Notes on the Mindoro Snake Eel *Lamnostoma mindorum* (Jordan and Richardson) (Ophichthidae: Pisces) in the Western Pacific

西太平洋稀有民多羅龍口蛇鰻

Shi-Tsang Chang and Chu-Fa Tsai

張世倉 蔡住發

Endemic Species Research Institute, Chichi, Nantou, Taiwan

行政院農業委員會特有生物研究保育中心 南投縣集集鎮民生東路1號

Abstract

The Mindoro snake eel *Lamnostoma mindorum* (Jordan and Richardson) is one of the rare species in the family Ophichthidae. Only four specimens have been collected in the western Pacific from the Mindoro and Luzon islands of the Philippines, the Waigeu Island of New Guinea, and the Hsiukuluan River of the eastern Taiwan. This paper reports the fifth specimen from the Limpen River of the southwest Taiwan. *L. mindorum* is more likely a marine eel living in sand and soil substrates along the Kuroshio Current in the tropical western Pacific. The specimens that have been collected might be the accidental intruders to freshwater rivers, a reason of its rarity in collection. This paper also reviews the systematic (generic) position of *L. mindorum*, and considers that *Lamnostoma taylori* (Herre) from Iba of the Philippines a valid species rather than a synonym to *L. mindorum* as previously assumed.

摘 要

民多羅龍口蛇鰻 (*Lamnostoma mindorum*) 爲蛇鰻科稀有魚種之一。至今只發現4隻標本，採集於菲律賓呂宋島及民多羅島、新幾內亞衛古島和台灣花蓮縣秀姑巒溪。本報告發表在屏東林邊溪採集之第五隻標本，推測民多羅龍口蛇鰻乃棲息於西太平洋熱帶區域沿黑潮邊海底土砂裡，偶然進入河口或淡水域中被捕獲，乃爲其稀有之原因。本文根據Herre(1923)的原始描述及本種比對結果，判定*Lamnostoma taylori* (Herre)爲一有效種。

Key words: *Lamnostoma mindorum*, Ophichthidae, distribution

關鍵詞：民多羅龍口蛇鰻、蛇鰻科、分布

Received: December 10, 2002 Accepted: May 1, 2003

收件日期：91年12月10日 接受日期：92年5月1日

The Mindoro snake eel *Lamnostoma mindorum* (Jordan and Richardson, 1908) is one of the rare species in the family Ophichthidae in the western Pacific. It was first described *Caecula mindora* by Jordan and Richardson (1908) nearly a century ago, based on a single specimen (holotype) collected from the Baco River on the Mindoro Island, Philippines (Fig. 1). A few years later another specimen was collected at the Waiho River on the Waigeu Island, New Guinea, and described as *Sphagebranchus mindora* (Jordan and Richardson) by de Beaufort in 1913 (Weber and de Beaufort 1916). Herre (1923) reviewed the eels of the Philippine Archipelago, and kept the species name as *Caecula mindora* (Herre 1924, 1953). He collected the third specimen at the Abra River near Vigan, Ilokos Sur Province, Philippines in the 1929 Philippines Expedition (Herre 1953). The above three specimens were about 400 mm in length and collected from freshwater not far upstream from the river mouths.

The review paper of Herre (1923) states that the genus *Caecula* Vahl, 1794 has gill openings without a duplication of gill membranes anteriorly, but the genus *Lamnostoma* Kaup, 1856 does have the duplication of gill membranes. Smith (1964) compared the holotype, No. 154, of *Caecula pterygera* Vahl, 1794 and the syntype, R.M.N.H. No. 3824, of *Lamnostoma pictum* Kaup, 1856, the type species of the two genera. He found that they are identical in all aspects, and furthermore, that these two type specimens are none other than the generally known species *Dalophis orientalis* McClelland, 1845 of the Indian Ocean and the western Pacific. He briefly redescribed *Caecula pterygera* Vahl, 1794 based on external characters, and assigned *L. pictum* and *D. orientalis* as synonyms of *C. pterygera*, and the genus *Lamnostoma* as a synonym of the genus *Caecula*

Smith (1964) also show the parts of the translation of the original description of *Caecula* Vahl, 1794 to point out that its gill openings are ventrally placed, and gill cover is not made of bone but formed by two skin-folds of which the exterior and larger fold covers most of the interior and smaller one. Apparently, Jordan and Richardson (1908) and Herre (1923, 1924, 1953) erroneously assumed that the genus *Caecula* has simple gill membranes (without duplication), and placed *mindora* under the genus.

Bohlke and McCosker (1975) compared the type specimens of *Caecula pterygera* Vahl, 1794 and *Sphagebranchus rostratus* Bloch, 1795 (type species of the genus *Sphagebranchus*). He found

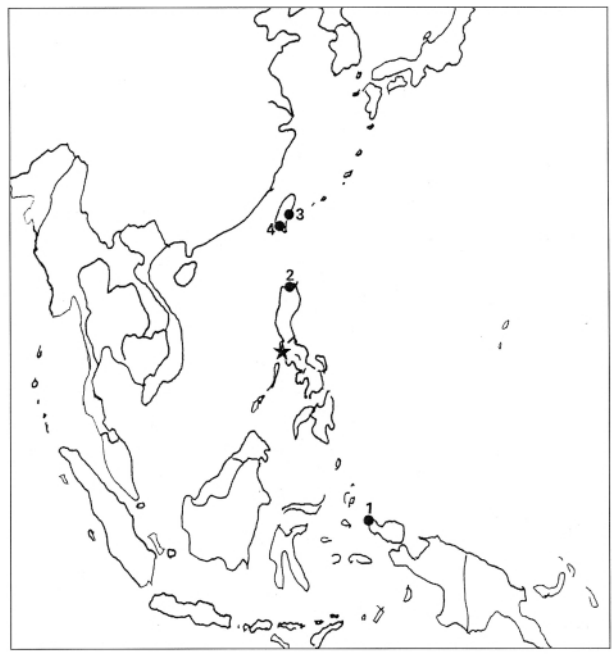

Fig. 1. Distribution of *Lamnostoma mindorum* (Jordan and Richardson) in the western Pacific (solid star, type locality, Baco River, Mindoro, Philippines; solid circles, localities of other collections; 1, Waiho River, Waigeu Island, New Guinea; 2, Abra River, Luzon, Philippines; 3, Hsiukuluan River, Hualien, Taiwan; and 4, Limpen River, Pingtung, Taiwan).

them to be the same species, and thus, the genus *Sphagebranchus* is a synonym of the genus *Caecula*. This made the genus *Caecula* to have the genera *Lamnostoma*, *Sphagebranchus*, and *Dalophis* as its junior synonyms, while the species name *Caecula mindora* had been retained since Jordan and Richardson (1908).

McCosker (1977) used external and osteological characters to revise the genera of the family Ophichthidae. He used the specimens of *Caecula pterygera* (USNM 206375), *Lamnostoma orientalis* (CAS 13957, 13968) and *Lamnostoma kampeni* (SU 24593) for the study, and concluded that both genera *Caecula* Vahl, 1794 and *Lamnostoma* Kaup, 1856 are valid, rather than that the latter is synonymous to the former as Smith (1964) proposed. We briefly describe herein the characters of the two genera based on the descriptions of McCosker (1977) and provide with the depositories of the type specimens of their type species (Smith 1964) as follows:

***Caecula* Vahl, 1794**

Caecula Vahl, 1794. The type species *Caecula pterygera* Vahl, 1794 (holotype No. 154, Universitetets Zool. Museum, Copenhagen, Denmark).

Lateral head profiles narrow evenly from epiotics to snout. Body elongated, its depth more

than 40 in length. Vertebrae 126-130 in number. Branchiostegal rays 25 in number with 12 free and 10 attached with epihyal. Anterior nostril flush with snout anteriorly, produced as a tube posteriorly; posterior nostril associated with a barbel. Gill opening entirely ventral, longer than isthmus, with an antero-lateral duplication forming a deep pouch. Second temporal pore and third preopercular pore present, but fourth preopercular pore absent. Teeth conical, uniserial, largest at intermaxillary.

***Lamnostoma* Kaup, 1856**

Lamnostoma Kaup, 1856. The type species *Lamnostoma pictum* Kaup, 1856 (syntype R.M.N.H. No. 3824, Leiden, Netherlands).

Lateral head profiles narrow sharply from epiotics to interorbital, and then, evenly to snout. Body stout, its depth less than 30 in length. Vertebrae 134-153 in number. Branchiostegal rays 29 in number with 26 free and 3 attached with epihyal. Anterior nostril flush along snout; posterior nostril with a pendulous flap. Gill openings inferior. Second temporal pore and third preopercular pore absent. Teeth slender, pointed, and recurved, uniserial or biserial, vomerine and intermaxillary teeth enlarged.

Based on the above descriptions abstracted from McCosker (1977), head profile, body depth/body length ratio, teeth size and structure, nostril structure, vertebral number, branchiostegal ray arrangement, and presence or absence of the second temporal pore and the third preopercular pores are important characters for distinction between C*aecula* and *Lamnostoma*. Of these characters, lateral head profile, body depth/total length ratio, and vomerine teeth structure are the key characters for the distinction. The location of gill openings and structure (duplication) of gill covers are no longer the primary diagnostic characters for the distinction of the two genera.

Smith's (1964) redescription of *Caecula pterygera* Vahl, 1794 states the characters to have an elongate and subcylinderical body, and its depth are about 40 in total length, as those mentioned by McCosker (1977). However, he does not mention the characters of *Lamnostoma pictum* Kaup, 1856 and *Dalophis orientalis* McClelland, 1845 other than duplicated gill covers in assuming the two species to be synonymous to *C. pterygera*, and the genus *Lamnostoma* to be synonymous to the genus *Caecula*. Apparently, Smith (1964) overlooked the external characters other than the structure of gill cover for the species and generic distinction, resulting in erroneous presumption on these species and genera to be synonymous (McCosker 1977).

According to the McCosker's (1977) classification system of the genera to the family Ophichthidae, the genus *Lamnostoma* consists of *Lamnostoma mindora* (Jordan and Richardson, 1908), *Lamnostoma taylori* (Herre, 1923), *Lamnostoma kampeni* (Weber and de Beaufort, 1916), and *Lamnostoma polyophthalmum* (Bleeker, 1853) (Smith 1964; McCosker 1977; Hatooka and Yoshino 1998) from the western Pacific. *Lamnostoma pictum* Kaup, 1856 is considered to be synonymous to *Lamnostoma orientalis* McClelland, 1845 by McCosker and Castle (1986), and both are regarded as the synonyms of *L. polyophthalmum* by Hatooka and Yoshino (1998). The genus *Caecula* has *Caecula pterygera* Vahl, 1794 from India as a

monotypic species. *Caecula rostratus* (Bloch, 1795) from the East Indies is presumed to be synonymous to *C. pterygera* (Bohlke and McCosker 1975; McCosker 1977), and *Dalophis polyphthalmus* Bleeker, 1853 once considered as one of the two species of *Caecula* (Bohlke and McCosker 1975) has been transferred to *Lamnostoma* (Hatooka and Yoshino 1998).

Kottelat *et al*. (1993) did not find *L. mindora* in the western Indonesia, but stated the species to be "expected in the area" in their book "Freshwater Fishes of Western Indonesia and Sulawesi". They cited this species from Jordan and Richardson (1908), but apparently, erroneously used the figure of *L. orientalis* (McClelland, 1845) to illustrate *L. mindora*, while the figure of the latter to illustrate the former.

Recently Hatooka and Yoshino (1998) corrected *Lamnostoma mindora* to *Lamnostoma mindorum*, because the generic name *Lamnostoma* is derived from the Greek "*Lamna*" (man-eating monster) and "*stoma*" (mouth), and the latter is neuter. They reported the fourth specimen from the Hsiuykuluan River, Hualien, in the eastern Taiwan. This specimen was the first record of the species in Taiwan, and the northernmost range of the species in the western Pacific (Fig. 1). Unlike the previous three specimens of 400 mm in total length and from freshwater streams of the Philippines (Herre 1923) and New Guinea (Weber and de Beaufort 1916), the specimen from Taiwan was 484 mm and from brackish water at the river mouth.

Also, Hatooka and Yoshino (1998) assigned *Caecula taylori* Herre, 1923 as a junior synonym of *Lamnostoma mindorum* (Jordan & Richardson, 1908), based on a calculation on body height in total length from the drawing in Plate 6, Fig. 2 of Herre's (1923) original description of *C. taylori*. The body height in total length of the drawing is 25 similar to that of *L. mindorum*, and not 18 as mentioned in the original description of *C. taylori*. However, for assigning *C. taylori* as a synonym of *L. mindorum*, Hatooka and Yoshino (1998) did not include the original description of Herre (1923) in their consideration.

In this study we summarize and compare the characters of *C. mindorum* and *C. taylori* described by Herre (1923) in Table 1. They differ greatly in body size, body dimensions, dentitions, and coloration, and are briefly described as follows:

Lamnostoma mindorum **(Jordan and Richardson, 1908)**

Caecula mindora Jordan and Richardson, 1908 (type locality, Baco River, Mindoro, Philippines).

Sphagebranchus mindora de Beaufort, 1913; Weber and de Beaufort, 1916.

Caecula mindora Herre, 1923, 1924, 1953.

Lamnostoma mindora McCosker, 1977; Kottelat *et al*., 1993; Chen and Fang, 2001.

Lamnostoma mindorum Hatooka and Yoshino, 1998.

Body slender, about 400 mm in total length. Body depth 25-30 and head length 7.4-7.7 in total length. Eyes small, embedded under skin, diameter 17-25 in head length. Vomerine teeth 6-10 in number; intermaxillary teeth stout, 3-5 in number of same sizes. Coloration uniformly dark brown on dorsum with a series of small whitish spots along the lateral line.

Table 1. A comparison of characters between *Lamnostoma mindorum* (Jordan and Richardson) and *Lamnostoma taylori* (Herre) based on the descriptions of Herre (1923)

Characters	***L. mindorum***	***L. taylori***
Locality	Mindoro Island, Philippines Waigeu Island, New Guinea	Iba, Zambales, Philippines
Habitat	Freshwater	-
Total length	Nearly 400 mm	164 mm
Body height in length	25-30	18.2
Head in length	7.4-7.7	8.86
Head in trunk	2.6-2.8	3
Eye	Small	Small, protuberant
Eye in head	17-25	14.8
Eye in snout	3.5	1.51
Snout	Slender, pointed	-
Snout in head	7	-
Mouth	Wide, extending far beyond eyes	-
Dorsal origin to gill opening	1/4 of head	9.25 in head
Vertical fins	Moderately developed	Very low
Jaw teeth	Small, sharp, recurved, in one row of same sizes	Small, sharp, recurved in one row; 2 frontal teeth stout on mandible
Vomerine teeth	Large, 6-10 in number	5 widely separated
Intermaxillary teeth	3-5 stout teeth of same size	3 small teeth
Gill opening	Lateral or vertical	Vertical
Coloration	Uniformly dark or grayish brown dorsum and yellow or pale ventrum; stellate whitish spots along lateral line; transverse white spots on vertex	Light yellow with olivaceous brown innumerable dots on dorsum, laterum and jaw

***Lamnostoma taylori* (Herre, 1923)**

Caecula taylori Herre, 1923, 1924, 1953. (type locality, Iba, Zambales, Philippines).

Lamnostoma tayleri McCosker, 1977; Hatooka and Yoshino, 1998.

Body stout, 164 mm in total length. Body depth 18.2 and head length 8.86 in total length. Eyes small, protuberant, diameter 14.8 in head length, Vomerine teeth 5 in number, widely spaced; intermaxillary teeth small, 3 in number.

Coloration olivaceous brown dorsum made by the coalescence of innumerable dots, extending down to laterum below the lateral lines and lower jaws.

Accordingly, it is reasonable to assume that the original description of *L. taylori* made by Herre (1923) is based on his type specimen, not from the drawing in Plate 6, Fig. 2 of his original description. It was likely that Herre (1923) mistakenly took the drawing of *L. mindorum* to illustrate *L. taylori*. Accordingly, we consider that *Lamnostoma taylori* (Herre, 1923) is a valid species, distinguishable from *Lamnostoma mindorum* (Jordan and Richardson, 1908), and not a synonym of the latter as assumed by Hatooka and Yoshino (1998).

Chen and Fang (2001) report *L. mindorum* in "The inland water fishes of Taitung, Taiwan" but the name is erred as *Lamnostoma mindora* Herre. They also erroneously describe the species to have long pectoral fins, and stated that the species occurs in the freshwater of the eastern Taiwan without mentioning localities of their collections.

For nearly a century since 1908 when Jordan and Richardson first described *C. mindora*, only four specimens have been reported from four localities: two in Philippines (Jordan and Richardson 1908; Herre 1953), one in New Guinea (Weber and de Beaufort 1916), and one in the eastern Taiwan (Hatooka and Yoshino 1998)(Fig. 1). In the recent inventory survey of freshwater fishes of Taiwan, we collected a specimen of *L. mindorum* (Fig. 2) by electric fishing from the freshwater portion of the Limpen River near the Shinpei Bridge, Pingtung County, about 5 km upstream from the mouth in the southwestern Taiwan (Fig. 1). This was the first specimen collected from the western part of Taiwan, the second specimen recorded for Taiwan, and the fifth specimen reported for this rare species in the western Pacific. It is 354 mm in total length, the smallest specimen collected so far for the species. It has the following characters: body height 24.3, head length 8.89, preanal length 2.33, trunk length

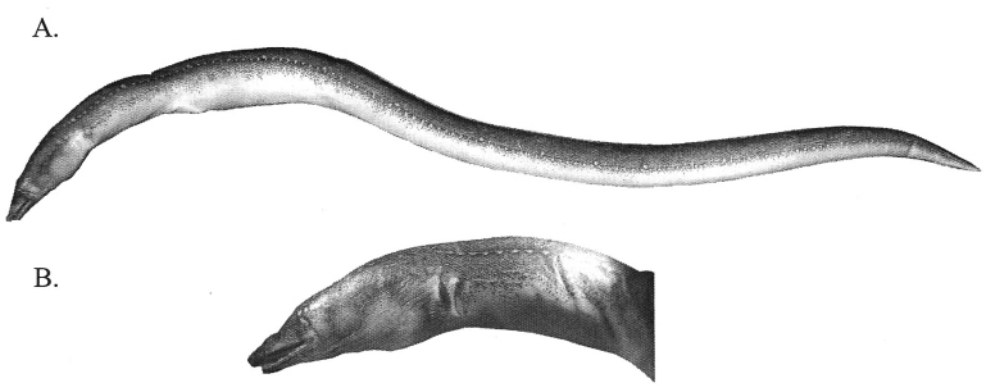

Fig. 2. Lateral view of *Lamnostoma mindorum* (Jordan and Richardson)(total length 354 mm) collected from the Limpen River of the southwestern Taiwan (A), and lateral view of its head portion (B).

3.20, and predorsal length 7.01 in total length; snout length 7.19, eye diameter 19.89, and maxillary length 2.28 in head length. Anterior nostril flushed along snout, and posterior nostril with a pendulous flap. Gill openings ventro-lateral. Vomerine teeth pointed, recurved, in a longitudinal row, nine in number: first one single and the remaining eight paired, each with a small, depressible anterior tooth and a large sessile posterior tooth. Intermaxillary teeth three in number, similar in sizes. Uniformly dark brown dorsum, pale yellow ventrum, with a longitudinal series of small white spots along the lateral line. The characters described above are similar to those described by Herre (1923) and Hatooka and Yoshino (1998). The sensory pores have 4 supraorbital pores, 6 infraorbital pores, 4 mandibular pores and 3 supratemporal pores (the second temporal pore and third preopecular pore absent), similar to those described by Hatooka and Yoshino (1998), with an exception that instead of 127, the number of lateral line pores is 141.

Chen and Fang (2001) speculate that *L. mindorum* is a migratory eel; adults live in freshwater streams but reproduce in ocean, and juveniles migrate to river mouths and freshwater streams of low elevations for living. However, the specimens that have been collected were from brackish water (Hatooka and Yoshio 1998) or freshwater not far from river mouths (Jordan and Richardson 1908; Weber and de Beaufort 1916; Herre 1953). Their sizes ranged between 354 mm and 484 mm, and no small juvenile has been collected from freshwater. Their number that have been collected was extremely small, only five specimens so far. Accordingly, it is reasonable to hypothesize that *L. mindorum* is a marine eel, living in sand or soil substrates of ocean bottom along the edge of Kuroshio Current in the tropical region of the western Pacific (Fig. 1). Large juveniles or sub-adults accidentally intrude to freshwater streams. All specimens that have been collected were the accidentally intruders to freshwater, a reason of their rarity in collection.

We are grateful to Messrs. R. C. Chang, C. Y. Chang, C. E. Shieh, and T. C. Yang who assisted in field collection. Professor Ming-Jenn Yu of the Department of Biology of the Tunghai University reviewed the manuscript.

Literature Cited

Bohlke, J. E., and J. E. McCosker. 1975. The status of the ophichthid eel general *Caecula* Vahl and *Sphagebranchus* Bloch, and the description of a new genus and species from fresh waters in Brazil. Proceedings of the Academy of Natural Sciences of Philadelphia 127 (1): 1-11.

Chen, I. S., and L. S. Fang. 2001. The inland water fishes of Taitung, Taiwan. Taiwan Marine Museum. 200 pp. (in Chinese)

Hatooka, K., and T. Yoshino. 1998. Two rare ophichthid species of the genus *Lamnostoma* (Pisces: Anguilliforms) from the western Pacific. Bulletin of the Osaka Museum of Natural History 52: 21-30.

Herre, A.W. C. T. 1923. A review of the eels of the Philippine Archipelago. The Philippine Journal of Science 23(2): 123-236.

Herre, A. W. C. T. 1924. Some rare Philippine eels. The Philippine Journal of Science 24(1): 107-111.

Herre, A. W. C. T. 1953. Check list of Philippine

fishes. U. S. Fish and Wildlife Service, Research Report 20. 977 pp.

Jordan, D. S., and R. E. Richardson. 1908. Fishes from islands of the Philippine Archipelago. Bulletin of the Bureau of Fisheries 27: 233-287.

Kottelat, M., A. J. Whitten, S. N. Kartikasari, and S. Wirjoatomodjo. 1993. Freshwater fishes of western Indonesia and Sulawesi. Periplus Editions (HK) Ltd. Indonesia.

McCosker, J. E. 1977. The osteology, classification, and relationships of the eel family Ophichthidae. Proceedings of the California Academy of Sciences. Series 4, 41(1): 1-123.

McCosker, J. E., and P. E. J. Castle. 1986. Family 42: Ophichthydiae. pp. 176-187. *In*: Smith, M. M., and P. C. Heemstra (eds.). Smith's sea fishes. Springer-Verlag, New York.

Smith, J. L. B. 1964. The discovery in Mozambique of the little known eel *Ophichtys tenuis* Gunther, 1870, a redescription of the type of *Caecula pterygera* Vahl, 1794, notes on other species and on generic relationships. The Annals and Magazine of Natural History 13, 7 (84): 711-723.

Weber, M., and L. F. de Beaufort. 1916. The fishes of the Indo-Australian Archipelago. Vol. 3. 455 pp.