-sea and pelagic fishes of the world...Smithsonian Contributions to Knowledge, vol. 30, No. 981 (also United States National Museum, Special Bulletin, vol. 3; and Memoirs of the Museum of Comparative Zoology, Harvard College, vol. 22), part 1 (text) pp. 1-553, part 2 (atlas) pp. 1-26, pls. 1-123, figs. 1-417.

GREY, MARION
1956. The distribution of fishes found below a depth of 2000 meters. Fieldiana: Zoology, vol. 36, no. 2, pp. 74-336.

GUNNER, JOHANN E.
1765. Efterretning om berglaxen, en rar norsk fishk, som kunde kaldes: *Coryphaenoides rupestris*. K. Norske Videnskabers Selskab Skrifter Trondhjem, vol. 3, no. 4, pp. 40-58.

GÜNTHER, ALBERT
1877. Preliminary notes on new fishes collected in Japan during the expedition of H.M.S. "Challenger." Annals and Magazine of Natural History, series 4, vol. 20, pp. 433-447.
1878. Preliminary notices of deep-sea fishes collected during the voyage of H.M.S. "Challenger." Annals and Magazine of Natural History, series 5, vol. 2, pp. 17-28.
1887. Report on the deep-sea fishes collected by H.M.S. "Challenger" during the years 1873-76. Report on the scientific results of H.M.S. "Challenger" during the years 1873-76, vol. 22, Zoology, part 1 (text), pp. 1-335; part 2 (plates), pls. 1-73.

HECTOR, JAMES
1875. Descriptions of five new species of fishes obtained in New Zealand Seas by H.M.S. "Challenger" Expedition. Annals and Magazine of Natural History, series 4, vol. 15, pp. 78-82.

HUBBS, CARL L., and KARL F. LAGLER
1958. Fishes of the Great Lakes region. Revised edition, Cranbrook Institute of Science Bulletin, no. 26, pp. 1-213.

IWAMOTO, TOMIO
1970. The R/V "Pillsbury" deep-sea biological expeditions to the Gulf of Guinea, 1964-65. 19. Macrourid fishes of the Gulf of Guinea. Studies in Tropical Oceanography, University of Miami, no. 4 (part 2), pp. 316-431.

JOHNSEN, SIGURD
1927. On some bathypelagic stages of macrurid fishes. Saertryk av Nyt Magazin for Nuturvidenskaberne, Oslo, 65, B, pp. 221-242.

JORDAN, DAVID S.
1900. Notes on recent fish literature. American Naturalist, vol. 34, pp. 897-898.

JORDAN, DAVID S., and BARTON W. EVERMANN
1896. A check-list of the fishes and fish-like vertebrates of North and Middle America. Report of the United States Commissioner of Fish and Fisheries for 1895, part 21, pp. 207-584.
1898. The fishes of North and Middle America. Bulletin of the United States National Museum, vol. 47, no. 3, pp. 2183-3134.
1900. The fishes of North and Middle America. Bulletin of the United States National Museum, vol. 47, no. 4, pp. 3135-3313, pls. 1-392.

JORDAN, DAVID S., BARTON W. EVERMANN, and HOWARD W. CLARK
1930. Check list of the fishes and fish-like vertebrates of North and Middle America north of the northern boundary of Venezuela and Colombia. Report of the United States Commissioner of Fish and Fisheries for 1928, part 2, pp. 1-670.

JORDAN, DAVID S., and CHARLES H. GILBERT
1899. The fishes of Bering Sea, pp. 433-492, pls. 42-85. *In*, David Starr Jordan, The fur seals and fur-seal islands of the North Pacific Ocean. Part 3, pp. 1-629, pls. 1-95, Washington, D.C.
1904. Macrouridae, pp. 602-621. *In*, David S. Jordan and Edwin C. Starks, List of fishes dredged by the steamer "Albatross" off the coast of Japan in the summer of 1900, with descriptions of new species and a review of the Japanese Macrouridae. Bulletin of the United States Fish Commission (for 1902), vol. 22, pp. 577-630, pls. 1-8.

JORDAN, DAVID S., and WILLIAM F. THOMPSON
1914. Record of fishes obtained in Japan in 1911. Memoirs of the Carnegie Museum, vol. 6, part 4, pp. 205-313.

KAMOHARA, TOSHIJI
1952. Revised descriptions of the offshore bottom-fishes of Prov. Tosa, Shikoku, Japan. Report of the Kochi University, Natural Science, no. 3, pp. 1-122.

KOEFOED, EINAR
1927. Fishes from the sea-bottom. Report on the Scientific Results of the "Michael Sars" North Atlantic Deep-Sea Expedition, 1910, vol. 4, no. 1, pp. 1-147, pls. 1-6.

LACÉPÈDE, BERNHARD GERMAIN ETIENNE
1801. Histoire naturelle des poissons, par le citoyen La Cepède, membre du Sénat, ...etc., vol. 5, pp. i-cxi, 1-414, pls. 1-12. Chez Plassan, Paris.

LÜTKEN, CHRISTIAN F.
1898. The ichthyological results of the expeditions of the "Ingolf." The Danish INGOLF Expedition, vol. 2, no. 1, pp. 1-39, pls. 1-4, 1 map.

MAKUSHOK, M.
1964. O vidovom tozhdestve *Nematonurus longifilis* (Günther, 1877) i *N. clarki* (Jordan et Gilbert, 1898) i nekotoryye zamechaniya o vosrastnoy izmenchivosti u Macruridae (Pisces). [Species identity of *Nematonurus longifilis* (Günther, 1877) and *N. clarki* (Jordan and Gilbert, 1898) and some notes on age variations in Macruridae (Pisces).] Trudy Instituta Okeanologii Akademiia Nauk SSSR, vol. 73, pp. 139-162. (In Russian with English summary). (Also trans-

lated into English by U. S. Fish and Wildlife Service, Seattle, Washington.)

1967. Whiptails (family Macrouridae or Coryphaenoididae Auct). Chapter IV. *In*, V. G. Kort (chief editor), Tikhiy Okean, Biologiya Tikhogo Okeana, Kn. III, Ryby Otkrytylch Vod, [Biology of the Pacific Ocean, Book III, Fishes of the open waters], pp. 3-273, Moscow. (Translated from Russian, United States Naval Oceanographic Office, Translation no. 528, Washington, D.C.).

MARSHALL, NORMAN B.

1973. Family Macrouridae. Fishes of the western North Atlantic. Memoirs of the Sears Foundation for Marine Research, no. 1 (Part 6), pp. 496-665.

MARSHALL, NORMAN B., and TOMIO IWAMOTO

1973. Genus *Coryphaenoides*. *In:* Norman B. Marshall, Family Macrouridae. Fishes of the western North Atlantic. Memoirs of the Sears Foundation for Marine Research, no. 1, (Part 6), pp. 565-580.

MATSUBARA, KIYOMATSU

1955. Fish morphology and hierarchy. Part II, Ishizaki-Shoten, Tokyo, Japan, pp. 791-1605. (In Japanese).

MAUL, G. E.

1951. Monografia dos Peixes do Museu Municipal do Funchal, Familia Macrouridae e Merlucciidae, Boletim do Museu Municipal do Funchal, no. 5, art. 12, pp. 5-55.

NOVIKOV, N. P.

1970. Biology of *Chalinura pectoralis* in the North Pacific. Pp. 304-331. *In:* P. A. Moiseev (editor), Soviet fisheries investigations in the northeastern Pacific Part V. Proceedings of the All-Union Scientific Research Institute of Marine Fisheries and Oceanography (VNIRO), vol. 70, and Proceedings of the Pacific Scientific Research Institute of Fisheries and Oceanography (TINRO), vol. 72. (English translation by Israel Program for Scientific Translations, Jerusalem, 1972).

NYBELIN, ORVAR

1957. Deep-sea bottomfishes. Reports of the Swedish Deep-Sea Expedition, 1947-48, vol. 2, Zoology, no. 20, pp. 247-345, pls. 1-7.

OKADA, YAICHIRO

1955. Fishes of Japan. Illustrations and descriptions of fishes of Japan. Maruzen Company, Limited, Tokyo, 434 pp.

OKADA, YAICHIRO, and KIYOMATSU MATSUBARA

1935. Illustrations of Japanese fishes. Sanshodo Book Company, Tokyo, 425 pp., 165 pls. (In Japanese).

1938. Keys to the fishes and fish-like animals of Japan, including Kuril Islands, southern Sakhalin, Bonin Islands, Ryukyu Islands, Korea and Formosa. Sanseido Co., Tokyo, 584 pp., 113 pls. (In Japanese).

OKAMURA, OSAMU

1963. Two new and one rare macrourid fishes of the genera *Coelorhynchus* and *Lionurus*, found in Japan waters. Bulletin of the Misaki Marine Biological Institute, Kyoto University, vol. 4, pp. 21-35.

1970. Fauna Japonica. Macrourina (Pisces). Academic Press of Japan, Tokyo, 216 pp., 64 pls.

1971. Studies on the macrouroid fishes of Japan. Morphology, ecology and phylogeny. Reports of the Usa Marine Biological Station, vol. 17, nos. 1-2, pp. 1-179, 85 figs.

PARR, ALBERT E.

1946. The Macrouridae of the western North Atlantic and Central American seas. Bulletin of the Bingham Oceanographic Collections, Yale University, vol. 10, article 1, pp. 1-99.

PEQUEÑO REYES, GERMÁN

1971. Sinopsis de Macrouriformes de Chile (Pisces, Teleostomi). Boletin del Museo Nacional de Historia Natural, Chile, vol. 32, pp. 269-298, figs. 1-17, maps 1-3.

RADCLIFFE, LEWIS

1912. Descriptions of a new family, two new genera, and twenty-nine new species of anacanthine fishes from the Philippine Islands and contiguous waters. Proceedings of the United States National Museum, vol. 43, no. 1924, pp. 105-140, pls. 22-31.

RASS, T. S.

1963. Glubokovodnyye ryby -- Dolgokhvosty (Pisces, Macruridae) Okhotskogo Morya. [Deep-sea fishes (Pisces, Macruridae) of the Sea of Okhotsk.], Trudy Instituta Okeanologii Akademiia Nauk SSSR, vol. 62, pp. 211-223. (In Russian) (Translated into English by United States Fish and Wildlife Service, Seattle, Washington.)

REGAN, C. TATE

1913. The Antarctic fishes of the Scottish National Antarctic Expedition. Transactions of the Royal Society of Edinburgh, vol. 49, part 2, no. 2, pp. 229-292, pls. 1-11.

ROEDEL, PHIL M.

1951. Noteworthy southern California records of four species of marine fishes. California Fish and Game, vol. 37, no. 4, pp. 509-510.

ROSEN, DONN E., and REEVE M. BAILEY

1963. The poeciliid fishes (Cyprinodontiformes), their

structure, zoogeography, and systematics. Bulletin of the American Museum of Natural History, vol. 126, art. 1, pp. 1-176.

ROULE, LOUIS
1919. Poissons provenant des campagnes du yacht PRINCESSE-ALICE (1891-1913) et du yacht HIRONDELLE II (1914). Résultats des Campagnes Scientifiques accomplies sur son yacht par, Albert Ier, Monaco, fascicule 52, pp. 1-190, pls. 1-7.

SCHMIDT, P. YU.
1950. Ryby Okhotskogo Morya. [Fishes of the Sea of Okhotsk.] Trudy Tikhookeanskogo Komiteta M.-L., Izd-vo Akademiia Nauk SSSR, vol. 6, pp. 1-392, pls. 1-20. (English translation by Israel Program for Scientific Translations, Jerusalem, 1965.)

SCHULTZ, LEONARD P., and ALLAN C. DELACY
1936. Fishes of the American Northwest. A catalogue of the fishes of Washington and Oregon, with distributional records and a bibliography. Second installment. Mid-Pacific Magazine, vol. 49, no. 1 (Jan.-Mar.), pp. 63-78.

TARANETZ, A. YA.
1933. Novyye dannyye poikhtiofaunae Beringova Morya. [New data on the ichthyofauna of the Bering Sea.] Vestnik Dal'nevostochnykh Filiala Akademiia Nauk SSSR, no. 1-3, pp. 67-78 (In Russian with English summary).
1937. Kratkiy opredelitel ryb Sovetskogo Dal'Nego Vostoka i prilezhascchikh vod. [Handbook for identification of fishes of Soviet Far East and adjacent waters.] Izvestiya Tikhookeanskogo Nauckno-Issledovaniya Instituta Rybnogo Khoz-va i Okeanografii [Bulletin of the Pacific Scientific Institute of Fisheries and Oceanography], vol. 11, pp. 1-200, 1 map. (In Russian).

TOWNSEND, CHARLES H., and JOHN T. NICHOLS
1925. Deep sea fishes of the "Albatross" Lower California Expedition. Bulletin of the American Museum of Natural History, vol. 52, pp. 1-20, pls. 1-4, 1 map.

VAILLANT, LÉON L.
1888. Expéditions scientifiques de TRAVAILLEUR et du TALISMAN pendant les années 1880, 1881, 1882, 1883. Poissons. Paris, France, pp. 1-406, pls. 1-28.

TABLE 1. *Frequency distribution of selected meristic characters of eight species of* Coryphaenoides.

	Segmented rays of first dorsal fin								Pectoral finrays*							
	7	8	9	10	11	12	13	14	16	17	18	19	20	21	22	23
C. pectoralis	1	7	6	--	--	--	--	--	1	2	3	12	3	3	--	--
C. longifilis	--	--	--	--	--	1	4	1	--	1	7	4	--	--	--	--
C. armatus																
(Atlantic)	--	6	8	--	--	--	--	--	--	--	--	2	14	6	1	--
(Pacific)	--	3	5	6	--	--	--	--	--	--	2	4	2	5	4	--
C. yaquinae	--	1	1	1	--	--	--	--	--	--	--	--	--	4	--	--
C. leptolepis																
(Atlantic)	--	2	3	--	--	--	--	--	--	--	--	--	3	5	1	--
(Pacific)	--	5	10	3	--	--	--	--	--	--	3	11	5	2	2	--
C. filifer	--	--	--	--	3	25	15	4	--	--	1	8	10	15	17	1
C. cinereus	--	--	--	8	8	3	--	1	--	1	--	3	10	6	6	2
C. acrolepis	--	--	8	8	3	--	--	--	--	--	--	4	5	3	2	--

* Includes counts from both right and left fins.

TABLE 1. *(Continued).*

	Pelvic finrays*							Scales below middle of first dorsal fin					
	6	7	8	9	10	11	12	6	7	8	9	10	11
C. pectoralis	2	20	4	--	--	--	--	--	--	--	--	1	1
C. longifilis	--	--	--	7	5	--	--	--	--	--	--	--	--
C. armatus													
(Atlantic)	--	--	--	1	21	1	--	1	4	1	--	--	--
(Pacific)	--	--	--	--	1	15	5	2	3	3	--	--	--
C. yaquinae	--	--	--	--	4	--	--	1	--	1	--	--	--
C. leptolepis													
(Atlantic)	--	--	--	7	3	--	--	3	--	--	--	--	--
(Pacific)	--	--	--	6	10	7	--	11	--	--	--	--	--
C. filifer	--	--	--	47	17	--	--	--	2	15	7	--	1
C. cinereus	--	--	2	30	2	--	--	--	--	5	--	--	1(?)
C. acrolepis	--	--	18	1	--	--	--	--	3	5	3	1	--

* Includes counts from both right and left fins.

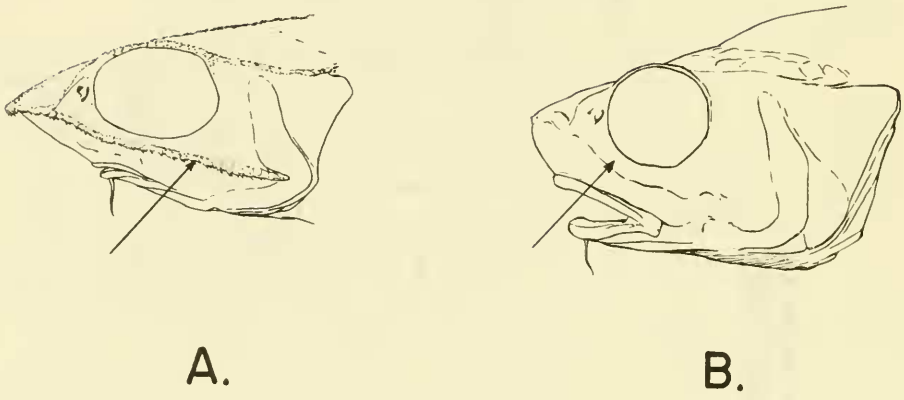

FIGURE 1. Diagrammatic illustrations of heads of (A) *Coelorinchus scaphopsis* and (B) *Nezumia liolepis*. Arrows point to suborbital ridge.

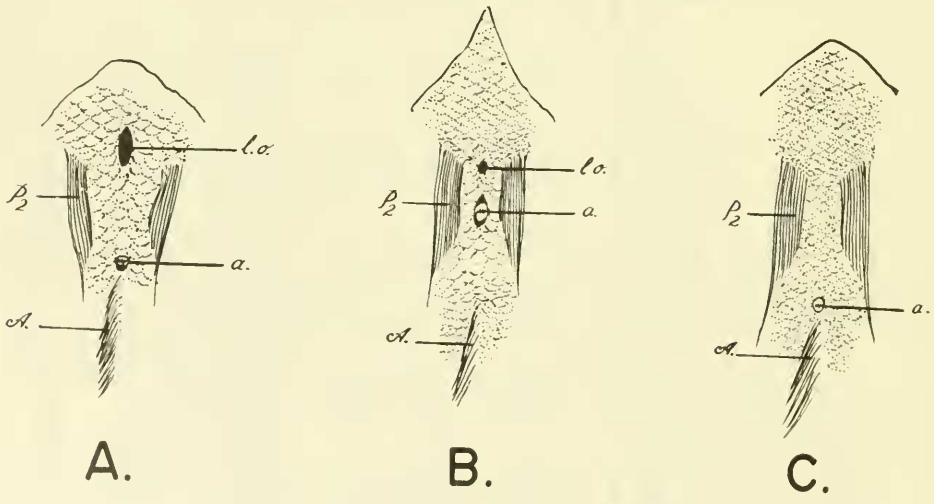

FIGURE 2. Diagrammatic illustrations showing ventral views of abdominal region of (A) *Coelorinchus scaphopsis*, (B) *Nezumia stelgidolepis* and (C) *Coryphaenoides acrolepis*. Abbreviations: *A.* -- anal fin; *a.* -- anus; *l.o.* -- naked fossa (dermal window of light organ); P_2 -- pelvic fin.

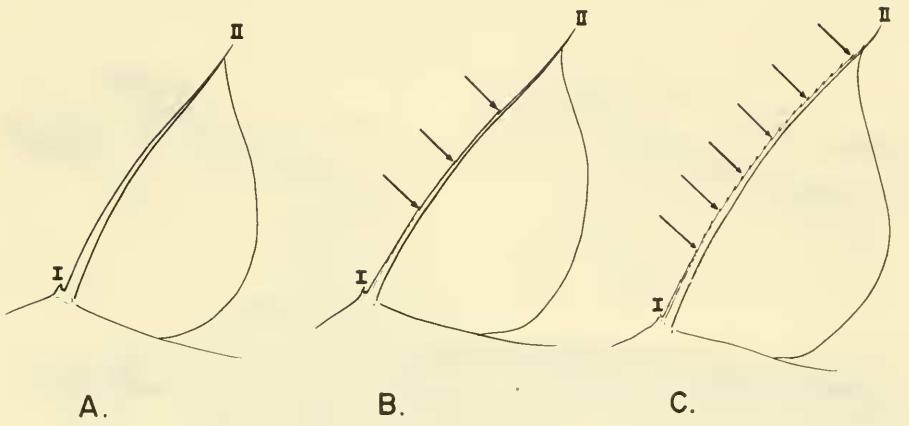

FIGURE 3. First dorsal fins of (A) *Coelorinchus*, (B) *Nezumia liolepis*, and (C) *Nezumia stelgidolepis*, showing different degrees of serration on leading edges of spinous second ray (II), and position and size of first spinous ray (I).

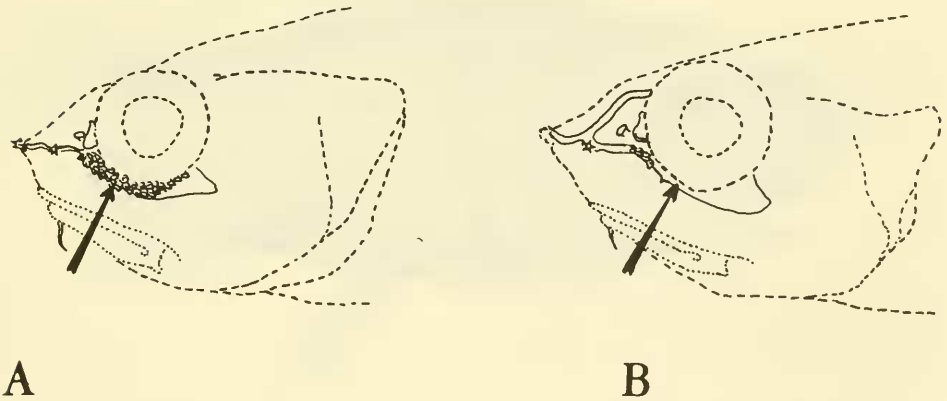

FIGURE 4. Diagrammatic illustrations of heads of (A) *Coryphaenoides filifer* and (B) *C. cinereus* comparing widths and scaling of suborbital shelf (arrows). Drawn by Katherine P. Smith.

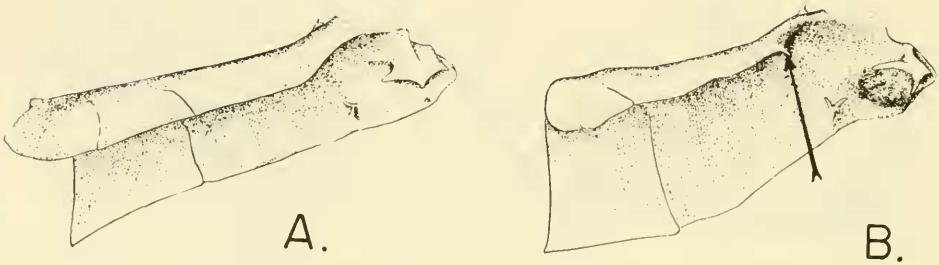

FIGURE 5. Right suborbital bones of (A) *Coryphaenoides filifer* and (B) *C. cinereus* comparing shape of suborbital shelf and presence of anteroventral branch (arrow) in *C. cinereus*.

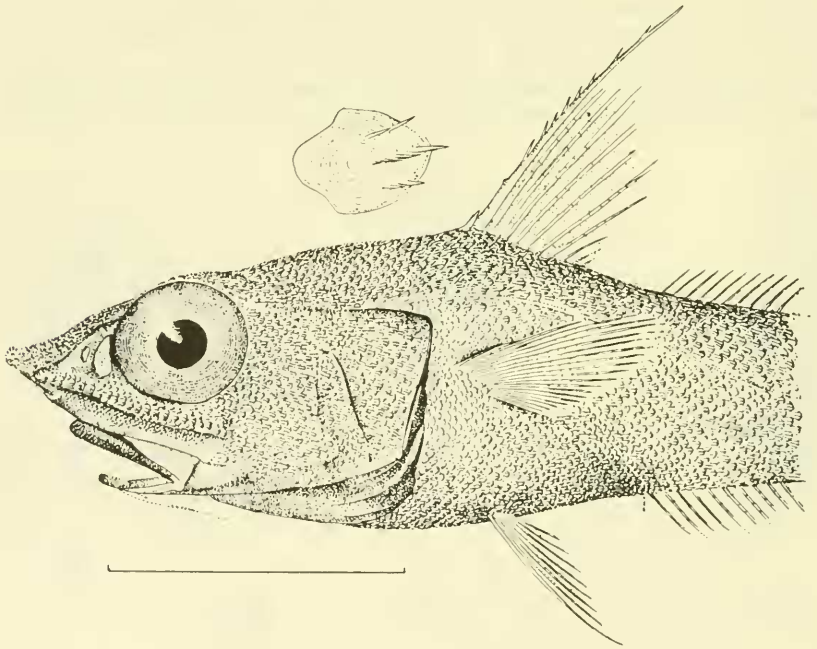

FIGURE 6. Juvenile of *Coryphaenoides (Coryphaenoides) acrolepis* from off Bogoslof Island, Bering Sea, *Albatross* station 3634. From Jordan and Gilbert (1899, pl. 82). Drawn by Anna L. Brown.

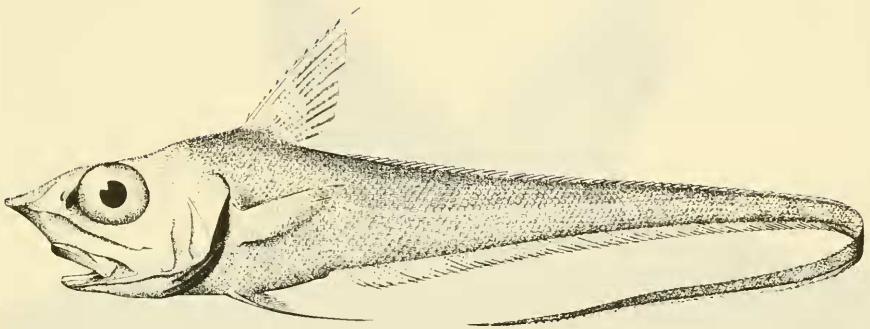

FIGURE 7. Adult of *Coryphaenoides acrolepis* from off Washington (51°23'N., 130°34'W.), *Albatross* station 2860 in 876 fathoms (1602 meters), 31 August 1888. Drawn by S. F. Denton.

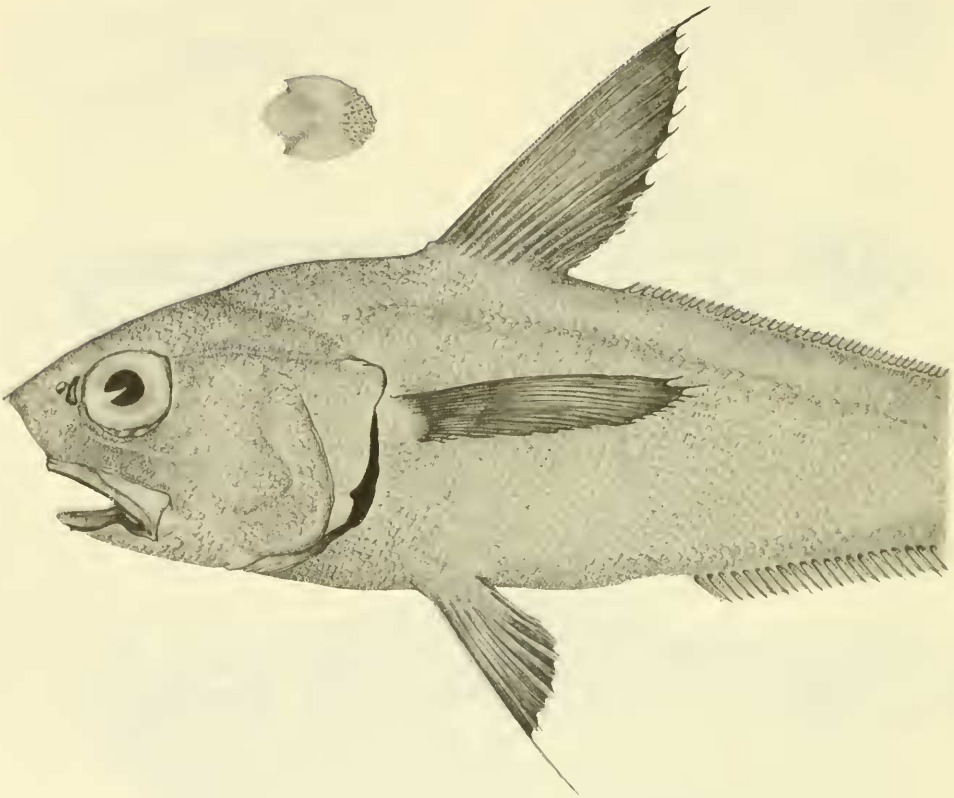

FIGURE 8. *Coryphaenoides (Coryphaenoides) filifer.* A specimen 108 mm. head length, 610 mm. total length (UBC64-444) from off Triangle Island, British Columbia. Drawn by Katherine P. Smith.

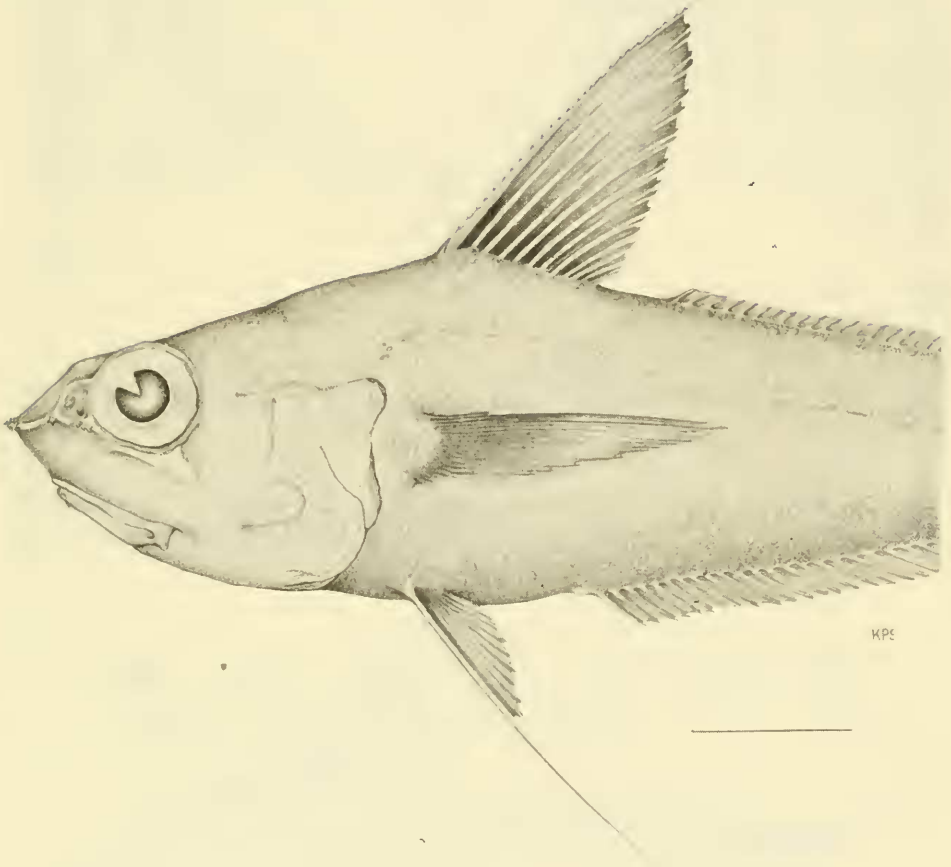

FIGURE 9. *Coryphaenoides (Coryphaenoides) cinereus.* A specimen 61 mm. head length, + 360 mm. total length (SU 22976) from the Okhotsk Sea. Drawn by Katherine P. Smith.

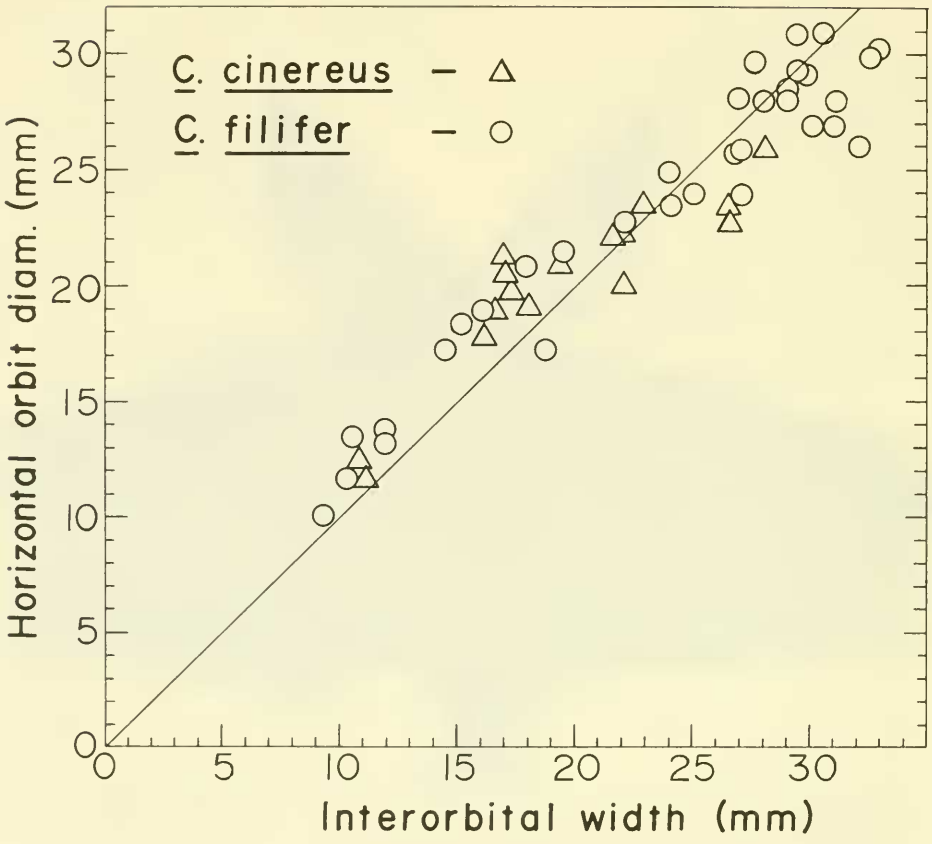

FIGURE 10. Scatter diagram showing relationship of orbit diameter to interorbital width in two species of *Coryphaenoides (C. cinereus* and *C. filifer)*. Note that the orbit diameter becomes proportionately smaller with increase in interorbital width. Diagonal line represents 1:1 ratio.

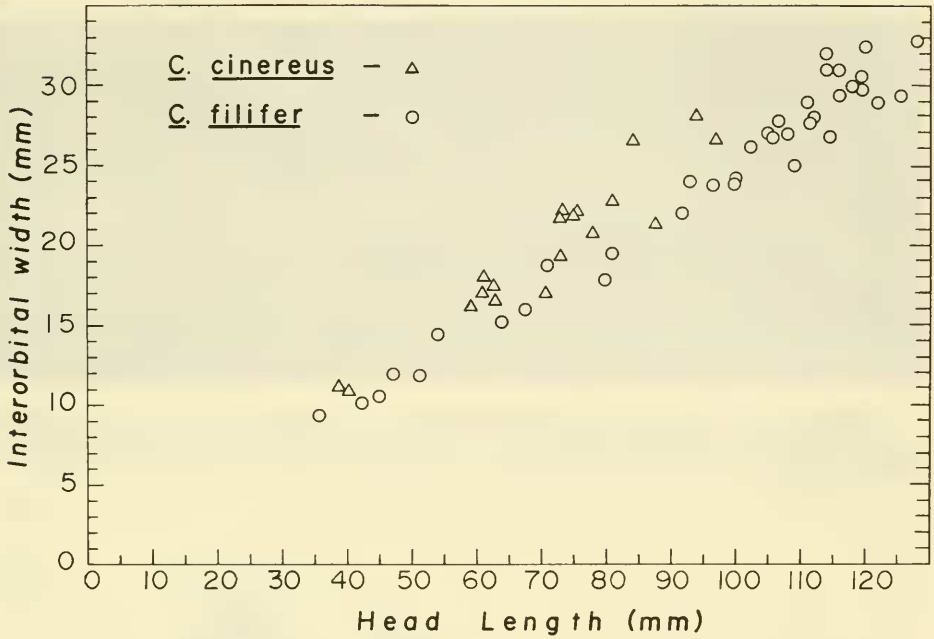

FIGURE 11. Scatter diagram comparing interorbital widths of *Coryphaenoides cinereus* and *C. filifer*.

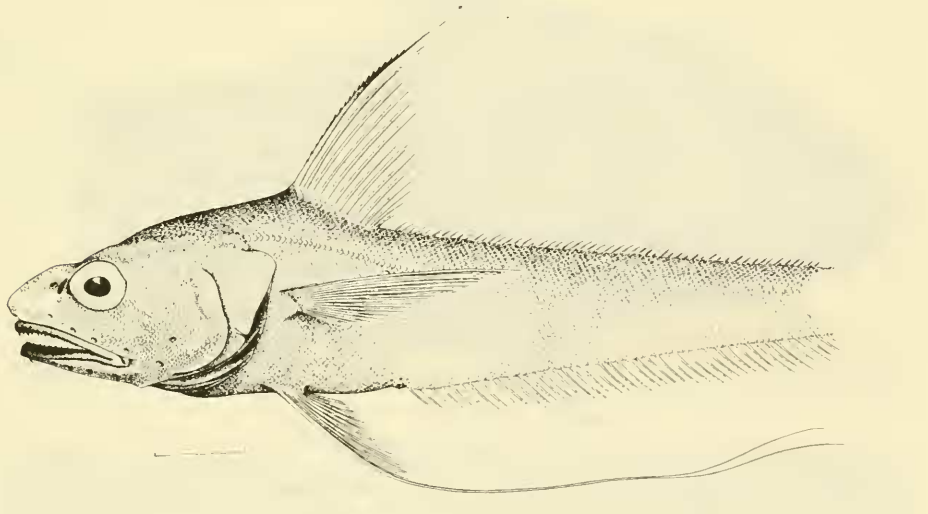

FIGURE 12. *Coryphaenoides (Nematonurus) longifilis* from off Bogoslof Island, Bering Sea. From Jordan and Gilbert (1899, pl. 83). Drawn by Chloe L. Starks.

FIGURE 13. *Coryphaenoides (Nematonurus) armatus* (Hector). Photograph of young specimen. approximately 200 mm. long from off Oregon.

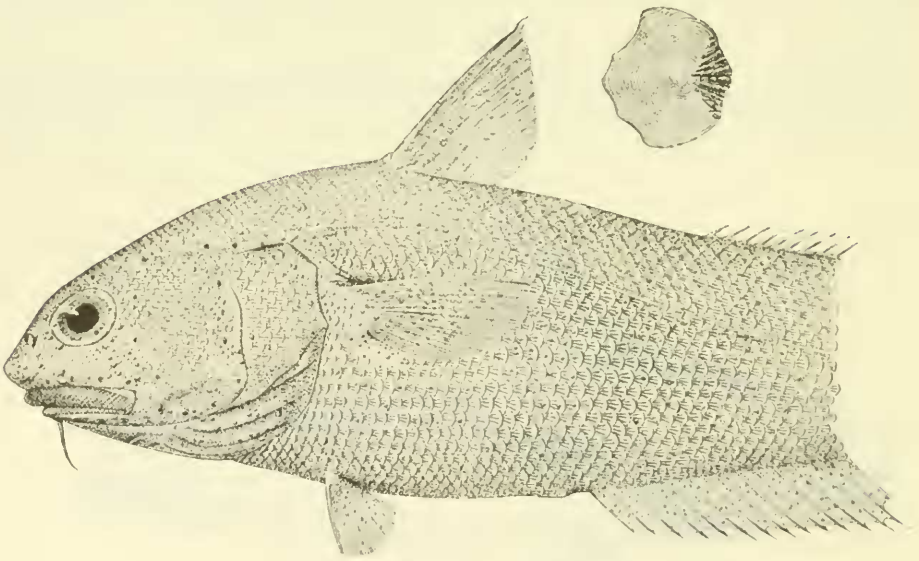

FIGURE 14. *Coryphaenoides (Nematonurus) armatus*. Illustration of specimen 803 mm. long, from *Albatross* station 4390, off Santa Catalina Island, California. From Gilbert (1915, pl. 21)

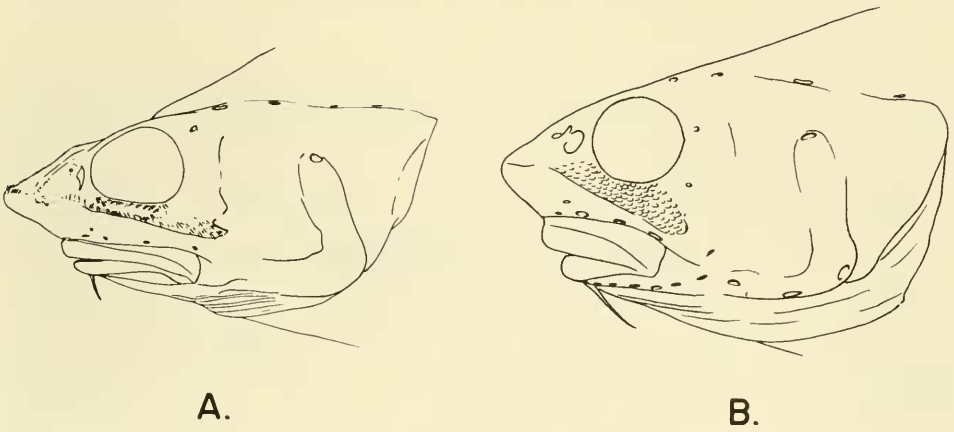

FIGURE 15. Diagrammatic illustrations of heads of (A) *Coryphaenoides yaquinae* and (B) *C. armatus* comparing size of sensory pores on head and scaling on suborbital shelves.

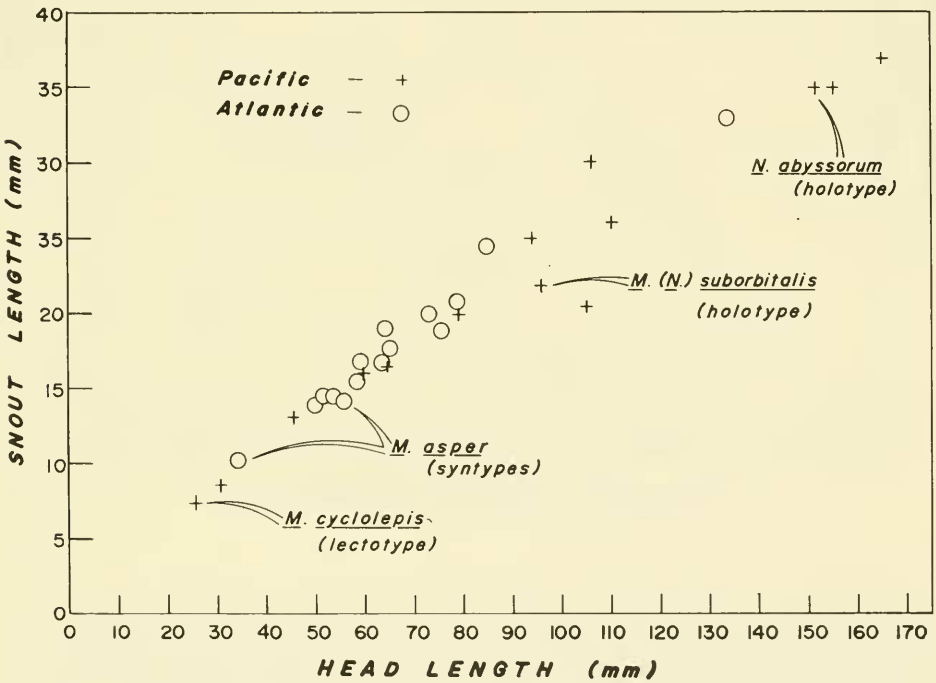

FIGURE 16. Scatter diagram comparing snout lengths of *Coryphaenoides armatus* specimens from the Pacific and Atlantic Oceans. Arrows point to plotted measurements of holotype of *Nematonurus abyssorum* Gilbert, holotype of *Macrurus (Nematonurus) suborbitalis* Gill and Townsend, two syntypes of *Macrurus asper* Goode and Bean, and lectotype of *Macrurus cyclolepis* Gilbert.

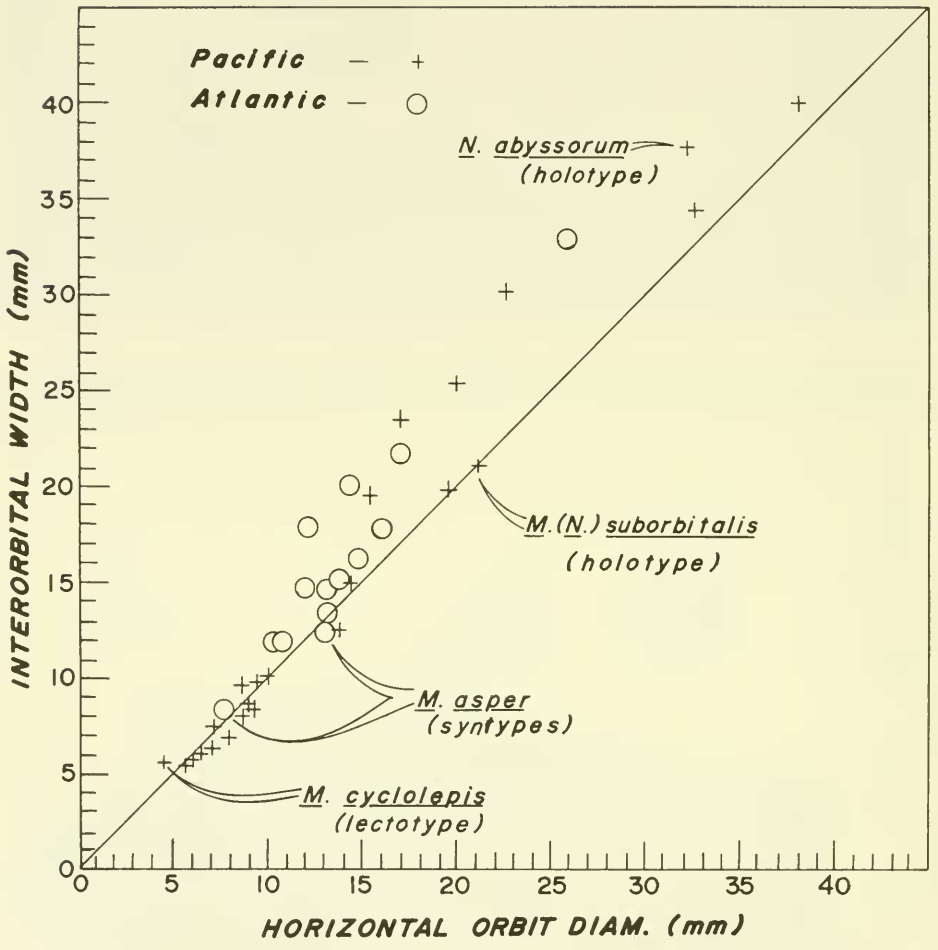

FIGURE 17. Scatter diagram plotting relationship of interorbital width to horizontal orbit diameter in specimens of *Coryphaenoides armatus* from the Pacific and the Atlantic Oceans. Arrows point to plotted measurements of holotype of *Nematonurus abyssorum* Gilbert, holotype of *Macrurus (Nematonurus) suborbitalis* Gill and Townsend, two syntypes of *Macrurus asper* Goode and Bean, and lectotype of *Macrurus cyclolepis* Gilbert. Diagonal line represents 1:1 ratio.

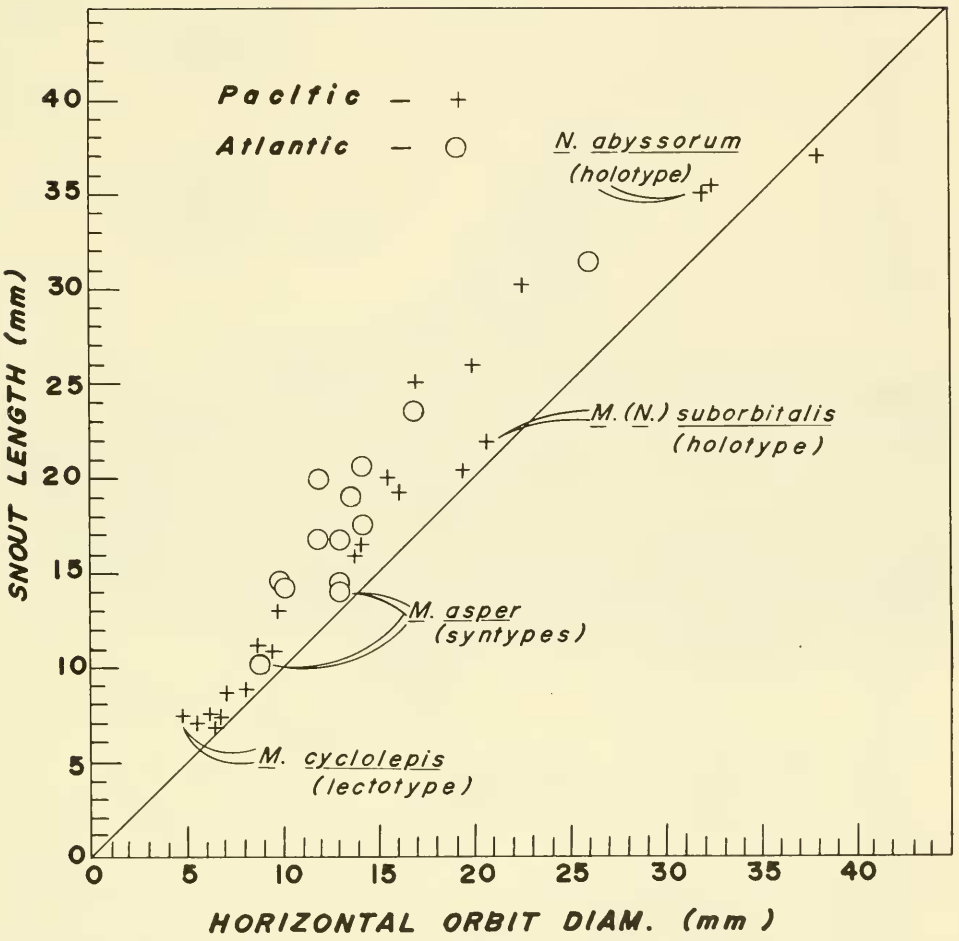

FIGURE 18. Scatter diagram showing relationship of snout length to horizontal orbit diameter in specimens of *Coryphaenoides armatus* from the Pacific and Atlantic Oceans. Arrows point to plotted measurements of holotype of *Nematonurus abyssorum* Gilbert, holotype of *Macrurus (Nematonurus) suborbitalis* Gill and Townsend, two syntypes of *Macrurus asper* Goode and Bean, and lectotype of *Macrurus cyclolepis* Gilbert. Diagonal line represents 1:1 ratio.

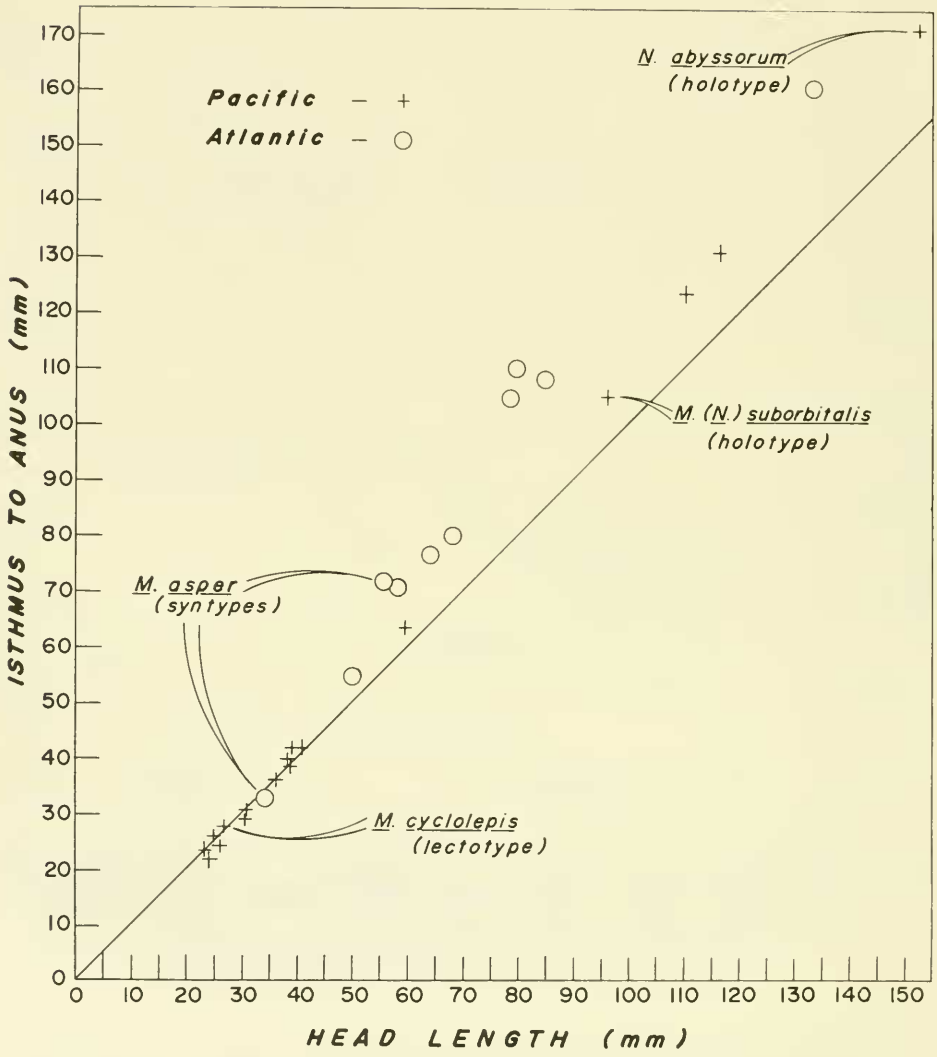

FIGURE 19. Scatter diagram comparing measurements of the distance from isthmus to anus in Pacific and Atlantic specimens of *Coryphaenoides armatus*. Arrows point to plotted measurements of holotype of *Nematonurus abyssorum* Gilbert, holotype of *Macrurus (Nematonurus) suborbitalis* Gill and Townsend, two syntypes of *Macrurus asper* Goode and Bean, and lectotype of *Macrurus cyclolepis* Gilbert. Diagonal line represents 1:1 ratio.

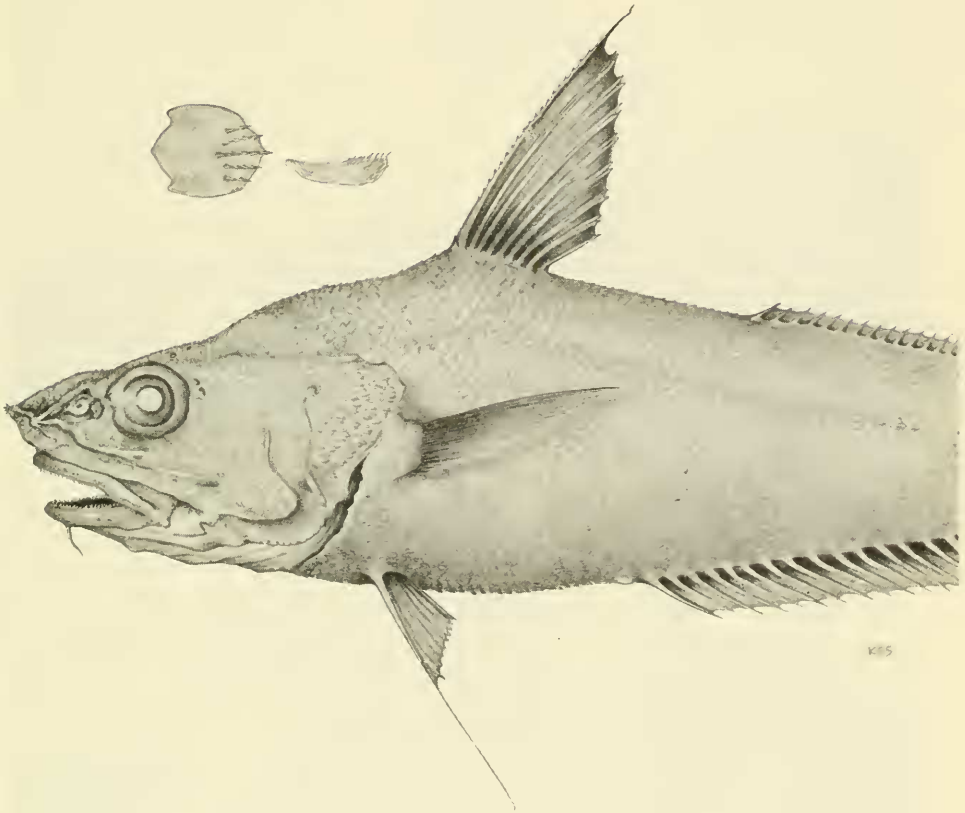

FIGURE 20. *Coryphaenoides (Nematonurus) yaquinae* new species. Holotype, (USNM uncat., 75 mm. H.L., 376 mm. T.L., Tufts Abyssal Plain, *Yaquina* station TP-3, haul 232, in 3724 meters. Drawn by Katherine P. Smith.

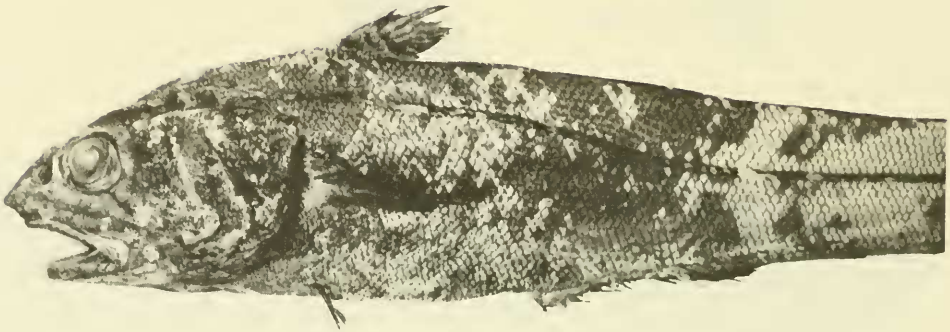

FIGURE 21. *Coryphaenoides (Nematonurus) pectoralis*. A specimen (CAS 20521) 110 mm. in head length, 450 mm. in total length from off Fort Bragg, California.

FIGURE 22. Photograph of a large specimen of *Coryphaenoides pectoralis* captured off the Columbia River by the National Marine Fisheries Service research vessel *Cobb*. Photograph provided by Richard B. Grinols.

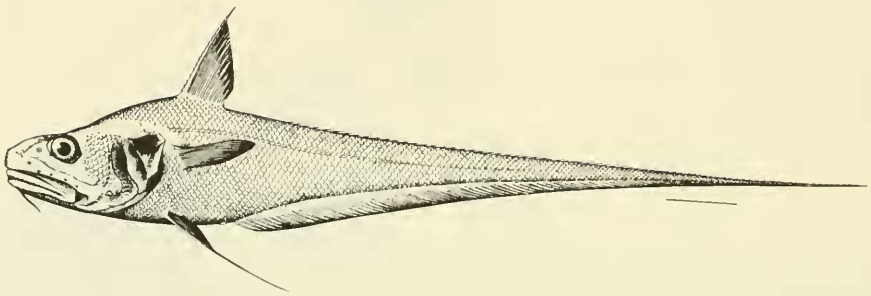

FIGURE 23. *Coryphaenoides (Chalinura) leptolepis.* From off Prince of Wales Island, Alaska, 55°20'N., 136°20'W., *Albatross* station 2859, in 1569 fathoms (2869 meters), 22 August 1888.

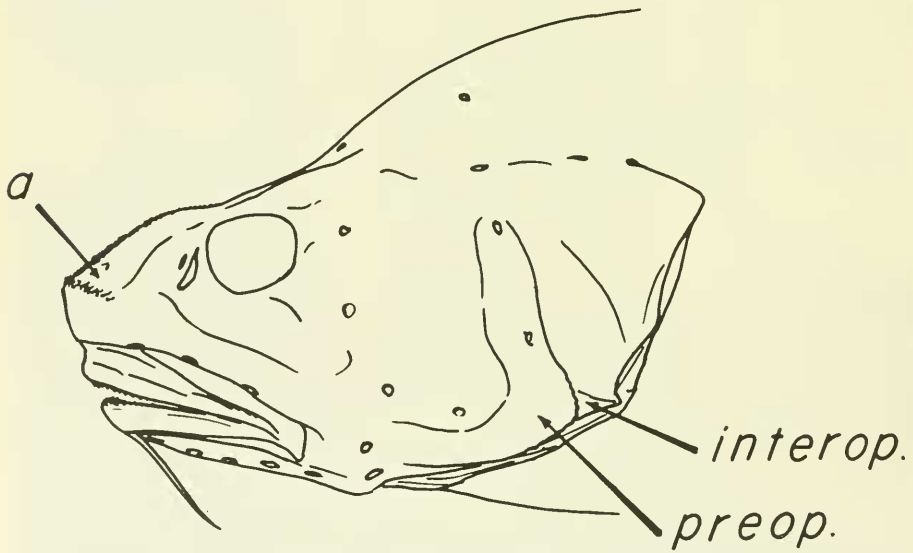

FIGURE 24. *Coryphaenoides (Chalinura) leptolepis.* Diagrammatic illustration showing size and locations of sensory pores on head. Arrow (a) indicates naked region on leading dorsal edge of snout. Note crenulated margin of preopercle (preop.) and narrow interopercle (interop.).

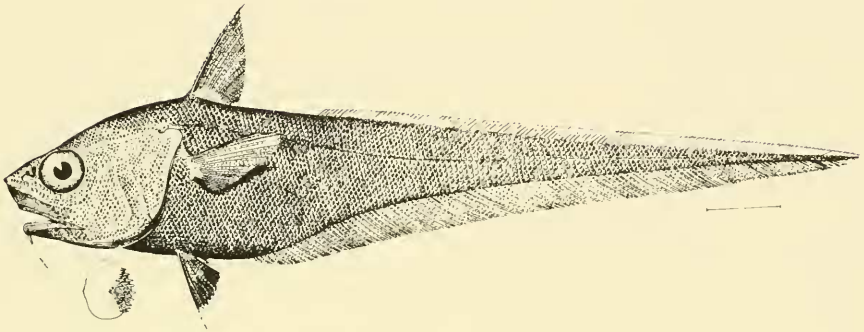

FIGURE 25. *Nezumia stelgidolepis*. From Pt. Conception, California. 34°10'45"N., 120°16'45"W., *Albatross* station 2960 in 267 fathoms (488 meters), 9 February 1889. Drawn by A. H. Baldwin.