

PROCEEDINGS
OF THE
CALIFORNIA ACADEMY OF SCIENCES
FOURTH SERIES

Vol. XL, No. 15, pp. 439-447; 2 figs.

October 3, 1975

**HERALDIA NOCTURNA, A NEW GENUS AND
SPECIES OF PIPEFISH (FAMILY SYNGNATH-
IDAE) FROM EASTERN AUSTRALIA,
WITH COMMENTS ON *MAROUBRA
PERSERRATA* WHITLEY**

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ABSTRACT: *Heraldia nocturna* is described as a new genus and species in the fish family Syngnathidae. The type locality is Sydney Harbour in eastern Australia. The species occurs on rocky reefs and is nocturnally active. The male has a brood area on the belly that lacks pouch folds or plates; the new genus is related to the *Doryrhamphus* complex of spiny, belly-pouch pipefishes. Variation in another related Sydney area pipefish, *Maroubra perserrata*, previously known from a single specimen is described.

INTRODUCTION

In the course of a survey of the fishes of Sydney Harbour, a number of small pipefishes were collected that resembled *Doryrhamphus*, but differed in the trunk and tail ridges, brood pouch, and head ornamentation. The capture of specimens with quinaldine and hand net allowed aquarium observations on the habits of the new pipefishes.

Australia is richly endowed with pipefishes and seahorses; Munro (1958) lists 71 Australian species in the family Syngnathidae, including such distinctive forms as the endemic sea dragons *Phyllopteryx* and *Phycodurus*. Scuba collecting in both tropical and temperate waters is adding to the known fauna.

METHODS

Methods for making counts and measurements follow Herald (1940). The first trunk ring is twice as long as the other rings and although actually

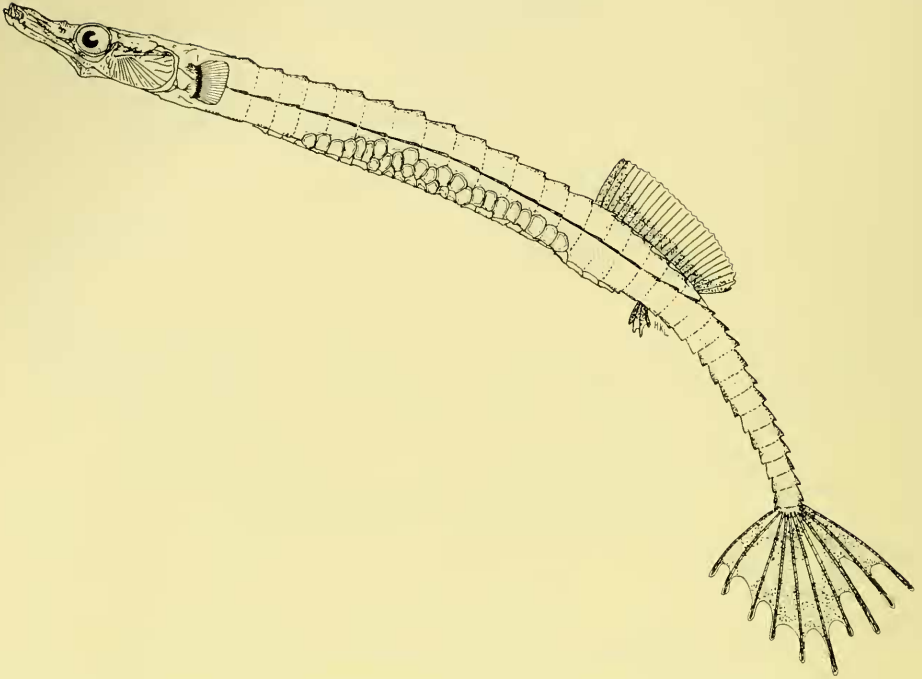


FIGURE 1. Holotype of *Heraldia nocturna*, AMS I.17328-001, 74.8 mm. SL.

double, is counted as a single ring (Herald and Randall, 1972). Four specimens were maintained in aquaria for varying periods up to two months. Observations on swimming behavior were made during light and dark periods. Abbreviations of measurements are as follows: SL—standard length; TL—total length; HL—head length.

Institutional abbreviations are as follows: AMS—Australian Museum, Sydney; BMNH—British Museum Natural History, London; BPBM—Bernice P. Bishop Museum, Honolulu; CAS—California Academy of Sciences, San Francisco; QM—Queensland Museum, Brisbane; WAM—Western Australian Museum, Perth.

ACKNOWLEDGMENTS

Rudi Kuitert, diver aquarist from Sydney, collected the majority of specimens of the new genus and species. His sure hand with the dipnet and knowledgeable observations are much appreciated. Clarrie Lawler, Barry Goldman, and Paul Zorn each collected a specimen. Helen Larson drew the figures and Bronwyn Wright typed the manuscript. C. E. Dawson and R. A. Fritzsche improved the paper with their critical comments.

Heraldia Paxton, new genus

DIAGNOSIS. Very stout, *Doryrhamphus*-like pipefish with abdominal brood area lacking lateral membranous folds or protecting plates. Lateral trunk ridge continuous with lateral tail ridge, which in turn becomes superior tail ridge; inferior trunk and tail ridges continuous and superior trunk ridge ending free on 1st, 2nd, or 3rd tail ring. Snout without spines in either sex; head intricately sculptured; body ridges pronounced—those of first 2–4 trunk rings with rounded edges but thereafter with points at posterior edge of each ring. Base of dorsal fin very dark; caudal fin large and deeply emarginate with individual rays extending beyond web. Trunk rings 16–17; tail rings 13–15; dorsal rays 23–26 located on $5\frac{1}{2}$ –7 rings, of which $3\frac{1}{2}$ – $4\frac{3}{4}$ are trunk rings and 2–3 are tail rings. Pectoral rays 19–22; anal 4; caudal 10–11. Maximum length 74.8 mm SL, 84.2 mm TL.

Heraldia is related to the other pipefish genera with an abdominal brood area and small spines on the posterior ends of the body ring ridges. *Heraldia* differs from *Doryrhamphus* and *Dentirostrum* in lacking brood pouch flaps, from *Dunckerocampus* in its shorter snout and fewer tail rings, and from *Oostethus* and *Maroubra* in having the dorsal fin mostly on the trunk.

The type species of *Heraldia*, *H. nocturna*, is new and the only known member of the genus. The first two specimens were sent to Dr. Earl Herald, who recognized them as a new genus and provided a brief description and diagnosis before his untimely death. His help and encouragement are gratefully acknowledged. *Heraldia* is named in honor of Earl Stannard Herald, whose contributions to syngnathid systematics and help to other ichthyologists were considerable.

Heraldia nocturna Paxton, new species.

(Figures 1–2).

MATERIAL EXAMINED. All 14 type specimens were collected with scuba from rocky reefs at depths from 2–15 meters in Sydney Harbour, New South Wales, Australia ($33^{\circ} 50'S.$, $151^{\circ} 15'E.$), or Seal Rocks, N.S.W. about 190 kilometers northeast of Sydney ($32^{\circ} 25'S.$, $152^{\circ} 35'E.$).

HOLOTYPE. AMS I.17328–001, male, 74.8 mm. SL (84.2 mm. TL), Village Point, Watson's Bay, Sydney Harbour, Australia, 3 m., quinaldine, R. Kuiter, 8 September 1973.

PARATYPES. AMS I.17328–002, female?, 69.5 mm. SL, collected with the holotype; AMS I.16516–001, 64.0 mm. SL, Green Point, Sydney Harbour, 15 m., rotenone, B. Goldman, 23 Sept. 1972; AMS I.17033–008, 67.6 mm. SL, off Store Beach, Sydney Harbour, 1–7 m., rotenone, G. Allen, D. Hoese, J. Paxton, D. Pollard, 6 April 1972; AMS I.17112–003, 60.6 mm. SL, Seal Rocks, 10 m., quinaldine, R. Kuiter, 29 April 1973; AMS I.17641–001, 65.5

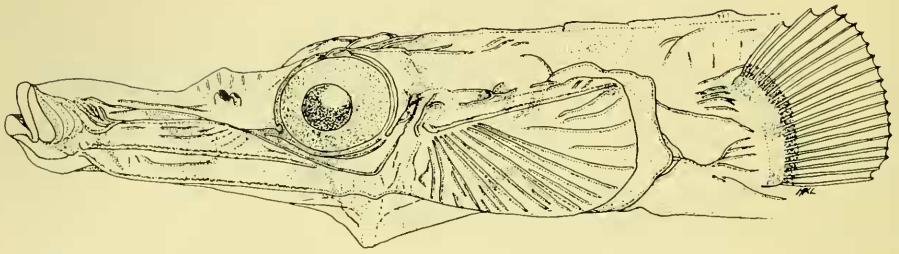


FIGURE 2. Head of holotype of *Heraldia nocturna*.

mm. SL, Seal Rocks, 10 m., quinaldine, R. Kuitert, 5 May 1973; AMS I. 17642-001, 40.6 mm. SL, Green Point, Sydney Harbour, 2 m., quinaldine, R. Kuitert, 31 Dec. 1973; AMS I.18075-001, 33.4 mm. SL, Watson's Bay, Sydney Harbour, 5 m., quinaldine, P. Zorn, 3 Nov. 1974; BMNH 1975. 2.19.1, 60.9 mm. SL, Parsley Bay, Sydney Harbour, quinaldine, R. Kuitert, 26 Dec. 1973; BPBM 18034, 66.5 mm. SL, Seal Rocks, 12 m., quinaldine, R. Kuitert, 27 Oct. 1974; CAS 32366, 66.4 mm. SL, Camp Cove, Sydney Harbour, 5 m., hand net, C. Lawler, 13 April 1969; CAS 32367, male, 62.7 mm. SL, Green Point, Sydney Harbour, quinaldine, R. Kuitert, 10 Aug. 1974; QM I.12920, 47.8 mm. SL, Camp Cove, Sydney Harbour, 15 m., quinaldine, R. Kuitert, 6 Jan. 1974; WAM P.25167-001, 61.0 mm. SL, Watson's Bay, Sydney Harbour, quinaldine, R. Kuitert, 3 Aug. 1974.

DIAGNOSIS. Counts and characteristics as given under *Heraldia* above; total rings 30-32; total rings plus dorsal fin rays 54-57; head in standard length 4.9-5.5; snout in head 2.3-2.7; dorsal fin base in head 1.4-1.6.

DESCRIPTION. The measurements of the holotype (74.8 mm. SL) in mm. are followed in parentheses by the range as percent SL for the 16 types. Head length 13.7 mm. (18.2-20.4%), snout length 5.8 mm. (5.9-8.7%), eye diameter 2.9 mm. (3.7-4.0%), dorsal fin base length 8.8 mm. (11.8-13.8%), pectoral fin length 2.8 mm. (3.4-4.4%), anal fin length 2.8 mm. (3.0-5.7%), caudal fin length 10.6 mm. (12.2-17.6%).

The head has a remarkable scrollwork of tiny ridges, some of which are not a part of the typical pipefish head ridge pattern; the ridges vary in number and development with individual specimens. The median snout ridge is without spines and is elevated slightly at the nostril area in front of the eyes; between the eyes it divides into two ridges, and is paralleled by at least four additional smaller ridges. The sides of the snout have a series of parallel ridges, two of which are more pronounced, those on the lateral median and on the lateral inferior surface. The supraorbital crest extends backward to the end of the eye, then divides into a series of radiating ridges. The principal opercular ridge extends diagonally completely across the upper portion of the opercle; radiating outward from it are 2-12 small ridges on the upper side

and 13–18 on the lower side. The supraopercular ridge has two sections, each with smaller radiating ridges present or absent. The prenuchal, nuchal, and occipital ridges are present but only slightly elevated. The pectoral cover plate has two ridges in upper and lower positions; the upper has several smaller ridges running parallel above it and the lower ridge has conspicuous ridges branching off the axis.

The brood area of the only male carrying eggs extends from the second to the penultimate (16th) trunk ring. The eggs are embedded in a gelatinous matrix; no lateral skin folds or protective plates are present and the matrix either dissolves or is absorbed shortly after the larvae are hatched. No other external sexual dimorphism is evident.

The anal and caudal fins are quite large, the latter measuring 10.6 mm. in length on the holotype; this is equivalent to a width of more than 5 trunk rings. The caudal rays number 10 in the holotype and 11 in all paratypes. There is no indication of regenerated rays.

The predominant color of the freshly killed male holotype was yellow-brown. The head is yellow-green with reddish brown blotches present on the snout, under and behind the eyes, and on the opercle. The pectoral fins are clear with a dark brown base. All of the body ridges are dark brown, anteriorly appearing as narrow dashed lines and posteriorly as wider solid lines. The base of the dorsal fin is dark reddish brown, as are the first 2 rays; the dark pigment decreases in extent in a descending line on the sixth ray. The basal third of the middle 14 rays are light yellow-green, the outer two-thirds are clear; the posterior 2 rays are dark brown. The basal two-thirds of the anal is brown tinged with red; the distal one-third of the anal is yellow-green. The caudal is reddish brown with yellow-green basal blotches; the tips of the caudal rays are white. Three yellow blotches are present on the ventral surface of the tail rings between the anal and caudal, each blotch covering one to two rings. Three less pronounced light blotches are present on the ventral surface of the trunk rings. In preserved specimens the basic body color varies from light yellow-brown to darker brown and the ventral light areas are white.

BIOLOGY. Two males carrying eggs were collected in September and October. A few hours after the holotype was placed in an aquarium, many of the eggs hatched. After formalin preservation, the remaining developing larvae fell from the egg sockets. The gelatinous matrix forming the sockets was firm and covered slightly less than half of each of the developing eggs. Sockets were present on the ventral surface of trunk rings 2–16 and extended onto the inferior lateral surfaces of rings 4–13; 173 sockets were present. The second egg-bearing male was collected on 10 September 1974 and placed in an aquarium; by 23 September all eggs had hatched or been lost and the male was preserved on 30 September. By this time almost all remnants of the

matrix had dissolved or been absorbed; only a few dark areas representing the edges of the sockets remained. No other sexually dimorphic character was evident and none of the remaining specimens were sexed. However, the holotype was collected under a rocky ledge with one other individual, possibly a female. Two of the Seal Rocks specimens were taken one week apart at the back of the same rocky hole and may represent a male and female. All other specimens were taken singly.

Newly hatched larvae measured 5–6 mm. TL and had fin folds but no fin rays present. The head was bent at an angle to the body, in this regard resembling a seahorse. The color was bright yellow-green with a few scattered melanophores. A bright silver and gold reflecting layer prominently surrounded the lens of the eye. All of the unhatched eggs appeared in much the same state of development, with the colors visible through the transparent egg case.

All of the Sydney Harbour specimens were taken in the outer harbor within 1.5 kilometers of the entrance, where the environment is similar enough to the open coast to support large brown kelp. Seal Rocks is on the open coast. The absence of this species from earlier collections is probably due to lack of scuba collecting from rocky regions in other areas. All specimens were collected in rocky areas—under rocky ledges, in crevices, holes, or small caves. Unlike many pipefishes, *H. nocturna* does not necessarily live in association with vegetation, as there was none at a number of collection sites (R. Kuitert, pers. comm.).

Four individuals were maintained in aquaria for periods of from one week to two months. During the day the pipefish remained in a small rock cave, swimming near the under surface of the overhanging rock in an upside down position. Only after some weeks in the aquarium would an individual leave the cave during periods of light and swim around the aquarium. During these brief forays, the fish righted itself and swam in a horizontal position close to the bottom, but did not come to rest. During most of this swimming, the tail was slightly bent in the region of tail rings 10–12. The large caudal was usually kept open and only rarely closed halfway like a fan, giving a propulsive burst forward. The fish swam equally well backward and forward and most of the propulsion appeared to be from the pectoral fins. At night the pipefish swam freely to all corners of the aquarium in a normal horizontal posture. When the lights were turned on the fish swam to the cave and resumed the diurnal upside down swimming. After five minutes of darkness, swimming about the bottom of the tank was resumed. Aquarium behavior indicates *Heraldia nocturna* is nocturnally active, residing in protected rocky areas during the day. *Doryrhamphus melanoptera* from the Gulf of California exhibits the same type of upside down swimming behavior (R. Fritzsche, pers. comm.).

NAME. The specific name of *Heraldia nocturna* is in reference to the nocturnal activity of the species. The diurnal swimming posture suggests the common name 'Upside down pipefish.'

RELATIONSHIPS. The genera *Heraldia*, *Doryrhamphus*, *Dunckerocampus*, *Dentirostrum*, *Oostethus*, and *Maroubra* appear to constitute a related group of pipefishes. All have abdominal brood areas, body ridges with spines, and the first body ring much longer than those remaining. The possible relationships of *Maroubra* are discussed in the next section. *Heraldia*, with a stout body and trunk rings more numerous than tail rings, appears most closely related to *Doryrhamphus*. The relationship between *Doryrhamphus* with brood pouch folds and *Heraldia* without folds is similar to that of another pair of related belly-pouch genera, *Dentirostrum* which has folds, and *Dunckerocampus* which lacks them.

Heraldia nocturna has several characteristics that are rarely or never found in other pipefishes. For example, the basal color pattern in the dorsal fin is unique among syngnathids. The anal fin is relatively larger than that of other species. Highly emarginate caudal fin rays are known in few pipefishes, *Dorichthys retzi* of the tropical Indo-Pacific and juveniles of *Oostethus* being examples. The magnificently sculptured head of *Heraldia* is without equal in the pipefish world.

Maroubra perserrata Whitley, 1948.

Whitley (1948) described *Maroubra perserrata* as a new genus and species of pipefish from a single specimen collected from Maroubra Beach near Sydney by McCulloch in 1912. Eight specimens of this species were taken in August and November, 1974 from outer Sydney Harbour at depths from 3 to 20 m. in rocky areas. As the species previously was known only from the holotype, it is redescribed below; counts and measurements of the holotype (AMS I.12659) are followed in parentheses by ranges of the 8 new specimens, 4 males and 4 females, 46.1–72.9 mm. SL.

Slender pipefish with abdominal brood area lacking lateral membranous folds or protective plates; small cutaneous fold extending from midventral ridge of trunk rings in males only. Lateral trunk ridge continuous with lateral tail ridge, which in turn becomes superior tail ridge; inferior trunk and tail ridges continuous and superior trunk ridge ending free on 4th or 5th tail ring. Snout ridge without spines; small spine at anterior border of orbit. Body ridges pronounced, with points at posterior edge of each ring. Small caudal fin slightly emarginate, darkly pigmented on ventral half; other fins clear. Trunk rings 17(16); tail rings 26(24–27); dorsal rays 24(21–25), located on $5\frac{1}{4}$ ($5-5\frac{1}{2}$) total rings, of which $\frac{1}{4}$ ($0-\frac{3}{4}$) are trunk rings and $5(4\frac{1}{4}-5\frac{1}{2})$ are tail rings. Pectoral rays 18(15–18); anal 4(4); caudal 10(9–10).

Total rings 43(40-43); total rings plus dorsal fin rays 67(61-68); head in standard length 6.9(6.7-7.6); snout in head 2.0(1.9-2.1); dorsal fin base in head 1.6(1.4-1.7). The median snout ridge is elevated in front of the eyes; posteriorly it divides into two short, low ridges. Secondary head ridges are present, but not as well developed as those in *Heraldia*. The main opercular ridge extends completely across the opercle and curves dorsally posteriad. Smaller ridges radiate ventrally from the main ridge, but none are present dorsally.

In four males a small cutaneous fold is present on the midventral ridge of all trunk rings. Egg-carrying males were collected in August and November, but no eggs remained after preservation. No gelatinous matrix was present in either specimen and the way in which the low midventral skin fold protects the eggs is not clear; no lateral folds or protective plates are present. The well developed midventral ridge must separate the eggs into two groups.

In preserved specimens the reddish brown color markings of the males are slightly more pronounced than those of the females, particularly on the head. A dark stripe is present on the side of the snout from the tip to the eye and stripes and bands are present on the anterior trunk rings dorsally and laterally, while the remaining rings are evenly pigmented. One male that had been carrying eggs is much more darkly pigmented laterally with white spots in the dark pigment.

The genus *Maroubra* appears to be related to the doryrhamphine pipefishes, with an abdominal brood area, well defined body rings with posterior points, and an elongate first trunk ring. The peculiar brood area with a midventral fold is a distinguishing feature, while the small caudal fin and posteriorly placed dorsal are not found in most of the related genera. The slender shape and large number of tail rings distinguish *Maroubra* from *Doryrhamphus* and *Heraldia*.

While comparing *Heraldia* and *Maroubra* with other pipefishes in the AMS collections, the holotypes of *Chocroichthys suillus* Whitley (1951) from Port Denison, Queensland, and *Chocroichthys suillus malus* Whitley (1954) from Masthead Island, Queensland were examined. The latter has all the characteristics of *Doryrhamphus*, and the presence of two dark stripes behind each eye indicates that *C. s. malus* is a synonym of *D. negrosensis* Herre. The holotype of *C. suillus* is a male with protective plates extending ventrally from the trunk rings; this feature, plus the lack of a lateral tail ridge, is diagnostic for the genus *Chocroichthys*.

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