

Two New Species of Freshwater Gobies of the Genus *Luciogobius* (Perciformes: Gobiidae) from Japan

Naoyuki KANAGAWA¹⁾, Takahiko ITAI²⁾ & Hiroshi SENOU³⁾

Abstract. Two new species of the goby genus *Luciogobius*, i.e. *L. fonticola* and *L. fluvialis*, are described on the basis of 23 specimens of each species from freshwater in rivers entering Suruga Bay, on the Pacific coast of Shizuoka Prefecture, southern Japan. *L. fonticola* is distinguished from other members of the genus by the following combination of characters: eye small and degenerated, embedded beneath skin, obscured after fixation; no scales on body; dermal ridge on cheek without barbels; second dorsal-fin origin slightly anterior to anal fin; pelvic fin present; no free soft rays on upper and lower ends of pectoral fin; second dorsal-fin rays modally I, 8; anal-fin rays modally I, 8; branched caudal-fin rays modally 8+7; vertebrae modally 15+16=31; interorbit region flat; upper jaw length $10.5 \pm 1.1\%$ (mean $\pm$ standard deviation) in standard length, $39.2 \pm 4.8\%$ in head length; predorsal length $261.2 \pm 12.9\%$ in head length; preanal length $267.9 \pm 14.2\%$ in head length; caudal peduncle depth $7.3 \pm 0.8\%$ in standard length. The other species, *L. fluvialis* is characterized by having the following combination of characters: eye small and degenerated, embedded beneath skin, obscured after fixation; no scales on body; dermal ridge on cheek without barbels; second dorsal-fin origin slightly anterior to anal fin; pelvic fin present; no free soft rays on upper and lower ends of pectoral fin; second dorsal-fin rays modally I, 9; anal-fin rays modally I, 9; branched caudal-fin rays modally 8+7; vertebrae modally 16+16=32; interorbit region flat; maximum width of head at cheek $11.5 \pm 0.9\%$ (mean $\pm$ standard deviation) in standard length; upper jaw length $8.5 \pm 1.0\%$ in standard length, $37.4 \pm 3.9\%$ in head length; predorsal length $307.4 \pm 15.7\%$ in head length; preanal length $315.8 \pm 17.1\%$ in head length.

Key words: Gobiidae, *Luciogobius fonticola* sp. nov., *Luciogobius fluvialis* sp. nov., Shizuoka Prefecture, Japan

Introduction

The gobiid genus *Luciogobius* Gill, 1859 is endemic to north-eastern Asian waters, distributed in Primorsky Kray, Korean Peninsula, China and Taiwan, and in Japan from Hokkaido to Iriomote Island of the Ryukyu Islands. The genus contains 15 nominal species, 14 of which are recognized as valid: *L. adapel* Okiyama, 2001, *L. albus* Regan, 1940, *L. ama* (Snyder, 1909), *L. brevipterus* Chen, 1932, *L. dormitoris* Shiogaki & Dotsu, 1976,

L. elongatus Regan, 1905, *L. grandis* Arai, 1970, *L. guttatus* Gill, 1859, *L. koma* (Snyder, 1909), *L. pallidus* Regan, 1940, *L. parvulus* (Snyder, 1909), *L. platycephalus* Shiogaki & Dotsu, 1976, *L. ryukyuensis* Chen, Suzuki & Senou, 2008, *L. saikaiensis* Dôtu, 1957 (Akihito *et al.*, 1988; Okiyama, 2001; Akihito *et al.*, 2002; Chen *et al.*, 2008). The species diversity is particularly high in Japan, with 13 of the species listed above recorded from Japanese waters. However, many species remain undescribed, and numbers are expected to increase to about 37 species (Suzuki & Shibukawa, 2004). The genus is mainly characterized by the following: elongated, worm-like body with a depressed small head; eyes small, or degenerated and embedded underneath skin, located dorsally; absence of the first dorsal fin (and even the second dorsal fin in *L. adapel*); and absence, or reduced coverage of scales on body.

In the Red Data Book of Shizuoka Prefecture, three undescribed species of *Luciogobius*, *L. sp. 1*, *L. sp. 2* and *L. sp. 3*, were reported from freshwater in rivers entering Suruga Bay, on the Pacific coast of Shizuoka Prefecture, southern Japan (Kanagawa *et al.*, 2004). Later, *Luciogobius sp. 2* was described

¹⁾ Shizuoka High School
66 Hase, Aoi, Shizuoka 420-8608, Japan
静岡県立静岡高等学校
〒420-8608 静岡県静岡市葵区長谷町 66
naokanagawa@par.odn.ne.jp

²⁾ Network for Shizuoka Prefecture Museum of Natural History
Tsuiji 4-4-17, Shimizu, Shizuoka, Shizuoka 424-0806, Japan
NPO 法人静岡県自然史博物館ネットワーク
〒424-0806 静岡県清水区辻 4 丁目 4-17 静岡県自然学習資料センター内

³⁾ Kanagawa Prefectural Museum of Natural History
499 Iryuda, Odawara, Kanagawa 250-0031, Japan
神奈川県立生命の星・地球博物館
〒250-0031 神奈川県小田原市入生田 499

in detail by Kanagawa & Itai (2009), but they did not assign a scientific name. We describe herein *L. sp. 1* and *L. sp. 2* as new.

Materials and Methods

Institutional abbreviations followed "A guide to fish collections in the Catalog of Fishes, online version, 5 Jan. 2011" edited by R. Fricke and W. N. Eschmeyer, except for CMNH-ZF (Coastal Branch of Natural History Museum and Institute, Chiba). All specimens were preserved in 70% ethanol after fixation by 10% neutralized formalin. Measurements were made with digital vernier calipers to the nearest 0.01 mm, and rounded off to one decimal place. Methods of counts and measurements followed Hubbs & Lagler (1964) unless otherwise stated, the latter expressed as percentage of standard length (SL) or head length (HL). Eyes of specimens become unclear due to fixation. Therefore, the interorbital width was measured as the least distance between both edges of orbits, which can be observed by pressing a glass slide (with a scale marked in 0.1 mm) to the region. Color descriptions were made using the color standards of Japan Color Research Institute (1993) on the basis of a color slide. The cephalic sensory system was observed by staining specimens with cyanine blue, following a method of Akihito *et al.* (2002). Osteological observations were made from soft X-ray photos and from cleared and stained specimens (KPM-NI 23660, 23661, 23662, 24385; NSMT-P 94273, 103695, 103700). The single dorsal fin composed of one spine and numerous soft rays, and opposite the anal fin, was regarded as the "second dorsal fin" based on consideration of the evolutionary trends of this genus (Okiyama, 2001).

The collection of specimens occurred in 1/5 of the area regarded as appropriate habitat to prevent damage to the population's sustainability. Adult fishes were observed in the region during monitoring the following year, and no long-term damage is expected.

Comparative materials. *Luciogobius albus*: NSMT-P 9361-9363, 9365 & 9366, 5 specimens, 27.8-41.9 mm SL; ZUMT 25693, holotype, 32.6 mm SL; ZUMT 25762, paratype, 1 specimen, 33.9 mm SL. *L. dormitoris*: NSMT-P 45176, holotype, 42.0 mm SL. *L. pallidus*: BSKU 092077, 1 specimen, 38.0 mm SL; NSMT-P 65157, 2 specimens, 41.4 & 43.4 mm SL; ZUMT 11607 & 16147, 2 syntypes, 36.2 & 52.6 mm SL.

Luciogobius fonticola sp. nov.

(New Japanese name: Yusui-mimizuhaze)

(Figs. 1-3)

Luciogobius sp. 1: Kanagawa *et al.*, 2004: 8 (right col. fig.), 132.

Holotype. KPM-NI 27293, male (30.9 mm SL), 15 Jun. 2003, the lower reaches of Oi River, Shizuoka Prefecture.

Paratypes. 22 specimens. CMNH-ZF 17422-17426, 3 males (28.3-31.9 mm SL) & 2 females (26.1 & 30.3 mm SL), 27 Apr. 2002, same locality as holotype. KPM-NI 24385, 2 males (24.9 & 25.7 mm SL) & 2 females (28.1 & 30.1 mm SL), including a cleared and stained specimen, 11 Jun. 1998, the lower reaches of Abe River, Shizuoka Prefecture; KPM-NI 27294 (1 female,

26.4 mm SL) & 27295 (1 male, 28.0 mm SL), 9 Nov. 2002, same locality as holotype; KPM-NI 27296 (1 female, 26.5 mm SL) & 27297 (1 male, 32.9 mm SL), 29 Apr. 2003, same locality as holotype; KPM-NI 27298 (1 male, 29.1 mm) & 27299 (1 male, 29.4 mm SL), 18 May 2003, same locality as holotype; KPM-NI 27300 (1 female, 28.2 mm SL) & 27301 (1 female, 24.4 mm SL), 15 Jun. 2003, same locality as holotype; KPM-NI 24387, 1 male (27.3 mm SL), 22 Jun. 2003, the lower reaches of Abe River, Shizuoka Prefecture. NSMT-P 103695, 1 male (25.4 mm SL), cleared and stained, 10 May 1998, same locality as holotype; NSMT-P 103700, 1 male (29.0 mm SL), cleared and stained, 13 Jun. 1998, same locality as holotype. TKPM-P 17349 (1 male, 30.2 mm SL) & 17350 (1 male, 28.6 mm SL), 28 Apr. 2002, same locality as holotype.

Non-types. KPM-NI 27303, 1 female (26.8 mm SL), 5 Oct. 2002, same locality as holotype; KPM-NI 27964, 1 female (37.0 mm SL), 4 May 2001, same locality as holotype.

Diagnosis. The new species is distinguished from congeners by having the following combination of characters: eye small and degenerated, embedded beneath skin, obscured after fixation; no scales on body; dermal ridge on cheek without barbels; second dorsal-fin origin slightly anterior to anal fin; pelvic fin present; no free soft rays on upper and lower ends of pectoral fin; second dorsal-fin rays modally I, 8; anal-fin rays modally I, 8; branched caudal-fin rays modally 8+7; vertebrae modally 15+16=31; interorbit region flat; upper jaw length $10.5 \pm 1.1\%$ (mean $\pm$ standard deviation) in SL, $39.2 \pm 4.8\%$ in HL; predorsal length $261.2 \pm 12.9\%$ in HL; preanal length $267.9 \pm 14.2\%$ in HL; caudal peduncle depth $7.3 \pm 0.8\%$ in SL (Tables 1 & 2).

Description. Counts and measurements are shown in Table 1. Second dorsal-fin rays I, 7-9 [I, 7 (1), I, 8 (13), I, 9 (9)]; anal-fin rays I, 7-9 [I, 7 (1), I, 8 (12), I, 9 (10)]; pectoral-fin rays 14-16 [14 (4), 15 (17), 16 (2)]; pelvic-fin rays I, 5 (23); branched caudal-fin rays 7-9+6-8 [8+6 (3), 7+8 (1), 8+7 (18), 9+7 (1)]. First dorsal pterygiophore just reaching neural spine of 15th vertebra (1) or inserted between 15th and 16th vertebrae (22); last dorsal pterygiophore inserted between 19th and 20th (5), 20th and 21st (16) or 21st and 22nd (2) vertebrae; total dorsal pterygiophores 8-10 [8 (2), 9 (9), 10 (6)]. Vertebrae 15-16+15-16=30-31 [15+15=30 (1), 15+16=31 (20), 16+15=31 (2)].

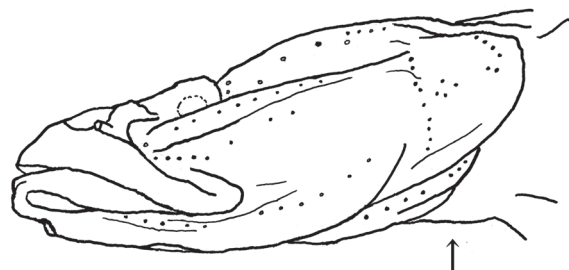


Fig. 1. Head of *Luciogobius fonticola* sp. nov., KPM-NI 27293, holotype, male, 30.9 mm SL, showing the arrangement of sensory papillae. The arrow indicates the position where the gill membrane attaches to the isthmus.



Fig. 2. *Luciogobius fonticola* sp. nov., preserved specimen, KPM-NI 27293, holotype, male, 30.9 mm SL, Oi River, Shizuoka Prefecture.

Body elongate, gradually compressed posteriorly. Head relatively large and strongly depressed. Lower jaw slightly projecting beyond upper jaw, or jaws terminal; maxilla extending posterior to the vertical at rear margin of orbit, except in some females. Jaws with an outer row and 3 to 4 inner rows of conical teeth; teeth of outer row larger, weakly curved inwardly. Gill opening narrow, extending ventrally to middle portion of opercle. Nares separated; anterior naris with a short tube, tip reaching to upper lip; posterior nare with simple, small pore close to eye. Eye small and degenerated, embedded beneath skin; clearly visible when fresh (Fig. 3), but obscured by bleaching after fixation (Fig. 2); orbit comparatively clear, even after fixation. Interorbit region horizontally flat. A longitudinal dermal ridge running from snout to cheek below eye, thin anteriorly; extent of development variable. Occipital region slightly bulging laterally and dorsally. Second dorsal-fin origin slightly anterior to anal fin; 4th to 8th (mostly 5th) rays longest in the former, 4th to 6th (mostly 5th) rays longest in the latter. Posterior margin of second dorsal and anal fins rounded. Pectoral fin rounded; lacking any free soft rays on both ends of the base; 6th to 8th (mostly 7th) rays longest. Pelvic fins fused, forming a small sucker; thin membranous frenum present. Caudal fin slightly oblong, posterior margin rounded. No scales on body. Cephalic sensory system as shown in Fig. 1. Pit organs arranged sparsely, forming some longitudinal rows on occipital region, cheek and mandible; two transverse rows present on opercle. Sensory canal and pore absent.

Coloration when fresh (Fig. 3): body translucent, light yellow to light reddish-yellow; cheek below eye and dorsal side of head with many light brown dots or speckles, especially dense in mid-occipital region; trunk and tail with many light brown dots or speckles, except on abdomen; abdomen white, pale pink or strong pink in parts; tail somewhat greenish. All fins translucent, somewhat yellowish or greenish in second dorsal, anal and caudal fins. The number, density and arrangement of dots or speckles varies between individuals.

Coloration in preserved specimens (Fig. 2): yellowish, reddish



Fig. 3. *Luciogobius fonticola* sp. nov., fresh specimen, KPM-NI 27303, female, 26.8 mm SL, Oi River, Shizuoka Prefecture.

and greenish colors faded; ground color of body pale yellow. All fins grayish-white. Dots and speckles retained.

Distribution. Known only from the Abe and Oi River Systems entering Suruga Bay, on the Pacific coast of Shizuoka Prefecture, southern Japan.

Size. The largest specimen is a non-type female of 37.0 mm SL (KPM-NI 27964).

Habitat. This new species was collected at the river mouth. It was found on a gravel substrate composed of sand and pebbles of 2–64 mm in diameter, where freshwater springs flow from gaps between the pebbles. A gobiid fish, *Tridentiger brevispinis* was the dominant species in number there.

Remarks. Among the 14 valid species of *Luciogobius*, *L. fonticola* is most similar to 3 congeners, *L. albus*, *L. dormitoris* and *L. pallidus* in having small eyes embedded beneath the skin, which are obscured after fixation. These three species also share the position of the dorsal fin and pigmentation on the body, i.e., dorsal-fin origin slightly anterior to anal fin, pigmentation on body much reduced. *Luciogobius fonticola*, however, can be readily distinguished from *L. dormitoris* and *L. pallidus* by having fewer abdominal and total vertebral counts (15–16 and 30–31 vs. 19 and 35–37 in *L. dormitoris* and *L. pallidus*). In the comparison with *L. albus* (data shown in Kanagawa & Itai, 2009), the new species differs in having the following features: interorbit region horizontally flat (swell in *L. albus*); upper jaw length $10.5 \pm 1.1\%$ of SL ($12.9 \pm 1.1\%$) and $39.2 \pm 4.8\%$ of HL ($48.3 \pm 2.8\%$); caudal peduncle depth $7.3 \pm 0.8\%$ of SL ($8.5 \pm 0.3\%$); margin of orbit

clearly visible after fixation (invisible).

Etymology. The specific name, *fonticola*, is a Latin noun meaning "dweller of fountain." It refers to the habitat of the new species, which is found in springwater gushing from the bottom of river. The new standard Japanese name is a combination of the Japanese words "yusui" meaning "springwater" and "mimizuhaze" meaning "worm-like goby."

***Luciogobius fluvialis* sp. nov.**

(Japanese name: Nagare-mimizuhaze)

(Figs. 4-6)

Luciogobius pallidus (not Regan, 1940): Aizawa & Kokuryo, 1980: 51, figs. 1 & 3.

Luciogobius sp. 2: Kanagawa *et al.*, 2004: 148.

Luciogobius sp.: Kanagawa & Itai, 2009: 71, figs. 1-4.

Holotype. KPM-NI 23668, male (32.2 mm SL), 30 May 2005, the middle reaches of Warashina River of the Abe River System, Shizuoka Prefecture.

Paratypes. 22 specimens from same river as holotype. CMNH-ZF 17132-17134, 3 males (25.4-27.8 mm SL), 2 Apr. 2005. KPM-NI 23660-23662, 3 females (25.5-31.2 mm SL), cleared and stained, 2 Apr. 2005; KPM-NI 23663-23667, 2 males (29.8 & 32.9 mm SL) & 3 females (29.0-30.9 mm SL), 9 Apr 2005; KPM-NI 23669, 1 male (28.9 mm SL), 15 Jun. 2005. NSMT-P 94273-94278, 3 males (28.6-31.7 mm SL) & 3 females (24.2-32.4 mm SL), including a cleared and stained specimen, 23 Apr. 2005; NSMT-P 94279, 1 female, (32.3 mm SL), 22 May 2005. TKPM-P 17322-17324, 1 male (27.1 mm SL) & 2 females (29.2 & 33.0 mm SL), 2 Apr. 2005.

Non-type. NSMT-P 20931, 1 female, 36.4 mm SL, 18 Mar. 1978, same river as holotype.

Diagnosis. The new species is distinguished from congeners by having the following combination of characters: eye small and degenerated, embedded beneath skin, obscured after fixation; no scales on body; dermal ridge on cheek without barbels; second dorsal-fin origin slightly anterior to anal fin; pelvic fin present; no free soft rays on upper and lower ends of pectoral fin; second dorsal-fin rays modally I, 9; anal-fin rays modally I, 9; branched caudal-fin rays modally 8+7; vertebrae modally 16+16=32;

interorbit region flat; maximum width of head at cheek $11.5 \pm 0.9\%$ (mean $\pm$ standard deviation) in SL; upper jaw length $8.5 \pm 1.0\%$ in SL, $37.4 \pm 3.9\%$ in HL; predorsal length $307.4 \pm 15.7\%$ in HL; preanal length $315.8 \pm 17.1\%$ in HL (Tables 1 & 2).

Description. Counts and measurements are shown in Table 1. Second dorsal-fin rays I, 8-10 [I, 8 (6), I, 9 (15), I, 10 (2)]; anal-fin rays I, 8-10 [I, 8 (2), I, 9 (20), I, 10 (1)]; pectoral-fin rays 14-16 [14 (4), 15 (17), 16 (2)]; pelvic-fin rays I, 5 (23); branched caudal-fin rays 7-8+6-8 [7+6 (4), 8+6 (2), 7+8 (1), 8+7 (15), 8+8 (1)]. First dorsal pterygiophore inserted between 15th and 16th (1), 16th and 17th (17) or 17th and 18th (2) vertebrae; last dorsal pterygiophore inserted between 20th and 21st (2), 21st and 22nd (16) or 22nd and 23rd (2) vertebrae; total dorsal pterygiophores 9 or 10 [9 (5), 10 (15)]. Vertebrae 16-17+15-16=31-33 [16+15=31 (2), 16+16=32 (15), 17+15=32 (5), 17+16=33 (1)].

Body very elongate, gradually compressed posteriorly. Head small and depressed. Lower jaw slightly projecting beyond upper jaw, or jaws terminal; maxilla not extending to the vertical at rear margin of orbit, except in some males. Jaws with an outer row and 3 to 4 inner rows of conical teeth; anterior teeth of outer row larger, more spaced, and weakly curved inwardly; teeth of inner rows smaller than those of outer row. Gill opening narrow, extending ventrally to middle portion of opercle. Nares separated; anterior naris with a short tube, tip reaching to upper lip; posterior nare with simple, small pore close to eye. Eye small and degenerated, embedded beneath skin; clearly visible when fresh (Fig. 6), but obscured by bleaching after fixation (Fig. 5); orbit comparatively clear, even after fixation. Interorbit region horizontally flat. A longitudinal dermal ridge running from snout to cheek below eye, thin anteriorly; extent of development variable. Occipital region slightly bulging laterally and dorsally. Second dorsal-fin origin slightly anterior to anal fin; 5th to 7th (mostly 6th) rays longest in each fin. Posterior margin of second dorsal and anal fins rounded. Pectoral fin rounded; lacking any free soft rays on both ends of the base; 5th to 8th (mostly 7th or 8th) rays longest. Pelvic fins fused, forming a small sucker; thin membranous frenum present. Caudal fin slightly oblong, posterior margin rounded. No scales on body. Cephalic sensory system as shown in Fig. 4. Pit organs arranged sparsely, forming some longitudinal rows on occipital region, cheek and mandible; some transverse rows present on opercle. Sensory canal and pore absent.

Coloration when fresh (Fig. 6): body translucent, pale yellow green except abdomen; occipital region through nape to back of anterior portion of trunk somewhat reddish; abdomen pale yellow, somewhat pinkish; light brown dots or speckles scattered on body except ventral sides of head and abdomen, especially dense in mid-occipital region. All fins translucent; light brown dots or speckles scattered on middle of caudal fin. The number, density and arrangement of dots or speckles varies between individuals.

Coloration in preserved specimens (Fig. 5): yellowish, reddish, greenish and pinkish colors faded; ground color of body pale yellow. All fins grayish-white. Dots and speckles retained.

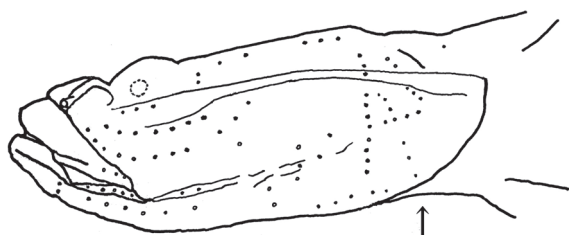


Fig. 4. Head of *Luciogobius fluvialis* sp. nov., KPM-NI 23668, holotype, male, 32.2 mm SL, showing the arrangement of sensory papillae. The arrow indicates the position where the gill membrane attaches to the isthmus.



Fig. 5. *Luciogobius fluvialis* sp. nov., preserved specimen, KPM-NI 23668, holotype, male, 32.2 mm SL, Warashina River, Abe River System, Shizuoka Prefecture.

Distribution. Known only from the Warashina River, which is a tributary of the Abe River System entering Suruga Bay, on the Pacific coast of Shizuoka Prefecture, southern Japan (Kanagawa & Itai, 2009; present study).

Size. The largest specimen is a non-type female of 36.4 mm SL (NSMT-P 20931).

Habitat. This new species was collected in the middle reaches of the river. It was found in a gravel substrate composed of pebbles of 3–5 cm in diameter and containing less than 5% of sands, where freshwater springs flow from between the pebbles. A gobiid fish, *Rhinogobius* sp. CB *sensu* Akihito *et al.* (2002) was the dominant species in number there. The ecological notes of this new species were documented in detail by Kanagawa and Itai (2009).

Remarks. *Luciogobius fluvialis* also belongs to a group of species that have small degenerated eye embedded beneath skin (see remarks of *L. fonticola*). Among these, *L. fluvialis* resembles *L. albus* and *L. fonticola* in having fewer vertebrae than the other species in the group (see Table 2). The species, however, is distinguishable from *L. albus* (data shown in Kanagawa & Itai, 2009) by the following features: abdominal vertebrae modally 16 (usually 15 in *L. albus*); total vertebrae modally 32 (31); interorbit region horizontally flat (swell); maximum width of head at cheek $11.5 \pm 0.9\%$ of SL (15.6 ± 1.2); upper jaw length $8.5 \pm 1.0\%$ of SL (12.9 ± 1.1) and $37.4 \pm 3.9\%$ of HL (48.3 ± 2.8); margin of orbit clearly visible after fixation (invisible). *L. fluvialis* also differs from *L. fonticola* in the following characters: abdominal vertebrae modally 16 (15 in *L. fonticola*); total vertebrae modally 32 (31); predorsal length $307.4 \pm 15.7\%$ of HL (261.2 ± 12.9); preanal length $315.8 \pm 17.1\%$ of HL (267.9 ± 14.2).

The fishes of *Luciogobius* are adapted to interstitial environments, but the habitat preference differs between species. Of the two new species described here, *L. fluvialis* was collected from freshwaters in the middle reaches of a river, whereas *L. fonticola* was found in freshwaters of the lower reaches. It is



Fig. 6. *Luciogobius fluvialis* sp. nov., fresh specimen, NSMT-P 94274, paratype, male, 31.7 mm SL, Warashina River, Abe River System, Shizuoka Prefecture.

known that *L. albus* and *L. pallidus* inhabit fresh and brackish waters of underground environments such as wells and caves close to the sea, or a gravel substrate of the lower reaches of a river, and *L. dormitoris* in the tidal region of a small river (Aizawa, 1996, 1998; Akihito *et al.*, 1988; Yoshida & Dotsu, 2001; Akihito *et al.*, 2002).

Etymology. The specific name, *fluvialis*, is a Latin adjective meaning "flowing" or "riverine." It refers to the habitat of the new species.

Acknowledgments

We express our sincere thanks to the following persons and institutions for the loan and/or registration of specimens: K. Sakamoto (ZUMT), H. Endo (BSKU), S. Shinohara (NSMT), Y. Sato (TKPM) and H. Kawase (Coastal Branch of Natural History Museum and Institute, Chiba). The following provided useful advice and/or information: M. Aizawa (BLIP), T. Mukai (Gifu University), T. Suzuki (Kawanishi-midoridai Senior High School), H. Kishimoto (IORD), Y. Dotsu (FNU), H. Aizawa and T. Kobayashi. We are also grateful to Y. Kokuryo who cooperated with the collection of type specimens of *Luciogobius fonticola*, and to Y. Iwasaki (Fukui Prefectural University) who provided comments on the manuscript.

Table 1. Counts and proportional measurements of *Luciogobius fonticola* sp. nov. and *L. fluvialis* sp. nov. Counts shown as mode (range). Proportional measurements (% of SL and % of HL) shown as mean±standard deviation (range).

	<i>L. fonticola</i> sp. nov.		<i>L. fluvialis</i> sp. nov.	
	Holotype	Paratypes (n=22)	Holotype	Paratypes (n=22)
Counts				
Second dorsal-fin rays	I, 8	I, 8 (7-9)	I, 9	I, 9 (8-10)
Anal-fin rays	I, 8	I, 8 (7-9)	I, 9	I, 9 (8-10)
Pectoral-fin rays	15	15 (14-16)	15	15 (14-16)
Pelvic-fin rays	I, 5	I, 5	I, 5	I, 5
Branched caudal-fin rays	8+7	8+7 (7-9+6-8)	8+7	8+7 (7-8+6-8)
Vertebrae (abdominal+caudal)	15+16	15+16 (15-16+15-16)	16+16	16+16 (16-17+15-16)
Total vertebrae	31	31 (30-31)	32	32 (31-33)
Standard length (mm)	30.9	28.5±2.1 (24.4-32.9) (n=19)	32.2	29.6±2.6 (24.2-33.0) (n=18)
% of SL				
Total length	120.6	120.7±2.9 (113.9-124.9) (n=19)	123.6	120.7±2.8 (116.2-126.1) (n=18)
Head length	26.2	26.8±1.3 (24.4-29.8) (n=19)	23.6	22.8±1.2 (20.3-25.3) (n=18)
Maximum width of head at cheek	14.7	13.7±1.0 (12.1-15.4) (n=19)	12.3	11.5±0.9 (10.0-13.2) (n=18)
Upper jaw length	10.7	10.5±1.1 (7.6-12.1) (n=19)	10.4	8.4±0.9 (7.3-10.2) (n=18)
Snout length	7.7	7.2±0.4 (6.5-8.3) (n=19)	6.9	6.3±0.6 (4.8-8.1) (n=18)
Interorbital width	6	5.2±0.5 (4.3-6.0) (n=19)	5.1	4.8±0.4 (3.9-5.4) (n=18)
Body depth	10.9	10.5±1.1 (9.1-12.5) (n=8 females) 9.6±1.2 (7.9-12.6) (n=11 males)	11.1	11.3±2.0 (8.4-13.7) (n=8 females) 9.9±0.6 (8.9-11.1) (n=10 males)
Length of longest pectoral-fin ray	16.9	16.7±1.4 (14.4-19.2) (n=19)	17.3	17.9±1.6 (14.2-20.4) (n=18)
Predorsal length	68.8	69.9±1.3 (68.0-72.4) (n=19)	71.2	70.0±1.4 (68.5-73.1) (n=18)
Length of second dorsal-fin base	15.7	14.2±1.2 (12.3-16.6) (n=19)	13.3	14.4±1.1 (11.7-16.5) (n=18)
Length of longest second dorsal-fin ray	11	10.9±1.6 (8.1-13.9) (n=19)	14.2	11.5±1.4 (9.4-14.3) (n=18)
Preanal length	70.4	71.7±1.4 (69.1-74.5) (n=19)	74	71.9±1.6 (69.8-75.1) (n=18)
Length of anal-fin base	14.2	12.5±1.4 (10.3-16.0) (n=19)	12.2	12.8±0.8 (11.1-14.1) (n=18)
Length of longest anal-fin ray	8.7	10.1±1.5 (7.5-13.3) (n=19)	11.2	10.5±1.7 (8.2-14.7) (n=18)
Caudal peduncle depth	8.1	7.2±0.8 (5.7-8.7) (n=19)	6.6	7.4±0.6 (6.4-8.4) (n=18)
Caudal peduncle length	17.6	18.0±1.2 (16.0-19.9) (n=19)	17.9	17.4±1.2 (14.6-19.5) (n=18)
Head length (mm)	8.1	7.6±0.7 (6.3-9.0) (n=19)	7.6	6.7±0.5 (6.1-7.7) (n=18)
% of HL				
Maximum width of head at cheek	56	51.1±5.0 (44.7-59.8) (n=19)	52.1	50.4±4.5 (41.6-58.9) (n=18)
Upper jaw length	40.9	39.1±4.9 (28.9-46.7) (n=19)	44.2	37.0±3.7 (30.6-43.3) (n=18)
Snout length	29.4	26.8±1.8 (23.7-30.3) (n=19)	29.3	27.6±2.2 (23.6-33.2) (n=18)
Interorbital width	22.8	19.5±2.0 (16.2-24.1) (n=19)	21.7	21.0±1.9 (17.1-24.3) (n=18)
Body depth	41.4	40.2±4.8 (34.5-49.1) (n=8 females) 35.5±4.9 (29.4-46.0) (n=11 males)	47.1	50.7±10.7 (36.2-67.4) (n=8 females) 42.8±2.4 (39.4-46.6) (n=11 males)
Length of longest pectoral-fin ray	64.3	62.3±6.0 (55.0-74.6) (n=19)	73.2	78.8±9.0 (63.2-97.8) (n=18)
Predorsal length	262.3	261.1±13.2 (237.3-288.2) (n=19)	301.4	307.7±16.1 (286.3-342.5) (n=18)
Length of second dorsal-fin base	59.9	53.0±5.7 (43.2-64.2) (n=19)	56.3	63.5±6.4 (48.8-76.8) (n=18)
Length of longest second dorsal-fin ray	42	40.5±6.2 (27.3-48.9) (n=19)	60	50.3±5.8 (42.2-64.1) (n=18)
Preanal length	268.2	267.9±14.6 (238.7-296.7) (n=19)	313.2	316.0±17.6 (292.2-363.6) (n=18)
Length of anal-fin base	54.1	46.8±5.9 (36.3-58.8) (n=19)	51.4	56.1±3.5 (50.8-62.1) (n=18)
Length of longest anal-fin ray	33.3	37.9±5.7 (26.3-49.3) (n=19)	47.6	46.1±8.0 (36.6-63.9) (n=18)
Caudal peduncle depth	31	27.0±3.4 (22.0-34.4) (n=19)	27.8	32.4±3.5 (26.1-38.2) (n=18)
Caudal peduncle length	66.9	67.0±4.7 (57.7-74.9) (n=19)	75.8	76.4±6.9 (64.9-95.8) (n=18)

Table 2. Comparison of selected diagnostic characters in *Luciogobius fluvialis* sp. nov., *L. fonticola* sp. nov. and fourteen other *Luciogobius* species.

Species	Second dorsal-fin rays	Anal-fin rays	Pectoral-fin rays	Pelvic-fin rays	Free rays on pectoral fin	Vertebrae (abdominal+caudal)	Eye embedded beneath skin, obscured after fixation	Squamation on body	Barbels	Black band on caudal fin	References
<i>L. adapel</i>	absent	absent	9-10	absent	absent	23+26-27=49-50	no	naked	absent	absent	Okiyama, 2001
<i>L. albus</i>	I, 8 (7-9)	I, 9 (8-9)	15-16	I, 5	absent	15+16=31	yes	naked	absent	absent	Regan, 1940; Kanagawa & Itai, 2009
<i>L. ama</i>	I, 8-9	I, 8-9	19-21	I, 5	1/1 (upper/lower)	14+17=31	no	scaly	absent	present	Snyder, 1909; Arai, 1981; Akihito <i>et al.</i> , 2002
<i>L. brevipterus</i>	I, 13	14 (probably I, 13)	16	I, 5	1 (upper)	38±1	no	naked	absent	absent	Chen, 1932; Arai, 1970; Chen <i>et al.</i> , 2008
<i>L. dormitoris</i>	I, 11	I, 11	14	I, 5	absent	19+17=36	yes	naked	absent	absent	Shiogaki & Dotsu, 1976
<i>L. elongatus</i>	I, 6	I, 7	8	I, 2-4	absent	20+22=42	no	naked	absent	absent	Regan, 1905; Akihito <i>et al.</i> , 1988; Chen <i>et al.</i> , 2008
<i>L. fluvialis</i> sp. nov.	I, 9 (8-10)	I, 9 (8-10)	15 (14-16)	I, 5	absent	16+16 (16-17+15-16)=32 (31-33)	yes	naked	absent	absent	present study
<i>L. fonticola</i> sp. nov.	I, 8 (7-9)	I, 8 (7-9)	15 (14-16)	I, 5	absent	15+16 (15-16+15-16)=31 (30-31)	yes	naked	absent	absent	present study
<i>L. grandis</i>	I, 15	I, 15	14	I, 5	4/2 (upper/lower)	19+22=41	no	naked	absent	absent	Arai, 1970; Akihito <i>et al.</i> , 1988
<i>L. guttatus</i>	I, 12	I, 13	18	I, 5	1 (upper)	17+21=38	no	naked	absent	absent	Akihito <i>et al.</i> , 1988; Chen <i>et al.</i> , 2008
<i>L. koma</i>	I, 10	I, 10-11	18-20	I, 5	1/1-2 (upper/lower)	14+17=31	no	scaly	absent	present	Snyder, 1909; Arai, 1981; Akihito <i>et al.</i> , 2002
<i>L. pallidus</i>	I, 10-11	I, 10 (10-11)	13 (13-15)	I, 5	absent	19+17 (16-18)=36 (35-37)	yes	naked	absent	absent	Regan, 1940; Kanagawa & Itai, 2009
<i>L. parvulus</i>	I, 8	I, 12	15	absent	absent or present	20+22=42	no	naked	absent	absent	Regan, 1940; Akihito <i>et al.</i> , 1988; Chen <i>et al.</i> , 2008
<i>L. platycephalus</i>	I, 10	I, 14	14	I, 5	3 (2-4) (upper)	17+24=41	no	naked	absent	absent	Shiogaki & Dotsu, 1976; Akihito <i>et al.</i> , 1988
<i>L. ryukyuensis</i>	I, 11	I, 11	15-16	present	1 (upper)	16+21=37	no	naked	absent	absent	Chen <i>et al.</i> , 2008
<i>L. saikaiensis</i>	I, 9	I, 9	17	I, 5	1/1 (upper/lower)	15+17=32	no	naked	present	present	Dôtu, 1957; Akihito <i>et al.</i> , 1988

Literature Cited

- Aizawa, H. & Y. Kokuryo, 1980. *Luciogobius pallidus* collected from Shizuoka Prefecture. *The Freshwater Fishes*, (6): 51-53. (In Japanese.)
- Aizawa, M., 1996. *Luciogobius pallidus* Regan, 1940. In Japan Fisheries Resource Conservation Association (ed.), Basic data on rare aquatic wildlife of Japan, pp.211-214, 234. Japan Fisheries Resource Conservation Association, Tokyo. (In Japanese.)
- Aizawa, M., 1998. *Luciogobius pallidus* Regan, 1940. In Japan Fisheries Resource Conservation Association (ed.), Data book on rare aquatic wildlife of Japan (Fisheries Agency version), pp.186-187. Japan Fisheries Resource Conservation Association, Tokyo. (In Japanese.)
- Akihito, K. Sakamoto, Y. Ikeda & K. Sugiyama, 2002. Gobioidae. In Nakabo, T. (ed.), Fishes of Japan with pictorial key to the species, English edition, pp.1139-1310. Tokai University Press, Tokyo.
- Akihito, Prince, M. Hayashi, T. Yoshino, K. Shimada, H. Senou & T. Yamamoto, 1988. Gobioidae. In Masuda, H., K. Amaoka, C. Araga, T. Uyeno & T. Yoshino (eds.), The fishes of the Japanese Archipelago (English ed., 2nd ed.), pp.236-289, 445, pls.235-258, 375. Tokai University Press, Tokyo.
- Arai, R., 1970. *Luciogobius grandis*, a new goby from Japan and Korea. *Bulletin of the National Science Museum, Tokyo*, **13**(2): 199-206, pl. 1.
- Arai, R., 1981. Fishes of *Luciogobius* and *Inu* (Gobiidae) from the Izu Peninsula, Central Japan. *Memoirs of the National Science Museum, Tokyo*, **14**: 151-166. (In Japanese with English summary.)
- Chen, I-S., T. Suzuki & H. Senou, 2008. A new species of gobiid fish, *Luciogobius* from Ryukyus, Japan (Teleostei: Gobiidae). *Journal of Marine Science and Technology*, **16**(4): 250-254.
- Chen, M. J. T. F., 1932. Note sur un nouveau poisson chinois appartenant au genre *Luciogobius*. *Bulletin du Muséum National d'Histoire Naturelle, Série 2*, **4**(6): 648-650.
- Dôtu, Y., 1957. A new species of a goby with a synopsis of the species of the genus *Luciogobius* Gill and its allied genera. *Journal of Faculty of Agriculture, Kyushu University*, **11**(1): 69-76, pl. 2.
- Gill, T., 1859. Notes on a collection of Japanese fishes, made by Dr. J. Morrow. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **11**: 144-150.
- Hubbs, C. L. & K. F. Lagler, 1964. Fishes of the Great Lakes region. xv+213pp., 44 col. pls. University of Michigan Press, Ann Arbor.
- Japan Color Research Institute (ed.), 1993. Concise manual of color names, revised edition. 90pp. Japan Color Enterprise Co. Ltd., Tokyo.
- Kanagawa, N. & T. Itai, 2009. Record of a gobiid fish *Luciogobius* sp. (Perciformes, Gobiidae) from the Abe River System in Shizuoka Prefecture, Central Japan. *Bulletin of the Biogeographical Society of Japan*, **64**: 69-77. (In Japanese with English abstract.)
- Kanagawa, N., T. Itai & Y. Kokuryo, 2004. *Luciogobius* sp. 3, *Luciogobius* sp. 1 and *Luciogobius* sp. 2. In Committee on Survey of Natural Environment, Shizuoka Prefecture (ed.), Red data book of Shizuoka Prefecture, edition for animals, pp.8, 131, 132 and 148. Hageromo Publishing Ltd., Shizuoka. (In Japanese.)
- Okiyama, M., 2001. *Luciogobius adapel*, a new species of gobiid fish from Japan. *Bulletin of the National Science Museum, Tokyo, Series A*, **27**(2): 141-149.
- Regan, C. T., 1905. On a collection of fishes from the Inland Sea of Japan made by Mr. R. Gordon Smith. *Annals and Magazine of Natural History, Series 7*, **15**: 17-26, pls. 2-3
- Regan, C. T., 1940. The fishes of the gobiid genus *Luciogobius* Gill. *Annals and Magazine of Natural History, Series 11*, **5**: 462-465.
- Shiogaki, M. & Y. Dotsu, 1976. Two new species of the genus *Luciogobius* (family Gobiidae) from Japan. *Japanese Journal of Ichthyology*, **23**(3): 125-129.
- Snyder, J. O., 1909. Descriptions of new genera and species of fishes from Japan and the Riu Kiu Islands. *Proceedings of the United States National Museum*, **36**: 597-610.
- Suzuki, T. & K., Shibukawa, 2004. Genus *Luciogobius*. In Senou, H. (ed.), A photographic guide to the gobioid fishes of Japan, pp.59-60. Heibonsha, Tokyo. (In Japanese.)
- Yoshida, T. & Y. Dotsu, 2001. *Luciogobius pallidus*. In Kawanabe, H., N. Mizuno & K. Hosoya (eds.), Freshwater fishes of Japan (3rd ed.), pp.582, 628-629. Yama-kei Publishers Co., Ltd., Tokyo. (In Japanese.)

摘 要

Kanagawa, N., T. Itai & H. Senou, 2011. Two new species of freshwater gobies of the genus *Luciogobius* (Perciformes: Gobiidae) from Japan. *Bull. Kanagawa prefect. Mus. (Nat. Sci.)*, (40): 67-74. (金川直幸・板井隆彦・瀬能 宏, 2011. 日本産ミミズハゼ属 (スズキ目ハゼ科) の2新種. 神奈川県立博物館研究報告 (自然科学), (40): 67-74.)

静岡県の駿河湾に流入する河川の淡水域から得られたミミズハゼ属 *Luciogobius* Gill, 1859 (スズキ目 Perciformes, ハゼ科 Gobiidae) の2新種を記載した。*Luciogobius fonticola* は、眼は小さく退化的で、皮下に埋没し、固定後は不明瞭になること、体に鱗がないこと、頬の皮質隆起にひげがないこと、第2背鰭の起点が臀鰭起点上方よりわずかに前にあること、腹鰭があること、胸鰭に遊離軟条を欠くこと、第2背鰭1棘8軟条 (モード、以下同様)、臀鰭1棘8軟条、尾鰭分枝軟条数8+7、総脊椎骨数31、腹椎骨数15、眼隔域はほぼ平らで、上顎長の体長比が10.5±1.1% (平均±標準偏差、以下同様)、頭長比が39.2±4.8%、背鰭前長の頭長比が261.2±12.9% であること、臀鰭前長の頭長比が267.9±14.2% であること、尾柄高の体長比が7.3±0.8% といった特徴の組み合わせにより既知種から区別される。*Luciogobius fluvialis* は、眼は小さく退代的で、皮下に埋没し、固定後は不明瞭になること、体に鱗がないこと、頬の皮質隆起にひげがないこと、第2背鰭の起点が臀鰭起点上方よりわずかに前にあること、腹鰭があること、胸鰭に遊離軟条を欠くこと、第2背鰭1棘9軟条 (モード、以下同様)、臀鰭1棘9軟条、尾鰭分枝軟条数8+7、総脊椎骨数32、腹椎骨数16、眼隔域はほぼ平らで、頭幅の体長比が11.5±0.9% (平均±標準偏差、以下同様)、上顎長の体長比が8.5±1.0%、頭長比が37.4±3.9%、背鰭前長の頭長比が307.4±15.7%、臀鰭前長の頭長比が315.8±17.1% であるといった特徴の組み合わせにより既知種から区別される。

なお、上記2種のカラー写真は本報告のPDF版 (<http://nh.kanagawa-museum.jp/kenkyu/bulletin/index.html>) を参照。

(受付2010年12月11日; 受理2011年2月3日)