Acentrogobius limarius (Gobiidae) from the Ryukyu Islands, Japan: First Northern Hemisphere Records

Kyoji Fujiwara¹,⁵, Kiyoshi Hagiwara², Toshiyuki Suzuki³, and Hiroyuki Motomura⁴

¹The United Graduate School of Agricultural Sciences, Kagoshima University, 1-21-24 Korimoto, Kagoshima 890-0065, Japan
E-mail: kyojifujiwara627@yahoo.co.jp

²Yokosuka City Museum, 95 Fukadadai, Yokosuka, Kanagawa 238-0016, Japan

³Osaka Museum of Natural History, 1-23 Nagai Park, Higashi-sumiyoshi, Osaka 546-0034, Japan

⁴The Kagoshima University Museum, 1-21-30 Korimoto, Kagoshima 890-0065, Japan

⁵Corresponding author

(Received 9 July 2020; Accepted 4 September 2020)

A single specimen (31.7 mm in standard length) and an underwater photograph of Acentrogobius limarius Allen, Erdmann, and Hadiaty, 2015 (recently described from Batanta Island, West Papua, Indonesia) from Amami-oshima and Iriomote-jima islands, Ryukyu Islands, Japan, respectively, represent the first Northern Hemisphere records of the species, the former being the northernmost record. A full description of the specimen is given and the new standard Japanese name "Hokosaki-kirara-haze" proposed for the species.

Key Words: Teleostei, distribution, range extension, Amami Islands, Yaeyama Islands.

Introduction

The genus Acentrogobius Bleeker, 1874 typically inhabits coastal bays, mangrove streams, and estuaries (Allen et al. 2015). Although currently a relatively large group of similar-appearing species, the definition of the genus is unclear (Larson and Lim 2005). In addition, species level taxonomic problems have been reported (Allen 2015), including some unidentified species (e.g., Akihito et al. 2013).

During a recent ichthyofaunal survey of the Amami Islands, Japan, a single unidentified specimen of Acentrogobius was collected (Hagiwara 2018, 2019). It was subsequently identified here as Acentrogobius limarius Allen, Erdmann, and Hadiaty, 2015, as was an underwater specimen photographed at Iriomote-jima island, Japan, but not collected. The species was originally described from eight specimens collected from Batanta island, West Papua, Indonesia, with the only other known record being several specimens collected in Milne Bay, Papua New Guinea in 2019 (M. Erdmann pers. comm.). Accordingly, the Japanese records are the first of A. limarius from the Northern Hemisphere. The Amami Islands specimen is fully described below.

Materials and Methods

Counts and measurements followed Allen et al. (2015). Measurements were made to the nearest 0.01 mm, except for standard length (nearest 0.1 mm), with needle-point calipers under a dissecting microscope. Standard length is abbreviated as SL. Cephalic sensory-canal pore terminology follows Akihito et al. (2013), the canals being observed using versatile staining with Cyanine Blue (Saruwatari et al. 1997). Osseological elements were examined from radiographs. The distributional map was prepared using GMT 5.3.1, with data from GSHHG (Wessel and Smith 1996). The specimen used in this study is deposited at YCM: Yokosuka City Museum, Yokosuka, Japan.

Acentrogobius limarius Allen, Erdmann, and Hadiaty, 2015
[English name: Batanta Mud Goby; new standard Japanese name: Hokosaki-kirara-haze] (Figs 1–3)

Acentrogobius limarius Allen et al., 2015: 35, figs 1–3 (original description; type locality: Batanta island, Raja Ampat Islands, West Papua, Indonesia).

Acentrogobius sp. 2 (not sensu Akihito et al. 2013): Hagiwara 2018: 331, unnumbered fig. (brief description; Amami-oshima island, Ryuku Islands, Japan: based on YCM-P 45483); Hagiwara 2019: 335, unnumbered fig. (same fig. as Hagiwara 2018).

Material examined. YCM-P 45483, female, 31.7 mm SL, Atetsu, Amami-oshima island, Amami Islands, Ryuku Islands, Japan, 10 m depth (muddy bottom), 11 December 2013, hand net, K. Hagiwara.

Description. Dorsal-fin rays VI+1, 10; anal-fin rays I, 10; pectoral-fin rays 19; pelvic-fin rays 1; branched caudal-fin rays 17; longitudinal scale series 28; transverse scales 8; pre-dorsal-fin scale rows 7; pre-pelvic-fin scale rows 5; gill rakers on first branchial arch 1+7 (counted on right side);
vertebrae 25. The following morphometrics are expressed as percentage of SL: head length 28.8; head depth 17.0; body depth at pelvic-fin origin 19.1, at anal-fin origin 16.1; caudal-peduncle length 18.1, depth 10.9; snout length 5.9; eye diameter 10.8; cheek depth 6.2; upper-jaw length 10.8; pre-1st dorsal-fin length 35.2; pre-2nd dorsal-fin length 54.7; pre-anal-fin length 53.8; pre-pelvic-fin length 28.2; base of dorsal fins 48.7; 1st spine length on 1st dorsal fin 12.3; 2nd dorsal-fin spine length 15.1 (tip broken after measurement); 3rd dorsal-fin spine length 13.3; 1st spine length on 2nd dorsal fin 12.7; longest dorsal-fin soft ray length (10th) 18.1; anal-fin spine length 7.1; longest anal-fin soft ray length (10th) 17.4; pectoral-fin length 24.3; pelvic-fin length 23.8; pelvic-fin spine 7.1; and caudal-fin

Fig. 1. Photographs of *Acentrogobius limarius* from: A–C, Atetsu, Amami-oshima island, Amami Islands, Ryukyu Islands, Japan (YCM-P 45483, 31.7 mm SL); D, Amitori Bay, Iriomote-jima island, Yaeyama Islands, Ryukyu Islands, Japan (specimen not collected). A, Fresh coloration; B, preserved coloration; C, radiograph; D, underwater photograph taken at 8 m depth (Photo: K. Yano).
First Northern Hemisphere records of Acentrogobius limarius

length 33.5.

Body slender, compressed, width much less than depth (Fig. 1A, B). Anus situated just before anal-fin origin. Head somewhat small, slightly depressed anteriorly, its height greater than width. Snout short, rounded, its length much less than eye diameter. Anterior and posterior nostrils close to each other, both located before vertical through anterior margin of eye, anterior nostril located anterointernally below posterior nostril; membranous tube on each nostril, that on anterior nostril much longer than on posterior nostril. Eye somewhat large. Interorbital region very narrow, flattened. Mouth terminal. Lower jaw longer than upper jaw, its posterior tip reaching to vertical through anterior margin of pupil. Chin relatively smooth, without mental frenum. Both jaws with several rows of densely arranged conical teeth, outer row teeth larger than those of inner row; 3 and 2 enlarged, recurved canine-like teeth on each side of upper-jaw symphysis and midway along lower jaw, respectively. Gill opening slightly narrowed, anteroventral point below middle of opercle (vertically level with preopercle), gill membranes attached anteriorly to isthmus. Preopercular and opercular margins rounded, upper end of latter horizontally level with middle of eye.

Head sensory canal pores well developed, comprising snout pore (B’), single anterior (C) and posterior (D) interorbital pores, four postorbital (E, F, G, and H’) and preopercular (M’, N, and O’) pores; and 2 posterior oculoscapular pores (K’ and L’); head sensory papillae in transverse pattern on cheek; a single row of transverse papillae on chin; papillae rows (papillae behind eye could not be observed because of abrasion) and sensory pores on head as shown in Fig. 2.

Body covered with weak ctenoid scales. Head, including nape, pectoral-fin base, cheek (lower portion damaged), opercle, and pre-dorsal- and pre-pelvic-fin regions completely covered with cycloid scales; anterior margin of pre-dorsal-fin scales just behind posterior interorbital pore; pre-pelvic-fin scales reaching to anteroventral point of gill opening; cheek with 2 rows of 3 scales each, those on lower row much larger than on upper row; opercle with 6 scales, lowermost scale largest of all cycloid scales (Fig. 2). Snout, suborbital region, and jaws naked.

First dorsal fin triangular, 2nd spine longest, all spines lacking filamentous tips (but see Remarks); dorsal-fin origin located slightly posterior to vertical through pectoral-fin base; all spines thin, flexible. Second dorsal and anal fins long, origin of latter under that of former, posteriormost rays of both fins longest, tips reaching to caudal-fin base. Pectoral fin somewhat long, pointed, middle rays longest, tips reaching to below 2nd dorsal-fin origin. Pelvic fins completely connected by membrane, with well-developed frenum; pelvic-fin origin located just below ventral end of pectoral-fin base. Caudal fin lanceolate, its length slightly greater than head length.

Coloration. Fresh coloration (based on Fig. 1A). Body ground color light brown dorsally, grayish-white ventrally. Snout dark brown. Check with 2 dark orange stripes, upper stripe horizontally level with lower eye margin, slightly indistinct lower stripe on lower margin of cheek, both with posterior tips curved upward. Opercle with dark orange smudges. Upper part of head and body scattered with small dark orange spots. About 4 or 5 small indistinct blackish-brown spots on dorsal and ventral edges of body (origins of 2nd dorsal and anal fins to caudal peduncle). Four large squarish blackish-brown spots on lateral midline, each of similar size to pupil, enclosing 2 small spots; most anterior spot located just below middle of 1st dorsal fin, 2nd and 3rd spots below 1st to 2nd and 8th to 10th soft ray bases of 2nd dorsal fin, respectively; last spot on caudal-fin base. Dor sal fins and upper half of caudal fin with small (same size as small body spots) dark orange spots. Pectoral, pelvic, and anal fins translucent white, with many black melanophores.

Coloration when preserved (based on Fig. 1B). Body brownish-white. Snout dark brown. Check with 2 dark brown stripes, lower stripe indistinct. Opercle with dark brown smudges. Small, formerly dark orange spots on upper
part of body, dorsal fins, and upper half of caudal fin dark brown. Four large squarish blackish-brown spots on lateral midline clearly apparent, but slightly paler than when fresh.

**Distribution.** Currently recorded only from Amami-oshima and Iriomote-jima islands in the Ryukyu Islands, Japan (this study), as well as Batanta island, Indonesia (Allen et al. 2015) and Milne Bay, Papua New Guinea (specimens deposited in Western Australian Museum fish collection; M. Erdmann pers. comm.) (Fig. 3).

**Remarks.** The Japanese specimen agreed very closely with the diagnosis of *Acentrogobius limarius* provided by Allen et al. (2015), although the numbers of transverse and pre-dorsal scales (diagnostic characters of *A. limarius*) differ slightly (viz., 8 and 7, respectively, in the Japanese specimen vs. 9 and 8–9, respectively). Such differences are very minor and regarded here as intraspecific variations.

Although the taxonomy of species of *Acentrogobius* is still incomplete, *A. limarius* clearly differs from other congeners in having a completely scaled cheek and opercle, and unique pattern of head sensory papillae (viz., transverse pattern on the cheek and single transverse row on the chin) (Allen et al. 2015; this study). Eleven species of *Acentrogobius*, including two unidentified species (given only standard Japanese names), have been recorded from Japanese waters to date (Akihito et al. 2013). *Acentrogobius limarius* is not likely to be mis-identified as a different Japanese congener due to its lanceolate caudal fin and coloration. Only *Acentrogobius viganensis* Steindachner, 1893 shares a similar caudal-fin shape with *A. limarius*, although the latter is easily distinguished by the lack of a black spot on the upper end of the opercle and a black strip just behind the eye (Akihito et al. 2013; this study).

An underwater photograph taken at Iriomote-jima island, Ryukyu Islands, Japan (Fig. 1D) was identified as *A. limarius*, having a lanceolate caudal fin, long filamentous tip on the 3rd dorsal-fin spine (an occasional character, possibly appearing only in males), and the above-described coloration (Allen et al. 2015; this study). The 2nd dorsal-fin spine also bore a long filamentous tip in the photographed individual, such a feature not having been described by Allen et al. (2015). However, as those authors pointed out, a long filamentous tip on the 3rd dorsal-fin spine was somewhat variable, which is likely to be applicable to the other spines. Hence, the condition depicted by the underwater photograph probably represents intraspecific variation in *A. limarius*. Similar intraspecific variation has been known in *Acentrogobius suluensis* (Herre, 1927) (Akihito et al. 2013).

*Acentrogobius limarius* has previously been recorded only from the original description (from Batanta island, West Papua, Indonesia) and unpublished specimens from Milne Bay, Papua New Guinea; the present specimen and underwater photograph (Fig. 1) being the first Northern Hemisphere records of the species, that from Amami-oshima island being the northernmost (Fig. 3). The species inhabits relatively deeper (8–26 m) muddy bottoms than other congeners [a habitat which is frequently overlooked and poorly collected (Allen 2015; Allen et al. 2015)], and is likely to occur between Japan and Indonesia. The new standard Japanese name "Hokosaki-kirara-haze" is proposed for *A. limarius* (based on YCM-P 45483). "Hokosaki" means ‘tip of halberd’ in Japanese, in reference to the lanceolate caudal fin of the species, and "kirara-haze" being the common Japanese name for the genus *Acentrogobius*.

**Acknowledgments**

We are very grateful to K. Yano (Diving Service Yano, Iriomote-jima Island) for providing an underwater photograph; M. Erdmann (Conservation International Indonesia Marine Program) for reading the manuscript and giving valuable comments; T. Hashimoto (Kagoshima University) for assistance in taking x-rays, and G. Hardy (Ngunguru, New Zealand) for reading the manuscript and providing help with English. This study was supported in part by a Grant-in-Aid from the Japan Society for the Promotion of Science for JSPS Fellows (DC1: 19J211103); JSPS KAKENHI Grant Numbers JP23580259, JP26450265, and JP20H03311; the JSPS Core-to-Core Program: B Asia-Africa Science Platforms; the "Biological Properties of Biodiversity Hotspots in Japan" project of the National Museum of Nature and Science, Tsukuba, Japan; and "Establishment of Global Research and Education Network in the Amami Islands" project of Kagoshima University, adopted by the Ministry of Education, Culture, Sports, Science and Technology, Japan.
References

Akihito, Sakamoto, K., Iwata, A., and Ikeda, Y. 2013. Gobioidei. Pp. 1347–1608, 2109–2211. In: Nakabo, T. (Ed.) Fishes of Japan with Pictorial Keys to the Species. Third Edition. Tokai University Press, Hadano. [In Japanese]

Allen, G. R. 2015. Descriptions of two new gobies (Gobiidae: Acentrogobius) from Milne Bay Province, Papua New Guinea. Journal of the Ocean Science Foundation 14: 1–13.

Allen, G. R., Erdmann, M. V., and Hadiaty, R. K. 2015. Acentrogobius limarius, a new species of goby (Pisces: Gobiidae) from West Papua Province, Indonesia. Journal of the Ocean Science Foundation 15: 33–40.

Hagiwara, K. 2018. Gobiidae. Pp. 331–369. In: Motomura, H., Hagiwara, K., Senou, H., and Nakae, M. (Eds) Identification Guide to Fishes of the Amami Islands, Japan. Kagoshima University Mu-

seum, Kagoshima, Yokosuka City Museum, Yokosuka, Kanagawa Prefectural Museum of National History, Odawara, and National Museum of Nature and Science, Tsukuba. [In Japanese]

Hagiwara, K. 2019. Gobiidae. Pp. 335–374. In: Motomura, H., Hagiwara, K., Senou, H., and Nakae, M. (Eds) Identification Guide to Fishes of the Amami Islands in the Ryukyu Archipelago, Japan. Minami Nippon Shimbun Kaisatsu Center, Kagoshima. [In Japanese]

Larson, H. K. and Lim, K. K. P. 2005. A Guide to Gobies of Singapore. Singapore Science Centre, Singapore, 164 pp.

Saruwatari, T., Lopez, J. A., and Pietsch, T. W. 1997. Cyanine Blue: a versatile and harmless stain for specimen observation. Copeia 1997: 840–841.

Wessel, P. and Smith, W. H. F. 1996. A global self-consistent, hierarchical, high-resolution shoreline database. Journal of Geophysical Research 101 (B4): 8741–8743.