



A NEW SPECIES OF GOBIID FISH, LUCIOGOBIUS FROM RYUKYUS, JAPAN (TELEOSTEI: GOBIIDAE)

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Acknowledgements

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A NEW SPECIES OF GOBIID FISH, *LUCIOGOBIUS* FROM RYUKYUS, JAPAN (TELEOSTEI: GOBIIDAE)

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Key words: new goby, *Luciogobius*, fish fauna, fish taxonomy, Japan.

ABSTRACT

A new gobiid fish has been collected from Ryukyu Archipelagos of Japan. This species is described herein as a new species, *Luciogobius ryukyuensis* sp. nov. It is characterized by the following unique combination of features: (1) second dorsal fin rays: I/11 and anal fin rays I/11; (2) pectoral fin rays 16 and with one upper, very short free soft ray; (3) vertebral count 37; and (4) specific coloration: head and body with many rounded light creamy white spots above creamy yellow to yellowish brown background. A diagnostic key to all nominal species of *Luciogobius* from West Pacific are provided herein.

I. INTRODUCTION

The gobiid fishes in Family Gobiidae comprise the most diverse group among teleost (Miller [11], Chen and Kottelat [5]). The great diversity of longitudinal gobioid fauna with higher vertebral count is mostly endemic to West Pacific and north-western Pacific. For example, the genus *Luciogobius* and other related genera is typically belonging to Eastern Asiatic, Japanese-Taiwanese-Chinese-Korean endemic in the freshwater to marine habitats (Akihito *et al.* [2], Suzuki and Shibukawa [18], Chen and Fang [4]). In Japanese waters, there are 12 nominal species have been revised as valid (Shiogaki and Dotsu [16], Okiyama [12], Akihito *et al.* [2]) and but there are still more than 20 undescribed species of the genus (Suzuki and Shibukawa [18]).

The uncovered, current species of *Luciogobius* from the Ryukyu and Amami O-shima Archipelagos have been considered as valid, undescribed herein which was first collected in 1980 by the second and third author (TS and HS). Recently, first author (ISC) had tried to revise this genus in Taiwan have yielded at least 2 undescribed species of *Luciogobius* (Chen,

unpublished data). One of our cooperative projects is to settle down the taxonomic status of species collections of *Luciogobius* from the Ryukyus which geographically is in bridge the mainland Japan and Taiwan, and the result seems to support that it is an undescribed species which is rather differed to all nominal species in Japan. Based on the reason of our cooperative project of this genus and also for very serious concern of its biodiversity conservation issue which has been listed as the endangered species on red-list of Japan, the real requirement for publishing such morphological distinct taxon is very essential and important for further governmental strategy and management of aquatic ecological conservation of endemic species of Japan. Herein we describe this one of Ryukyu as new species from Japanese waters. An artificial key for all nominal species from Japan are also provided within this paper.

II. MATERIALS AND METHODS

All type specimens of the new species were collected by second author (TS). All counts and measurements were made from specimens preserved in 70% ethanol. Morphometric methods follow Miller [11] and meristic methods follow Akihito *et al.* [1], Chen and Shao [6], Chen and Kottelat [5]. Terminology of cephalic sensory canals and free neuromast organ (sensory papillae) is from Wongrat and Miller [20], based on Sanzo [15].

Type specimens and comparative materials are deposited at Osaka Museum of Natural History, Osaka (OMNH) and Yokosuka City Museum, Yokosuka (YCM). Meristic abbreviations: A, anal fin; C, caudal fin; D1, and D2, 1st and 2nd dorsal fins respectively; P, pectoral fin; V, pelvic fin; and VC, vertebral count. All fish lengths are standard length (SL).

III. SYSTEMATICS

Luciogobius ryukyuensis Chen, Suzuki and Senou new species

(Japanese name: Minami-hime-mimizuhaze)
(Figs. 1, 2 and 3)

Luciogobius sp. 1 Suzuki et Shibukawa, 2004: 60.

Luciogobius sp. Suzuki, Sakamoto et Senou, 2006: 199.

Materials examined

Holotype. OMNH-P 20480, 33.5 mm SL, upper end of tidal region, Aira-gawa River, Iriomote Island, Japan, Dec. 28, 1990,

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Fig. 1. Alive photo of *Luciogobius ryukyuensis*, about 45 mm SL, 30 cm depth, Aira-gawa River, Iriomote Island, Japan. Photograph by Mr. Korechika Yano.

coll. T. Suzuki and M. Suzuki.

Paratypes. NTOUP 2007-07-068, 2 specimens, 37.4-37.6 mm SL, Makiyaokawa-gawa River, Okinawa Island, Japan, July 17, 2006, coll. T. Suzuki *et al.* (originally from OMNH-P 31324). OMNH-P 20481, 35.2 mm SL, upper end of tidal region, Aira-gawa River, Iriomote Island, Japan, Dec. 28, 1990, coll. T. Suzuki and M. Suzuki. OMNH-P 20482, 2 specimens, 32.2-33.4 mm SL, upper end of tidal region, Aira-gawa River, Iriomote Island, Japan, Dec. 28, 1990, coll. T. Suzuki and M. Suzuki. OMNH-P 20484, 3 specimens, 21.6-26.6 mm SL, middle reaches of Aira-gawa River, Iriomote Island, Japan, Aug. 11, 1991, coll. T. Suzuki and M. Suzuki. OMNH-P 20508, 37.1 mm SL, middle reaches of Aira-gawa River, Iriomote Island, Japan, July 21, 1998, coll. T. Suzuki and M. Suzuki. OMNH-P 20509, 38.7 mm SL, middle reaches of Aira-gawa River, Iriomote Island, Japan, July 21, 1998, coll. T. Suzuki and M. Suzuki. OMNH-P 20510, 12 specimens, 25.7-35.8 mm SL, middle reaches of Aira-gawa River, Iriomote Island, Japan, July 21, 1998, coll. T. Suzuki and M. Suzuki. OMNH-P 20523, 41.2 mm SL, upper end of tidal region, Nishifonera-gawa River, Iriomote Island, Japan, Aug. 15, 2001, coll. T. Suzuki and M. Suzuki. OMNH-P 20524, 39.6 mm SL, upper end of tidal region, Nishifonera-gawa River, Iriomote Island, Japan, Aug. 15, 2001, coll. T. Suzuki and M. Suzuki. OMNH-P 20525, 6 specimens, 26.4-33.6 mm SL, upper end of tidal region, Nishifonera-gawa River, Iriomote Island, Japan, Aug. 15, 2001, coll. T. Suzuki and M. Suzuki. OMNH-P 20528, 5 specimens, 23.6-28.8 mm SL, upper end of tidal region, Nishifonera-gawa River, Iriomote Island, Japan, Aug. 15, 2001, coll. T. Suzuki and M. Suzuki. OMNH-P 31323, 45.4 mm SL, data same as NTOUP 2007-07-068.

Non-types. YCM-SSP 9126, 36 specimens, 21.5-38.3 mm SL, Aira-gawa River, Iriomote Island, Japan, July 21, 1980, coll. T. Suzuki and H. Senou; YCM-SSP 9127, 14 specimens, 16.8-25.0 mm SL, Maera-gawa River, Iriomote Island, Japan, July 22, 1980, coll. T. Suzuki and H. Senou.

Diagnosis

Luciogobius ryukyuensis can be distinguished by the all other congeneric species by the following unique combination of features: (1) second dorsal fin rays: I/11 and anal fin rays I/11; (2) pectoral fin rays modally 16 and with one upper, very short



Fig. 2. *Luciogobius ryukyuensis*, Above holotype, male, OMNH-P 20480, 33.5 mm SL, and Below paratype, female, OMNH-P 20524, 39.6 mm SL.

free soft ray; (3) vertebral count: $16 + 21 = 37$; and (4) specific coloration: head and body with many rounded light creamy white spots above creamy yellow background.

Description

Body very slender, cylindrical anteriorly and somewhat compressed posteriorly (All morphometric data is shown in Table 1). Head flat and depressed. Cheek slightly fleshy. Eye moderate small. A horizontal dermal fold on upper part of cheek and below orbit.

Snout flat and short. Anterior nasal opening as a protruded, horizontal short tube and posterior nasal opening as a round hole. Interorbital region rather wide, about two times of eye diameter. Mouth oblique, maxillary extending to vertical of rear margin of orbit. Lower jaw more prominent compared to upper jaw. Teeth rather minute, with 4-5 rows of tiny conical teeth which outer rows larger in both jaws. Tongue somewhat pointed, but the anterior tip bilobed. Gill opening rather restricted, extending merely slightly below lower margin of pectoral base. Anus located in posterior half of body. Vertebral count $16 + 21 = 37$ (counted by X-rays from 18 type specimens).

Fins. D2 I/11(18), A I/11(18), P 15(1)-16(17) (all counted from 18 specimens). D1 absent. D2 with the middle one third portion of rays longest. A shape similar to D2. Both first spines in D2 and A relatively short. A origin in front of D2 origin. D2 origin inserted the vertical through between 2nd and 3rd branched rays of A. Both rear tip of D2 and A is far from the procurrent rays of C when depressed. P rounded and its length about equal to postorbital length. P with a short, free soft ray on upper margin near upper basal region. C rounded. V as a round sucking disc with complete frenum and rather small which just somewhat larger than orbit, but smaller than snout length.

Scales. Both body and head entirely naked without any scale.

Head lateral-line system (Fig. 3). Head canals: whole head in lacking any canal and head pores. Sensory papillae: the series of infraorbital sensory papillae all representing typically longitudinal pattern. Row *a* long and extending to snout which upward

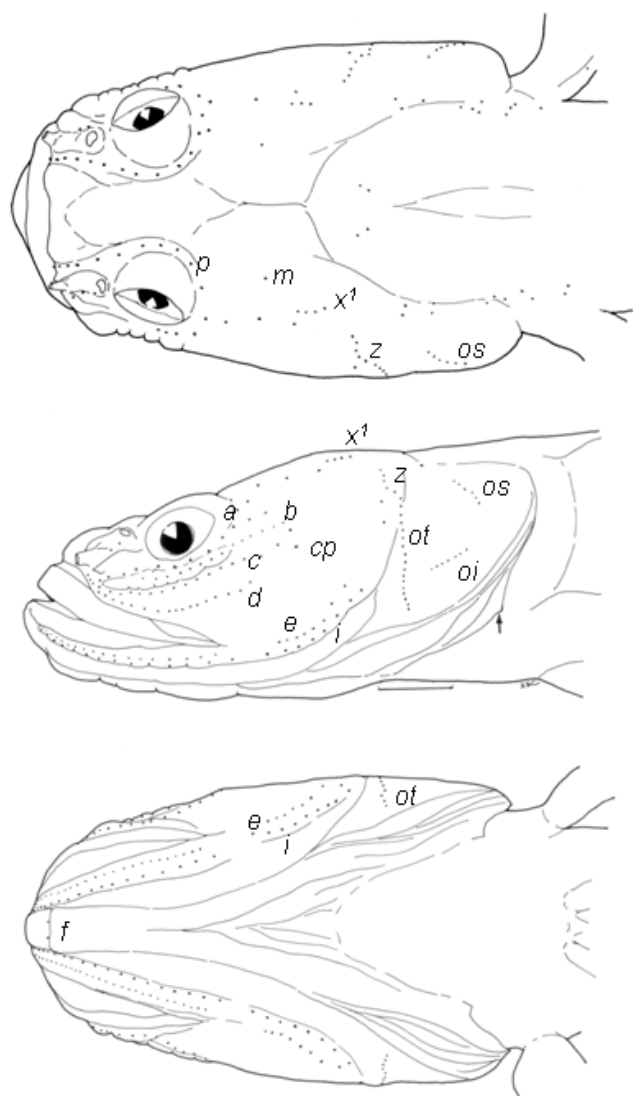


Fig. 3. Head lateral-line system of *Luciogobius ryukyensis*, paratype, OMNH-P 20510, 32.2 mm SL. Bar = 1 mm.

to surrounded eye diameter in interorbital region. Row *b* rather long starting on anterior portion of dermal ridge. Row *c* mainly below the dermal fold and rather long. A single *cp* located below rear Row *c*. Row *d* slightly shorter than row *c*. Rows *z* and *ot* seems to be connected together. Row *f* paired only as two papillae. Opercle with three rows *ot*, *os*, and *oi*. Rows *os* and *ot* well separated. Rows *z* and *ot* connected together as single vertical row. Other papillae are shown in detail in Fig. 3.

Coloration when fresh.- Based on the fresh specimens from Iriomote Island (Figs. 1 and 2), the body and head light creamy yellow to yellowish brown background. Head and body with many rounded light creamy white spots which about equal to the size of pupil. Belly spotless, uniform pale white or creamy white. Caudal fin with many light brown spots. Other fins pale yellow and translucent, spotless, and darker in rays of D2 and A. The specimens while in alcoholic preservation have yielded uniformly light, pale yellow. The round light spots on head and body are faded and indistinct except a few still can be observed

Table 1. Morphometry of *Luciogobius ryukyensis*.

Morphometric characters	MIN	MAX	Average (n = 12)
Percent standard length (%SL)			
Head length	19.7%	24.2%	22.1%
Snout to 2nd dorsal origin	65.7%	70.2%	67.7%
Snout to anus	57.7%	61.2%	59.4%
Snout to anal fin origin	62.6%	64.7%	63.8%
Prepelvic length	20.0%	24.5%	21.3%
Caudal peduncle length	20.9%	24.2%	22.5%
Caudal peduncle depth	7.7%	9.4%	8.6%
2nd dorsal fin base	14.6%	17.3%	16.1%
Anal fin base	15.6%	18.7%	16.9%
Caudal fin length	12.8%	14.9%	14.2%
Pectoral fin length	10.7%	14.2%	12.5%
Pelvic fin length	4.7%	6.3%	5.5%
Body depth at pelvic fin origin	9.5%	12.2%	10.7%
Body depth at anal fin origin	9.4%	12.4%	11.0%
Body width at anal fin origin	6.2%	7.8%	6.8%
Pelvic fin origin to anus	35.8%	39.9%	38.0%
Percent head length (% HL)			
Snout length	23.6%	28.0%	26.1%
Eye diameter	11.4%	16.3%	13.6%
Cheek depth	17.3%	24.6%	20.2%
Postorbital length	59.3%	67.9%	64.2%
Head width in maximum	44.4%	53.7%	49.7%
Head width in upper gill	30.3%	38.6%	34.7%
Bony interorbital width	11.2%	16.3%	13.9%
Fleshy interorbital width	21.6%	28.2%	24.8%
Lower jaw length	37.0%	43.5%	40.7%

PS: MIN: minimum; MAX: maximum

on dorsal head.

Distribution

This species (formerly *Luciogobius* sp. 1) have been found and observed from several localities including the Amami O-shima, Okinawa, Ishigaki and Iriomote islands of southern Japan (Suzuki and Shibukawa [18]) although the type series are currently based on gobiid specimens from Iriomote Island. It is highly possible to be the Ryukyu endemic since no further specimens record from mainland Japan and Taiwan.

Habitats

This species inhabits among gravels at the rapids which are in the most lower reaches in the freshwater area on the river.

Etymology

The specific name, *ryukyuensis*, is referred to the type locality from Ryukyu Archipelagos, Japan.

Remarks

This new species, *Luciogobius ryukyuensis*, shares the typical longitudinal pattern of infraorbital sensory papillae, rather slender body and lacking first dorsal fin as all congeneric species of Japan and China (Gill [10], Chen [7], Di Caporiacco [8], Akihito *et al.* [2], Suzuki and Shibukawa [18]). In Japanese Archipelagos, *Luciogobius ryukyuensis* can be immediately separated from species group with small scales on caudal peduncle including: *Luciogobius ama* (Snyder, 1909) [17] and *Luciogobius koma* (Snyder, 1909) [17], and the new species is well differed to recently described species, *Luciogobius adapel* Okiyama, 2001 [12] which lacks the dorsal and anal fins.

Luciogobius ryukyuensis share the feature as anal fin origin in front of second dorsal fin origin with following five species: *Luciogobius guttatus* Gill, 1859 [10], *Luciogobius elongatus* Regan, 1908 [13], *Luciogobius parvulus* (Snyder, 1909) [17], *Luciogobius grandis* Arai, 1970 [3], and *Luciogobius platycephalus* Shiogaki et Dotu, 1976 [16], and unlike other four remaining species with second dorsal fin origin in front of anal fin origin including following four species: *Luciogobius albus* Regan, 1940 [14], *Luciogobius pallidus* Regan, 1940 [14], *Luciogobius saikaiensis* Dotu, 1957 [9], and *Luciogobius dromitoris* Shiogaki et Dotu, 1976 [16] respectively.

Luciogobius ryukyuensis is rather similar to *Luciogobius guttatus* than four remaining congeneric species in body and pectoral fin shape. *Luciogobius ryukyuensis* is rather differed to *Luciogobius parvulus* by the presence of pelvic fin vs. absence of that. *Luciogobius ryukyuensis* is also well differentiated with *Luciogobius elongatus* as one free soft ray on upper margin of pectoral fin vs. absence of any free rays of pectoral fin, and second dorsal fin I/11 vs. I/6. *Luciogobius ryukyuensis* can be distinguished from the following two species including *Luciogobius grandis* and *Luciogobius platycephalus* by pectoral fin merely with one free ray vs. representing 2-5 free soft rays on upper margin.

The two published nominal species of Chinese waters share the similar feature of this Japanese endemic *Luciogobius ryukyuensis* with normal size of eyes. However, *Luciogobius ryukyuensis* is differed from *Luciogobius brevipterus* Chen, 1932 [7] by second dorsal fin rays I/11 vs. I/13; anal fin rays I/11 vs. I/13; and pectoral fin length in head 1.6-1.9 (average 1.8) vs. 2.5. *Luciogobius ryukyuensis* can be well distinguished from *Luciogobius martellii* Di Caporiacco, 1947 [8] by pectoral fin rays modally 16 vs. 19. However, we considered that *L. martellii* Di Caporiacco, 1947 [8] should be a junior synonym of *Luciogobius guttatus* Gill, 1859 [10] (Chen, unpublished data).

Therefore, *Luciogobius ryukyuensis* can be well distinguished from very common, closely related species: *Luciogobius guttatus* of Japan by following features: (1) second dorsal fin rays: I/11 vs. modally I/12; (2) anal fin rays: I/11 vs. I/13; (3) Pectoral fin rays: modally 16 vs. modally 18-19; (4) vertebral count: 16 + 21 = 37 vs. 17 + 21 = 38; and (5) head shape: somewhat square in dorsal view and cheek slightly fleshy vs.

elliptical in dorsal view and cheek very fleshy in male; (6) coloration: creamy yellow background vs. brown to deep brown background. So far, this genus is still needed to be revised not only Japanese but also Taiwanese and Chinese waters where very few nominal species had been formerly recorded.

Diagnostic key for all nominal species of genus, *Luciogobius* from West Pacific

1. body in lacking dorsal and anal fins ----- *adapel*
- body with second dorsal and anal fins ----- 2
2. body at least with scales on caudal peduncle ----- 3
- body entirely naked ----- 4
3. D2 I/10; P base with a vertical black bar ----- *koma*
- D2 I/8-9; P base without such mark ----- *ama*
4. dermal ridge on cheek with barbels ----- *sakaiensis*
- dermal ridge on cheek no barbels ----- 5
5. eye reduced and embedded beneath skin; D2 origin in front of A origin ----- 6
- eye normal size and not embedded; A origin in front of D2 origin ----- 8
6. D2 I/9; head length 25% ----- *albus*
- D2 I/10-11; head length about 20% ----- 7
7. D2 modally I/10; body depth about 12-13% ----- *dromitoris*
- D2 modally I/11; body depth about 10% ----- *pallidus*
8. V absent ----- *parvulus*
- V present ----- 9
9. D2 modally 6 soft rays; P in lacking any upper free soft ray ----- *elongatus*
- D2 more than 10 soft rays; P at least with 1 or more upper free soft rays ----- 10
10. 1 free soft ray near upper basal origin of P ----- 11
- 2-5 free soft rays on upper margin of P ----- 13
11. D2 modally I/13; HL/P 2.5 ----- *brevipterus*
- D2 modally I/11-12; HL/P 1.7-2.0 ----- 12
12. D2 modally I/12; A modally I/13; P modally 18-19; VC 38 ----- *guttatus*
- D2 I/11; A I/11; P modally 16; VC 37 ----- *ryukyuensis*
13. P with 2-3 free soft rays on lower margin; D2 I/15; A I/15 ----- *grandis*
- P in lacking free rays on lower margin; D2 I/10; A I/14 ----- *platycephalus*

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