

A Review of Congrid Eels of the Genus *Ariosoma* from Taiwan, with Description of a New Species

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Shih-Chieh Shen (1998) A review of congrid eels of the genus *Ariosoma* from Taiwan, with description of a new species. *Zoological Studies* 37(1): 7-12. Diagnosis, description, and figures are presented for the 4 Formosan species of *Ariosoma* which include *A. anago* (Temminck and Schlegel, 1842), *A. anagoides* (Bleeker, 1864), *A. shiroanago major* (Asano, 1958) and a new species *A. nancyae*. *Ariosoma nancyae* is distinctive in its combination of a stout body; 157 total vertebrae; 53 preanal lateral-line pores, and 95 pores behind anus to tail; upper end of gill opening at level of 1/4 upper end of pectoral-fin base; black spots on head, and black bands on body, tail, and fins.

Key words: Fish taxonomy, Congridae, Fish fauna, New species, Taiwan.

The congrid eel genus *Ariosoma* Swainson, 1838 is not a well-known group of fishes because of its small size and unusual habitats. It is, however, one of the most abundant and diverse congrid genera in the world. Asano (1962) divided the Japanese species of *Ariosoma* into 2 genera, *Anago* Jordan and Hubbs and *Alloconger* Jordan and Hubbs, based on the number of head pores, the relative number of precaudal and caudal vertebrae, and the presence or absence of myorhabdoi. Lee and Yang (1966) followed the classification of Asano, and placed 3 Formosan species in 2 genera: *Anago anago*, *Alloconger anagoides* and *Alloconger shiroanago major*. Chen and Weng (1967) elevated *Alloconger shiroanago major* to the species level. Mok (1993) overlooked Smith (1989), in which *Anago* and *Alloconger* were synonymized with *Ariosoma*, and treated 2 Formosan species as *Anago anago* and *Alloconger anagoides*. He also missed *Alloconger shiroanago major* which was reported by Lee and Yang (1966) and Chen and Weng (1967).

Ariosoma, placed in the subfamily Bathymyrinae of the family Congridae, is distinguished from the other congrid genera by the following features: a moderately stout body, not extremely elon-

gate; preanal length more than 40% of total; tip of tail blunt and stiff, caudal fin reduced; dorsal fin insertion origin near level of pectoral fin base; pectoral fin well developed; snout rounded, projecting slightly beyond lower jaw; upper and lower lips with well-developed flanges; anterior nostril tubular, near tip of snout; posterior nostril small, elliptical, in front of eye, somewhat below mid-eye level; head pores small; teeth small, acute, in patch or bands; vomerine tooth patch elongate, from 1/3 to 1/2 of maxillary patch; maxillary and mandibular teeth in narrow bands wider anteriorly; dorsal and anal fin rays unsegmented.

MATERIALS AND METHODS

All specimens studied are now deposited in the Museum of the Department of Zoology, National Taiwan University (NTUM), Institute of Zoology, Academia Sinica (ASIZP), National Sun Yat-sen University (NSYSU), and Tunghai University (THUP). Methods for measurements and counts follow Smith (1989). Total length and head length are expressed throughout as TL and HL, respectively.

SPECIES ACCOUNT

Genus *Ariosoma* Swainson, 1838

Ariosoma Swainson, 1838: 220 (type species *Ophisoma acuta* Swainson, 1839 = *Muraena balearica* Delaroche, 1809, subsequent designation by Bleeker, 1864) (not seen).

Ophisoma Swainson, 1839: 334 (type species *Ophisoma acuta* Swainson, 1839 = *Muraena balearica* Delaroche, 1809)(not seen).

Anago Jordan and Hubbs, 1925: 191 (type species *Conger anago* Temminck and Schlegel, 1842, by original designation).

Alloconger Jordan and Hubbs, 1925: 192 (type species *Leptocephalus flavirostris* Snyder, 1908, by original designation).

Body moderately stout, not extremely elongate; preanal length more than 40% of total; tip of tail blunt and stiff, caudal fin reduced; dorsal fin beginning near level of pectoral fin base; pectoral fin well developed; snout rounded, projecting slightly beyond lower jaw; upper and lower lips with well-developed flanges; anterior nostril tubular, near tip of snout; posterior nostril small, elliptical, in front of eye, somewhat below mid-eye level; head pores small; teeth small, acute, in patch or bands; vomerine tooth patch elongate, from 1/3 to 1/2 of maxillary tooth patch; maxillary and mandibular teeth in narrow bands, wider anteriorly; dorsal and anal fin rays unsegmented.

Key to species of the genus *Ariosoma* from Taiwan

- 1a. Head with small black spots; body and fins with 12-14 black cross bands *Ariosoma nancyae*
- 1b. Head without spots; body and fins without black cross bands 2
- 2a. Sensory pores on head about 18 on each side, no pore on supratemporal commissure *Ariosoma anago*
- 2b. Sensory pores on head about 25 on each side, 3 pores on supratemporal commissure throughout its entire length (1 pore on mid-dorsal, 1 pore on each side) 3
- 3a. Head and body rather deep brown; vertical fins with broad black margin; lateral-line pores to anus 45-46; vertebrae 131 *Ariosoma anagoides*
- 3b. Head and body pale; vertical fins with narrow dark margin; lateral-line pores to anus 50; vertebrae 140 *Ariosoma shiroanago major*

Ariosoma anago
(Temminck and Schelegel, 1842)
(Figs. 1, 5A, 6A)

Conger anago Temminck and Schelegel, 1842: 259, pl. 113, fig. 1 (Nagasaki).

Anago anago: Asano, 1962: 72; Lee and Yang, 1966: 53; Chen and Weng, 1967: 43; Mok, 1993: 116.

Materials: NTUM 00320, 2 specimens, 299.6 and 314.0 mm TL, Aug. 1958, Penghu; NTUM

03790, 1 specimen, 393.3 mm TL, Sept. 1967, Penghu; ASIZP 054463, 2 specimens, 332.5 and 332.5 mm TL, 6 Jan. 1970, Nanfangao; NSYSU 1659, 1 specimen, 284.7 mm TL, 3 June 1973, Tainan; NSYSU 2534, 1 specimen, 349.3 mm TL, July 1978, Tungkuang.

Diagnosis: Lateral-line pores to anus 54-60; sensory pores on head about 19 on each side, no pore on supratemporal commissure; intermaxillary teeth enlarged; both upper and lower posterior margin of eye with a dark spot; body without cross bands, a little pale ventrally.

Description: D.177-219; A.131-158; P.12-16; total vertebrae 146-157; preanal vertebrae 54-61; lateral-line pores 136-148; lateral-line pores to anus 54-60; lateral-line pores to gill opening 8-9.

Proportions in total length (TL): head length 5.22-5.63; preanal length 2.05-2.12; predorsal length 5.15-5.58; body depth at gill-opening 11.72-13.13, at nape 15.24-17.47; body width at gill opening 14.31-18.49, at postorbital 16.75-18.58.

Proportions in head length (HL): snout length 4.92-5.84; upper jaw length 2.92-3.30; eye diameter 4.06-5.49; interorbital width 4.99-6.83; longest dorsal ray 4.04-4.95; longest anal ray 6.12-6.67; length of pectoral fin ray 2.55-2.92.

Body stout, subcylindrical except posterior half of tail; dorsal fin origin in front of gill opening; gill opening nearly vertical, well below midlateral region, upper end of gill-opening at level of 1/4 of upper end of pectoral-fin base.

Tip of snout very blunt; upper jaw slightly projecting beyond tip of lower jaw; no groove or fleshy keel on lower surface of tip of snout; upper and lower lips with well-developed flanges; anterior nostril short tubular, behind tip of snout; posterior nostril small, elliptical, in front of eye, somewhat below mid-eye level.

Intermaxillary teeth enlarged, not separated from maxillary teeth; vomerine tooth patch elongate, wider anteriorly, separated from intermaxillary teeth, extending posteriorly to about 3/5 of maxillary tooth patch, posterior teeth enlarged; maxillary teeth in narrow band, about in 1 to 2 series, some teeth enlarged; mandibular teeth in band, wider anteriorly, posterior teeth about in 1 to 2 series (Fig. 5A).

Sensory pores on head varying in number: about 8-10 on preoperculomandibular canal; 5 on infraorbital canal, but 2 specimens with 2 additional pores along posterior margin of eye; 3 on supraorbital canal, but 1 specimen with only 2 pores near tip of snout; no pore on supratemporal commissure (Fig. 6A).

Color in life: head and body brownish above, pale below; both upper and lower posterior margins of eye with a dark spot; dorsal, anal, and caudal fins with narrow dark margin.

***Ariosoma anagoides* (Bleeker, 1864).**
(Figs. 2, 5B, 6B)

Ophisoma anagoides Bleeker, 1864: 27, Tab. 149, fig. 3 (Singapore; Celebes; Batjan; Ambonia; Banda).

Alloconger anagoides: Asano, 1962: 76; Lee and Yang, 1966: 54; Chen and Weng, 1967: 45; Mok, 1993: 115.

Materials: ASZIP 056620, 1 specimen, 332.6 mm TL, 3 Aug. 1965, Tungkang; THUP 00172, 1 specimen, 320.2 mm TL, Feb. 1960, Kaohsiung; THUP 03080, 1 specimen, 367.3 mm TL, Aug. 1965, Tungkang; THUP 03104, 1 specimen, 368.7 mm TL, Feb. 1966, Kaohsiung.

Diagnosis: Lateral-line pores to anus 45-46; vertebrae 130-131; sensory pores on head 25 on each side, 3 pores on supratemporal commissure throughout its entire length; pectoral fin long, 2.21-2.60 in head length; body dark brown, no cross bands; vertical fins with broad black margin.

Description: D.178-188; A.132-135; P.13-14; total vertebrae 130-131; preanal vertebrae 45-47; lateral-line pores 123 (1 specimen with 127); lateral-line pores to anus 45-46; lateral-line pores to gill opening 8.

Proportions in total length (TL): head length 5.90-6.42; preanal length 2.24-2.29; predorsal length 6.48-6.75; body depth at gill-opening 18.07-19.29, at nape 20.01-21.44; body width at gill opening 24.44-26.15, at postorbital 22.71-26.15.

Proportions in head length (HL): snout length 4.42-4.90; upper jaw length 3.33-3.68; eye diameter 5.42-5.94; interorbital width 6.42-8.17; longest dorsal ray 3.50-5.42; longest anal ray 4.38-5.37; length of pectoral fin ray 2.21-2.60.

Body stout, subcylindrical except posterior half of tail; dorsal fin origin in front of gill opening; gill opening nearly vertical, well below midlateral region, upper end of gill-opening just at level of 1/4 of upper end of pectoral-fin base.

Tip of snout slightly pointed; upper jaw slightly projecting beyond tip of lower jaw; no groove or fleshy keel on lower surface of snout tip; upper and lower lips with well-developed flanges; anterior nostril short tubular, behind tip of snout; posterior nostril small, elliptical, in front of eye, somewhat below mid-eye level.

Intermaxillary tooth patch somewhat broader than long, separated from maxillary teeth; vomerine tooth patch elongate, wider anteriorly, separated

from intermaxillary teeth, extending posteriorly to about midpoint of maxillary tooth patch, posterior teeth enlarged; maxillary teeth in narrow band, wider anteriorly; mandibular teeth in band, wider anteriorly (Fig. 5B).

Sensory pores on head: about 8-12 (mostly 8-9) on preoperculomandibular canal, 7 on infraorbital



Fig. 1. *Ariosoma anago*.



Fig. 2. *Ariosoma anagoides*.



(A)



(B)

Fig. 3. (A) *Ariosoma nancyae* n. sp., showing dorsal fin with white margin; (B) *Ariosoma nancyae* n. sp.



Fig. 4. *Ariosoma shiroanago major*.

canal; 7 on supraorbital canal; 3 pores on supra-temporal commissure (one pore on mid-dorsal, one pore on each side) (Fig. 6B).

Color in life: body dark brown, no cross bands; vertical fins with broad black margin.

***Ariosoma nancyae* n. sp.**
(Figs. 3A, 3B, 5C, 6C)

Holotype: NTUM 07871: 750.1 mm TL; 15 Sept. 1987; Nanfangao fish market, northeastern coast of Taiwan; bottom trawl, local fishermen; collected by K. Y. Wu.

Paratypes: ASIZP 058529: 2 specimens, 435.5 and 474.4 mm TL; 12 Aug. 1994; Taitung; collected by H. M. Chen.

Diagnosis: Body stout, anus situated at 43%-44% total length; dorsal fin origin in front of upper end of gill opening; jaw ending below middle of eye; intermaxillary tooth patch somewhat broader than long, indistinctly separated from maxillary teeth; head with small black spots, body and fins with 12-14 black cross bands.

Description of holotype (paratypes in parentheses): D.245; A.189; P.14; total vertebrae 157 (154-159); preanal vertebrae 55 (53-55); lateral-line pores 146 (145-147); lateral-line pores to anus 53 (53-54); lateral-line pores to gill opening 9 (9-10).

Proportions in total length (TL): head length 6.37 (5.55-5.84); preanal length 2.29 (2.26-2.31); predorsal length 7.36 (6.72-7.09); body depth at gill-opening 16.12 (13.57-14.78), at nape 21.20 (17.28-21.37); body width at gill opening 18.95 (25.03-26.07), at postorbital 26.0 (24.47-26.36).

Proportions in head length (HL): snout length 3.85 (4.09-4.15); upper jaw length 3.02 (3.14-3.17); eye diameter 6.51 (5.53-5.77); interorbital width 5.82 (7.27-8.53); longest dorsal ray 3.84 (4.51-5.16); longest anal ray 4.27 (5.65-6.54); length of pectoral fin ray 3.73 (3.44-3.60).

Body stout, subcylindrical except posterior half of tail; dorsal fin origin on rear of head, in front of gill opening; anal fin origin immediately behind anus which is situated before mid-body (43%-44%); gill opening nearly vertical well below midlateral region, upper end of gill-opening just at level of 1/4 of upper end of pectoral-fin base.

Snout tip duck-bill shaped; upper jaw slightly projecting beyond tip of lower jaw; no groove or fleshy keel on lower surface of snout tip; upper and lower lips with well-developed flanges; anterior nostril short tubular, behind tip of snout; posterior nostril small, elliptical, in front of eye, somewhat below mid-eye level.

Intermaxillary tooth patch somewhat broader than long, indistinctly separated from maxillary teeth; vomerine tooth patch elongate, wider anteriorly,

separated from intermaxillary teeth, extending posteriorly to about midpoint of maxillary tooth patch; maxillary teeth in narrow band, wider anteriorly; mandibular teeth in band, wider anteriorly (Fig. 5C).

Sensory pores on head: about 17-22 on preoperculomandibular canal, 8 on infraorbital canal; 14-19 on anterior canal of supraorbital; 3 pores on supratemporal commissure (1 pore on mid-dorsal, 1 pore on each side) (Fig. 6C).

Color in life: body pale, overlain with about 12-14 large black cross bands on lateral side, of which some forming \cap -shaped bands, 4 bands on trunk, and 8-10 bands on tail, wider than interspaces; head with small black spots; dorsal fin pale, overlain with large black spots and white margin; small black spots on anal and base of pectoral.

Etymology: The species is named for my wife Nancy Hsio-Jen Lin Shen in appreciation of her patience and help, and her contribution to our family for 45 yr.

***Ariosoma shiroanago major* (Asano, 1958).**
(Figs. 4, 5D, 6D)

Alloconger shiroanago major Asano, 1958: 191, fig. 1 (Kagoshima).

Alloconger shiroanago major: Lee and Yang, 1966: 55.

Alloconger major: Chen and Weng, 1967: 47.

Ariosoma shiroanago major: Nakabo, 1993: 187.

Materials: THUP 03295, 1 specimen, 314.9 mm TL, date unknown, Kaohsiung.

Diagnosis: Lateral-line pores to anus 50; vertebrae 146; sensory pores on head about 25 on each side, 3 pores on supratemporal commissure throughout its entire length; pectoral fin short, 3.16 in head length; body pale, without cross bands; vertical fins with black margin.

Description: D.200; A.146; P.12; total vertebrae 146; preanal vertebrae 50; lateral-line pores 138; lateral-line pores to anus 49; lateral-line pores to gill opening 9.

Proportions in total length (TL): head length 5.79; preanal length 2.29; predorsal length 6.32; body depth at gill-opening 15.75, at nape 20.19; body width at gill opening 22.49, at postorbital 21.87.

Proportions in head length (HL): snout length 4.46; upper jaw length 3.32; eye diameter 4.95; interorbital width 7.16; longest dorsal ray 4.73; longest anal ray 5.39; length of pectoral fin ray 3.16.

Body stout, subcylindrical except posterior half of tail; dorsal fin origin in front of gill opening; gill opening nearly vertical well below midlateral re-

gion, upper end of gill-opening just at level of 1/4 of upper end of pectoral-fin base.

Tip of snout blunt; upper jaw slightly projecting beyond tip of lower jaw; no groove or fleshy keel on lower surface of snout tip; upper and lower lips with well-developed flanges; anterior nostril short tubular, behind tip of snout; posterior nostril small, elliptical, in front of eye, somewhat below mid-eye level.

Intermaxillary tooth patch somewhat broader than long, not separated from maxillary teeth;

vomerine tooth patch elongate, wider anteriorly, separated from intermaxillary teeth, extending posteriorly to about midpoint of maxillary tooth patch, posterior teeth only in single series and enlarged; maxillary teeth in narrow band, wider anteriorly; mandibular teeth in band, wider anteriorly (Fig. 5D).

Sensory pores on head: 9 on preoperculo-mandibular canal, 7 on infraorbital canal; 7 on supraorbital canal; 3 pores on supratemporal commissure (one pore on mid-dorsal, one pore on each side) (Fig. 6D).

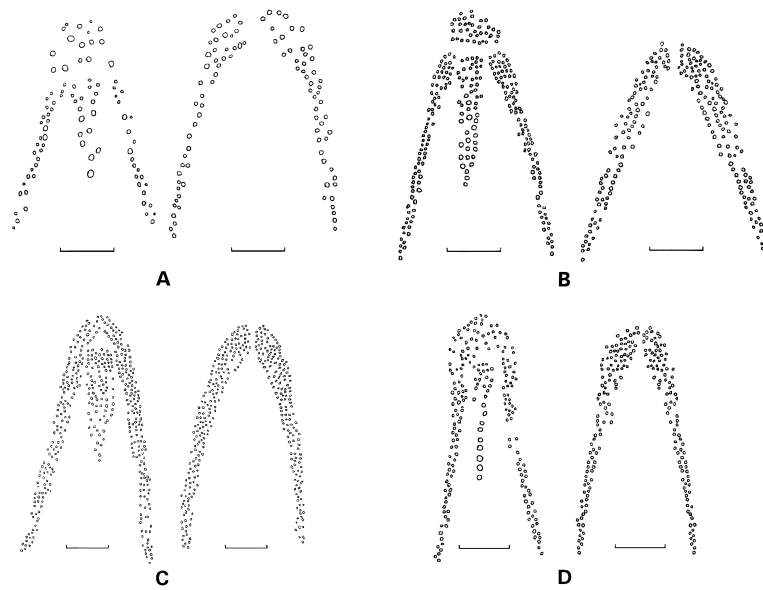


Fig. 5. Outline of dentition patterns of the upper jaw (left) and lower jaw (right) in 4 species of *Ariosoma* from Taiwan. (A) *Ariosoma anago*; (B) *Ariosoma anagoides*; (C) *Ariosoma nancyae*; (D) *Ariosoma shiroanago major*. Scales indicate 5 mm each.

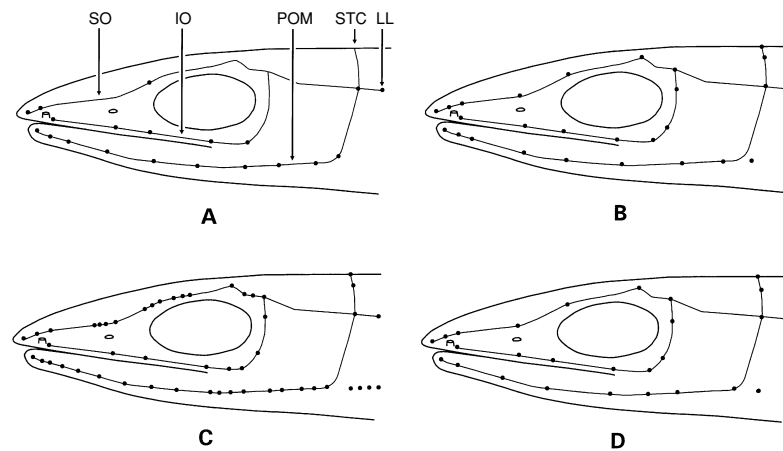


Fig. 6. Outline of lateral aspects of the cephalic lateral line system in 4 species of *Ariosoma* from Taiwan. (A) *Ariosoma anago*; (B) *Ariosoma anagoides*; (C) *Ariosoma nancyae*; (D) *Ariosoma shiroanago major*. IO, infraorbital canal; LL, lateral line; POM, preoperculo-mandibular canal; SO, supraorbital canal; STC, supratemporal commissure.

Color in life: body pale, without cross bands; vertical fins with dark margin.

DISCUSSION

According to the color pattern, *Ariosoma nancyae* n. sp. is very similar to *Poeciloconger fasciatus* Günther, 1871, but all characters agree well with those of the subfamily Bathymyrinae and the genus *Ariosoma*. There are some doubts whether the species treated by Smith (1989), Randall (1986), and Klausowitz (1971) as *Poeciloconger fasciatus* Günther, 1871 was placed in the subfamily Congrinae by these authors. Günther (1871: 673) designated the species by the small nostrils, tubeless at the anterior nostril, having longitudinal lines in dorsal fin, and a dark margin in anal fin. Smith (1989: 482) distinguished the two subfamilies Congrinae and Bathymyrinae by the following: preanal length usually greater than 40% TL, posterior nostril below mid-eye level, dorsal and anal fin rays unsegmented for Bathymyrinae; and preanal length usually less than 40% TL, posterior nostril at or above mid-eye level, dorsal and anal fin rays segmented for Congrinae.

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REFERENCES

- Asano H. 1958. Studies on the congrid eels of Japan. I. Description of two new subspecies referable to the genus *Alloconger*. Zool. Mag. **67**: 191-196.
- Asano H. 1962. Study on the congrid eels of Japan. Bull. Misaki Mar. Biol. Inst. Kyoto Univ. **1**: 1-143.
- Bleeker P. 1864. Atlas ichthyologique des Indes orientales Néerlandaises, publiés sous les auspices du Gouvernement colonial Néerlandaises. Tome IV. Murènes, Synbranches, Leptocéphales. Amsterdam: Versl. Akad., p. 150, pls. 145-193.
- Chen JFH, HTC Weng. 1967. A review of the apodal fishes of Taiwan. Biol. Bull. Tunghai Univ. **32**: 1-86.
- Günther A. 1871. Report on several collections of fishes recently obtained for the British Museum. Proc. Zool. Soc. Lond. **1871**: 652-675.
- Jordan DS, CL Hubbs. 1925. Record of fishes obtained by David Starr Jordan in Japan, 1922. Mem. Carnegie Mus. **10**: 93-346, fig. 1, pls 5-12.
- Klausowitz K. 1971. *Poeciloconger fasciatus* Günther, ein Neunachweis für Madagaskar (Pisces: Apodes: Congridae). Senckenbergiana Biol. **52**: 197-200.
- Lee SC, HC Yang. 1966. Notes on the congrid eels of Taiwan. Biol. Bull. Taiwan Normal Univ. **1**: 52-63.
- Mok HK. 1993. Family Congridae. In SC Shen, ed. Fishes of Taiwan. Taipei: Natl. Taiwan Univ. Pr., pp. 115-118.
- Nakabo T. 1993. Fishes of Japan with pictorial keys to the species. Tokyo: Tokai Univ. Pr., 1474 pp.
- Randall JE. 1986. 106 new records of fishes from the Marshall Islands. Bull. Mar. Sci. **38**: 170-252.
- Smith DG. 1989. Family Congridae. In EB Böhlke, ed. Fishes of the western North Atlantic. Part 9, Vol. 1. Orders Anguilliformes and Saccopharyngiformes. New Haven: Sears Foundation for Marine Research, Yale Univ. Pr., pp. 460-567.
- Snyder JO. 1908. Descriptions of eighteen new species and two new genera of fishes from Japan and Riu Kiu Islands. Proc. U. S. Natl. Mus. **35**(1635): 93-111.
- Temminck CJ, JH Schlegel. 1842. Pisces. In PF Seibold, ed. Fauna Japonica. Leiden: Apud A. Arnj et Socios, 323 pp.

臺灣產錐體康吉鰻屬之覆檢及一新種

沈世傑¹

臺灣產錐體康吉鰻屬共四種。白錐體康吉鰻 *Ariosoma anago* (Temminck and Schlegel, 1846)，擬錐體康吉鰻 *A. anagoides* (Bleeker, 1866)，大錐體康吉鰻 *A. shiroanago major* (Asano, 1958)，以及一新種南希錐體康吉鰻 *A. nancyae*。本文除報告一新種外並提供錐體康吉鰻屬之檢索表，其他三種之描述、分佈、同種異名，以及彩色照片、齒型與側線分佈之圖解。

關鍵詞：魚類分類，康吉鰻，魚類相，新種，臺灣。

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