

New Record of a Worm Eel *Muraenichthys gymnopterus* (Anguilliformes: Ophichthidae: Myrophinae) from Korea

By Byung-Gi Kim, Choong-Hoon Jeong^{1,*} and Kyung-Nam Han

Department of Ocean Science, College of Natural Sciences, Inha University, Incheon 402-751, Korea

¹Research Center for Coastal Environments of Yellow Sea, Inha University, Incheon 402-751, Korea

ABSTRACT A single specimen of the ophichthid *Muraenichthys gymnopterus* (254.6 mm TL) was collected from the middle Yellow Sea off Incheon, Korea. It represents the first record of the species, the genus, and the subfamily from Korea. This species is characterized by the following combination of characters: a constricted midlateral gill opening; dorsal fin origin before anus, closer to the anus than to the gill opening; blunt teeth, jaw teeth in bands, and multiserial dentition; third preopercular pore present; single infraorbital pore between anterior and posterior nostrils; brownish colour; depth and width of gill opening 43.2 times and 33.7~65.3 times in total length, respectively; eye diameter 15.0~31.0 times in head length and total vertebrae 154~161. New Korean names are proposed, "Gaet-mul-baem-a-gwa" for the subfamily Myrophinae, "Gaet-mul-baem-sok" for the genus *Muraenichthys*, and "Gaet-mul-baem" for *M. gymnopterus*.

Key words : Ophichthidae, Myrophinae, *Muraenichthys gymnopterus*, first record, Korea

INTRODUCTION

The family Ophichthidae comprising about 52 genera with about 290 species, including 11 genera in the subfamily Myrophinae (worm eel) and 41 genera in the Ophichthinae (snake eel), in the world (Castle and McCosker, 1999; Nelson, 2006), and about 21 genera and 59 species were recorded from the East Asia (McCosker and Randall, 1993; Mok, 1993; McCosker and Chen, 2000; Hatooka, 2002; Tang and Zhang, 2004; Kim *et al.*, 2005). In Korean waters, seven species of snake eels of the subfamily Ophichthinae, family Ophichthidae were reported by Kim *et al.* (2005).

For several decades, the genus *Muraenichthys* Bleeker, 1853 was reviewed by McCosker (1970), Machida and Ohta (1993b), McCosker and Parin (1995) and Castle and McCosker (1999). Castle and McCosker (1999) elected a new genus, *Skythrenchelys* of the family Ophichthidae, and elevated concurrently the subgenera *Muraenichthys* Bleeker, 1853 and *Scolecenchelys* Ogilby, 1892 of the genus *Muraenichthys* to the generic level. They characterized the genus *Muraenichthys* by

having a constricted gill openings at mid lateral; centre of orbit at mid-jaw; teeth blunt, jaw teeth in bands, and multiserial dentition; intermaxillary teeth in a patch; posterior nostril with a prominent flap in outer lip; third preopercular pore present or absent; and a single infraorbital pore between anterior and posterior nostrils.

Following Castle and McCosker (1999), the present specimen is identified as a member of the genus *Muraenichthys* as above characters. Among five to seven valid species within the Indo-Pacific genus *Muraenichthys*, three species, i.e., *M. gymnopterus* (Bleeker, 1853), *M. malabonensis* Herre, 1923 and *M. schultzei* Bleeker, 1857, are known from East Asian waters.

In June 2007, unrecorded a single worm-eel of a member of the genus *Muraenichthys* was collected from the Yellow Sea, off Incheon, Korea. We herein described as a new to Korea, and given an artificial key to the three *Muraenichthys* species from the East Asia. Also, this is the first record of the subfamily Myrophinae and genus *Muraenichthys* from Korea.

MATERIALS AND METHODS

A single worm-eel specimen was collected from mid-

*Corresponding author: Choong-Hoon Jeong Tel: 82-32-860-7715,
Fax: 82-32-876-7710, E-mail: chjeongfish@korea.com, chjeong@inha.ac.kr

dle Yellow Sea, coast of Sorae fish market from bycatch, Incheon, Korea, approx., 126°44'E, 37°23'N, June 24, 2007, and this specimen is identified as *Muraenichthys gymnopterus*. The specimen is deposited in the Laboratory of Fisheries, Department of Ocean Science, College of Natural Sciences, Inha University (FSIU), Incheon, Korea.

The methods of counts and measurements generally followed McCosker (1970, 1977, 1979). Terminology and counts of the cephalic sensory pores followed Machida and Ohta (1993a) and Castle and McCosker (1999). Vertebrae counted from soft X-ray negatives. Total length is abbreviated as TL, head length as HL throughout text.

RESULTS

Subfamily **Myrophinae** Lütken, 1851
(New Korean name: Gaet-mul-baem-a-gwa)

Diagnosis. Gill openings midlateral, a constricted opening; dorsal fin origin mid-trunk; caudal fin rays conspicuous, confluent with dorsal and anal fins, but rarely very small and difficult to observe; tail tip flexible; pectoral fin present or absent; dorsal and anal fins continuous with rayed caudal fin around tip of tail; coloration uniform, often darkened dorsally (modified from McCosker, 1977; Hatooka, 2002; Nelson, 2006).

Genus *Muraenichthys* Bleeker, 1853
(New Korean name: Gaet-mul-baem-sok)
Muraena Bleeker, 1853: 505 (type species: *Muraena*

gymnopterus Bleeker, 1853, by original description); Fowler, 1932: 55-56; McCosker, 1970: 509; McCosker, 1977: 58; Kuang and Yu in Kuang *et al.*, 1986: 31-32; Cheong and Zheng, 1987: 110, 755; Kuang in Pan *et al.*, 1991: 57; Asano in Masuda *et al.*, 1992: 30; McCosker and Parin, 1995: 232; Castle and McCosker, 1999: 121; Smith and McCosker, 1999: 1664.

Diagnosis. A constricted gill openings at mid lateral; centre of orbit at mid-jaw; posterior nostril opening outside of mouth, a hole along upper lip preceded by a flap; teeth blunt, jaw teeth in bands, and multiserial dentition; intermaxillary teeth in a patch; third preopercular pore present or absent; and a single infraorbital pore between anterior and posterior nostrils (modified from McCosker, 1977; Castle and McCosker, 1999).

Key to the East Asian species of *Muraenichthys*

- 1a. Dorsal fin origin behind anus *M. schultzei*
- 1b. Dorsal fin origin before anus 2
- 2a. Dorsal fin origin almost midway between anus and gill opening; vomerine teeth in one to two rows regularly, and teeth in jaw uniserial
..... *M. malabonensis*
- 2b. Dorsal fin origin closer to the anus than to the gill opening; vomerine teeth in one to three rows irregularly, and teeth in jaw multiserial
..... *M. gymnopterus*

Muraenichthys gymnopterus (Bleeker, 1853)
(New Korean name: Gaet-mul-baem)
(Figs. 1 ~ 3; Table 1 ~ 2)

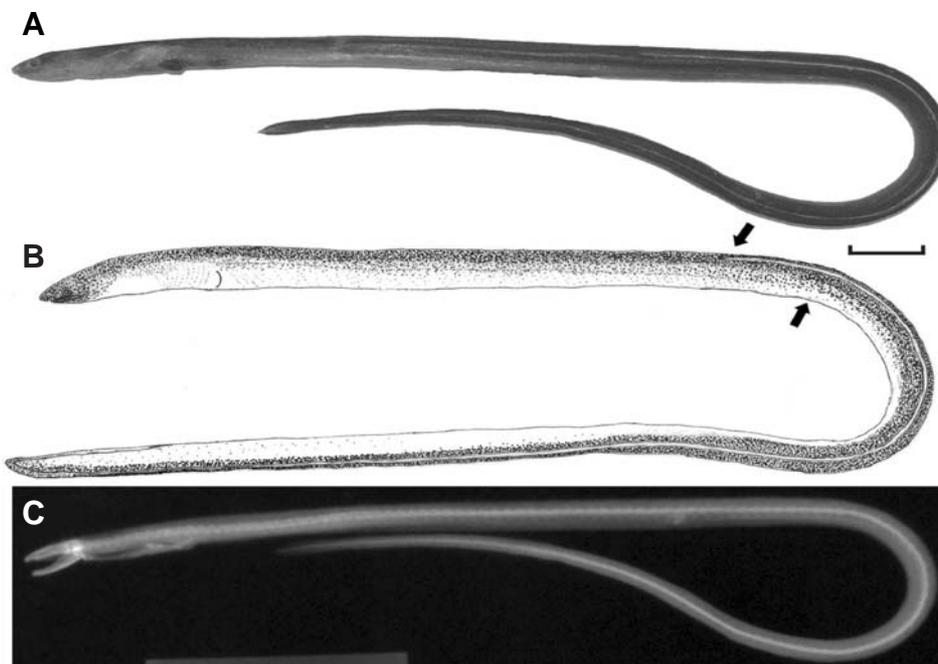


Fig. 1. Left lateral view of *Muraenichthys gymnopterus*, FSIU 2144, 254.6 mm TL. A. Photograph, B. Schematic drawing, C. Radiograph. Scale bar indicates 10 mm. Upper arrow indicates dorsal fin origin, lower arrow anus.

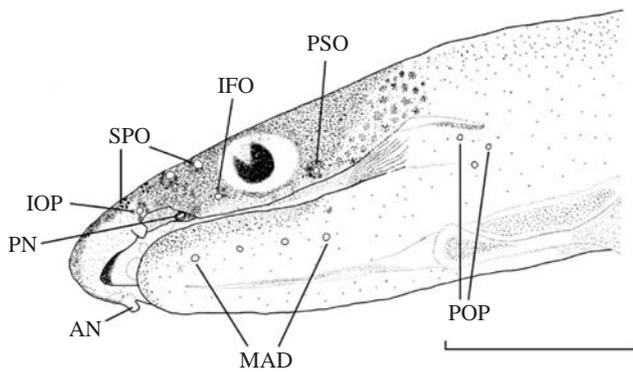


Fig. 2. Head of *Muraenichthys gymnopterus*, FSIU 2144, ventrolateral view. AN, anterior nostril; IFO, infraorbital pores; IOP, infraorbital pores between anterior and posterior nostrils; MAD, mandibular pores; PN, posterior nostril; POP, preopercular pores; PSO, postorbital pores; SPO, supraorbital pores; Scale bar indicates 3 mm.

Muraena gymnopterus Bleeker, 1853: 52 (= *Muraenichthys gymnopterus*; original description; type locality: Jakarta, Java, Indonesia); Fowler, 1932: 56; Chu *et al.*, 1963: 153-154; McCosker, 1970: 508; McCosker, 1977: 59; Kuang and Yu in Kuang *et al.*, 1986: 31-32; Cheong and Zheng, 1987: 110, 755; Castle and McCosker, 1999: 121; Smith and McCosker, 1999: 1667; Tang and Zhang, 2004: 20.

Muraenichthys hattae Jordan and Snyder, 1901: 862, Fig. 12 (type locality: Wakanoura, Wakayama Prefecture, Japan); McCosker, 1970: 508; McCosker, 1977: 59; Asano in Masuda *et al.*, 1992: 30, pl. 33; Castle and McCosker, 1999: 121 (synonym of *Muraenichthys gymnopterus*); Hatooka in Nakabo, 2000: 217; Hatooka in Nakabo, 2002: 217.

Material examined. FSIU 2144, a single specimen, 254.6 mm TL, middle Yellow Sea, coast of Sorae fish market from bycatch, Incheon, Korea, approx., 126° 44'E, 37° 23'N, June 24, 2007, collected by B.-K. Kim.

Description. Counts and measurements are given in Tables 1 and 2. Measurements in mm (in % TL in parentheses)- 254.6 mm TL, head length 24.3 mm (9.5), trunk length 73.4 mm (28.8), tail length 155.8 mm (61.2), body length 97.7 mm (38.8), body depth at gill opening 5.9 mm (2.3), body depth at anus 6.0 mm (2.4), preanal length 96.9 mm (38.1), predorsal length (snout tip to dorsal fin origin) 91.9 mm (36.1). Measurements in mm (in % HL in parentheses)-Anus to dorsal fin origin 7.4 mm (30.5), head width 3.9 mm (16.0), head depth 5.0 mm (20.6), gill opening length 2.4 mm (9.9), snout length 3.0 mm (12.3), upper jaw length 6.4 mm (26.3), eye diameter 1.4 mm (5.8), interorbital width 2.4 mm (9.9).

Body elongate, cylindrical, compressed posteriorly; tail much longer than head plus trunk length (Fig. 1).

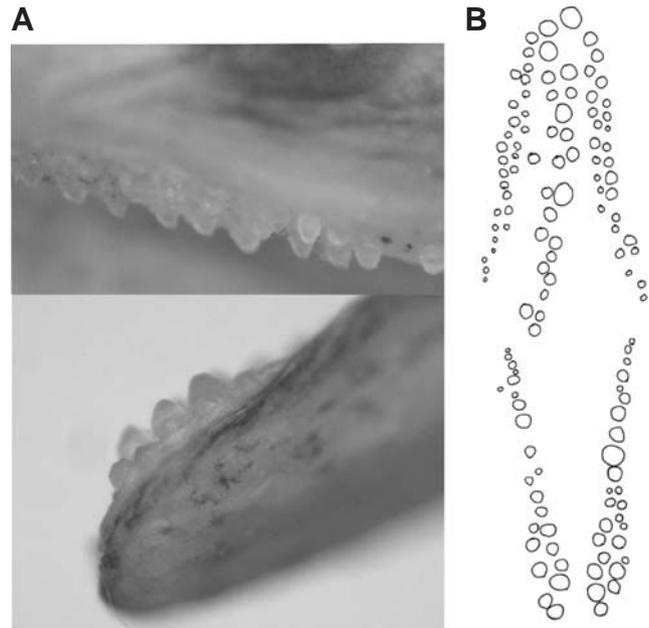


Fig. 3. Teeth and dentition of *Muraenichthys gymnopterus*, FSIU 2144. A. Lateral view of upper and lower teeth, shown partially; B. Upper and lower dentition.

Mouth inferior; cleft of mouth large, extending backward one eye diameter beyond posterior margin of eye. Gill-opening along lateral midline a constricted hole smaller than eye diameter. Snout moderately acute, projecting, extending beyond tip of lower jaw. Tip of lower jaw reaching to the anterior edge of the anterior nostril. Anterior nostrils tubular, shorter than eye diameter. Posterior nostril outside mouth, as an elongated slit with an anterior flap. Eye moderate in size, circular, larger than interorbital width. Dorsal fin origin notably before anus, closer to the anus than to the gill opening. Caudal fin ray conspicuous, confluent with dorsal and anal fins; tail tip flexible. Pectoral fin absent. Scales absent.

Total vertebrae approximate 156 (Fig. 1C). Cephalic sensory pores minute, numerous; single infraorbital pores between anterior and posterior nostrils, single infraorbital pores, single postorbital pores, four supraorbital pores, three preopercular pores, and four mandibular pores (Fig. 2). Teeth blunt, short, stout (Fig. 3A); tooth bands narrow, undivided; vomerine teeth in one to three rows; maxillary teeth single row anteriorly, two or three rows medially, single row posteriorly; most teeth arranged irregularly; teeth in jaw multiserial (Fig. 3B).

Color. Uniform brown above lateral midline with many small melanophores, and light brown ventrally. Coloration slightly faded in alcohol.

Distribution. Yellow Sea, East and South China Seas, southern Japan, and the Indo-West Pacific (Chu *et al.*, 1963; Hatooka, 2002; Tang and Zhang, 2004).

Table 1. Comparisons of proportional measurements of *Muraenichthys* species from the East Asia, all numerals expressed as times in TL and HL, and as percentage in parentheses

Measurements	Present study (FSIU 2144)	Species				
		<i>M. gymnopterus</i>			<i>M. malabonensis</i>	<i>M. schultzei</i>
		Bleeker, 1853 ^a	Jordan and Snyder, 1901 ^b	Chu <i>et al.</i> , 1963	Kuang and Yu, 1986	Randall, 1995
Total length, mm	254.6	215.0~266.0	330.2	175~303	165.0~185.0	144.0~230.0 ^c
In total length						
Head length	10.5 (9.5%)	7.3~8.5	—	8.9~9.8	7.4~7.8	7.8~9.0 ^c
Trunk length	3.5 (28.8%)	—	—	—	—	—
Body length	2.6 (38.8%)	—	—	2.3~2.6	—	—
Tail length	1.6 (61.2%)	—	—	—	—	1.6 ^c
Depth at GO	43.2 (2.3%)	—	—	—	27.3~32.4	22.2 ^c
Width at GO	65.3 (1.5%)	—	—	33.7~58.0	36.0~37.5	—
Depth at anus	42.4 (2.4%)	28.0~34.0	—	34.8~52.8	27.3~32.4	20.0~30.0
Preal anal length	2.6 (38.1%)	—	—	—	—	2.2~2.3
DFO	2.8 (36.1%)	—	—	—	—	—
In head length						
Anus to DFO	3.3 (30.5%)	—	—	—	—	—
Head width	6.2 (16.0%)	—	—	—	—	—
Head depth	4.9 (20.6%)	—	4.0	—	—	—
GO length	10.1 (9.9%)	—	—	—	—	—
Snout length	8.4 (11.9%)	—	7.3	6.4~9.0	6.6~8.1	5.6 ^c ~7.5
Upper jaw length	3.8 (26.3%)	3.0~3.5	4.0	3.6~4.3	3.1~3.4	—
Eye diameter	17.4 (5.8%)	15.0	—	18.0~31.0	11.0~16.7	11.5 ^c
Interorbital width	10.1 (9.9%)	—	—	6.9~10.5	9.2~11.2	—
Head in trunk	3.0 (33.1%)	—	2.2	—	—	—
Head+trunk in tail	1.6 (62.7%)	—	1.5	—	—	—

^aOriginal description; ^bOriginal description of *M. hattae* (=synonym of *M. gymnopterus*); ^cAsano (1981)'s data included. DFO, dorsal fin origin; GO, gill opening

Table 2. Comparisons of characters of *Muraenichthys* species from the East Asia

Characters	Present study	Species		
		<i>M. gymnopterus</i>	<i>M. malabonensis</i>	<i>M. schultzei</i>
		Asano, 1992 ^b	Kuang and Yu, 1986	Randall, 1995
DFO	Before anus	Before anus	Before anus	Behind anus
Dentition	Multiserial	Uniserial	Uni- or biserial	Uniserial
Teeth	Blunt	—	—	Conical ^c
Color	Brown	(Brown)	Dark brown	Dark brown
Snout	Acute	(Acute)	(Acute)	Blunt
Vertebrae	156 ^a	154~161	—	122~132 ^d
POP	3	—	—	—
IOP	1	—	—	—

^aApproximate; ^b*M. hattae* (=synonym of *M. gymnopterus*); ^cAsano (1981)'s data included; ^dAsano (1992)'s data included. DFO, dorsal fin origin; IOP, infraorbital pores between anterior and posterior nostrils; POP, preopercular pores

DISCUSSION

Castle and McCosker (1999) synonymized *Muraenichthys hattae* Jordan and Snyder, 1901 with *Muraenichthys gymnopterus* (Bleeker, 1853) in their provisional list without giving any comment, but we followed their result in this study. And then, they proposed *Muraenichthys malabonensis* Herre, 1923 is a “probable synonym” of *Muraenichthys thompsoni* Jordan and Richard-

son, 1908, but we used as *M. malabonensis* owing to lacking comment in their research, and as described in Chu *et al.* (1963), Kuang and Yu (1986), and Tang and Zhang (2004).

The morphological characters of the specimen (FSIU 2144) of *Muraenichthys gymnopterus* do not correspond with the simple original description of Bleeker (1853) in proportional measurements (Table 1), but well correspond with the some characters given by Bleeker (1853) in having by vomerine teeth triserial anteriorly

and bi- or uniserial posteriorly, and with the descriptions of McCosker (1970), Chu *et al.* (1963), Kuang and Yu (1986), Asano (1992; as *M. hattae*), Castle and McCosker (1999), Hatooka (2002; as *M. hattae*) and Tang and Zhang (2004). *M. gymnopterus* is characterized by the following combination of characters: a constricted gill openings at mid lateral; dorsal fin origin before anus, closer to the anus than to the gill opening; blunt teeth, jaw teeth in bands, and multiserial dentition; third preopercular pore present; single infraorbital pore between anterior and posterior nostrils; brownish colour; depth and width at gill opening 43.2 times and 33.7~65.3 times in total length, respectively; eye diameter 15.0~31.0 times in head length; and total vertebrae 154~161.

Among the five to seven congeneric species, *Muraenichthys gymnopterus* is most similar to *M. malabonensis* and *M. schultzei* in general body shape, head length, depth at anus, and snout length. But, *M. gymnopterus* differs from *M. malabonensis* and *M. schultzei* in combination of following characters: dorsal fin origin starting before anus, more pointed snout, blunt teeth, multiserial dentition, large eye, brownish body coloration, and a greater number of vertebrae. Furthermore *M. gymnopterus* differs from *M. malabonensis* by having large body (over 330 mm TL vs. less than 185 mm TL), deep body at gill opening (43.2 vs. less than 32.4), mixed dentition (multiserial vs. uni- or biserial), and a lighter body coloration (brown vs. dark brown). *M. gymnopterus* also differs from *M. schultzei* by having preceding position of dorsal fin origin (before anus vs. behind anus), a larger eye (15.0~31.0 vs. 11.5), mixed dentition (multiserial vs. uniserial), less pointed teeth (blunt vs. sharp), and a greater number of vertebrae (154~161 vs. 122~132) (Table 1 and 2).

ACKNOWLEDGEMENTS

This research was supported by funds from the Inha University grant program and a grant from the Ministry of Environment of the Korean Government. We are grateful to Professor Tetsuji Nakabo, The Kyoto University Museum, Kyoto University, Kyoto, Japan, for his kind advice and assistance with literature.

REFERENCES

- Asano, H. 1981. Ophichthidae. In: Okada, K., S. Uchida, and T. Uchida (eds.). New illustrated encyclopedia of the fauna of Japan III. Hokuryukan Co. Ltd., Tokyo, pp. 216-217. (in Japanese)
- Asano, H. 1992. Ophichthidae. In: Masuda, H. (ed.). The fishes of the Japanese archipelago. 3rd ed. Tokai University Press, Tokyo, pp. 30-32, pl. 33.
- Bleeker, P. 1853. Bijdrage tot de kennis der Muraenoiden en Symbranchoiden van den Indischen Archipel. Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschappen, 25: 71.
- Castle, P.H.J. and J.E. McCosker. 1999. A new genus and two new species of Myrophine worm-eels, with comments on *Muraenichthys* and *Scolecenchelys* (Anguilliformes: Ophichthidae). Records of the Australian Museum, 51: 113-122.
- Cheng, Q.T. and B.S. Zheng (eds.). 1987. Systematic synopsis of Chinese fishes. Science Press, Beijing, pp. 110-115, 775-764. (in Chinese)
- Chu, Y.T., T.L. Tchang and Q.T. Cheng. 1963. Fishes of the East China Sea. Science Press, Beijing, pp. 153-154. (in Chinese)
- Fowler, H.W. 1932. A synopsis of the fishes of China. Part III. The eels. The Hong Kong Naturalist, 3: 46-63.
- Hatooka, K. 2002. Ophichthidae. In: Nakabo, T. (ed.). Fishes of Japan with pictorial keys to the species. Tokai Univ. Press, Tokyo, pp. 215-225.
- Jordan, D.S. and J.O. Snyder. 1901. A review of the apodal fishes or eels of Japan, with descriptions of 19 new species. Proc. U. S. Natl. Mus., 23: 862-863.
- Kim, I.S., Y. Choi, C.L. Lee, Y.J. Lee, B.J. Kim and J.H. Kim. 2005. Illustrated book of Korean fish. Kyohak Publishing Co. Ltd., Seoul, pp. 86-89. (in Korean)
- Kuang, Y. and T. Yu. 1986. Anguilliformes. In: Kuang, Y., X. Jin, Y. Ni, H.L. Wu and K. Lu (eds.). The freshwater and estuaries fishes of Hainan Island. Guangdong Science and Technology Press, Guangzhou, pp. 26-36. (in Chinese)
- Machida, Y. and S. Ohta. 1993a. New record for *Neeenchelys daedalus* (Ophichthidae) from Japan. Japan. J. Ichthyol., 39: 391-394.
- Machida, Y. and S. Ohta. 1993b. *Muraenichthys japonicus*, a new worm eel from the Sea of Japan (Ophichthidae: Myrophinae). Japan. J. Ichthyol., 40: 323-326.
- McCosker, J.E. 1970. A review of the eel genera *Leptenchelys* and *Muraenichthys*, with the descriptions of a new genus, *Schismorhynchus*, and a new species, *Muraenichthys chilensis*. Pacific Science, 24: 506-516.
- McCosker, J.E. 1977. The osteology, classification, and relationships of the eel family Ophichthidae. Proceedings of the California Academy of Sciences, 41: 1-123.
- McCosker, J.E. 1979. The snake eels (Pisces, Ophichthidae) of the Hawaiian Islands, with the description of new species. Proceedings of the California Academy of Sciences, 42: 57-67.
- McCosker, J.E. and J.E. Randall. 1993. Finless snake-eels of

- the genus *Cirricaecula* (Anguilliformes: Ophichthidae), with the description of *C. macdowellii* from Taiwan. Japan. J. Ichthyol., 40: 189-192.
- McCosker, J.E. and N.V. Parin. 1995. A new species of deepwater worm-eel, *Muraenichthys profundorum* (Anguilliformes: Ophichthidae), from the Nazca Ridge. Japan. J. Ichthyol., 42: 231-235.
- McCosker, J.E. and Y.-Y. Chen. 2000. A new species of deepwater snake-eel, *Ophichthus aphotistos*, with comments on *Neenchelys retropinna* (Anguilliformes: Ophichthidae) from Taiwan. Ichthyol. Res., 47: 353-357.
- Mok, H.K. 1993. Ophichthidae. In: Shen, S.C. (ed.). Fishes of Taiwan. Depart. Zool., Natl. Taiwan Univ., Taipei, pp. 110-114.
- Nelson, J.S. 2006. Fishes of the world. 4th ed. John Wiley & Sons, Inc., New Jersey, pp. 120-121.
- Randall, J.E. 1995. Coastal fishes of Oman. Crawford House Publishing Pty Ltd., Bathurst, pp. 60-63.
- Smith, D.G. and J.E. McCosker. 1999. Ophichthidae. In: Carpenter, K.E and V.H. Niem (eds.). FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Vol. 3. Batoid fishes, chimaeras and bony fishes. Part 1 (Elopidae to Linophrynidae), FAO, Rome, pp. 1662-1669.
- Tang, W.Q. and C.G. Zhang. 2004. A taxonomic study on snake eel family Ophichthidae in China with the review of Ophichthidae (Pisces, Anguilliformes). J. Shanghai Fish. Univ., 13: 16-22. (in Chinese with English abstract)

한국산 바다뱀과 어류 1미기록종 *Muraenichthys gymnopterus* (Anguilliformes: Ophichthidae: Myrophinae)

김병기 · 정충훈¹ · 한경남

인하대학교 자연과학대학 해양학과, ¹인하대학교 서해연안환경연구소

요 약 : 인천 연안에서 뱀장어목 바다뱀과 어류 1개체(전장 254.6 mm)가 채집되었다. 한국에서는 미기록 종인 *Muraenichthys gymnopterus*로 동정되었고, 본종이 포함되는 속(*Muraenichthys*), 아과(Myrophinae) 역시 한국 미기록으로 확인되었다. 본 종은 아가미구멍이 수축되었고, 체측면의 중앙에 열려있으며, 등지느러미 기부는 항문보다 전방에 위치하고, 아가미구멍보다는 항문에 더 가깝다. 모든 이빨은 끝이 뾰족하며, 하악치는 띠를 형성하고, 상악치, 하악치, 서골치의 치열은 다열형이다. 세번째 preopercular pore (전새개골공)가 있으며, 전비공과 후비공 사이에 하나의 infraorbital pore (안하골공)가 있다. 체색은 갈색을 띠고, 아가미구멍에서의 체고에 대한 전장은 43.2배, 체폭에 대하여는 33.7~65.3배, 두장은 눈 지름의 15.0~31.0배이다. 척추골수는 154~161개이다. Subfamily Myrophinae는 “갯물뱀아과”, genus *Muraenichthys*는 “갯물뱀속”, *M. gymnopterus*는 “갯물뱀”으로 각각 국명을 신칭한다.

찾아보기 낱말 : *Muraenichthys gymnopterus*, 바다뱀과, 갯물뱀아과, 갯물뱀속, 갯물뱀, 한국미기록종