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Results of the research cruises of FRV "Walther Herwig" to South America LX. *Nemamyxine kreffti*, a new species of hagfish from off Argentina

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With 1 table

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Kurzfassung

Ergebnisse der Forschungsreisen des FFS „Walther Herwig“ nach Südamerika. LX.
Nemamyxine kreffti, eine neue Ingerart aus dem Archibenthal Argentinien.

Ein zweites Exemplar der Gattung *Nemamyxine*, ein juveniles Weibchen von 400 ml TL, gefangen von FFS "Walther Herwig" in 800 m Tiefe vor der Mündung des Rio de la Plata, Argentinien, wird als neue Art beschrieben und mit publizierten Daten des einzigen bisher bekannt gewordenen Stückes verglichen. Dieses Exemplar, *N. elongata* Richardson, 1958, wurde etwa 137 m stromaufwärts in einem kleinen Gezeiten-Fluß in der Bay of Plenty, Neuseeland, gefangen.

Abstract

A second known specimen of *Nemamyxine* (Myxinidae), a young female, 400 mm TL, taken by the FRV "Walther Herwig" from 800 meters, off Rio de la Plata, Argentina, is described as new and compared with published data on the first known specimen, *N. elongata* Richardson, 1958, taken 150 yards upstream in a small tidal river, Bay of Plenty, New Zealand.

A. Introduction

Hagfishes (Vertebrata, Agnatha, Myxinidae) are cartilaginous, bottom-dwelling, entirely marine, feeding on dead or moribund fishes, and on invertebrates, and without jaws; two sets of keratinous teeth (cusps), each side are attached to a dental plate, in turn attached to the anterior end of the dental muscle, a cylindrical complex of muscles and cartilages (the club-shaped, or lingual muscle of authors) which laterally evert and contract the two sets, providing a biting-cutting mechanism for feeding. Hagfishes are essentially blind, with vestigial eyes embedded in flesh of head and covered by integument. Internal gill pouches are supplied with water entering the nasopharyngeal opening above the mouth and by a velum in the pharynx which acts as a pump. Discharge is via one or more pairs of adjacent openings to the exterior (branchial apertures) and the pharyngocutaneous duct, an enlarged opening confluent with or contiguous to the last (or only) aperture on the left side.

A row of internal mucus-secreting (slime) glands and associated external pores occur on each side, usually one per body segment. Habitat is usually soft mud at varying depths; some species live in shallow depths and among rocks in cold waters.

Six genera of myxinids are recognized but the speciation is uncertain, due primarily to a paucity of collections throughout the oceans, and lack of published data.

From 1965 until his death in 1979 Dr. CARL L. HUBBS attempted a revision of the Myxinidae and gathered a large amount of material toward that effort. Unfortunately, his steadily failing health in latter years precluded completion of the revision. This paper represents a small, but significant, portion of that great amount of accumulated data. The single specimen to be described below was sent to Dr. HUBBS by Dr. GERHARD KREFFT in March, 1971. It was taken in 1966 by the FRV "Walther Herwig" off Río de la Plata, Argentina, at 800 meters, and is the second known of the genus *Nemamyxine*; the first, *N. elongata*, was described by RICHARDSON (1958) from a single specimen taken in the estuary of a small tidal river, Bay of Plenty, New Zealand.

B. Generic Description

Nemamyxine Richardson, 1958

Nemamyxine Richardson, 1958 (type species *Nemamyxine elongata* Richardson, 1958: 284, No. 2006, Dominion Museum, Wellington, New Zealand; taken in a whitebait net 150 yards upstream from the mouth of the Kaituna River, Bay of Plenty, North Island, New Zealand, by original designation). RICHARDSON categorized *Nemamyxine* as: "Slender myxinids having one pair of external branchial apertures, the left the larger, no separate aperture from an oesophageo-cutaneous duct; no ventrolateral fin-folds, median ventral fin-fold extending between the branchial apertures terminating anteriorly shortly behind the true head; mucus glands segmentally arranged; median teeth of both series, bifid¹⁾."

Genus *Nemamyxine* was extracted from genus *Myxine* Linnaeus, 1758, on the basis of its very slender body, 1.4 % of total length vs about 4 % for *Myxine glutinosa*. *Nemamyxine* differs from *Notomyxine* Nani and Gneri, 1951 (type species *Myxine tridentiger* Garman, 1899), in the absence of a separate opening for the pharyngocutaneous duct (the oesophageocutaneous duct of RICHARDSON) posterior to the left branchial aperture (a key character of *Notomyxine*); it differs from *Neomyxine* Richardson, 1953 (type species *Myxine biniplicata* Richardson and Jowett, 1951; holotype 265 mm, in Dept. Zool., Victoria University College, Wellington, N.Z.) in having one mucus pore per body segment, in contrast to more than one, and in the absence of short, paired lateral finfolds in the pre-branchial area (a key character of *Neomyxine biniplicata*). The above four genera form a group having but one pair of branchial apertures, differing from genera *Paramyxine* and *Eptatretus*, which have more than one pair (5 to 15). *Paramyxine* is characterized in part in having the apertures very closely spaced, often more than one per body segment, and in relatively straight to strongly curved, sometimes circular, rows (variable with species); this is in marked contrast to the more widely spaced apertures in essentially straight rows in *Eptatretus*.

C. The New Species

Nemamyxine kreffti n. sp.

a) Material and methods

Holotype (and only known specimen): ISH 1144/66; a young female, 400 mm TL. "Walther Herwig" Station 244/66; 36° 51' S, 54° 01' W, BT 140, 800 m, June 14, 1966.

¹⁾These "bifid" median teeth are herein termed "multicusps" (two or more unicusps fused to their bases). Apparently RICHARDSON considered the bifid condition as a generic character; but, as the number of fused cusps varies within genera, we regard it as only of species value.

Additional material: None

Total length was measured by stretching the specimen along a meter stick; other measurements were taken on the left side with dial calipers. Due to severe coiling in preservation it was necessary to pull the specimen into a straight form. The characters used herein were chosen to conform to those used by RICHARDSON (1958) for *N. elongata*.

Definitions of characters used:

Total length (TL): from tip of rostrum to tip of tail.

Prefinfold length: from tip of rostrum to origin of finfold.

Prebranchial length: from tip of rostrum to anterior margin of first branchial aperture.

Trunk length: from anterior margin of pharyngocutaneous duct (PC) to origin of cloaca (the "abdominal region" of RICHARDSON, 1958).

Tail length: from anterior margin of cloaca to tip of tail.

Depth at midbody: midway between tip of rostrum and tip of tail.

Multicusps: the anteriormost two or three cusps of both pairs of the anterior and posterior rows of teeth that are fused as a unit.

Unicusps: cusps with free, unfused margins.

b) Diagnosis

Body extremely slender, somewhat rounded, the depth about 2.5 % of TL and only slightly greater than the width. Body depth remarkably uniform throughout; tail depth equal to greatest body depth. Tip of rostrum bluntly rounded. Ventral finfold well anterior to PC duct. No external evidence of eyespots. No lateral line canals on head or elsewhere on body.

c) Description of holotype

Counts and measurements of holotype (and only specimen) are given in Table 1 and are compared with similar data for the holotype (and only specimen) of *Nemamyxine elongata* Richardson, 1958. Color in preservative a medium brown; a scattered mottling of paler brown over body may be due to erosion of skin through handling or preservation. Head only slightly lighter in color than rest of body. Proximal margin of ventral finfold of same color as body but distal margin unpigmented throughout; posterior to cloaca the pale margin is scarcely discernible.

Ventral finfold prominent, well developed, extending from near head to cloaca; it is barely evident around end of tail and extends only a short distance along dorsal margin.

Mucus pores tiny, about equally spaced, one per segment, and without whitish margins, beginning far forward; distance between tip of rostrum and first pore about 4.5 % of TL. On the left side nine pores occur before origin of finfold, eight on the right. Three mucus pores overlie the cloaca, each side; space between last trunk pore and first cloacal pore slightly greater than length of cloaca. Cloacal and caudal pores form a straight line with a slight posteroventral slant.

Eight internal gill pouches, each side, the anteriormost at tip of dental muscle complex (the lingual muscle of authors); all others lie posterior to the tip. Ventral aorta unbranched with all afferent arteries given off posterior to tip of muscle. The left branchial aperture (and opening of the pharyngocutaneous duct) is about twice the length of right aperture; the two are almost directly opposed. Both apertures are slit-like and difficult to see as they lie very near the ventral finfold and under overhanging skin.

Three multicusps and six unicusps on each anterior series of teeth, two multicusps and seven unicusps on each posterior series; total number of cusps 36. Unicusps of the posterior series are longer, more slender, more curved and sharply pointed than those of anterior series. Cutting away of integument overlying the entire head revealed slit-like recessions in flesh in an area where embedded eyes of hagfishes normally occur. Presumably these represent eyes in *N. krefftii* but no semblance of eyeball or pupil is evident; no dissection of the slits was done.

The holotype is a young female with immature ova ranging in length from about 0.1 to 1.5 mm; only two ova have attained the larger size and are typically elongate. Smaller ova are rounded, elongating with increasing size.

d) Comparison with *Nemamyxine elongata*

While cognizant of the dangers inherent in describing a new species from a single specimen, comparison with RICHARDSON'S description of *N. elongata* indicates differences of sufficient magnitude to warrant specific status for the southwestern Atlantic specimen (Table 1). Notable differences are the number of multicusps in the anterior series of teeth (3 vs 2), and the total numbers of mucus pores (140 vs 200), the principal differences being the numbers of prebranchial pores (42 vs 52) and of trunk pores (84 vs 130). Another possibly significant difference is that *N. elongata* has an even more slender body; although 214 mm longer (614 mm TL) its depth at midbody is only 1.5 % of TL vs 2.9 % for *N. krefftii* (400 mm TL).¹⁾

RICHARDSON reported that poorly defined eye patches were present in *N. elongata*; they are not apparent in *N. krefftii*. Possibly skin color faded in preservation so that eye patches are no longer visible. Of some significance is an apparent difference in color; *N. elongata* was described as "black-pigmented" (RICHARDSON, 1979: 284), whereas *N. krefftii* is definitely brown at this writing; color notes were not made at the first examination (in 1971).

The ventral finfold of *N. elongata* was described as dividing around the cloaca, but in *N. krefftii* the finfold ends abruptly at origin of cloaca. Richardson's illustration (1958, fig. 2) shows only one or two mucus pores anterior to origin of ventral finfold, which begins very far forward. *N. krefftii* has nine pores on the left side, eight on the right, preceding the finfold origin; the prebranchial ratios are the same (26 % of TL) but the distance from rostrum to origin of finfold is extremely different, being much farther back in *N. krefftii* (Table 1).

In both species the mucus pores appear as one per body segment and more or less evenly spaced. There is a significantly greater number of total mucus pores in *N. elongata* (Table 1), which is also considerably greater in total length.

Unfortunately, RICHARDSON did not open his specimen to determine either its sex or the number and arrangement of internal gill pouches. While no sexual dimorphism has ever been shown in hagfishes it would have been of value to compare the number and position of the gill pouches with respect to the dental muscle and the branching of the ventral aorta in the two species of *Nemamyxine*.

The capture of *N. krefftii* at 800 m in an oceanic environment, and of *N. elongata* in the mouth of a tidal river, may indicate a significant difference in ecological requirements, particularly in temperature and salinity. Capture data for *N. krefftii* list a bottom temperature of 3.64° C and a salinity of 34.1 ‰; similar data are not available for *N. elongata* but it is unlikely that the above figures are approached.

¹⁾The specimen now measures 385 mm TL, having shrunk between the initial measurement (III:5:1971) and re-measure for this study (I:17:1980); both measures were taken by the senior author.

Table 1 Body proportions (in thousandths of total length), numbers of mucus pores and cusps for *Nemamyxine kreffti* and *N. elongata*.

	<i>N. kreffti</i>	<i>N. elongata</i>
Prebranchial length	260	260
Prefinfold length	70	57
Trunk length	625	625
Tail length	113	114
Depth at midbody	29	15
Numbers of mucus pores:		
Prebranchial	40-40	52-55
Trunk	85-84	130-130
Caudal (including cloacal)	16-16	18-16
Total mucus pores	141-140	200-201
Numbers of cusps:		
Total multicusps	5-5	4-4
Unicusps (anterior)	6-6	7-7
Unicusps (posterior)	7-7	7-7
Total cusps	36	36

HUBBS (in correspondence with Dr. J.A.F. GARRICK, Victoria University, Wellington, August, 1972) questioned the veracity of the capture data for *N. elongata*, but the following reply by GARRICK supports it:

“So far as I can gather I don’t think there is any doubt about the accuracy of the statement regarding the place of capture of the type of *Nemamyxine elongata*. The doubt must lie in the representativeness of the site and its conditions for the species, which is a very different matter indeed.

The type was forwarded to the Dominion Museum by a Marine Department Fisheries Inspector who obtained it from a whitebaiter fishing 150 yards upstream from the mouth of the Kaituna River. There appears to be no reason at all to question the veracity of the Inspector. I have not seen the Kaituna River but am told that it is a small river which widens into an estuary near its mouth and is strongly under tidal influence. Whitebaiters fishing near the mouth would tend to fish it on the incoming tide at which time the flow would be strongly or almost wholly saline. I could well imagine marine species entering or being carried into the estuary under those circumstances. The fact that no further specimens of *Nemamyxine* have been taken there suggests that it is not a coastal or shelf species.”

The mouth of the Kaituna River is at about 37° 46’ S, 176° 26’ E (Chart of Sediments, Bay of Plenty, prepared by the New Zealand Oceanographic Institute, Wellington, and published in 1979 by the Department of Scientific and Industrial Research). The chart shows a long narrow bar nearly blocking off the river mouth and extending close to Town Point, which forms the western boundary of the estuary; rocks are shown at the tip of the Point. Assuming that *N. elongata* lives on an entirely mud bottom (as many hagfishes do), the nearest shown is at least 14 miles distant at about 200 m. Patches of mud-sand occur about seven miles offshore, with constant mud-sand 11 miles off at 100 m; nearer shore the bottom is entirely sand. The nearest 800 m contour (the depth at which *N. kreffti* was taken) is about 27 miles distant, with mud-sand bottom. Thus, unless *N. elongata* lives among rocks at Town Point, or on sand only, or partly sand, it had migrated, or was transported by current, the considerable distance of at least seven miles from an even partly mud bottom.

e) Etymology

We are pleased to dedicate this new species to Dr. GERHARD KREFFT in honor of his many valuable contributions to oceanic ichthyology.

D. Acknowledgements

We thank Dr. GERHARD KREFFT for the loan of the specimen, and for his kindness in translating the Abstract into German.

Also, we are most pleased to have this manuscript included among those honors accorded to Dr. KREFFT on the occasion of his 70th birthday.

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