

## A new species of *Neamia* (Perciformes: Apogonidae) from the West Pacific Ocean

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### Abstract

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A new species of apogonid fish, *Neamia articycla*, is described from Australia, Indonesia, Philippines and Fiji, bringing the total number of described *Neamia* spp to three. It is distinguished from *Neamia notula* in preservation by: a circular, ocellated dark spot rather than one that is oval-shaped and flattened along its anterior margin, with an outer, narrow darkish edge clockwise dorsally from abutting edge of preopercle around to meeting ventral abutting edge of preopercle, a faint, narrow, horizontal line of melanophores below the eye reaching the preopercle ridge; in life no darkish marks behind the eyes, a circular spot with pale outer band without dark edging instead of an oval spot flattened along preopercle edge with a darkish edge; five predorsal scales instead of four; usually 22 pored, lateral-line scales instead of 23 and a longer pectoral fin. *Neamia articycla* can be distinguished from *Neamia octospina* by having 14 pectoral rays instead of 17–21 and by having seven visible first-dorsal spines instead of eight.

### Keywords

Apogonidae, *Neamia articycla*, *Neamia notula*, cardinalfish, new species *Apogonichthys*, *Foa*, *Fowleria*.

### Introduction

Ichthyologists collecting from poorly sampled habitats in depths of 10–40 m continue to find new species of cardinalfish. We describe here a new *Neamia* which is associated with *Halimeda* beds growing in deeper coral reef systems of the western Pacific Ocean. The new species represents the third known species in this clade. There may be other material in museums identified as *Fowleria* because of the similar physiognomy. *Neamia* spp can be distinguished from similar *Fowleria* species by the following characters: fused hypurals in the caudal-fin skeleton, completely pored lateral-line scales in adults (versus partially pored and then pitted, except one undescribed species of *Fowleria*), cycloid scales on the head and anterior portions of the body (weakly ctenoid scales on the nape for species of *Fowleria*, elsewhere on the head, weak to strongly ctenoid scales and ctenoid on entire body).

Methods for counts and measurements were described in detail by Fraser and Lachner, 1985. All measurements are in mm to the nearest 0.1. Percentages are of standard length. Institutional acronyms follow Eschmeyer, 1998 and Leviton et al., 1985. Field station numbers are listed for additional collection information, for example, VGS 69–23. Radiographs (X-rays) have been taken from type material. A camera lucida attachment on a Wild microscope and a needle blowing air were used to make the diagrammatic drawings of the pores. The description of pores refers to larger and to smaller

perforations (referred to as minipores) of the skin over the canal systems of the head. The latter are sometimes obscured by congealed mucous.

*Neamia* Smith and Radcliffe in Radcliffe, 1912

*Type species. Neamia octospina* Smith and Radcliffe in Radcliffe, 1912.

*Diagnosis.* An apogonine with 3 hypurals, 1 and 2 fused, 3 and 4 fused, 5 free, hypurals 3+4 fused to urostylar centrum; 1 pair of reduced or slender uroneurals; 3 epurals; 3 supraneurals; 2 supernumerary dorsal-fin spines; smooth preopercle edges and ridge, smooth post-temporal; no basisphenoid; a reduced, tiny supramaxilla; no palatine teeth; scales on cheek and opercle cycloid; lateral-line scales extending from post-temporal to base of caudal fin, all ctenoid with simple pores; rounded caudal fin; 9 dorsal-fin spines, 8th spine visible or hidden by skin, dorsal fin deeply notched and considered separate, the 9th spine at beginning of 2nd dorsal fin; dorsal-fin rays 9; anal-fin rays 8; pectoral-fin rays 13–21; pale stomach, intestine and peritoneum.

*Neamia articycla* sp. nov.

Figures 1–4

*Holotype.* AMS I.25121-005; 1, 35.5; Australia, Great Barrier Reef, Qld, 14°41'S, 145°30'E, east of Lizard I.; 31 Jan 1982; 36–38 m, J. Leis.

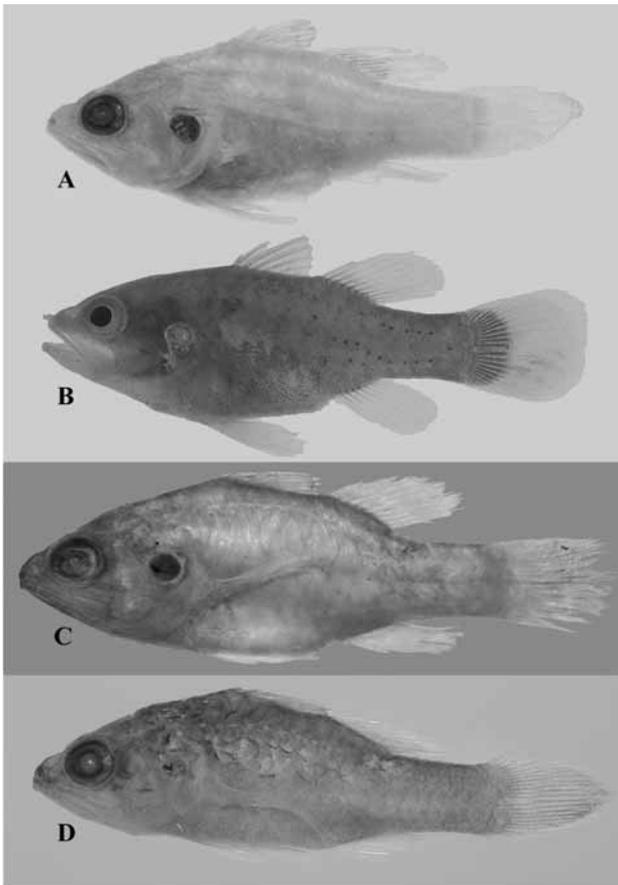


Figure 1. *Neamia articycla*: A. Holotype, AMS I.251221-005, 35.5 mm SL (preserved), Australia, Qld, east of Lizard I. B. Paratype, USNM 370291, 23.5, mm SL, Philippines, Mindanao I., modified from colour image of a fresh specimen by J. T. Williams. C. Paratype, USNM 209665, 32.4 mm SL (preserved), Indonesia, Moluccas, Ceram I. D. Paratype CAS 223500, 32.9 mm SL (preserved), Fiji, Viti Levu, Nanani-i-cake I.

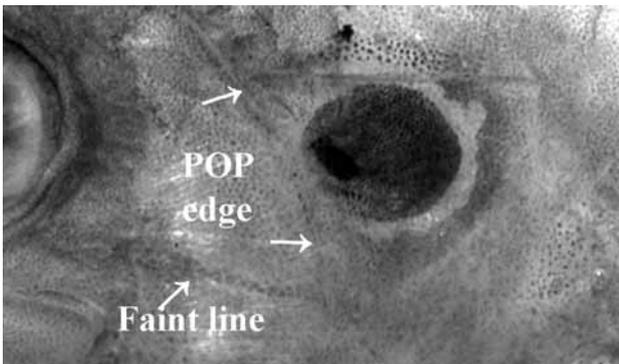


Figure 3. Post-ocular melanophore patterns on the cheek (faint line) and circular spot with pale interval and outer edging of melanophores starting along posterior edge of preopercle (POP). USNM 209665 paratype, 32.4 mm SL (preserved).

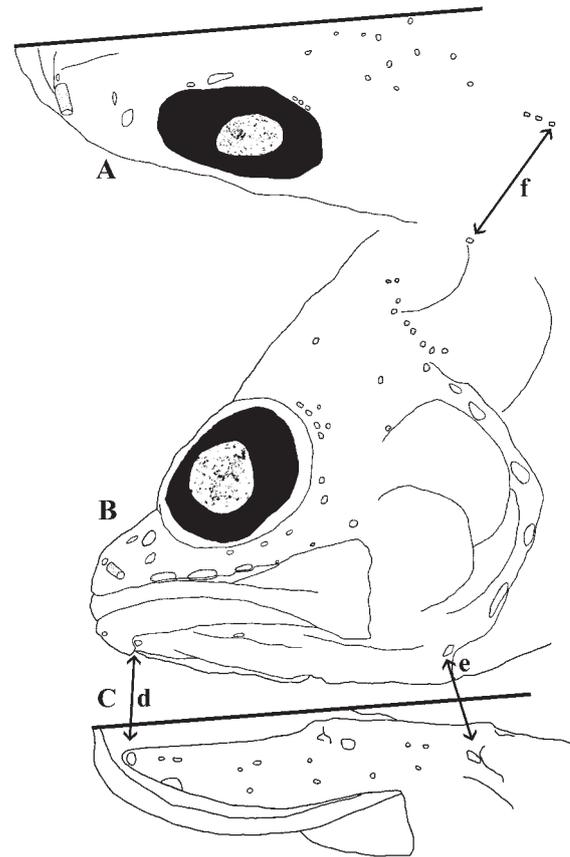


Figure 2. Cephalic lateral system of pores on the head of the holotype, *Neamia articycla*. A. Dorsal view. B. Lateral view slightly tilted. C. Ventral view of dentary-articular. d. ventral mandibular pore. e. posterior articular pore. f. post-temporal pore.

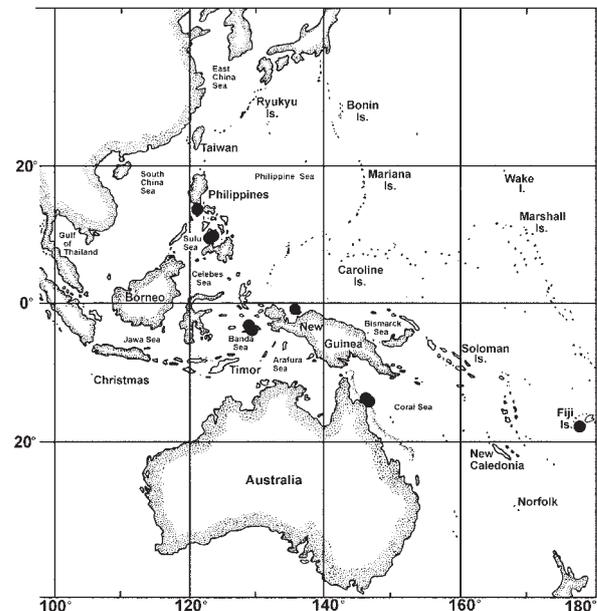


Figure 4. Distribution of the collections sites for *Neamia articycla*.

*Paratypes.* Pacific Ocean: Indonesia: USNM 209665; 8, 14.2–32.3; Ceram, Piru Bay; VGS 73–6; 10 Jan 1973; 8 m. USNM 209929; 5, 22.5–27.7; Saparua; VGS 73–14; 18 Jan 1973; 9 m; X-ray. Fiji: CAS 223500; 1, 32.9; 17°19.462'S, 178°14.250'E, Nananui-i-cake I., Viti Levu; G02-76; 15 Mar 2002; 1–3 m, colour transparency. Australia, Qld: AMS I.40665-004; 1, 34.3; & AMS I.40665-005; 1, 17.0; 14°38.20'S, 145°32.30'E, between Lizard I. & Yonge Reef, Great Barrier Reef; 26 Jan 2001; 27 m. AMS I.40666-012; 1, 31.1 & AMS I.40666-013; 1, 19.0; 14°38.16'S, 145°32.16'E, between Lizard I. & outer barrier reef, Great Barrier Reef; 29 Jan 2001; 25 m, colour digital photos. Philippines: USNM 370291; 1, 23.5; 13°10.04'N, 120°35'12'E, Mindanao I.; Min00-62; 3 Jun 2000; 30 m; X-ray, colour digital photos.

*Non-type material.* Indonesia: USNM 209847; 3, 10.0-20.4; Ceram, Piru Bay; VGS 73-5; 9 Jan 1973; 5–7 m, WAM P.32771-002; 23.4; 01°36.252'S, 135°24.553'E, Tanjung Woka, Yapen I., Papua, Indonesia; 13 Feb 2006; 34 m. Philippines: USNM 369983; 2, 18.0-27.4; 13°45'N, 120°55'E, Anilao, Batangas; 26 Apr 1980; 22 m. USNM 268318; 1, 32.6; 9°04'38'N, 123°16'44'E, Apo I.; SP78-36; 7 Jun 1978; 39 m.

*Other material.* *Fowleria* sp. AMS I.23585-001; 1, 45.0; 14°34'S, 145°34'E, south-west of Carter Reef, Great Barrier Reef, Australia; 31 Jan 1982; 30 m, J. Leis. *Apogonichthys nafa* Holotype, USNM 62947; 22.1; Japan, Okinawa, Naha.

*Diagnosis.* A species of *Neamia* with 7 visible first-dorsal spines, 8th spine hidden by skin, darkish circular spot on the opercle below opercular spine within a pale area; in life, body uniformly reddish to brownish, all fins pale, 13–14 pectoral rays, 5 predorsal scales, eye diameter 10–12%, pectoral fin 25–31% and body depth 37–40% of standard length.

*Description.* For general body shape see fig. 1a–d. Holotype proportions and characteristics first with range of values in parentheses for paratypes and other material. Proportions as % of standard length: greatest body depth 37.4 (34–40); head length 44.6 (41–46); eye diameter 10.0 (11–12); snout length 8.3 (8–10); bony interorbital width 3.7 (4–6); upper jaw length 20.3 (20–22); caudal peduncle depth 15.7 (15–17); caudal peduncle length 20.9 (19–22); 1st dorsal-fin spine length 1.7 (2–4); 2nd dorsal-fin spine length 6.6 (6–10); 3rd dorsal-fin spine length 16.9 (16–21); 4th dorsal-fin spine length 16.0 (16–19); spine in 2nd dorsal fin 9.7 (9–12); 1st anal-fin spine length 2.0 (2–5); 2nd anal-fin spine length 10.0 (8–12); pectoral fin length 28.9 (25–31); pelvic fin length 25.7 (24–30).

Dorsal fin VII(I)-I,9, 8th spine hidden under skin, 3rd and 4th spines about the same thickness; anal fin II,8; pectoral fin 14; pelvic fin I,5; principal caudal rays 9+8; caudal fin rounded; pored lateral-line scales 22 (11–12 for specimens 17–20 mm SL, 18 for specimens 20–24 mm SL, 22–23 in specimens greater than 26 mm SL); transverse scale rows above lateral line 2; transverse scale rows below lateral line 6; median predorsal scales 5; circumpeduncular scale rows 12 (5+2+5). Total rudiments and gill rakers 15 (13–15), 2+1-5+7 (1-2+1-5-6+5-7), well developed gill rakers 6 (6–7), upper arch 1(1), lower arch 5 (5–6). Rudiments on lower arch as flattened tooth patches. 2nd arch with 1 short, nob-like raker in angle, upper arch with 1–2 flattened tooth patches, lower arch with 5–6 nob-like rakers followed by flattened tooth patches.

Villiform teeth in a band of about 5 rows becoming 2–3 rows on side of premaxilla; villiform band of about 5 rows becoming 2–3 rows on side of dentary; 3–4 rows of villiform

teeth on vomer; none on palatine, ectopterygoid, endopterygoid or basihyal.

Vertebrae 10+14. 3 hypurals 1+2 fused, 3+4 fused to urostyle centrum, 1 pair uroneurals, 2 large epurals (a 3rd epural could not be identified from the radiograph), a free parhypural. 3 supraneurals, 2 supernumerary spines on 1st dorsal pterygiophore, 8th dorsal-fin spine hidden as a nubbin. Basisphenoid status unknown, lower portion apparently absent, but unclear on X-ray. Status of suspensory pharyngeal unknown. Supramaxilla present. Posttemporal smooth on posterior margin. Preopercle smooth on vertical and horizontal margins. Infraorbital edges smooth.

Cephalic pored sensory system (fig. 2) – all larger pores bilateral. No variation for the following pores: 2 nasal pores at anterior end of supraorbital canal system, 1 medial to tubular anterior nare, 1 slightly anterior and medial to posterior nare, 1 near edge of orbit on interorbital; 4 infraorbital pores at anterior part of infraorbital canal, 1 between ventral edge of lachrymal and flat posterior nare, 2 on ventral edge of lachrymal, 1 on ventral edge of 2nd infraorbital; dentary with 3 pores at anterior end of mandibular canal, 1 on tip of lip, 1 behind lip, and 1 lateral; 7 articulo-preopercular pores near posterior edge along the preopercular canal. Variation in number and location of minipores: supraorbital with none or 1 pore near edge of orbit on interorbital area; paired pores along upper and lower portions of infraorbitals below orbit; dentary and articular with 4 pairs (inner and outer) of posterior pores, with several unpaired pores on dentary and articular; preopercular minipores along narrow upper portion of preopercle. Minipores variably present posterior to eye on upper portion of infraorbitals, on nape and above preopercle ending on the post-temporal.

All scales cycloid on head, nape and breast. Scales becoming ctenoid above breast and behind pelvic fin. Scales above lateral line ctenoid. All lateral-line scales ctenoid, except first. Pored lateral-line scales simple (with 1 opening above and below main pore), extending from post-temporal to base of caudal fin.

*Life colours.* Colours based on photographs are from fresh dead specimens shortly after collection. From B. M. Carson-Ewart photograph (AMS I.40666-012) – body, pelvic, caudal and dorsal fins orangish red, flank grading to white on abdomen; head without marks extending from orbit edge, lips whitish; circular spot on opercle yellowish with faint outer margin of melanophores dorsally, large inner circle of dark melanophores about size of pupil; iris whitish with narrow inner ring of light yellow surrounding pupil.

From B. M. Carson-Ewart photograph (AMS I.40666-013) – body and caudal fins a pale orangish red to more yellowish posteriorly, with brownish marks in caudal fin, flank grading to white on abdomen; head without marks extending from orbit edge, lips whitish; circular spot on opercle yellowish with outer margin ring (~270°) of melanophores except posteriorly, large inner circle of dark melanophores about size of pupil; iris whitish with narrow inner ring of light yellow surrounding pupil.

From D. W. Greenfield photograph (CAS 223500) – body and caudal fin dark brownish, head without markings extending

from orbit edge, lower half of head and breast tannish white extending posteriorly to opercular spot and then above pectoral-fin base descending to near anal base; pelvic fins whitish; spot on opercle whitish tan with inner darkish ring smaller than eye diameter; iris tannish white with narrow inner ring of light yellow surrounding pupil.

From J. T. Williams' photograph (USNM 370291) – body generally uniform brownish, with 2 rows of small spots along caudal peduncle, about 5 pairs, 3 spots extended anteriorly in the lower row with 2 spots below the 3 spots; head without markings extending from orbit edge; all fins generally pale with numerous small melanophores in caudal fin; round spot on opercle with complete brownish outer edge of body colour around pale area with large dark inner spot; narrow whitish bars on lower lip; iris orangish.

*Colour in ethyl alcohol.* Holotype uniform light tannish in alcohol with tiny melanophores on head, body, both dorsal fins, denser on membranes of 2nd dorsal fin, melanophores absent on anal, pelvic and pectoral fins; large rounded dark spot on opercle, surrounded by pale area, melanophores at edge of pale zone forming about a half-circle; faint series of melanophores in a horizontal line from lower orbit to preopercular ridge (fig. 3). Pale stomach, intestine and peritoneum. Paratypes and non-type material uniform brownish to tannish in alcohol with tiny melanophores on head, body, both dorsal fins, denser on membranes of 2nd dorsal fin, melanophores absent on anal, pelvic and pectoral fins; large rounded dark spot on opercle, surrounded by pale area, melanophores at edge of pale zone forming about a half-circle; faint, darkish, horizontal line of melanophores from lower orbit to preopercular ridge; lips with a few narrow pale bars or lips indistinct.

*Etymology.* The Greek words *artios*, complete or perfect and *cyclus*, circle as *articycla* an adjective referring to the dark spot on the opercle with its edge as a complete or perfect circle.

*Distribution.* The new species is apparently widespread in the western Pacific from Sumatra to Fiji, and eastern Australia north to the Philippines (fig. 4). Although it has been collected at relatively few locations, future collections will no doubt expand the known distribution. Due to their cryptic habits, the species of *Neamia* are seldom observed by divers, rather they are collected with ichthyocides, dredges and sleds. Collection data suggest *N. articycla* frequents the 10–40 m depth zone, in association with beds of a calcareous algae, *Halimeda* or calcareous rubble, sometimes mixed with the pocilloporid coral *Seriatopora hystrix*. The URL <http://www.amonline.net.au/fishes/about/research/halimeda.htm> has more information about other fishes collected in such *Halimeda* beds and a link to colour photographs of this species.

*Remarks and discussion.* *Neamia articycla* has an ocellated opercular spot that in life lacks an outer dark margin posteriorly, but in preservation has a darkish edge from dorsal edge abutting preopercle around to ventral edge abutting preopercle. It has no darkish marks behind the eyes in life, but in preservation does have a faint, narrow, horizontal line of melanophores below the eye reaching the preopercle ridge. In contrast, *N. notula* has an oval spot flattened along the preopercle edge with a darkish

edge outside of the pale area in life, four predorsal scales instead of five, usually 22 pored, lateral-line scales instead of 23 and a longer pectoral fin. *Neamia articycla* can be distinguished from *Neamia octospina* by having 14 pectoral rays instead of 17–21 and by having seven visible first-dorsal spines instead of eight.

Fraser and Allen, 2001 discussed the relationships of *Neamia* with other apogonid genera. *Neamia articycla* does not have characters that alter that discussion. *Neamia articycla* is more similar to *N. notula* based on the presence of the opercle spot, the reduced, hidden, eighth dorsal spine, larger eye and the lower pectoral fin-ray count than to *N. octospina*. Specimens of *N. articycla* less than about 25 mm SL have incompletely pored lateral-line scales (the number of pored scales varies with size) and may therefore be confused with *Fowleria*, most species of which have an incomplete lateral line – see the figure of *Fowleria nafaе*, Snyder, 1909 in Snyder, 1912 one of the nominal species originally described as *Apogonichthys nafaе*.

Some similarities exist between *N. articycla* and species of *Fowleria*. The ocellus-like opercular spot, tubular anterior nare, lack of palatine teeth and body shape are characteristics *N. articycla* shares with most species of *Fowleria*. However, these genera can be distinguished by fused caudal skeletal characteristics in *Neamia*, completely pored lateral-line scales in adult *Neamia*, (number of pitted scales in *N. articycla* decreases posteriorly with growth, unlike *Fowleria*), and cycloid scales on the head and anterior portions of the body (weakly ctenoid scales on nape for species of *Fowleria*, elsewhere on head weak to strongly ctenoid scales and ctenoid on body). Bergmann, 2004 noted some variation in the pore pattern on the dentaries for the four species of *Fowleria* examined. None appeared to be similar to *N. articycla* in spatial organization, with *F. vaiulae* perhaps having a few of its slightly larger minipores spaced and located in a similar fashion.

Ida and Moyer, 1974, fig. 3 compared the cephalic lateralis and free neuromasts of five genera of cardinalfishes (including three subgenera), *Apogon (Ostorhinchus)*, *Apogon (Apogon)*, *Fowleria*, *Cheilodipterus*, *Rhabdamia (Verulux)*, and *Pseudamia*. Bergmann, 2004 provided a more extensive survey of these systems for these same genera and another 30 apogonid genera and subgenera in two subfamilies. Species of *Neamia* differ most obviously from illustrations of *Fowleria*, *Foa*, and *Apogonichthys* in having fewer pores on the dentary. A comparison of the descriptions of *Neamia* suggest that *N. octospina* and the holotype of *N. articycla* show similarities in the three slit-like pores along the ventral edge of the lachrymal (first infraorbital) and second infraorbital, three suborbital pores and the paired dentary pores. Differences were apparent: location of the anterior-most supraorbital pore back near the anterior nare in *N. articycla*, slit-like in *N. octospina* located along the margin with the premaxilla; larger pores along the posterior edge of the subopercle-preopercle in *N. articycla* than for *N. octospina*, and no mini-pores just posterior to the preopercle ridge in *N. articycla* versus numerous minipores; few paired pores on the dentary and articular in *N. articycla* versus numerous paired pores; no minipores in *N. articycla* versus many minipores on snout and interorbit; and fewer minipores on the nape in *N. articycla* versus widespread and numerous.

Ida and Moyer, 1974 failed to indicate the taxonomic value of pore characteristics, although their fig. 3 was suggestive. Bergmann, 2004 found four characteristics of the cephalic lateralis which were shared by all cardinalfishes examined. *Neamia articycla* has these four characteristics: a terminal lachrymal pore, a pair of ventral lachrymal pores, an anterior dentary pore in the lower lip and a mental (ventral dentary pore) immediately behind the lower lip. Bergmann, 2004 identified eight characteristics that had variation, and proposed that these various states had phylogenetic value within cardinalfishes. *Neamia articycla* has: (1) the terminal end of the supra-orbital canal ending in a large pore near anterior nare; (2) the lateral margin of the supra-orbital canal near the posterior nare with a single large pore; (3) the lateral margin of the supra-orbital canal midway on interorbit with a large pore, but also with an additional smaller anterior pore (variably present) apparently intermediate to having multiple canal projections; (4) the postorbit pores with simple canal projections with minipores; (5) the supratemporal canal anterior margin smooth; (6) the supratemporal canal posterior margin with few canal projections with minipores; (7) the lateral margin of the mandibular canal with relatively large and simple pores; and (8) a terminal mandibular pore (here called the posterior articular pore) near the boundary with the preopercle. The usefulness of these eight characteristics and their character states will be further developed through examination of many species not yet reported in the literature. Many of the other minipores had some variation in number and location among individuals of *N. articycla*.

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Greenfield, J. M. Leis (taken by B. M. Carson-Ewart) and J. T. Williams provided colour images of the new species. Useful comments were provided by D. W. Greenfield, J. M. Leis and an anonymous reviewer.

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