Specimens of the genus *Gnathopogon* (Cypriniformes: Cyprinidae) deposited in the Department of Zoology, The University Museum, The University of Tokyo

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Abstract

Specimens of the genus *Gnathopogon* (Cypriniformes: Cyprinidae) in the Department of Zoology, The University Museum, The University of Tokyo (ZUMT) were examined and found to represent four species and subspecies as follows: *Gnathopogon caerulescens* (Sauvage, 1883); *Gnathopogon elongatus elongatus* (Temminck & Schlegel, 1846); *Gnathopogon elongatus suwae* Jordan & Hubbs, 1925; *Gnathopogon strigatus* (Regan, 1908).

Introduction

The genus *Gnathopogon* Bleeker 1860 (Cypriniformes: Cyprinidae) is primarily characterized by the following characters: body size small; body elongate or rather oblong; body and head moderately compressed, head deeper than wide; mouth terminal horizontal or slightly directed upwards; lip thin and smooth; usually a pair of small or minute barbels at the corner of mouth; pharyngeal teeth in two rows, their tips pointed and hooked, usually 5 teeth in the main row, 2 or 3 in the second (Bănărescu and Nalbant, 1973; Kawase 2018). The genus is distributed mainly in East Asia, contains 14 valid species and subspecies (Bănărescu and Nalbant, 1967, 1973; Bogutskaya et al., 2008).

During arrangement of the cyprinid fish collection in the Department of Zoology, The University Museum, The University of Tokyo (ZUMT), 418 specimens were identified as *Gnathopogon*. They are listed below with some notes.

Material and Methods

Specimens of *Gnathopogon* in the Department of Zoology, The University Museum, The University of Tokyo (abbreviated as ZUMT) were identified during the present study following generally Bănărescu and Nalbant (1967, 1973) and Hosoya (2013). Standard lengths (SL) were measured for all specimens, some specimens were counted and measured in detail based on Hubbs and Lagler (2004) and Bogutskaya et al. (2019). Relative measurements except for SL, are given as percentage of SL. The last two rays of the dorsal and anal fins were counted as one ray. Radiographs were used for observing vertebrae. Vertebral counts followed Hosoya (1983), included the first four vertebrae with the Weberian apparatus and one fused vertebra of the hypural complex. Statistical analyses were conducted using R v. 4.3.2 (R Core Team, 2023). Analysis of covariance (ANCOVA) procedures, all morphometric characters were standardized by log-transformation.

All specimens are arranged herein in alphabetical order by species. Collectors' name and affiliations are given where known (from ZUMT specimen catalog or tags), with Japanese language equivalents in parentheses. The following list includes ZUMT number, SL, collection locality, collection date, collecting method, collector or donator and affiliation, local name, literature containing specimens, and remarks when applicable. For some specimens without collecting dates in the ledgers or specimen tags, according to Koeda et al. (2022), the numbers of years before which the specimen was collected were estimated by their specimen numbers. Catalog numbers after ZUMT 61000 were newly given during this study. Institutional codes follow Sabaj (2020).

Results

A total of 418 specimens of four species and subspecies of *Gnathopogon* were confirmed in the ZUMT fish collection. No type specimens of the genus were found in the collection.

Species Accounts

Cyprinidae　コイ科
Gnathopogon Bleeker, 1860　タモロコ属
Gnathopogon caerulescens (Sauvage, 1883)　ホンモロコ

JAPAN
Shiga Pref.
ZUMT 1884, 2, 75.7–84.6 mm SL, vicinity of Katata, Otsu [近江堅田（大津市堅田付近）], Feb. 1898, local name "Yanagimoroko (ヤナギモロコ)".
ZUMT 1896, 3, 81.6–85.3 mm SL, vicinity of Funaki, Omihachiman [近江舟木（近江八幡市船木町付近）], Jan. 1898.
ZUMT 5691, 56.9 mm SL, Biwa Lake (琵琶湖), before 1915.
ZUMT 5980, 3, 76.7–97.0 mm SL, Biwa Lake (琵琶湖), before 1915, donated by Kyoto Shimazu Corporation (京都島津製作所寄贈).
ZUMT 17910, 90.4 mm SL, **ZUMT 17911**, 87.6 mm SL, **ZUMT 17912**, 72.4 mm SL, **ZUMT 17913**, 89.5 mm SL, **ZUMT 17914**, 72.7 mm SL, **ZUMT 17915**, 67.0 mm SL, **ZUMT 17916**, 89.4 mm SL, **ZUMT 17917**, 95.5 mm SL, **ZUMT 17918**, 96.6 mm SL, **ZUMT 17919**, 67.1 mm SL, **ZUMT 17920**, 74.0 mm SL, **ZUMT 17921**, 77.4 mm SL, **ZUMT 17922**, 100.2 mm SL, **ZUMT 17923**, 100.2 mm SL, **ZUMT 17924**, 84.4 mm SL, **ZUMT 17925**, 83.3 mm SL, **ZUMT 17926**, 73.1 mm SL, **ZUMT 17927**, 90.7 mm SL, **ZUMT 17928**, 77.0 mm SL, **ZUMT 17929**, 97.3 mm SL, **ZUMT 17930**, 78.5 mm SL, **ZUMT 17931**, 73.2 mm SL, **ZUMT 17932**, 71.1 mm SL, **ZUMT 17933**, 94.0 mm SL, Otsu [大津（大津市）], before 1927, collected by D. Miyaji (宮地伝三郎採集).
ZUMT 18014, 99.7 mm SL, Biwa Lake (琵琶湖), before 1927, collected by N. Yosezato (与世里成春採集).
ZUMT 30155, 15, 88.8–109.1 mm SL, Biwa Lake (琵琶湖), before 1934, donated by Shiga Prefectural Fisheries Experimental Station (滋賀県水産試験場寄贈).
ZUMT 33189, 88.4 mm SL, vicinity of Otsu [大津（大津市付近）], July 1906, collected by K. Fujitsuna (藤綱藏太郎採集), as used in Tanaka (1907).
ZUMT 38785, 93.1 mm SL, **ZUMT 38786**, 89.1 mm SL, Biwa Lake (琵琶湖), 1909, collected by T. Yanagimoto (柳本斗夫採集).
ZUMT 49398, 103.3 mm SL, **ZUMT 49429**, 77.5 mm SL, **ZUMT 49430**, 72.4 mm SL, **ZUMT 49431**, 77.9 mm SL, **ZUMT 49432**, 70.3 mm SL, Biwa Lake (琵琶湖), 1958, collected by Y. Makino (牧野四子吉採集).
ZUMT 56140, 56.8 mm SL, Matsubara-naiko Lagoon (currently disappeared), Matsubara, Hikone [松原内湖（彦根市松原，現在松原内湖は消失）], July 1911.
ZUMT 56173, 82.8 mm SL, vicinity of Kannonji, Otsu [琵琶湖実験所下（大津市観音寺町付近）], 27 Mar. 1924, collected by Ozaki.
ZUMT 56174, 93.2 mm SL, vicinity of Kannonji, Otsu [琵琶湖実験所下（大津市観音寺町付近）], Apr. 1924, collected by Ozaki.
ZUMT 57269, 73.2 mm SL, Biwa Lake, Hikone (彦根市琵琶湖), 15 Jan. 1988.
ZUMT 57322, 61.8 mm SL, Biwa Lake, Hikone (彦根市琵琶湖), 3 Oct. 1987.
ZUMT 65638, 71.0 mm SL, **ZUMT 65704**, 100.3 mm SL, Matsubara-naiko Lagoon (currently disappeared), Matsubara, Hikone [松原内湖（彦根市松原，現在松原内湖は消失）], 22 Mar. 1933.

Tokyo market
ZUMT 35270, 94.5 mm SL, before 1936.

Locality Unknown
ZUMT 66354, 74.0 mm SL, 1940.

Remarks. A single specimen (ZUMT 35270) collected before 1936 from Tokyo Market, was confirmed. It suggests that the species was already in general circulation at the time.

Gnathopogon elongatus elongatus (Temminck & Schlegel, 1846)　タモロコ

JAPAN
Tokyo
ZUMT 19053, 56.5 mm SL, **ZUMT 19054**, 63.3 mm SL, vicinity of Asa-kawa River, Hachioji (八王子市浅川付近), before 1929, collected by R. Azuma (阿妻利八採集).
ZUMT 55916, 55.3 mm SL, Hobokubo River, Tama-gawa River system, Hyakuso, Hino (日野市百草程久保川), 9 Nov. 1986, collected by M. Aizawa (藍澤正宏採集).
ZUMT 55951, 4, 45.9–71.9 mm SL, vicinity of the junction of Aasa-kawa and Tama-gawa rivers, Tama-gawa River system, Hyakuso, Hino (日野市百草浅川出合), 35°39'43"N, 139°25'43"E, hand net, 16 Nov. 1986, collected by M. Aizawa (藍澤正宏採集).
ZUMT 57281, 66.1 mm SL, **ZUMT 57282**, 70.1 mm SL, Hobokubo River, Tama-gawa River system, Hyakuso, Hino (日野市百草程久保川), 35°39'28"N, 139°26'09"E, hand net, 5 Oct. 1987, collected by M. Aizawa (藍澤正宏採集).
ZUMT 57320, 5, 59.2–71.2 mm SL, vicinity of the junction of Aasa-kawa and Tama-gawa rivers, Tama-gawa River system, Hyakuso, Hino (日野市百草浅川出合), 35°39'43"N, 139°25'43"E, hand net, 1 Nov. 1987, collected by M. Aizawa (藍澤正宏採集).

Kanagawa Pref.
ZUMT 21308, 62.4 mm SL, vicinity of Fujisawa [藤沢 (藤沢市付近)], 20 Sept. 1925, donated by Kanagawa Normal School (神奈川師範学校寄贈).
ZUMT 21470, 61.6 mm SL, vicinity of Atsugi [厚木 (厚木市付近)], donated by K. Senba belonging to Kanagawa Prefectural Atsugi Junior High School on 28 Apr. 1929(神奈川県立厚木中学校所属の仙波高尚より 1929 年 4 月 28 日に寄贈).

Ishikawa Pref.
ZUMT 43037, 56.1 mm SL, **ZUMT 43038**, 56.8 mm SL, Imae Lagoon (currently disappeared), vicinity of Takuei, Komatsu [今江潟(小松市拓栄町付近，今江潟は現在は消失)], before 1952.

Fukui Pref.
ZUMT 4434, 79.3 mm SL, **ZUMT 4446**, 43.2 mm SL, vicinity of Kohama [若州小濱 (小浜市付近)], before 1915, donated by N. Taniguchi (谷口直太郎寄贈).

Yamanashi Pref.
ZUMT 18020, 60.1 mm SL, Kamatani, Fuefuki, Nigori, or Ara-kawa rivers, Fuji River system (富士川水系の釜無川，笛吹川，濁川，および荒川のいずれか), collected by T. Yashima belonging to Kofu Junior High School (甲府中学校所属の矢島種次採集), local names “Kamappaya (カマッパヤ)”, “Moroppaya (モロッパヤ)”, “Ishippaya (イシッパヤ)”, “Magurippaya (マグリッパヤ)”, and “Honmoroko (ホンモロコ)”.
ZUMT 43941, 43, 33.0–80.0 mm SL, **ZUMT 43969**, 14, 17.7-26.1 mm SL, vicinity of Kofu [甲府付近（甲府市付近）], before 1952.
ZUMT 44720, 55.5 mm SL, **ZUMT 44721**, 54.3 mm SL, **ZUMT 44722**, 46.8 mm SL, **ZUMT 44723**, 71.6 mm SL, vicinity of Kofu [甲府付近（甲府市付近）], 21 July 1921.
ZUMT 56152, 56, 20.1–75.5 mm SL, vicinity of Kofu [甲府（甲府市付近）], 30 Sept. 1910.

Nagano Pref.

ZUMT 2122, 13, 39.5–68.8 mm SL, Shinshu (信州), Aug. 1905, donated by T. Yagi (八木貞介寄贈), as used in Tanaka (1909a, 1912).

ZUMT 38590, 69.4 mm SL, Kosui? (湖水？), 1915, donated by A. Tanaka (田中阿歌麿寄贈).

ZUMT 65639, 42.4 mm SL, Omachi, Omachi (大町市大町), before 1911, donated by T. Yagi (八木貞介寄贈), local name "Moroko (モロコ)", as used in Tanaka (1909a, 1912).

ZUMT 65640, 2, 33.7–35.3 mm SL, Aisome, Ikeda, Kitaazumi (北安曇郡池田町会染), before 1911, donated by T. Yagi (八木貞介寄贈), local name "Tarekan (タレカン)", as used in Tanaka (1909a, 1912).

ZUMT 65641, 2, 40.2–40.5 mm SL, Ta-kawa River (田川), before 1911, donated by T. Yagi (八木貞介寄贈), local name "Haya (ハヤ)", as used in Tanaka (1909a, 1912).

ZUMT 65642, 2, 48.7–54.2 mm SL, vicinity of Shimohisakata, Tenryu River, Iida [下伊那郡飯田市下久堅村天竜川（飯田市下久堅付近天竜川）], before 1911, donated by T. Yagi (八木貞介寄贈), local name "Moro (モロ)", as used in Tanaka (1909a, 1912).

ZUMT 65643, 2, 38.9–42.2 mm SL, Tenryu River, Takagi, Shimoina (下伊那郡喬木村天竜川) ,before 1911, donated by T. Yagi (八木貞介寄贈), local name "Moro (モロ)", as used in Tanaka (1909a, 1912).

ZUMT 65644, 3, 38.7–47.8 mm SL, western of Chino [諏訪郡永明村（茅野市西部）], before 1911, donated by T. Yagi (八木貞介寄贈), local name "Ishimuro (イシムロ)".

Gifu Pref.

ZUMT 2408, 80.1 mm SL, 12 Feb. 1909, donated by T. Nekoyama (猫山常蔵寄贈), as used in Tanaka (1910b).

ZUMT 5652, 48.1 mm SL, vicinity of Mitake, [御嵩（御嵩町付近）], before 1915, collected by I. Ando (安藤伊三次郎採集), local name "Moroko (モロコ)".

ZUMT 5694, 97.2 mm SL, donated by Sakai Aquarium in June 1903 (堺水族館より 1903 年 6 月に寄贈).

ZUMT 13428, 51.1 mm SL, **ZUMT 13429**, 55.8 mm SL, Aki, Fuchi, or Kiso rivers, Kiso River system [恵那郡木曽川，付知川．阿木川（木曾川水系木曽川，付知川，および阿木川のいずれか）], 9 July 1924, collected by H. Niwa belonging to Nakatsu Elementary School (中津小学校の丹羽　彌採集), local name "Moroko (モロコ)".

ZUMT 23334, 54.9 mm SL, male, Omote River?, Ogaki (大垣市表川？), 24 Mar. 1931, collected by S. Hama belonging to Gifu Prefectural Daini Technical High School (岐阜県立第二工業学校の波磨実太郎採集).

ZUMT 24502, 72.7 mm SL, Nagara River Gifu (岐阜市長良川), Aug. 1931, collected by S. Hama belonging to Gifu Prefectural Daini Technical High School (岐阜県立第二工業学校の波磨実太郎採集).

ZUMT 24506, 70.5 mm SL, Kuise River, southern part of Ogaki [安八郡南杭瀬村杭瀬川（大垣市南部杭瀬川）], Aug. 1927, collected by S. Hama belonging to Gifu Prefectural Daini Technical High School (岐阜県立第二工業学校の波磨実太郎採集).

ZUMT 27876, 45.4 mm SL, vicinity of Ueda, Minami, Gunjo [美濃高砂（郡上市美並町上田付近）], before 1934, collected by S. Yamada belonging to Minami Village Takayama Elementary School (美並村立高山小学校の山田修一郎採集).

ZUMT 34373, 62.9 mm SL, a stream of southern part of Gifu [加納町の川（岐阜市南部の川）], donated by T. Nekoyama (猫山常蔵寄贈), local name "Moroko (モロコ)".

ZUMT 34374, 76.8 mm SL, a stream vicinity Takehana, Hishima [竹ケ鼻町の小川（羽島市竹鼻町付近の川）], donated by T. Nekoyama (猫山常蔵寄贈), local name "Shirahae (シラハエ)".

Shizuoka Pref.

ZUMT 17815, 5, 36.2–44.5 mm SL, Ukishima Pond [駿東郡原町字植田付近浮島沼（沼津市浮島沼）], 26 Aug. 1927, collected by N. Kuroda (黒田長礼採集).

ZUMT 38685, 64.4 mm SL, Tenryu River, southeastern part of Chuo-ku, Hamamatsu [浜名郡和田村龍光天竜川（浜松市中央区南東部天竜川）], 1 June 1931, collected by S. Ito (伊東信太郎採集), local name "Moro (モロ)".

ZUMT 44288, 38.2 mm SL, **ZUMT 44289**, 37.8 mm SL, **ZUMT 44290**, 37.2 mm SL, **ZUMT 44291**, 36.4 mm SL, **ZUMT 44292**, 46.0 mm SL, **ZUMT 44293**, 32.1 mm SL, **ZUMT 44294**, 36.7 mm SL, Ukishima Pond, Numazu [駿東郡原町字植田付近浮島沼（沼津市浮島沼）], 26 Aug. 1927.

Aichi Pref.

ZUMT 16399, 39.5 mm SL, **ZUMT 16400**, 42.7 mm SL, western part of Shinshiro [南設楽郡千郷村（新城市西部）], Aug. 1925, collected by S. Yoshikane (吉兼宗一採集) local name “Moroko (モロコ)”.

ZUMT 16402, 50.7 mm SL, vicinity of Toyokawa [三河豊川（豊川市付近）], Aug. 1925, collected by S. Yoshikane (吉兼宗一採集), local name “Moroko (モロコ)”.

ZUMT 26124, 81.3 mm SL, vicinity of Shinshiro [三河新城（新城市付近）], Aug. 1925, donated by S. Yoshida (吉田関子寄贈), local name “Morokobaya (モロコバヤ)”.

ZUMT 26125, 88.7 mm SL, eastern part of Toyokawa [三河八名郡大和村（豊川市東部）], 10 May 1933, donated by S. Yoshida (吉田関子寄贈), local name “Morokobaya (モロコバヤ)”.

Mie Pref.

ZUMT 9987, 57.6 mm SL, **ZUMT 9988**, 71.6 mm SL, vicinity of Aho, Iga [伊賀国名賀郡阿保村（伊賀市阿保付近）], before 1923, collected by H. Nakamoto (中本久俊採集).

Shiga Pref.

ZUMT 1837, 2, 48.3–62.5 mm SL, vicinity of Makino, Takashima [近江国高島郡百瀬村（滋賀県高島市マキノ町付近）], Nov. 1906, donated by Kyoto Shimazu Factory (京都島津製作所寄贈), local name “Moroko (モロコ)”.

ZUMT 1882, 7, 53.2–84.3 mm SL, **ZUMT 1883**, 2, 46.2–52.1 mm SL, vicinity of Katata, Otsu [近江堅田（大津市堅田付近）], Feb. 1898, local name “Yanagimoroko (ヤナギモロコ)”..

ZUMT 2581, 20.1 mm SL, vicinity of Zeze, Otsu [近江膳所（滋賀県大津市膳所付近）], 1909, donated by F. Fujitsuna (藤綱藤太郎寄贈) as used in Tanaka (1910a).

ZUMT 5982, 70.7 mm SL, Biwa Lake (琵琶湖), donated by Shimazu Factory (島津製作所寄贈).

ZUMT 38774, 102.0 mm SL, **ZUMT 38775**, 106.0 mm SL, **ZUMT 38776**, 75.8 mm SL, **ZUMT 38777**, 63.1 mm SL, Biwa Lake (琵琶湖), 1909, donated by T. Yanagimoto (柳本斗夫寄贈) local name “Sugojimoroko (スゴジモロコ)”.

ZUMT 49425, 62.8 mm SL, **ZUMT 49426**, 61.3 mm SL, **ZUMT 49427**, 61.6 mm SL, **ZUMT 49428**, 58.4 mm SL, Biwa Lake (琵琶湖), 1958, collected by Y. Makino (牧野四子吉寄贈).

ZUMT 55818, 45.3 mm SL, a stream of Yamagawara, Echi River system, Echigawa, Echi (愛知郡愛知川町山川原愛知川水系細流), 35°11'17"N, 136°11'36"E, hand net, 1 Nov. 1986, collected by M. Aizawa et al. (藍澤正宏他採集).

ZUMT 55819, 48.4 mm SL, Echi River, Inae, Hikone (彦根市稲枝町愛知川), 1 Nov. 1986, collected by M. Aizawa, H. Senou and T. Urano (藍澤正宏・瀬能　宏・浦野貴史採集).

ZUMT 56106, 54.9 mm SL, Biwa Lake (琵琶湖), 30 Sept. 1911, donated by T. Yanagimoto (柳本斗夫寄贈).

ZUMT 56139, 16, 30.1–62.4 mm SL, Matsubara-naiko Lagoon (currently disappeared), Matsubara, Hikone [彦根市松原町松原内湖（彦根市松原，現在松原内湖は消失）], July 1911.

ZUMT 56167, 2, 22.4–26.1 mm SL, Biwa Lake, Matsubara, Hikone (彦根市松原琵琶湖), May 1898.

ZUMT 61343, 4, 61.2–67.7 mm SL, Biwa Lake (琵琶湖), Aug. 1924, collected by J. Kawabata (川端重五郎採集).

ZUMT 61352, 6, 26.7–46.5 mm SL, Matsubara-naiko Lagoon (currently disappeared), Matsubara, Hikone [彦根市松原松原内湖（彦根市松原，現在松原内湖は消失）], Aug. 1921, collected by S. Tanaka (田中茂穂採集).

Kyoto Pref.

ZUMT 6603, 75.8 mm SL, Oi River, Kameoka [丹波南葉田郡亀岡町付近大堰川（亀岡市大堰川）], before 1915, collected by H. Ibaraki (茨木　一採集), local name “Moroko (モロコ)”.

ZUMT 6605, 72.9 mm SL, Yura River, Fukuchiyama [丹波天田郡福知山由良川（福知山市由良川）], before 1915, collected by H. Ibaraki (茨木　一採集).

ZUMT 6670, 46.2 mm SL, vicinity of Fukuchiyama [丹波天田郡福知山町付近（福知山市付近）], before 1915, collected by H. Ibaraki (茨木　一採集).

ZUMT 39103, 72.6 mm SL, Yura River, Komori, Oe, Fukuchiyama [加佐郡河守町河守由良川上流（福知山市

大江町河守由良川）], May 1934, collected by S. Tsuji belonging to Komori Sericultural School (河守蚕業学校の辻　季吉採集), local name “Moroko (モロコ)”.

ZUMT 39141, 71.6 mm SL, **ZUMT 39142**, 71.9 mm SL, Yura River, Komori, Oe, Fukuchiyama [加佐郡河守町河守由良川上流（福知山市大江町河守由良川）], Apr. 1934, collected by S. Tsuji belonging to Komori Sericultural School (河守蚕業学校の辻　季吉採集), local name “Yanagibae (ヤナギバエ)”.

ZUMT 66352, 37.4 mm SL, Takeno, Kyotanba, Funai (船井郡京丹波町竹野), 1940, collected by Yamashima (山島採集).

Hyogo Pref.

ZUMT 7162, 81.8 mm SL, southwestern part of Sanda [摂津有馬郡貴志村（三田市南西部）], before 1918, collected by K. Yamatori belonging to Mikage Normal School (御影師範学校の山鳥吉五郎採集).

ZUMT 7170, 2, 53.4–53.5 mm SL, northern part of Tanbasasayama [丹波多紀郡北河内村（丹波篠山市北部）], before 1918, collected by K. Yamatori belonging to Mikage Normal School (御影師範学校の山鳥吉五郎採集).

ZUMT 8640, 63.7 mm SL, **ZUMT 8641**, 55.3 mm SL, vicinity of Fukusumi, Izushi, Tomioka [出石郡室埴村福住（豊岡市出石町福住付近）], before 1918, collected by M. Nagasawa, principal of the Fukusumi Ordinary Elementary School (福住尋常小学校長の永沢松太郎採集).

ZUMT 9066, 67.8 mm SL, **ZUMT 9067**, 62.9 mm SL, **ZUMT 9068**, 60.8 mm SL, vicinity of Himeji [姫路（姫路市付近）], before 1920, collected by R. Abe and C. Sakamoto (阿部良平と坂本長蔵採集).

ZUMT 9855, 7, 45.5–66.6 mm SL, before 1920, collected by K. Yamadori (山鳥吉五郎採集).

ZUMT 18938, 70.8 mm SL, **ZUMT 18939**, 59.1 mm SL, vicinity of Yamada, Himeji [神崎郡山田村（姫路市山田町付近）], 28 Oct. 1928, collected by T. Saito belonging to Funamachi Fisheries Experimental Station (舟町水産試験場の斎藤敏夫採集), local names “Moroko (モロコ)”, “Gamappaya (ガマッパヤ)”, “Moroppaya (モロッパヤ)”, “Ishippaya (イシッパヤ)”, “Magurippaya (マグリッパヤ)”, and “Honmoroko (ホンモロコ)”.

ZUMT 25211, 78.2 mm SL, vicinity of Hidaka, Maruyama River, Toyooka [円山川江原付近（豊岡市日高町付近円山川）], before 1932, collected by T. Dobashi (土橋忠重採集), local name “Yamajako (ヤマジャコ)”.

ZUMT 42960, 51.4 mm SL, **ZUMT 42961**, 51.9 mm SL, **ZUMT 42963**, 51.4 mm SL, **ZUMT 44539**, 83.5 mm SL, **ZUMT 44554**, 41.5 mm SL, **ZUMT 44555**, 65.7 mm SL, **ZUMT 44556**, 56.7 mm SL, **ZUMT 44557**, 46.2 mm SL, **ZUMT 44559**, 61.6 mm SL, **ZUMT 44694**, 16, 34.9–71.1 mm SL, vicinity of Sumoto, Awaji Island [淡路洲本（淡路島洲本市付近）], before 1952.

ZUMT 66601, 6, 47.4–79.0 mm SL, collected by H. Yamada (山田兵士労郎採集).

Wakayama Pref.

ZUMT 20325, 58.6 mm SL, vicinity of Tanabe [紀州田辺（田辺市付近）], Sept. 1921, collected by N. Ui (宇井縫蔵採集).

ZUMT 22013, 47.2 mm SL, Jan. 1920.

Okayama Pref.

ZUMT 2191, 4, 48.9–62.6 mm SL, **ZUMT 2192**, 48.2 mm SL, **ZUMT 2193**, 46.9 mm SL, vicinity of Tsuyama [作州津山（津山市付近）], 26 May 1909, donated by T. Kageyama (影山藤作寄贈), local name “Kasuke (カスケ)”.

ZUMT 2784, 90.4 mm SL, vicinity of Higashi-ku, Okayama [上道郡九珊（岡山市東区付近）], 15 May 1910, donated by Okayama Fisheries Experimental Station (岡山水産試験場寄贈), reared specimen, as used in Tanaka (1910c).

ZUMT 2813, 2, 56.6–63.3 mm SL, vicinity of Yoshii, Ihara [後月郡芳井村小田井（井原市芳井町付近）], 27 Aug. 1910, donated by Okayama Fisheries Experimental Station (岡山水産試験場寄贈), local name “Yanagibae (ヤナギバエ)”, as used in Tanaka (1910b).

ZUMT 3194, 68.9 mm SL, before 1911, collected by F. Katsurada (桂田富士郎採集).

ZUMT 25380, 59.7 mm SL, vicinity of Hiruzenshimowa, Shitawa River, Asahi River system, Maniwa [眞庭郡中和村下和旭川最上流下和川（真庭市蒜山下和付近旭川水系下和川）], Aug. 1931, donated by Kataoka-gun (片岡郡寄贈), local name “Tanokobae (タノコバエ)”.

Hiroshima Pref.

ZUMT 10523, 60.4 mm SL, Numata River southern part of Hiroshima Prefecture (広島県南部沼田川), before 1923, collected by K. Sawahara belonging to Hiroshima Prefectural Chukai Junior High School (広島県立忠海中学校の沢原一二採集), local name “Mugibae (ムギバエ)”.

Ehime Pref.

ZUMT 20116, 50.8 mm SL, **ZUMT 20117**, 50.5 mm SL, **ZUMT 20118**, 49.6 mm SL, **ZUMT 20119**, 66.3 mm SL, vicinity of Ozu [大洲（大洲市付近）], before 1930, collected by K. Yamashita belonging to Ozu Junior High School (大洲中学校の山下幸平採集).

ZUMT 24948, 54.4 mm SL, vicinity of Horie Coast, Horie, Matsuyama [温泉郡堀江村海岸（松山市堀江町堀江海岸付近）], Oct. 1931, collected by Z. Ishikawa belonging to Matsuyama Girls' High School (松山高等女学校の石川重次郎採集).

Locality Unknown

ZUMT 19935, 52.0 mm SL, before 1930, donated by Okayama Dairoku High School (岡山第六高等学校寄贈).

ZUMT 27948, 53.8 mm SL, southern Japan? (南日本？).

ZUMT 29220, 42.4 mm SL, before 1934, collected by Y. Ito belonging to Shizuoka Junior High School (静岡中学校の伊藤芳夫採集).

ZUMT 32589, 44.7 mm SL, before 1936, collected by T. Nekoyama (猫山常蔵採集).

ZUMT 40666, 33.7 mm SL, **ZUMT 40667**, 30.8 mm SL, before 1952, Morioka? (盛岡？).

ZUMT 44901, 6, 28.3–39.9 mm SL, collected by N. Onodera belonging to Shizuoka Prefectural Mitsuke Junior High School (静岡県立見付中学校の小野寺直一採集).

ZUMT 46502, 68.3 mm SL, **ZUMT 46503**, 57.4 mm SL, **ZUMT 46504**, 58.8 mm SL, **ZUMT 46505**, 61.2 mm SL, **ZUMT 46506**, 81.7 mm SL, **ZUMT 46507**, 74.0 mm SL, **ZUMT 46508**, 56.4 mm SL, **ZUMT 46509**, 59.5 mm SL, **ZUMT 46510**, 58.1 mm SL, **ZUMT 46511**, 72.4 mm SL, **ZUMT 46512**, 50.5 mm SL, **ZUMT 46513**, 60.5 mm SL, **ZUMT 46514**, 62.4 mm SL, before 1952.

ZUMT 56123, 2, 33.8–37.3 mm SL, Japan, 30 Sept. 1910.

ZUMT 56292, 67.6 mm SL, **ZUMT 65711**, 63.6 mm SL, **ZUMT 66519**, 47.4 + mm SL, **ZUMT 66720**, 50.4 mm SL.

ZUMT 65648, 81.8 mm SL, 1952.

Remarks. In this study, four specimens (ZUMT 19053; ZUMT 19054; ZUMT 21308; ZUMT 21470) collected before 1929 from Kanto region, were confirmed. Although the species is generally considered to be a domestic alien species in Kanto region (Matsuzawa and Senou, 2008; Kawase, 2019), has been recorded in the region before 1950s (Aoyagi, 1957). The status of native or non-native of the species in the region will probably need to be verified in detail.

Gnathopogon elongatus suwae Jordan & Hubbs, 1925　スワモロコ

JAPAN

Nagano Pref.

ZUMT 65645, 72.0 mm SL, Suwa Lake [信州諏訪湖（諏訪湖）], before 1911, donated by T. Yagi (八木貞介寄贈), local name “Ishimuro (イシムロ)”, as used in Tanaka (1909a, 1912).

ZUMT 65646, 3, 52.5–60.8 mm SL, **ZUMT 65647**, 3, 44.3–60.6 mm SL, Suwa Lake (諏訪湖), before 1911, donated by T. Yagi (八木貞介寄贈), local name “Muro (ムロ)”, as used in Tanaka (1909a, 1912).

Remarks. The present specimens were identified as *G. elongatus suwae* because these were collected from Suwa Lake (Hosoya, 2013). Jordan and Hubbs (1925), Miyaji (1935), Matsubara (1955), Kuroda (1960), and Hosoya (2013) also suggested that *G. elongatus suwae* was distinguishable from *G. elongatus elongatus* as follows: body depth of the former about 4–4.7 times greater than SL (3.4–4.3 times greater than SL in the latter); caudal-peduncle

length about 2 times greater than caudal-peduncle depth (less than 2 times); caudal-peduncle depth less than 45 % of head length (more than 47 %); having many black blotches (few black blotches). Although, detail comparisons between *G. elongatus elongatus* (131 specimens) and *G. elongatus suwae* (fifteen specimens, including type specimens) were conducted in this study, it was not possible to clearly distinguish both subspecies using these recognized characters, as follows: body depth about 3.8–5.2 times greater than SL in *G. elongatus suwae* (3.1–4.9 times greater than SL in *G. elongatus elongatus*); caudal-peduncle length about 1.5–1.9 times greater than caudal-peduncle depth (1.1–1.9 times); caudal-peduncle depth 37–48 % of head length (34–57 %); both species having many black blotches (Figs. 1, 2). In the future, it will be necessary to examine new recognized character of *G. elongatus elongatus* and *G. elongatus suwae*.

Hosoya (1987) reported *G. elongatus* inhabiting lake, (including *G. elongatus suwae*) are shaped limnetic form, as follows: limnetic populations of body and caudal-peduncle depth tend to be shallower; barbels tend to be longer; tend to have more lateral-line scales, gill rakers, and vertebrae. Although, compared *G. elongatus elongatus* from Tenryu River system (twenty-nine specimens) and *G. elongatus suwae* (fifteen specimens, including type specimens) in this study, above characters, except for caudal-peduncle depth, were not differed between both groups (Fig. 3; Table 2, 3), and ANCOVA was showed barbel length was significantly ($P < 0.01$) shorter in *G. elongatus suwae* (Table 3; Fig. 3).

Significant ($P < 0.01$) differences for 6 morphometric characters by Welch's t-test, and 3 morphometric characters by ANCOVA were showed between *G. elongatus elongatus* from Tenryu River system and *G. elongatus suwae* (Fig. 3; Table 3). Among these characters, although head length and pre-pectoral length showed significant ($P < 0.01$) differences between both groups by only Welch's t-test, it was assumed to difference of body sized between both groups, and body proportions (% of SL) of above characters decreased with growth in both groups, were cause (Table 3; Fig. 3). Also, 3 characters (eye diameter, postorbital length, and interorbital width) related to eye showed significant differences between both groups (Table 3; Fig. 3). Among these, although body proportions of eye diameter between both groups decreased with growth, ANCOVA was showed eye diameter tended to be significantly ($P < 0.01$) larger in *G. elongatus suwae* (Table 3; Fig. 3).

Gnathopogon strigatus (Regan, 1908)　シマモロコ

CHINA

ZUMT 41680, 83.8 mm SL, **ZUMT 41681**, 61.0 mm, probably before 1952, Manchuria, Boley (満州国勃利).

ZUMT 42466, 71.7 mm SL, **ZUMT 42500**, 67.1 mm SL, **ZUMT 42531**, 65.7 mm SL, **ZUMT 42548**, 65.8 mm, Manchuria (満州国), 28 June 1942, collected by H. Kuwano (桑野久任採集).

Comparative material examined: *Gnathopogon elongatus elongatus*: KUN-P 48405, 47.4 mm SL, KUN-P 48406, 52.7 mm SL, Tenryu River system, Nagano Prefecture, Japan, 6 August 2018, K. Mochizuki; KUN-P 51145, 60.8 mm SL, KUN-P 51151, 60.8 mm SL, KUN-P 51152, 48.0 mm SL, Tenryu River system, Nagano Prefecture, Japan, 4 May 2019, K. Mochizuki; KUN-P 55289, 56.8 mm SL, KUN-P 55290, 51.9 mm SL, KUN-P 55291, 52.0 mm SL, KUN-P 55313, 48.9 mm SL, KUN-P 55314, 48.5 mm SL, KUN-P 55315, 47.5 mm SL, KUN-P 55316, 55.3 mm SL, KUN-P 55317, 50.0 mm SL, KUN-P 55318, 55.9 mm SL, KUN-P 55319, 52.2 mm SL, KUN-P 55320, 45.8 mm SL, KUN-P 55321, 48.5 mm SL, Tenryu River system, Nagano Prefecture, Japan, 2 November 2019, K. Mochizuki and M. Fujita. *Gnathopogon elongatus suwae*: FMNH 58708, holotype, 68.9 mm SL, Suwa Lake, Nagano Prefecture, Japan, 1922, Jordan, D. S.; CAS-SU 23541, paratypes, 62.6–70.9 mm SL, 5, Suwa Lake, Nagano Prefecture, Japan, 1922, Jordan, H. S.; FAKU-P 485, 3, 45.5-57.2 mm SL, Suwa Lake, August 1927, D. Miyaji.

Acknowledgements

We are also grateful D. Oyama, K. Kobayashi, T. Kaneko, A. Eto, N. Osakabe, K. Fujiwara, S. Oda, D. Suda, M. Fukatani, S. Ito, M. Saito, A. Iinuma, S. Fujiwara, H. Kamei, A. Takahashi, and other volunteers for curatorial

assistance, M. Matsunuma (FAKU) for opportunities to valuable specimens, K. Hosoya (Kindai University) for providing valuable literature and comments, K. Fujiwara (NSMT) for providing valuable comment as an editor, D. Catania (CAS) and S. Mochel (FMNH), helps to observe the type series of *Gnathopogon elongatus suwae*.

References

Aoyagi, H. 1957. General notes on the freshwater fishes of the Japanese Archipelago. Taishukan, Tokyo. 272 pp. (In Japanese)

Bănărescu, P. and Nalbant, T. T. 1973. Pisces, Teleostei, Cyprinidae (Gobioninae). Das Tierreich, Lieferung 93. Walter de Guryter, Berlin. 304 pp.

Bogutskaya, N. G., Diripasko, O. A., Zupančič, P., Jelić, D. and Naseka, A. M. 2019. Phenotypic diversity in an endangered freshwater fish *Squalius microlepis* (Actinopterygii, Leuciscidae). ZooKeys, 897: 115–147.

Bogutskaya, N. G., Naseka, A. M., Shedko, S. V., Vasil'eva, E. D. and Chereshnev, I. A. 2008. The fishes of the Amur River: updated check-list and zoogeography. Ichthyological Exploration of Freshwaters, 19 (4): 301−366.

Hosoya, K. 1983. Geographic variation of number of vertebrae in *Squalidus*. The Freshwater Fishes, 9: 43−48. (In Japanese)

Hosoya, K. 1987. Phylogeny and character displacement of *Gnathopogon* fish. Pp. 31–40. In. Mizuno, N. and Goto, A. (ed) Freshwater Fishes of Japan: on their Distribution, Variation, and Speciation. Tokai University, Tokyo. (In Japanese)

Hosoya, K. 2013. Cyprinidae, carps. Pp. 308−327, 1813−1819. In: Nakabo, T. (ed) Fishes of Japan with pictorial keys to the species, third edition. Tokai University, Press, Hadano. (In Japanese)

Hubbs, C. L. and Lagler, K. F. 2004. Fishes of the Great Lakes region. Revised edition. University of Michigan, Bloomfield Hills. xxxii + 276 pp.

Jordan, D. S. and Hubbs, C. L. 1925. Record of fishes obtained by David Starr Jordan in Japan, 1922. Memoirs of the Carnegie Museum, 10 (2):93–346.

Kawase, S. 2018. *Gnathopogon*. Pp. 102–103. In: Nakabo, T. (ed) The natural history of the fishes of Japan. Shogakukan, Tokyo. (In Japanese)

Kawase, S. 2019. *Gnathopogon elongatus elongatus*, pp. 143–144. In: Hosoya, K. (ed) Freshwater fishes of Japan, 2nd edition. Yamatokeikoku-sha, Tokyo. (In Japanese)

Koeda, K., Hata, H., Aizawa, M., Sakamoto, K. and Ueshima, R. 2022. History of the fish collection of the Department of Zoology, The University Museum, The University of Tokyo. The University Museum, The University of Tokyo Material Reports, 129: 1−24. (In Japanese)

Kuroda, N. 1960. A new list of the fishes of Lake Suwa. Japanese Journal of Ichthyology, 8 (1/2): 35−46. (In Japanese)

Matsubara, K. 1955. Fish Morphology and Hierarchy. Ishizaki-Shoten, Tokyo. 1605 pp., 135 pls. (In Japanese)

Matsuzawa Y. and Senou, H. 2008. Alien fishes of Japan. Bun-ichi Sogo Shuppan Co. Ltd., Tokyo. 157 pp. (In Japanese)

R Core Team. 2023. R: A language and environment for statistical computing (Version 4.3.2).

Sabaj, M. H. 2020. Codes for natural history collections in ichthyology and herpetology. Copeia, 108: 593−69.

Tanaka, S. 1907. Fish report. Zoological Magazine Tokyo, 19 (4): 129−132. (In Japanese)

Tanaka, S. 1909a. Notes on fresh-water fishes from the Province of Shinano, Japan. Annotationes zoologicae Japonenses, 7 (2): 125−138.

Tanaka, S. 1909b. The 17th fish report. Zoological Magazine Tokyo, 21 (7): 311−314. (In Japanese)

Tanaka, S. 1909c. The 19th fish report. Zoological Magazine Tokyo, 21 (9): 409−413. (In Japanese)

Tanaka, S. 1910a. The 22th fish report. Zoological Magazine Tokyo, 22 (1): 28−35. (In Japanese)

Tanaka, S. 1910b. The 25th fish report. Zoological Magazine Tokyo, 22 (4): 268−271. (In Japanese)

Tanaka, S. 1910c. The 27th fish report. Zoological Magazine Tokyo, 22 (6): 355−357. (In Japanese)

Tanaka, S. 1910d. The 27th fish report. Zoological Magazine Tokyo, 22 (12): 580−581. (In Japanese)

Tanaka, S. 1912. Freshwater fishes from Shinano Region, Japan. Shinano-Hakubutsugakuzasshi, 38: 29−37. (In Japanese)

Table 1. Counts and measurements (expressed as percentages of standard length) of specimens of *Gnathopogon elongatus suwae* in ZUMT.

	n = 7	
Standard length (SL; mm)	43.4–61.9	
Counts		Modes
Dorsal-fin rays	III, 6 or 7	III, 7
Anal-fin rays	III, 5–7	III, 6
Pectoral-fin rays	14 or 15	14
Pelvic-fin rays	8 or 9	9
Pored lateral-line scales	34–38	35
Scale rows above lateral-line	5 or 6	5
Scale rows below lateral-line	4	4
Pre-dorsal-fin scales	14–16	15
Caudal peduncle scales	14–16	15
Scales between anus and anal fin origin	1–3	1
Gill rakers	6–8	6
Vertebrae (abdominal + caudal)	20 or 21 + 14–16 = 34–37	20 + 16 = 36
Measurements (% of SL)		Means
Body depth	19.2–24.9	22.9
Body width	11.2–19.0	14.7
Head length	25.1–28.3	26.6
Head width	12.6–15.5	14.1
Snout length	6.4–8.6	7.5
Eye diameter	6.0–8.0	7.1
Pupil diameter	2.7–3.7	3.2
Postorbital length	12.6–14.6	13.7
Interorbital width	9.2–10.0	9.5
Upper jaw length	6.1–7.0	6.7
Lower jaw length	5.5–7.2	6.4
Barbel length	3.6–5.6	4.6
Pre-dorsal length	50.2–52.3	51.4
Pre-anal length	66.2–74.9	71.3
Pre-pectoral length	24.7–28.0	25.7
Pre-pelvic length	45.7–52.8	49.7
Length between pectoral fin origin and pelvic fin origin	25.3–29.4	27.0
Length between pelvic fin origin and anal fin origin	21.3–24.7	23.2
Length between anus and anal fin origin	1.4–2.2	1.9
Dorsal fin length	19.0–23.0	20.7
Anal fin length	14.9–16.6	15.6
Pectoral fin length	14.3–18.7	16.3
Pelvic fin length	14.2–16.5	15.2
Dorsal fin base length	9.7–13.7	12.1
Anal fin base length	8.3–9.9	9.0
Caudal-peduncle depth	10.4–12.5	11.5
Upper caudal-peduncle length	34.2–39.3	37.4
Lower caudal-peduncle length	18.7–21.6	20.1

Table 2. Frequency distribution of selected counts of *G. elongatus elongatus* from Tenryu River system, and *G. elongatus suwae*.

	Gill rakers					Pored lateral-line scales						
	5	6	7	8	9	32	33	34	35	36	37	38
G. elongatus elongatus (Tenryu River system)	4	12	10	3					10	13	5	
G. elongatus suwae	1	5	3	1	1	1		3	4	4	3	1

	Abdominal vertebrae		Caudal vertebrae			Total vertebrae			
	20	21	14	15	16	34	35	36	37
G. elongatus elongatus (Tenryu River system)	5	2		5	2			7	
G. elongatus suwae	4	3	1	3	3	1	1	4	1

Table 3. Results of values of Pearson's correlation coefficient, and analysis of Welch's t-test and covariance (ANCOVA) for *Gnathopogon elongatus elongatus* from Tenryu River system and *Gnathopogon elongatus suwae*. Values of Pearson's correlation coefficient (*r*) close to −1 or 1 indicate a strong liner association between standard length (SL) and measurements. Welch's t-test calculated the *P*-value for morphometric characters (all as % of SL). ANCOVA using SL as a covariate, calculated the *P*-value for the intercepts of morphometric characters (all as % of SL) among both groups. ANCOVA was performed for only morphometric characters with the correlation ($r \geqq 0.2$ or $r \leqq -0.2$) in the same direction in both groups using Pearson's correlation coefficient.

	t-test (*P*-value)	Pearson's correlation Coefficient (*r*)		ANCOVA (*P*-value)
		G. elongatus elongatus	*G. elongatus suwae*	
Body depth	0.665	0.478	-0.079	-
Body width	0.639	0.363	0.375	0.086
Head length	0.002*	-0.333	-0.209	0.119
Head width	0.264	0.197	0.217	-
Snout length	0.026	-0.326	0.102	-
Eye diameter	0.018	-0.756	-0.545	0.000*
Pupil diameter	0.017	-0.296	-0.600	0.586
Postorbital length	0.001*	0.122	-0.061	-
Interorbital width	0.000*	-0.044	-0.013	-
Upper jaw length	0.852	0.023	-0.067	-
Lower jaw length	0.114	-0.490	0.397	-
Barbel length	0.044	0.534	0.295	0.000*
Pre-dorsal length	0.738	0.001	0.473	-
Pre-anal length	0.753	-0.056	0.480	-
Pre-pectoral length	0.003*	-0.545	0.380	0.831
Pre-pelvic length	0.075	0.127	0.527	-
Length between pectoral fin origin and pelvic fin	0.669	0.519	0.478	0.143
Length between pelvic fin origin and anal fin origin	0.071	-0.035	0.154	-
Length between anus and anal fin origin	0.005*	-0.460	-0.117	-
Dorsal fin length	0.060	-0.374	-0.076	-
Anal fin length	0.012	-0.368	0.267	-
Pectoral fin length	0.018	0.216	0.126	-
Pelvic fin length	0.000*	-0.247	0.216	-
Dorsal fin base length	0.050	0.369	0.201	0.001*
Anal fin base length	0.055	0.216	0.179	-
Caudal-peduncle depth	0.073	-0.023	-0.658	-
Upper caudal-peduncle	0.143	0.148	-0.188	-
Lower caudal-peduncle	0.481	0.213	-0.329	-

*P < 0.01

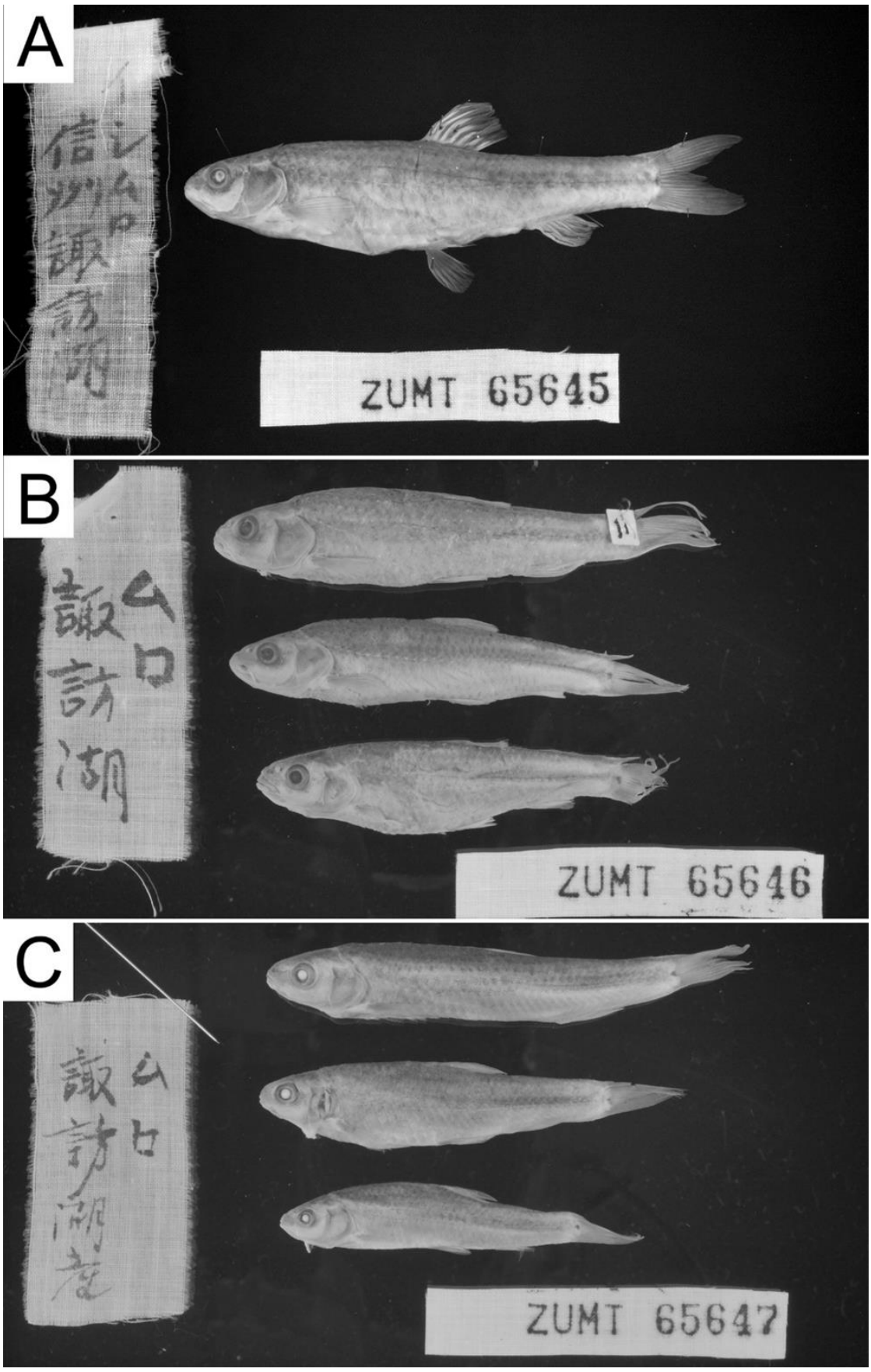

Figure 1. Preserved specimens of *Gnathopogon elongatus suwae* collected from Suwa Lake, Japan. A: ZUMT 65645, 71.3 mm SL; B: ZUMT 65646, 3, 54.0–61.9 mm SL; C: ZUMT 65647, 3, 43.4–60.0 mm SL.

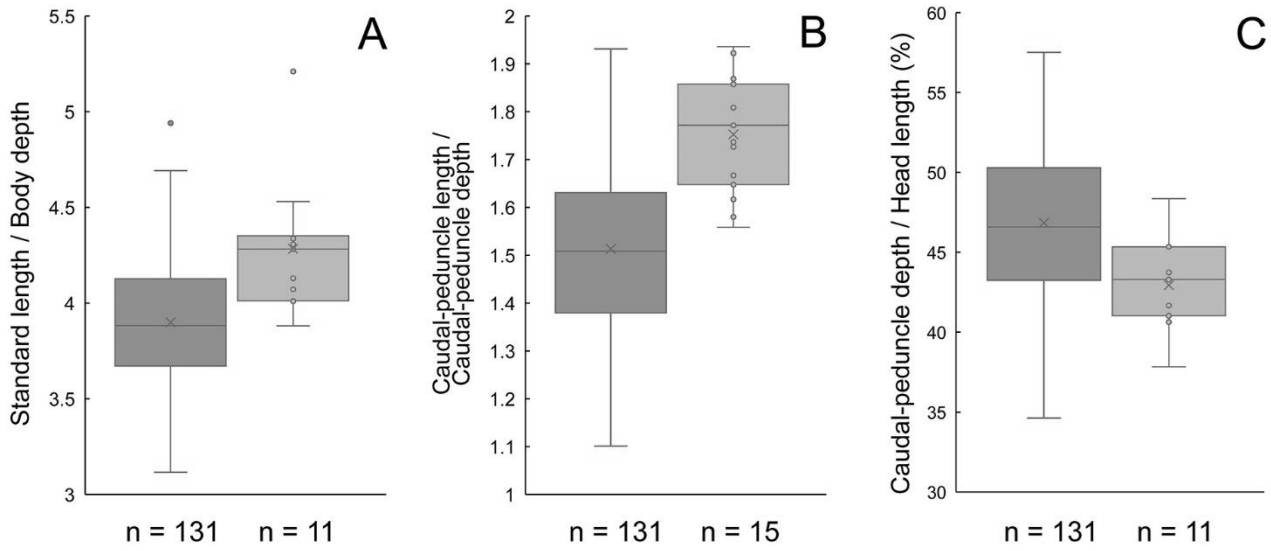

Figure 2. Boxplots for ratio of standard length and body depth (A); caudal-peduncle length and caudal-peduncle depth (B); and caudal-peduncle depth and head length (C) in *Gnathopogon elongatus elongatus* (orange boxplots) and *Gnathopogon elongatus suwae* (green boxplots).

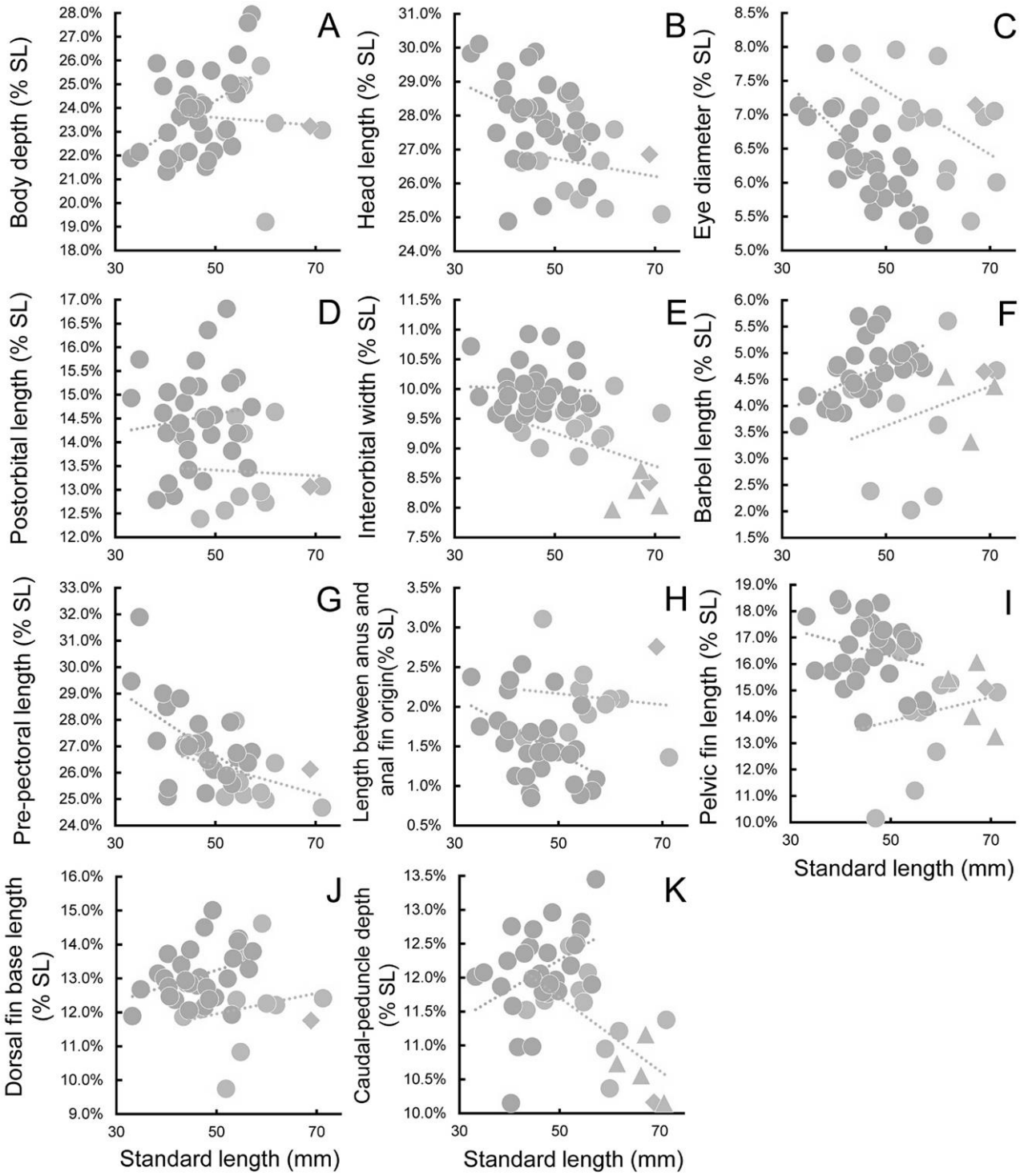

Figure 3. Relationships between body depth (A); head length (B); eye diameter (C); postorbital length (D); interorbital width (E); barbal length (F); pre-pectoral length (G); length between anus and anal fin origin (H); pelvic fin length (I); dorsal fin base length (J); and caudal-peduncle length (K) (all as % of SL) and standard length (mm) in *Gnathopogon elongatus elongatus* from Tenryu River system (blue circles) and *Gnathopogon elongatus suwae* (green circles, rhombi, and triangles), showing selected measurements. Rhombi and triangles indicates holotype and paratypes, respectively.