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A New Species of Giant Seven-gilled Hagfish (Myxinidae: *Eptatretus*) from New Zealand

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Eptatretus goliath **new species, is described from a specimen caught at the head of the Hauraki Canyon off the northeast North Island, New Zealand, at 811 m depth. It differs from all other seven-gilled *Eptatretus* in having three-cusp multicusps in anterior and posterior rows, 11–13 unicusps in anterior rows, nine unicusps in posterior rows, total cusps 54, 14–15 prebranchial pores, 57–58 trunk pores, 13–14 tail pores, 92 total pores, and a prominent ventral finfold. The single specimen, at 1275 mm TL and 6.2 kg, is the largest hagfish yet known.**

THE seven-gilled hagfishes of the genus *Eptatretus* (Myxinidae) from the Pacific Ocean have been previously studied by McMillan and Wisner (1984), who recorded four species: *E. carlhubbsi* from the northern Pacific, *E. cirrhatus* from southeastern Australia and New Zealand, *E. laurahubbsae* from Juan Fernández Islands, and *E. strahani* from the Philippines. Prior to the present account, *Eptatretus carlhubbsi* had been the largest known hagfish, with nine specimens measuring 810–1160 mm total length (McMillan and Wisner, 1984).

During exploratory commercial fishing for deep-water crabs in 2002, a single specimen of an extremely large hagfish was taken off northeastern New Zealand and returned to the Museum of New Zealand. Detailed study indicates this species belongs to an undescribed species. Herein we describe it as a new seven-gilled *Eptatretus*. Measuring 1275 mm total length, it is the largest hagfish reported to date.

MATERIALS AND METHODS

Methods for measurements and counts follow those of Fernholm and Hubbs (1981) and McMillan and Wisner (1984). Terminology of anatomical structures follows Wisner and McMillan (1995) and Mok (2001). Length of specimens (in mm) is given as total length (TL), defined as the distance from the front of the rostrum to the posterior margin of caudal finfold. All other measurements are given in millimeters and as percentage of TL. Counts of gill pouches (GP), gill apertures (GA), cusps, and slime pores were taken from both sides of the specimen. Institutional abbreviations are as listed in Leviton et al. (1985), except MOVI–Museu Oceanográfico do Vale do Itajaí (Itajaí, Brazil).

***Eptatretus goliath*, new species**

Goliath Hagfish

Figures 1, 2

Holotype.—NMNZ P.40729, adult female, 1275 mm TL, 6.2 kg, off New Zealand, northeastern North Island, from the head of the Hauraki Canyon, 35°27′54″S, 175°36′08″E, 811 m depth, collected in a crab pot, 22 March 2002, Greg Gibbs.

Diagnosis.—*Eptatretus goliath* can be distinguished from its congeners by the unique combination of the following characters: seven pairs of gill pouches; three-cusp multicusps in anterior and posterior rows; 11–13 unicusps in anterior rows; nine unicusps in posterior rows; total cusps 54; 14–15 prebranchial pores; 57–58 trunk pores; 13–14 tail pores; 92 total pores; ventral finfold prominent.

Description.—Body subcylindrical and extremely robust, slightly deeper than wide at prebranchial and branchial regions, laterally compressed at trunk, and strongly compressed at tail. Rostrum bluntly rounded, slightly projecting. One pair of conspicuous nasal-sinus papillae symmetrically placed on inner dorsal surface of nasal sinus. Three pairs of barbels on head, first two pairs about equal in size (15 mm) and adjacent to opening of nasopharyngeal duct; third pair longer (21 mm) and immediately adjacent to oral cavity. Ventral finfold (VFF) conspicuous, nine mm high, beginning 300 mm behind the last gill aperture and extending posteriorly to cloaca. Caudal finfold nearly rounded, extending around tail to dorsal surface, ending nearly over cloaca.

Total length 1275 mm; preocular length 55 mm (4.3% TL); prebranchial length 240 mm (18.8% TL); branchial length 85 mm (6.7% TL); trunk length 750 mm (58.8% TL);

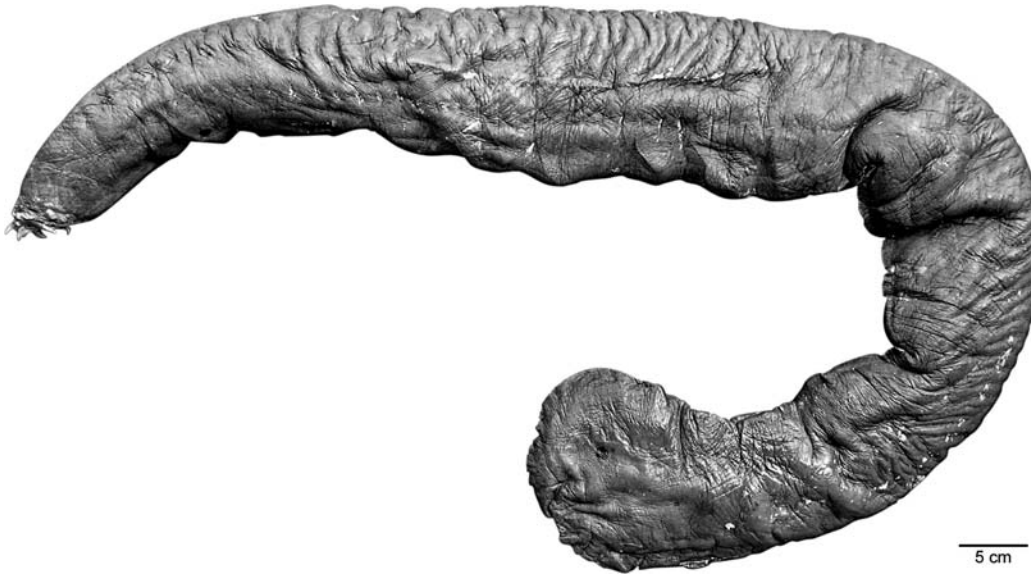

Fig. 1. *Eptatretus goliath,* new species, holotype NMNZ P.40729, 1275 mm TL.

tail length 200 mm (15.7% TL); body width at prebranchial region 82 mm (6.4% TL); body depth at mid-trunk including VFF 130 mm (10.2% TL); body depth excluding VFF 121 mm (9.5% TL); body depth at cloaca 104 mm (8.2% TL); tail depth 145 mm (11.4% TL). Three-cusp multicusps in anterior and posterior rows of cusps on each side; 13 unicusps in anterior and nine unicusps in posterior row on left side; 11 unicusps in anterior and nine unicusps in posterior row on right side; total cusps 54. Cusps proportionally small, slender, and pointed; palatine tooth conical (Fig. 2). Segmentally arranged row of slime pores on each side. Prebranchial pores (left/right) 14/15; branchial pores 6/7; trunk pores 58/57; tail pores 14/13; total pores 92/92. One slime pore associated with each gill aperture except for that of the pharyngocutaneous duct (PCD).

Seven pairs of gill pouches corresponding to seven pairs of gill apertures. Last branchial duct confluent with PCD on left side, forming a large aperture. Length of dental muscle 23% of total length; posterior tip of dental muscle reaches fourth gill pouch. Ventral aorta branches at seventh (last) gill pouch, very close to the heart; all afferent branchial arteries connected to branched portion of ventral aorta.

Body color in alcohol dark brown; rostrum and tip of barbels whitish; conspicuous eyespots; irregular white spots around mouth; gill apertures, slime pores, and VFF colored as body; caudal finfold with a narrow dark distal margin; dark spots of different sizes and shapes randomly distributed over entire body.

The holotype is an adult female containing dozens of small eggs, measuring about 45 × 14 mm. All eggs are still in the mesentery, which is attached to the body wall; terminal anchor filaments and hooks are not present on any of the eggs.

Distribution.—Known only from type locality.

Comparisons.—In the Pacific Ocean, four seven-gilled species of *Eptatretus* have been recorded: *E. carlhubbsi* from the northern Pacific, *E. cirrhatus* from southeastern Australia and New Zealand, *E. laurahubbsae* from the Juan Fernández Islands, and *E. strahani* from the Philippines.

Eptatretus goliath differs from *E. carlhubbsi* in the following characters: multicusp pattern (3/3 vs. 2/3), number of anterior unicusps (11–13 vs. 15–17), posterior unicusps (9 vs. 11–13), total cusps (54 vs. 63–71), trunk pores (57–58 vs. 60–70), and ventral finfold (present vs. absent). Whilst *E. goliath* seems to be more robust than *E. carlhubbsi*, the body proportions for both species are very similar, except the tail depth (11.4 vs. 8.9–10.5% TL, respectively). *Eptatretus goliath* and *E. carlhubbsi* are the only species of hagfish that attain more than one meter in length. Nine specimens of *E. carlhubbsi* examined by McMillan and Wisner (1984) measured between 813 and 1160 mm TL.

Eptatretus goliath and *E. cirrhatus* have the same multicusp pattern (3/3), but differ in the

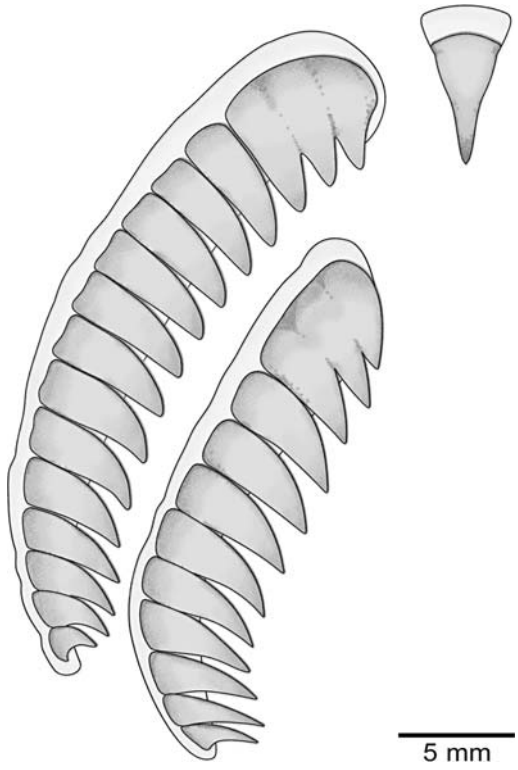

Fig. 2. Dentition (left side series and palatine tooth) of *Eptatretus goliath*, new species, holotype NMNZ P.40729, 1275 mm TL; anterior toward top.

following characters: preocular length (4.3 vs. 5.2–6.7% TL), prebranchial length (18.8 vs. 21.4–23.9% TL), trunk length (58.8 vs. 52.5–56.3% TL), body depth over cloaca (8.2 vs. 5.7–7.5% TL), tail depth (11.4 vs. 7.7–9.1%TL), number of anterior unicusps (11–13 vs. 8–11), total cusps (54 vs. 43–51), prebranchial pores (14–15 vs. 16–20), and total pores (92 vs. 83–90). The largest known specimen of *E. cirrhatus* is 830 mm TL (Fernholm, 1998).

Eptatretus goliath differs from *E. laurahubbsae* in the following characters: tail length (15.7 vs. 18.1–21.3% TL), tail depth (11.4 vs. 8.2–9.9% TL), multicusp pattern (3/3 vs. 2/2), number of anterior unicusps (11–13 vs. 13–17), posterior unicusps (9 vs. 11–16), total cusps (54 vs. 61–68), trunk pores (57–58 vs. 60–67), and total pores (92 vs. 97–105). *Eptatretus laurahubbsae* is also only known from juvenile specimens (maximum 375 mm TL), so its adult size is not known (McMillan and Wisner, 1984).

Eptatretus goliath differs from *E. strahani* in the following characters: preocular length (4.3 vs. 5.7–6.8% TL), prebranchial length (18.8 vs. 21.0–23.1% TL), trunk length (58.8 vs. 50.0–53.7% TL), tail length (15.7 vs. 17.4–20.0% TL), total cusps (54 vs. 47–52), trunk pores (57–58 vs. 45–48), and total pores (92 vs. 76–80). The largest known specimen of *E. strahani* is 520 mm TL (McMillan and Wisner, 1984).

Two seven-gilled species of *Eptatretus* occur in the western Atlantic Ocean: *E. caribbeaus* from the Caribbean Sea and *E. menezesi* from southeastern and southern Brazil. *Eptatretus caribbeaus* and *E. menezesi* share the same multicusp pattern (3/3) as *E. goliath*, but differ in the number of trunk pores (57–58 for *E. goliath* vs. 47–52 for *E. caribbeaus* and 48–55 for *E. menezesi*) and total pores (92 for *E. goliath* vs. 79–85 for *E. caribbeaus*). The maximum total lengths recorded for *E. caribbeaus* and *E. menezesi* are 385 and 900 mm, respectively (Fernholm, 1982; Mincarone, 2000, unpubl. data).

Besides *E. goliath* and *E. cirrhatus*, three other species of Myxinidae are known from the New Zealand region: *E. eos*, *Nemamyxine elongata*, and *Neomyxine biniplicata*. *Eptatretus eos* is a five-gilled species possessing a tube-shaped elongated snout and a very high slime pore count of 128–130, including 27 in the caudal series (Fernholm, 1991). In addition, the unique specimen known was bright fluorescent pink when first captured. *Nemamyxine elongata* possesses a very slender body, one pair of gill apertures, ten pairs of gill pouches, ventral finfold originating before gill apertures, 2/2 multicusp pattern, 36–38 total cusps, and 200–201 total pores (Richardson, 1958; Mincarone, unpublished data). It is only known from the 614-mm holotype and from another specimen (NMNZ P.37198, 790-mm female) recently trawled off north Canterbury Bight, South Island, 44°20.3′S, 172°00.5′E, at 132 m depth on 21 March 2000. *Neomyxine biniplicata* has one pair of gill apertures, seven pairs of gill pouches, one pair of ventro-lateral finfolds, 2/2 multicusp pattern, 30–34 total cusps, and 138–188 total pores (Richardson, 1953; Mincarone, unpubl. data).

Etymology.—Named *goliath*, the Philistine giant of biblical fame. A noun in apposition.

Remarks.—Where multiple specimens are available, species of New Zealand Myxinidae demonstrate wide depth ranges. Both *E. cirrhatus* and *N. biniplicata* are recorded from one to ~1100 m depth. The two known specimens of *N. elongata* are from the subtidal and 132 m depth. *Eptatretus eos*, known from only one specimen, was taken between 900–1013 m. The only known specimen of *E. goliath* was collected at 811 m.

Eptatretus cirrhatus and *N. biniplicata* can both form locally abundant populations; inshore, the former is often associated with reefs (A. L.

Stewart, pers. obs.). Generally these two species can be easily sampled by divers or inshore commercial trawling. The other three species, however, appear to either avoid being captured by trawl or are able to escape through the mesh. Added to that is the aversion of most fishermen to have these fishes on board their vessels, which has limited the number of specimens being returned to scientific institutions. As deepwater species are known just from a few specimens their distribution, abundance, and biology remains poorly understood.

Material Examined

Eptatretus carlhubbsi.—USNM 227440, paratype, 868 mm TL, 24°48′N, 167°14′W, 853 m, 9 Dec. 1980; USNM 233742, paratype, 940 mm TL, 14°59′N, 145°13′E, 1016 m, 5–6 Apr. 1981; CAS 50705, paratype, 1000 mm TL, Leeward Islands, Hawaii, Nov. –Dec. 1981; CAS 50706, paratype, 950 mm TL, Leeward Islands, Hawaii, 481 m, 19 Nov. 1981.

Eptatretus cirrhatus.—MOVI 27797, 1, 460 mm TL, 37°34.00′S, 178°20.00′E, 17 m, 28 June 1988; MOVI 27798, 1, 620 mm TL, 37°11.50′S, 176°10.00′E–37°10.50′S, 176°11.50′E, 190–265 m, 22 Jan. 1979; SAM F5363, 433 mm TL, 37°59′S, 150°05′E, 452 m, 14 Oct. 1984; SAM F5360, 439 mm TL, 37°44′S, 150°16′E, 620 m, 14 Oct. 1984; SAM F5356, 441 mm TL, 38°11′S, 149°58′E, 620 m, 15 Oct. 1984.

Eptatretus laurahubbsae.—USNM 227441, paratypes, 2, 185–200 mm TL, and CAS 49125, paratypes, 2, 225–270 mm TL, Juan Fernandes Island, 33°31′S, 78°50′W, 2400 m, 12–13 Dec. 1965.

Eptatretus strahani.—MNHN 1981-0722, paratype, 500 mm TL, SIO 81-116, paratype, 430 mm TL, and USNM 227442, paratype, 435 mm TL, South China Sea, near Lugbarg Island, Philippines, 14°00′N, 120°18.2′E, 189 m, 21–22 March 1976.

Eptatretus caribbeaus.—USNM 218405, paratype, 340 mm TL, Caribbean Sea, Nicaragua-Colombia, 200 fms (366 m), 5 July 1972; UF 27894, paratype, 334 mm TL, Caribbean Sea, Nicaragua, WSW of Quitasueño, 14°08′N, 81°55′W, 200–244 fms (366–446 m), 21 May 1962; UF 27895, paratype, 350 mm TL, Caribbean Sea, Honduras, W of Rosalind Bank, 16°50′N, 81°21′W, 200 fms (366 m), 7 June 1962.

Eptatretus menezesi.—MOVI 14729, holotype, 737 mm TL, off Santa Catarina, Brazil, 29°14′S, 48°02′W, 250 m, 31 July 1998; MZUSP 52492, paratypes, 2, 390–462 mm TL, off Rio de Janeiro, Brazil, 24°09′19″S, 43°14′13″W, 510 m, 6 Dec. 1997; MZUSP 52493, 12, 314–602 mm TL, off Santa Catarina, Brazil, 29°37′42″S, 48°00′30″W, 380 m, 27 April 1997.

Nemamyxine elongata.—NMNZ P.37198, 1, 790 mm TL, north Canterbury Bight, South Island, New Zealand, 44°20.3′S, 172°00.5′E, 132 m, F/V Sapun Gora, trawl, 21 March 2000, B. Liddle.

Neomyxine biniplicata.—AMS I.24337001, 1, 305 mm TL, no data (probably New Zealand), L. R. Richardson and J. P. Jowett, 1957; AMS I.24336001, 1, 324 mm TL, no data (probably New Zealand), 1958, L. R. Richardson; AMS IB.3806, 1, 314 mm TL, and AMS IB.3807, 1, 350 mm TL, 41°15′S, 172°34′E, 73 m, 1957, L. R. Richardson; MOVI 27795, 1, 380 mm TL, 41°44′S, 174°16′E, 146.3 m, 5 Nov. 1952; MOVI 27796, 1, 446 mm TL, 42°44.30–45.00′S, 176°02.40–00.20′E, 778–798 m, 8 Jan. 1989; NMNZ P.24787, 2, 410–450 mm TL, 42°44.30–45.00′S, 176°02.400–0.20′E, 778–798 m, 8 Jan. 1989; NMNZ P.1171, 1, 375 mm TL, 41°44′S, 174°16′E, 146.3 m, 5 Nov. 1952; SIO 94-1, 1, 333 mm TL, south of Cape Campbell, New Zealand, 40–50 fms (73–91 m).

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