

First records of a rare snake eel, *Leiuranus versicolor* (Anguilliformes, Ophichthidae) from Japan

Yusuke HIBINO^{*1}, Yukiya OGATA^{2,3}, Shunsuke ENDO⁴, Masaaki WADA⁵, Atsunobu MURASE^{2,6}, Noritaka MOCHIOKA⁴

¹Kitakyushu Museum of Natural History and Human History, Kitakyushu, Fukuoka 805-0071, Japan.

²Nobeoka Marine Science Station, Field Science Center, University of Miyazaki, 376-6 Akamizu, Nobeoka, Miyazaki, 889-0517, Japan.

³Graduate School of Agriculture, University of Miyazaki, 1-1 Gakuen-kibanadai-nishi, Miyazaki 889-2192, Japan.

⁴Laboratory of Fisheries Biology, Faculty of Agriculture, Kyushu University, Fukuoka 819-0395, Japan.

⁵Fisheries cooperative association of Iorigawa, 6-188 Iorigawa-nishi, Kadogawa-cho, Miyazaki 889-0605, Japan.

⁶Department of Marine Biology and Environmental Sciences, Faculty of Agriculture, University of Miyazaki, 1-1 Gakuen-kibanadai-nishi, Miyazaki 889-2192, Japan.

Corresponding author: *E-mail: yusukeelology@gmail.com

Abstract

Leiuranus versicolor (Richardson, 1848) is recorded based on a specimen from Miyazaki Prefecture, southern Japan. It represents the first Japanese and northernmost record. *Leiuranus versicolor* is similar to *L. semicinctus*, its single congener. The former can be easily separated from the latter by its unique banded pattern, usually with a narrow whitish yellow slit (vs. slit absent). The species was also photographed from Kashiwajima, southern part of Kochi Prefecture, southern Japan.

Keywords: Ophichthidae, 16S rRNA, Miyazaki Prefecture, Kochi Prefecture, Underwater photograph.

Zoobank: urn:lsid:zoobank.org:pub:4C015067-8BC5-463A-BF1A-73418BDB07D5

Introduction

The Indo-Pacific eel genus *Leiuranus* Bleeker, 1852 is small, including two valid species viz. *Leiuranus semicinctus* (Lay and Bennett, 1839) and *L. versicolor* (Richardson, 1848). This genus is characterized by its slender body, conical snout with a ventral groove, anterior nostrils tubular with wide margins posteriorly, and two preopercular pores (McCosker 1977). The former is widely distributed, but uncommon from East Africa to Hawaii Islands. The latter is more rare species, only recorded a few times from Maluku, Philippines, eastern coast of Australia and small islands, Palau, and Papua New Guinea (Richardson 1848; Fraser-Brunner 1934; Francis 1993; Myers 1999; Allen and Erdmann 2012; McCosker 2014). Records from the northern Hemisphere are restricted only to Philippines and Palau. We herein report upon a specimen collected from Miyazaki Prefecture, Japan. In addition, underwater photographs of the species from Kochi Prefecture, Japan is also provided.

Material and Methods

Methods for morphological observation follow Hibino et al. (2019). The vertebral count was made from soft-X ray photo, and mean vertebral formula follow Böhlke (1982). After the specimen was captured, tissue samples were dissected from right side of tail. DNA extraction, polymerase chain reaction (PCR) amplification of the 16S rRNA, and sequencing methods follow Tawa et al. (2012). The primers for PCR amplification and sequencing were 5'-GGTCCWRCCTGCCAGTGA-3' and 5'-CCGGTCTGRACYAGATCACGT-3'. 16S sequences of the present study (about 500 bp) are registered in DNA Data Bank of Japan (DDBJ) (Table 1). Neighbor-joining (NJ) tree based on Kimura-2-parameter model (Kimura 1980) was constructed using MEGA7 (Kumar et al. 2016) and its confidence was evaluated by 1000 bootstrap replications. In NJ tree, 5 species of 2 genera from same subfamily and *L. semicinctus* were used as ingroup and *Muraenesox cinereus* (KX426278) and *Cynoponticus ferox* (DQ65698) were used as outgroup.

Total length is abbreviated as TL. Institutional abbreviations follow Fricke and Eschmeyer (2019). The whole specimen was initially deposited in the fifth author's laboratory of Nobeoka Marine Science Station, University of Miyazaki (UMNB), and subsequently donated to the Kanagawa Prefectural Museum (KPM), Kanagawa,

Table 1. Accession numbers of sequences for the present study.

Species	Accession no.	Museum reg. no.
<i>Myrichthys maculosus</i>	LC506436	FRLM 38878
<i>Myrichthys colubrinus</i>	LC506437	OCF-P03190
<i>Ophichthus zophistius</i>	LC506438	FRLM 36519
<i>Ophichthus shaoi</i>	LC506439	FRLM 53871
<i>Ophichthus cephalozona</i>	LC506440	OCF-P03979
<i>Leiuranus versicolor</i>	LC506441	KPM-NI 50816
<i>Leiuranus semicinctus</i>	LC506442	FRLM 52255



Figure 1. Fresh condition of *Leiuranus versicolor*, KPM-NI 50816, 381.8 mm TL (photo catalog number KPM-NR 200320C), Kadogawa, Miyazaki Prefecture, Japan.

Japan. Photographs (Fig. 1) of the specimen are deposited in the image database of the Kanagawa Prefectural Museum of Natural History (KPM-NR) and will be uploaded to FishPix (<http://fishpix.kahaku.go.jp/fishimage/>) provided by the museum.

Results

Leiuranus versicolor (Richardson, 1848)

English common name: Convict Snake Eel

New Japanese standard name: Torano-o-umihebi

Leiuranus versicolor: Richardson, 1848:103 (type locality: Maluku Islands, Indonesia).

Ophichthus cyclorhinus Fraser-Brunner, 1934:466 (type locality: Low Isles, Queensland, Australia).

Leiuranus versicolor: Francis 1993:157 (Australia); Allen and Erdmann 2012:106; McCosker 2014:339 (Philippines).

Elapsopsis versicolor: Myers 1999:56 (Palau).

Leiuranus sp.: Murase 2019:60 (Kadogawa, Japan).

Material examined: KPM-NI 50816 (formerly UMN-B-I 6856), 381.8 mm TL (head and anterior trunk damaged), Kadogawa Bay, Miyazaki Prefecture, Japan (32°28'37"N, 131°39'42"E), set net, 8 Feb. 2018, collected by M. Wada.

Description: Measurements in mm: total length 381.8; preanal length 170.8; tail length 211.0; predorsal length 28.9; body depth at mid-anus 9.8; body width at mid-anus 9.1. Counts: predorsal vertebrae 7; preanal vertebrae

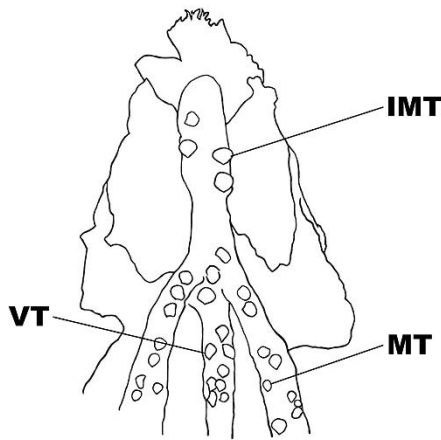


Figure 2. Line drawing of dentition on maxilla and palatal area of *Leiuranus versicolor*, KPM-NI 50816, 381.8 mm TL. IMT = intermaxillary teeth; MT = maxillary teeth; VT = vomerine teeth. Illustrated and digitalized by Y. Ogata.

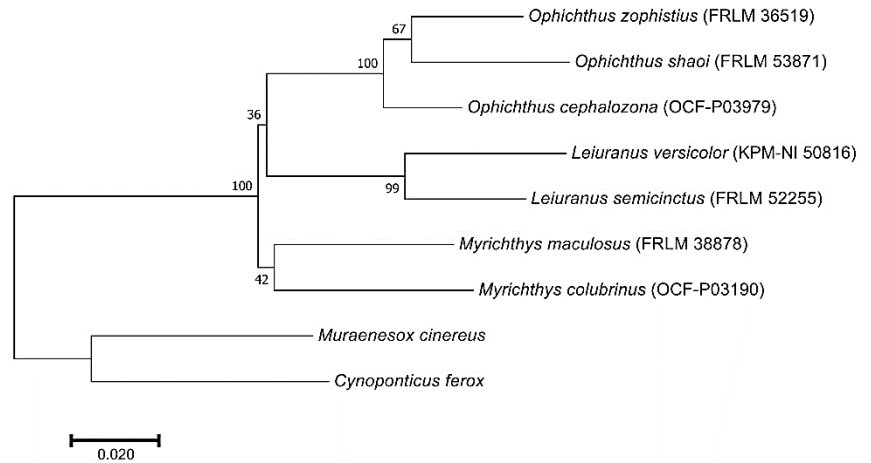


Figure 3. NJ tree of several ophichthid species based on partial 16S rRNA sequences.

65; total vertebrae 164. Body elongated, cylindrical, laterally compressed in posterior part of tail; tail longer than preanal length. Head totally damaged (Fig. 1); teeth conical, pointed, weakly recurved toward posteriorly; teeth present but weakly damaged and some lost (Fig. 2); intermaxillary teeth and vomerine teeth biserial, both parts not connected; teeth on maxilla biserial or uniserial; teeth on dentary uniserial. Low dorsal and anal fins present but not connected at tip of tail, both medial fins ended slightly before tip of tail. Body whitish with 15 broad dark brown bands, most of them notched dorsally with a middle narrow whitish yellow slit (but one divided completely into two parts), and bands on posterior tail lack the slit; interspace between bands narrow; tip of tail whitish; color of dorsal fin similar to body pattern; anal fin whitish.

Distribution. Maluku Islands, Indonesia (type locality); Queensland, Australia (type locality); Philippines; Palau; southern Japan (present study).

Discussion and remarks: The present specimen is in poor condition; its head and anterior trunk are seriously damaged. The specimen was collected as a captured individual from the set net, but the condition indicates it was initially eaten by sea krait and subsequently vomited (McCosker 1975; Tawa et al. 2018; Tashiro et al. 2018). Because of the condition, many of generic characters of *Leiuranus* are difficult to observe from the specimen. In the result of comparison with other ophichthid species including *L. semicinctus* (Fig. 3) based on 16S sequences, the sequence of the present specimen is clustered with that of *L. semicinctus*. Unfortunately, we could not conduct DNA barcoding with *L. versicolor* because no reference data is present. However, we conclude the present specimen is *L. versicolor* based on its unique color pattern, i.e., most of darker bands are divided by a narrow whitish yellow slit from dorsal side (Fig. 1). The pattern is unique within Ophichthidae. In addition, *L. versicolor* differs from *L. semicinctus* in the presence of the vomerine teeth (present in *L. versicolor* vs. absent in *L. semicinctus*).

Information of the other characters of *L. versicolor* is insufficient for this specimen. The vertebral formulae for this specimen and for its synonym, *Ophichthus cyclorhinus* (holotype, BMNH 1933.8.12.13 is 7/66/158) overlaps with the range of the total vertebrae of *L. semicinctus* (164–171, John. E. McCosker, pers. comm.; Hibino, unpublished). The total vertebral count of *L. versicolor* overlap with *L. semicinctus* may be fewer as additional specimens are discovered.

As mentioned above, *L. versicolor* has been recorded from Australia, Indonesia, Papua New Guinea and

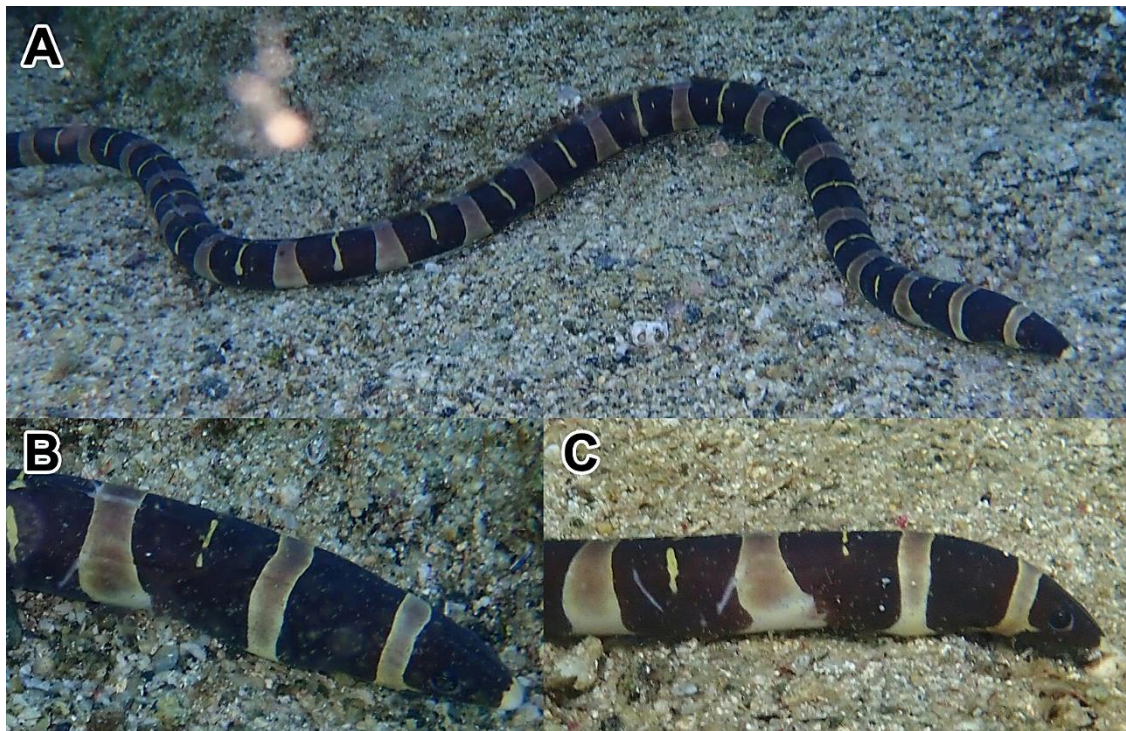


Figure 4. Underwater photographs of *Leiuranus versicolor*, Kashiwajima, Kochi Prefecture, Japan (photographed by Mamatsuko sp.). A, whole image (right side); B, dorsolateral head (right side); C, lateral head (right side).

Philippines. Consequently, the present material from Miyazaki is the first record of the species from Japan and northernmost record. One individual of *L. versicolor* was photographed from sandy bottom of 3 m depth, Kashiwajima, southern part of Kochi Prefecture, southern Japan in 23 September 2018 (Fig. 4). It is easily identified as the species by the color pattern, pointed snout and slender body.

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