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NEW OCEANIC CHEILODIPTERID FISHES FROM THE INDIAN OCEAN

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ABSTRACT

The collections made in or adjacent to the Indian Ocean during voyages of R/V *Anton Bruun* and the "Monsoon" Expedition of Scripps Institution of Oceanography include six species of high-seas cheilodipterid fishes. Two, *Rosenblattia robusta* and *Florenciella lugubris*, are described here as new genera and species; the other four, *Howella brodiei*, *Bathysphyaenops simplex*, *Brinkmannella elongata*, and a second unidentified species of *Brinkmannella* are new records for the Indian Ocean. Included in the description of *Rosenblattia robusta* is material taken in the sub-Antarctic part of the Pacific Ocean during the Antarctic Research Program of the University of Southern California.

INTRODUCTION

In addition to the abundant mesopelagic malacopterygians such as myctophids and gonostomatids, midwater nets fished far from shore occasionally take spiny-rayed fishes which are related to coastal groups. We are concerned here with one such group, the midwater segment of the percomorph family Cheilodipteridae (Apogonidae), a family that is chiefly coastal, but that does contain a few off-shore species.

Although these fishes are customarily referred to the Cheilodipteridae, the family relationships have not properly been established. For example, Norman (1957:242A)

tentatively placed the genera *Howella*, *Neoscombrops*, *Bathysphyaenops*, and *Apogonops* in the serranid subfamily Serraninae. The problem is the recognition of those characters which are adaptations for mesopelagic life as distinct or partially distinct from those which reflect ancestry and relationship to an inshore family or subfamily. Various features found in these fishes, such as reduction or loss of color pattern, lack of countershading, occasional presence of terminal and horizontal antrorse teeth in the jaws, increased development of the lateral line, etc., are certainly characteristic of many mesopelagic fishes of diverse relationships. Variability in other characters, such as number of anal spines, deciduous *vs.* adherent scales, presence or absence of opercular spines, and the extension of the lateral line onto the caudal fin, suggests that the group is not homogeneous. However, some of these features also may reflect the requirements of oceanic life as well as ancestry. A critical study of the family relationships is clearly in order, but cannot be attempted here.

The midwater species discussed below are so different from their coastal relatives that comparison is pointless. However, mindful of the possibility that these forms may represent the pelagic young or juveniles of benthic cheilodipterids from the continental shelf and abyssal plain, various benthic genera (e.g. *Brephostoma* Alcock, *Synagrops* Günther, *Epigonus* Rafinesque, *Neoscombrops* Gilchrist, *Paroncheilus*

Smith) were considered while arriving at the identifications which are given.

Only two oceanic cheilodipterids, *Oxyodon macrops* Brauer 1906 and *Hymnodus atherinoides* Gilbert, 1905 (Fourmanoir, 1957) have been previously reported from the Indian Ocean. Neither of these is represented in our collections.

The area with which we are primarily concerned is the Indian Ocean. The type locality of *Rosenblattia robusta* lies in the southwestern Pacific, but the species was also caught in the Indian Ocean. In addition, we have included in our description of this species a few specimens taken in the sub-Antarctic part of the Pacific Ocean. Our principal material was taken during Cruises III and VI of R/V *Anton Bruun* during the American Program in Biology, International Indian Ocean Expedition. Cruise III fished along the 60°E meridian from 12°N to 44°S, 13 August to 13 September, 1963. Cruise VI sampled waters along 65°E from 18°N to 41°S, 17 May to 4 July, 1964. Supplementing the *Anton Bruun* collections are several lots taken by Scripps Institution of Oceanography during its "Monsoon" Expedition to the Pacific and Indian Oceans, October, 1960 to March, 1961 (Clarke, 1963), and a few lots taken by the R/V *Eltanin* during the Antarctic Research Program of the University of Southern California.

Both cruises of the *Anton Bruun* used a 10-foot Isaacs-Kidd Midwater Trawl; the Foxton Trousers (see Foxton, 1963), an opening-closing device designed to separate a shallow from a deep fraction of the trawl haul; and occasionally a time-depth recorder. Attempts to calibrate the Foxton Trousers by repeated lowerings of the instrument on the hydrographic wire showed that the depth at which the device triggered varied greatly. The device did separate the shallow from the deep part of the catch, but the actual depth of such separation was imprecise. Even limits of error of half or double the nominal depth of separation may be unrealistically narrow.

Our methods of counting and measuring are chiefly those of Hubbs and Lagler (1947). The tip of the snout is taken as the midpoint of the upper jaw, even though this point may not be terminal. The length of the head is taken from the tip of the snout to the most posterior edge of the gill flap exclusive of opercular spines. The number of scales between the first dorsal fin and the lateral line is counted along the oblique row beginning at the base of the second dorsal spine. This count includes the small scale at the base of the fin but excludes the lateral line scale. The count between the lateral line and anal fin is made on the oblique row terminating at the base of the first anal spine. This count also excludes the lateral line scale, and is somewhat variable due to the occasional presence of a half scale at either end of the row. The last soft dorsal and the last anal rays may or may not be divided to the base, but in either instance the ray is counted as one.

The following abbreviations are used: IIOE (International Indian Ocean Expedition), IKMT (Isaacs-Kidd Midwater Trawl), l.s.t. (local standard time), t.d.r. (time-depth recorder), s.l. (standard length), ANSP (Academy of Natural Sciences of Philadelphia), LACM (Los Angeles County Museum), MCZ (Museum of Comparative Zoology, Harvard University), SIO (Scripps Institution of Oceanography), USC (University of Southern California), and USNM (United States National Museum).

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gram of which the *Anton Bruun* cruises were a part. This study was aided by Grant GF147 from the National Science Foundation to Harvard University, whose support is here gratefully acknowledged.

ROSENBLATTIA, NEW GENUS

Type species: Rosenblattia robusta new species. Gender of generic name: feminine.

Generic characters. *Rosenblattia* is distinguished from all other known oceanic cheilodipterid fishes by the more robust body and by the pair of caudal keels formed by the scales of the mid-lateral series of the caudal peduncle. The high number (*ca.* 52) of scales in the lateral line and the antrorse teeth anteriorly in both jaws distinguish this genus from all others except *Florenciella* which is discussed below.

All scales strongly ctenoid; head almost completely covered, fins largely naked. Scales on body small and numerous; about four between base of dorsal fin and lateral line and about fifteen between lateral line and base of anal fin. Lateral line complete, uninterrupted, and continuing onto caudal fin, the scales along the caudal peduncle particularly spinulose and V-shaped. Strong spines in vertical fins. Anal fin with two spines. Body raised and stiffened at origins of unpaired fins. Procurrent caudal fin rays stiff and spiny, their tips free. Eye large, a small aphakic space present. A few discrete simple spines along the upper edge of opercle; opercle and subopercle elsewhere serrated. Upper edge of orbit spiny when viewed from above. Teeth present on jaws, vomer, and palatines; some of anterior jaw teeth antrorse.

This genus is named in honor of Dr. Richard Rosenblatt of Scripps Institution of Oceanography, friend and fellow ichthyologist.

ROSENBLATTIA ROBUSTA, NEW SPECIES

Holotype. An 84.8 mm s.l. specimen taken in the South Pacific by the Scripps Institution of Oceanography "Monsoon" Expedition; IKMT haul no. 17; 28 February

to 1 March, 1961; 2206 to 0250 hrs. l.s.t.; 46° 53'S, 179°48'W to 46°42'S, 179°32'W; maximum calculated depth 1878 m, open net. SIO 61-45.

Paratypes. Two, 94.4 and 48.8 mm s.l.; same data as holotype. MCZ and SIO, respectively.

One, 75.8 mm s.l.; R/V *Eltanin*, USC Antarctic Research Program, Cruise II; Sta. 882; 30 December 1963; 0805 to 1210 hrs. l.s.t.; 55°10'S, 114°15'W to 55°52'S, 114°22'W; IKMT; maximum depth of sampling 1737 m, open net. LACM 10075.

One, 67.0 mm s.l.; R/V *Eltanin*, USC Antarctic Research Program, Cruise 10; Sta. 846; 10 November 1963; 2315 to 0330 hrs. l.s.t.; 57°52'S, 74°43'W to 57°27'S, 74°42'W; IKMT; maximum depth of sampling 1829 m, open net. LACM 10074.

One, 61.0 mm s.l.; R/V *Eltanin*, USC Antarctic Research Program, Cruise 13; Sta. 1107; 24 May 1964; 0513 to 0855 hrs. l.s.t.; 57°59.6'S, 90°36.3'W to 58°20'S, 90°46.9'W; IKMT; maximum depth of sampling 713 m, open net. LACM 10077.

One, 49.9 mm s.l.; R/V *Eltanin*, USC Antarctic Research Program, Cruise 13; Sta. 1099; 22 May 1964; 1510 to 1845 hrs. l.s.t.; 56°59.9'S, 89°09.3'W to 57°03.1'S, 88°54.3'W; IKMT; maximum depth of sampling 759 to 1207 m, open net. LACM 10076.

One, 49.5 mm s.l.; R/V *Eltanin*, USC Antarctic Research Program, Cruise 15; Sta. 1380; 17-18 November 1964; 2250 to 0250 hrs. l.s.t.; 54°01'S, 145°02'W to 53°53'S, 145°13'W; IKMT; maximum depth of sampling 841 m, open net. LACM 10078.

One, 49.0 mm s.l.; R/V *Eltanin*, USC Antarctic Research Program, Cruise 6; Sta. 348; 4 December 1962; 1125 to 1445 hrs. l.s.t.; 54°40.1'S, 58°57.8'W to 55°05.8'S, 59°05.3'W; IKMT; maximum depth of sampling 896 m, open net. LACM 10073.

One, 35.1 mm s.l.; "Monsoon" Expedition; IKMT haul no. 13; 13 January 1961; 0004 to 0457 hrs. l.s.t.; 49°26'30"S, 132°18'24"E to 49°21'00"S, 132°39'24"E; maximum calculated depth 1878 m, open net. SIO 61-41.

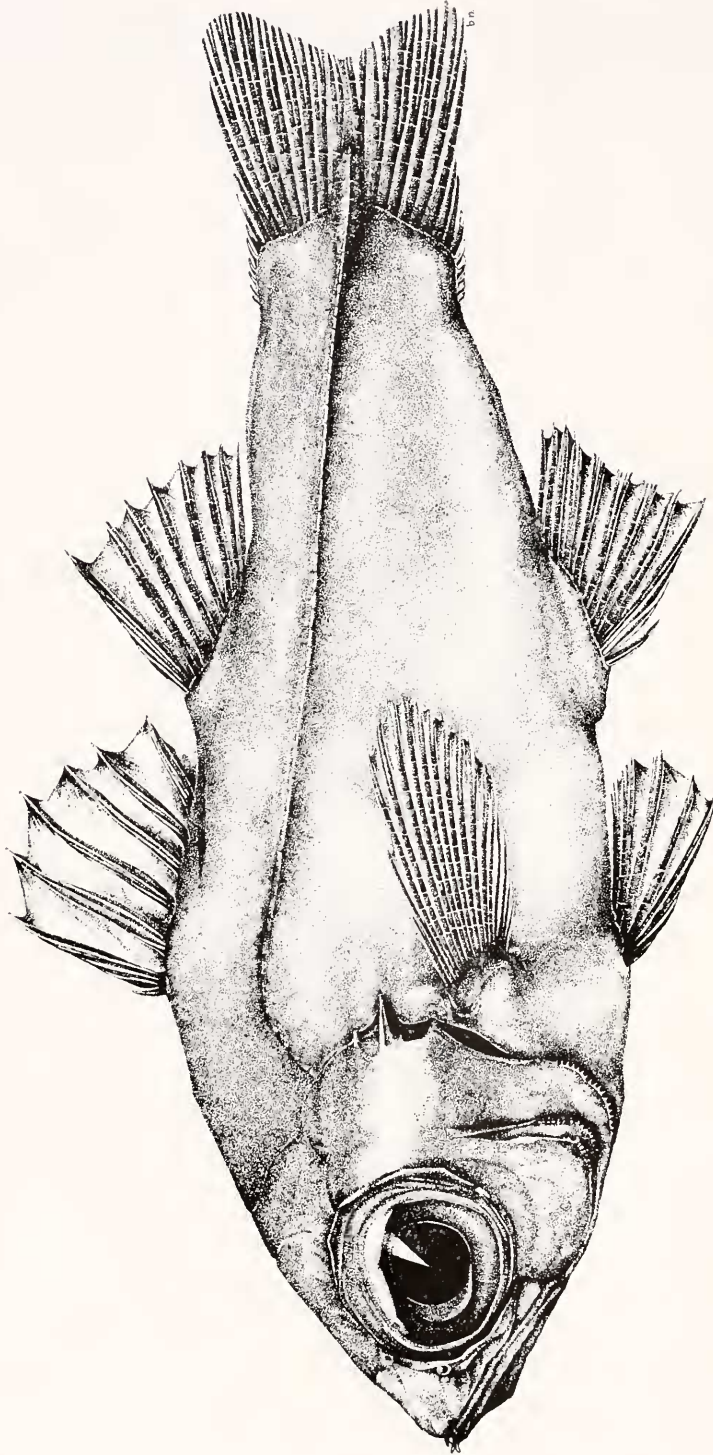


Figure 1. *Rosenblattia robusta*, new genus and species; holotype, 84.8 mm in standard length; SIO 61-45. Squamation not shown. Drawn by Basil G. Nafpaktitis.

TABLE 1. PROPORTIONAL DIMENSIONS (IN PER CENT OF STANDARD LENGTH) OF NINE SPECIMENS, INCLUDING THE HOLOTYPE, OF *Rosenblattia robusta*

	SIO 61-45	Holotype, SIO 61-45	LACM 10075	LACM 10074	LACM 10077	LACM 10076	LACM 10073	SIO 61-45	SIO 61-41
Standard length (mm)	94.4	84.8	75.8	67.0	61.0	49.9	49.0	48.8	35.1
Fork length	112.0	113.1	111.2	110.6	115.1	114.2	112.4	111.2	118.2
Greatest depth of body	36.8	38.0	38.7	38.7	40.0	38.5	39.8	42.0	39.9
Least depth of caudal peduncle	16.2	17.3	15.0	14.9	14.9	13.6	14.7	14.5	14.0
Greatest width of body	23.3	23.6	22.3	24.2	26.4	24.0	25.1	25.0	27.4
Snout to origin of first dorsal fin	40.8	40.8	39.6	43.7	41.0	42.1	43.3	45.5	48.7
Snout to origin of anal fin	67.3	64.4	67.7	65.8	73.1	72.1	71.6	68.0	72.4
Snout to insertion of ventral fin	41.7	40.3	47.9	41.8	50.0	47.7	47.8	46.3	47.6
Snout to insertion of pectoral fin	36.7	36.0	38.4	37.0	41.0	39.3	40.4	41.0	43.9
Length of base of first dorsal fin	17.8	17.1	16.2	14.5	14.9	14.6	15.9	14.7	14.2
Length of base of second dorsal fin	11.6	11.2	11.2	10.9	10.5	13.0	11.8	10.6	11.7
Distance between first and second dorsal fins	7.6	8.1	7.7	7.5	7.4	8.2	7.1	7.4	7.4
Distance between anus and insertion of ventral fin	19.6	18.6	16.2	19.3	18.4	21.8	19.0	20.5	18.5
Distance between anus and origin of anal fin	5.9	6.1	4.4	4.9	5.1	5.2	5.3	5.5	8.3
Length of pectoral fin	24.9	24.8	25.7	27.6	26.7	28.7	28.6	28.7	29.9
Length of ventral fin	16.9	18.9	19.5	21.6	20.3	20.0	20.8	19.5	21.7
Length of head	35.5	35.1	34.7	36.3	38.0	37.3	39.0	38.9	42.2
Length of snout	8.5	7.9	8.6	8.1	8.7	7.6	8.4	8.4	8.8
Length of upper jaw	14.9	15.9	15.6	16.7	17.7	18.0	17.6	18.2	20.8
Horizontal diameter of eye	13.3	15.0	14.5	15.7	17.5	17.2	18.8	17.4	21.4
Width of interorbital space	9.7	12.0	12.3	14.6	14.4	13.8	14.7	10.0	11.4

Two juveniles, 25.0 and 27.5 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. VI; Sta. 353A; 2 July 1964; 1115 to 1925 hrs. l.s.t.; 37°59'S, 64°56'E to 38°15'S, 64°45'E; maximum calculated depth 2394 m; IKMT, deep fraction of catch with Foxton Trousers nominally set at 350 m, specimens probably from below 175 m. MCZ.

One juvenile, 26.5 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. VI; Sta. 354A; 4 July 1964; 0915 to 1510 hrs. l.s.t.; 40°48'S, 65°03'E to 40°51'S, 64°49'E; maximum calculated depth 1650 m; IKMT, considered to be an open net. USNM.

Two juveniles, 24.5 and 25.5 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. VI; Sta. 354B; 4 July 1964; 1605 to 2210 hrs. l.s.t.; 40°51'S, 64°49'E to 40°56'S, 64°25'E; maximum calculated depth 885 m; IKMT, considered to be an open net. SIO.

Description. Morphometric data on the larger specimens are provided in Table 1. Meristic data (value, followed in paren-

theses by the number of specimens) as follows: first dorsal fin VII (14); second dorsal fin I, 7 (2) or 1, 8 (12); anal fin II, 8 (14); pectoral fin (left side) 18 (9) or 19 (5); gill rakers on first arch 5 (3), 6 (9) or 7 (2) + 1 + 13 (1), 14 (1), 15 (5), 16 (5) or 17 (2) totaling 20 to 24; branchiostegal rays 4 + 3 (14); complete scale rows between origin of first dorsal fin and lateral line, 4 (14); between lateral line and origin of anal fin, 14 (1), 15 (11) or 16(2); scales in lateral line from origin to base of mid-caudal ray, 49 (1), 50 (3), 51 (3), 52 (5) or 53 (1); lateral line scales overlying central caudal rays 1 to 4, somewhat correlated with size of fish. Vertebrae, 10 + 14 + 1 = 25 (2).

The notes which follow are based chiefly on the four larger specimens. Observations of juvenile conditions are identified as such. Body compressed and relatively deep; its greatest depth (at origin of dorsal fin) 2.4 to 2.7 in s.l. Greatest width 1.5 to 1.7 in

greatest depth. All of body and head, except for the tip of the snout anterior to the eye and the isthmus, covered by heavy, strongly ctenoid, adherent scales, the cteni of which continue onto the surface of the scale as transverse ridges. Squamation on the body is complete in our smallest juvenile (24.5 mm s.l.), although the cteni and ridges are poorly developed and the scale coverings on the head and fins are incomplete. The lateral line is well developed. The lateral line scales are produced laterally to form a pair of mid-caudal keels, the beginnings of which are evident in juveniles. Aside from the single simple transverse tube, the anterior scales of the lateral line are similar to their neighbors. The lateral line continues onto the proximal half of the caudal fin. Other fins are naked.

Distance between snout and origin of first dorsal fin 2.1 to 2.5 in s.l.; preanal distance 1.4 to 1.6 in s.l., preventral distance 2.0 to 2.5 in s.l., prepectoral distance 2.3 to 2.8 in s.l. Spines in fins strong and sharp. Those in first dorsal lie alternately to the right or left of center when the fin is depressed. The second anal and ventral spines are as long or nearly as long as the succeeding soft rays. Pectoral fin set at about 45° with the horizontal, its length 1.4 in length of head. The anus is located about one-fourth of the distance from anal origin to the base of the ventral fin and is separated from the first anal spine by about four scales.

Head broad; interorbital slightly convex, 2.5 to 3.9 in length of head. Eye large, aphakic space small but prominent. Horizontal diameter of eye 2.0 to 2.7 in length of head. Dorsal, and to a lesser extent posterior, edge of orbit spinulose, the spines small and nearly uniform in size. Preopercle with two free edges, the posterior spinulose, the anterior less so or completely without serrations. Opercle, especially its lower half, armed with small simple cteni. Three simple spines, the longest in the middle, present along the upper edge of the opercle.

Gill openings wide. Branchiostegal membranes attached to isthmus but not overlapping. Pseudobranchs present, formed of about 14 filaments. Gill rakers on first arch long and of the usual lath-like shape, those on successive arches reduced to spinulose knobs. Gill filaments notably few and short, those on the first arch no more than half the length of the gill rakers opposite them.

Teeth present on jaws, vomer, and palatines. Tongue toothless. Posterior end of maxillary but little expanded posteriorly and incompletely covered by the suborbitals. Premaxillaries separate and protractile. Each premaxillary bears one to three large antrorse teeth that lie in a horizontal plane and are excluded from the mouth when it is closed. These, as well as the similar teeth at the tip of the lower jaw, are present in juveniles as well as in adults. Premaxillary with a row of minute teeth posterior to the anterior protruding series. Mandibular teeth similar, with antrorse fangs lateral to the median terminal bony boss followed posteriorly by a row of minute teeth. A transverse patch of small teeth present on the vomer, and an irregular band can be found on each palatine.

In alcohol, the adults are uniformly yellowish brown. All fins slightly dusky. Iris and linings of pharyngeal and abdominal cavities black. Juvenile coloration is far more striking. Pigmentation of the caudal part of the body appears last during development; and in young, shorter than 35 mm, the caudal peduncle and fin are completely colorless, while the more anterior part is dark brown or black. There is a darker broad vertical band at about the level of the second dorsal and anal fins, a narrower band through the rear part of the gill cover, and a dark patch on the body ventrally where the black peritoneum can be seen through the body wall. In these young the body coloration is not solid but formed of melanophores more or less closely spaced. When newly caught, the 20–30 mm young showed a ventral reflective zone anterior

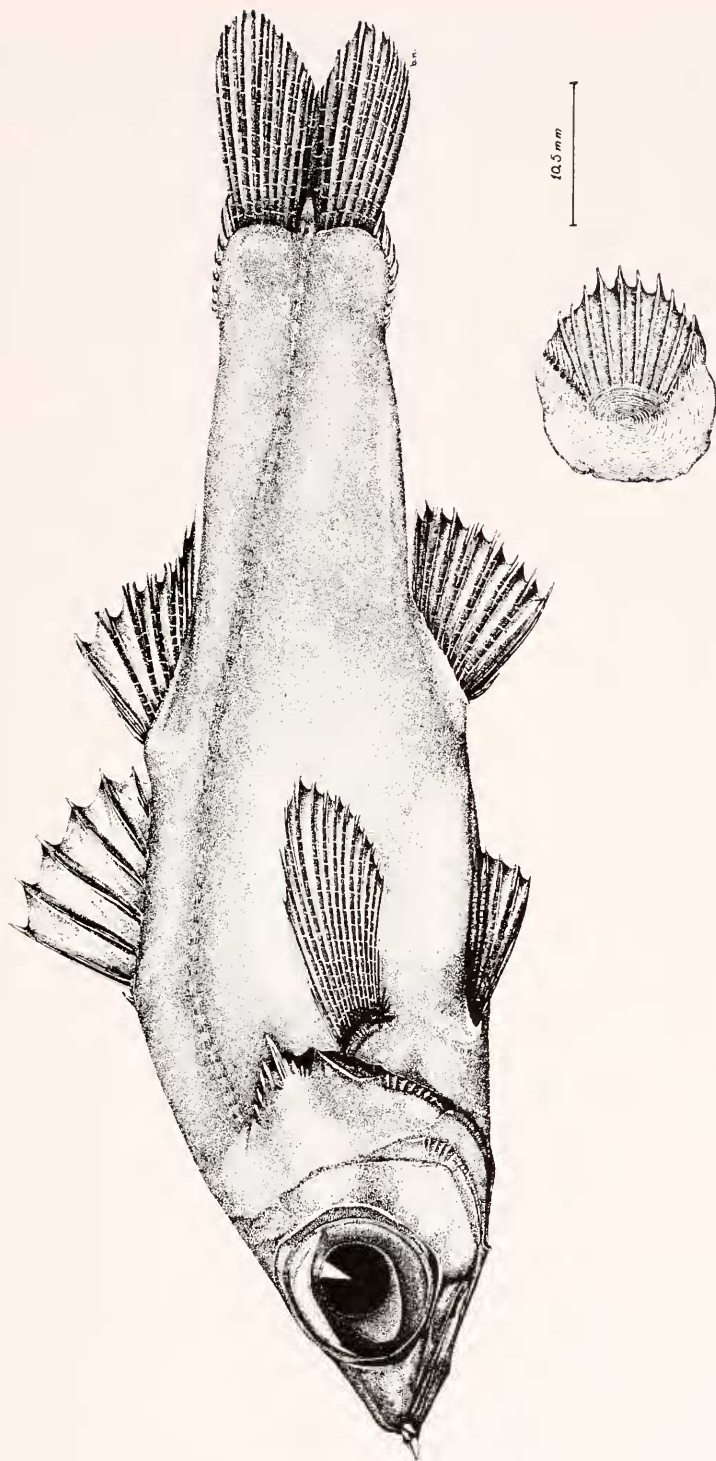


Figure 2. *Florenciella lugubris*, new genus and species; holotype, 89.2 mm in standard length; MCZ 43089. Squamation not shown; the scale illustrated is typical of those on the flank under tip of pectoral fin. Drawn by Basil G. Nafpaktitis.

to the pelvic fins reminiscent of some luminescent systems reported in other cheilodipterid genera (e.g. *Siphamia*, Haneda, 1961), but no structural evidence has been found.

FLORENCIELLA, NEW GENUS

Type species: Florenciella lugubris new species. Gender of generic name: feminine.

Generic characters. This genus most closely resembles *Rosenblattia*, especially by the presence of relatively large antrorse teeth in the anterior parts of both jaws. However, it lacks the mid-lateral caudal keels of *Rosenblattia* and has a less deep body than that genus.

All scales strongly ctenoid. Head almost completely covered by scales; fins largely naked. Lateral line complete, uninterrupted, and extending onto the caudal fin. Mid-lateral scales of caudal peduncle differing from those adjacent to them only by the presence of a lateral line channel. About three rows of scales between base of dorsal fin and lateral line, about seventeen between lateral line and base of anal fin. Strong spines in vertical fins. Two anal spines. Procurrent caudal spines stiff, spiny, and exposed. Eye large, aphakic space prominent. One prominent spine, simple or multifid, at upper end of gill flap which is flanked above and below by lesser spines. Subopercle and preopercle with feeble spines or serrations. Spines present along upper edge of orbit. Teeth present on jaws, palatines, and usually vomer.

FLORENCIELLA LUGUBRIS, NEW SPECIES

Holotype. A 89.2 mm s.l. specimen taken in the equatorial Indian Ocean by R/V *Anton Bruun*, IIOE, Cruise III; Sta. 6, coll. AE13B; 21 August 1963; 0155 to 0440 hrs. l.s.t.; 01°58'S, 60°06'E to 02°06'S, 60°02'E; maximum calculated depth 510 m (depth from t.d.r. 500 m); IKMT, considered an open net collection. MCZ 43089.

Paratypes. Fifty-seven specimens, 22.7 to 97.0 mm s.l.; same data as holotype. Eight specimens in USNM; eight in SIO;

eight in ANSP; three in Zoological Museum, University of Copenhagen; remainder, including one cleared and stained individual, in MCZ.

One, 89.9 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. III; Sta. 5, coll. AE12A; 19 August 1963; 2035 to 2350 hrs. l.s.t.; 01°23'N, 60°11'E to 01°22'N, 60°04'E; maximum calculated depth 750 m (maximum depth from t.d.r. 800 m); shallow fraction of catch with Foxton Trousers set for ca. 275 m, specimen probably from above 550 m. MCZ.

Seven, 22.7 to 65.5 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. III; Sta. 6, coll. AE14B; 21 August 1963; 0445 to 1010 hrs. l.s.t.; 02°06'S, 60°02'E to 01°48'S, 59°50'E; maximum calculated depth 1600 m; deep fraction of catch with Foxton Trousers set for ca. 275 m, specimens probably taken below 140 m. MCZ and USNM.

Two, 24.7 and 25.9 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. III; Sta. 7, coll. AE15D; 23 August 1963; 0250 to 0610 hrs. l.s.t.; 05°03'S, 60°10'E to 04°52'S, 60°02'E; maximum calculated depth 685 m; deep fraction of catch with Foxton Trousers set for ca. 150 m, probably taken below 75 m. MCZ.

One, 26.1 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. III; Sta. 13, coll. AE24A; 8 September 1963; 1055 to 1500 hrs. l.s.t.; 31°58'S, 59°45'E to 32°11'S, 59°30'E; maximum calculated depth 1360 m (depth from t.d.r. 1350 m); deep fraction of catch with Foxton Trousers set for 275 m, probably taken below 110 m. Cleared and stained in MCZ.

One, 26.8 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. VI; Sta. 336B; 27 May 1964; 0047 to 0530 hrs. l.s.t.; 01°50'N, 65°06'E to 01°37'N, 65°07'E; maximum calculated depth 1250 m; deep fraction of catch with Foxton Trousers set for 275 m, probably taken below 140 m. USNM.

One, 26.0 mm s.l.; R/V *Anton Bruun*, IIOE, Cr. VI; Sta. 337A; 27 May 1964; 2130 to 0245 hrs. l.s.t.; 00°03'N, 65°00'E to 00°14'S, 65°03'E; maximum calculated depth 525 m; deep fraction of catch with Foxton

TABLE 2. PROPORTIONAL DIMENSIONS (IN PER CENT OF STANDARD LENGTH) OF A SERIES OF 21 SPECIMENS, INCLUDING THE HOLOTYPE, OF *Florenziella lugubris* CAUGHT BY R/V *Anton Bruuni*, HOE, CRUISE III.

	Sta. 6 AE24A		Sta. 6 AE13B		Sta. 6 AE14B		Sta. 6 AE13B		Sta. 6 AE12A		Sta. 6 AE13B		Sta. 6 AE13B								
	AE24A	AE13B	AE13B	AE14B	AE14B	AE13B	AE13B	AE13B	AE12A	AE13B	AE13B	AE13B	AE13B	AE13B							
Standard length	26.1	28.8	33.1	36.6	45.6	54.4	57.7	58.9	61.6	65.5	66.2	70.5	73.0	76.0	78.5	84.7	89.2	89.9	90.3	95.4	97.0
Fork length	111.9	108.7	110.3	111.5	109.0	112.7	109.2	111.0	109.1	109.6	108.5	109.2	108.5	110.4	108.9	109.6	108.4	107.4	106.7	107.6	108.2
Greatest depth of body	27.2	26.7	27.8	25.1	26.3	27.6	27.6	28.5	28.4	28.1	25.5	26.9	25.9	27.4	27.4	26.2	29.1	29.6	28.2	28.3	27.5
Least depth of caudal peduncle	10.0	11.1	12.4	11.5	11.4	11.9	13.3	12.7	12.8	11.1	14.1	13.6	13.4	14.1	12.9	13.9	14.3	13.9	13.9	13.8	13.1
Greatest width of body	21.1	14.2	15.4	17.2	17.1	17.1	17.3	17.1	16.2	17.7	16.9	18.4	17.0	17.8	18.1	18.0	17.4	19.7	18.6	18.7	19.2
Snout to origin of first dorsal fin	46.7	44.1	41.4	37.7	41.0	38.8	37.1	38.9	39.9	39.9	39.1	39.0	38.1	38.4	37.5	35.3	38.2	38.3	36.8	38.3	36.8
Snout to origin of anal fin	65.1	62.5	65.0	64.7	63.6	62.5	60.7	61.5	60.5	60.9	60.3	59.4	60.7	60.8	61.5	57.0	59.6	59.3	60.8	58.3	60.4
Snout to insertion of ventral fin	43.7	39.6	37.2	39.6	35.7	37.3	37.3	37.7	36.2	37.3	36.1	35.0	36.3	37.4	35.8	36.4	33.7	34.6	35.2	34.6	35.4
Snout to insertion of pectoral fin	40.6	36.8	35.9	35.8	33.8	34.7	33.4	33.8	33.8	34.8	33.2	32.8	32.6	34.2	32.6	33.2	31.9	33.5	33.8	31.1	33.0
Length of base of first dorsal fin	16.1	13.9	13.9	14.2	13.6	12.5	13.7	13.4	16.2	15.1	12.5	13.6	15.8	15.7	12.7	13.3	13.7	13.7	13.5	14.5	14.3
Length of base of second dorsal fin	10.3	11.1	11.2	10.9	10.5	10.7	11.4	11.5	9.7	11.5	10.3	11.1	10.7	11.1	10.6	10.4	11.5	11.0	10.4	10.9	11.1
Distance between first and second dorsal fins	8.0	6.9	9.1	8.7	7.5	9.6	9.7	9.8	4.7	8.6	9.1	9.5	9.7	8.9	10.3	8.6	8.4	11.0	9.3	9.0	10.3
Length of base of anal fin	13.8	10.7	10.6	11.2	9.4	11.0	11.3	11.4	11.0	11.1	10.6	9.4	10.8	11.2	10.7	11.3	11.2	11.1	10.4	10.7	11.0
Distance between anus and insertion of ventral fin	17.6	19.4	18.1	18.9	19.5	18.9	18.2	17.1	18.8	17.7	19.9	20.8	19.9	19.0	19.5	18.1	20.2	19.7	18.8	19.8	16.4
Distance between anus and origin of anal fin	6.1	5.2	8.2	8.2	7.5	5.5	7.8	7.0	6.3	5.8	7.1	6.1	6.4	6.6	7.3	6.0	6.8	7.3	6.8	6.0	6.8
Length of pectoral fin	23.8	21.5	26.0	24.6	20.8	24.4	24.4	24.6	23.2	25.0	24.8	23.0	22.2	23.6	22.9	23.0	22.6	22.2	21.6	20.4	21.2
Length of ventral fin	19.9	16.7	17.8	18.3	16.7	17.6	16.5	17.1	17.9	15.1+	14.5	15.9	15.5	16.2	15.3	15.0	15.1	12.3+	15.5	14.7	14.9
Length of head	40.6	37.5	35.0	32.5	35.7	36.0	34.7	34.0	34.2	35.1	32.5	33.2	32.1	33.8	32.5	31.9	34.1	33.5	32.4	34.2	33.5
Length of snout	10.7	9.7	9.4	7.4	7.0	9.2	6.4	7.5	6.8	8.6	6.3	6.9	7.0	7.8	7.1	6.8	7.0	7.3	7.2	6.4	7.2
Length of upper jaw	19.5	19.1	18.2	18.0	16.9	16.5	16.1	16.8	16.4	16.3	15.9	15.9	15.6	15.8	14.9	14.4	15.0	13.6	14.6	15.0	15.2
Horizontal diameter of eye	19.5	16.7	16.0	15.8	15.4	14.3	15.6	15.8	15.1	15.3	13.8	13.8	14.5	14.2	13.4	13.2	13.5	11.2	12.7	12.8	13.6
Width of interorbital space	13.4	8.3	9.4	9.0	9.9	10.7	9.5	10.0	9.4	9.5	10.1	10.1	9.2	11.1	10.4	9.8	10.3	9.9	10.4	9.5	9.7

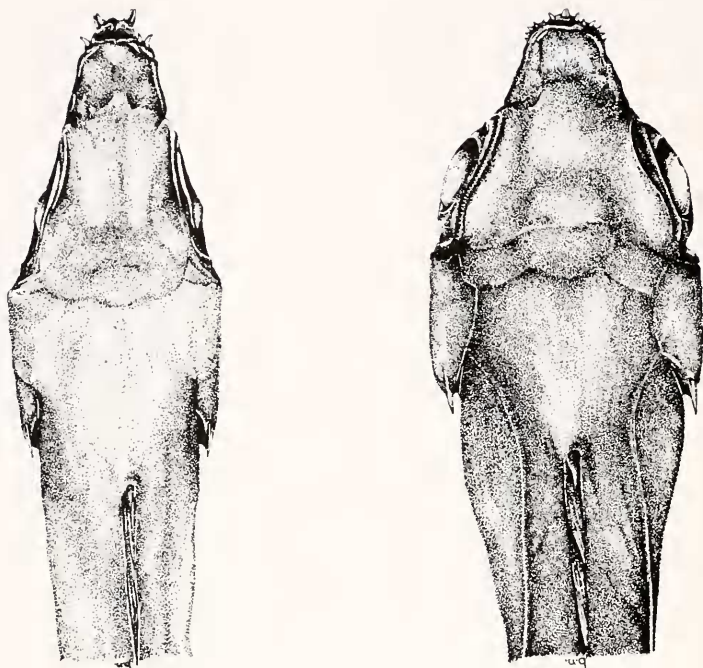


Figure 3. Dorsal views of heads of *Rosenblattia robusta* (left) and *Florenciella lugubris* (right). Squamation not shown. Drawn by Basil G. Nafpaktitis.

Trousers set for 275 m, probably taken below 140 m. MCZ.

Description. Morphometric data, taken from the type and a series of paratypes, are provided in Table 2. Meristic data were taken from fifty specimens including the type. These data (value, followed in parentheses by the number of specimens) follow: first dorsal fin VII (50); second dorsal fin I, 8 (50); anal fin II, 8 (49) or rarely II, 7 (1); pectoral fin (left side, or if damaged the right) 16 (1), 17 (28), 18 (20) or 19 (1); gill rakers on first arch 5 (1), 6 (39) or 7 (10) + 1 + 14 (16), 15 (32) or 16 (2) totaling 20 (2), 21 (13), 22 (24) or 23 (11); branchiostegal rays 4 + 3 (50); complete rows of scales between origin of first dorsal fin and lateral line 4 (50); between lateral line and origin of anal fin 15 (5), 16 (37) or 17 (8); scales in lateral line from origin to base of mid-caudal ray 49 (3), 50 (14), 51 (18), 52 (8) or 53 (7);

one to four lateral line scales on caudal fin, some of these frequently missing and apparently more numerous in larger than in smaller specimens. Vertebrae, 10 + 14 + 1 = 25 (8) or 10 + 13 + 1 = 24 (1).

Body compressed and relatively shallow, its greatest depth (at origin of first dorsal fin) 3.3 to 3.8 in s.l., its greatest width (immediately behind orbit) 1.3 to 1.8 in greatest depth. All of body and head, except for the snout anterior to eye, covered by adherent ctenoid scales, the cteni of which are continuous with transverse ridges on the surface of each scale. Squamation essentially complete at 30 mm s.l., but at this size the cteni and associated ridges are scarcely evident. Scales of lateral line normal, the line terminating with one, two or three pored scales overlying central rays of the caudal fin. The other fins, both paired and vertical, are naked and there are no axillary scales.

Distance between snout and origin of first dorsal fin 2.2 to 2.8 in s.l.; preanal distance 1.5 to 1.8 in s.l.; preventral 2.3 to 2.9 in s.l.; prepectoral 2.5 to 3.2 in s.l. Spines in fins strong, high and sharp, those in the first dorsal fin lying alternately on the right or left of center when the fin is depressed. Dorsal and second anal spines about as long as the soft rays which follow them; spiny elements in the vertical fins longer than the soft. Base of pectoral fin set at about 45° angle with the horizontal, the fin relatively short and rounded, its length 1.4 to 1.7 in length of head. Anus located about one-fourth of the way from origin of anal to insertion of ventral fins and separated from the first anal spine by about five scales. Head broad and bony, its greatest width 1.7 to 2.3 in length of head, its length 2.5 to 3.1 in s.l. Interorbital nearly flat, its least bony width 3.0 to 3.7 in length of head. Eye large, its horizontal diameter 2.1 to 3.0 in length of head. Pupil elliptical, aphakic space prominent. Dorsal and posterior edges of orbit spinulose, the supra-orbital ridge terminating anteriorly in a broad, flat spine. Free edge of preopercle single, usually smooth, but occasionally (especially in smaller individuals) bearing a few minute spines. A complex cluster of spines originate near the more posterior part of the opercular bone. The largest spine is the most posterior; it is usually simple in smaller specimens, but compound in the larger. Smaller and more or less simple spines lie above and below that at the angle of the operculum. Elsewhere the free edge of the gill cover is either smooth or weakly serrated.

Gill openings wide, the gill flaps and branchiostegal membranes meeting at the ventral midline but not overlapping. Pseudobranchs present, formed of about 14 filaments. Gill rakers on first arch of the usual lath-like shape and about half as long as diameter of eye. Gill filaments unusually short and few, those of first arch about two-thirds as long as the opposite rakers.

Symphysis of upper jaw toothless. On

each side lateral to the midpoint is a patch of minute teeth and two or three conical, slightly recurved antrorse teeth. A single series of minute teeth is present on the more posterior biting edge of the premaxilla. The two or three conical antrorse canines on the mandible are followed by a row of small teeth. The vomer may bear a few minute, sharp teeth or be completely toothless. Palatines with teeth in a simple series or in a band. Tongue toothless.

In alcohol, the flanks are uniformly dusky, with more pigment along the margins of the scale pockets than elsewhere and with darker areas along the bases of the vertical fins. All fins are dark brown. The eye is dark, but elsewhere the head is similar in pigmentation to the body. Linings of mouth, pharynx, and abdominal cavity black. In young of about 35 mm s.l., the black linings of the body cavities are evident through the lighter dermal pigmentation, the black bases of the second dorsal and anal fins contrast in a more striking way with the pale flanks, the tip of the caudal is black, and there is a prominent dark vertical bar across the caudal peduncle in an area bounded by the upper and lower procurrent caudal rays.

HOWELLA BRODIEI OGILBY 1898

The three nominal species of *Howella* have never been critically compared. The type specimen of *Howella brodiei* was found on the beach at Lord Howe Island near Australia. The type locality for the second species, *H. sherborni* (Norman, 1930, as *Rhectogramma sherborni*) lies in the eastern Atlantic off South Africa, ca. 34°S, 17°E. The third species, *H. pammelas* (Heller and Snodgrass, 1903, as *Galcagra pammelas*) was first taken at Wenman Island in the Galapagos group.

The type of *H. pammelas* (Heller and Snodgrass, 1903: pl. 4) and additional eastern Pacific material of this species from the collections of Scripps Institution of Oceanography show both an upper and a lower opercular spine to be complex. In

contrast, only the upper opercular spine is complex in specimens of *Howella* from the western Pacific and Atlantic. On this basis alone, other morphometric data being similar, our Indian Ocean specimens, all of which have only an upper complex opercular spine, are referred here to *H. brodiei*, a species of which *H. sherborni* is tentatively considered conspecific. A critical and more detailed examination of the now considerable material from all oceans is obviously in order.

This genus is hitherto unknown from the Indian Ocean, the nearest records being the South African-Atlantic type locality of *H. sherborni*, the Australian type locality of *H. brodiei*, and a Philippine locality reported for the latter species by Herre and Herald (1951).

The *Anton Bruun* took specimens of *H. brodiei* at each of the following twelve stations:

One, 18.0 mm s.l.; Cr. III; Sta. 2, coll. AE6E; 15 August 1963; 0350 to 0715 hrs. l.s.t.; 10°09'N, 59°55'E to 10°00'N, 60°01'E; maximum calculated depth 560 m (depth from t.d.r. 520 m); IKMT, deep fraction of catch with Foxton Trousers nominally set for 150 m, specimen probably taken below 75 m. MCZ.

One, 14.5 mm s.l.; Cr. III; Sta. 3, coll. AE8B; 16 August 1963; 1845 to 2213 hrs. l.s.t.; 06°54'N, 59°55'E to 06°37'N, 59°57'E; maximum calculated depth 750 m; IKMT, shallow fraction of catch with Foxton Trousers set for 150 m, probably taken above 300 m. MCZ.

One, 13.6 mm s.l.; Cr. III; Sta. 5, coll. AE12B; 19 August 1963; 2035 to 2350 hrs. l.s.t.; 01°23'N, 60°11'E to 01°22'N, 60°04'E; maximum calculated depth 750 m (depth from t.d.r. 800 m); IKMT, shallow fraction of catch with Foxton Trousers set for 275 m, probably taken above 550 m. Zoological Museum, University of Copenhagen.

One, 65.0 mm s.l.; Cr. III; Sta. 7, coll. AE16D; 23 August 1963; 0625 to 1350 hrs. l.s.t.; 04°52'S, 60°02'E to 04°27'S, 59°55'E; maximum calculated depth 2030 m; IKMT,

deep fraction of catch with Foxton Trousers set at 275 m, probably caught below 140 m. MCZ.

One, 42.5 mm s.l.; Cr. III; Sta. 16, coll. AE30B; 12 September 1963; 1110 to 1710 hrs. l.s.t.; 40°53'S, 60°01'E to 41°07'S, 59°52'E; maximum calculated depth 2750 m; IKMT, deep fraction of catch with Foxton Trousers set for 275 m, probably taken below 140 m. SIO.

One, 61.0 mm s.l.; Cr. III; Sta. 16, coll. AE31B; 12 September 1963; 1725 to 2105 hrs. l.s.t.; 41°07'S, 59°52'E to 41°07'S, 60°08'E; maximum calculated depth 635 m; IKMT, deep fraction of catch with Foxton Trousers set for 150 m, probably from below 75 m. MCZ.

Two, each 14.6 mm s.l.; Cr. VI; Sta. 334A; 24 May 1964; 1912 to 2345 hrs. l.s.t.; 06°01'N, 64°59'E to 05°48'N, 64°57'E; maximum calculated depth 700 m; IKMT, deep fraction of catch with Foxton Trousers set for 275 m, probably taken below 140 m. MCZ.

One, 47.0 mm s.l.; Cr. VI; Sta. 335 B; 26 May 1964; 0100 to 0850 hrs. l.s.t.; 03°46'N, 65°05'E to 03°27'N, 65°07'E; maximum calculated depth 2575 m; IKMT, deep fraction of catch with Foxton Trousers set for 275 m, probably taken below 140 m. USNM.

One, 15.5 mm s.l.; Cr. VI; Sta. 337B; 28 May 1964; 0300 to 0930 hrs. l.s.t.; 00°14'S, 65°03'E to 00°29'S, 65°08'E; maximum calculated depth 2250 m; IKMT, shallow fraction of catch with Foxton Trousers set for 275 m, probably taken above 550 m. USNM.

Three, 11.8 to 14.6 mm s.l.; Cr. VI; Sta. 340B; 31 May 1964; 1945 to 0155 hrs. l.s.t.; 05°55'S, 64°48'E to 06°08'S, 64°58'E; maximum calculated depth 746 m; IKMT, shallow fraction of catch with Foxton Trousers set for 275 m, probably taken above 550 m. MCZ.

Two, 11.1 and 11.9 mm s.l.; Cr. VI; Sta. 341B; 1-2 June 1964; 2200 to 0300 hrs. l.s.t.; 07°56'S, 65°14'E to 07°57'S, 64°51'E; max-

imum calculated depth 504 m; IKMT, considered an open net. MCZ.

Three, 10.2 to 12.4 mm s.l.; Cr. VI; Sta. 342A; 2 June 1964; 1755 to 2250 hrs. l.s.t.; 09°57'S, 64°55'E to 10°01'S, 64°19'E; maximum calculated depth 580 m; IKMT, deep fraction of catch with Foxton Trousers set for 200–250 m, probably taken below 125 m. MCZ.

BATHYSPHYRAENOPS PARR 1933

Bathysphyaenops, a monotypic genus, has been known only from the type series of *B. simplex* Parr 1933, which was taken off the Bahamas and adjacent islands, and from unpublished catches made elsewhere in the Atlantic and Pacific. Our Indian Ocean collection contains two specimens, 84.5 and 90.8 mm s.l., which we have critically compared with the holotype of *B. simplex* (Bingham Oceanographic Lab. no. 2847). Meristic values, with the possible exception of the number of scale rows between the lateral line and origin of anal fin, are nearly identical, and differences in body proportions, armature, etc. are insignificant. These Indian Ocean *B. simplex* were taken at the following station:

R V Anton Bruun, IOE, Cr. III; Sta. 6, coll. AE13B; 21 August 1963; 0155 to 0440 hrs. l.s.t.; 01°58'S, 60°06'E to 02°06'S, 60°02'E; maximum calculated depth 510 m (depth from t.d.r. 500 m); IKMT, considered an open net. MCZ and USNM.

BRINKMANNELLA PARR 1933

Included within the small group of oceanic cheilodipterids with single anal spines and unarmed opercular flaps are *Brinkmannella elongata* Parr, previously known only from midwaters off the Bahama Islands (Parr, 1933:26), and *Brephostoma carpenteri* Alcock, an abyssal benthic species from the Bay of Bengal (Alcock, 1889:383). *Brinkmannella elongata* has deciduous scales and teeth in jaws, palatines, and vomer. *Brephostoma carpenteri* has adherent scales and a toothless mouth. In

other respects the two genera are suspiciously similar.

Our Indian Ocean material contains two lots of specimens within this group. The first is a single individual, 104.5 mm s.l., which is larger but otherwise identical to the Atlantic *Brinkmannella elongata*. It was taken as follows:

Scripps Institution of Oceanography "Monsoon" Expedition; IKMT haul no. 9; 19 December 1960; 0324 to 0829 hrs. l.s.t.; 33°19'18"S, 72°34'24"E to 33°38'06"S, 72°31'00"E; maximum calculated depth 1878 m, open net. SIO 61-37.

The second lot contains four fishes, ca. 64-ca. 103 mm s.l., all in poor condition, which are meristically more similar to *Brephostoma carpenteri* than to *Brinkmannella elongata* but show the generic characters diagnostic of this latter genus: teeth in jaw, palatines, and vomer; deciduous scales; and an area of relatively light pigmentation on the flanks posterior to the anal fin. These are characters which possibly could change as a pelagic young assumes a benthic adult life. Therefore, pending further study, the identity of this lot is left open as "*Brinkmannella* sp." The series came from the following locality:

R V Anton Bruun, IOE, Cr. III; Sta. 6, coll. AE13B; 21 August 1963; 0155 to 0440 hrs. l.s.t.; 01°58'S, 60°06'E to 02°06'S, 60°02'E; maximum calculated depth 510 m (depth from t.d.r. 510 m); IKMT, considered an open net. MCZ.

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