

New Record of a Lumpfish, *Lethotremus awae* (Scorpaeniformes: Cyclopteridae) from Korea as a Filling of Distributional Gap in the Western North Pacific

By Byung-Jik Kim*

Biological and Genetic Resources Utilization Division, National Institute of Biological Resources,
Hwangyeong-ro 42, Seo-gu, Incheon 404-708, Korea

ABSTRACT Five specimens of *Lethotremus awae* (Cyclopteridae) were collected from the northern coastal waters of Jeju Island, Korea, during a survey on larval and juvenile fishes flocking to aquatic lamp in 2004 ~ 2007. They were characterized by having a spherical body with three barbel-like tubes on head and the first dorsal fin overgrown by skin with undiscernible rays as well as VIII-9 dorsal fin rays, 8 ~ 9 anal fin rays and 22 ~ 23 pectoral fin rays. A new Korean name, "Eom-ji-do-chi", was proposed for the species.

Key words : Cyclopteridae, *Lethotremus awae*, Jeju Island, new Korean record

The cyclopterid genus *Lethotremus* Gilbert, 1896 is characterized by total absence of bony plates and of lateral line or pores on sides of head and body (Jordan and Snyder, 1902). The genus currently comprises only two species of *L. muticus* Gilbert, 1896 known from the eastern Bering Sea and Aleutian Islands to Unimak Pass and *L. awae* Jordan and Snyder, 1902 from the east and west coasts of central Japan and near Chefoo, Yellow Sea (Cheng and Zhou, 1997; Nakabo, 2002; Mecklenburg and Sheiko, 2003).

During a survey of larval and juvenile fishes using an aquatic lamp in the northern coastal waters of Jeju Island, Korea from 2004 to 2007, I collected five small spherical fish with short caudal peduncle belongs to the cyclopterid genus *Lethotremus* and subsequently identified them as *L. awae* representing new to Korea. The species has been known from the Japanese waters and also from the Yellow Sea in the western North Pacific as mentioned above, however, there was no any formal record based on specimen from the intervening seas between Yellow Sea and the Japanese waters to date. Thus, I described here *L. awae* as the first formal record from the intervening sea

as well as the first record from Korea, and also compared with those from the Japanese waters to provide morphological variety along with geographical distribution.

MATERIALS AND METHODS

Fish specimens were collected from the Hamdeok fishing port located at the northern coast of Jeju Island, Korea using an aquatic lamp (200 W) conducted from 2004 to 2007. They were preserved in 5% formalin solution made with seawater in the field, transferred into 70% ethanol for long-term preservation within a few days, and deposited in the National Institute of Biological Resources (NIBR-P), Korea at present. Counts and measurements generally follow those of Hubbs and Lagler (1964) with some exception, *i.e.*, the second dorsal and anal fin rays were counted as one whether it is divided at base or not and caudal fin rays were not classified as branched or unbranched rays. Median fins and vertebrae were counted by radiographs.

Collection data for four specimens of *Lethotremus awae* from the Korean waters as follows: NIBR-P4828 [formerly MRIC (Marine and Environmental Research Institute, Cheju National University, Korea) 1579], 13.9 mm in

*Corresponding author: Byung-Jik Kim Tel: 82-32-590-7127,
Fax: 82-32-590-7223, E-mail: kimbyungjik@gmail.com

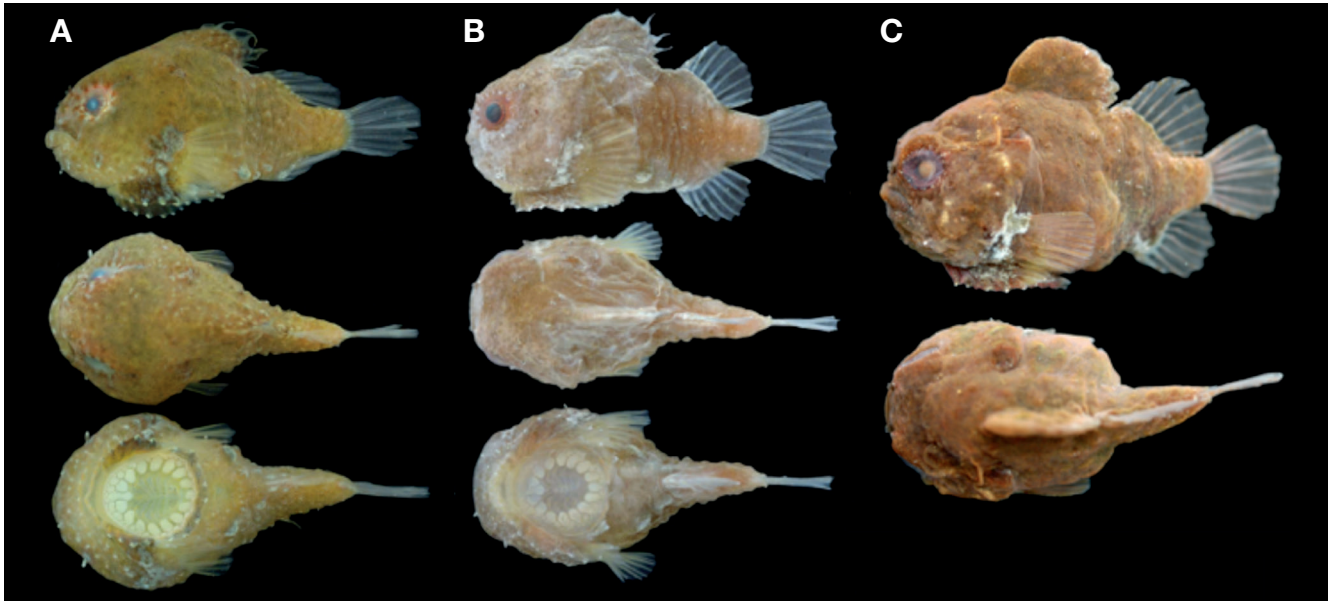


Fig. 1. *Lethotremus awae* collected from northern coast of Jeju Island, Korea. A. NIBR-P uncatalog, 9.8 mm SL; NIBR-P4831, 14.3 mm SL; C. NIBR-P4830, 17.9 mm SL.

standard length (SL), 18 : 50~19 : 50 on 9 February, 2004, NIBR-P4829 (MRIC 1839), 16.3 mm SL, 18 : 35~19 : 35 on 21 January 2005, NIBR-P4830 (MRIC 2838), 17.9 mm SL, 19 : 00~20 : 00 on 24 January 2006, NIBR-P4831 (MRIC 4781), 14.3 mm SL, 19 : 00~20 : 00 on 30 December, 2006, NIBR-P uncatalog (MRIC 4822), 9.8 mm SL, 27 April, 2007, Hamdeok fishing port, Jocheon-eup, Jeju-si, Jeju-do, Korea, aquatic lamp (200W), collected by B.J. Kim.

Genus *Lethotremus* Gilbert, 1896

(type species: *Lethotremus muticus* Gilbert, 1896,
by monotypy)

(New Korean name: Eom-ji-do-chi-sog)

Body and head entirely naked, without any bony tubercles, spinous plates, dermal warts, and tentacles. Interorbital pore present or absent; three pores present on occipital canal on each side. Distinct long tubular pores on operculomandibular canal well developed (from Ueno, 1970).

Remarks. Although Ueno (1970) provided the character state of interorbital pore as a useful taxonomic feature discriminating the genus *Lethotremus* from its similar genus *Cyclopsis* Popov, 1930, it is not sound because both character states (*i.e.*, presence or absence) were observed from the Korean '*awae*'.

Lethotremus awae Jordan and Snyder, 1902

(New Korean name: Eom-ji-do-chi)

(Fig. 1; Tables 1~2)

Lethotremus awae Jordan and Snyder, 1902: 344 (type locality: Kominato, Awa, mouth of Tokyo Bay, Japan); Ueno, 1970: 129 (Japan); Kido in Masuda *et al.*, 1984: 337 (Japan); Cheng and Zhou, 1997: 439 (Chefoo, Chingtao, China); Nakabo, 2002: 662 (Japan, China); Nakabo and Kai, 2013: 1202 (Japan, Southern Tsushima, Yellow Sea, northern East China Sea).
Cyclopsis awae Lindberg and Legeza, 1955: 57 (Japan).

Description. Dorsal fin rays VIII-9, last spine sometimes minute; anal fin rays 8~9; pectoral fin rays 22~23; caudal fin rays 11; vertebrae 24. Proportion of % SL: body depth 51.0~52.5 (mean 51.8); body width 48.2~54.5 (52.3); head length 50.4~52.1 (51.5); snout length 14.0~18.7 (16.0); upper jaw length 15.5~20.9 (18.5); eye diameter 13.7~14.7 (14.2); interorbital width 23.1~26.6 (25.1); snout to origin of first dorsal fin 46.9~50.6 (48.9); snout to origin of second dorsal fin 68.3~78.7 (75.0); snout to origin of pectoral fin 46.9~49.6 (47.9); snout to origin of sucking disk 29.4~40.3 (35.2); snout to origin of anal fin 74.1~85.6 (78.9); caudal peduncle depth 12.9~1.4 (13.4); caudal peduncle length 13.2~15.3 (14.4); base of second dorsal fin 18.4~24.1 (22.0); base of anal fin 16.0~18.7 (17.0); longitudinal diameter of whole

Table 1. Comparison of diagnostic characters between *Lethotremus* and *Cyclopsis*

Characters	<i>Lethotremus</i> Gilbert, 1895	<i>Cyclopsis</i> Popov, 1930*
Skin condition	Completely naked	Covered with small tubercles-warts with barbel
Pores on head and body	Absent	Present
First dorsal fin	–	Completely overgrown by muscle

*modified by Lindberg and Legeza (1955)

Table 2. Comparison of meristic characters between Korean and Japanese specimens of *Lethotremus awae*

	Korean specimens	Japanese specimens	Holotype* (SU 6539)
Standard length (mm)	13.9~17.4 ($n=4$)	13.2~20.6 ($n=16$)	$n=1$
Second dorsal fin rays	VIII, 9	V-VII, 8~9 (VI, 9)	VI, 8
Anal fin rays	8~9	6~9 (8)	7
Pectoral fin rays	22~23 (modally 22)	20~23 (21)	21
Caudal fin rays	11 (11)	10~11 (10)	10
Vertebrae	24	–	24

*taken from a radiograph image in *Catalog of Fishes* (www.calacademy.org)

sucking disk 37.8~41.0 (39.1); transverse diameter of whole sucking disk 33.8~36.2 (34.7); longitudinal diameter of inner surface of sucking disk 14.7~18.0 (16.3); transverse diameter of inner surface of sucking disk 14.7~18.4 (16.6); caudal fin length 24.5~28.2 (26.6).

Body almost spherical, its width nearly equal to its depth, with slightly compressed short caudal peduncle. Head relatively large and stout. Snout very short and blunt. Eye relatively large, interorbital region broad and nearly flat. Mouth small, terminal, its posterior tip nearly reaching a vertical at anterior margin of pupil; small conical teeth arranged in three to four rows irregularly on both jaws, teeth on inner row larger than others; no teeth on vomer and palatines. Gill opening narrow, located on postero-dorsal portion of head and not reaching pectoral origin. Three short barbel-like tubes present: above eye, on lower jaw, and on lower edge of cheek. Dorsal fin two, first dorsal fin overgrown by skin with undiscernible rays; smaller specimens with filamentous rays in posterior portion of first dorsal fin. Ventral sucking disk composed of modified pelvic fin elements round with a wide free margin; three to four rows of plates arranged on ventral disc, their plates size various. Caudal fin round. Skin wrinkled without scales. Small tubercle-like projections irregularly distributed on head and body, prominent in smaller specimens and their size and number decreased with growth. Interorbital pore present or absent, four infraorbital pores present, two pores on a branch of supraorbital canal present, three pairs of pore on occipital canal on each side of head present.

Color when fresh. Head and body yellowish brown to dark brown. Eye sometimes reddish brown. Second dor-

sal, anal, pectoral, and caudal fins transparent.

Color in alcohol. Head and body wholly brownish, without any dark spots or bands.

Ecological note. All of the present specimens were collected from a small fishing port located at the northern coast of Jeju Island, Korea by an aquatic lamp in winter to spring seasons (December to April). The water depth of the sampling site was about 5 m at high tide, and bottom condition was nearly sandy except for around the breakwater with rock. In addition, two free-swimming larvae of *L. awae* were also collected from the same locality above mentioned by an aquatic lamp from March to April. It means the species at least comes over coastal waters for spawning in winter season and their larvae might use shallow waters such as near fishing port as their nursery ground.

Distribution. Known from the eastern and western coasts of central Japan (Kumamoto and Nagasaki Prefectures northward to Aomori Prefecture and south to Mie Prefecture), Yellow Sea of China (Chefoo, Chingtao), East China Sea, and South Sea of Korea (northern coastal waters of Jeju Island) (Cheng and Zhou, 1997; Mecklenburg and Sheiko, 2003; Abe and Sato, 2009; Nagamatsu, 2009; Nakabo and Kai, 2013; present study).

Remarks. Although many workers have been recognizing the species as a member of the genus *Lethotremus* (Kido in Masuda *et al.*, 1984; Lindberg and Krasukova, 1987; Nakabo, 2002; Mecklenburg and Sheiko, 2003; Nakabo and Kai, 2013) since Jordan and Snyder (1902) described firstly *Lethotremus awae* from Japan, its allocation to the genus seems not to be still clearly settled (Popov, 1930; Lindberg and Legeza, 1955). Gilbert (1896)

originally defined the genus *Lethotremus* describing *L. muticus* Gilbert as the type species as follows: smooth skin without any bony plates or tubercles and the absence of pores on head. Jordan and Snyder (1902) also mentioned that the skin of the small cyclopterid specimen collected at Kominato in Japan was entirely smooth, describing a new species (*Lethotremus awae*). However, the species was transferred into the genus *Cyclopsis* by Lindberg and Legeza (1955) owing to having “first dorsal fin overgrown by skin with undiscernible rays and barbels on cheek and chin”. It is seemed resulted from their recognition of three barbels on head of *L. awae* as a type of dermal head armors closely related to those of *Cyclopsis tentacularis* Popov, 1930. However, Ueno (1970: 131) recognized the barbels on head of *L. awae* as babel-like tubes in the operculomandibular region. The tube-like structure was also confirmed from the Korean ‘*awae*’ specimens with high magnification. According to Lindberg and Legeza (1955), the genus *Lethotremus* is clearly differentiated from the genus *Cyclopsis* by having completely naked skin and no pores on head and body (*vs.* skin covered with small tubercles-warts with barbels and well defined pores on head and body for *Cyclopsis*) as shown in Table 1. In addition, Ueno (1970) have added several diagnostic characters discriminating two genera, that is, states of pore on sensory canal system of head as well as several osteological characteristics (see Ueno, 1970 for more information). As a result, the genus *Lethotremus* seems to be clearly differentiated from its similar genus *Cyclopsis* as follows: absence of bony plates or small tubercles-warts (*vs.* presence for *Cyclopsis*), first dorsal fin overgrown by skin (*vs.* not overgrown), absence of interorbital pore (*vs.* presence), and three pairs of pore on occipital canal (*vs.* two pairs). However, the states of interorbital pore and skin have to be eliminated from the diagnostics, because both character states (*i.e.*, absence or presence of interorbital pore; skin with small projections or smooth skin) were observed from the Korean ‘*awae*’ specimens in the present study.

On the other hand, Kido (1984: 322) noted that *L. awae* from Japan has smooth skin without any dermal projections and also have the first dorsal not covered with flesh. I confirmed that all Japanese specimens examined in this study including type specimens of *L. awae* (both holotype from digital images provided by CAS and a paratype) have entirely smooth skin without tubercles or projection. However, some specimens from Korea have small projections on surface of body, although it is not clear that whether they belongs to the tubercles-warts (*sensu* Lindberg and Legeza, 1955) or not. The projection was

also especially more prominent in smaller specimen than large one (Fig. 1), however, a specimen shows smooth skin after eliminating mucous layer.

Because other major characters, except for the states of skin, agree well those of the Japanese ‘*awae*’ specimens including type materials (Table 2), I assign the Korean ‘*awae*’ collected from the coastal waters of Jeju Island to the genus *Lethotremus* in this study. It is needed to clarify the character states of the skin between the genus *Cyclopsis* and *Lethotremus* in the near future based on much more materials collected from various localities.

The present study represents the first record of *Lethotremus awae* from Korea, because it has been reported only from central Japan and Chefoo, China without any report based on specimen from intervening area to date. Thus, it is also the first formal report fulfilling a distributional gap of the species in the western North Pacific. From Korea, following five cyclopterid species have been reported to date: *Aptocyclus ventricosus* Pallas, 1769, *Cyclopteropsis beri* Popov in Soldatov and Popov, 1929, *Eumicortremus birulai* Popov, 1928, *E. orbis* Günther, 1861, and *E. pacificus* Schmidt, 1904 (Chyung, 1977; Kim *et al.*, 2005; Kweon *et al.*, 2012). All species are distributed in only the northern coasts of the East Sea in Korea (Kim *et al.*, 2005), *Lethotremus awae* however is the only species among the Korean lumpfishes extending its distribution to the South Sea of Korea. Although it is not included into the description of the present study due to bad condition of specimens, *L. awae* is also occurring the southwestern seas (Jangdo Island) and northern seas (Goseong) of the East Sea of Korea (unpublished data). In the near future, it is needed to clarify the regional and individual variations as well as the identification to the species level and further discussion of generic diagnosis. We proposed a new Korean name of ‘Eom-ji-do-chi’ for the present species referring to smaller size compared to its congeners.

Comparative materials. *Lethotremus awae* ($n = 18$): SU 6970, 22.8 mm SL, paratype of *Lethotremus awae*, Bay of Tokyo, Japan; HUMZ (Laboratory of Marine Zoology, Hokkaido University, Japan) 79055, 17.9 mm SL; HUMZ 79071, 18.6 mm SL; HUMZ 79078, 13.2 mm SL; HUMZ 79079, 14.1 mm SL; HUMZ 79082, 15.1 mm SL; HUMZ 79085, 15.8 mm SL; HUMZ 79087, 14.9 mm SL; HUMZ 79089, 17.4 mm SL; HUMZ 79090, 17.5 mm SL; HUMZ 79092, 17.4 mm SL; HUMZ 79093, 18.4 mm SL; HUMZ 79094, 18.5 mm SL; HUMZ 79095, 17.9 mm SL; HUMZ 79096, 20.6 mm SL; HUMZ 79097, 19.6 mm SL; HUMZ 79098, 20.5 mm SL; NSMT-P 35263, 7.6 mm SL; NSMT-P 41970, 9.7 mm SL.

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제주도 북부 연안해역에서 채집된 도치과 (Cyclopteridae) 한국미기록종, *Lethotremus awae*

김병직

국립생물자원관 유용자원활용과

요 약 : 수중 집어등에 의한 제주도 북부 연안역 자치어 조사 과정에서 2004년부터 2007년 사이에 채집된 도치과 어류 5개체 (표준체장 9.8~17.9 mm)에 근거로 *Lethotremus awae*를 한국미기록종으로 기재하였다. 이들의 체형은 구형으로 두부에 3개의 수염과 유사한 관상 돌기가 있는 점, 제1등지느러미가 기조수를 세기 어려울 정도로 두꺼운 피부로 덮혀 있는 점, 등지느러미 기조수 VIII-9, 뒷지느러미 기조수 8~9, 가슴지느러미 기조수 22~23인 특징이 있다. 본 종의 신한국명으로는 크기가 작은 점에서 ‘엄지도치’라 명명한다.

찾아보기 낱말 : *Lethotremus awae*, 도치과, 한국미기록종, 기재, 제주도