

A re-examination of Gobiid Fish, *Luciogobius guttatus*, with First Record of *L. martellii* in Korea

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ABSTRACT A re-examination of *Luciogobius guttatus* was conducted using 84 samples, which lives on all coastal waters of Korea. As a result, 41 specimens (31.3~54.4 mm SL) collected from the west and south coasts were classified as *L. martellii*. The morphological features of *L. martellii* as follows: number of abdominal vertebrae 16; total number of vertebrae 35~37; dorsal fin base length longer than upper caudal peduncle length or equal; one free ray on its upper pectoral fin; and edge of tail fin white. Among these, the most prominent morphological difference in *L. guttatus* is comparing the dorsal fin base length and upper caudal peduncle length, which is also well observed in syntypes of *L. martellii*. We proposed a new Korean name, “Geom-jeong-mi-kken-mang-duk” referring to their color.

Key words: Gobiidae, *Luciogobius guttatus*, *Luciogobius martellii*, first record, Korea

INTRODUCTION

The gobiid fishes of genus *Luciogobius* Gill, 1859, are characterized based on the following morphological features: absence first dorsal fin and pterygiophore; origin of second dorsal fin and anal fin positioned at the rear of the body; elongated body whit scaleless body; depressed head; small eye; more than 31 total vertebrae (Shibukawa *et al.*, 2019).

Recently, Shibukawa *et al.* (2020) confirmed the validity of the genus *Inu*, and this made *L. ama*, *L. koma*, and *L. saikaiensis* to be reclassified into the genus *Inu*.

Consequently, 16 valid species in the genus *Luciogobius* have been reported to be restricted to Eastern Asia regions such as Korea, Japan, China, Taiwan, Hong Kong, and Russia (Yamada *et al.*, 2009; Ikeda *et al.*, 2019; Dyldin *et al.*, 2020; Koreeda and Motomura, 2022).

Six species of *Luciogobius* have been reported in Korea; they include *L. elongatus*, *L. grandis*, *L. guttatus*, *L.*

pallidus, *L. parvulus*, and *L. platycephalus* (Kim, 2012; Cho and Choi, 2014; Kim *et al.*, 2021). Among them, *L. guttatus* as a single species has been questioned due to morphological and ecological considerations.

Therefore, we compared the specimens collected from all coast of Korea, including Baekryeong Island in the northwestern part of Korea and Jeju Island, with the syntypes of *L. martellii*, which had been misclassified as *L. guttatus* owing to their morphological resemblance. As a result, we identified the presence of *L. martellii* in the samples collected in Korea, so we described *L. martellii* for the first time in Korea.

MATERIALS AND METHODS

All specimens are fixed in 10% formalin thereafter preserved in 70% ethanol. Methods of counting and measurements followed Hubbs and Lagler (2004) and are expressed in percentage of standard length (SL) or head length (HL). Measurements were made to the nearest 0.1 mm using digital vernier calipers. Vertebrae were determined from radiographs (X-eye 5000NSL, SEC, Korea)

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Table 1. Comparison of counts and proportional measurements of *Luciogobius martellii* and *L. guttatus*

	<i>L. martellii</i>				<i>L. guttatus</i>	
	Present specimens	Di Caporiacco (1948)	Re-measurement of Syntypes	Shibukawa <i>et al.</i> (2019)	Present study	Shibukawa <i>et al.</i> (2019)
Standard length (mm)	31.3~54.4	30.5~44.0	40.0~42.2	16.1~55.2	40.0~73.1	15.0~63.1
Number of specimens	41	2	2	47	43	168
Dorsal fin rays	11~14	12	–	11~14	11~14	11~14
Anal fin rays	12~15	12	–	12~14	12~15	12~15
Pectoral fin rays	15~18	19	–	18~19	14~19	16~19
Free ray on pectoral fin	1	–	–	1	1	1
Vertebrae	16 + 20 – 21 = 36 – 37 (n = 6)	–	–	16 + 19 – 21 = 35 – 37	17 – 18 + 20 – 21 = 38 – 39 (n = 12)	16 – 18 + 20 – 22 = 38 – 39
Measurements in % of SL						
Head length	22.9~28.9	23.9~25.4	23.0~23.7	–	18.1~25.7	–
Body depth	7.4~15.5	10.8~11.4	10.6~12.2	–	6.7~13.2	–
Pre-dorsal length	61.8~70.7	–	65.6~69.3	–	62.1~73.6	–
Pre-anal length	61.4~69.6	–	63.8~64.1	–	59.5~72.3	–
Dorsal fin base	16.1~19.8	20.5~29.5	18.7~22.4	–	13.4~18.0	–
Anal fin base	14.5~19.6	19.3~26.2	16.6~20.2	–	13.5~19.2	–
Caudal peduncle length	16.4~19.6	–	15.0~16.9	–	16.4~25.3	–
Upper caudal peduncle length	14.9~18.3	–	15.9~18.8	–	16.0~23.2	–
Caudal peduncle depth	7.5~9.8	–	10.1~10.2	–	6.1~9.9	–
Measurements in % of HL						
Snout length	24.8~33.3	–	23.7~31.2	–	21.0~33.5	–
Eye diameter	7.1~13.5	16.7~19.4	13.2~13.7	–	7.2~14.9	–
Interorbital width	19.0~31.6	14.3~16.1	25.5~26.3	–	13.9~33.3	–

and count method followed Akihito in Masuda *et al.* (1984) (NNIBR-P42096~42098(3), 44977~44978(2), 44992, 45005~45007(3), 45046, 45054, 45099, 45111, 45113, 45151~45154(4)). The vouchers are deposited at the Nakdonggang National Institute of Biological Resources, Korea.

TAXONOMIC ACCOUNTS

Luciogobius martellii Di Caporiacco, 1948

(New Korean name: Geom-jeong-mi-kken-mang-duk)
(Figs. 2, 3; Table 1)

Luciogobius martellii Di Caporiacco, 1948: 200 (type locality: Hong Kong); Okiyama, 2001: 141; Shibukawa *et al.*, 2019: 29 (Shizuoka, Japan).

Luciogobius sp. Arai, 1981: 161 (Izu Peninsula, Japan).

Luciogobius sp. 6 Akihito *et al.*, 2013: 1378 (Japan).

Luciogobius sp. Matsui *et al.*, 2014: 4 (Wakasa Bay, Japan).

Material examined. Total 41 specimens (Fig. 1): 10 specimens (SOKN-P1039~P1048), 45.0~51.5 mm SL, Eurwang-dong, Jung-gu, Incheon, Korea, 23 June 2020; 8 specimens (SOKN-P1050~P1057), 46.2~54.4 mm SL, Uihang-ri, Sowon-myeon, Taean-gun, Chungcheongnam-do, Korea, 18 June 2020; 1 specimen (SOKN-P1059), 53.7 mm SL, Seondo-ri, Biin-myeon, Seocheon-gun, Chungcheongnam-do, Korea, 1 July 2020; 8 specimens (SOKN-P1060, P1062~P1068), 37.9~48.7 mm SL, Dodun-ri, Seo-myeon, Seocheon-gun, Chungcheongnam-do, Korea, 2 July 2020; 2 specimens (SOKN-P1179, P1181), 41.0~44.1 mm SL, Mangchi-ri, Irun-myeon, Geoje-si, Gyeongsangnam-do, Korea, 21 May 2020; 6 specimens (SOKN-P1182~P1186, P1188), 40.6~53.7 mm SL, Seungeon-ri, Anmyeon-eup, Taean-gun, Chungcheongnam-do, Korea, 21 June 2020; 1 specimen (SOKN-P1210), 31.3 mm SL, Nampo-ri, Baengnyeong-myeon, Ongjin-gun, Incheon, Korea, 31 March 2021; 1 specimen (NNIBR-P45099), 48.8 mm SL, Uihang-ri, Sowon-myeon, Taean-gun, Chungcheongnam-do, Korea, 18 June 2020; 2 specimens (NNIBR-P45005, P45007), 40.1~43.8 mm SL,

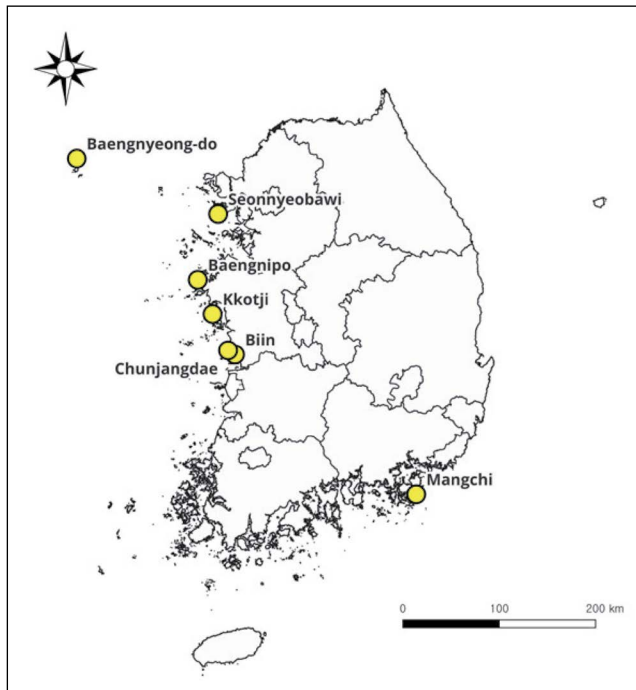


Fig. 1. Sampling sites of *Luciogobius martellii* from Korea.

Uihang-ri, Sowon-myeon, Taean-gun, Chungcheongnam-do, Korea, 18 June 2020; 2 specimens (NNIBR-P45111, P45113), 44.5~48.7 mm SL, Seungeon-ri, Anmyeon-eup, Taean-gun, Chungcheongnam-do, Korea, 21 June 2020, collected by Seung-Ho Choi and Min-Soo Kim, hand net at gravel beaches.

Description. Meristic and measurements are shown in Table 1. Dorsal fin rays 11~14; anal fin rays 12~15; pectoral fin rays 15~18; free ray on upper pectoral fin 1; abdominal vertebrae 16; total number of vertebrae 36~37.

Body elongated, lacking scales, consistent depth throughout and slight compression towards the posterior end. Head depressed. Mouth terminal and maxilla extending beyond the posterior border of eye. Lower jaw above the upper jaw. Small conical teeth on both jaws. Pectoral fin rounded shape. Pelvic fin united, forming a sucker. First dorsal fin absent. Anal fin originates anterior to the dorsal fin. Length of dorsal fin base is longer than length of upper caudal peduncle length or equal. Margin of caudal fin circular.

Coloration when fresh. The head and body background white, with black blotches covered very densely. Ventral area white, with few spots present from the chin to the origin of anal fin. Black spots concentrate at the base of all fins and gradually diminish towards the edges, giving the appearance of relative transparency. Edge of caudal fin translucent white.

Coloration after preserved specimen. Body predominantly dark brown. Dorsum darker than ventral surface. White edge of the caudal fin consistently preserved.

Ecological notes. This species inhabits rocky intertidal zones and gravel beaches. Places unaffected by freshwater or very little, even though they are affected.

Distribution. Hong Kong (The original description is Hong Kong, but in tags of syntypes, it was noted as Shanghai) (Nocita and Vanni, 1997), Japan (Shibukawa *et al.*, 2019) and Korea.

Remarks. In Japan, taxonomic discussions on *L. guttatus* and several related studies have consistently suggested the existence of more than two species within the *L. guttatus* group, with very broad habitat range (Arai, 1981; Mukai and Nishida, 2004; Yamada *et al.*, 2009; Hashimoto *et al.*, 2014; Matsui *et al.*, 2014; Shibukawa *et al.*, 2019).

Arai (1981) distinguished two types of *L. guttatus*, the ocean type and the freshwater type, based on the differences in the number of abdominal vertebrae in the specimens from Izu Peninsula in Japan. Mukai and Nishida (2004) and Hashimoto *et al.* (2014) supported the report of Arai (1981) because mtDNA genetic analysis revealed the there are some lineage groups whose habitats are separated into intertidal zones and estuaries.

These studies seems nuclear and confusing due to the limited research on *L. martellii*, a species which resembles *L. guttatus*. Shibukawa *et al.* (2019) addressed this issue by directly examining the syntypes of *L. martellii* and presented the morphological features of *L. martellii* as follows: dorsal fin base length longer than upper caudal peduncle length or equal; abdominal vertebrae 16; total number of vertebrae 35~37; and edge of tail fin white. Furthermore, we reaffirmed the classification method of Shibukawa *et al.* (2019) by measuring the syntypes of *L. martellii* from Natural History Museum, “La Specola” Section, Florence University.

In this study, the samples collected from the west and south coasts reflected the aforementioned Japanese research results, showing apparent differences in morphological characteristics and habitats; hence, we identified these specimens as *L. martellii*.

Additionally, *L. martellii*, has a free ray on its upper pectoral fin, a feature shared by *L. guttatus*. However, *L. martellii* can be distinguished from the five *Luciogobius* species recorded in Korea, excluding *L. guttatus*, as follows: *L. elongatus* (1 vs. 0), *L. grandis* (1 vs. 3~4), *L. pallidus* (1 vs. 0), *L. parvulus* (1 vs. 0), and *L. platycephalus* (1 vs. 3~4) (Arai, 1970; Kim, 2012; Cho and Choi, 2014; Kim *et al.*, 2021).

Therefore, in this study, *L. martellii* is listed as an



Fig. 2. Syntypes of *Luciogobius martellii* (MZUF-5556, 42.2 mm SL; MZUF-5557, 40.0 mm SL). Photo by Annamaria Nocita.



Fig. 3. *Luciogobius martellii*, NNIBR-P45005, 43.8 mm SL, from the Irun-myeon, Geoje-si, Gyeongsangnam-do, Korea.

unrecorded species in Korea, and we proposed a new Korean name, “Geom-jeong-mi-kken-mang-duk” referring to their color.

Comparative materials. *L. martellii*: Total 2 specimens: MZUF-5556~5557, 40.0~42.2 mm SL, syntypes of *L. martellii*, Hong Kong.

L. guttatus: Total 43 specimens: 6 specimens (SOKN-P1012, P1014~P1018), 48.3~64.3 mm SL, Sadong-ri, Jindong-myeon, Masanhappo-gu, Changwon-si, Gyeongsangnam-do, Korea, 19 May 2020; 3 specimens (SOKN-P1019~1021), 59.2~63.0 mm SL, Mulchi-ri, Ganghyeon-myeon, Yangyang-gun, Gangwon-do, Korea, 28 April 2020; 1 specimen (SOKN-P1022), 52.9 mm SL, Eosin-ri, Hoehwa-myeon, Goseong-gun, Gyeongsangnam-do, Korea, 19 May 2020; 1 specimen (SOKN-P1023), 56.1 mm SL, Yojang-ri, Jindong-myeon, Masanhappo-gu, Changwon-si, Gyeongsangnam-do, Korea, 19 May 2020; 1 specimen (SOKN-P1049), 49.4 mm SL, Uihang-ri, Sowon-myeon, Taean-gun, Chungcheongnam-do, Korea, 18 June 2020; 2 specimens (SOKN-P1061, P1069), 40.2~44.7 mm SL, Dodun-ri, Seo-myeon, Seocheon-gun, Chungcheongnam-do, Korea, 2 July 2020; 3 specimens

(SOKN-P1070, P1072~P1073), 62.7~70.0 mm SL, Gwanpo-ri, Jangmok-myeon, Geoje-si, Gyeongsangnam-do, Korea, 24 May 2020; 4 specimens (SOKN-P1172~P1175), 61.5~73.1 mm SL, Jangjwa-ri, Donghae-myeon, Goseong-gun, Gyeongsangnam-do, Korea, 20 May 2020; 1 specimen (SOKN-P1176), 56.3 mm SL, Sinwol-ri, Goseong-eup, Goseong-gun, Gyeongsangnam-do, Korea, 19 May 2020; 4 specimens (SOKN-P1194~P1197), 56.4~59.1 mm SL, Haye-dong, Seogwipo-si, Jeju-do, Korea, 9 September 2020; 4 specimens (SOKN-P1205~P1206, P1208~P1209), 49.5~52.4 mm SL, Nampo-ri, Baengnyeong-myeon, Ongjin-gun, Incheon, Korea, 31 March 2021; 1 specimen (SOKN-P1212), 65.3 mm SL, Jeongdo-ri, Wando-eup, Wando-gun, Jeollanam-do, Korea, 5 June 2020; 2 specimens (NNIBR-P44977~P44978), 60.2~63.7 mm SL, Sadong-ri, Jindong-myeon, Masanhappo-gu, Changwon-si, Gyeongsangnam-do, Korea, 19 May 2020; 1 specimen (NNIBR-P45046) 67.7 mm SL, Gwanpo-ri, Jangmok-myeon, Geoje-si, Gyeongsangnam-do, Korea, 24 May 2020; 1 specimen (NNIBR-P44992), 64.7 mm SL, Jangjwa-ri, Donghae-myeon, Goseong-gun, Gyeongsangnam-do, Korea, 20 May

2020; 4 specimens (NNIBR-P45151~P45154), 53.3~71.5 mm SL, Haye-dong, Seogwipo-si, Jeju-do, Korea, 9 September 2020; 3 specimens (NNIBR-P42096~P42098), 50.8~51.3 mm SL, Nampo-ri, Baengnyeong-myeon, Ongjin-gun, Incheon, Korea, 31 March 2021; 1 specimen (NNIBR-P45054), 62.6 mm SL, Jeongdo-ri, Wando-eup, Wando-gun, Jeollanam-do, Korea, 5 June 2020, collected by Seung-Ho Choi and Min-Soo Kim, hand net at gravel beaches.

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한국산 망둑어과 (Gobiidae) 미끈망둑 (*Luciogobius guttatus*)의 재검토 및 첫기록종, *L. martellii*

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요 약 : 우리나라 전 해안을 대상으로 미끈망둑 (*Luciogobius guttatus*)에 대한 분류학적 재검토를 실시하였다. 그 결과 41개체 (31.3~54.4 mm SL)가 *L. martellii*로 분류되었다. 본 종의 형태학적 특징은 다음과 같다: 복추골 수 16개; 총 척추골 수 35~37개; 등지느러미 기저부의 길이가 미병부 상부의 길이보다 길거나 같음; 가슴지느러미 상부에 1개의 유리연조; 꼬리지느러미 끝이 하얀색인 특징이 있다. 그중에서 *L. guttatus*와 형태학적으로 가장 뚜렷한 차이점인 등지느러미 기저부 길이와 미병부 상부의 길이의 차이는 *L. martellii*의 총모식표본과도 잘 일치하였다. 본 종의 한국명으로 “검정미끈망둑”을 제안한다.

찾아보기 낱말 : 망둑어과, *Luciogobius guttatus*, *Luciogobius martellii*, 한국미기록종