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NEW SERIES, NO. 44

Rare Fishes of the Deep-Sea Genus *Halieutopsis*: A Review with Descriptions of Four New Species (Lophiiformes: Ogcocephalidae)

Margaret G. Bradbury

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A Contribution in Celebration
of the Distinguished Scholarship of Robert F. Inger
on the Occasion of His Sixty-Fifth Birthday

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- LANGDON, E. J. M. 1979. Yagé among the Siona: Cultural patterns in visions, pp. 63-80. In Browman, D. L., and R. A. Schwarz, eds., *Spirits, Shamans, and Stars*. Mouton Publishers, The Hague, Netherlands.
- MURRA, J. 1946. The historic tribes of Ecuador, pp. 785-821. In Steward, J. H., ed., *Handbook of South American Indians*. Vol. 2, *The Andean Civilizations*. Bulletin 143, Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.
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Rare Fishes of the Deep-Sea Genus *Halieutopsis*: A Review with Descriptions of Four New Species (Lophiiformes: Ogcocephalidae)

Abstract

The lophiiform genus *Halieutopsis* is characterized on the basis of the study of 39 specimens, from among which four new species are described, each from a single specimen. Pelagic larvae are reported for the genus for the first time. *Halieutopsis* is shown to occur throughout the Indian and tropical Pacific oceans, including one species from the Pacific plate. The genus is shown to have the deepest bathymetric range of any ogcocephalid genus, from upper slope to abyssal depths.

Introduction

The family Ogcocephalidae is a small assemblage of nine genera with about 60 species. Most species have strongly depressed bodies that bespeak benthic lives. Divers have observed and photographed individuals sitting inactive on the sea floor in shallow water or moving about on relatively mobile, leglike, paired fins. Most bathyal species also have depressed body shapes, and the adults are most often captured with bottom nets, so they are also regarded as benthic. However, ogcocephalids with globose bodies occasionally are taken in midwater nets; these specimens usually prove to be larval or metamorphosing individuals. Moreover, adults of the genus *Coelophrys* are globose in body form instead of depressed, suggesting they may be bathypelagic; if so, collection depths for the few specimens known indicate they are near-bottom bathypelagics.

Specimens of *Halieutopsis* are uncommon in collections. More than half the material treated in

this paper emanates from expeditions by the ship *Albatross* to the eastern and western Pacific Ocean around the turn of the century. The rest was added to museum holdings during the burst of oceanographic exploration in the 1950s as well as by the International Indian Ocean Expedition and a few subsequent expeditions to the western Pacific. For this review, 39 specimens from the Pacific and Indian oceans were available, including nine larval specimens. Though small, this collection represents nine species, four of which are described here as new.

In a past effort to delimit genera of Ogcocephalidae (Bradbury, 1967), I assigned to *Halieutopsis* the two-gilled species sharing the following characters, which are distinctive for the genus: (1) the illicial bone relatively simple and spinelike, lacking foramina in the base; (2) the pterygiophore of the illicium lacking a "bridge element" or remnant of dorsal spine II (Pietsch, 1981); (3) the presence of two or more specialized lateral-line scales with neuromasts on either side of the anus; (4) teeth absent from both palate and ceratobranchial V.

The purposes of this paper are to more fully characterize the genus *Halieutopsis*, to make known the new forms, and to describe the geographical and bathymetric distributions of the genus.

Methods

Terminology and methods are those developed for a study of the genus *Ogcocephalus* (Bradbury,

1980). In *Halieutopsis* the lateral-line count was difficult to take in many specimens, so counts were not obtained for all. Counts for three lateral-line series not used for *Ogcocephalus* were useful for *Halieutopsis*: the preopercular series, the dorso-lateral branch of the subopercular series, and the tail lateral-line series (see fig. 1 for a diagram showing how these counts were taken). Counts of the supraorbital series were attempted for *Halieutopsis*, but relatively few were obtained.

Some measurements taken for *Ogcocephalus* were not useful for *Halieutopsis* and were omitted. Conversely, two measurements not used for *Ogcocephalus* were used in this study: skull length, the distance between the center of the upper lip and the groove between the skull and first vertebra; and jaw-to-anal fin distance, the distance from the center of the lower lip to the base of the first anal fin ray.

In lophiiform fishes, the first vertebra is fused to the skull. In the present study, vertebral counts do not include this fused vertebra. Counts begin with the first free vertebra and include the hypural fan.

Symbolic codes for collections are the standardized symbolic codes (Leviton et al., 1985).

Halieutopsis Garman

TYPE SPECIES—*Halieutopsis tumifrons* Garman, 1899, by original designation.

DIAGNOSIS—Ogcocephalids with head moderately to greatly depressed. No teeth on palate or ceratobranchial V. Two or more lateral-line scales with neuromasts on either side of anus (figs. 1–2). Pectoral pedicels attached to body wall by membranes entirely occupying axillae in all except *H. tumifrons*. Vertebral count usually 17–19 (table 1). Illicial bone spinelike, its base not perforated by foramina. Gills 2.

DESCRIPTION—Fin rays: dorsal 4–6, anal always 4, pectorals 13–16. Vertebral counts: 16–20.

Skeleton in some species weakly calcified, with skin flabby from associated fatty or gelatinous tissue; in others skeleton firm and skin taut. Body shape extremely variable relative to other genera, outline of disk circular or elliptical or triangular or subquadrangular. Paired fins variable in size, very small in some species, large with thin, delicate rays and membranes in others. Disk with cranium little to moderately elevated above disk surface. Illicial cavity moderate size to very large, the roof

of the cavity formed of the shelf- or domelike rostrum. Floor of illicial cavity membranous, premaxillary bones visible through membrane. Interorbital relatively wide to very wide, eyes small, mouth moderate to very large.

Jaw teeth villiform, in narrow bands, the bands sometimes confined to the median half or third of the jaw. No teeth on palate or ceratobranchial V.

Olfactory organs sexually dimorphic in adults: olfactory organs in males larger and containing more and larger lamellae than those in females.

Holobranchs present on gill arches 2 and 3; no gill filaments on arches 1 and 4. Gill rakers shaped as finger-like pedicels flaring out from gill bar at nearly right angles, with clusters of tiny teeth at distal ends; some species with thin lamellae stretching between pedicels and gill bar, the assembly resembling rows of triangular plates (Bradbury, 1967, fig. 7a). Gill rakers of adjacent gill bars interdigitating, gill rakers present on arches 1, 2, and 3, but not on 4.

Squamation consisting of nonoverlapping pyramidal tubercles with stellate bases, 4 to 12 facets, drawn out to 1 or more spines distally. Size of tubercles variable among species, from very small with slender spines so skin looks semivelvety to large, long-spined tubercles ankylosed to underlying skeleton. Tubercles present on most of dorsal surface of disk and tail, except tubercles always absent from skin surrounding gill openings and from confluent skin forming membrane between pectoral pedicels and body wall. Tubercles present on skin surrounding eyeballs in some species. Rostrum formed of tubercles ankylosed to each other; tubercles on edges of disk large relative to those elsewhere on body, ankylosed to each other and underlying skeleton. Neuromasts of lateralis system always prominent on ventral surface of body, sometimes so on dorsal surface. Tubercles associated with neuromasts cup-shaped, with protective spines extending over top of neuromasts (Bradbury, 1967, fig. 5d), usually lying in strongly excavated channels on the anterior and ventral surfaces of the disk, these excavated channels sometimes also occurring on lateral sides of tail and on dorsal surface of disk. Tubercles absent from ventral surfaces of disk in some species, except lateral-line scales near anus invariably present (figs. 1–2).

Pattern of lateralis system shown in Figures 1 and 2 (diagrams exaggerate size of neuromasts for sake of showing pattern). Lateral-line series on dorsal surface of disk, here called body lateral line extending posteriorly past origin of dorsal fin (fig

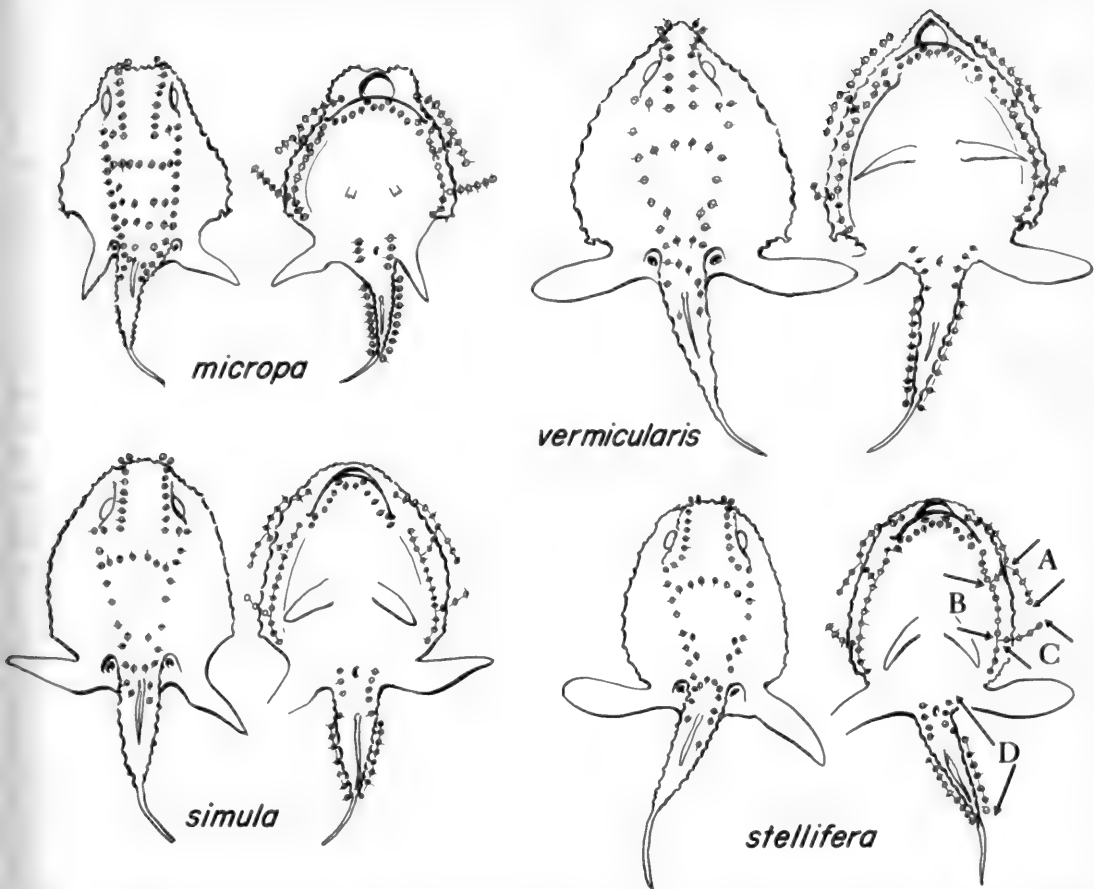


FIG. 1. Outlines showing body shapes and the dorsal and ventral patterns of the lateralis system in four species of *Halieutopsis* sketched from the following specimens: *H. micropa*, USNM 169029, 77.0 mm SL; *H. vermicularis*, the holotype, USNM 70272, 60.9 mm SL; *H. simula*, the holotype, USNM 70274, 65.3 mm SL; *H. stellifera*, the holotype, USNM 70273, 71.2 mm SL. Small circles with lines through them symbolize lateral-line scales, shown much exaggerated in size in order to emphasize pattern. The sketch of the ventral surface of *H. stellifera* is used to demonstrate four lateral-line series as follows: preopercular series (A), subopercular series (B), dorsolateral branch of the subopercular (C), and tail lateral line (D).

1). Body lateral line separate from a posterior series on lateral side of tail, here called tail lateral line. Tail lateral line continuous with and including lateral-line scales on ventral surface of disk in a series reaching to, or anterior to, anus. Counts: body lateral-line series 0-17, tail lateral-line series 7-15, premaxillary series 0-3, cheek series 8, preopercular series 2-4, subopercular series 4-7, dorsolateral branch of subopercular series 1-6, supraorbital series 3-10 (see Bradbury, 1967, 1980, for illustrations of premaxillary and cheek series).

Esca consisting of paired, ventral, rounded glandular lobes and dorsal, median, leaflike structure, the latter incised or lobed dorsally.

DISCUSSION—I provisionally include the species originally described as *Dibranchius micropus* (Wood-Mason & Alcock, 1891) in *Halieutopsis* on the basis of illicial bone morphology (Bradbury, 1967). However, *H. micropa* agrees with *Coelophrys* in having very reduced ventral fins and very small tubercles with slender spines (Radcliffe, 1912) and in having jaw dentition restricted to patches of villiform teeth near the symphysis of each jaw. *Halieutopsis micropa* is intermediate between *Halieutopsis* and *Coelophrys* in having the head flattened ventrally, yet more globose and less disk-like than other species of *Halieutopsis*, and in the vertebral count: *Coelophrys* has 16-17 vertebrae

(based on 8 specimens), *H. micropa* has 16–18 (table 1), all other *Halieutopsis* have 17–20, usually 18–19.

Body shape is undoubtedly strongly affected by preservation in species with weakly calcified skeletons. Such species include *Halieutopsis simula*, *H. stellifera*, *H. micropa*, and *H. andriashevi*. As body tissues shrink, the skeleton beneath may bend to an unnatural shape, particularly the skeleton of the disk. A known case is that of *H. stellifera*. A photograph of a specimen freshly caught shows a relatively wide, round disk with smooth skin and rounded body contours (Okamura et al., 1984, p. 282), but the same specimen preserved has the disk oval-shaped (resembling the holotype as outlined in fig. 1) and the skin flabby and wrinkled.

The size of the glandular esca also varies with preservation. Therefore, only the general morphological appearance of the esca has been a useful taxonomic character, not its proportions. I formerly used the external appearance of the esca to differentiate genera (Bradbury, 1967), noting that, within the majority of genera, the esca was not intraspecifically differentiated. In this paper, however, I use the general morphological appearance of the esca for differentiating some species of *Halieutopsis*.

Sexual dimorphism in the size of the olfactory organs in ogocephalids is reported here for the first time. In addition to finding that males are macrosomatic in species of *Halieutopsis*, I have determined that macrosomatic males also occur in species of *Dibranchus*, a genus with a bathymetric range from outer continental shelf to upper slope depths. However, with the exception of a single species, this sexual dimorphism is not present in *Ogocephalus*, a genus whose bathymetric range is restricted to continental shelf depths. The pattern of occurrence of this dimorphism suggests that it is related to the deep-sea habitat. It is known in other groups of Lophiiformes: Macrosomatic males are reported for Lophiidae (Caruso, 1975), which includes outer continental and slope species (Caruso, 1981, 1983), and most ceratioids (Bertelsen et al., 1981), which are bathypelagic.

Specimens need to be in good condition with skin unabraded in order to see lateral-line scales

and neuromasts on the dorsal surface of the disk in *Halieutopsis* (on the ventral surface of the body, these organs tend to lie in excavations and are thus protected and better preserved). Patterns on the dorsal surfaces of the disks in Figures 1 and 2 are drawn from specimens that were favorably preserved or had been stained to show the lateral-line scales; however, these agree in having the posterior region of the lateral-line series extend dorsally on either side of the base of the dorsal fin. One species, *H. andriashevi*, described herein from a single specimen, apparently lacks lateral-line scales on the dorsal surface of the disk, but should be examined for this character by staining when more material is available. If lateral-line scales are confirmed to be lacking in *H. andriashevi*, it will be the only species in the family with this condition.

The pattern of neuromasts on the ventral surface of the disk is exactly like that seen in all other members of the family (Bradbury, 1967, 1980). Four series in *Halieutopsis* (and in most members of the family) show variation in count (fig. 1A–D). The single variation in pattern of the lateralis system that distinguishes *Halieutopsis* from other genera is the anterior extension of the tail lateral line onto the ventral surface of the disk to, or anterior to, the anus (figs. 1–2). Only some species of *Coelophrys* share this feature with *Halieutopsis*. Other genera with lateral-line scales adjacent to the anus never have more than one on each side (*Dibranchus*, *Halicometus*, *Halieutaea*, *Halieutichthys*, and some species of *Malthopsis*).

DISTRIBUTION (FIG. 4)—*Halieutopsis* is distributed from the Indian Ocean to the eastern Pacific Ocean at tropical and subtropical latitudes, but the majority of species (seven of nine) are Indo-western Pacific. *Halieutopsis* is absent from the Pacific plate, except for *H. bathyoreos*, newly described herein from a single specimen from Horizon Guyot in the central North Pacific in the vicinity of Hawaii. The southern limit for the genus may be extended slightly if the presence of *H. micropa* off Durban, South Africa, can be verified; a specimen in very poor condition from this locality has been identified provisionally as *H. micropa*.

Provisional Key to Adults of Species of *Halieutopsis*

- 1A. Mouth upturned; entire rostrum posterior to mouth *Halieutopsis ingerorum* new species (fig. 5C–D)
western Indian Ocean, Mozambique Channel
- 1B. Mouth terminal or ventral; rostrum overhanging mouth

- 2A. Ventral fins extremely reduced (figs. 1–2); head globose but flattened ventrally *Halieutopsis micropa* (Alcock),
Indian and western Pacific oceans
- 2B. Ventral fins of ordinary proportions; head depressed 3
- 3A. Disk small relative to tail, subopercular length 3 times into standard length (SL). Tubercles at edges
of disk forming saw-toothed ridges (fig. 2) *Halieutopsis andriashevi* new species (fig. 5A–B),
Indian Ocean, vicinity of Mascarene Is., 3800–4000 m
- 3B. Disk 2.5 times or less in SL. No saw-toothed ridges formed of tubercles along edges of disk ... 4
- 4A. Esca covered with a mass of filaments (fig. 3G) *Halieutopsis simula* (Smith and Radcliffe, 1912) (fig. 1),
China Sea off Malavatuau and Sandakan is., Philippines
- 4B. Esca with 2 rounded ventral lobes and leaflike dorsal lobe; no filaments on any of these 5
- 5A. Ventral surface of disk covered with tubercles 6
- 5B. Tubercles absent from ventral surface of disk 7
- 6A. Interorbital space very wide (fig. 1), 7 times into SL or less, 3 times into length of disk margin ...
..... *Halieutopsis stellifera* (Smith and Radcliffe, 1912),
western Pacific Ocean from Celebes to Philippine archipelago
and Okinawa trough
- 6B. Interorbital relatively narrow, nearly 9 times into SL, 3.5 times into length of disk margin
..... *Halieutopsis galatea* new species (fig. 7),
western Indian Ocean off Kenya
- 7A. Anterior margin of disk indented; rostrum not extending anterior to disk margin
..... *Halieutopsis tumifrons* Garman, 1899,
eastern Pacific Ocean, off the Galapagos Is.
- 7B. Rostrum extending well anterior to disk margin 8
- 8A. Esca much wider than high (fig. 3E) *Halieutopsis vermicularis* Smith and Radcliffe, 1912,
western Pacific Ocean from north of New Guinea to Japan
- 8B. Esca higher than wide (fig. 3B) *Halieutopsis bathyoreos* new species,
central North Pacific Ocean, mid-Pacific mountains

Species Accounts

Halieutopsis micropa (Alcock, 1891), Figure 1.

Dibranchius micropus Alcock, in Wood-Mason and Alcock, 1891, p. 25 (original description, 2 syntypes from Bay of Bengal); Bradbury, 1967, p. 412 (diagnosis of *Halieutopsis* with rationale for assigning *micropus* to *Halieutopsis*).

Possible reference: Brauer, 1906, p. 329 (1 specimen from equatorial Indian Ocean off Africa).

Coelophrys micropus Norman, 1939, p. 114 (2 specimens from Gulf of Aden); Yamakawa, in Okamura et al., 1984, p. 380 (description of specimen from Okinawa Trough).

SYNTYPES—ZSI 13029 and ZSI 13030 (Menon & Yazdani, 1968), Bay of Bengal, 15°56'50"N, 81°30.5'E, 439–494 m. (Original description states that the largest of the two syntypes is 66 mm long.)

DIAGNOSIS—A species of *Halieutopsis* distinctive for very small ventral fins (fig. 1), low vertebral

count (table 1), high lateral-line count (table 2), and high count for dorsolateral branch of subopercular lateral line (table 3).

DESCRIPTION—Counts given in Tables 1–3, body proportions in Table 4. Disk subglobose, its ventral surface flat. Interorbital and cranial widths greatest for genus, illicial cavity very large, mouth second widest for genus.

Disk trapezoidal in outline (fig. 1), cranium strongly elevated above disk. Dorsal surface of rostrum broad, flat; anterior margin of rostrum slightly concave, no enlarged median spine. Illicial cavity very large. Lower jaw projecting relative to upper jaw. Tail relatively short, slender. Skeleton weak, body sometimes flabby and sagging, especially in larger specimens. Esca with rounded, paired, ventral lobes and a broad, relatively low, dorsal lobe (Bradbury, 1967, fig. 3a).

Gill rakers formed as triangular plates with tiny teeth at distal angle (Bradbury, 1967, fig. 7a), about 9 gill rakers on each side of arch 2. Patches of villiform teeth near symphysis of each jaw.

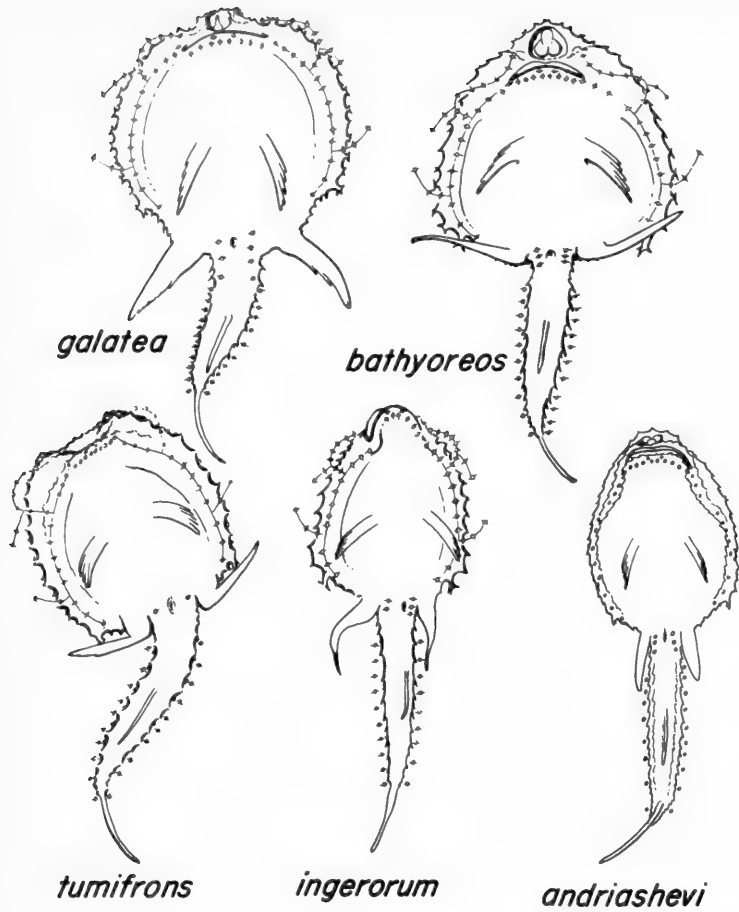


FIG. 2. Outlines showing body shapes and the ventral patterns of the lateralis system in five species of *Halieutopsis* sketched from the following specimens: *H. galatea*, new species, the holotype, 55.1 mm SL; *H. bathyoreos*, new species, the holotype, 62.6 mm SL; *H. tumifrons*, MCZ 28730, 64.0 mm SL; *H. ingerorum*, new species, the holotype, 44.2 mm SL; *H. andriashevi*, new species, the holotype, 46.2 mm SL. Small circles with lines through them symbolize lateral-line scales.

Skin translucent, flabby. Small tubercles with slender spines covering entire body, giving body a semivelvety appearance. Tubercles of disk edge no larger to only slightly larger than tubercles elsewhere on body, the spines bifid. Subopercular spines weakly developed.

Fins weak, ventral fins extremely reduced in size. *Color in Life*—"Uniform blue-black" (Wood-Mason & Alcock, 1891). "Head and body grayish brown. Pectoral and pelvic fins dark brown, other fins and esca pale yellow" (Yamakawa, in Oklamura et al., 1984).

TABLE 1. Frequency distributions for dorsal and pectoral fin ray counts and vertebral counts in species of *Halieutopsis*.

Species	Ray counts														
	Dorsal fin				Pectoral fin					Vertebrae					
	N	4	5	6	N	13	14	15	16	N	16	17	18	19	20
<i>H. micropa</i>	11	...	11	...	22	2	5	12	3	8	2	5	1	...	...
<i>H. stellifera</i>	5	...	1	4	10	...	3	6	1	3	...	...	3	...	...
<i>H. simula</i>	2	...	...	2	4	...	1	3	...	2	...	...	2	...	...
<i>H. vermicularis</i>	6	...	4	2	14	1	6	7	...	4	...	...	4	...	...
<i>H. galatea</i>	1	1	...	...	2	...	2	...	...	1	...	1	...	...	...
<i>H. andriashevi</i>	1	1	...	...	2	...	...	2	...	1	...	...	...	1	...
<i>H. ingerorum</i>	1	...	1	...	2	...	2	...	...	1	...	...	...	...	1
<i>H. bathyoreos</i>	1	...	...	1	2	...	...	1	1	1	...	...	...	1	...
<i>H. tumifrons</i>	2	...	1	1	4	...	2	...	2	2	...	...	...	2	...

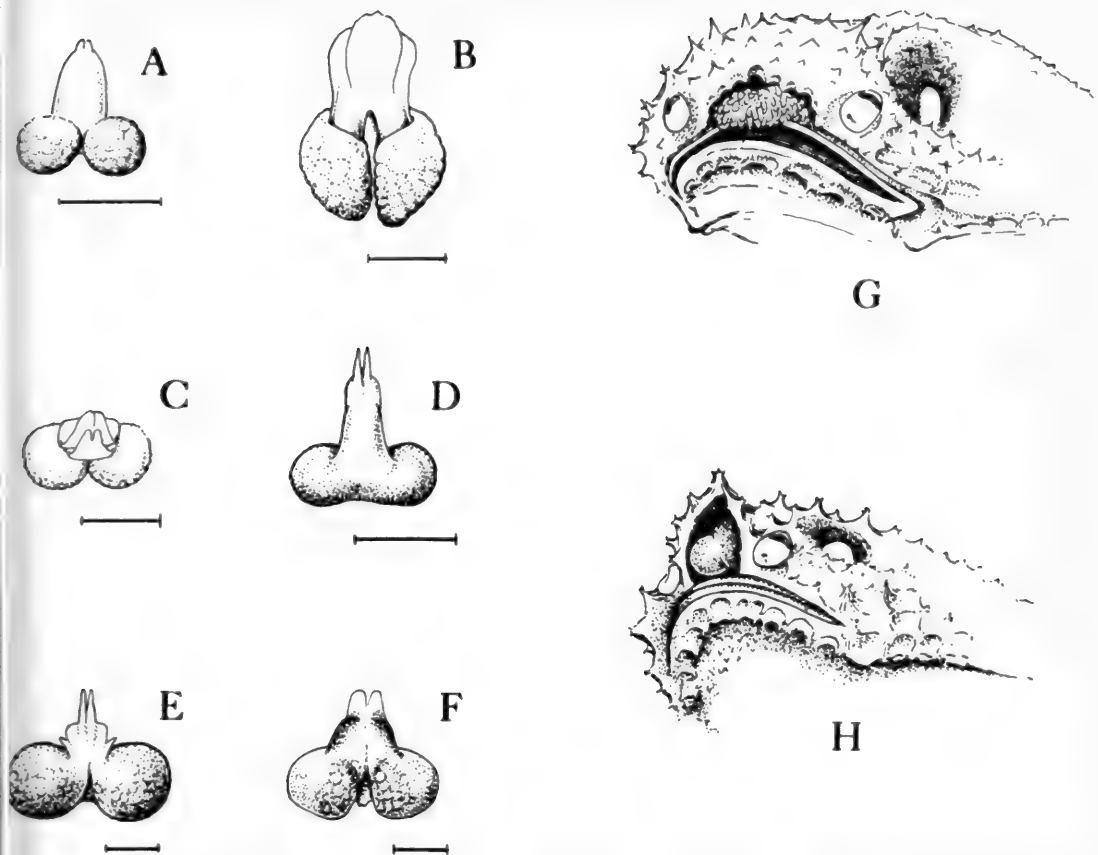


FIG. 3. A-F, Frontal views of escae of species of *Halieutopsis*. A, *Halieutopsis andriashevi*, the holotype; B, *H. bathyoreos*, the holotype; C, *H. ingerorum*, the holotype; D, *H. galatea*, the holotype; E, *H. vermicularis*, USNM 182931; F, *H. stellifera*, USNM 70273. Size bars equal 2 mm. G-H, Frontal-lateral views of the face of two species of *Halieutopsis* sketched from the following specimens: G, *H. simula*, USNM 70274, 65.3 mm SL, showing filaments of esca protruding from illicial cavity; H, *H. stellifera*, USNM 122306, 57.1 mm SL.

Color in Alcohol—Body colorless to gray; peritoneum dark gray to black, visible through translucent skin. Paired fins black in some specimens, colorless in others. Median fins same tone as body. Dermal flaps associated with lateralis system scales sometimes dark brown or black.

DISTRIBUTION (FIG. 4)—*Halieutopsis micropa* occurs throughout the Indian Ocean as well as in the western Pacific from off southern Celebes to the Okinawa trough, the widest distribution for any species of *Halieutopsis* so far known. Benthic specimens have been captured at 500–1400 m. Depths of capture for midwater specimens are unknown.

I have examined one specimen, RUSI 12750, about 66 mm SL, from 900 m off Durban, South Africa. It is in extremely poor condition and only provisionally assigned to *Halieutopsis micropa*.

Literature records include the two syntypes from the Bay of Bengal (Wood-Mason & Alcock, 1891), one specimen from the equatorial Indian Ocean off Africa (Brauer, 1906), and two specimens from the Gulf of Aden (Norman, 1939).

MATERIAL—A total of 16 specimens from 11 collections was studied. This total consisted of 5 larvae and 1 juvenile taken in midwater nets and 10 adults taken in bottom trawls.

BSKU 26446 (1 female 84.1 mm SL), Okinawa trough, 1000–1140 m. CAS 42744 (3 larvae 16.0–22.5 mm SL), IIOE Anton Bruun VI, Hydro Sta. 336, 26–27 May 1964, 1735–0025 hrs, 02°03'N, 65°04'E, Trawl 336A shallow fraction, Isaacs-Kidd Midwater Trawl (IKMT) max. depth 817 m. CAS 42745 (1 larva 23.1 mm SL), IIOE Anton Bruun VI, Hydro Sta. 339, 30 May 1964, 0140–0645 hrs, 04°01'S, 65°00'E, Trawl 339A shallow fraction,

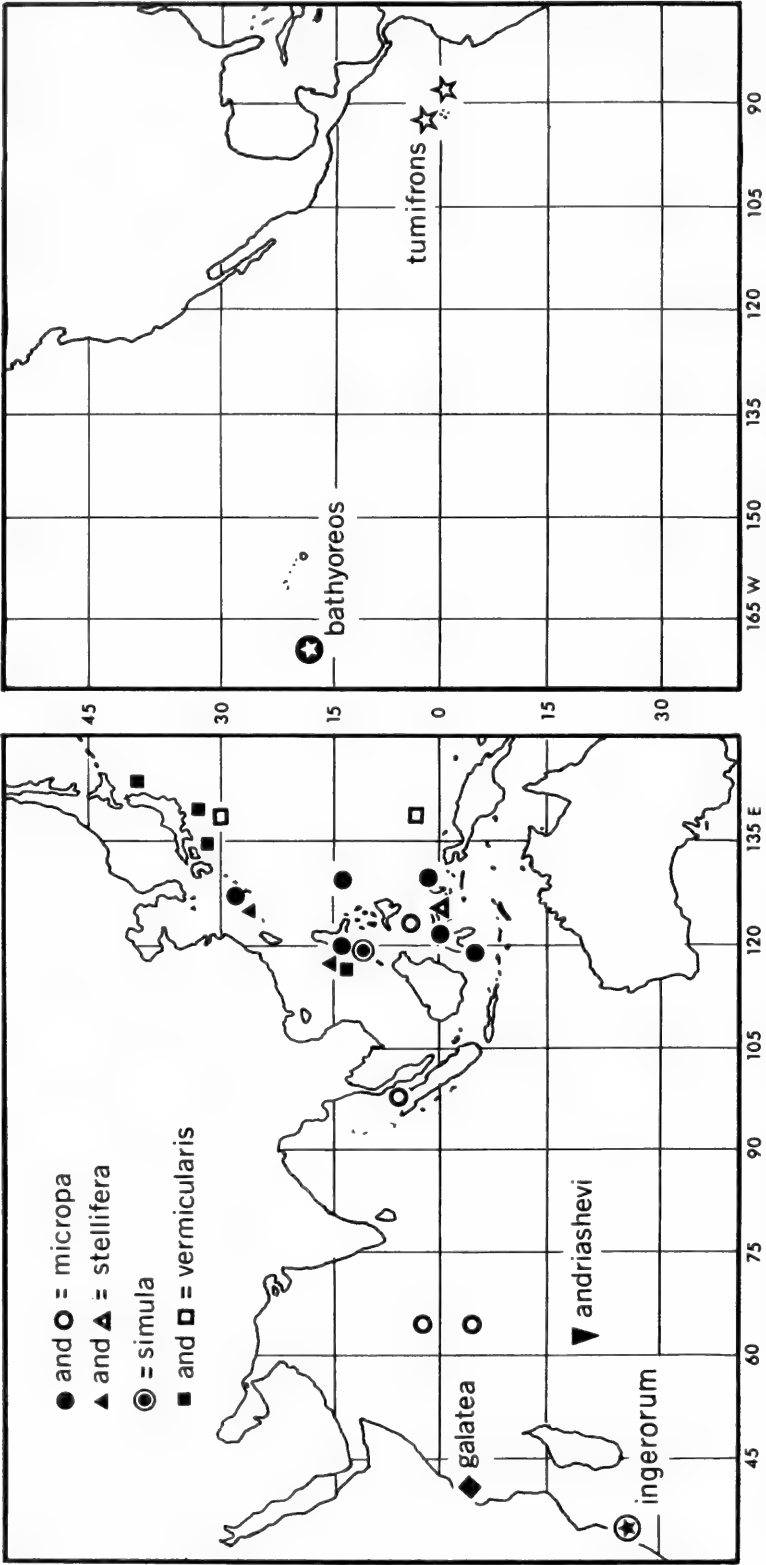


Fig. 4. Distribution of species in the genus *Halieutopsis*. Only specimens examined for this review are shown (see text for literature records). Some symbols represent more than one collection. Open symbols represent captures by pelagic nets; solid symbols represent captures by bottom trawls.

TABLE 2. Frequency distributions for lateral-line scale counts in species of *Halieutopsis*.

Species	Lateral-line scale counts																							
	Body										Tail													
	N	0	6	7	8	9	10	11	12	13	14	15	16	17	N	7	8	9	10	11	12	13	14	15
<i>H. micropa</i>	20	...	...	...	...	...	...	1	2	8	3	5	1	20	...	6	4	5	2	1	...	...	...	...
<i>H. stellifera</i>	4	...	...	...	...	1	3	...	...	...	...	...	...	6	...	...	...	...	2	1	2	1	...	...
<i>H. simula</i>	4	...	...	...	...	1	1	...	...	...	...	...	...	4	...	...	...	...	1	1	2	...	...	...
<i>H. vermicularis</i>	6	...	...	...	...	4	1	1	...	...	...	...	...	14	1	1	3	2	3	3	...	1	...	...
<i>H. galatea</i>	2	...	...	...	...	1	1	...	...	...	...	...	...	2	...	...	...	...	...	...	1	1	...	...
<i>H. andriashevi</i>	2	2	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	1	1	...	...
<i>H. ingerorum</i>	2	...	...	...	...	1	1	...	...	...	...	...	...	2	...	...	...	...	...	...	...	2	...	...
<i>H. bathyoreos</i>	2	...	...	...	2	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	1	1	...
<i>H. tumifrons</i>	3	...	1	2	...	...	...	...	...	...	...	...	...	4	...	...	1	1	2	...	...	...	...	...

TABLE 3. Frequency distributions for counts in four series of cephalic lateral-line scales in species of *Halieutopsis* (fig. 1).

Species	Cephalic lateral-line scale counts																																			
	Preopercular							Subopercular							Dorsolateral branch of subopercular							Supraorbital														
	N	2	3	4	N	4	5	6	7	N	1	2	3	4	5	6	N	3	4	5	6	7	8	9	10	N	3	4	5	6	7	8	9	10		
<i>H. micropa</i>	20	2	16	2	20	1	15	4	...	20	...	...	1	18	1	20	...	...	...	...	...	...	...	...	...	20	...	...	...	...	...	...	...	...
<i>H. stellifera</i>	10	...	4	6	8	...	4	4	...	10	...	...	1	8	1	...	4	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...
<i>H. simula</i>	4	...	4	...	4	...	3	1	...	4	...	...	2	2	...	2	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...
<i>H. vermicularis</i>	14	8	5	1	14	2	9	3	...	14	...	...	14	...	...	4	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...
<i>H. galatea</i>	2	...	2	...	2	...	2	...	...	2	...	...	2	...	...	2	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...
<i>H. andriashevi</i>	2	2	...	...	2	...	2	...	...	2	...	...	2	...	...	2	1	1	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...
<i>H. ingerorum</i>	2	2	...	...	2	...	2	...	...	2	...	...	2	...	...	2	2	2	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...
<i>H. bathyoreos</i>	2	2	...	...	2	...	2	...	...	2	...	...	2	...	...	2	2	2	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...
<i>H. tumifrons</i>	4	4	...	...	4	...	2	2	...	4	1	1	2	...	...	4	1	3	...	...	...	...	...	...	...	4	1	3	...	...	...	...	...	...	...	...

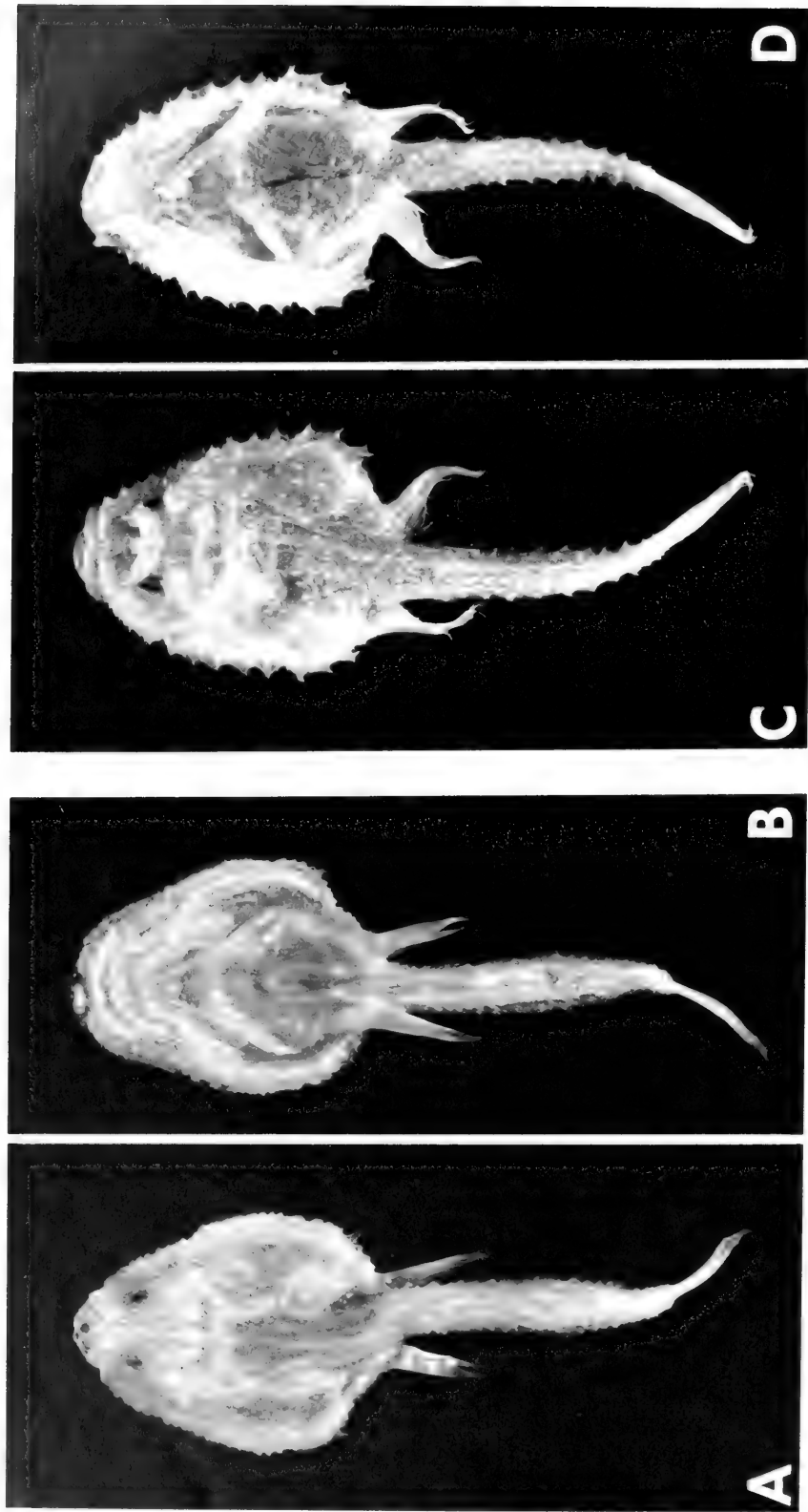


FIG. 5. *Halieutopsis andriashevi*, new species, sio 61-14-65A, 46.2 mm sl: **A**, dorsal view; **B**, ventral view; *Halieutopsis ingerorum*, new species, CAS 57249, 44.2 mm sl: **C**, dorsal view; **D**, ventral view.

TABLE 4. Range and mean for body measurements as percentage of standard length in species of *Halieutopsis*.

Species	N	Disk margin length	Skull length	Jaw-to-anal fin distance	Jaw-to-anus distance	Snout-to-dorsal distance	Inter-orbital width	Cranium width	Jaw length	Mouth width	Eye width	Pectoral fin length
<i>H. micropa</i>	9	370-447 x = 407	247-358 x = 309	745-791 x = 767	576-703 x = 620	648-709 x = 676	202-251 x = 224	261-306 x = 287	140-193 x = 173	256-291 x = 273	101-142 x = 127	192-322 x = 278
<i>H. stellifera</i>	4	415-479 x = 449	299-408 x = 333	717-774 x = 752	594-696 x = 651	661-767 x = 714	140-192 x = 159	243-253 x = 249	156-208 x = 172	228-280 x = 251	105-154 x = 127	280-347 x = 336
<i>H. simula</i>	2	450-451	301-340	770-775	588-639	(1)796	203-214	263-289	173-184	303-318	130-133	311-326
<i>H. vermicularis</i>	9	413-475 x = 450	288-346 x = 314	712-800 x = 766	587-639 x = 619	766-789 x = 778	095-110 x = 102	227-303 x = 249	148-194 x = 158	232-286 x = 252	105-120 x = 116	246-329 x = 290
<i>H. galatea</i>	1	396	287	739	548	675	114	236	127	231	098	294
<i>H. andriashevi</i>	1	344	249	701	526	573	097	173	115	173	061	204
<i>H. ingerorum</i>	1	439	276	722	561	615	127	210	124	186	086	430
<i>H. bathyoreos</i>	1	414	249	697	524	564	112	240	115	193	085	203
<i>H. tumifrons</i>	2	396-408	217-242	both 706	493-527	604-609	113-125	200-216	116-117	184-205	073-077	...

IKMT max. depth 615 m. CAS 42746 (2 specimens, a female 28.2 and male 48.2 mm SL), Te Vega Exped. Cr. 1, Sta. 58, 27 Sept. 1963, outer section of Teluk Kau, Halmahera, 01°31'N, 128°13'E, beam trawl 525-570 m. CAS 57250 (1 female 35.1 mm SL), IIOE Anton Bruun I, Hydro Sta. 17, 21 March 1963, 07°40'N, 97°09'E. CAS 57372 (1 larva 12.8 mm SL), IIOE Anton Bruun VI, Hydro Sta. 336, 26-27 May 1964, 1735-0025 hrs, 02°03'-01°50'N, 65°04'-65°06'E, Trawl 336A deep fraction, IKMT max. depth 817 m. USNM 169025 (1 specimen 38.8 mm SL), Albatross Sta. D.5607, 18 Nov. 1909, Gulf of Tomini, Celebes, 04°00'S, 121°36'E, Agassiz trawl 1392 m. USNM 169026 (1 specimen 56.0 mm SL), Albatross Sta. D.5115, 20 Jan. 1908, Sombrero I., Philippines, 13°37'11"N, 120°43'40"E, Tanner beam trawl with mud bag 622 m. USNM 169027 (2 males 46.8-49.1 mm SL), Albatross Sta. D.5283, 18 July 1908, China Sea, Malavatu I. off southern Luzon, Philippines, 13°48'30"N, 128°28'40"E, Agassiz trawl with mud bag 512 m. USNM 169028 (2 females 34.2-36.3 mm SL), Albatross Sta. D.5286, 20 July 1908, China Sea, Malavatu I. off southern Luzon, Philippines, 13°38'15"N, 120°34'20"E, Agassiz trawl with mud bag 823 m. USNM 169029 (1 male 77.0 mm SL), Albatross Sta. D.5664, 28 Dec. 1909, Macassar Strait, 04°43'22"S, 118°53'18"E, Agassiz trawl 732 m (remarks: no bottom sample in net).

***Halieutopsis stellifera* (Smith and Radcliffe, 1912),**

Figure 1.

Dibranchus stellifer Smith and Radcliffe, in Radcliffe, 1912, p. 210 (original description, type from Flores Sea off coast of Celebes); Weber and de Beaufort, 1962, p. 227 (description after Radcliffe; key); Bradbury, 1967, p. 412 (diagnosis of *Halieutopsis* with rationale for assigning *stellifer* to *Halieutopsis*).
Halieutopsis sp., Yamakawa, in Okamura et al., 1984, p. 381, fig. 197 (description and photograph of 1 specimen from Okinawa Trough).
 Probable reference: *Halieutopsis vermicularis*, Kamohara, 1937, p. 12 (description; figure).
 Doubtful reference: *Dibranchus nasutus*, Weber, 1913, p. 568 (descriptions of 4 specimens; figures of 2 specimens; Macassar Straits, Banda Sea, and Timor Sea, 724-1886 m).

HOLOTYPE—USNM 70273, a male 71.2 mm SL, Flores Sea off coast of Celebes, 05°36'30"S, 120°49'E, 1266 m.

DIAGNOSIS—A species of *Halieutopsis* with wide interorbital (fig. 1, table 4), tubercles present on ventral surface of disk, lateral-line scales in pre-

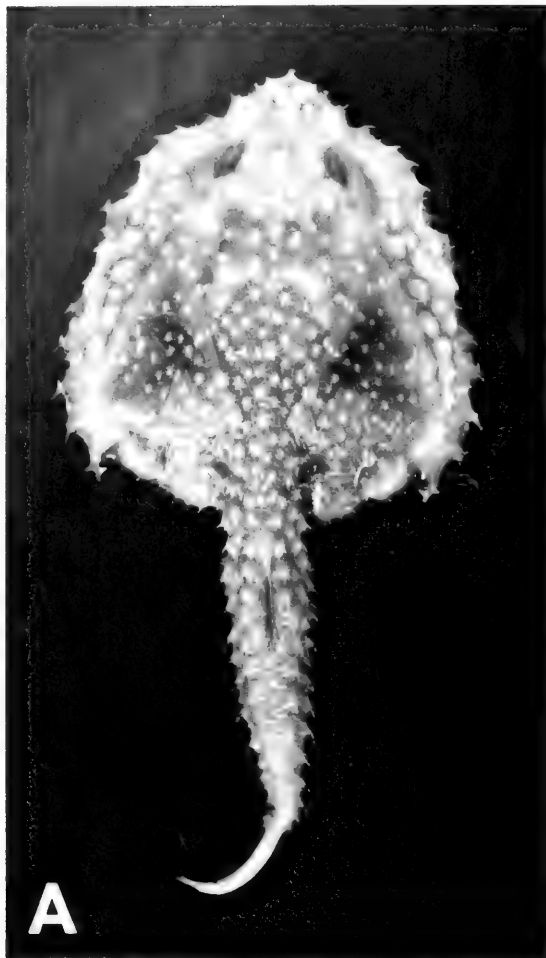


FIG. 6. *Halieutopsis bathyoreos*, new species, STO 84-43, 62.6 mm SL: **A**, dorsal view; **B**, ventral view; **C**, frontal view.

opercular series 3-4, and dorsolateral branch of subopercular series usually 8 (table 3).

DESCRIPTION—Counts given in Tables 1-3, body proportions in Table 4. Disk depressed, oval in

outline (fig. 1). Disk relatively long as reflected in the following measurements compared to SL: disk margin length, skull length, and jaw-to-anus distance. Interorbital moderately wide; jaw compar-

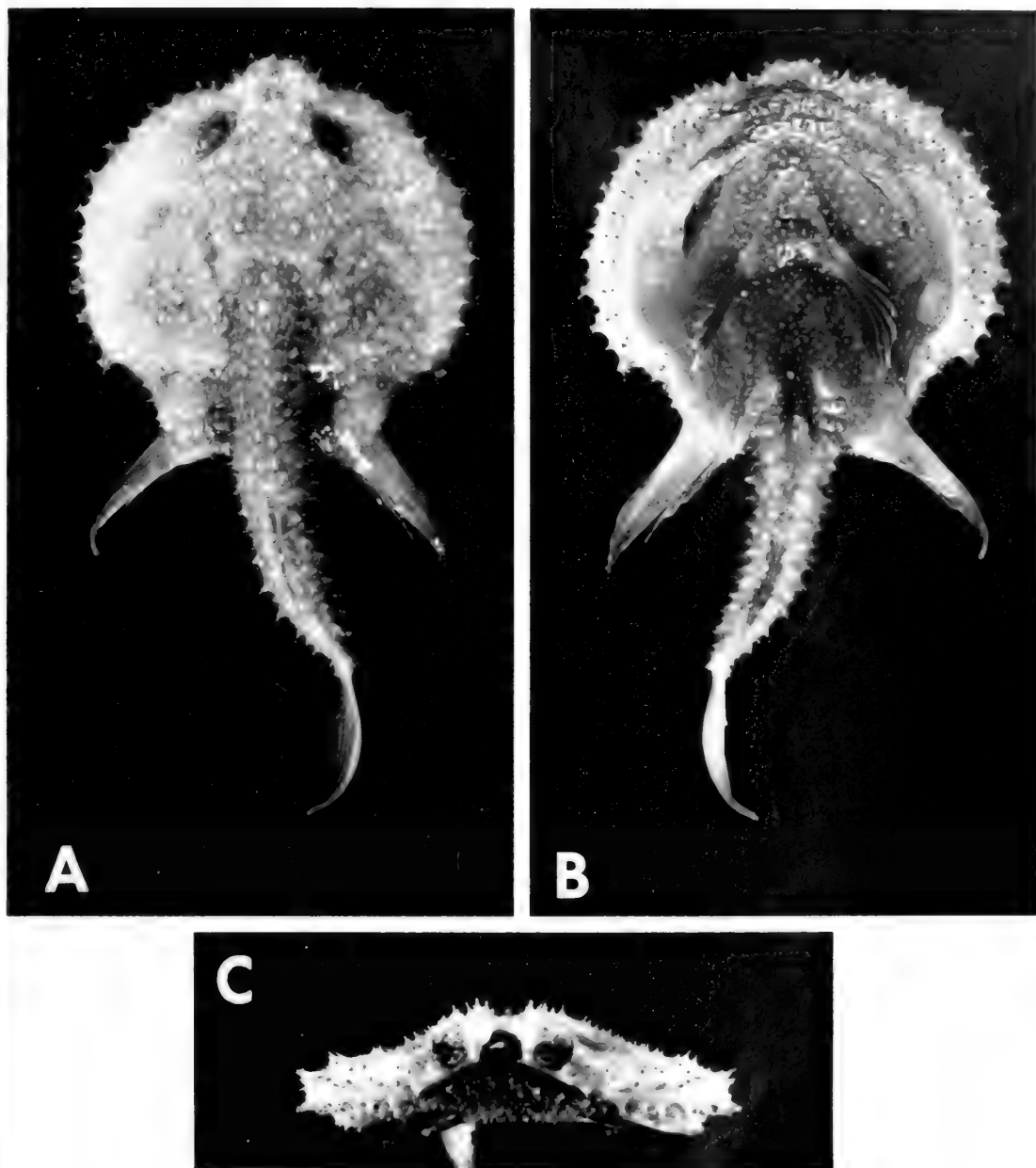


FIG. 7. *Halieutopsis galatea*, new species, ZMUC P922207, 55.1 mm SL: **A**, dorsal view; **B**, ventral view; **C**, frontal view.

atively long. Rostrum short, overhanging the mouth only slightly. Aperture of illicial cavity with a dorsal median notch (fig. 3H). Esca as in Figure 3F, broader than aperture of illicial cavity in some specimens.

Gill rakers in the form of finger-shaped pedicles with thin plates filling angles between pedicles and gill arch; clusters of tiny teeth at distal ends of

pedicles. About 7–8 gill rakers on each side of arch 2. Villiform teeth in narrow bands on jaws.

Skin translucent, somewhat flabby, especially on belly, markedly puffed around gill openings and bases of pectoral fins. Tubercles with 6–7 facets, usually with 1 slender spine. Bifid, sometimes trifid, spines on lateral margins of disk and rostrum. On dorsal surface of disk, small tubercles inter-

spersed among larger ones; ventral surfaces of disk and tail covered by tubercles. Small tubercles covering skin surrounding eyeballs. Subopercular spines slightly developed.

Fins moderate sized, weak; fin membranes and rays delicate.

Color in Life—Dorsal surface of body uniform yellowish brown; all fins dark brown; peritoneum black (Yamakawa, in Okamura et al., 1984).

Color in Alcohol—Pale dusky, melanophores densest around bases of tubercles, giving an effect of a thin-threaded, dark reticulum. Fins colorless in some specimens, dark in others. Peritoneum dark.

DISTRIBUTION (FIG. 4)—*Halieutopsis stellifera* is known from northern Celebes to the Philippine archipelago and Okinawa trough. Benthic specimens have a bathymetric range of 410–1372 m. Depths for midwater specimens are unknown.

MATERIAL—A total of 5 specimens from 5 collections was studied. The total comprises 2 larvae taken in midwater nets and 3 benthic adults.

BSKU 29775 (1 female 65.1 mm SL), Okinawa trough, 410–420 m. CAS 57248 (1 larva 24.0 mm SL), Alpha Helix Sta. 147, 21 May 1975, 0635–0935 hrs, Halmahera Sea, 00°40'S, 128°58.5'E, rectangular midwater trawl 0–1200 m. SIO 69–19 (1 larva 26.2 mm SL), Circe Exped. T-1 Leg II, Sta. 14, 21 April 1968, 1200–1655 hrs, Celebes Sea, 06°00.5'N, 122°35.6'E, 3,000 meters wire out (MWO), IKMT. USNM 70273 (holotype, a male 71.2 mm SL), Albatross Sta. D.5660, 20 Dec. 1909, Flores Sea off coast of Celebes, 05°36'30"S, 120°49'E, Agassiz trawl 1266 m. USNM 122306 (1 male 57.1 mm SL), Albatross Sta. D.5611, 19 Nov. 1909, Buka Buka I., Philippines, 00°40'30"S, 121°50'00"E, Agassiz trawl 1372 m.

***Halieutopsis simula* (Smith and Radcliffe, 1912), Figure 1.**

Dibranchius simulus Smith and Radcliffe, in Radcliffe, 1912, p. 211 (original description, type from off southern Luzon, Philippine Is.); Bradbury, 1967, p. 412 (diagnosis of *Halieutopsis* with rationale for assigning *simulus* to *Halieutopsis*).

Possible reference: *Dibranchius infranudus* de Beaufort, in Weber and de Beaufort, 1962, p. 228 (original description, specimen from Flores Sea).

HOLOTYPE—USNM 70274, 65.3 mm SL, male; China Sea, Malavatuan I. off southern Luzon, Philippines, 13°48'30"N, 120°28'40"E, 512 m.

DIAGNOSIS—A species of *Halieutopsis* lacking tubercles on ventral surface of disk and with bulbous rostrum, wide mouth (table 4), and lobes of esca covered with masses of short filaments (fig. 3G).

DESCRIPTION—Counts given in Tables 1–3, body proportions in Table 4. Disk rounded (fig. 1), compressed, cranium moderately elevated, with bulbous rostrum rising slightly above it and extending anterior to mouth (figs. 1, 3G); illicial cavity very large. Interorbital very wide, eyes directed laterally. Mouth very wide compared to rest of genus, lower jaw projecting. Unusually long snout-to-dorsal distance (i.e., tail short). Esca trilobed, much wider than high, covered by masses of short filaments, except dorsal tip of dorsal lobe smooth, deeply cleft.

Gill rakers in the form of finger-shaped pedicels, with thin plates filling the angles between pedicels and gill arch; tiny teeth clustered at distal ends. About 8–9 gill rakers on each side of arch 2. Viliform teeth in narrow bands on jaws.

Skin flabby and translucent, markedly puffed around gill openings and bases of pectorals. Tubercles spaced relatively far apart compared to other species of *Halieutopsis*, with 6–7 facets, present on tail and dorsal surface of disk including skin surrounding cornea, absent from ventral surface of disk except for lateral-line scales associated with neuromasts on either side of anus. Subopercular spines not developed.

Fins weak; anal relatively long, reaching base of caudal.

Color in Alcohol—Ground color of dorsal surface light dusky brown, tubercles pale, membranes around gill openings colorless. Ventral surface of disk colorless except dusting of melanophores around excavations of subopercular lateral-line series. Dorsal fin dusky, dorsal surface of pectorals dusky basally, pale distally. Pelvics and anal colorless. Caudal dusky basally and on dorsal and ventral margins. Esca colorless. Peritoneum dark.

MATERIAL—Only 2 specimens from 2 collections are known to me, both adults.

USNM 70274 (holotype, male, 65.3 mm SL), Albatross Sta. D.5283, 18 July 1908, China Sea, Malavatuan I. off southern Luzon, Philippines, 13°48'30"N, 120°28'40"E, Agassiz trawl 512 m. USNM 122675 (1 male 48.8 mm SL), Albatross (no station number given), Sandakan I., Philippines, 2 March 1908 (date probably in error; collecting on this date consisted only of beach seining [Anon., 1911]).

***Halieutopsis vermicularis* Smith and Radcliffe, 1912, Figure 1.**

Halieutopsis vermicularis Smith and Radcliffe, in Radcliffe, 1912, p. 209 (original description, type from Balayan Bay, Luzon, Philippine Is.); Bradbury, 1967, p. 412 (diagnosis of *Halieutopsis*).

HOLOTYPE—USNM 70272, 60.9 mm SL, female; Balayan Bay, Luzon, Philippines.

DIAGNOSIS—A species of *Halieutopsis* with narrow interorbital (fig. 1, table 4), no tubercles on the ventral surface of the disk (except lateral-line scales on either side of anus), and supraorbital series with 6 or more lateral-line scales.

DESCRIPTION—Counts given in Tables 1–3, body proportions in Table 4; snout-to-dorsal origin proportionately long, interorbital narrow.

Disk depressed, subtriangular in outline (fig. 1). Membrane connecting pectoral pedicles to body less extensive than in *Halieutopsis stellifera* or *H. simula*, the pedicel and fin forming an elbow. Rostrum triangular in outline, acutely pointed, overhanging mouth, its terminal spine upswept. Aperture of illicial cavity with a broad dorsal median notch. Jaws equal or lower jaw slightly included. Esca as in Figure 3E.

Gill rakers in the form of finger-like pedicels with thin plates filling the angles between the pedicels and gill arch; a cluster of tiny teeth at distal end of each pedicel. About 6–8 gill rakers on each side of gill arch 2. Villiform teeth on narrow bands in jaws.

Skin soft, especially flabby on ventral surface of disk, which lacks tubercles except lateral-line scales on either side of anus. On dorsal surface of disk, small tubercles interspersed among large ones. Tubercles with 6–7 facets, many with single spines; bifid spines on tubercles of disk margin, rostrum, and tail. Tubercles of disk margin, rostrum, and dorsal surface of cranium large and ankylosed to underlying bone. Subopercular spines developed.

Fins moderate sized, weak.

Color in Alcohol—Ground color medium brown with wide, pale, vermiculate markings covering dorsal surface. In the holotype and another specimen the same size, ventral surface of disk pale; in another larger specimen, ventral surface of disk dark brown. Lips, skin of olfactory organs, and dermal flaps associated with lateralis system dark brown. Fin rays dusky, the pectorals and sometimes dorsal and caudal with faint vermiculated pattern; fin membranes transparent except at bases

of paired fins, where membranes thickened and puffed. Peritoneum dark.

DISTRIBUTION (FIG. 4)—*Halieutopsis vermicularis* is known from off the Philippine and Japanese archipelagoes and from a larval specimen from north of New Guinea. The bathymetric range for benthic specimens is 391–1141 m, but depths for larval specimens are unknown.

MATERIAL—A total of 10 specimens from 8 collections was studied. This total comprises 2 larvae taken in midwater nets and 8 benthic adult specimens.

SIO 70-308 (1 larva 25.6 mm SL), Antipode Exped. Sta. 4-25A-Tr#3, 30 Aug. 1970, 29°58.8'N, 137°11.5'E–29°36.1'N, 137°20.3'E, IKMT 0–1350 m. USNM 70272 (holotype, a female 60.9 mm SL), Albatross Sta. D.5365, 22 Feb. 1909, Balayan Bay, Luzon, Philippines, 13°44'24"N, 120°45'30"E, Agassiz trawl 391 m. USNM 135661 (1 male 37.5 mm SL), Albatross Sta. D.5083, 20 Oct. 1906, 34°04'20"N, 137°57'30"E, Agassiz trawl 1141 m. USNM 135694 (2 males 26.3–26.0 mm SL), Albatross Sta. D.4980, 1 Sept. 1906, 34°09'N, 137°55'E, Agassiz trawl 927 m. USNM 150449 (1 male 33.0 mm SL), Albatross Sta. D.4957, 23 Aug. 1906, 32°36'N, 132°23'E, 799 m. USNM 182931 (2 females 59.0–78.0 mm SL), Albatross, 20 Jan. 1908, Sombrero I., Philippines (no other data; 3 dredging stations were occupied by *Albatross* on this date in this vicinity; depth range for the 3, 366–622 m [Anon., 1911]). USNM 197661 (1 specimen 42.7 mm SL), Albatross Sta. D.5044, 3 Oct. 1906, 42°10'40"N, 142°14'E, Agassiz trawl 565–657 m. ZMUC uncataloged (1 larva 22.2 mm SL), Dana 3751 VII, 7 Dec. 1929, 03°40.4'N, 137°53'E, 3,000 MWO.

***Halieutopsis tumifrons* Garman, 1899, Figure 2.**

Halieutopsis tumifrons Garman, 1899, p. 90 (original description, two syntypes from vicinity of Cocos I.); Bradbury, 1962, p. 2 (designation of lectotype); 1967, p. 412 (diagnosis of *Halieutopsis*).

LECTOTYPE—MCZ 28729, 69.0 mm SL, male; eastern tropical Pacific near the Galapagos archipelago, 00°36'S, 86°46'W, 2418 m.

DIAGNOSIS—A species of *Halieutopsis* with disk markedly indented at rostrum (fig. 2), 9–11 tail lateral-line scales (table 2) and 2 preopercular lateral-line scales (table 3), skull and jaw-to-anus lengths relatively short (table 4), and no tubercles

on ventral side of disk or tail anterior to anal fin (except the lateral-,line scales on either side of anus).

DESCRIPTION—Counts given in Tables 1–3, body proportions in Table 4. Disk compressed, subquadrangular (fig. 2), very short relative to SL as indicated by the following measurements: skull length, snout-to-dorsal distance, and jaw-to-anus distance (table 4). Rostrum short, overlying the mouth, but not extending anterior to margin of disk. Eyes small, interorbital narrow, mouth small, subterminal, lower jaw included. Esca with 2 rounded ventral lobes and a thin, elongate, median dorsal lobe, bifurcate at distal end (Garman, 1899, plate 25, fig. 4).

Gill rakers small, cone-shaped, with few teeth. Sparse villiform teeth in narrow bands on jaws.

Skin firm, tubercles large, harsh, giving body a carapace-like feeling of hardness. Tubercles with 8–12 facets, those along disk margins and dorsally along vertebral column ankylosed to skeleton, their spines bifid or trifid. Subopercular spines small but distinct. Dermal flaps associated with lateral-line scales relatively weakly developed.

Fins strong but small; membrane between pectoral pedicles and body reduced, the pectorals strongly elbowed.

Color “brownish white, muscular portions with light flesh color; the entire body evidently brilliant in life with some variety of red” (Garman, 1899, p. 92).

Color in Alcohol—Nearly colorless; only a faint overall duskiess remains. Peritoneum and lining of branchial cavities also pale dusky.

DISTRIBUTION (FIG. 4)—*Halieutopsis tumifrons* is known only from the equatorial eastern Pacific in the vicinity of the Galapagos archipelago at depths of 2418–2487 m.

MATERIAL—Only the original 2 specimens from 2 collections are known, both adults.

MCZ 28729 (lectotype, a male 69.0 mm SL), Albatross Sta. 3400, 27 March 1890, 00°36'S, 86°46'W, 2418 m. MCZ 28730 (1 male 64.0 mm SL), Albatross Sta. 3413, 5 April 1890, 02°34'N, 92°06'W, 2487 m.

Halieutopsis andriashevi Bradbury, new species, Figures 2–3A and 5A–B.

Oncocephalidae (1), Andriashev, 1958, p. 203 (listed).

HOLOTYPE—SIO 61-14-65A, a female 46.2 mm SL, central western Indian Ocean, 19°09'S, 63°07.5'E, 3800–4000 m.

DIAGNOSIS—A *Halieutopsis* with disk unusually small, the disk margin length much smaller and the cranium narrower compared to SL than in any other species (table 4). Eyes also smaller than in other species (table 4). Tubercles along edges of disk and sides of tail dorsoventrally flattened and closely adjoining, forming thin, continuous saw-toothed ridges, those on sides of tail even, extending on either side of the caudal fin like keels. Tubercles absent from ventral surface of disk. From 3800–4000 m, deeper by more than 1500 m than any other ogocephalid.

DESCRIPTION (BASED ON HOLOTYPE)—Counts given in Tables 1–3, body proportions in Table 4, body measurements in Table 5. The relatively small disk reflected in body proportions; these compare to other members of genus as follows: shortest disk margin and narrowest cranium; skull one of the shortest; predorsal distance, jaw-to-anus distance, and jaw-to-anal fin distance all relatively short. Eye width, jaw length, and mouth width all relatively small compared to SL.

Disk relatively flat, the cranium not markedly elevated. Tail long, appearing stout relative to disk size. Because of keel-like ridges of tubercles extending the length of the tail and onto the caudal fin, tail not tapered-looking as in other *Halieutopsis*. Skeleton weak, disk probably misshapen to some extent. Conspicuous trunk curvature (fig. 5), an artifact caused by packing (sketch in fig. 2 made from a photograph taken before this deformity incurred).

Esca as in Figure 3A; no pigment cells present, but the 2 ventral glandular lobes bright tan. From a radiograph taken to show the vertebral column, illicial bone appearing elongate as for *Halieutopsis*, but its detailed nature indistinct. Esca slightly exerted from the illicial cavity in this specimen, tipped forward more than 90°.

Gill rakers formed as thin, triangular plates perpendicular to gill arch, each with tiny teeth clustered distally; 7 gill rakers on anterior, 6 on posterior side of arch 2. Tiny teeth in single ragged row on each jaw.

Internal structures visible through transparent skin; otoliths visible, indicating skull also transparent. Tubercles absent from ventral surface of disk, but present on all other parts of body, these moderate in size with 4–6 facets. Tubercles on face, edges of disk, and sides of tail greatly flattened and closely adjoining, forming thin, continuous saw-toothed ridges, lateral-line scales with neuromasts lying in grooves between ridges. Two parallel saw-toothed ridges running laterally on each

side of tail, these curving toward anus anteriorly, posteriorly continuing out on basal fifth of caudal fin, resembling keels. No lateral-line scales or neuromasts detectable on dorsal surface of disk.

Paired fins relatively small, pectoral pedicels joined to body by membrane. Dorsal and anal fins small, last ray of dorsal attached to body by membrane. Body, fins, peritoneum, and branchial membranes all colorless.

DISTRIBUTION (FIG. 4)—*Halieutopsis andria-shevi* is known only from the type locality, the vicinity of the Mascarene Islands in the Indian Ocean, 19°09'S, 63°07.5'E, 3800–4000 m. It is by far the deepest ogocephalid ever taken, more than 1500 m deeper than the heretofore deepest-known specimens.

ETYMOLOGY—The name *Halieutopsis andria-shevi* honors Dr. Anatole P. Andriashev, whose contributions to deep-sea ichthyology are legion. He first recognized this new ogocephalid and kindly made it available to me for study. For 20 years he waited patiently for the results.

MATERIAL—SIO 61-14-65A (1 specimen 46.2 mm SL), Soviet Antarctic Exped., Ob Sta. 135, 29 May 1956, 19°09'S, 63°07.5'E, Sigsbee Gorbunov trawl 3800–4000 m.

Halieutopsis ingerorum Bradbury, new species, Figures 2–3C and 5C–D.

HOLOTYPE—CAS 57249, a female 44.2 mm SL, Mozambique Channel, 21°18'S, 36°18'E, 1510–1600 m.

DIAGNOSIS—A species of *Halieutopsis* with face upturned, rostrum entirely posterior to mouth, 20 vertebrae.

DESCRIPTION (BASED ON HOLOTYPE)—Counts given in Tables 1–3, body proportions in Table 4, body measurements in Table 5. Relative to SL, cranium and interorbital widths both narrow. Jaws short, strongly curved, mouth narrow. Other proportions (skull length, eye width, predorsal distance, jaw-to-anal fin distance, and jaw-to-anus distance relative to SL) all around the median value for the genus. Face strongly upturned, gape nearly vertical, rostrum very abbreviated, tipped upward, set back to anterior margins of eyes. Outline of disk oval, cranium slightly elevated above general disk surface. Tail slender, tapered toward caudal.

Esca as in Figure 3C. Ventral lobes lentil-shaped, dorsal lobe folded and wrinkled, sketched as in specimen, but unlikely so folded in life. Illicial

TABLE 5. Body measurements of new species of *Halieutopsis*.

Measurements	<i>andria-shevi</i>	<i>bathy-oreos</i>	<i>galatea</i>	<i>ingerorum</i>
Standard length	46.2	62.6	55.1	44.2
Disk margin length	15.9	25.9	21.8	19.4
Skull length	11.5	15.6	15.8	12.2
Predorsal distance	26.5	35.3	37.2	27.2
Jaw-to-anal fin distance	32.4	43.6	40.7	31.9
Jaw-to-anus distance	24.3	32.8	30.2	24.8
Interorbital width	4.5	7.0	6.3	5.6
Cranium width	8.0	15.0	13.0	9.3
Jaw length	5.3	7.2	7.0	5.5
Mouth width	8.0	12.1	12.7	8.2
Eye width	2.8	5.3	5.4	3.8
Pectoral fin length	9.4	12.7	16.2	19.0

cavity small, esca slightly exerted from illicial opening.

Gill rakers cone-shaped, tiny teeth clustered distally on each, 7 gill rakers on anterior, 7 on posterior side of gill arch 2. Minute teeth in narrow bands on jaws.

Skin thin, somewhat transparent, internal structures indistinctly visible through it. On face and edges of disk, tubercles large and closely adjoining one another. Elsewhere tubercles smaller and spaced slightly apart, with puffs and wrinkles in skin intervening (patches of skin with impressions of coarse cloth used to wrap specimen at one time). Tubercles of edges of disk and tail with thick, short spines; elsewhere on body, spines shorter. Tubercles absent from ventral surface of disk (except lateral-line scales on either side of anus) and from skin around eyeballs.

Paired fins small and weak. Dorsal and anal fins somewhat abraded but clearly small; anal fin lapet-like.

No pigment anywhere externally on body or fins. Peritoneum dusky, lining of branchial cavities pale. Glandular ventral lobes of esca medium tan.

DISTRIBUTION (FIG. 4)—*Halieutopsis ingerorum* is known only from the type locality, Mozambique Channel, western Indian Ocean, 21°18'S, 36°18'E, 1510–1600 m.

ETYMOLOGY—This species is named in honor of Robert F. Inger and in memory of the late Mary Lee Inger for friendship and wise counsel through the years.

MATERIAL—CAS 57249 (1 specimen 44.2 mm SL), IIOE Anton Bruun VIII, Sta. 399C, 2 Oct. 1964, 21°18'S, 36°18'E, shrimp trawl 1510–1600 m.

***Halieutopsis bathyoreos* Bradbury, new species,**
Figures 2–3B and 6.

Halieutopsis n. sp., Wilson et al., 1985 (list of species from Horizon Guyot, central Pacific Ocean).

HOLOTYPE—SIO 84-43, a female 62.6 mm SL, central North Pacific, 19°14.3'N, 169°07.3'W, 1500 m.

DIAGNOSIS—A species of *Halieutopsis* with rostrum completely anterior to mouth, the esca and illicial cavity completely visible from the ventral view, no tubercles on ventral surface of disk (except lateral-line scales on either side of anus), predorsal and jaw-to-anal fin distances relative to SL the shortest in genus (table 4), esca as in Figure 3B.

DESCRIPTION (BASED ON HOLOTYPE)—Counts given in Tables 1–3, body proportions in Table 4, body measurements in Table 5. Disk relatively small, the jaw-to-anus, jaw-to-anal fin, and predorsal distances all short relative to SL. Skull length and interorbital width relatively small, disk margin length and cranium width near the median proportion for genus. Jaw short, mouth narrow, eye small.

Disk subtriangular in outline. Cranium somewhat elevated from disk surface. Rostrum completely anterior to mouth, esca and illicial cavity completely visible from the ventral view. Tail stout, slightly narrowed at junction with disk, tapered caudally. Skeleton strong, larger tubercles of face, top of head, and sides of disk strongly attached to one another, forming thick, stiff armor.

Esca as in Figure 3B, the relatively wide, leaf-shaped dorsal lobe slightly bisected ventrally. From a radiograph taken to show vertebral column, illicial bone with long spine characteristic of *Halieutopsis*, but details of surface sculpturing indistinct because of small scale. Rostrum resembling a shelf, the illicial cavity shallow, its opening broad.

Gill rakers shaped as triangular plates with tiny teeth clustered distally, 5 gill rakers on anterior, 6 on posterior side of arch 2. Villiform teeth in narrow bands on each jaw.

Skin tough, somewhat translucent, pale, dusted with melanophores, lines of melanophores outlining tubercles along disk margins. Dark lining of branchial chambers, dark peritoneum, and pelvic musculature visible through translucent skin of ventral surface of disk. Tubercles completely absent from skin surrounding eyes and from ventral surface of disk (except lateral-line scales on either side of anus). Tubercles of disk edge and sides of

tail large relative to tubercles spread over dorsal surface of disk, all tubercles strong, harsh, with stout, sharp spines.

Paired fins moderate size, strong. Dorsal and anal fins short, anal fin lappet-like.

Body grayish tan, the tubercles lighter than background, giving effect of pale spots on slightly darker background; melanophores outline bases of large tubercles of disk edge and tail. Olfactory sacs and lips darkly pigmented. Dark dermal flaps associated with lateral-line scales on ventral surface of disk and sides of tail, giving effect of double row of small, black spots. Peritoneum, lining of oral cavity, and lining of branchial cavities black. Pectoral, pelvic, dorsal, and anal fin membranes dark.

DISTRIBUTION (FIG. 4)—*Halieutopsis bathyoreos* is known only from the type locality, Horizon Guyot in the central North Pacific Ocean, 19°14.3'N, 169°07.3'W, 1500 m. This is the first ogocephalid known from a seamount, and the second species of *Halieutopsis* known from outside of the Indo-western Pacific (the other, *H. tumifrons*, is from the eastern Pacific in the vicinity of the Galapagos Islands).

ETYMOLOGY—The specific epithet *bathyoreos* is a feminine noun in the genitive case, announcing that this is a species of a deep mountain.

MATERIAL—SIO 84-43 (1 specimen 62.6 mm SL), Awash Exped. Leg I, Sta. 179, 25 June 1983, Horizon Guyot, 19°14.3'N, 169°07.3'W, trawl 1500 m.

***Halieutopsis galatea* Bradbury, new species,**
Figures 2–3D and 7.

HOLOTYPE—ZMUC P922207, a male 55.1 mm SL, Indian Ocean off Kenya, 04°00'S, 41°27'E, 1551 m.

DIAGNOSIS—A species of *Halieutopsis* with tubercles present on ventral surface of the disk, vertebral count 17, tail lateral-line count 14–15, teeth restricted to median third of each jaw, esca as in Figure 3D.

DESCRIPTION (BASED ON HOLOTYPE)—Counts given in Tables 1–3, body proportions in Table 4, body measurements in Table 5. Body proportions near middle of range for genus in nearly all cases (table 4); interorbital distance relatively small.

Disk relatively flat, the cranium little elevated above surface of disk. Tail stout, tapering to caudal.

Esca as in Figure 3D, its skin relatively thick, ventral lobes less distinctly separated from one another relative to other species. From a radiograph taken to show vertebral column, illicial bone with the long spine characteristic of *Halieutopsis*, but details of surface sculpturing indistinct because of small scale. Rostrum shelllike, overhanging mouth so that much of rostrum, esca, and illicial cavity can be seen from ventral view.

Gill rakers shaped as stout pedicels with small teeth clustered distally, 6 gill rakers on anterior, 5 on posterior side of arch 2. Jaw teeth in a single short row in center third in each jaw.

Skin somewhat translucent, with tubercles present over entire body surface, including tiny tubercles in skin over eyeballs. Tubercles around edge of disk markedly flattened, with spines bifurcate, tubercles of the sides of the disk and tail larger, and with stouter, longer spines than tubercles elsewhere.

Paired fins relatively large and stout. Dorsal and anal fins small; anal fin lappet-like.

Body bright tan, darkly pigmented around edges of disk, edges of gill pores, on olfactory sacs, lips, and fin membranes. Dark cirri associated with lateral-line scales on ventral surface of disk and sides of tail, giving effect of double row of small, chocolate brown spots. Peritoneum dark brown, membranes of branchial cavities pale.

DISTRIBUTION (FIG. 4)—*Halieutopsis galatea* is known only from the type locality in the western Indian Ocean off Kenya, 04°00'S, 41°27'E, 1551 m.

ETYMOLOGY—The specific name *galatea* is a feminine noun in apposition and means sea nymph. It recalls the name of the vessel *Galathea*, which secured this specimen during the 1950–1952 expedition.

MATERIAL—ZMUC P922207 (1 specimen 55.1 mm SL), Galathea Exped. 1950–1952, Sta. 241, 15 March 1951, 04°00'S, 41°27'E, 1551 m.

Discussion

Besides *Halieutopsis*, two other genera of Ogcocephalidae, *Dibranchus* and *Coelophrys*, have their bathymetric distributions chiefly within upper slope depths. The distribution of *Coelophrys* is far more restricted than that of *Halieutopsis*, extending from off the west coast of Sumatra to Celebes and the Okinawa Trough. The distribution of *Dibranchus* is worldwide in tropical and subtropical

latitudes, including the Atlantic Ocean from which *Halieutopsis* is absent. Compared to *Halieutopsis*, *Dibranchus* is more speciose (at least eight species, some undescribed) in the eastern Pacific, where it is found on upper continental slopes from the coast of Baja California to the Peru trench, as well as in the Galapagos archipelago, while *Halieutopsis* has just a single species in the eastern Pacific, in the vicinity of the Galapagos Islands.

The distributions of both *Halieutopsis* and *Dibranchus* resemble the distributions of the Indo-Pacific shelf genera *Halieutaea* and *Malthopsis* with respect to the Pacific plate: they are absent from the Pacific plate except from the vicinity of the Hawaiian archipelago. *Halieutopsis* is represented by *H. bathyoreos*, described above, from Horizon Guyot about 1,300 km west of Hawaii in the mid-Pacific mountains. Springer (1982) called attention to the large number of organisms whose distributions in some way coincide with the margins of the Pacific plate. He called the distribution pattern, in which a group is present on both sides of the Pacific, but absent from the Pacific plate except for Hawaii, the "Hawaiian exception." He thought that, for deep-water groups, the pattern probably indicated dispersal from the vicinity of Japan northward along continental coasts and thence to Hawaii by way of the Emperor seamounts. Unfortunately, phylogenetic relationships within *Halieutopsis* are not yet understood. However, the new species *H. bathyoreos* from Horizon Guyot has its strongest phenetic resemblances to *H. vermicularis*, which occurs from off Japan, and to *H. tumifrons*, the single member of *Halieutopsis* known from the eastern Pacific and probably a relatively derived form.

Halieutopsis is particularly poorly known from the Indian Ocean. Only six specimens were available for study from the Indian Ocean, three of them larvae of *H. micropa* and three of them new species described herein. The material at hand merely establishes the presence of the genus in the southern Indian Ocean. Literature records also indicate that *Halieutopsis micropa* is present in the western Indian Ocean; at this time it appears to be the only widespread species in the genus, ranging from Africa to Halmahera, the Philippines, and the Okinawa trough.

The bathymetric range for the family (table 6) is extremely broad, from shallow subtidal depths to 4000 m. *Halieutopsis* is recorded from depths of 400–4000 m, with most specimens from depths of 1000–2500 m. The few specimens of *Coelophrys* that are known come from depths of 500–1000 m.

TABLE 6. Distributions of genera of Ogocephalidae with comparisons of their bathymetric ranges.

Genera	No. of species	Geographic range	Bathymetric range
OLD WORLD			
<i>Coelophrys</i>	4	Indo-western Pacific	Upper continental slope (pelagic?)
<i>Halieutopsis</i>	9	Indian Ocean to eastern Pacific	Upper continental slope to 4000 m
<i>Halicmetus</i>	2	Indo-western Pacific	Outer continental shelf
<i>Malthopsis</i>	6	Indian Ocean to Hawaii, western Atlantic	Outer continental shelf
<i>Halieutaea</i>	8	Indian Ocean to Hawaii	Continental shelf
NEW WORLD			
<i>Halieutichthys</i>	1	Western Atlantic Ocean	Continental shelf
<i>Zalieutes</i>	2	Western Atlantic, eastern Pacific	Continental shelf
<i>Ogocephalus</i>	12	Western Atlantic, eastern Pacific	Subtidal to outer continental shelf
WORLD WIDE			
<i>Dibranchus</i>	18	Indian, Pacific, and Atlantic oceans	Outer continental shelf to upper continental slope

Dibranchus has been recorded from depths of 200–2500 m, but only one species, *Dibranchus atlanticus*, occurs at outer continental depths; most specimens of *Dibranchus* come from 500–1500 m. For the present, it appears that *Halieutopsis* has its center of depth distribution somewhat deeper than either *Coelophrys* or *Dibranchus*.

Pelagic larvae of Ogocephalidae are poorly known. A pelagic larva of the monotypic Atlantic genus, *Halieutichthys*, was the first ever described for the family. The peculiar globose specimen was assigned to a separate genus and species, *Halietella lappa*, by Goode and Bean (1885), no doubt because its nearly spherical body, covered uniformly with tubercles, is so unlike the flattened body of the benthic adult with its naked belly. Larvae of *Halieutichthys* grow large, reaching 25–30 mm SL before metamorphosing.

The report in this paper of larval specimens of *Halieutopsis micropa*, *H. stellifera*, and *H. vermicularis* is the first for the genus. These halieutopsid larvae are also globose and large (more than 20 mm SL), and it turns out that pelagic larvae are not uncommon among genera of Ogocephalidae. Other larval ogocephalids I have examined in the course of work on the family may be assigned to *Dibranchus* (two species), *Malthopsis* (one species), and *Halicmetus* (one species), so at least some species in each of five of the nine genera of Ogocephalidae have pelagic larvae. (Despite a thorough search, I have not found pelagic larvae of the common western Atlantic genus *Ogocephalus*. Fahay [in Pietsch, 1984] erred in calling his larval material *Ogocephalus*. The high pectoral fin ray

count of the fish shown by Pietsch [1984, p. 321, fig. 164C] indicates that *Halieutichthys* is represented, not *Ogocephalus* as captioned. Furthermore, sketches C and D of Pietsch's Figure 164 have been switched inadvertently: C, labeled *Chaunax*, is actually *Halieutichthys*, while D, labeled *Ogocephalus*, is actually *Chaunax*.)

The function of the illicium and esca among ogocephalids is still something of a mystery. Combs (1973) believed that *Ogocephalus cubifrons*, a shallow-water species off Florida, uses a secretion from the glandular esca to attract gastropods out of the substrate, after which it tracks them visually and ingests them. The evidence is indirect. Stomach content studies of *O. cubifrons* show that the species takes large numbers of burrowing predaceous gastropods; these are known to have chemosensors and might be expected to respond to a chemical lure. The fish is capable of protruding the illicium and flicking it from side to side, and it can move the esca relative to the illicium, tipping it forward. Presumably, this is when the secretion is released, for *O. cubifrons* has a large pore on the back side of the dorsal lobe of the esca, opening directly to the outside. The interior of the esca is composed of follicles of secretory cells and ducts which lead into a collecting chamber; this collecting chamber empties via the pore mentioned above (Combs, 1973). Combs speculated that the secretion may be ejected by the pressure exerted by connective tissue surrounding the follicles pulled taut by muscles demonstrated to be present.

I have prepared histological sections of the esca

of *H. micropa* which show that follicles formed of a secretory epithelium are present, as are ducts and a pore opening to the outside. The morphology of the esca in *Halieutopsis* is fundamentally like that of *Ogcocephalus*. However, the nature of the diet in species of *Halieutopsis* is not yet established. Radiographs of specimens taken to show the vertebral column sometimes show gastropod shells present in the gut. Examination of stomach contents of a few specimens of *Halieutopsis* reveals the remains of polychaetes and foraminiferans as well as the gastropods (most gut tracts examined were empty). While these examinations suggest that halieutopsids in general depend for food on the benthic infauna and epifauna, there is no indication of whether chemical luring is involved in food-getting. Only the esca morphology suggests its function may be similar to that hypothesized for *Ogcocephalus*. Among lophiiform fishes, direct evidence for chemical luring has been obtained only for *Antennarius striatus* (Pietsch & Grobeck-er, 1987).

Since luminous lures are characteristic of ceratioids, it is logical to consider luminescence as a possible function for the lure in deep-sea ogcocephalids. Crane (1968) had mixed results in testing the esca of *Dibranchius atlanticus*, a species of the outer continental shelf, for fluorescence (which indicates certain luciferins are present) and luminescence: The esca did not fluoresce, and it emitted light in only one of several tests.

Halieutopsis has never been tested for luminescence, and there is no report of anyone having witnessed a display of luminescence in *Halieutopsis*. Considering the rarity of these fish, however, and the little chance there has been for observing them, it is too early to dismiss the possibility of luminescence as a function of the esca.

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ginning a study of this family, requested Dr. Andriashev in my behalf that I be permitted to include the specimen in my study. Not only did Dr. Andriashev consent, but he later sent a helpful publication. I am most grateful. I thank others who gave me scholarly and technical assistance: M. Eric Anderson and David Catania, California Academy of Sciences; Karsten Hartel, Museum of Comparative Zoology; E. Bertelsen, Zoological Museum, University of Copenhagen; Osamu Okamura, Faculty of Science, Kochi University; Kenji Mochizuki, University Museum, University of Tokyo; Takeshi Yamakawa, Kochi Senior High School; R. R. Wilson, Jr., Scripps Institution of Oceanography. I especially thank T. W. Pietsch and an anonymous reviewer for their valuable time, effort, and constructiveness.

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