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FIRST RECORD OF THE SOUTHERN HAGFISH *Myxine australis* (MYXINIDAE) IN BRAZILIAN WATERS

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The hagfishes previously recorded in Brazilian waters are *Eptatretus menezesi*, *Myxine sotoi*, and *Nemamyxine kreffti*. In this paper, a fourth species, *Myxine australis*, is recorded based on two specimens (292–250 mm TL) bottom trawled off Rio Grande Sul State, at depth between 30 and 45 m, southern Brazil. Additional data about the morphology, distribution and ecology of the species are also provided.

As espécies de peixe-bruxa previamente registradas em águas brasileiras são *Eptatretus menezesi*, *Myxine sotoi* e *Nemamyxine kreffti*. Neste trabalho, uma quarta espécie, *Myxine australis*, é registrada com base em dois espécimes (292–250 mm CT) coletados com arrasto de fundo frente a costa do Estado do Rio Grande do Sul, entre 30 e 45 m de profundidade, sul do Brasil. Dados adicionais sobre a morfologia, distribuição e ecologia da espécie também são apresentados.

Hagfishes of the genus *Myxine* Linnaeus, 1758 are characterized by having the following characters: all efferent gill-pouch ducts discharging into a single aperture on each side of the body, the left one being confluent with the aperture of the pharyngocutaneos duct; ventral finfold not extending to branchial apertures; and ventrolateral finfolds absents.

Among the 21 recognized species of *Myxine*, seven are found in the western South Atlantic: *M. fernholmi* and *M. knappi* (near Falkland Islands); *M. australis* (near Strait of Magellan, and off southern South America); *M. debueni* and *M. affinis* (Strait of Magellan); *M. dorsum* (off southern Argentina); and *M. sotoi* (southeastern and southern Brazil).

During commercial trawling off the State of Rio Grande do Sul, southern Brazil, two specimens of a species of *Myxine* were collected. This material was deposited in the Centro de Estudos Bio-Ecológicos Costeiros, Limnológicos e Marinhos (CEBECLIM) and latter transferred to Museu Oceanográfico do Vale do Itajaí (MOVI), but only recently was examined and identified as *Myxine australis*, the fourth hagfish species recorded in Brazilian waters.

In this paper, these specimens are briefly described and compared with specimens of *M. australis* from southern Argentinean waters, examined by Wisner & McMillan (1995).

Material and Methods

The two specimens of *M. australis*, a mature female 292 mm TL (MOVI 06237) (Fig. 1), and an immature female 250 mm TL (MOVI 06238), were bottom trawled by fishing vessel off southern Brazil, 33º00'-33º20'S, 52º00'-52º15'W, depth 30-45 m, on July 18, 1986.

The specimens were identified according to Wisner & McMillan (1995). Measurements and counts essentially follow Fernholm & Hubbs (1981) and McMillan & Wisner (1984). Measurements were made with dial calipers on the left side and counts on both left and right sides of specimens.

The following comparative material was examined: *M. australis* – USNM 176460, 18 specimens (174-340 mm TL), 42º29'S, 72º46'W; SIO 78-51, 10 (128-350 mm), 54º45.4'S, 64º09.9'W, 14 m depth; *M. affinis* – SIO 78-43, 10 (330-593 mm), 55º03'S, 68º10'W, 30 m depth; *M. knappi* – SIO 90-144, 1 paratype (560 mm), 49º16'S, 57º02'W, 630-650 m depth; *M. sotoi* – MOVI 14961 (holotype), 1 (506 mm), 27º28'08"S, 46º53'02"W, 810 m depth; MOVI 14950-14960, 11 (410-511 mm) and MZUSP 62880, 6 (399-485 mm), collected with holotype; MCP 26199, 2 (395-428 mm), MOVI 14936-14941, 6 (393-522 mm), MZUSP 62879, 3 (398-495), and USNM 364209, 1 (356 mm), 24º13'52"S, 43º11'08"W, 690 m depth.

Institution abbreviations are as listed in Leviton *et al.* (1985), except MOVI – Museu Oceanográfico do Vale do Itajaí (Itajaí, SC, Brazil).

Results and Discussion

The two specimens of *M. australis* caught off southern Brazil have a body slender, slightly deeper than

Figure 1. *Myxine australis*, mature female 292 mm TL (MOVI 06237), with egg.

wide. Rostrum triangular with pointed tip. A 2-cusp multicusp on both the anterior and posterior sets of cusps. Ventral finfold 3-4 mm high, originating within anterior 13% of trunk. Tail narrow, its length 13.0-14.4% of TL, its depth 32-37% of its length. Three slime pores above area between anterior and posterior ends of cloaca. Caudal finfold thin, internal supporting rays visible, extending around tail to about over cloacal origin. Six gill pouches on each side; dental muscle reaching second gill pouch; ventral aorta unbranched.

Body color of preserved specimens (70% ethanol) brown with ventral region slightly lighter; rostrum and barbels dark; mouth with pale margin; ventral finfold yellowish; prebranchial pores and gill apertures without whitish margins; trunk pores, tail pores and cloaca with narrow whitish margins. Measurements and counts are given in Table 1.

The mature female 292 mm TL, contained 7 large eggs measuring between 17.0 x 6.0 and 18.0 x 7.4 mm, but no anchor filaments visible. Several small eggs in initial stage of development found in immature female 250 mm TL.

According to Wisner & McMillan (1995) *M. australis* occurs principally in and near the Strait of Magellan, being also collected from farther north, off southern Chile (48°29'S, 78°46'W) and off southern Argentina (48°18'S, 65°06'W). The occurrence of *M. australis* off southern Brazil enlarges the distribution range of the species in the western Atlantic Ocean (Fig. 2).

As most hagfish species, the Brazilian specimens of *M. australis* were captured on soft mud bottom. A relatively diverse bottom fauna was trawled with *M. australis*, including: coral – *Astrangia rathbuni*; gastropods – *Adelomelon becki*, and *A. brasiliana*; crabs – *Libinia spinosa*, *Hepatus pudibundus*, and *Dardanus insignis*; sharks – *Galeorhinus galeus*, *Mustelus canis*, *M. fasciatus*, *M. schmitti*, *Rhizoprionodon porosus*, *Sphyrna lewini*, *Carcharias taurus*, *Squalus* spp., *Squatina guggenheim*, and *S. punctata*; rays – *Rhinobatus horkelli*, *R. percellens*, *Zapteryx brevirostris*, *Rioraja agassizii*, *Sympterygia acuta*, *S. bonapartei*, *Psammobatis* spp., *Atlantoraja castelnaui*, *A. cyclophora*, and *A. platana*; bonyfishes – *Ophichthus gomesi*, *Conger orbignyanus*, *Urophicis brasiliensis*, *Porichthys porosissimus*, *Lophius gastrophysus*, *Prionotus punctatus*, and *Micropogonias furnieri*.

Despite large geographic separation between specimens of *M. australis* from southern Brazil (33º20'S, 52º15'W), and specimens from the Strait of Magellan and off southern Argentina (48°18'S, 65°06'W) (Fig. 2), no significant differences in body proportions are found. However, no overlapping was observed in the number of total cusps (39 in *M. australis* from southern Brazil *vs*. 29-38 in *M. australis* from southern Argentina). Of 131 specimens of *M. australis* examined by Wisner & McMillan (1995) none had 39 total cusps (Table 1).

A second *Myxine* species is found off southwestern and southern Brazil, *M. sotoi*, which can be distinguished from *M. australis* by its maximum total length (522 *vs*. 394 mm TL), and color pattern (pinkish red with whitish

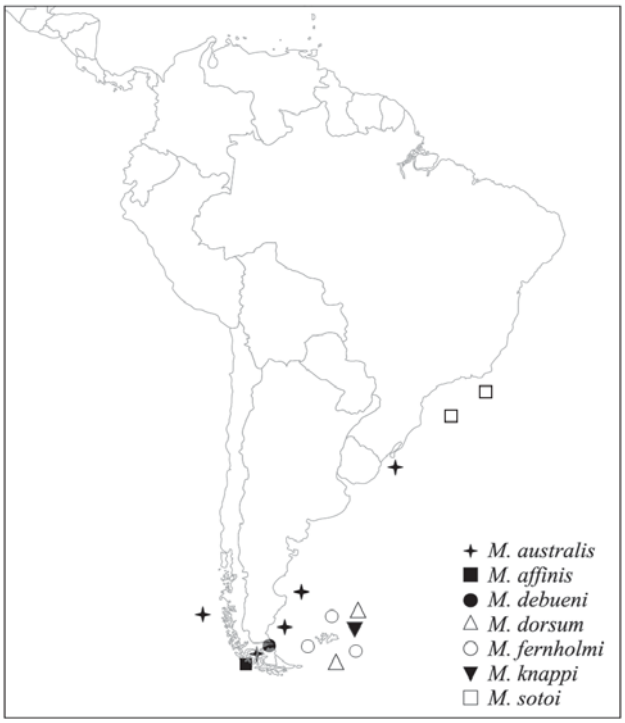

Figure 2. Distribution of the western South Atlantic *Myxine* species. *Myxine australis* and *M. affinis* are represented by one symbol in the Strait of Magellan, but they were collected in several stations around the Strait (Modified from Wisner & McMillan, 1995).

Table 1. Measurements and counts from *Myxine australis*.

	Present paper		Wisner & McMillan (1995)
	MOVI 06237	MOVI 06238	131 specimens range (mean)
Total length TL (mm)	292	250	91-394
Measurements in % of TL			
Prebranchial length	28.8	28.8	26-32 (27)
Trunk length	58.2	56.8	53-60 (58)
Tail length	13.0	14.4	11-19 (15)
Body width	3.8	3.4	2-5 (4)
Body depths:			
Inc. ventral finfold	5.8	5.0	4-8 (6)
Exc. ventral finfold	4.4	3.8	5-7 (5)
Over cloaca	4.3	3.6	4-6 (5)
Tail depth	4.8	4.6	4-7 (5)
Counts:			
Cusps:			
Cusps on multicusps	2/2	2/2	2/2
Anterior unicusps	7+8	7+8	4-7 (5.5)
Posterior unicusps	8+8	8+8	5-8 (6.5)
Total cusps	39	39	29-38 (33.7)
Slime pores:			
Prebranchial	39+34	36+41	22-42 (31.3)
Trunk	61+61	59+59	51-68 (58.5)
Tail	12+11	13+13	8-14 (11.1)
Total pores	112+106	108+113	86-118 (102.0)

head anterior to first slime pore and a whitish middorsal stripe extending from caudal finfold to about over gill apertures *vs*. reddish to dark brown). A great difference of depth range separates these two *Myxine* species in Brazilian waters. *Myxine australis* was collected in the shallow waters on the continental shelf (30-45 m), whereas *M. sotoi* occurs in the deep waters on the continental slope (690-810 m).

Three other *Myxine* species from the western South Atlantic, *M. affinis*, *M. dorsum*, and *M. knappi*, also have the same pattern of cusps on multicusp (2/2) and gill pouches (six pairs) than *M. australis*, but they are not similar to that species. The remaining two known western South Atlantic *Myxine* species, *M. fernholmi* and *M. debueni*, also have six pairs of gill pouches, but their pattern of cusps on multicusp is 3/2.

Myxine australis is the fourth hagfish species recorded in Brazilian waters. The other hagfishes previously recorded are *Eptatretus menezesi*, *Myxine sotoi*, and *Nemamyxine kreffti* (Mincarone, 2000, 2001a, 2001b).

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Literature Cited

Fernholm, B. 1998. Hagfish systematics. p.33-44. In: Jørgensen, J. M., Lomholt, J. P., Weber, R. E., and Malte, H. (eds.). *The Biology of Hagfishes*. London: Chapman & Hall. 578p.

Fernholm, B. & Hubbs, C. L. 1981. Western Atlantic hagfishes of the genus *Eptatretus* (Myxinidae) with description of two new species. *Fishery Bulletin* 79(1): 69-83.

Leviton, A. E.; Gibbs Jr., R. H.; Heal E. & Dawson, C. E. 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985(3): 802-832.

McMillan, C. B. & Wisner, R. L. 1984. Three new species of seven-gilled hagfishes (Myxinidae, *Eptatretus*) from the Pacific Ocean. *Proceedings of the California Academy of Sciences* 43(16): 249-267.

Mincarone, M. M. 2000. *Eptatretus menezesi*, a new species of hagfish (Agnatha, Myxinidae) from Brazil. *Bulletin of Marine Science* 67(2): 815-819.

Mincarone, M. M. 2001a. *Myxine sotoi*, a new species of hagfish (Agnatha, Myxinidae) from Brazil. *Bulletin of Marine Science* 68(3): 479-483.

Mincarone, M. M. 2001b. Further description of the hagfish *Nemamyxine kreffti* McMillan & Wisner, 1982 (Agnatha, Myxinidae). *Mare Magnum* 1(1): 19-22.

Mok, H.-K. & Kuo, C.-H. 2001. *Myxine formosana*, a new species of hagfish (Myxiniformes: Myxinidae) from the southwestern waters of Taiwan. *Ichthyological Research* 48: 295-297.

Wisner, R. L. & McMillan, C. B. 1995. Review of new world hagfishes of the genus *Myxine* (Agnatha, Myxinidae) with descriptions of nine new species. *Fishery Bulletin* 93: 530-550.

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