

A Taxonomic Revision of the Genus *Periophthalmus* (Pisces : Gobiidae) from Korea with Description of a New Species

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The taxonomic revision of the genus *Periophthalmus* from Korea was made based on the fish specimens collected in the southern and western coasts of Korea from September 1983 to October 1994. The genus *Periophthalmus* in Korea was classified into two species : *P. modestus* and *P. magnuspinnatus* n. sp. *P. magnuspinnatus* differs from all other species of the genus by ventral fin united about two – third the fin and first dorsal fin relatively large, convex, distinct black submarginal band.

Introduction

The genus *Periophthalmus* are well known as mudskippers and widely distributed from the Indo – Pacific and Australian regions to the east coast of Africa. Murdy (1989) classified twelve species in the genus *Periophthalmus* in the world.

Only one species of the genus *Periophthalmus*, *P. cantonensis* (Osbeck), has been reported in Korea (Mori, 1952 ; Chyung, 1977 ; Akihito *et al.*, 1984 ; Kim *et al.*, 1986). Recently, Ryu (1990) reported that *Periophthalmus* has been the subject of much nomenclatural confusion. This study by examining materials collected from 1983 to 1994 in the southern and western coasts of Korea, revealed that the

genus contains two species, *P. modestus* and *P. magnuspinnatus* n. sp.

In the present paper, therefore, *P. modestus* is redescribed in detail and *P. magnuspinnatus* is described as a new species.

Materials and Methods

Counts and measurements of the body parts are after those of Hubbs & Lagler (1964) except for the following additions. The last two rays of dorsal and anal fins are very close together, share the ultimate pterygiophore, counted as a single element. Lateral scale rows are counted in a series from the scales at the posterior end of the upper part of the gill membrane to the middle scale on the base of the caudal fin and

transverse scale from the origin of the second dorsal fin ventroposteriorly to the anal fin base. The arrangement of pit organs was observed after staining by suminol cyanine. Counts for vertebrae and pterygiophore were taken from cleared and stained materials (Taylor, 1967). The spinous dorsal fin pterygiophore formula is given according to the annotation of Birdsong *et al.* (1988). The specimens of present study are deposited in the Department of Biology, Chonbuk National University, Chonju (CNUC). The distributions of the two species of *Periophthalmus* are shown in Fig. 1.

Systematic Accounts

Genus *Periophthalmus* Bloch et Schneider

Periophthalmus Bloch & Schneider, 1801 :

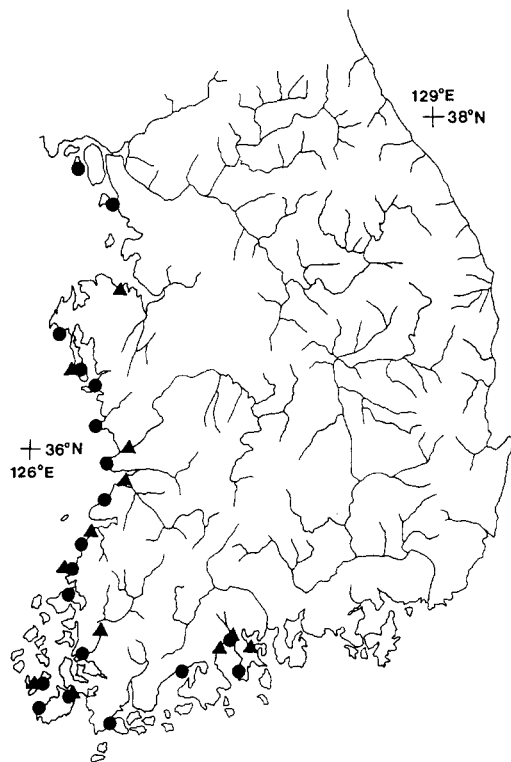


Fig. 1. Map showing the collection sites of *Periophthalmus* in Korea.
Solid circle, *P. modestus* ; solid triangle, *P. magnuspinnatus* n. sp.

63 (type species *Periophthalmus papilio* Bloch & Schneider [= *Gobius barbarus* Linnaeus], subsequent designation by Bleeker, 1874 : 326).

Periophthalmus modestus Cantor

(Korean Name : Malddug - mangdung^ㄹ)

Periophthalmus modestus Cantor, 1842, p. 484 (type locality Chusan, China).

Periophthalmus cantonensis Mori, 1952. Mem. Hyogo Univ. Agr., 1(3), p. 149 (Pusan, estuary of Nakdong, Mokpo, Chemulpo, Chinnampo) ; Chyung, 1977, Ilji - Sa, pp. 495 - 496 ; Kim *et al.*, 1986, Bull. Korean Fish. Soc., 19 (4), p. 404.

Material examined 15 specimens, 65.4 - 71.5mm SL, Maeum - ri, Samsan - myon, Kanghwa - gun, Kyongki - do, July 8, 1989 ; 13, 73.4 - 77.9mm SL, Tong - gu, Inchon - shi, Aug. 20, 1990 ; 11, 60.2 - 71.8mm SL, Yongsin - ri, Kunhung - myon, Sosan - gun, Chungchongnam - do, June 2, 1989 ; 7, 63.5 - 72.2 mm SL, Chongdang - ri, Anmyon - up, Sosan - gun, Chungchongnam - do, July 20, 1989 ; 7, 62.5 - 77.3mm SL, Sosong - ri, Ochon - myon, Poryong - gun, Chungchongnam - do, Aug. 6, 1988 ; 5, 59.3 - 73.8mm SL, Maryang - ri, Piin - myon, Sochon - gun, Chungchongnam - do, July 2, 1989 ; 32, 31.5 - 80.2mm SL, Soryong - dong, Kunsan - shi, Chollabuk - do, July 15, 1987 ; 3, 34.8 - 56.6mm SL, Paekryon - ri, Haso - myon, Puan - gun, Chollabuk - do, Sep. 27, 1994 ; 18, 63.2 - 69.7mm SL, Kori - po, Sangha - myon, Kochang - gun, Chollabuk - do, July 10, 1989 ; 15, 70.5 - 73.5mm SL, Song - sok - ri, Haeje - myon, Muan - gun, Chollanam - do, July 15, 1990 ; 15, 51.1 - 71.9mm SL, Tasu - ri, Changsan - myon, Shinan - gun, Chollanam - do, Oct. 10, 1986 ; 4, 39.5 - 40.5mm SL, Pyogpa - ri, Kogun - myon, Chindo - gun, Chollanam - do, June 6, 1987 ; 15, 65.2 -

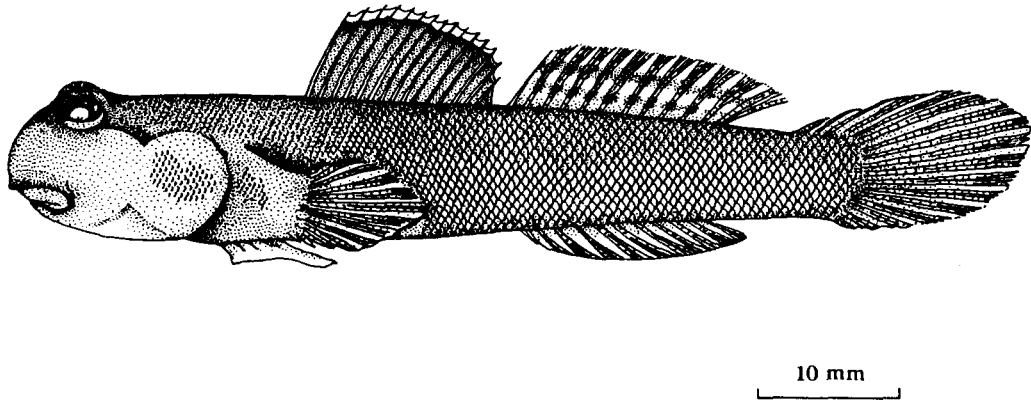


Fig. 2. *Periophthalmus modestus*, adult male, 63.3 mm SL, from Kori - po, Sangha - myon, Kochang - gun, Chollabuk - do, Korea, July 10, 1989.

73.4mm SL, Tojang - ri, Chisan - myon, Chindo - gun, Chollanam - do, Sep. 10, 1990 ; 1, 45.5mm SL, Taemun - ri, Kunoe - myon, Wandogun, Chollanam - do, June 7, 1987 ; 17, 60.5 - 71.5mm SL, Tugryang - myon, Posong - gun, Chollanam - do, July 28, 1989 ; 3, 45.8 - 72.3mm SL, Hwayang - myon, Yochon - gun, Chollanam - do, July 12, 1986.

Diagnosis Ventral fin united anteriorly by a moderate to strong frenum and a connecting membrane, posterior margin notched ; median rays united by a membrane for about half their length ; first dorsal fin moderate, dark with round margin and no spots on fin, no elongate spines ; second dorsal fin with single dusky stripe inframarginally and rays with black spots ; dorsal fins not connected by membrane.

Description Spinous dorsal fin X - XIV (mean = XII) ; second dorsal fin I, 10 - 12(11) ; anal fin I, 10 - 11(11) ; pectoral fin 13 - 15(14) ; ventral fin I, 5 ; lateral scales 75 - 84(79) ; transverse scales 24 - 26(25) ; predorsal scales 35 - 40(37) ; head length 25.9 - 28.0(27.1)% in standard length (SL) ; body depth 15.7 - 21.5(18.6)% in SL ; caudal peduncle length 17.8 - 22.3(20.1)% in SL ; pre - dorsal length 33.8 - 36.9(35.9)% in SL ; pre - ventral length 24.8 - 28.7(26.7)% in SL ; pre - anal

length 59.4 - 64.5(62.2)% in SL ; length of 1st dorsal fin 20.4 - 25.3(23.2)% in SL ; length of ventral fin width 14.0 - 19.6(17.1)% in SL ; snout length 36.3 - 47.4(40.4)% in HL(head length) ; eye diameter 15.7 - 20.2(18.0)% in HL ; caudal peduncle depth 36.1 - 55.0(45.4)% in caudal peduncle length (CPL).

Body elongate, posteriorly a little compressed. Scales cycloid, covering entire body except for snout, isthmus and interorbital region. Scales on caudal peduncle larger than those of front of body. Head large ; snout notably short and blunt anteriorly. Eye close together, their upper edges projecting above dorsal contour. Cleft of mouth horizontal ; lips thin and pendulous ; posterior nostril a tube in a triangular lobule above upper lip. Teeth in a single row in each jaw, uneven anterior ones more or less caninoid. Gill opening small ; no barbels on chin.

Spinous dorsal fin pterygiophore formula (DF), 3 - 1301000 ; number of precaudal and caudal vertebrae, 10 + 16 = 26 ; number of anal fin pterygiophores anterior to first heamal spine, 2 ; epural number, 1.

Color in formalin No marked change except disappearance of dark spots around body. Ground color darker above than below, small dark specks scattered over sides and upper

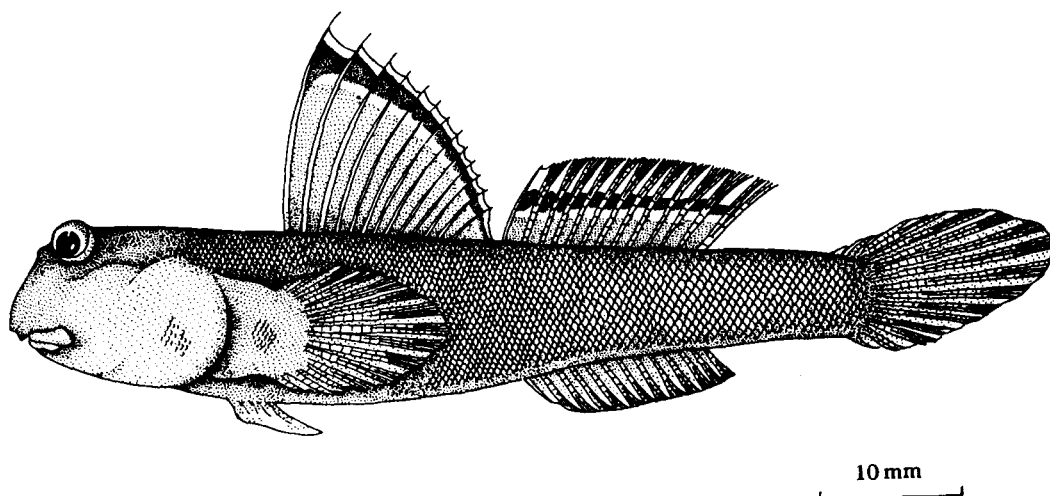


Fig. 3. *Periophthalmus magnuspinnatus* n. sp. new species, Holotype, adult male, 69.5mm SL, from Hodu-ri, Haeryong-myon, Sungju-gun, Chollanam-do, Korea, August 10, 1987 (CNUC 10678).

parts. First dorsal fin moderate, mostly grey with whitish margin, when depressed not reaching insertion of second dorsal; second dorsal fin with transparent margin, infra-marginally a greyish strips, ventral to this stripe is a whitish one with grey spots basally on fin rays; caudal fin brownish with dark brown area in middle of fin; anal and pelvic fins whitish; pectoral fins yellow brown with dusky spots proximally.

Cephalic lateral line system No open head pores. Several rows of cutaneous papillae on head as Fig. 4.

Sexual dimorphism Urogenital papilla distinct; pointed in the male and truncated in the female. No sexual dimorphism in meristic characters, color pattern and fin rays.

Distribution and habit The western and southern coasts of Korea (Fig. 1) southward to Hong Kong and southern Japan. This species inhabit muddy bottoms of intertidal flat and coastal areas near river mouth.

Remarks *Periophthalmus modestus* has frequently been referred to as *P. cantonensis* (Jordan et Snyder, 1901; Tomiyama, 1936; Mori,

1952; Kobayashi *et al.*, 1971, 1972; Fowler, 1972; Chyung, 1977; Matsubara, 1979; Rhyu and Lee, 1979; Akihito *et al.*, 1984; Kim *et al.*, 1986; Lee, 1990). *P. cantonensis* (= *Apocrystes cantonensis* by Osbeck) is pre-Linnaean and has no taxonomic standing (Murdy, 1989). Most characters of the present specimens agree well with the original description of *P. modestus* given by Cantor (1842).

***Periophthalmus magnuspinnatus* n. sp.**

(New Korean Name : Kunbyot-malldug-mangdungo)

Material examined. Holotype : CNUC 10678, 69.5mm in SL, male, Hodu-ri, Haeryong-myon, Sungju-gun, Chollanam-do, Korea, 34° 52'N, 127° 32'E, Aug. 10, 1987.

Paratypes : CNUC 10652 - 10661(10), 69.2 - 90.0mm SL, Yongdu-ri, Pyelyang-myon, Sungju-gun, Chollanam-do, Aug. 9, 1987.

Additional specimens : CNUC 10662 - 10664(3), 60.9 - 81.6mm SL, Tangsan-ri, Songsan-myon, Tangjin-gun, Chungchongnam-do, Aug. 2, 1986; CNUC 10665(1), 70.9 mm SL, Chongdang-ri, Anmyon-up, Sosan -

Table 1. Counts and proportional measurements of *Periophthalmus magnuspinnatus* n. sp. Data show ranges and means in parentheses.

Sex Cat. No.	Holotype	Paratypes	
	male CNUC 10678	males CNUC 10658 - 61	females CNUC 10652 - 59
No. fish	1	4	6
Dorsal fin rays	XI - I, 12	XII ~ XIII - I, 12	XI ~ XIII - I, 12
Pectoral fin rays	13	12 - 14	13 - 14
Anal fin rays	I, 12	I, 12	I, 11 - 12
Lateral scales	90	86 - 90	87 - 90
Transverse scales	25	24 - 27	24 - 26
Predorsal scales	32	31 - 32	31 - 32
Standard length(mm)	69.5	69.2 - 73.8	73.5 - 90.0
In % of standard length			
Head length	25.6	27.2 - 27.8	25.8 - 27.9
Body depth	17.5	17.4 - 18.9	16.8 - 20.8
Caudal peduncle length	22.0	20.1 - 21.7	19.8 - 22.8
Pre - dorsal length	32.4	33.6 - 36.1	32.9 - 35.6
Pre - ventral length	26.5	26.2 - 27.9	25.8 - 27.5
Pre - anal length	59.5	59.4 - 61.8	60.0 - 62.2
Length of 1st dorsal fin	25.2	28.3 - 30.3	25.2 - 28.4
Length of ventral fin width	16.8	14.4 - 16.4	62.7 - 69.8
In % of head length			
Snout length	38.7	38.6 - 40.3	37.8 - 41.3
Eye diameter	18.5	18.7 - 19.8	17.3 - 19.8
In % of caudal peduncle length			
Caudal peduncle depth	45.1	39.4 - 42.4	37.5 - 41.9

gun, Chungchongnam - do, Sep. 15, 1983 ; 5, 40.3 - 53.0mm SL, Hwayang - myon, Sochon - gun, Chungchongnam - do, Apr. 16, 1985 ; 33, 18.0 - 85.7mm SL, Kojon - ri, Chinbong - myon, Kimje - gun, Chollabuk - do, Oct. 2, 1994 ; 3, 74.0 - 81.5mm SL, Samin - ri, Simwon - myon, Kochang - gun, Chollabuk - do, June 3, 1992 ; 2, 71.7 - 71.9mm SL, Pobsong - myon, Yonggwang - gun, Chollanam - do, Dec., 1990 ; CNUC 10672(1), 78.0mm SL, Mongsan - ri, Mongtan - myon, Muan - gun, Chollanam - do, Aug. 30, 1985 ; CNUC 10666 - 10668(3), 74.5 - 81.6mm SL, Soho - ri, Samho - myon, Yongam - gun, Chollanam - do Apr. 26, 1986 ; CNUC 10669 - 10670(2), 69.2 - 90.0mm SL, Tasu - ri, Changsan - myon, Shinan - gun, Chollanam - do, Oct. 10, 1986 ; CNUC 10671 (1), 70.5mm SL, Pyogpa - ri, Kogun - myon, Chindo - gun, Chollanam - do, June 6, 1987 ;

4, 72.1 - 88.6mm SL, Sunchon - shi, Chollanam - do, Aug. 13, 1987.

Diagnosis The present new species is distinguished from all other members of the genus *Periophthalmus* in the combination of ventral fin united about two - third the fin, basal membrane well developed ; first dorsal fin relatively large, convex, distinct black submarginal band ; number of fin rays and scales(Table 1).

Description Counts and proportional measurements of holotype and paratypes are shown in Table 1. Body elongate, posteriorly a little compressed. Scale cycloid, covering most of body except for isthmus ; largest scales posteriorly, smallest embedded in snout ; scales series irregular, difficult to count accurately. Head truncate, scaled above behind eyes and on cheek and opercle, to totally scaled. Eye close together and prominent above dorsal profile,

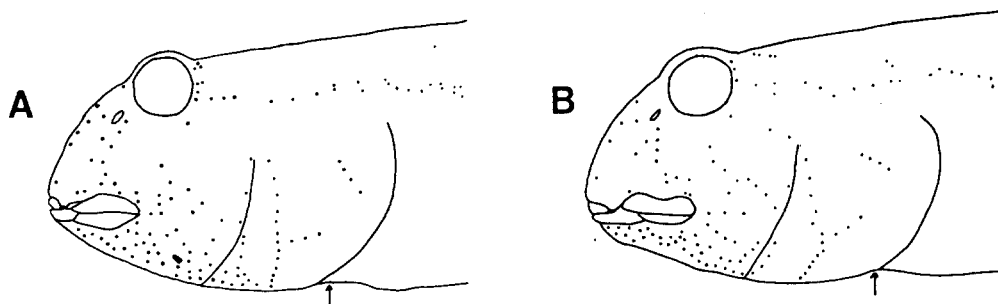


Fig. 4. Fit organs on head of *Periophthalmus modestus* (A) and *P. magnuspinnatus* n. sp. (B). The arrow showing the position where the gill membranes are attached to the isthmus.

lower eyelid well developed. Snout broad obtuse. Posterior nostril is a tube in a triangular lobule above the upper lip, mouth horizontal, jaws nearly equal. Teeth in both jaws with a single row, uneven anterior ones more or less caninoid. Tongue tip rounded, nearly totally adnate to floor of mouth. Gill openings narrow, isthmus broad. Dorsal fin close together. First dorsal fin longer than high, triangular, margin a little convex, first ray in male a little prolonged. Second dorsal fin lower than first, but higher than anal fin. Ventral fin united by a frenum and a connecting membrane, infundibuliform, emarginate posteriorly. Pectoral fins with a muscular base, bent on place of insertion of rays. Anal fin shorter and lower than second dorsal fin, oblong. Caudal fin obtuse asymmetrical, obliquely rounded.

Spinous dorsal fin pterygiophore formula (DF), 3 - 131100 ; number of precaudal and caudal vertebra, 10 + 16 = 26 ; number of anal fin pterygiophores anterior to first heamal spine, 2 ; epural number, 1.

Coloration of holotype and paratypes in formalin Ground color gray brown to black brown, ventral part lighter. The scales in *P. magnuspinnatus* are distinct, so that the myomeres are visible. First dorsal fin with narrow white margin, below it a dark brown longitudi-

nal band, in front part interrupted by the second ray. Second dorsal fin with broad light margin, a dark brown submarginal band, below which a white strip, base dark gray. Ventral fin light gray with some dark central part. Pectoral and anal fin dusky, lighter towards margin. Caudal fin gray brown with black transverse strips.

Cephalic lateral line system No open head pores. Several rows of cutaneous papillae on head as Fig. 4. No intraspecific difference are found in the sensory papillae.

Sexual dimorphism Urogenital papilla distinct ; pointed in the male and truncated in the female. First dorsal fins in the spawning season, males more or less elongate than in females. No sexual dimorphism in meristic characters and color pattern was noted.

Distribution and habit Two species of *Periophthalmus* have been captured on the western and southern coastal slope of Korea where *P. magnuspinnatus* is sympatric with *P. modestus*, partially (Fig. 1). Inhabit mud flats along the shores at bays. Creeps on mud flats at low tide preying on small animals but stays in a burrow in the mud at high tide.

Etymology The specific name *magnuspinnatus* derived from the Latin *magnus* meaning large and the Latin *pinnatus*, finned ; alluding

to the enlarged shape of first dorsal fin.

Remarks Most characters of the present specimens agree well with the description of the genus *Periophthalmus* by Murdy (1989). However, this specimens is clearly distinguished from the other twelve species of the genus *Periophthalmus* by the shape of ventral fin, the band and size of first dorsal fin, the number of dorsal fin rays and the scales in a longitudinal series. So we have identified the present specimens as the new species. This new species is founded as a sympatric species with *P. modestus* from the western and southern coasts of Korea. The proposed new species is allied to *P. modestus* in having united ventral fin and convex margin in first dorsal fin, but it is readily distinguished by having a higher the first dorsal fin and the second dorsal rays of 1, 12 – 13. The new species is similar to *P. argentilineatus* from Japan (Akihito *et al.*, 1984 ; Nakabo, 1993) in having higher first dorsal fin. However, it is readily divided from *P. argentilineatus* by having a united ventral fin and convex margin in the first dorsal fin.

Acknowledgments

We express our sincere thanks to Prof. Ik – Soo Kim, Chonbuk National University, for critically reviewing the manuscript and for many helpful suggestions.

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한국산 말뚝망둥어屬 어류의 분류학적 재검토 및 1신종

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1983년 9월부터 1994년 10월까지 우리 나라의 연안에서 채집된 말뚝망둥어屬 어류의 분류학적인 위치와 특징을 재검토한 결과 말뚝망둥어 *Periophthalmus modestus*와 큰벚말뚝망둥어 (국명신칭) *P. magnuspinnatus* n. sp.의 두 種으로 분류되었으며, 지금까지 국내에 출현하는 것으로 알려졌던 *P. cantonensis*는 *P. modestus*의 동종이명으로 확인되었다.