



Journal of Fish Biology (2010) **77**, 841–869

doi:10.1111/j.1095-8649.2010.02716.x, available online at wileyonlinelibrary.com

Review of the *Halieutichthys aculeatus* species complex (Lophiiformes: Ogcocephalidae), with descriptions of two new species

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(Received 3 March 2009, Accepted 19 May 2010)

The *Halieutichthys aculeatus* species complex is reviewed. Members of this clade are distinguished by the presence of tubercles on the tail and a reticulate dorsal pigmentation pattern. Three species are recognized, including two species new to science. A neotype is chosen for *H. aculeatus*. *Halieutichthys hispinosus* n. sp. is characterized by having relatively strong tubercles on the dorsal surface, a row of tubercles almost always present dorsal to the orbit, both sphenotic tubercles well developed and sharp, trifold principal tubercles on the disk margin with anterior spinelet enlarged, dense arrangement of tubercles on the tail and a comparatively large adult body size. *Halieutichthys intermedius* n. sp. can be distinguished from congeners by having both sphenotic tubercles strongly reduced, the tubercles almost always absent dorsal to the orbit, principal tubercles on the disk margin uniformly short and blunt tubercles, with all spinelets generally reduced.

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Key words: Gulf of Mexico; morphometrics; pancake batfish.

INTRODUCTION

The batfish family Ogcocephalidae is characterized by a depressed body disk, which appears circular or triangular in dorsal view (except in *Coelophrys* and some species of *Halieutopsis* where the body is box shaped). The genus *Halieutichthys*, commonly known as pancake batfishes, comprises a group of small lophiiform fishes occurring in the western Atlantic Ocean (40° N to c. 2° S), including the coasts of the southern U.S., West Indies, the Gulf of Mexico and Caribbean Sea. Species of *Halieutichthys* are bottom dwellers often found over a sandy substratum ranging from 10 to >800 m in depth. *Halieutichthys* can be distinguished from other ogcocephalid genera by the possession of a rounded body disk, a very small illicial cavity that is occluded by puffy membranous folds, a lack of tubercles on the body associated with lateral line neuromasts and the possession of 16–19 pectoral fin rays.

The taxonomic history of species of *Halieutichthys* has been somewhat complicated. *Lophius aculeatus* Mitchill, 1818 was described from the Bahamas Strait,

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but the name was preoccupied by *L. aculeatus* (Walbaum, 1792) (now recognized as synonym of *Lophius piscatorius* L.). Gill (1863) subsequently described a new genus and species, *Halieutichthys reticulatus*, and oddly attributed authorship to the Cuban ichthyologist Felipe Poey, stating only that the specimen was 'discovered by Prof. Poey last year (*i.e.* 1862) at the island of Cuba.' Gill (1863) was evidently unaware of the presence of *L. aculeatus* Mitchill and did not mention this species in the description of *H. reticulatus*. Subsequently, Jordan & Gilbert (1883) placed *L. aculeatus* Mitchill in *Halieutichthys* and synonymized *H. reticulatus* with *H. aculeatus* (Mitchill). *Lophius aculeatus* Mitchill, 1818 is herein treated as valid by 'reversal of precedence' as provided by Article 23.9.1 of the International Code of Zoological Nomenclature (ICZN, 1999).

Four additional species have also been described as or placed within *Halieutichthys*. *Halieutichthys caribbaeus* Garman, 1896 was described on the basis of two specimens collected from Jamaica and Barbados, and *Halieutichthys smithii* Evermann & Marsh, 1900 was described from a single individual collected from Puerto Rico. Examination of type specimens of both species reveals that they may be conspecific (H.-C. Ho, unpubl. data). *Halieutichthys fitzsimonsi* Gilchrist & Thompson, 1916 was described based on a single specimen collected from South Africa and was later placed within the Indo-west Pacific genus *Halieutaea* by Bradbury (1967). *Halieutella lappa* Good & Bean, 1885 described from a postlarval specimen was subsequently determined to belong to *Halieutichthys* (Bradbury, 1967, 2003a), but its specific status is uncertain. Bradbury (1967) indicated that there were two valid species of *Halieutichthys*, but did not specify which species were valid. Since that time, only *H. aculeatus* has been recognized as valid (Böhlke & Chaplin, 1968; Hoese & Moore, 1977; McEachran & Fechhelm, 1998), whereas *H. caribbaeus* and *H. smithii* have rarely been mentioned in the literature. In her annotated checklist, Bradbury (2003a) concluded that there was only a single valid species in *Halieutichthys*, stating that all species were synonymized with *H. aculeatus* based on a 'sponge-like structure' present on most specimens (M. G. Bradbury, pers. comm.).

While conducting studies on the systematics of Ogocephalidae, most museum holdings of this group were examined. As a result, two species complexes are herein recognized within *Halieutichthys*: the *H. aculeatus* species complex, characterized by a reticulate pattern on the dorsal body surface and many tubercles present on the tail [(Fig. 1(a)], and the *H. caribbaeus* species complex, which lacks a reticulate pattern on the dorsal body surface and possesses no, to at most a few, tubercles on the tail [Fig. 1(b)]. Three species in the *H. aculeatus* species complex are recognized herein, including two which are new to science: *H. aculeatus*, *H. bispinosus* n. sp. and *H. intermedius* n. sp.

MATERIALS AND METHODS

Standard length (L_S) is used throughout this study. The methods and definitions follow Bradbury (1980, 1988, 1999). Terminology used in describing the angling apparatus follows Bradbury (1967). For the principal component analysis (PCA) of shape, digital images were taken for the dorsal side of each specimen. Only specimens that were preserved unbenched and of adult size were used. Landmarks (putatively homologous points on anatomical structures) were chosen in order to best represent the external shape of the body (Fig. 2). *tpsDIG2*

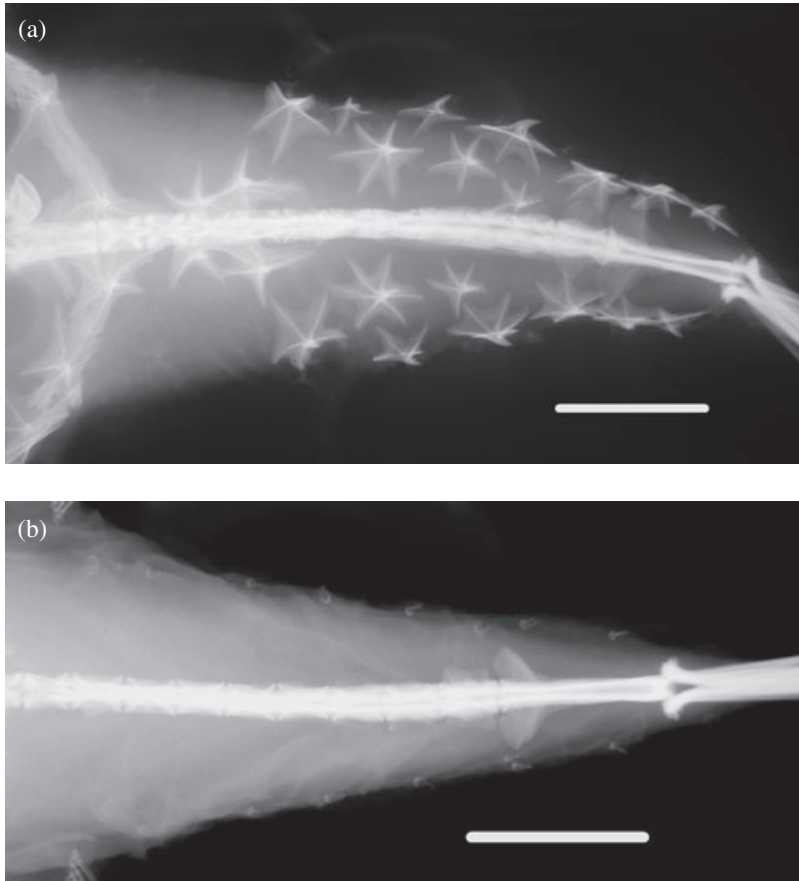


FIG. 1. Dorsal view of radiographs comparing tail regions of two *Halieutichthys* species groups, showing tubercles: (a) *H. aculeatus* species complex, *H. bispinosus* n. sp., FMNH 59921, 82.3 mm standard length (L_S) and (b) *H. caribbaeus* species complex, *H. caribbaeus*, FMNH 65243, 54.3 mm L_S . Scale bar = 10 mm.

(version 2.10; Rohlf, 2006) was used to digitize the landmarks on the images. Generalized least squares (GLS) procrustes superimposition was performed to remove size from these data. In the optimal superimposition, the distance minimized is the procrustes distance, calculated as the square root of the summed squared distances between homologous landmarks (Rohlf & Slice, 1990; Goodall, 1991). This superimposition, and the PCA, was performed using *PCAGEN* (Sheets, 2001).

All specimens examined in this study are deposited at the following institutions: American Museum of Natural History, New York, U.S.A (AMNH); California Academy of Sciences, San Francisco, California, U.S.A. (CAS); Field Museum of Natural History, Chicago, Illinois, U.S.A. (FMNH); Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana, U.S.A. (LSUMZ); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A. (MCZ); University of Florida, Florida State Museum, Gainesville, Florida, U.S.A. (UF); National Museum of Natural History, Washington D.C., U.S.A. (USNM). Specimens listed in the Appendix are used for various analyses and for generating the distribution maps. Information on specimens examined is given in the following order: museum register number, number of specimens, L_S range, collection ship, collection locality, collection depth and collection date.

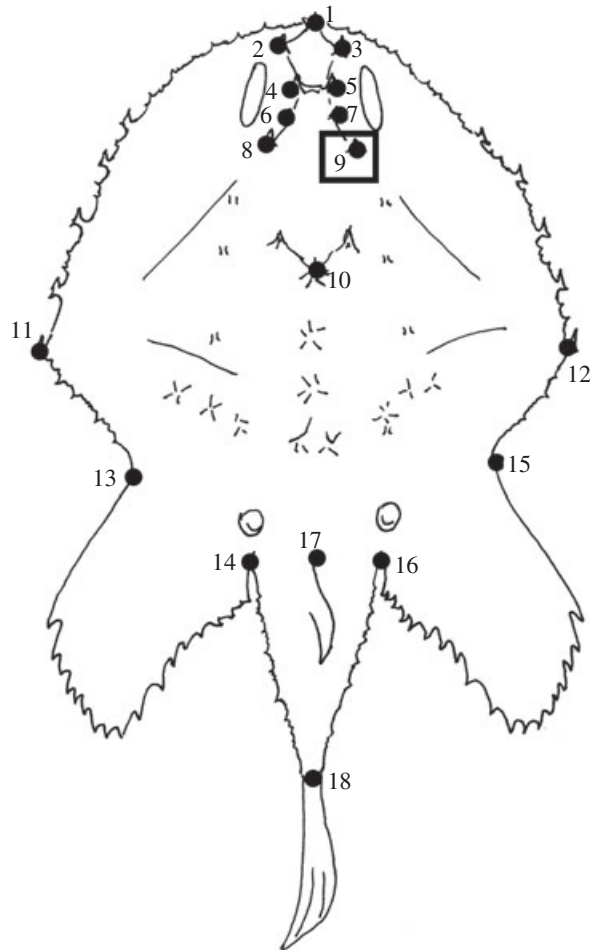


FIG. 2. Landmarks used for principal component analysis: 1, tip of rostrum; 2, first frontal spine, left; 3, first frontal spine, right; 4, second frontal spine, left; 5, second frontal spine, right; 6, third frontal spine, left; 7, third frontal spine, right; 8, fourth frontal spine, left; 9, fourth frontal spine, right; 10, first tubercle of median row; 11, subopercular tubercle, left; 12, subopercular tubercle, right; 13, anterior base of left pectoral fin; 14, posterior base of left pectoral fin; 15, anterior base of right pectoral fin; 16, posterior base of right pectoral fin; 17, origin of dorsal fin; 18, tip of hypural plate. Square at right eye corner indicates the region where scanning electron micrographs in Fig. 6 were taken.

RESULTS

HALIEUTICHTHYS POEY, 1863

Haliutichthys aculeatus species complex

Species of the *H. aculeatus* species complex are differentiated from those of the *H. caribbaeus* species complex in having a reticulate pattern on the dorsal surface of the body, many tubercles on the tail, and usually two black bands extending fully across the pectoral fin. In addition, the *H. aculeatus* species complex occurs

mainly along the Atlantic coast of the southern U.S. and in the Gulf of Mexico, whereas the *H. caribbaeus* species complex occurs mainly in the Caribbean Sea and the West Indies.

HALIEUTICHTHYS ACULEATUS (MITCHILL, 1818)

Synonymy

Lophius aculeatus Mitchill, 1818:325 [no types known, Bahama Straits, depth 73.2 m (40 fathoms)].

Halieutichthys aculeatus (Mitchill, 1818): Jordan & Gilbert, 1883:851. Jordan & Evermann, 1898:2739. Evermann & Marsh 1900:338. Böhlke & Chaplin, 1968:726. Hoese & Moore, 1977:144. McEachran & Fechhelm, 1998:836.

Halieutichthys reticulatus Poey in Gill, 1863:91 (no type known, off Cuba). Goode, 1879:109.

Material

Neotype: AMNH 76821, 64.6 mm, 32° 28' N; 78° 47' 9" W, c. 92.38 km at 107 degrees off Charleston Light, South Carolina, U.S.A., Atlantic Ocean, no depth information, 2 April 1977.

Other materials: As listed in Appendix.

Diagnosis

A member of the *H. aculeatus* complex distinguished by possession of two narrow black bands across pectoral fin; outer sphenotic tubercle well developed and inner sphenotic tubercle strongly reduced; tubercles relatively small but sharp; tubercles almost always absent dorsal to orbit; relatively fine reticulate pigmentation pattern on dorsal surface (*i.e.* densely arranged network of melanophores). A relatively small species with adult body size usually attaining <70 mm L_S .

Description

[Figs 3(a), 4(a), 5(a) and 6(a)]

Morphometric and selected meristic data provided in Tables I and II.

Rostrum acute, bearing a single, trifold tubercle. Rostral tubercle usually upturned, not well extended and overhanging illicial cavity and mouth. Esca usually visible in dorsal view. Interorbital space narrow and measuring less than half of orbital diameter. No tubercles dorsal to orbit, except for <1% of all examined specimens with few small tubercles dorsal to orbit. Principal tubercles on disk margin usually trifold. Spinelets of tubercles usually short [Fig. 4(a)], anterior spinelet about equal in size with two posterior ones. Tubercles on dorsal body surface relatively small and weak, but sharp. Outer sphenotic tubercle well developed, inner sphenotic tubercle strongly reduced [Fig. 6(a)]. Tubercles on tail relatively sparse in arrangement. Pectoral fin with 16–19 rays, usually 18 (Table II).

Colouration

Base body colouration greenish to light brown, with pale, yet fine and detailed, reticulate colour pattern on dorsal surface [Fig. 3(a)], and two or three narrow black

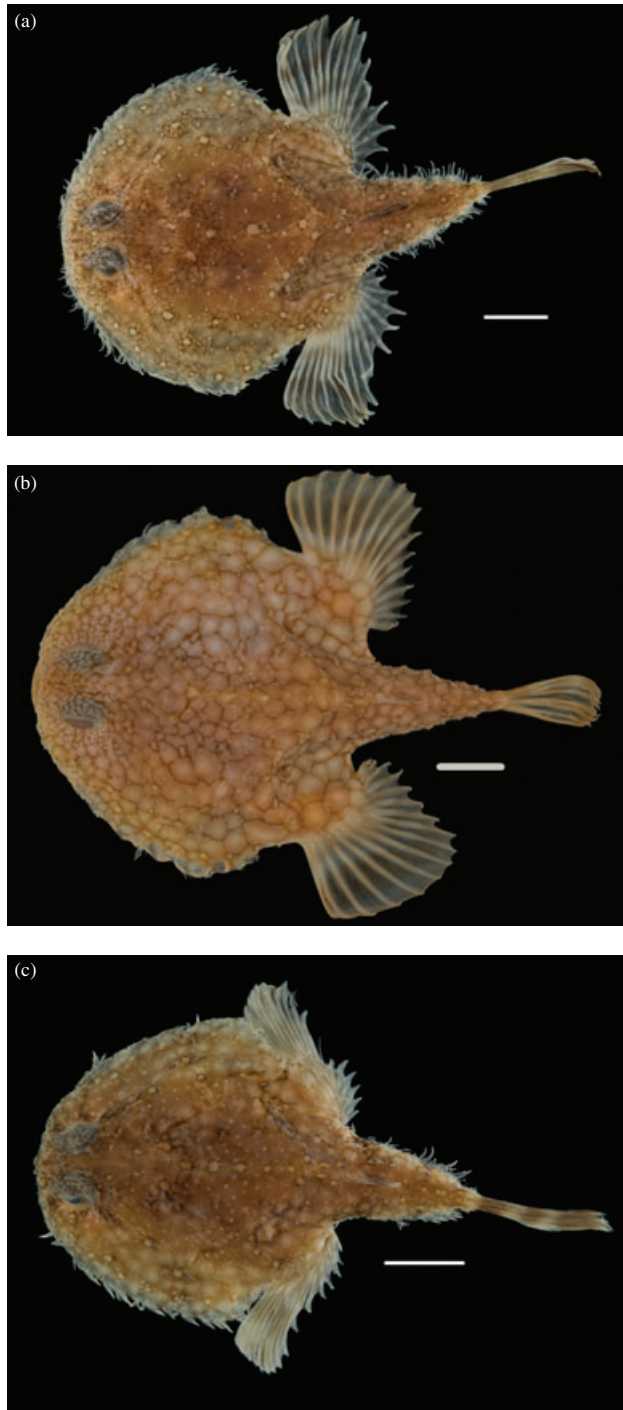


FIG. 3. (a) *Halieutichthys aculeatus*, USNM 358206, 64.4 mm standard length (L_S), (b) *H. bispinosus*, n. sp., paratype, MCZ 91278, 87.7 mm L_S , provided by MCZ, and (c) *H. intermedius* n. sp., paratype, USNM 388188, 43.0 mm L_S . Scale bar = 10 mm.

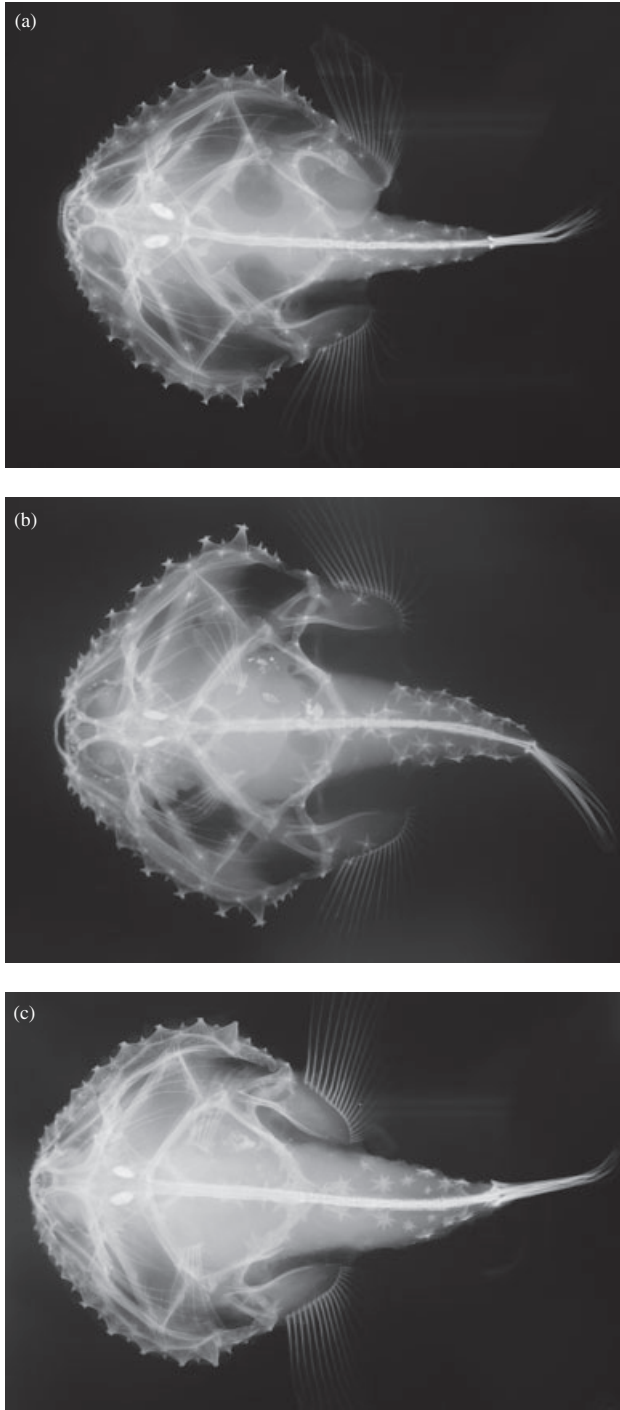


FIG. 4. Dorsal view radiographs of three species in the *Halieutichthys aculeatus* complex: (a) *H. aculeatus*, FMNH 59922, 51.9 mm standard length (L_S), (b) *H. bispinosus* n. sp., FMNH 59921, 82.3 mm L_S and (c) *H. intermedius* n. sp., FMNH 96353, 60.7 mm L_S . Not to scale.

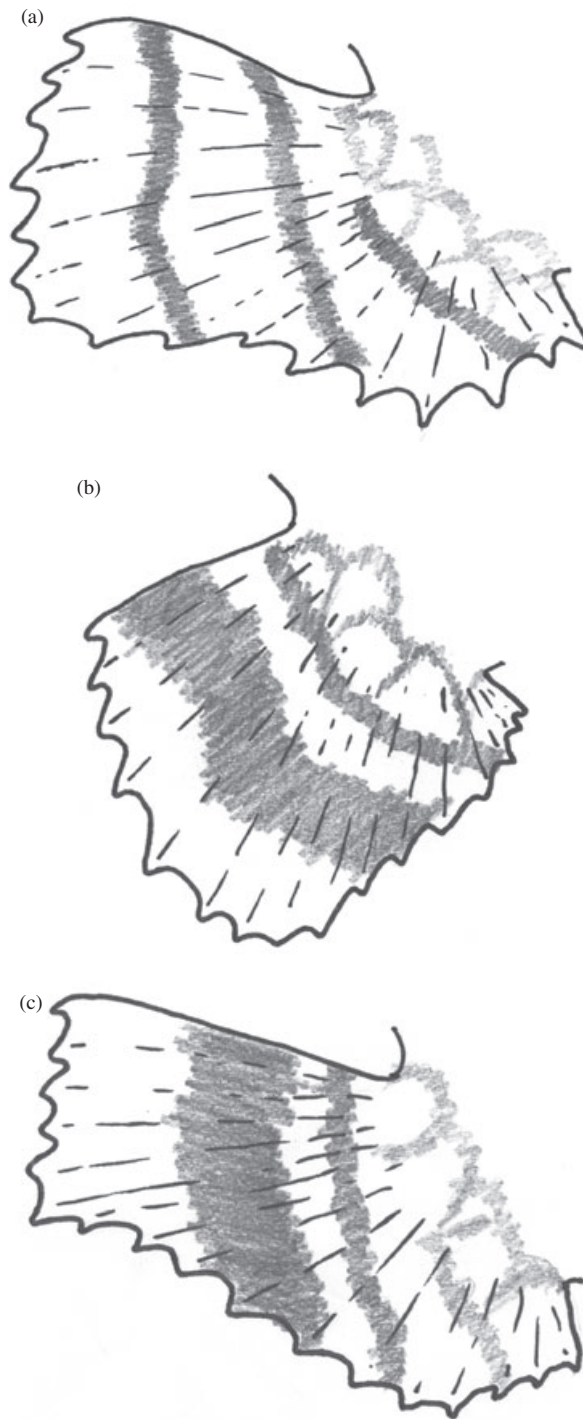


FIG. 5. Pectoral fin pigmentation pattern of three species in *Halieutichthys aculeatus* complex: (a) *H. aculeatus*, (b) *H. bispinosus* n. sp. and (c) *H. intermedius* n. sp. Not to scale.

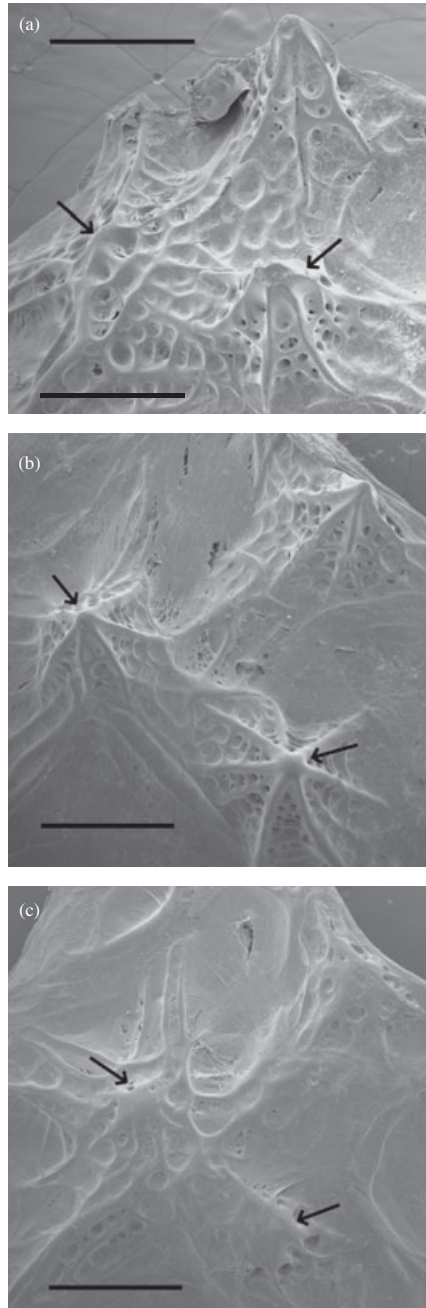


FIG. 6. Scanning electron micrographs of frontal and sphenotic region (right side) of three species in *Halieutichthys aculeatus* complex: (a) *H. aculeatus*, USNM 169201, 53.6 mm standard length (L_S), with strongly reduced inner sphenotic tubercle, (b) *H. bispinosus* n. sp., USNM 153233, 55.8 mm L_S , with inner and outer sphenotic tubercles well developed and (c) *H. intermedius* n. sp., paratype, USNM 388188, 46.6 mm L_S , with strongly reduced inner and outer sphenotic tubercles. See Fig. 2 for position of sphenotic region. \longrightarrow , the position of inner (left) and outer (right) sphenotic tubercles. Scale bar = 1 mm.

TABLE I. Morphometric data for members of *Halieutichthys aculeatus* species complex

	<i>H. aculeatus</i> n. sp.			<i>H. bispinosus</i> n. sp.			<i>H. intermedius</i>		
	Neotype	n = 20	Holotype	n = 51	Holotype	n = 40	Holotype	n = 40	Range
L_S (mm)	64.6	25–69.2	77	36.1–86.1	65.7	31.2–69.6	65.7	31.2–69.6	
In % L_S		Mean \pm s.d.*		Mean \pm s.d.*		Mean \pm s.d.*		Mean \pm s.d.*	Range
Skull length	30.7	30.5 \pm 1.4	29.9	30.1 \pm 1.3	27.3–34.1	29.4 \pm 1.7	30.7	29.4 \pm 1.7	23.0–32.7
Head depth	28.6	29.1 \pm 1.7	29.6	28.8 \pm 1.4	25.6–31.6	28.3 \pm 1.7	28.6	28.3 \pm 1.7	23.3–32.3
Head width	21.8	22.8 \pm 1.3	23.0	21.8 \pm 1.3	18.7–24.4	22.2 \pm 1.1	22.8	22.2 \pm 1.1	19.6–24.2
Eye diameter	12.5	12.4 \pm 0.8	11.8	12.5 \pm 1.0	10.5–14.7	11.8 \pm 0.7	12.9	11.8 \pm 0.7	9.5–13.1
Interorbital width	4.8	5.0 \pm 0.9	4.8	4.8 \pm 0.4	3.9–5.5	4.8 \pm 0.5	4.9	4.8 \pm 0.5	3.4–5.8
Pre-dorsal length	71.2	69.4 \pm 1.8	69.7	70.5 \pm 1.1	68.2–73.8	69.2 \pm 1.6	67.7	69.2 \pm 1.6	63.6–71.5
Pre-anus length	65.9	62.3 \pm 2.2	59.5	62.4 \pm 2.0	57.9–67.7	61.4 \pm 1.6	62.3	61.4 \pm 1.6	57.5–64.0
Pre-anal length	79.9	74.7 \pm 2.0	74.9	75.4 \pm 2.0	70.6–79.8	74.5 \pm 1.6	75.5	74.5 \pm 1.6	70.1–77.1
Disk margin	48.3	50.0 \pm 2.4	49.9	51.3 \pm 2.1	46.1–55.1	50.0 \pm 1.8	49.5	50.0 \pm 1.8	46.5–54.6
Mouth width	13.8	14.9 \pm 1.2	11.9	13.8 \pm 1.0	11.6–16.0	14.3 \pm 1.1	14.6	14.3 \pm 1.1	11.2–17.4
Tail length	23.2	25.6 \pm 2.0	28.4	25.1 \pm 1.5	22.3–29.1	26.1 \pm 1.5	30.1	26.1 \pm 1.5	23.2–30.1
Dorsal fin length	12.7	14.3 \pm 1.4	14.0	15.6 \pm 1.5	12.2–19.2	16.1 \pm 1.2	15.1	16.1 \pm 1.2	12.6–18.0
Anal fin length	18.3	19.1 \pm 1.8	17.9	19.5 \pm 1.4	16.3–22.4	19.1 \pm 1.8	19.3	19.1 \pm 1.8	15.1–24.4
Pectoral fin length	32.4	32.6 \pm 2.2	27.0	30.3 \pm 2.3	26.3–35.0	30.5 \pm 1.9	27.7	30.5 \pm 1.9	26.3–33.8
Caudal fin length	36.1	36.4 \pm 2.5	28.7	33.4 \pm 2.0	28.8–38.3	33.3 \pm 1.8	29.7	33.3 \pm 1.8	29.7–38.1

L_S , standard length; *, specimens excluding the holotype or neotype.

TABLE II. Selected meristic data for members of *Halieutichthys aculeatus* species complex. Pectoral fin rays counted from both sides of specimen examined

	n	Dorsal-fin rays					Pectoral-fin rays				
		3	4	5	6	Modal	16	17	18	19	Modal
<i>H. aculeatus</i>	92		14	76	2	5	7	50	117	10	18
<i>H. bispinosus</i> n. sp.	237	2	25	203	7	5	58	319	97		17
<i>H. intermedius</i> n. sp.	178		18	154	6	5	62	230	58	6	17

bands across pectoral fin [Fig. 5(a)]. Distalmost two bands extend fully across fin. Juvenile colouration similar to that of adult.

Distribution

Widespread along Atlantic coast of southern U.S.A. (18.0°–36.5° N) and throughout Gulf of Mexico [Fig. 7(a)]. Specimens collected from shoreline to depth of 422 m; however, most specimens collected from 50 to 150 m (Table III).

Remarks

The species name, *L. aculeatus* Mitchill, 1818, is preoccupied by *L. aculeatus* Walbaum, 1792. This senior homonym (*L. aculeatus* Walbaum, 1792) has not been used since its erection in 1792 and the junior homonym (*L. aculeatus* Mitchill, 1818) has been used as a valid name in at least 25 works, published by at least 10 authors in the preceding 50 years, and encompassing a span of not <10 years (Bradbury, 1967, 1977, 2002, 2003a, b; Böhlke & Chaplin, 1968, 1993; Williams & Gaines, 1974; Hoese & Moore, 1977; Robins *et al.*, 1980, 1991; Uyeno & Aizawa, 1983; Robins & Ray, 1986; Boschung, 1992; Hubbs *et al.*, 1994; Humann, 1994; Tunnell & Alvarado, 1996; Eschmeyer, 1998; McEachran & Fechhelm, 1998; De Moura *et al.*, 1999; Ramjohn, 1999; Wu *et al.*, 1999; Claro & Parenti, 2001; Moore *et al.*, 2003; Schwartz *et al.*, 2003; Nelson *et al.*, 2004; Brooks *et al.*, 2005; Richards & Bradbury, 2006; Pietsch & Orr, 2007). These conditions allow for 'reversal of precedence' as provided by Article 23.9.1 of the Code (ICZN, 1999). Walbaum (1792) described his species as 'Frogfish of Montisbay Borlasa h. n. of Cornwell [England?]' where 'the dorsal spine [illicium] is $1\frac{3}{4}$ as long as pectoral fin and $\frac{3}{4}$ as long as total length', which is characteristic of antennarids or lophiids. The *Catalog of Fishes* (Eschmeyer & Fricke, 2010) currently lists the species as a junior synonym of *L. piscatorius*. *Lophius aculeatus* Mitchill, 1818 is herein regarded as valid, qualifying as a nomen protectum in accordance with the Code (Article 23.9.1).

Mitchill (1818) mentioned that a potential type specimen of *L. aculeatus* was in 'Fraser's collection', and Gill (1863) noted that the only specimen of *H. reticulatus* obtained by Poey was sent to the Smithsonian Institution (USNM). A search for the type specimens of both species has been unsuccessful. The condition meets Article 75.3.4 of the Code (ICZN, 1999), and a neotype of *H. aculeatus* is thus designated to verify the diagnostic characters herein.

Moreover, the original descriptions of both species contain only general (non-diagnostic) information without presenting apomorphic features necessary for

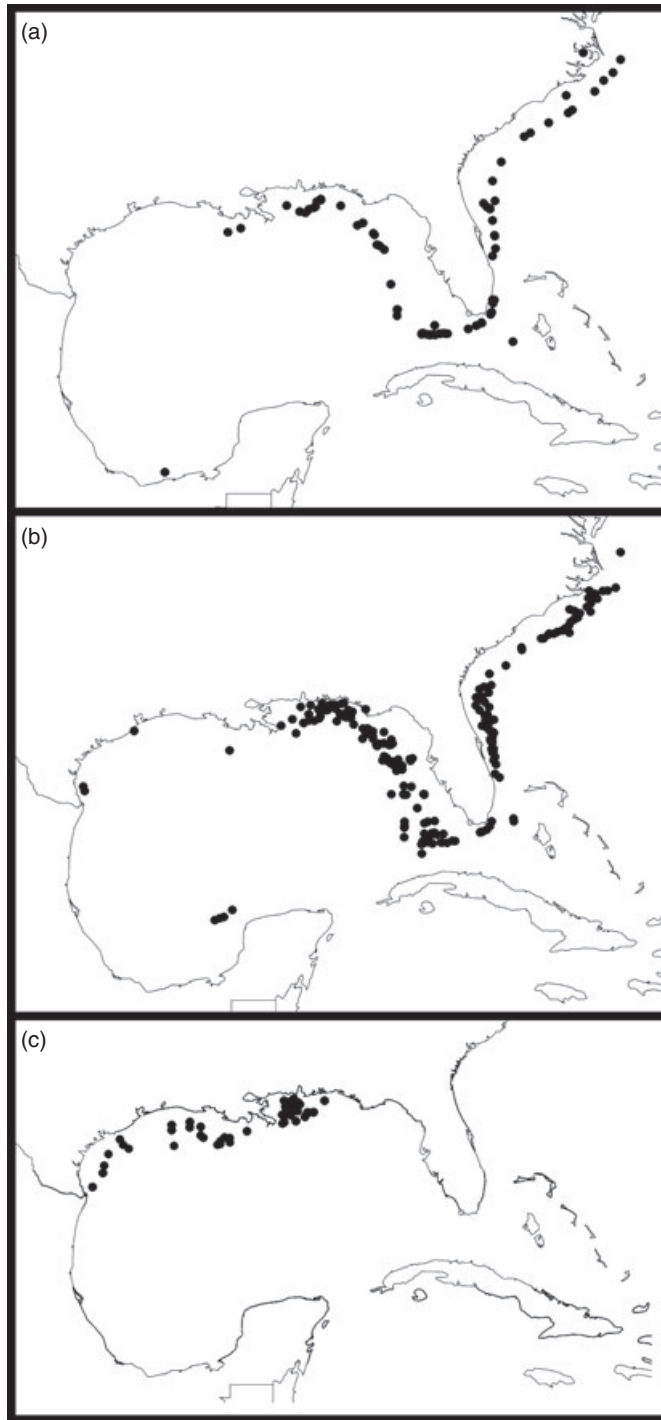


FIG. 7. Distribution maps of three species in *Halieutichthys aculeatus* complex: (a) *H. aculeatus*, (b) *H. bispinosus* n. sp. and (c) *H. intermedius* n. sp. (●, may represent more than one capture).

TABLE III. Distribution depth frequencies for members of *Halieutichthys aculeatus* species complex

	n	Depth of capture (m)				Mean
		0–50	51–100	101–150	>151	
<i>H. aculeatus</i>	94	3	42	36	13	110.54
<i>H. bispinosus</i> n. sp.	244	89	128	18	9	68.26
<i>H. intermedius</i> n. sp.	40	25	10	3	2	64.42

n, captures.

diagnosing species. Hence, *H. reticulatus* is considered a junior synonym of *H. aculeatus* following Jordan & Gilbert's (1883) decision.

HALIEUTICHTHYS BISPINOSUS N. SP.

Synonymy

Halieutichthys aculeatus (not of Mitchill, 1818): Böhlke & Chaplin, 1968:726.

Material

Holotype: AMNH 246517, out of AMNH 85715, 77.0 mm, 27° 24' 11" N; 84° 07' 11" W, off Florida, U.S.A., Gulf of Mexico, 3 February 1978, no depth information, coll. Shipp, Searcy and Williams.

Paratypes: AMNH 85715, 157, 47.3–80.1 mm, collected with the holotype; CAS 82262, 8, 69.1–91.1 mm, M.V. *Silver Bay*, 29° 17' N; 80° 19' W, off Florida, U.S.A., Atlantic Ocean, 43.2 m, 2 May 1961; CAS 74295, 4, 76.3–90.6 mm, M.V. *Silver Bay*, sta. 159, 29° 36' N; 86° 01' W, off Florida, Gulf of Mexico, 40 m, 23 August 1957; FMNH 66748, 1, 78.8 mm, M.V. *Silver Bay*, sta. 4003, 34° 29' N; 76° 03' W, off North Carolina, U.S.A., Atlantic Ocean, 42 m, 26 May 1962; FMNH 74292, 13, 68.2–87.8 mm, R.V. *Silver Bay*, sta. 5204, 29° 13' 30" N; 80° 24' W, off Florida, U.S.A., Atlantic Ocean, 46 m, 7 November 1963; MCZ 59555, 1, 72.2 mm, R.V. *Delaware Cr II*, sta. 70, 34° 1' N; 76° 20' W, off North Carolina, U.S.A., North Sargasso Sea, Atlantic Ocean, 60 m, 26 March 1981; LSUMZ 13163, 3, 61.3–70.0 mm, collected with the holotype; MCZ 91278, 1, 87.7 mm, R.V. *Eastward*, 32° 47' N; 78° 26' W, off South Carolina, U.S.A., Atlantic Ocean, 38 m, 24 March 1972; USNM 151876, 1, 99.3 mm, M.V. *Albatross III*, 32° 33' N; 78° 55' W, off Seabrook Island, South Carolina, U.S.A., Atlantic Ocean, 38 m, 26 May 1949; USNM 207793, 1, 88.9 mm, M.V. *Silver Bay*, sta. 1693, 33° 25' N; 77° 00' W, off South Carolina, U.S.A., Atlantic Ocean, 187–190 m, 29 February 1960.

Non-type: As listed in Appendix.

Diagnosis

A member of the *H. aculeatus* complex distinguished by possession of relatively strong and sharp tubercles on dorsal part of body; both inner and outer sphenotic tubercles well developed; a row of tubercles almost always present dorsal to orbit; trifold principal tubercles on disk margin with anterior spinelet enlarged; and dense

arrangement of tubercles on the tail. A relatively large species with adult body size usually exceeding 60 mm L_S .

Description

[Figs 3(b), 4(b), 5(b) and 6(b)]

Morphometric and meristic data provided in Tables I and II.

Rostrum acute, consisting of single, generally trifold, tubercle. Rostral tubercle extends slightly beyond illicial cavity and mouth. Esca not visible in dorsal view. Interorbital space narrow, measuring less than half of orbital diameter. A row of strong tubercles present dorsal to orbit, except for <1% of all examined specimens lack these tubercles. Five trifold principal tubercles on each side of disk margin. Spinelets of these tubercles more well developed than in congeners [Fig. 4(b)] and anterior spinelet markedly enlarged, about twice size of remaining spinelets. Tubercles on dorsal body surface relatively strong and sharp, bearing small spinelets on base. Both outer and inner sphenotic tubercles strong and well developed [Fig. 6(b)]. Tubercles on tail relatively dense in arrangement [Figs 1(a) and 4(b)]. Pectoral fin with 16–18 rays, usually 17 (Table II).

Colouration

Base body colouration in life greenish to dark brown, with pale reticulate pattern on dorsal surface [Fig. 3(b)]. An outer broad black band and an inner narrow black band extend fully across pectoral fin [Fig. 5(b)]. A bright white band present between two black bands, and margin of pectoral fin usually bright yellow in live or freshly caught specimens. Colouration in juveniles (<30 mm L_S) varies slightly from that of adults: large black pectoral patch usually present, but not extending completely across pectoral fin.

Distribution

Widespread along Atlantic coast of the southern U.S.A. and throughout Gulf of Mexico [Fig. 7(b)]. Specimens collected at depths extending from shoreline to 400 m, with most individuals taken from <100 m (Table III).

Etymology

The specific epithet, *bispinosus*, refers to the well-developed inner and outer sphenotic tubercles, which is unique to species within complex.

HALIEUTICHTHYS INTERMEDIUS N. SP.

Material

Holotype: AMNH 246516, out of AMNH 86419, 65.7 mm, 29° 31' N; 87° 37' 45" W, Florida, U.S.A., Gulf of Mexico, c. 57 m, 15 March 1978.

Paratypes: AMNH 80126, 3, 36.4–55.3 mm, 29° 47' 10" N; 88° 16' W, off Alabama, U.S.A., Gulf of Mexico, 7 October 1972; AMNH 80138, 5, 45.7–52.7 mm, 29° 52' 30" N; 88° 20' W, off Alabama, U.S.A., Gulf of Mexico, 7 October 1972; CAS 64081, 4, 53.3–58.7 mm, M.V. *Pelican*, 28° 09' N; 91° 32' W, off south-west of New Orleans, Louisiana, U.S.A., Gulf of Mexico, 7 December 1938; LSUMZ

13164, 3, 52.7–40.5 mm, 29° 47' 10" N; 88° 16' W, off Alabama, U.S.A., Gulf of Mexico, 7 October 1972; UF 70435, 4, 50.5–59.6 mm, R.V. *Tursiops*, 29° 25' N; 88° 23' W, off Alabama, U.S.A., south-west of Mobile Bay, Gulf of Mexico, 55 m, 19 October 1971; USNM 207809, 5, 55–59.4 mm, R. V. *Oregon II*, sta. 10301, 29° 19' N; 81° 55' W, off Louisiana, U.S.A., Gulf of Mexico, 62 m, 1 September 1969; USNM 388188, out of USNM 358208, 13, 34.8–61.8 mm, R.V. *Suncoaster*, 29° 23' 24" N; 87° 58' 43" W, off Alabama, U.S.A., Gulf of Mexico, 82 m, 9 August 1997.

Non-type: As listed in Appendix.

Diagnosis

A member of the *H. aculeatus* complex distinguished by the presence of uniformly blunt tubercles; tubercles almost always absent dorsal to orbit; both inner and outer sphenotic tubercles strongly reduced; and principal tubercles of disk margin blunt with spinelets generally reduced in degree of development. A relatively small species with adult body size attaining <70 mm L_S .

Description

[Figs 3(c), 4(c), 5(c) and 6(c)]

Morphometric and meristic data provided in Tables I and II.

Rostrum acute, bearing a single, trifid tubercle. The rostral tubercle not extending beyond illicial cavity and mouth. Esca visible in dorsal view. Interorbital space narrow, measuring less than half of orbital diameter. No tubercles dorsal to orbit, except for <1% of all examined specimens possess few small tubercles. Principal tubercles on disk margin trifid or blunt, spinelets on these tubercles present in smaller individuals and strongly reduced in degree of development in larger specimens [Fig. 4(c)]. Tubercles on dorsal body surface relatively weak and blunt. Both outer and inner sphenotic tubercles extremely reduced [Fig. 6(c)]. Tubercles on caudal peduncle usually blunt and fewer in number compared to other members of complex [Fig. 4(c)]. Pectoral fin with 16–19 rays, usually 17 (Table II).

Colouration

In preservation, base body colouration uniformly dark brown or greyish brown with pale reticulate pattern on dorsal surface. Ventral surface lighter than dorsal. An outer broad black band and an inner narrow black band complete and extending fully across pectoral fin [Fig. 5(c)]. No colour information for freshly caught specimens. Pigmentation pattern faint in most specimens examined. Colouration in juveniles (<30 mm L_S) varies slightly from that of adults: large black patch usually present on pectoral fin, but not extending completely across the fin.

Distribution

Currently known only from northern Gulf of Mexico [Fig. 7(c)]. Specimens collected from shoreline to depth of 366 m, although most individuals taken from <50 m (Table III).

Etymology

The specific epithet, *intermedius*, refers to 'intermediate' character states observed in this taxon when compared to *H. aculeatus* and *H. bispinosus* in the complex.

Remarks

The majority of specimens examined have blunt tubercles on the body surface, including the disk margin, dorsal body surface and tail. The tubercles on the disk margin are usually embedded under the skin. Approximately 5% of specimens examined have sharp tubercles on the tail; however, the caudal tubercles are never as well developed as those of *H. bispinosus* and *H. aculeatus*.

Six specimens were tentatively identified as *H. intermedius* n. sp. (listed in Appendix). These specimens collected from off the Atlantic coast of Florida and Georgia are in poor condition (*i.e.* pigmentation pattern faded in preservation and squamation damaged). Although all other specimens of this species that were positively identified were collected from the northern Gulf of Mexico, if confirmed by additional material, these six specimens tentatively identified as *H. intermedius* would expand the range of this species eastward and northward up the Atlantic coast of the U.S.A.

COMPARISON OF ADULT BODY SIZE FOR SPECIES

Analysis of L_S (excluding postlarval individuals) reveals that *Halieutichthys bispinosus* attains a larger adult body size than congeners in the *H. aculeatus* species complex. The average L_S of *H. bispinosus* is 65.6 mm, followed by *H. intermedius*, 48.1 mm and *H. aculeatus*, 47.6 mm. The largest known specimen of *H. bispinosus* measured 99.3 mm L_S , *H. intermedius* 71.4 mm L_S and *H. aculeatus* 69.2 mm L_S . Most adult specimens of *H. bispinosus* measured between 50 and 90 mm L_S (80% of specimens examined), whereas adults of the remaining two species in this complex, almost without exception, measured <70 mm L_S (100% of *H. aculeatus* and 98% of *H. intermedius* specimens examined).

PRINCIPAL COMPONENT ANALYSIS

The three species comprising the *H. aculeatus* species complex overlap on all axes of the PCA. No single species clusters together on any axes of variation. Principal component (PC) 1 explains 40% of the variation in shape among specimens, PC2 explains 18% and PC3 explains 12% of shape variation. The variation along PC1 is largely due to variation in body width.

KEY TO THE *H. ACULEATUS* SPECIES COMPLEX

- 1A. Tubercles on body well developed [Fig. 4(b)]; row of tubercles almost always present dorsal to orbit; both inner and outer sphenotic tubercles well developed [Fig. 6(b)] – *H. bispinosus* n. sp.
- 1B. Tubercles on body weakly developed; tubercles almost always absent dorsal to orbit; inner sphenotic tubercle strongly reduced and outer sphenotic tubercle either reduced or well developed – go to 2.
- 2A. Outer sphenotic tubercle well developed [Fig. 6(a)]; spinelets on principal tubercles of disk margin short [Fig. 4(a)]; two narrow black bands extending fully across pectoral fin [Fig. 5(a)] – *H. aculeatus*.

- 2B. Outer sphenotic tubercle strongly reduced [Fig. 6(c)]; principal tubercles of disk margin generally blunt and spinelet strongly reduced [Fig. 4(c)]; outer broad black band and an inner narrow black band extend across pectoral fin [Fig. 5(c)]
– *H. intermedius* n. sp.

DISCUSSION

SYSTEMATICS

Bradbury (2003a) concluded that *Halieutichthys* is a monotypic genus based on the presence of a 'sponge-like structure' in most specimens (M. G. Bradbury, pers. comm.). Based on the present examination, three pairs of small, rounded, sponge-like structures on the ventral body surface are frequently, but not always, present. These structures were observed in c. 60% of specimens examined (including those of the *H. caribbaeus* species complex). When the sponge-like structures are present, they are always paired and located at either side of the lower jaw, the base of the pelvic fin and near the origin of the anal fin. Sponge-like structures have never been observed in other lophiiforms and these features are unique (apomorphic) for *Halieutichthys*, although not present in all specimens. The anatomy and function of the sponge-like structures are unknown and their presence is neither sexually dimorphic nor associated with different ontogenetic stages. Although no distinct grouping of specimens was revealed based on traditional or geometric morphometrics, consistent variation was found in a number of morphological traits that are diagnostic for the species described here.

SEXUAL DIMORPHISM

Caruso (1975) reported that male lophiids usually have larger olfactory bulbs than females and that the lamellae are about twice the size in males compared to similarly sized conspecific females. Bradbury (1999) reported that there are more lamellae in males than in females of *Dibranchius atlanticus* Peters. Based on the present studies, males of *Halieutichthys* have both relatively larger olfactory bulbs (c. 1.5 times larger in diameter) and more lamellae than those of females, which corroborates previous observations for lophiids and ogocephalids (Caruso, 1975; Bradbury, 1999).

In the analysis of L_S of *H. bispinosus*, the average for males and females was similar (66.8 mm for males and 66.5 mm for females). A total of 349 specimens of *H. bispinosus* were dissected to determine the sex ratio for this species. A total of 182 males and 167 females were examined resulting in a sex ratio for this species of 1.09 males per female.

POSTLARVAL SPECIMENS

Richards & Bradbury (2006) studied the early development of Atlantic batfishes and provided detailed descriptions for different postlarval stages of *H. aculeatus*. In addition, many postlarval specimens of *Halieutichthys* were examined during the course of the current investigation. Postlarval individuals of *Halieutichthys* are characterized by a globular body; 16–19 pectoral fin rays; tubercles covering the entire body surface, except a region between the lower jaw and the pelvic-fin base;

the anterior portion of the snout extending forward and greatly overhanging the mouth; five pairs of trifid tubercles on each side of the disk margin.

The majority of the postlarval specimens were collected *via* midwater trawls, although some were also retrieved from the stomachs of marlins (*Makaira* spp) or tunas (*Thunnini*). Most of these specimens were collected over a wider and more northern range than the known distribution of adults.

GEOGRAPHIC AND BATHYMETRIC DISTRIBUTION

Table III shows the distribution depth frequencies for captures in the *H. aculeatus* species complex. *H. bispinosus* and *H. aculeatus* show a similar distributional pattern, with most specimens occurring in the north-eastern Gulf of Mexico and along the Atlantic coast of the U.S.A. *Halieutichthys aculeatus* has been collected offshore on the outer continental shelf and upper slope [Fig. 7(a)]. Most captures were made at a depth >50 m and nearly half of these were made deeper than 100 m. *Halieutichthys bispinosus* has been collected both inshore and offshore [Fig. 7(b)]. About one third of collections were made at <50 m in depth, whereas only about one tenth were from deeper than 100 m. These two species are rarely collected together although both are less abundant in the north-western Gulf of Mexico. In contrast, *H. intermedius* is somewhat restricted to the north-western Gulf of Mexico [Fig. 7(c)], and about four fifth of the captures were made in waters <100 m deep.

Markle *et al.* (1980) mentioned that some subtropical fish larvae have been dispersed northwards by the Gulf Stream to Canada, and their description of a single ogocephalid specimen from the Scotian Shelf is most likely that of a *Halieutichthys* species. Based on evidence from adult distributions, they also concluded that <10% of these larvae would survive. Moore *et al.* (2003) recorded a single adult *H. aculeatus* from New England (MCZ 94475, east of Block Canyon); however, this specimen has subsequently been re-identified as *D. atlanticus*. Notably, a small specimen of *H. aculeatus* (MCZ 63034, 21 mm) was collected by a night diver off the coast of Massachusetts (40° 2' N; 67° 48' W), indicating that this species can occasionally reach and survive at higher latitudes.

We are grateful to B. Brown, R. Arrindell (AMNH), T. Iwamoto, D. Catania, J. Fong, M. Hoang (CAS), K. Liem, K. Hartel (MCZ), L. Page, G. Burgess, R. Robins (UF), L. Parenti, J.-K. Song, D. Johnson, T. Munroe, J. Williams, S. Raredon, K. Murphy, D. Pitassy and D. Smith (USNM) for their help with various aspects of this study. Special thanks go to S. Raredon (USNM), A. Williston (MCZ) and R. Arrindell (AMNH) for preparing the colour and X-ray images. We thank the MCZ for permission to reprint the colour photograph of *Halieutichthys bispinosus* [Fig. 3(b)] and W. Eschmeyer (CAS) for discussions on nomenclature. This work was partially supported by grants from CAS (Lakeside Foundation), MCZ (Ernst Mayr Grants), USNM, AMNH (Lerner-Gray Fund for Marine Research) and FMNH (Visiting Scholarships) to HCH, and by grants from NSF (DEB-0444842) and AMNH to JSS.

References

- Böhlke, J. E. & Chaplin, C. C. G. (1968). *Fishes of the Bahamas and Adjacent Tropical Waters*. Wynnewood, PA: Livingstone Publishing Co.
- Böhlke, J. E. & Chaplin, C. C. G. (1993). *Fishes of the Bahamas and Adjacent Tropical Waters*, 2nd edn. Austin, TX: University of Texas Press.
- Boschung, H. T. (1992). Catalogue of freshwater and marine fishes of Alabama. *Alabama Museum of Natural History Bulletin* **14**, 1–266.

- Bradbury, M. G. (1967). The genera of batfishes. *Copeia* **1967**, 399–422.
- Bradbury, M. G. (1977). Family Ogcocephalidae. In *FAO Species Identification Sheets for Fishery Purposes. Western Central Atlantic (Fishing Area 31)* (Fischer, W., ed.), pp. 1–4. Rome: FAO.
- Bradbury, M. G. (1980). A revision of the fish genus *Ogcocephalus* with descriptions of new species from the western Atlantic Ocean (Ogcocephalidae; Lophiiformes). *Proceedings of the California Academy of Sciences* (Series 4) **42**, 229–285.
- Bradbury, M. G. (1988). Rare fishes of the deep-sea genus *Halieutopsis*: a review with descriptions of four new species (Lophiiformes: Ogcocephalidae). *Fieldiana Zoology (New Series)* **44**, 1–22.
- Bradbury, M. G. (1999). A review of the fish genus *Dibranchius* with descriptions of new species and a new genus, *Solocisquama*. *Proceedings of the California Academy of Sciences* **51**, 259–310.
- Bradbury, M. G. (2002). Ogcocephalidae. In *Species Identification Guide for Fisheries Purposes. The Living Marine Resources of the Western Central Atlantic*, Vol. 2 (Carpenter, K. E., ed.), pp. 1054–1056. Rome: FAO.
- Bradbury, M. G. (2003a). Family Ogcocephalidae Jordan 1895 – batfishes. *California Academy of Sciences Annotated Checklists of Fishes* **17**, 1–17.
- Bradbury, M. G. (2003b). Ogcocephalidae. In *Taxonomic Composition and Relative Frequency of the Benthic Fish Community Found on Natural Sand Banks and Shoals in the Northwestern Gulf of Mexico. USGS Outer Continental Shelf Studies Ecosystem Program Report* (Brooks, R. A., Keitzer, S. C. & Sulak, K. J., eds), pp. 1054–1056. Gainesville, FL: Florida Integrated Science Center, CARS.
- Brooks, A. R., Keitzer, C. S. & Sulak, K. J. (2005). *Taxonomic Composition and Relative Frequency of the Benthic Fish Community Found on Natural Sand Banks and Shoals in the Northwestern Gulf of Mexico. (A Synthesis of the Southeast Area Monitoring and Assessment Program's Groundfish Survey Database, 1982–2000). USGS Outer Continental Shelf Studies Ecosystem Program Report*. Gainesville, FL: Florida Integrated Science Center, CARS.
- Caruso, J. H. (1975). Sexual dimorphism of the olfactory organs of lophiids. *Copeia* **1975**, 380–381.
- Claro, R. & Parenti, L. R. (2001). The marine ichthyofauna of Cuba. In *Ecology of the Marine Fishes of Cuba* (Claro, R., Lindeman, K. C. & Parenti, L. R., eds), pp. 21–57. Washington, DC: Smithsonian Institution Press.
- De Moura, R. L., Gasparini, J. L. & Sazima, I. (1999). New records and range extensions of reef fishes in the western South Atlantic, with comments on reef fish distribution along the Brazilian coast. *Revista Brasileira de Zoologia* **16**, 513–530.
- Eschmeyer, W. N. (1998). *Catalog of Fishes. Center for Biodiversity Research and Information, Special Publication Number 1* (Vols 1–3). San Francisco, CA: California Academy of Sciences.
- Evermann, B. W. & Marsh, M. C. (1900). The fishes of Porto Rico. *Bulletin of the United States Fish Commission* **20**, 49–350.
- Gill, T. N. (1863). Descriptions of some new species of Pediculati, and on the classification of the group. *Proceedings of the Academy of Natural Sciences of Philadelphia* **15**, 88–92.
- Goodall, C. (1991). Procrustes methods in the statistical analysis of shape. *Journal of the Royal Statistical Society B* **53**, 285–339.
- Goode, G. B. (1879). A preliminary catalogue of the fishes of the St. John's River and the east coast of Florida, with descriptions of a new genus and three new species. *Proceedings of the United States National Museum* **2**, 108–121.
- Hoese, H. D. & Moore, R. H. (1977). *Fishes of the Gulf of Mexico. Texas, Louisiana, and Adjacent Waters*. College Station, TX: A & M University Press.
- Hubbs, C., McEachron, J. D. & Smith, C. R. (1994). *Freshwater and Marine Fishes of Texas and the Northwestern Gulf of Mexico*. Austin, TX: The Texas System of Natural Laboratories, Inc.
- Humann, P. (1994). *Reef Fish Identification: Florida, Caribbean, Bahamas* Jacksonville, FL: New World Publications.
- ICZN (1999). *International Code of Zoological Nomenclature*, 4th edn. London: The International Commission on Zoological Nomenclature.

- Jordan, D. S. & Evermann, B. W. (1898). The fishes of north and middle America. Part III. *Bulletin of the United States National Museum* **47**, 2184–3136.
- Jordan, D. S. & Gilbert, C. H. (1883). A synopsis of the fishes of North America. *Bulletin of the United States National Museum* **16**, 1–1018.
- Markle, D. F., Scott, W. B. & Kohler, A. C. (1980). New and rare records of Canadian fishes and the influence of hydrography on resident and nonresident Scotian Shelf ichthyofauna. *Canadian Journal of Fishery and Aquatic Sciences* **37**, 49–65.
- McEachran, J. D. & Fechhelm, J. D. (1998). *Fishes of the Gulf of Mexico*, Vol. 1. Austin, TX: University of Texas Press.
- Mitchill, S. L. (1818). Memoir on ichthyology. The fishes of New York, described and arranged. *American Monthly Magazine and Critical Revue 1817–1818* **2**, 241–248, 321–328.
- Moore, J. A., Hartel, K. E., Craddock, J. E. & Galbraith, H. K. (2003). An annotated list of deepwater fishes from off the New England region, with new area records. *Northeastern Naturalist* **10**, 159–248.
- Nelson, J. S., Crossman, E. J., Espinosa-Pérez, H., Findley, L. T., Gilbert, C. R., Lea, R. N. & Williams, J. D. (2004). Common and scientific names of fishes from the United States, Canada, and Mexico, 6th edn. *American Fisheries Society Special Publication* **29**.
- Pietsch, T. W. & Orr, J. W. (2007). Phylogenetic relationships of deep-sea anglerfishes of the suborder Ceratioidei (Teleostei: Lophiiformes) based on morphology. *Copeia* **2007**, 1–34.
- Ramjohn, D. D. (1999). Checklist of coastal and marine fishes of Trinidad and Tobago. *Fisheries Information Series* **8**, 1–151.
- Richards, W. J., Bradbury, M. G. (2006). Ogcocephalidae: batfishes. In *Early Stages of Atlantic Fishes: An Identification Guide for the Western Central North Atlantic*, Vol. 1 (Richards, W. J., ed.), pp. 793–798. Boca Raton, FL: CRC Press.
- Robins, C. R. & Ray G. C. (1986). *A Field Guide to Atlantic Coast Fishes of North America*. Boston, MA: Houghton Mifflin Company.
- Robins, C. R., Bailey, R. M., Bond, C. E., Brooker, J. R., Lachner, E. A., Lea, R. N. & Scott, W. B. (1980). A list of common and scientific names of fishes from the United States and Canada. *American Fisheries Society Special Publication* **12**, 1–174.
- Robins, C. R., Bailey, R. M., Bond, C. E., Brooker, J. R., Lachner, E. A., Lea, R. N. & Scott, W. B. (1991). Common and scientific names of fishes from the United States and Canada (5th edn). *American Fisheries Society Special Publication* **20**, 1–183.
- Rohlf, F. J. & Slice, D. E. (1990). Extensions of the Procrustes method for the optimal superimposition of landmarks. *Systematic Zoology* **39**, 40–59.
- Schwartz, F. J., Barans, C. A. & Boylan, J. M. (2003). Distributions and biological aspects of seven species of batfishes (Lophiiformes: Ogcocephalidae) in the western North Atlantic, North Carolina – Florida. *Journal of the North Carolina Academy of Science* **119**, 93–102.
- Tunnell, J. W. Jr. & Alvarado, S. A. (1996). *Current Status and Historical Trends of the Estuarine Living Resources Within the Corpus Christi Bay National Estuary Program Study Area. Volume 4. Checklist of Species Within Corpus Christi Bay National Estuary Program Study Area: References, Habitats, Distribution, and Abundance*. Austin, TX: Texas Natural Resource Conservation Commission.
- Uyeno, T. K. & Aizawa, M. (1983). *Halieutichthys aculeatus*. In *Fishes Trawled off Surinam and French Guiana* (Uyeno, T., Matsuura, K. & Fujii, E., eds), p. 251. Tokyo: Japan Marine Fishery Resource Research Center.
- Walbaum, J. J. (1792). *Petri Artedi sueci genera piscium. In quibus systema totum ichthyologiae proponitur cum classibus, ordinibus, generum characteribus, specierum differentiis, observationibus plurimis. Redactis speciebus 242 ad genera 52. Ichthyologiae pars III. Grypeswaldiae: Ant. Ferdin. Rose*.
- Williams, E. H. Jr. & Gaines, J. L. Jr. (1974). Acanthcephala of fishes from marine and brackish waters of the Mobile Bay region. *Journal of Marine Sciences of Alabama* **2**, 135–148.
- Wu, H.-L., Shao, K.-T. & Lai, C.-F. (1999). *Latin-Chinese Dictionary of Fishes Names*. Taiwan: The Sueichan Press.

Electronic References

- Eschmeyer, W. N. & Fricke, R. (Eds) (2010). *Catalog of Fishes*. Available at <http://research.calacademy.org/ichthyology/catalog/fishcatmain.asp/> (accessed 12 March, 2010).
- Rohlf, F. J. (2006). *tpsDig, version 2.10* Stony Brook, NY: Department of Ecology and Evolution, State University of New York at Stony Brook. Available at <http://life.bio.sunysb.edu/morph/>
- Sheets, H. D. (2001) *PCAgen*. Buffalo, NY: Canisius College. Available at <http://www2.canisius.edu/~sheets/morphsoft.html>

APPENDIX

Specimens not included in the type series, but examined in this study and used for various analyses and for generating the distribution maps

HALIEUTICHTHYS ACULEATUS

ATLANTIC COAST OFF SOUTH AMERICA

AMNH 18912, 3, 22.8 mm, Florida, 72.8 m; AMNH 52612, 3, 44.4–54.3 mm, 34° 09' 07" N; 77° 04' 06" W; AMNH 76371, 28.8 mm, 29° 02' N; 80° 05' W; AMNH 76395, 5, 41.6–61.4 mm, 30° 39' N; 80° 05' W; AMNH 76619, 4, 27.3–58.7 mm, 29° 31' 05" N; 80° 11' 09" W; AMNH 76821, 64.6 mm, 32° 28' N; 78° 47' 09" W; CAS 39546, 4, 23.1–36.7 mm, 25° 44' 24" N; 80° 4' 12" W; CAS 64051, 43.5 mm, 33° 33' 30" N; 76° 49' W; CAS 64052, 28° 23' 30" N; 79° 59' 30" W; 117–137 m; CAS 64057, 60.1 mm, 34° 46' N; 75° 32' W; 137 m; CAS 64072, 2, 34° 19' N; 75° 54' W; 183 m; CAS 64076, 45.8 mm, 28° 42' 30" N; 90° 23' 30" W; CAS 64088, 45.4 mm, 28° 33' N; 90° 55' W; CAS 74287, 8, 28–31.4 mm, 25° 16' N; 80° 7' W; 119 m; FMNH 64337, 45.9 mm, 34° 54' N; 75° 25' W; 137 m; FMNH 66180, 2, 50.2–57 mm, 29° 40' N; 80° 12' W; 155 m; UF 13232, 29° 50' N; 79° 59' W; 69.5–70.2 m; UF 32432, 24° 23' 36" N; 81° 55' 54" W; 99–105 m; UF 36452, 24° 23' 46" N; 82° 2' 7" W; 102.5 m; UF 36481, 33° 26' N; 76° 59' W; 135.4 m; UF 36499, 35° 54' N; 76° 22' W; 161 m; UF 37259, 24° 24' 49" N; 82° 5' 17" W; 33–84 m; UF 40790, 33° 2' N; 77° 47' W; 115–120 m; UF 79924, 24° 23' 38" N; 82° 12' 52" W; 75.9 m; UF 81804, 24° 23' 21" N; 82° 14' 49" W; 83.4–123 m; UF 86600, 29° 30' N; 80° 11' W; 137.3 m; UF 86603, 27° 53' N; 79° 58' W; 109.8 m; UF 86623, 32° 37' N; 78° 32' W; 117.1–126 m; UF 86625, 27° 34' 30" N; 80° 5' W; 64.1–67.5 m; UF 86636, 35° 5' N; 75° 9' W; 183 m; UF 86949, 29° 44' N; 80° 27' W; 42.1 m; UF 86650, 31° 26' N; 79° 44' W; 84.2–100.8 m; UF 107557, 6, 56–58 mm, 24° 20' 34" N; 82° 25' 50" W; 75 m; UF 108828, 24° 20' 36" N; 82° 36' 25.2" W; 97–102.6 m; UF 108843, 24° 20' 31.8" N; 82° 38' 6" W; 100.8–104.3 m; UF 108929, 24° 20' 55.2" N; 82° 39' 57" W; 95.2–97.2 m; UF 108944, 24° 20' 57.6" N; 82° 41' 5.4" W; 97–122.4 m; UF 109089, 24° 21' 28.8" N; 82° 44' 34.2" W; 91.5–91.8 m; UF 109204, 24° 21' 41" N; 82° 32' 29" W; 91.5–93.6 m; UF 109240, 24° 21' 50" N; 82° 30' 55" W; 78.7–86.4 m; UF 111035, 24° 21' 29.2" N; 82° 44' 28.3" W; 89.7 m; UF 111419, 12, 50.9–67 mm, 24° 24' 24" N; 82° 59' W; 91.5–91.8 m; UF 111470, 24° 22' 7.8" N; 82° 59' 1.8" W; 136.8–137.8 m; UF 113875, 28° 25' 12" N; 80° 0' 6" W; 64.1 m; UF 116963, 24°

23° 30' N; 82° 58' 43" W; 105–109 m; UF 137673, 24° 35' 15" N; 81° 4' 48" W; 64.1–225 m; UF 147334, 56.4 mm, Florida, 112 m; UF 149717, 29° 35' N; 80° 19' W; 47.6 m; UF 209966, 24° 50' 39" N; 80° 31' 57" W; 91.5 m; UF 210122, 24° 50' 24" N; 80° 32' 15" W; 91.5 m; UF 210209, 24° 49' 36" N; 80° 31' 18" W; 91.5 m; UF 212335, 25° 46' 30" N; 80° 0' 48" W; 183 m; UF 213470, Florida, Atlantic, 92–110 m; UF 217139, Florida, Atlantic; UF 217397, 24° 25' N; 82° 56' W; 64 m; UF 217427, 24° 23' N; 82° 57' W; 82–97 m; UF 218398, 25° 47' N; 80° 5' W; 101–115 m; UF 220519, 24° 24' N; 82° 57' W; 86 m; UF 220967, 25° 11' N; 80° 10' W; 110–113 m; UF 220988, 25° 13' N; 80° 10' W; 88–108 m; UF 231801, 24° 49' 6" N; 80° 32' 48" W; 88–93 m; UF 231905, 24° 23' N; 82° 56' W; 91 m; USNM 45644, 32° 55' N; 77° 54' W; 144 m; USNM 45651, 2, 33° 18' 30" N; 77° 07' W; 174 m; USNM 45657, 38° 55' N; 72° 50' 30" W; 422 m; USNM 74090, 51.8 mm, Key West, Florida, 110 m; USNM 134270, 34° 26' N; 76° 12' W.

GULF OF MEXICO

AMNH 82497, 38.6 mm, 29° 38' 20" N; 88° 30' 40" W; AMNH 83230, 14, 28.9–69.2 mm, 29° 54' 30" N; 87° 07' W; 60 m; AMNH 83212, 3, 63.8–83.4 mm, 29° 48' N; 87° 17' W; 72 m; AMNH 83282, 3, 30.8–49.4 mm, 29° 52' N; 87° 06' 30" W; 128 m; AMNH 84312, 2, 25–51.7 mm, 29° 33' N; 87° 24' W; AMNH 84596, 2, 21.5–22.9 mm, 28° 49' 59.1" N; 85° 37' 01.9" W; AMNH 84801, 23.6 mm, 26° 24' 56.8" N; 84° 15' W; 182 m; AMNH 85309, 5, 36.3–58.6 mm, 29° 35' N; 87° 20' 01" W; 72.8 m; AMNH 85358, 60.5 mm, 28° 26' 24" N; 84° 55' 12" W; 91 m; AMNH 83212ex, 3, 27.2–38.6 mm, 29° 48' N; 87° 17' W; 72.8 m; AMNH 82380, 5, 34.1–36.3 mm, 29° 33' N; 87° 23' 07" W; 92 m; AMNH 246519 (ex. AMNH 85552), 26° 25' 12" N; 83° 49' 48" W; CAS 74276, 9, 36.1–58.4 mm, 18° 43' N; 93° 30' W; 64 m; CAS 222690 (ex. SU 9545), 53.7 mm, Gulf of Mexico; FMNH 38704, 49.9 mm, Texas; FMNH 45287, 6, 56.2–60.5 mm, 27° 20' N; 96° 20' W; 183 m; FMNH 45288, 27° 30' N; 96° 28' W; 73 m; FMNH 45289, 2, 44.7–61.9 mm, 27° 29' N; 96° 16' W; 106 m; FMNH 45290, 4, 43.6–61.6 mm, 27° 25' N; 96° 13' W; 139 m; FMNH 46721, 52.8 mm, 22° 14' N; 91° 26' W; 91 m; FMNH 46723, 3, 60.8–68.9 mm, 29° 20' N; 87° 42' W; 185 m; FMNH 59916, 59 mm, 22° 27' N; 89° 59' W; 68 m; FMNH 59922, 42.1–51.9 mm, 24° 24' N; 82° 55' W; 58 m; FMNH 64141, 63.2–69.6 mm, 28° 47' N; 87° 50' W; 103 m; MCZ 28119, 44.5 mm, 22° 30' N; 89° 30' W; 64 m; MCZ 27783, 61.2 mm, 28° 44' N; 85° 16' W; 108 m; MCZ 63034, 22.1 mm, 40° 02' N; 67° 48' W; MCZ 166059 (ex. MCZ 46620), 4, 41.4–59.3 mm, 24° 36' N; 83° 11' W; 55 m; UF 11663, Keys, Florida, Gulf of Mexico, 146.4 m; UF 27409, 27° 50' N; 84° 31' W; UF 37836, 29° 29' 16" N; 87° 36' 21" W; 72 m; UF 70826, 28° 56' N; 85° 24' W; 93 m; UF 71395, 28° 56' N; 85° 23' W; 104 m; UF 71420, 28° 30' N; 84° 58' W; 92 m; UF 79211, 28° 30' N; 84° 58' W; 100 m; UF 81437, 28° 2' 12" N; 84° 49' W; 153.7 m; UF 116656, 27° 59' 19.8" N; 84° 42' 0.6" W; 165 m; UF 116966, 24° 44' 11" N; 82° 27' 14" W; 24.9 m; UF 123330, 25° 22' 46.2" N; 83° 59' 37.8" W; 133–135 m; UF 123417, 25° 22' 50.4" N; 83° 58' 39" W; 130–134 m; UF 123444, 25° 7' 38.4" N; 83° 59' 30" W; 128 m; UF 150850, 27° 50' N; 84° 31' W; UF 150908, 29° 38' N; 86° 18' W; UF 152146, 4, 53.2–56.7 mm, 27° 50' N; 84° 31' W; 91.5 m; USNM 45646, 28° 44' N; 85° 16' W; 110 m; USNM 45647, 28° 45' N; 85° 02' W; 55 m; USNM 45657; USNM 104931, 52.3 mm, Florida; USNM 112741, 4, 25.6–56.6 mm,

91 m; USNM 358206, 5, 40.1–66.7 mm, 29° 20' 50" N; 87° 44' 41" W; 107 m; USNM 358207, 66.5 mm, 29° 21' 05" N; 87° 43' 56" W; 107 m.

***HALIEUTICHTHYS BISPINOSUS* N. SP.**

ATLANTIC COAST

AMNH 19712, 2, 30.2–47.7 mm; keys, Florida; AMNH 75694, 50.6 mm, 35° 03' N; 75° 18' W; 71 m; AMNH 76498, 6, 67.6–75.5 mm, 32° 56' N; 78° 05.9' W; AMNH 76932, 10, 20.2–22.1 mm, 33° 05.8 N; 77° 48.2 W; 26 m; AMNH 82822, 5, 26° 25' N; 82° 58' W; AMNH 225620, 84 mm, 32° 05' N; 72° 30' W; CAS 32504, 2, 75.3–81.4 mm, 20–23 m; CAS 32707, 2, 43.8–75.2 mm, 33° 12' N; 77° 26' W; 49 m; CAS 48067, 28° 9' N; 80° 7' W; 40 m; CAS 64045, 86.6 mm, 29° 10' N; 80° 19' W; CAS 64046, 86.1 mm, 30° 28' N; 80° 43' 30" W; CAS 64048, 30° 28' N; 80° 48' 30" W; CAS 64049, 83.8–84.9 mm, 30° 54' 30" N; 80° 28' 30" W; CAS 64050, 62.6–62.7 mm, 34° 36' N; 76° 6' W; 32–34 m; CAS 64053, 34° 55' N; 75° 32' W; 51 m; CAS 64054, 28° 46' 30" N; 80° 8' W; CAS 64055, 30° 58' 30" N; 80° 10' 30" W; CAS 64056, 30° 29' 30" N; 80° 33' W; CAS 64060, 29° 16' 30" N; 80° 33' 30" W; 27 m; CAS 64061, 3, 66.2–84.3 mm, 28° 59' N; 80° 4' W; CAS 64062, 28° 43' N; 80° 13' W; 37–42 m; CAS 64064, 79.7 mm, 30° 17' N; 80° 27' 30" W; CAS 64065, 33° 59' 30" N; 76° 29' 30" W; CAS 64066, 29° 3' N; 80° 13' W; 51 m; CAS 64067, 52.5 mm, 30° 3' 30" N; 80° 16' W; 75 m; CAS 64068, 81.5 mm, 30° 23' 30" N; 80° 41' W; CAS 64069, 85.5 mm, 29° 32' N; 80° 25' W; 40 m; CAS 64070, 29° 03' N; 80° 12' 30" W; CAS 64071, 87.3 mm, 30° 8' N; 80° 49' W; 31 m; CAS 64073, 87.3 mm, 34° 3' N; 76° 3' W; 55 m; CAS 64448, Snapper Banks, Florida; CAS 74279, 88.4 mm, 29° 10' N; 80° 18' W; 37 m; CAS 74294, 25° 16' N; 82° 49' W; 44 m; MCZ 49564, 5, 31.3–59.8 mm, Dry Tortugas, Florida, 60 m; FMNH 64097, 3, 87.1–90.1 mm, 31° 50' N; 79° 45' W; 46 m; FMNH 64289, 81.9 mm, 30° 14' N; 80° 16' W; 73 m; FMNH 64339, 72 mm, 34° 26' N; 75° 55' W; 72.8 m, 72 m; FMNH 65294, 82.6 mm, 31° 46' N; 75° 51' W; 40 m; FMNH 66153, 69.7 mm, 33° 20' N; 77° 13' W; 73 m; FMNH 66155, 53.1 mm, 25° 01' N; 80° 19' 30" W; 84 m; FMNH 66175, 80.2 mm, 29° 17' N; 80° 19' W; 43 m; FMNH 66748, 78.8 mm, 34° 29' N; 76° 03' W; 42 m; FMNH 74291, 84.7 mm, 27° 27' N; 80° 14' 30" W; 15 m; FMNH 74290, 74.8 mm, 27° 59' N; 80° 02' 30" W; 60 m; MCZ 63263, 65.8 mm, 30° 52' N; 80° 45' W; 23 m; MCZ 90259, 8, 76–98.2 mm, 32° 55' N; 78° 25' W; 36 m; MCZ 99460, 5, 60.6–79.1 mm, 32° 2' N; 79° 34' W; 39 m; UF 13061, 28° 35' 30" N; 80° 8' W; 62.2–63 m; UF 19983, 23° 56' N; 83° 04' W; 58.6 m; UF 25940, 25° 24' N; 79° 15' W; UF 35422, 24° 27' 30" N; 81° 41' W; 69 m; UF 36449, 24° 23' 9" N; 82° 1' 10" W; 117.1 m; UF 36510, 33° 16' N; 77° 13' W; 98.8 m; UF 36999, 33° 37' N; 76° 53' W; 64.1 m; UF 79898, 24° 23' 30" N; 82° 13' 39" W; 67.5–82.5 m; UF 81709, 24° 23' 35" N; 82° 13' 66" W; 66.9–75.6 m; UF 86590, 29° 2' N; 80° 7' 30" W; 80.5–90 m; UF 86601, 33° 8' N; 77° 46' W; 49.4–54 m; UF 86604, 28° 40' 30" N; 80° 11' W; 47.6 m; UF 86605, 29° 2' N; 80° 7' 30" W; 80.5–90 m; UF 86611, 29° 44' N; 80° 27' W; 42.1 m; UF 86613, 27° 50' N; 80° 4' 30" W; 38.4 m; UF 86619, 29° 45' N; 80° 20' W; 64.1–66.6 m; UF 86620, 27° 59' N; 80° 2' W; 64.1 m; UF 86621, 29° 10' N; 80° 19' W; 45.8 m; UF 86622, 32° 56' N; 78° 6' W; 91.5 m; UF 86629, 33° 43' N;

76° 43' 30" W; 45.8 m; UF 86624, 34° 5' 30" N; 76° 45' W; 36.6 m; UF 86632, 32° 27' N; 78° 54' W; 43.9–57.6 m; UF 86641, 29° 27' N; 80° 20' W; 54.9 m; UF 86630, 27° 40' N; 79° 58' 30" W; 91.5 m; UF 86633, 28° 40' N; 80° 12' 30" W; 49.4 m; UF 86634, 34° 9' N; 76° 55' W; 31.1 m; UF 86635, 29° 27' N; 80° 20' W; 54.9 m; UF 86637, 31° 27' N; 80° 15' W; 32.9–34.2 m; UF 86639, 29° 3' N; 80° 13' W; 51.2 m; UF 86644, 25° 17' N; 80° 9' 30" W; 49.4 m; UF 86640, 31° 27' N; 80° 15' W; 32.9–34.2 m; UF 86647, 29° 19' N; 80° 18' W; 45.8 m; UF 86649, 30° 48' 30" N; 80° 40' W; 25.6–28.8 m; UF 86651, 29° 35' N; 80° 19' W; 47.6 m; UF 86654, 27° 59' N; 80° 1' W; 73.2 m; UF 86656, 30° 39' 30" N; 80° 17' W; 40.3–41.4 m; UF 86948, 31° 48' N; 79° 34' W; 65.9–68.4 m; UF 86638, 34° 37' 30" N; 75° 48' W; 54.9–55.8 m; UF 86653, 33° 43' N; 76° 45' W; 54.9 m; UF 98467, 24° 24' 5" N; 82° 16' 21" W; 71–122.6 m; UF 108385, 24° 25' 50" N; 83° 2' 21" W; UF 108396, 24° 19' 6" N; 83° 4' 33" W; 400 m; UF 111943, 24° 23' 42" N; 82° 56' 59" W; 94 m; UF 111034, 24° 25' 23.5" N; 82° 52' 53" W; 54.9 m; UF 111036, 24° 25' 15" N; 82° 52' 12" W; 49.4–54 m; UF 111154, 24° 25' 10" N; 82° 51' 12" W; 53.1 m; UF 137674, 2, 137.3 m, Florida, 135 m; UF 137680, 34° 56' N; 75° 20' W; 109.8 m; UF 200707, 36.6–90 m, Florida, Atlantic, 36–90 m; UF 203681, 24° 27' 48" N; 81° 47' 54" W; 51 m; UF 207047, 34° 24' N; 76° 2' W; 54.9 m; UF 210136, 24° 49' 21" N; 80° 38' 24" W; 36 m; UF 210201, 29° 32' N; 80° 18' W; 54.9 m; UF 210240, 24° 50' 54" N; 80° 32' 54" W; 73.2 m; UF 217407, 24° 21' N; 82° 37' W; 59 m; UF 217437, 24° 50' N; 80° 37' W; 37 m; UF 217472, 25° 5' N; 80° 14' W; 95 m; UF 217675, 25° 17' N; 79° 14' W; UF 220926, 24° 50' N; 80° 38' W; 40–49 m; UF 221830, 28° 19' 30" N; 80° 4' 30" W; 67.5–67.7 m; UF 221846, 28° 19' 30" N; 80° 4' 30" W; 67.5–67.7 m; UF 226972, 27° 7' N; 79° 50' W; 61 m; UF 231673, 24° 50' 48" N; 80° 35' 36" W; 40–44 m; UF 233549, 24° 50' N; 80° 37' 30" W; 36.6–42 m; UF 231719, 24° 24' N; 82° 43' W; 42–60 m; UF 233259, 29° 2' N; 80° 7' 30" W; 80.5–90 m; USNM 45645, 24° 25' 45" N; 81° 46' W; 82 m; USNM 83879, 83.8 mm, 34° 15' N; 76° 11' 30" W; 0–57 m; USNM 100578, 16.5 mm, 39° 55' N; 71° 13' W; USNM 101512, 64.6 mm, 34° 35' 30" N; 75° 45' 30" W; 59 m; USNM 151966, 85 mm, 33° 21' N; 77° 06' W; 91 m; USNM 152031, 60.2 mm, North Carolina; USNM 153112, 76.1 mm, Florida, 90–110 m; USNM 207786, 30.8 mm, 34° 37' N; 76° 08' W; 38 m; USNM 207788, 2, 50.3–57.2 mm, 34° 48' N; 75° 51' W; 33 m; USNM 207792, 3, 57.7–74.3 mm, 33° 10' N; 76° 55' 30" W; 82–95 m; USNM 207794, 2, 68.6–71.9 mm, 34° 05' N; 76° 43' W; 38 m; USNM 207801, 4, 70.7–78.1 mm, 27° 16' 30" N; 80° 01' W; 53–55 m; USNM 207802, 78.7 mm, 28° 12' N; 80° 05' W; 60 m; USNM 207811, 8, 73.3–87.7 mm, 33° 08' 30" N; 77° 34' 30" W; 91 m; USNM 207813, 81.2 mm, 29° 56' N; 80° 40' W; 33–35 m; USNM 387993 (ex. USNM 74090), 3, 36.5–62.5 mm, Florida, 110 m; USNM 387996, 2, 28° 35' N; 80° 09' 30" W; 51 m; USNM 387997, 54.5 mm, 24° 56' N; 80° 22' W; 73–75 m; USNM 387998, 73.6 mm, 33° 28' N; 76° 56' 30" W; 137–150 m.

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AMNH 16460, Louisiana; AMNH 81288, 4, 61–71.7 mm, 30° 12' N; 86° 25' W; 49–63 m; AMNH 81366, 2, 65–70 mm, 30° 07' N; 86° 55' W; AMNH 81648, 5, 57.3–78.1 mm, 30° 08' 30" N; 87° 42' W; AMNH 81760, 38 mm, 29° 59' N; 87° 04' 30" W; AMNH 81832, 69.4 mm, 30° 09' N; 86° 46' 30" W; AMNH 82165,

14, 66.3–76.8 mm, 29° 04' N; 85° 14' W; AMNH 82273, 5, 59.4–65.3 mm; 26° 25' N; 83° 50' W; AMNH 82289, 62.3 mm, 27° 50' N; 84° 31' W; AMNH 82306, 5, 59.2–71.9 mm, 28° 26' N; 84° 56' W; AMNH 82340, 5, 29° 58' N; 85° 24' W; AMNH 82795, 2, 68.9–71.4 mm, 29° 50' N; 86° 05' 05" W; 36 m; AMNH 82888, 4, 45.7–60.5 mm, 28° 29' N; 84° 21' W; AMNH 82935, 29° 45' 30" N; 87° 46' 30" W; AMNH 82999, 5, 19–70 mm, 30° 05' N; 87° 00' W; AMNH 83028, 9, 57.1–81.2 mm, 30° 10' N; 86° 50' W; AMNH 83468, 58.2 mm, 29° 28' 30" N; 86° 36' W; 72 m; AMNH 83569, 4, 65.1–76.3 mm, 30° 07' 50" N; 86° 55' 30" W; 43 m; AMNH 83691, 36.6 mm, 30° 14' N; 86° 18' 30" W; 29 m; AMNH 83713, 36.1 mm, 30° 14' N; 86° 19' 30" W; 27 m; AMNH 83722, 2, 68.6–72.4 mm, 30° 06' N; 86° 44' 30" W; AMNH 84224, 77.3 mm, 29° 55' 59" N; 86° 06' 28.8" W; AMNH 84437, 59.1 mm, 29° 39' 59.6" N; 87° 17' W; AMNH 84446, 69.6 mm, 29° 39' 59.6" N; 87° 17' W; AMNH 84612, 3, 59.9–62 mm, 28° 57' 59.4" N; 85° 23' 00" W; AMNH 84767, 9, 61.7–72.4 mm, 26° 24' 59.5" N; 83° 49' 57.6" W; 101 m; AMNH 84787, 3, 26° 24' 59.5" N; 83° 49' 57.6" W; 101 m; AMNH 84825, 9, 58.7–69 mm, 27° 24' 12" N; 84° 07' 18" W; 85 m; AMNH 84833, 8, 60.7–69.4 mm, 27° 24' 12" N; 84° 07' 18" W; 85 m; AMNH 84841, 14, 53.8–84.9 mm, 27° 40' N; 84° 12' W; 85 m; AMNH 84873, 73.7 mm, 27° 37' 12" N; 83° 53' 30" W; 53 m; AMNH 84894, 3, 58.3–61.7 mm, 27° 50' N; 84° 31' W; 102 m; AMNH 84905, 2, 61.5–65.4 mm, 27° 50' N; 84° 31' W; 102 m; AMNH 84908, 6, 27° 50' N; 84° 31' W; 102 m; AMNH 84940, 2, 66–67.9 mm, 28° 26' 24" N; 84° 55' 48" W; 87 m; AMNH 84955, 2, 56.5–65.6 mm, 27° 52' 58" N; 83° 34' 11" W; 32 m; AMNH 85125, 62 mm, 28° 57' 58" N; 85° 23' 01" W; 94 m; AMNH 85217, 75.6 mm, 28° 57' 58" N; 85° 23' 01" W; 94 m; AMNH 85263, 62.6 m, 28° 57' 58" N; 85° 23' 01" W; AMNH 85403, 2, 57–65.1 mm, 28° 26' 24" N; 84° 55' 12" W; 94 m; AMNH 85760, 4, 62.4–79.5 mm, 27° 24' 11" N; 84° 07' 11" W; AMNH 85824, 2, 38.4–39.9 mm, 27° 52' 48" N; 83° 34' 12" W; AMNH 85935, 21, 23.9–77.9 mm, 28° 29' N; 84° 21' W; AMNH 85975, 75.7 mm, 28° 29' N; 84° 21' W; AMNH 86092, 22.9 mm, 27° 50' N; 84° 42' W; 188 m; AMNH 86603, 3, 25.2–32.3 mm, 24 m; AMNH, 228362, 19.4 mm, 30° 13' 30" N; 87° 13' W; AMNH 228472, 19.5 mm, 30° 10' 26" N; 87° 13' W; CAS 64063, 4, 29° 32' N; 86° 04' W; 73 m; CAS 64089, 29° 47' N; 86° 28' 30" W; CAS 64095, 78.7 mm, 29° 4' N; 95° 02' W; CAS 64099, 83.8 mm, 29° 02' 30" N; 85° 06' W; CAS 67115, 2, 46.1–49.4 mm, 26° 33' N; 97° 05' 30" W; 384 m; CAS 67117, 41.5 mm, 26° 44' 24" N; 97° 09' 18" W; 128 m; CAS 74282, 21° 14' N; 91° 28' W; 46 m; CAS 74283, 5, 21° 9' N; 91° 41' W; 51 m; CAS 74293, 21° 17' N; 91° 18' W; 37 m; CAS 82250, 2, 28° 45' N; 93° 15' W; 33–37 m; CAS 85296, 8, 28° 58' N; 88° 18' W; CAS-SU 9545, Gulf of Mexico; CAS-SU 1679, Pensacola, Florida; FMNH 46722, 55.2 mm, 20° 45' N; 92° 12' W; 49 m; FMNH 46724, 31.1 mm, Gulf of Mexico; Alacran Reef; FMNH 46727ex, 72.5 mm, 29° 20' 30" N; 88° 08' W; 82 m; FMNH 46729, 3, 59.6–70.1 mm, 21° 38" N; 92° 10' 30" W; 53 m; FMNH 55950, 28° 00' N; 85° 00' W; FMNH 59917, 64.5 mm, 20° 18' N; 91° 48' W; 37 m; FMNH 59919, 22° 15' N; 88° 55' W; 46 m; FMNH 59920, 28.8 mm, 28° 50' 48" N; 85° 28' W; 104 m; FMNH 59921, 82.3 mm, 27° 36' N; 83° 50' W; 59 m; FMNH 59923, 79.2 mm, 78.6 mm, 24° 47' N; 83° 18' W; 64 m; FMNH 64140, 2, 78.6–81 mm, 29° 00' N; 85° 01' W; 29 m; FMNH 82681, 2, 55.7–71.5 mm, 25° 00' N; 83° 02' W; 51 m; FMNH 83444, 59.1 mm, 29° 55' N; 88° 25' W; 29 m; MCZ 46620, 14, 42.7–62.8 mm, 24° 36' N; 83° 11' W; 55 m; MCZ 46631, 11, 43.1–73.3 mm,

24° 47' N; 83° 11' W; 60 m; MCZ 54141, 33.5 mm, 24° 32' N; 83° 17' W; 60 m; UF 3595, 28° 50' N; 85° 6' W; 64.1 m; UF 3619, 29° 30' N; 87° 46' W; 54.9 m; UF 21011, 26° 44' N; 83° 30' W; 58.6 m; UF 26783, 28° 58' N; 85° 23' W; 91.5 m; UF 26823, 29° 46' N; 87° 46' W; 36.6 m; UF 26829, 26° 25' N; 84° 20' W; 183 m; UF 27387, 28° 26' N; 84° 56' W; 91.5 m; UF 27416, 27° 24' N; 84° 7' W; UF 27423, 28° 29' 58.6'' N; 84° 20' 59'' W; 36.6 m; UF 27428, 26° 24' N; 83° 49' W; 91.4 m; UF 27430, 28° 44' N; 84° 92' W; 88.8 m; UF 29727, 26° 24' N; 83° 49' W; 91.5 m; UF 29736, 29° 39' 49.5'' N; 86° 17' 11.7'' W; 76.9 m; UF 29743, 29° 56' N; 86° 7' W; 36.6 m; UF 29777, 29° 35' N; 87° 20' W; 106.1 m; UF 30303, 21° 34' 36'' N; 90° 57' W; UF 35453, 25° 17' 30'' N; 82° 32' W; 32.4 m; UF 37828, 29° 29' 31'' N; 87° 32' 6'' W; 63 m; UF 37882, 30° 4' 31'' N; 88° 6' 10'' W; 19.8 m; UF 38325, 29° 17' 1'' N; 88° 55' 22'' W; 36 m; UF 38362, 29° 56' 2'' N; 87° 5' 31'' W; 81 m; UF 38386, 29° 53' 25'' N; 87° 18' 8'' W; 45.8 m; UF 46971, 24° 37' N; 83° 48' W; 194 m; UF 47075, 25° 50' N; 83° 15' W; 64.1 m; UF 68775, 29° 1' N; 84° 38' 30'' W; 40 m; UF 70369, 29° 20' N; 85° 54' W; 64 m; UF 70379, 28° 33' N; 84° 39' W; 55 m; UF 70439, 29° 56' 24'' N; 86° 59' 18'' W; 181 m; UF 70588, 28° 44' N; 85° 6' W; 84 m; UF 70729, 30° N; 86° 40' W; 93 m; UF 70757, 28° 32' N; 84° 39' W; 55 m; UF 70775, 28° 33' N; 84° 39' W; 61 m; UF 70780, 28° 30' N; 84° 58' W; 98 m; UF 70798, 29° 42' N; 86° 6' W; 49 m; UF 71245, 29° 1' N; 85° 21' W; 183 m; UF 71510, 30° 10' N; 86° 42' W; 36 m; UF 75338, 29° 52' N; 85° 57' W; 36 m; UF 79209, 29° 10' N; 85° 20' W; 40 m; UF 79210, 27° 52' N; 84° 3' W; 55 m; UF 79212, 28° 56' N; 85° 23' W; 93 m; UF 79213, 28° 30' N; 84° 58' W; 93 m; UF 81387, 28° 31' 42'' N; 84° 52' 18'' W; 58.6 m; UF 81570, 29° 47' 12'' N; 86° 16' 12'' W; 69.5 m; UF 81617, 29° 48' 18'' N; 86° 12' W; 49.4 m; UF 86597, 27° 47' N; 84° 18' W; 62.2 m; UF 86609, 27° 46' N; 84° 6' W; 56.7 m; UF 86614, 26° 46' N; 83° 49' W; 91.5 m; UF 86615, 29° 58' N; 87° 22' W; 27.5 m; UF 86617, 28° 15' N; 91° 4' W; 73.2 m; UF 98811, Louisiana, 60.3 m; UF 111823, 24° 42' 3.6'' N; 82° 42' 17.4'' W; 24.3–159.2 m; UF 111832, 24° 48' 36.6'' N; 82° 32' 28.8'' W; 28.8 m; UF 116649, 27° 56' 33'' N; 84° 31' 43.8'' W; 86–95 m; UF 121323, 28° 0' 11.4'' N; 84° 38' 11.4'' W; 100.7–100.8 m; UF 146488, 25° 3' 23.4'' N; 83° 47' 15.6'' W; 99–100 m; UF 146504, 25° 5' 46.8'' N; 83° 47' 17.4'' W; 101 m; UF 146524, 25° 1' 12.6'' N; 83° 47' 39'' W; 100 m; UF 146649, 25° 15' 55.2'' N; 83° 47' 5.4'' W; 103 m; UF 149716, 27° 50' N; 84° 31' W; 91.5 m; UF 150846, 14, 59–74.5 mm, 26° 25' N; 83° 50' W; UF 150883, 28° 58' N; 85° 24' W; UF 151336, 26° 25' 30'' N; 82° 59' 30'' W; UF 151381, 68 mm, 27° 48' 42'' N; 83° 31' 54'' W; UF 151431, 29° 4' N; 85° 14' W; UF 152132, 26° 25' N; 83° 50' W; 91.5 m; UF 152364, 24° 47' N; 82° 39' W; 32.9 m; UF 152420, 24° 48' N; 82° 34' W; 32.9 m; UF 152628, 27° 27' N; 83° 53' W; 91 m; UF 152790, 28° 58' N; 85° 23' W; 91.5 m; UF 152951, 28° 32' N; 84° 17' W; 40 m; UF 153113, 27° 24' N; 84° 7' W; 36.6 m; UF 153116, 27° 24' N; 84° 7' W; 36.6 m; UF 153135, 27° 37' N; 83° 53' W; 183 m; UF 153162, 27° 55' N; 83° 27' W; 30.2 m; UF 153185, 27° 49' N; 84° 31' W; 102 m; UF 153430, 29° 50' N; 86° 13' W; 55 m; UF 153469, 29° 9' N; 85° 18' W; 41 m; UF 153652, 28° 42' N; 84° 20' W; UF 154650, 65–82 mm, 29° 45' 27'' N; 86° 0' 51'' W; UF 154651, 28° 42' N; 84° 20' W; UF 154750, 28° 26' N; 84° 55' W; 88.8 m; UF 154761, 28° 58' N; 85° 23' W; 91.5 m; UF 200834, 24° 45' N; 82° 10' W; UF 202072, 24° 45' N; 82° 10' W; 29.3 m; UF 202381, 24° 45' N; 82° 10' W; UF 203581, 24° 45' N; 82° 10' W; UF 203852, 25° 12' 30'' N; 82° 57' 30'' W; 51.2 m; UF 204621, 24° 46' N; 82° 58' W; 43.9 m; UF 205189, 24° 43' 42'' N; 82°

26° 48' W; USNM 45648, 28° 47' 30" N; 84° 37' W; 44 m; USNM 45649, 27° 04' N; 83° 21' 15" W; 48 m; USNM 45650, 26° 33' 30" N; 083° 15' 30" W; 49 m; USNM 45652, 29° 24' 30" N; 88° 01' W; 64 m; USNM 45653, 22° 08' 30" N; 86° 53' 30" W; USNM 86135, 77.1 mm, Gulf of Mexico, 50 m; USNM 101570, 66.8 mm, 28° 28' N; 84° 25' W; 38 m; USNM 126780, 73.2 mm, Florida; USNM 134197, 71.7 mm, 29° 10' N; 85° 31' W; 55 m; USNM 153113, 2, 56.5–59.6 mm, Florida, 91–110 m; USNM 153233, 4, 54.9–60.5 mm, Florida; USNM 190366, 81.2 mm, 32° 32' N; 78° 40' W; 73–91 m; USNM 207800, 2, 71.7–80.2 mm, 29° 58' N; 87° 11' W; 46 m; USNM 315536, 26.3 mm, 33° 48' 36" N; 76° 34' 06" W; 69 m; USNM 329678, 4, 68.8–76.5 mm, 36° 32' N; 74° 48" W; 71–73 m; USNM 356432, 14, 56.6–75.6 mm, 27° 37' N; 083° 58' W; 55 m; USNM 358025, 63.3 mm, 29° 24' 01" N; 087° 59' 30" W; Alabama, 75–77 m; USNM 358208, 71.9 mm, 29° 23' 24" N; 087° 58' 43" W; Alabama, 82 m; USNM 387990, 2, 41.4–49.2 mm, 26° 24' N; 082° 58' W; 37 m; USNM 387991, 66 mm, 26° 24' N; 82° 43' W; 73 m; USNM 387992, 5, 61.5–68.9 mm, 27° 37' N; 84° 13' W; 73 m; USNM 387999, 2, 75.8–81.1 mm, 28° 18' 30" N; 80° 10' W; 40 m; USNM 388004, 47.2 mm; USNM 388312, 55.8–58.3 mm, 20° 14' N; 92° 07' W; 64 m.

OTHER LOCALITIES

AMNH 19712, 3, 30.2–47.7 mm, Florida; AMNH 82043, 72.4 mm, Florida; AMNH 82070, 2, 70.2–71.3 mm; AMNH 82092, Florida; AMNH 82607, 13, 59.4–73.4 mm, Florida; AMNH 84991, 4, 61.7–66.0 mm, Florida; AMNH 86982, 66.3 mm, no data; AMNH 238772, 3, 65.7–72.3 mm, no data; AMNH 238773, 36.1 mm, no data.

HALIEUTICHTHYS INTERMEDIUS N. SP.

GULF OF MEXICO

AMNH 16324, 2, 45.2–48.3 mm, Louisiana; AMNH 51477, 9, 27.3–36.4 mm, Alabama; AMNH 52056, 10, 28.5–40.4 mm, Alabama; AMNH 80093, 52.1 mm, 29° 44' 30" N; 88° 23' 15" W; AMNH 80154, 2, 48.2–52 mm, 29° 38' 20" N; 88° 30' 40" W; AMNH 80165, 15, 26.1–52.1 mm, 29° 30' 30" N; 88° 36' 40" W; AMNH 80178, 19, 29° 30' 30" N; 88° 36' 40" W; AMNH 80589, 2, 51.2–58.2 mm, 29° 53' N; 88° 00' W; AMNH 80788, 47, 36.5–51.7 mm, 30° 00' N; 88° 30' W; 27.3 m; AMNH 80811, 11, 39–51.7 mm, 30° 00' N; 88° 21' W; 27.3 m; AMNH 80828, 50.9 mm, 29° 58' N; 88° 04' W; 27.3 m; AMNH 81061, 4, 47.2–50.2 mm, 30° 00' N; 88° 21' W; 27.3 m; AMNH 81146, 6, 44.6–50.1 mm, 30° 00' N; 88° 30' W; AMNH 81161, 6, 41.1–52.2 mm, 30° 00' N; 88° 21' W; 27.3 m; AMNH 85552, 58.4 mm, 26° 25' 12" N; 83° 49' 48" W; AMNH 86419, 69.6 mm, 29° 31' N; 87° 37' 45" W; 3 m; AMNH 86605, 51.1 mm, Texas, 56.4 m; AMNH 86652, 4, 51.1–57.7 mm, 29° 48' 30" N; 88° 15' W; 34.6 m; AMNH 86813, 40.1 mm; AMNH 86840, 41mm, south Sand Island, 10.5 m; AMNH 87007, 2, 54.3–58.5 mm, south of Sand Island; AMNH 87017, 3, 52.9–55.6 mm; AMNH 87039, 2, 56.5–61.2 mm; AMNH 87107, 4, 46.1–54.6 mm, 34.6 m; AMNH 87269, 50 mm, 29° 36' N; 88° 06' W; 39.6 m; CAS 64077, 53.7 mm, 28° 15' N; 91° 00' W; 104 m; CAS 64078,

2, 51.3–56 mm, 28° 53' 30" N; 92° 43' 30" W; CAS 64079, 3, 51.4–55.2 mm, 28° 11' N; 91° 24' 30" W; CAS 64080, 2, 55.2–57.7 mm, 28° 27' 0" N; 92° 8' 0" W; CAS 64082, 58.2 mm, 28° 28' N; 91° 13' 30" W; CAS 64083, 53.2 mm, 28° 14' N; 91° 41' W; CAS 64084, 59.7 mm, 28° 19' 30" N; 91° 24' W; CAS 64086, 5, 46.4–62 mm, 27° 15' N; 96° 24' W; 146 m; CAS 64087, 9, 44.6–63.1 mm, 26° 56' 30" N; 96° 27' W; CAS 64090, 48.4 mm, 29° 7' 30" N; 92° 43' W; CAS 64091, 53.1 mm, 28° 6' N; 93° 24' W; 80 m; CAS 64092, 53.8 mm, 28° 33' N; 92° 15' 30" W; CAS 64093, 53.1 mm, 28° 23' N; 95° 43' 30" W; CAS 64094, 56.6 mm, 26° 10' N; 96° 54' W; 33 m; CAS 64096, 58.9 mm, 27° 45' N; 96° 13' W; CAS 64097, 2, 50.1–51.9 mm, 28° 55' N; 92° 15' 30" W; CAS 64098, 3, 57.5–61.1 mm, 27° 59' N; 95° 20' 30" W; FMNH 45288, 56.1 mm, 27° 30' N; 96° 28' W; 73 m; FMNH 46725, 3, 58.1–63.5 mm, 29° 27' N; 87° 45' W; 68 m; FMNH 46727, 3, 60.9–69.4 mm, 29° 20' 30" N; 88° 08' W; 82 m; FMNH 59918, 2, 68.0–70 mm, 19° 54' 06" N; 91° 43' W; 42 m; FMNH 91486, 53.8–60.2 mm, 30° 04' 24" N; 88° 31' W; 18 m; FMNH 96353, 6, 55.5–60.7 mm, 29° 42' N; 88° 29' W; 37 m; LSUMZ 13629, 1, 28° 60' N; 89° 33' W; 55 m; LSUMZ 13632, 1, 28° 59' N; 89° 33' W; 55 m; USNM 101519, 29° 32' N; 87° 45' W; 46 m; USNM 185420, 27° 18' N; 96° 02' W; 366 m; USNM 207807, 55.2 mm, 28° 46' 05" N; 93° 30' W; 27 m; USNM 219103, 3, 58.9–62.3 mm (locality original entered Indonesia, apparently in error); USNM 356431, 71.2 mm, 20° 14' N; 92° 07' W; 64 m; USNM 358205, 68 mm, 29° 20' 57" N; 87° 46' 45" W; 101–103 m; USNM 387987, 28° 26' 30" N; 91° 00' 30" W; 37–40 m; USNM 387988, 28° 09' N; 95° 35' 30" W; UF 37854, 29° 32' 28" N; 87° 40' 11" W; 49.5 m; UF 37923, 30° 8' 32" N; 88° 15' 20" W; 32.4 m; UF 38004, 29° 55' 30" N; 88° 4' 48" W; 30.6 m; UF 38078, 29° 47' 13" N; 88° 37' 07" W; 22.6 m; UF 38111, 12, 29° 40' 30" N; 88° 33' 34" W; 23.4 m; UF 38283, 6, 29° 26' 29" N; 88° 45' 1" W; 25.2 m; UF 70435, 4, 29° 25' N; 88° 23' W; 55 m; UF 70436, 12, 29° 7' N; 88° 40' W; 93 m; UF 81527, 29° 23' N; 88° 40' 48" W; 50.4 m; UF 86612, 29° 10' N; 88° 10' W; 360 m; UF 86626, Mississippi; UF 98768, 4, 59.4 m, Louisiana; UF 99032, 61.5 m, Louisiana; UF 99250, 2, 58.5 m, Louisiana; UF 103046, Louisiana; UF 152113, 6, 29° 33' N; 87° 24' W; 90 m; UF 232673, 29° 00' N; 93° 30' W; 20 m; UF 232898, 2, 30° 3' N; 88° 40' 30" W; 18–20 m.

SPECIMENS TENTATIVELY IDENTIFIED AS *H. INTERMEDIUS*

CAS 64058, 66.2 mm, 31° 29' N; 79° 33' W; 110 m; CAS 64059, 2, 70.6–71.4 mm, 30° 03' N; 86° 56' W; 110 m; CAS 64074, 71.4 mm, 29° 29' N; 80° 10' W; 183 m; CAS 64075, 68.9 mm, 29° 04' N; 88° 44' 30" W; CAS 64085, 47.9 mm, 28° 43' 30" N; 90° 16' W.

UNIDENTIFIED JUVENILES

USNM 220934, 39° 45' N; 70° 00' W; collected from stomach of *Tetrapturus albidus* Poey; USNM 219080–219102 (12 lots, 181), 38° 35' N; 68° 14' W; all collected from stomach of *Thunnus* spp; MCZ 35373, Florida; MCZ 55211, 29° 56' N; 80° 8' W; 0–120 m; MCZ 55212, 30° 5' N; 80° 13' W; 0–140 m; MCZ 55214, 41° 16' N; 57° 37' W; 65–85 m; MCZ 55218, 3, 23° 13' N; 94° 50' W; 124–128 m; MCZ 55590, 34° 25' N; 75° 16' W; 0–400 m; MCZ 55592, 33° 44' N;

74° 23' W; 0–200 m; MCZ 55594, 30° 5' N; 80° 13' W; 90–100 m; MCZ 55595, 32° 11' N; 77° 46' W; 0–430 m; MCZ 55596, 32° 22' N; 77° 48' W; 0–400 m; MCZ 55597, 10, 34° 38' N; 75° 35' W; 50–100 m; MCZ 55598, 4 spec, 34° 38' N; 75° 35' W; 0–560 m; MCZ 55599, 3, 30° 1' N; 80° 10' W; 0–250 m; MCZ 56356, 2, 32° 28' N; 78° 0' W; 0–250 m; MCZ 60759, 26° 26' N; 79° 0' W; 0–330 m; MCZ 62216, 36° 51' N; 73° 53' W; 0–612 m; MCZ 62217, 39° 30' N; 64° 14' W; 0–203 m; MCZ 62218, 39° 9' N; 65° 57' W; 3–400 m; MCZ 62219, 37° 15' N; 74° 24' W; 0–250 m; MCZ 62220, 36° 50' N; 73° 40' W; 0–101 m; MCZ 62221, 36° 50' N; 73° 40' W; 0–50 m; MCZ 62222, 36° 50' N; 73° 40' W; 29–101 m; MCZ 62223, 36° 54' N; 73° 54' W; 0–383 m; MCZ 62224, 37° 12' N; 74° 18' W; 0–1007 m; MCZ 62225, 36° 50' N; 73° 40' W; 30–101 m; MCZ 62226, 36° 50' N; 73° 40' W; 30–101 m; MCZ 62227, 41° 5' N; 63° 33' W; 0–250 m; MCZ 76937, 34° 24' N; 75° 50' W; MCZ 76938, 39° 1' N; 60° 57' W; 0–800 m; MCZ 76941, 13° 13' N; 59° 56' W; 140–160 m; MCZ 93168, 38° 25' N; 74° 39' W; 35 m; MCZ 101079, 38° 26' N; 71° 58' W; 50–100 m; MCZ 103524, 2, 39° 82' N; 60° 49' W; 0–300 m; MCZ 166361, 39° 55' N; 67° 32' W; 503 m; MCZ 166360, 26° 25' N; 78° 46' W; MCZ 163999, 40° 34' N; 67° 01' W, 0–230 m.