

# New Korean Record of *Artediellus fuscimentus* (Scorpaeniformes: Cottidae)

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**ABSTRACT** Sixteen specimens of *Artediellus fuscimentus*, belonging to the family Cottidae, were collected from the coastal waters off Samcheok and Donghae, Korea, in December 2010 and February 2015, respectively. The specimens are characterized by four preopercular spines, 12~13 second dorsal fin rays, 10~12 anal fin rays, a first preopercular spine with no minute spine on the inner side, and pectoral fin extending past the origin of the anal fin. We also analyzed 600 base pairs of the mitochondrial DNA cytochrome *b* sequence to confirm the taxonomic status of the specimens. The sequences of our specimens corresponded completely to those of Japanese *A. fuscimentus*, but differed from those of *A. atlanticus* ( $d=0.057\sim 0.061$ ). We propose the new Korean names “Eom-ji-hoet-dae-sok” for the genus *Artediellus* and “Eom-ji-hoet-dae” for the species *A. fuscimentus*.

**Key words:** *Artediellus fuscimentus*, new record, Cottidae, East Sea, Korea

## INTRODUCTION

The family Cottidae, in the suborder Cottoidei, contains 256 species and 56 genera worldwide, with 37 species and 19 genera in Korea (NIBR, 2011; Froese and Pauly, 2016). The species of Cottidae are characterized by a large head, large eyes placed high on the head, a separated dorsal fin, no spines on the anal fin, pelvic fins with one spine, 2~5 fin rays, and no swim bladder (Kim *et al.*, 2005; Nelson, 2006). The genus *Artediellus* contains 15 species throughout the world, distributed in the Pacific Ocean, North Atlantic Ocean, and Arctic Ocean (Nelson, 1986; Froese and Pauly, 2016). Eight species of the genus *Artediellus* occur in Japan: *A. camchaticus* Gilbert and Burke, 1912, *A. aporosus* Soldatov, 1921, *A. ochotensis* Gilbert and Burke, 1912, *A. neyelovi* Muto, Yabe and Amaoka, 1994, *A. fuscimentus* Nelson, 1986, *A. schmidtii* Soldatov, 1915, *A. dydymovi* Soldatov, 1915, and *A. minor* (Watanabe, 1958) (Nakabo and Kai, 2013), but no occurrence of the genus *Artediellus* has been re-

ported in Korea (NIBR, 2011). The genus *Artediellus* is characterized by two or four preopercular spines, a dorsally curved first preopercular spine, pelvic fins with one spine and three rays, no developed anal papilla, a single row of lateral line pores, and a smooth naked body, except for lateral line scales (Jordan and Starks, 1904; Schmidt, 1927; Nelson, 1986; Muto *et al.*, 1994). In this study, we confirmed that specimens collected from Donghae and Samcheok, Korea, were *A. fuscimentus* using morphological and molecular methods, and provide a morphological description of these specimens as a new record based on these specimens (Fig. 1).

## MATERIALS AND METHODS

Sixteen specimens of *A. fuscimentus*, of the family Cottidae, were collected from the coastal waters off Donghae and Samcheok, Korea, in December 2010 and February 2015, respectively. The specimens were fixed in 10% formalin and then preserved in 70% ethanol. Counts and measurements were made according to the methods of Hubbs and Lagler (2004) and Nelson (1986), and body

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Fig. 1. *Artediellus fuscimentus* Nelson, 1986, PKU 53729, 74.3 mm standard length, collected Samcheok, Gangwon-do.

Table 1. Comparison of counts and measurements of *Artediellus fuscimentus*

	Present study	Nelson (1986)		Nakabo & Kai (2013)
		Holotype	Holotype + Paratypes	
No. specimens	16	1	27	—
Standard length (mm)	52.4~74.3	52.7	38.1~61.5	—
<b>Counts</b>				
Dorsal fin rays	VII~VIII-12~13	VII-13	VII~VIII-12~14	VII~VIII-12~14
Anal fin rays	10~12	11	10~12	10~12
Pectoral fin rays	19~21	19	19~22	19~22
Vertebrae	28~30	30	28~30	—
Lateral line pores	27~29	28	26~29	26~29
<b>Measurements</b>				
In % standard length				
Head length	33.4~37.4 (35.4)	34.9	33.0~40.7 (36.4)	
Snout length	7.6~9.5 (8.6)	8.2	7.4~9.7 (8.5)	
Orbit diameter	9.5~10.5 (10.1)	12.1	10.3~13.4 (11.3)	
Interorbital width	1.6~2.4 (2.0)	2.1	1.6~2.1 (1.9)	
Upper jaw length	13.7~17.0 (14.8)	16.7	14.0~16.7 (15.2)	
Body depth	15.0~20.7 (17.3)	20.5	17.5~22.1 (19.7)	
Predorsal fin length	30.0~35.6 (32.7)	30.4	28.5~36.0 (32.7)	
Prepelvic fin length	24.2~29.3 (26.8)	26.9	24.8~32.2 (29.2)	
Pelvic fin length	14.1~18.7 (16.7)	—	15.2~21.4 (17.5)	
Length of 1st dorsal base	15.2~21.3 (17.9)	19.9	15.3~22.8 (19.0)	
Length of 2nd dorsal base	27.5~33.3 (30.1)	31.8	28.7~33.1 (31.1)	
Length of anal base	26.7~30.2 (28.5)	29.0	27.0~30.6 (29.6)	
Pelvic-anal space	22.8~29.6 (26.8)	25.6	23.5~30.5 (26.6)	
Dorsal-caudal space	13.5~17.7 (15.9)	17.0	13.3~18.0 (15.8)	
Anal-caudal space	15.4~18.5 (17.4)	18.1	15.0~18.1 (16.6)	
Caudal peduncle depth	5.2~6.6 (5.8)	7.0	5.6~7.1 (6.3)	

Parenthesis indicates average value.

parts were measured to the nearest 0.1 mm with Vernier calipers. The terminology for describing the head cirri and the cephalic sensory system was according to Nelson (1986). All fin rays and the numbers of vertebrae were counted from radiographs (Sehwa Medical System SMS-CM, Korea). The specimens of *A. fuscimentus* were deposited at the Ichthyological Laboratory, Pukyong National University (PKU), Korea. Genomic DNA was

extracted from the muscle tissues with 10% Chelex 100 Resin (Bio-Rad, Hercules, CA). A polymerase chain reaction (PCR) was used to amplify the mitochondrial cytochrome *b* gene using primers, GluDG (5'-TGACTTGA ARAACCAYCGTTG-3') and CB3 (5'-GGCAAATA GGAARTATCATTC-3') (Palumbi *et al.*, 2002). The condition of PCR, purification of PCR products and sequencing were followed by the method of Kim *et al.* (2006),

with some modification. The sequences were aligned with ClustalW (Thompson *et al.*, 1994) in BioEdit ver. 7 (Hall, 1999). Genetic distances were calculated with the Kimura two-parameter method (Kimura, 1980) in MEGA 5 (Tamura *et al.*, 2011). A neighbor-joining tree was constructed with the Kimura two-parameter method (Kimura, 1980) and tested with 1,000 bootstrap replications in MEGA 5 (Tamura *et al.*, 2011).

### Genus *Artediellus* Jordan, 1885

(New Korean genus name: Eom-ji-hoet-dae-sok)

*Artediellus* Jordan, 1885: 898 (type species: *Cottus uncinatus* Reinhardt, 1835 = *Artediellus uncinatus*).

*Evermanniana* Taranetz, 1935: 91 (type species: *Blenniocottus clarki* Evermann and Gill, 1907).

**Description.** Two or four preopercular spines, first preopercular spine curved dorsally; pelvic fins with one spine and three rays; no anal papilla developed; single row of lateral line pores; body naked and smooth, except for lateral line scales (Jordan and Starks, 1904; Schmidt, 1927; Nelson, 1986; Muto *et al.*, 1994).

### *Artediellus fuscimentus* Nelson, 1986

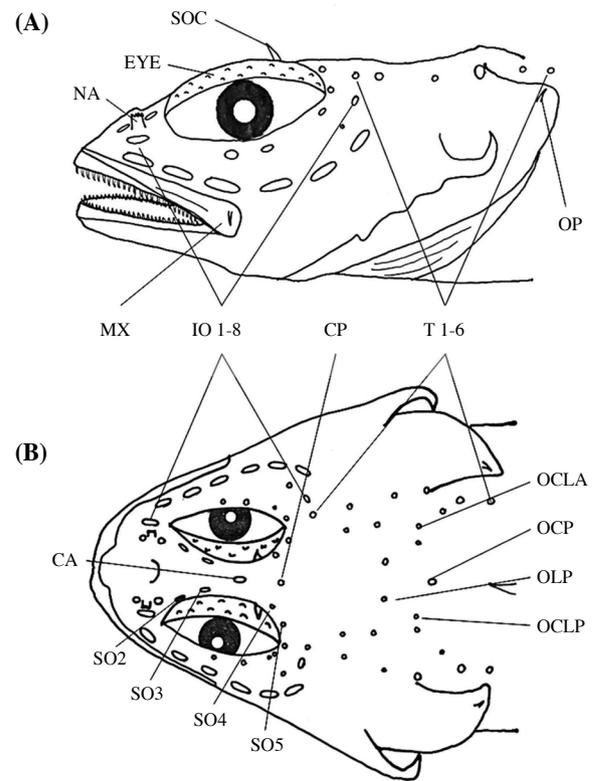
(New Korean name: Eom-ji-hoet-dae)

(Table 1, Fig. 1)

*Artediellus fuscimentus* Nelson, 1986: 41 (type locality: Southern Sea of Japan); Nakabo and Kai in Nakabo, 2013: 1178.

**Materials examined.** PKU 5062, 15 specimens, 52.4~65.1 mm SL, Donghae, Gangwon-do, Korea, 4 Dec 2010; PKU 53729, one specimen, 74.3 mm SL, Samcheok, Gangwon-do, Korea, 1 Feb 2015.

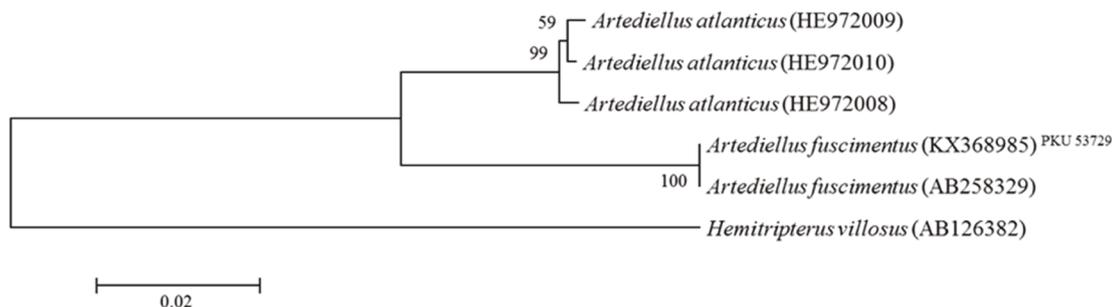
**Description.** All counts and measurements are listed in Table 1. Head depressed and large. Snout short and blunt. Mouth terminal; anterior tips of upper and lower jaws almost equal; small conical teeth on both jaws in three rows; posterior margin of the maxilla round, reaching to the middle of the eye. Two pairs of nostrils, located in front of the orbit; nostrils small and circular. Eyes oval and close to the dorsal margin of the head. Four preopercular spines; first preopercular spine larger than other spines, strongly curved dorsally; first preopercular spine has no minute spine on the inner side. The posterior tip of the opercular region extends to the second spine of the dorsal fin. Two dorsal fins; dorsal fin base long (Table 1). Pectoral fin large, extending past the origin of the anal fin. Pelvic fins located below the pectoral fins; posterior tips of pelvic fin rays do not reach the anus. Origin of the



**Fig. 2.** Cephalic semisensory system of *Artediellus fuscimentus*. A. Lateral views. B. Dorsal views. CA, anterior coronal pore; CP, posterior coronal pore; EYE, eye cirri; IO, infraorbital pores; MX, maxillary cirri; NA, nuchal cirri; OCLA, anterior central pores; OCLP, lateral posterior central pores; OCP, posterior medial pore; OLP, posterior lateral pores; OP, opercular cirri; SO, supraorbital pores; SOC, supraorbital cirri; T, postorbital pores.

anal fin vertically below the posterior tip of first dorsal fin base. Anus located in front of the origin of the anal fin. Caudal fin truncated. Body naked and smooth, except for lateral line scales. Lateral line single, beginning at the upper tip of the gill opening and extending to the base of the caudal fin. Cirri on head (Fig. 2): maxillary, nuchal, eye, supraocular, and opercular cirri present. Cirri are ribbon-like in shape, except on the eye. Supraocular cirri longer than other cirri. Tip of nuchal cirri branched. Eye cirri present as granules on upper surfaces of eyeballs. Pores on the cephalic sensory system (Fig. 2): second to fifth supraorbital pores present; first supraorbital pore absent. First to eighth infraorbital pores present. Anterior and posterior coronal pores present. First to sixth postorbital pores present. Lateral anterior central, posterior medial, lateral posterior central, and posterior lateral pores present. Area of preopercular mandibular pores damaged. Other pores absent.

**Coloration.** After fixation in formalin, dorsal half of



**Fig. 3.** Neighbor joining tree showing the relationships among two species of the genus *Artediellus* including *A. fuscimentus* (PKU 53729). *Hemitripteris villosus* is outgroup. Numbers at branches indicate bootstrap probabilities in 10,000 bootstrap replications. Bar indicates genetic distance of 0.02.

body brown, ventral half of body light yellow. Many dark brown spots on back and sides. Branchiostegal membranes black or light yellow.

**Distribution.** East Sea, Korea (present study), Japan (Nakabo and Kai, 2013).

**Remarks.** The present specimens were collected from the coastal waters of Donghae and Samcheok, Korea, and identified as *A. fuscimentus*, based on the following features: four preopercular spines, 12~13 second dorsal fin rays, 10~12 anal fin rays, first preopercular spine with no minute spine on the inner side, and the pectoral fin extending past the origin of the anal fin. Most counts and measurements in our specimens corresponded well to the original description by Nelson (1986), although our specimens differed slightly in the orbit diameter (Table 1). These subtle differences in some measurements seem to be geographic variations within the species in samples from the coast of the East Sea and the Southern Sea of Japan. We analyzed 600 base pairs of the mitochondrial cytochrome *b* sequence. The sequences of our specimens (KX368985) corresponded completely to those of Japanese *A. fuscimentus*, but differed considerably from those of *A. atlanticus* (genetic distance,  $d=0.057\sim0.061$ ) (Fig. 3). *Artediellus fuscimentus* differs from *A. camchaticus*, *A. aporosus*, *A. ochotensis*, and *A. neyelovi* in having four preopercular spines (Nelson, 1986; Muto *et al.*, 1994; Nakabo and Kai, 2013), and from *A. schmidtii* and *A. dydymovi* in that its first preopercular spine has no minute spine on the inner side (Nelson, 1986; Nakabo and Kai, 2013). *Artediellus fuscimentus* can be distinguished from *A. minor* by the number of dorsal fin rays (12~14 in *A. fuscimentus* vs 11~12 in *A. minor*), the number of anal fin rays (10~12 vs 9~10, respectively), and the length of the pectoral fin (extending past origin of anal fin in *A. fuscimentus* but not reaching the origin of the anal fin in *A. minor*) (Nelson, 1986; Nakabo and Kai, 2013). We pro-

pose the new Korean genus name “Eom-ji-hoet-dae-sok” for *Artediellus* and the new Korean name “Eom-ji-hoet-dae” for *A. fuscimentus*.

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## 한국산 독중개과 (Cottidae) 어류 1미기록종, *Artediellus fuscimentus* Nelson, 1986

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**요 약** : 2010년 12월 4일 강원도 동해시에서 15개체, 2015년 2월 1일 강원도 삼척시에서 1개체의 *Artediellus fuscimentus*가 처음 채집되었다. 본 종은 전새개골 가시 4개, 제2등지느러미 줄기 12~13개, 뒷지느러미 줄기 10~12개를 가지며, 첫번째 전새개골 가시 안쪽에 작은 가시가 없고 가슴지느러미 뒤끝이 뒷지느러미 기점을 지나 는 특징을 가지고 있다. 또한 mtDNA cytochrome *b* 염기서열 600 bp를 이용하여 분류학적 위치를 확인하였다. 그 결과, 본 종은 *Artediellus atlanticus*와 차이( $d=0.057\sim0.061$ )를 보였으나, 일본산 *A. fuscimentus*와는 완전히 일치 하였다. *Artediellus*속의 국명으로 “엄지횃대속”을, *A. fuscimentus*의 국명으로는 “엄지횃대”를 새롭게 제안한다.

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**찾아보기 낱말** : *Artediellus fuscimentus*, 미기록종, 독중개과, 동해, 한국