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Distribution of the attached eggs of *Gnathopogon caerulescens* along the coast of Lake Biwa, Japan: fluctuation over the last 80 years based on field and literature surveys

Kohji Mabuchi, Kazuya Nishida and Makoto A. Yoshida*

Abstract *Gnathopogon caerulescens* is an endangered species endemic to Lake Biwa that is suffering as a result of the deterioration of its spawning habitat (lakeside vegetation zone). To determine the current distribution of spawning sites along the coast of Lake Biwa, a field survey was conducted in 2020, mainly in the North Basin, following the previous published surveys conducted in 2019 in the South Basin. A total of 1,950 eggs (67 egg populations) were collected from the submerged roots of *Salix* trees at 180 points between May 6 and June 23. DNA analysis of 524 eggs, sampled approximately equally from all egg populations, identified 331 *G. caerulescens* eggs, which were found at 56 of the 67 points and distributed in 19 of the 28 areas investigated (the entire lakeshore was divided into 51 areas spanning 8 shore regions). Combined with the findings from the 2019 survey, the present analysis demonstrated that *G. caerulescens* eggs were distributed in 29 of the 41 surveyed areas and 7 of the 8 shore regions. A review of the published literature from five time points since 1940, however, revealed that the spawning sites were distributed across almost the entire lakeshore around 1940, but that the distribution area continued to decline considerably until the mid-1990s when spawning sites were found only in 17 of the 50 literature-verifiable areas and 5 of the 8 regions. These results verified that this species has experienced significant declines and recovery with respect to spawning site distribution over the last 80 years. The timing and degree of the fluctuations, however, differed across the eight regions, likely reflecting the history of land modifications and the original spawning levels in each region. Artificial water level control since 1992, thought to have resulted in a catch decrease, was not considered responsible for the decline in the distribution of spawning sites, since the latter had already occurred prior to the water level control.

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First Pacific record of *Platyberyx mauli* (family: Caristiidae) off northeastern Japan and first record of *Platyberyx andriashevi* off Hokkaido

Makoto Okamoto*, Yoshiaki Kai, Ryo Misawa, Yuto Suzuki and Shun Tokioka

Abstract A single specimen (130.0 mm standard length: SL) of *Platyberyx mauli* Kukuev, Parin and Trunov, 2012, collected at 452–453 m depth off Shizugawa Bay, Miyagi Prefecture, Japan, is the first record of the species from the Pacific Ocean. Previously reported only from

the eastern central Atlantic, *P. mauli* is characterized by the following combination of characters: dorsal-fin rays 28 (28 in present specimen); anal-fin rays 17 (17); pectoral-fin rays 17 or 18 (18); total vertebrae number 33 or 34 (34); head length 30.4–33.9% SL (30.5% SL); body depth 45.6–52.2% SL (46.3% SL); prepectoral length 34.2–35.3% SL (34.2% SL); dorsal-fin base length 75.4–79.1% SL (76.1% SL); ventral caudal spur absent; procurrent rays cylindrical; gill rakers stout, rounded, with many small bristles, especially near tip and midway along each raker; jaw teeth in multiple rows anteriorly; posterior margin of upper jaw extending nearly to posterior margin of orbit; dorsal pharyngeal papillae multifid; conspicuous multifid papillae throughout inside of mouth cavity. The new standard Japanese name "Shamoji-yaegisu" is proposed for the species. Additionally, a single specimen (176.9 mm SL) of *Platyberyx andriashevi* (Kukuev, Parin and Trunov, 2012), collected off the Pacific coast of Hokkaido, represents the first record of the species from that region. A key to the six species of Caristiidae currently known from Japan is provided.

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First record of *Lestidium bigelowi* (Aulopiformes: Paralepididae) from the northwestern Pacific

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Abstract The rare barracudina *Lestidium bigelowi* Graae, 1967 was reported for the first time from the northwestern Pacific, based on four specimens collected from the vicinities of Okino-torishima Island, Japan, and Guam, at depths of 85–150 m. Previous records of the species had been limited to east of the Seychelles in the western Indian Ocean (type locality), the eastern Pacific off Colombia, and the southwestern Pacific off New Caledonia. *Lestidium bigelowi* is the only paralepidid species known to have six small, round, discrete mid-ventral luminescent organs, evenly spaced from the isthmus to near the anus, whereas in other species of the family, the luminescent organ is absent or represented by an elongate slender duct (s) extending along the mid-ventral line from the chest to the anus. The following characters are also useful to distinguish the species from its congeners: dorsal fin origin and outer pelvic-fin base more-or-less vertically level, anal-fin rays 28–30, vertebrae 80 or 81, predorsal fin length 54.3–56.5% of standard length (SL), and prepelvic fin length 53.7–56.3% of SL. Because *L. bigelowi* was previously known only from juveniles, the morphology of much larger individuals (72.3–123.7 mm SL) is described herein. Two specimens collected southwest of Okino-torishima Island represent the first record of *L. bigelowi* in Japanese waters (within the Exclusive Economic Zone). The new standard Japanese name "Botan-namehadaka" is proposed for the species, being derived from the button-like luminescent organs ("botan") and the Japanese name for barracudina ("namehadaka").

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Phylogeography of upstream fat minnow *Rhynchocypris oxycephala* in central Japan

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Abstract The phylogeographic patterns of freshwater fishes provide clues for understanding the relationships between geological events and biota formation. In central Honshu, Japan, many mountain ranges (e.g., the Fossa Magna) divide watershed areas, resulting in long-term biogeographical barriers to the freshwater fishes. Almost all of the freshwater fishes from the upland areas, however, occur naturally in more than one river system. Such ichthyofaunal similarity among river systems is hypothesized as having resulted from headwater river captures. Accordingly, to clarify the processes behind present-day ichthyofaunal patterns in the upland area of central Honshu, the present study investigated the mitochondrial phylogeographic pattern of upstream fat minnow, *Rhynchocypris oxycephala*, distributed in mountainous streams in western Japan. The phylogenetic analyses, using mitochondrial cytochrome *b* gene sequences (1,140 bp) obtained from 451 individuals from 86 sites throughout the species distribution range, indicated eight major clades in Japan. Of these, the Biwa-Tokai clade was distributed in the major area of central Honshu, and divided into three geographically differentiated groups: (i) Lake Biwa group in the tributaries that flow into Lake Biwa; (ii) Ise Bay group in the Pacific drainages that flow into Ise Bay, and (iii) Hida group in the Japan Sea drainages. These groups were isolated by watershed areas in the IbukiSuzuka and Hida Mountains. However, haplotype distributions in the headwaters of the Shou (Japan Sea side) and Nagara Rivers (Pacific side) suggested former dispersal of freshwater fishes from the Pacific to Japan Sea drainages via river capture in the Hirugano Highlands watershed area. Similar distributions of mtDNA haplotypes observed in three other headwater areas also suggested previous river captures. During the present study, however, some mtDNA haplotypes collected from Gifu, Shizuoka and Kanagawa Prefectures were found to be identical to those in the Lake Biwa group, suggesting that artificial transplantations of *R. oxycephala* had occurred in several areas.

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First records of two morays, *Gymnothorax mucifer* and *Gymnothorax niphostigmus* (Anguilliformes: Muraenidae) from Japan

Yusuke Hibino* and Yuichi Ito

Abstract Two species of the moray eels, *Gymnothorax mucifer* Snyder, 1904 and *Gymnothorax niphostigmus* Chen, Shao and Chen, 1996 are reported from Japanese waters for the first time. The former has been previously recorded from Australia, Taiwan, New Caledonia and Hawaii, and the latter from Vietnam and Taiwan. Two specimens of *G. mucifer* [356 mm and 392 mm of total length (TL), collected from Okinawa Island] conformed with the diagnostic characters and the presence of dark streaks on the branchial basket of the species. Although *Gymnothorax mucifer* is closely similar to *Gymnothorax kidako* (Temminck and Schlegel, 1846) in general body coloration and proportions, they differ in color pattern of the anal fin (whitish margin mostly continuous but posteriorly represented by separated spots in *G. mucifer* vs. entirely continuous in *G. kidako*), the pattern of the lower jaw (no defined patterned vs. obscured reticulation), and the presence of dark streaks on the branchial basket (present vs. absent or not obvious). One specimen of *G. niphostigmus* (514 mm TL, collected from Danjo Islands, western Nagasaki Prefecture) fully conformed with the diagnostic characters of the species. The color of the margin of dorsal fin was described as "darkish" for the species in the original description. However, the species including holotype and paratypes has a broken whitish margin on the fin. Although *G. niphostigmus* is closely similar to *Gymnothorax intesi* (Fourmanoir and Rivaton, 1979) in both proportional characters and coloration, the former is characterized by smooth edges of the teeth (vs. distinct serrations), the presence of mid-premaxillary teeth (vs. absent), and the margin of the dorsal fin coloration discontinuous whitish, the width less than the anal fin margin (vs. continuous whitish, the width similar to the anal fin margin). The new standard Japanese names, "Takanoha-utsubo" and "Watayuki-utsubo", are proposed for *G. mucifer* and *G. niphostigmus*, respectively.
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First Japanese record of *Astronesthes gemmifer* (Stomiidae: Astronesthinae) collected from the vicinity of the Ogasawara Islands, Japan

Katsuya Kimura*, Yuichi Tsuda and Naohide Nakayama

Abstract The stomiid snaggletooth genus *Astronesthes* Richardson, 1845, including 49 valid species distributed in tropical to temperate waters of all oceans, is characterized by the following combination of characters: anal fin with 11–22 rays; maxillary teeth comblike, closely spaced, and slanting rearward; and photophores in the ventral series arranged in regular intervals. To date, 13 species of the genus have been reported from Japanese waters. A single specimen of *Astronesthes* (111.9 mm in standard length) was collected in December 2020, during a mid-water trawl survey conducted by R/V *Shunyo-Maru* in the vicinity of the Ogasawara Islands, Japan. Subsequently identified as *Astronesthes gemmifer* Goode and Bean, 1896, the specimen clearly differed from all congeners in having the following combination of characters: four premaxillary fangs in the main row (vs. 5–6); the posteroventral part of the

terminal bulb of the chin barbel black (vs. usually not black or terminal bulb absent); and the last six VAV (photophores from the inner-pelvic space to the end of the row posterior to the anal-fin origin) located above the anal fin (vs. 1–4). Although *A. gemmifer* has been often recorded from the North Atlantic, records from the South Atlantic, Indian, and Pacific oceans are sparse. In the Pacific Ocean, the species has been recorded in Hawaiian waters from O‘ahu to the Hancock Seamounts, but not previously reported from Japanese waters, the present specimen representing the first Japanese record of *A. gemmifer*. The new standard Japanese name “Sumitsuki-tokagehadaka” is proposed for the species.

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Habitat characteristics of larvae of the alien bitterling *Acheilognathus macropterus* in rivers flowing into Lake Kasumigaura, Ibaraki Prefecture, eastern Japan

Tensei Yamamoto*, Tomiji Hagiwara, Takahiro Morosawa and Kouki Kanou

Abstract The bitterling *Acheilognathus macropterus*, introduced from the continent of China to the Tone River system, including Lake Kasumigaura, is designated as an invasive alien species by the Invasive Alien Species Act of Japan, due to their potentially negative impacts on other threatened bitterling species through interspecific competition. Although ecological studies of immature and adult stages of *A. macropterus* have already been reported in both China and Japan, little is known about larval and juvenile stages in the wild. To ascertain habitat characteristics in early life stages of the species, spatial distribution of larval and juvenile *A. macropterus* and environmental variables were investigated at 131 sites in two river systems (Ono R. and Shintone R.) flowing into Lake Kasumigaura in June 2018. A total of 1,118 larval and juvenile specimens (5.8–18.4 mm in body length, BL) were collected using hand nets during the study period, ca. 93% of the total number being larvae. A generalized liner mixed model based on the data for larval density with a variety of environmental variables (i.e., water temperature, dissolved oxygen, water depth, flow velocity, vegetation density, mud content ratio in the bottom sediment, distance from a freshwater pearl farm, and wave height) at each site revealed that greater vegetation density with higher dissolved oxygen and distance to pearl farms utilizing the unionid hybrid mussel *Sinohyriopsis schlegeli* × *S. cumingii* were the most significant determinants of larval density. The results indicated that appropriate management of river vegetation and pearl farm factors are necessary for the establishment of essential controls, so as to manage the reproduction and expansion of *A. macropterus* in the Ono and Shintone River systems.

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Distribution of native and non-native loaches (genus *Misgurnus)* in Ichinomiya, Aichi, central Japan

Takahiko Mukai* and Masanao Hashimoto

Abstract The weather loach *Misgurnus anguillicaudatus*, an important freshwater fish in rural areas of Japan, although comprising both native and non-native mitochondrial DNA lineages, exists in reduced populations in many prefectures and is listed as NT (Near Threatened) in the Red List (Ministry of the Environment of Japan, 2020). On the other hand, the pond loach *M. dabryanus*, introduced into Japan from continental Asia, is expanding its distribution in various parts of the country. A survey of the spatial distributions of *M. anguillicaudatus* (native and non-native lineages) and *M. dabryanus* in Ichinomiya (113.8 km^2), Aichi Prefecture, Japan, examined 117 agricultural ditch sites for presence/absence of the loaches from May to August, 2020. Native and non-native *M. anguillicaudatus* were identified by mitochondrial cyt*b* gene sequencing. Although loaches were collected from 52 of 117 sites, *M. dabryanus* was dominant (293 individuals from 41 sites) over *M. anguillicaudatus* (55 individuals from 14 sites), the species co-occurring at only three sites. The relationships between loach presence and several environmental factors were analyzed using the generalized linear model (GLM), which showed that the probability of loach presence (either species) was mainly explained by the presence of ditch vegetation (positive effect) and proportion of agricultural land use (but not paddy fields) (negative effect). The probability of *M. anguillicaudatus* presence (versus *M. dabryanus*) was mainly explained by water depth in winter. The results indicated that an increase in concrete ditch construction (no vegetation) and conversion of paddy fields to other agricultural usages, may result in habitat reduction for both species, whereas a decrease in water depth in winter may promote an increase in *M. dabryanus*. The mtDNA analysis showed that the native lineage of *M. anguillicaudatus* was found in only 7 sites, thus being critically endangered in the area.

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First northwestern Pacific records of *Etelis boweni* (Perciformes: Lutjanidae) from the Osumi Islands, Kagoshima Prefecture, Japan

Byeol Jeong*, Jun Ohtomi and Hiroyuki Motomura

Abstract Four specimens (390.5–576.0 mm standard length; SL) of *Etelis boweni* Andrews, Fernandez-Silva, Randall and Ho, 2021 (Perciformes: Lutjanidae), collected from the Osumi Islands, Kagoshima Prefecture, Japan, were similar to *Etelis carbunculus* Cuvier, 1828 in sharing the following characters: dorsal fin with a deep notch and lacking scales; maxilla covered with scales; caudal-fin lower lobe whitish; and length of caudal-fin upper lobe greater than 3.3 in SL. However, the specimens differed from *E. carbunculus* in having the opercular spine posterior end rounded (pointed in the latter), 14 scale rows below the lateral line (vs. 12),

and tip of the caudal-fin upper lobe black in both fresh and preserved specimens (vs. reddish in fresh specimens, yellowish in preserved specimens). Furthermore, a sequence analysis of the mitochondrial cytochrome oxidase I gene of the four Osumi Islands' specimens showed a divergence of only 0.0–0.5% from the holotype of *E. boweni*, the five specimens comprising a clade separated by 7.5–8.8% sequence divergence from *E. carbunculus*. Although *E. boweni* is widely distributed in the IndoWest Pacific (from the Red Sea and Seychelles to Samoa), the Osumi Islands' specimens (for which the standard Japanese name "Oo-akamutsu" is newly proposed) represent the first specimen-based records of *Etelis boweni* from Japanese waters as well as from the northwestern Pacific Ocean. Additionally, the apparently sympatric occurrence of *E. boweni* and *E. carbunculus* was evidenced by the collection together of the two species (KAUM–I. 160343, 390.5 mm SL and KAUM–I. 160342, 407.9 mm SL, respectively).

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mtDNA sequence of the *Acheilognathus tabira jordani* lineage in the Hokuriku Region, Toyama Prefecture, Japan

Yuji Yamazaki*, Masaki Nishio and Ryosuke Kawakami

Abstract Environmental DNA (eDNA) techniques are being used increasingly in fish faunal surveys, although misidentifications may still occur due to, for example, incomplete databases. Although an *Acheilognathus tabira* subspecies has been reported from the Hokuriku region (Toyama Prefecture, Japan) as *A. t. jordani*, a recent eDNA survey in the area also found *A. t. tohokuensis*. The present genetic analysis of *A. t. jordani* collected from the Hokuriku region revealed genetic characteristics that differed from those of *A. t. jordani* from the Sanin region (southwest Honshu), according to the database used for species determination in the eDNA survey. It was concluded that *A. t. tohokuensis* previously reported in the eDNA survey was likely have been a misidentification due to database limitations.

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Collecting pressure from fish enthusiasts and traders implicated in the rapid decline of reintroduced populations of the small scale bitterling *Acheilognathus typus*

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Abstract Although overfishing has been recognized as a major factor threatening the

existence of rare freshwater fishes, no case studies exist on the impact of collection pressure by fish enthusiasts and traders. In 2021, a habitat of reintroduced *Acheilognathus typus*, a species rarely seen the previous year, was visited every day by such enthusiasts. A monitoring survey indicated subsequently that the mean number of captured *A. typus* had decreased from 25.0 individuals/day in July 2021 to 1.6 individuals/day in October, the October 2021 figure being about one-tenth of that for September-October 2020. In addition, the standard length of *A. typus* in 2021 (56.8–59.5 mm) was greater than in 2020 (47.2 mm), possibly due to a thinning effect caused by the reduced fish numbers. During the period surveyed, some 50 to 100 fish enthusiasts and traders visited the habitat, apparently collecting thousands of *A. typus* by fishing or in bait traps. Such collecting pressure has clearly driven the reintroduced population of these rare fish to significantly low levels within a short period.

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A rare syngnathid fish, *Microphis (Coelonotus) argulus* (Teleostei: Syngnathidae), from Tokushima Prefecture, Shikoku, Japan; northernmost record of the species

Taiki Ito*, Kosei Shono and Hiroshi Senou

Abstract A single juvenile specimen (93.2 mm standard length) of the rare syngnathid fish *Microphis* (*Coelonotus*) *argulus*, collected from the Uchizuma-gawa River, Tokushima Prefecture, Shikoku Island, Japan, is the first record from Shikoku Island and northernmost record of the species. We newly found that *M.* (*C.*) *argulus* is distinguished from *M.* (*C.*) *leiaspis* in the fresh juvenile specimens by the following combination of characters: jaws to snout reddish (vs. brownish in the latter); small white dots present from behind eye to pectoral-fin base (vs. absent); operculum and pectoral-fin base brownish (vs. silverywhite). The *M.* (*C.*) *argulus* specimen may have been transported northward by the Kuroshio Current from the usual distribution range of the species, and recruited to the Uchizuma-gawa River.

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Description of juvenile specimens of *Odontanthias borbonius* (Serranidae: Anthiadinae) from Japan

Toshiaki Mori*, Makoto Okamoto, Shinya Yamauchi, Rintaro Ishii and Subaru Joukura

Abstract Three juvenile specimens of *Odontanthias borbonius* were collected from Suruga Bay (2 specimens, 20.0–23.4 mm standard length (SL), 95–100 m depth) and Okinawa (23.7 mm SL, 180 m depth), Japan. Because little is known of juvenile morphology of the species, the specimens are described and compared with adults from Japan. Fresh coloration of the

juveniles was similar to that of adults, being characterized by a pale pink body and large yellow spots. Following fixation, the juvenile coloration was lost, although black pigment vesicles scattered in the former positions of the yellow spots indicated that *O. borbonius* can be distinguished from all other congeners, which lack such spots. Juveniles of the former had a large, smooth, interopercular spine, the supraocular ridge with serrations, and serrated posttemporal spines.

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