

Review of codfish family Moridae (Teleostei: Gadiformes) from Taiwan

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Abstract

The codfish family Moridae of Taiwan is reviewed herein. A total of 11 species in 6 genera are recognized. Among them, *Antimora microlepis* Bean, 1890, *Guttigadus nana* Taki, 1953, *Physiculus longifilis* Weber, 1913 and *P. rhodopinnis* Okamura, 1982 are newly recorded from Taiwanese waters. An unidentified species of *Physiculus* is also recognized. *Physiculus roseus* was a misidentification of *P. chigodarana* and should be excluded from Taiwanese fauna. A key to all Taiwanese species are provided.

Key words: Taxonomy, Pisces, Teleostei, new record, Taiwan

Introduction

The cod family Moridae is a small group of bottom-living fishes usually collected by bottom trawls in Taiwan. Very little attention has been paid to this family due to their relatively low commercial value. About 107 species are recognized in the world (Eschmeyer and Fang, 2012). However, there are only a few recorded species from Taiwanese waters. Chen and Yu (1986) recognized 7

species from the Taiwanese waters, including *Physiculus japonicus*, *P. tosaensis* (= *Lotella tosaensis*), *P. roseus*, *P. jordani* (= *Godella jordani*), *P. inbarbatum*, *Lotella maximowiczii* (= *Physiculus japonicus*), and *Lotella physis*. However, Shen et al. (1993) reported only four species, *P. japonicus*, *P. maximowiczii*, *P. roseus* and *P. inbarbatum*, due to the lack of vouchers for other species. Subsequently, Shao et al. (2008) added *Physiculus nigripinnis* from the

southern Taiwan and Shen & Wu (2011) added *Laemonema palauense* (= *L. rhodochir*).

Although nine species of Moridae fishes have been recorded in the Taiwan Fish Database (Shao, 2012), there remains three species that lack vouchers. By examining specimens previously deposited in the collections, including those recently collected from the fish landing grounds, we recognized four species that have never been recorded in Taiwanese waters. Moreover, the presence of *Gadella jordani* and *Physiculus japonicus* in Taiwan were confirmed, specimens of *Physiculus roseus* are reidentified as *P. chigodarana*, and examination of two specimens previously identified as *Lotella phycis* and *Physiculus yoshidae* revealed that both were misidentifications of *P. japonicus*. In total, 11 species in 6 genera are recognized, including an unidentified species. The purpose of present study is to document all species and to provide useful information for further identification.

Methods and materials

Standard length (SL), measured from upper jaw symphysis to base of caudal fin, and head length (HL), measured from upper jaw symphysis to posterior end of opercle, were used throughout. Predorsal and prepelvic lengths, measured from upper jaw symphysis to fin origins; body

depth, measured at origin of dorsal fin and body width measured at base of pectoral fin; snout length, measured from symphysis of upper jaw to anterior margin of orbit; eye diameter, length of longest horizontal distance of bony margin; interorbital width, measured from least distance of upper bony margins of orbit; post-orbital length, measured from posterior bony margin to posterior end of opercle; upper-jaw length, measured from symphysis of upper jaw to posterior end of maxilla; pelvic-fin length, measured from origin of the fin to tip of the longest ray; barbel length, measured from base to tip; first dorsal-fin height, measured from the longest ray. Measurements of interventral line to origin of anal fin (InV-af), interventral line to light organ (InV-LO), light organ length (LO), and interventral line to anus (InV-anus) followed Paulin (1989). Morphometric data were taken to nearest 0.1 mm using digital calipers, except for SL which was to nearest 1 mm. Institutional abbreviations follow Fricke & Eschmeyer (2010). Specimens examined in the present study were deposited at Biodiversity Research Museum, Academia Sinica (ASIZP) and Pieces Collection of National Museum of Marine Biology and Aquarium (NMMB-P).

Results

***Antimora microlepis* Bean, 1890**

細鱗擬深海鱈

Fig. 1, Table 1

Antimora microlepis Bean, 1890:38 (Type locality: British Columbia, Canada).

Small, 1981:347. Okamura in Masuda et al. 1984:90.

Material examined. ASIZP 64276 (1, 324 mm), R/V OR I, sta. CD136, SW Taiwan, South China Sea, otter trawl, 998 m, 11 Nov. 2001.

Description. Dorsal fin rays 5+53; anal fin rays 37; pectoral fin rays 18; pelvic fin 6 rays; gill rakers on first gill arch 4+8=12; scale rows between middle of first dorsal base and lateral line 11. Measurement in SL: head length 4.2; body depth 5.4; body width 9.4; snout to origin of first dorsal 4.1; snout to pelvic 5.3. Measurement in HL: snout length 2.9; orbit diameter 3.6; interorbital width 4.0; post-orbital length 1.9; upper jaw 2.1; first dorsal-fin height 1.1; pelvic-fin length 1.3; barbel length 7.5.

Body slender and compressed; tail compressed; head moderate and depressed anteriorly; snout a broad flat bony plate with lateral keels, protrudes well beyond upper jaw; mouth large, subterminal; maxillary extending to rear margin of orbit. Eye large; interorbital space broad, its width slightly smaller than eye diameter. Teeth villiform, in broad band on both jaws; outer premaxillary teeth not enlarged; vomer with a small patch of teeth; palatine toothless. Barbel on chin shorter than eye diameter. Scale cycloid, covered on body and head, including lips, snout, branchiostegal membranes, gular region, and fin membranes. Luminous organ absent; anus in front of origin of anal fin. Origin of first dorsal fin slightly behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, outermost two rays filamentous, extending to about midpoint between origins of pelvic and anal fins; origin of anal fin far behind to that of second dorsal fin; caudal fin rounded,



Fig. 1. *Antimora microlepis* Bean, 1890, ASIZP 64276, 324 mm SL, preserved, lateral view.

Tab. 1. Morphometric data of five morid species examined in the present study.

	<i>Antimora microlepis</i>	<i>Gadella jodani</i>		<i>Guttigadus nana</i>		<i>Laemonema rhodochir</i>		<i>Lotella tosaensis</i>	
SL (mm)	311 (n=1)	145-230 (n=15)		49-68 (n=3)		102-157 (n=14)		86-131 (n=13)	
In %SL		Mean (Range)	SD	Mean (Range)	SD	Mean (Range)	SD	Mean (Range)	SD
Body depth	18.7	18.2 (16.3-21.0)	1.3	17.6 (16.2-18.3)	1.2	18.0 (15.2-21.3)	1.7	23.5 (21.5-26.5)	1.2
Body width	10.6	12.5 (9.3-14.4)	1.3	14.9 (14.7-15.2)	0.2	12.0 (11.3-12.9)	0.5	17.1 (14.6-23.5)	2.2
Head length	23.9	22.2 (20.3-24.4)	1.3	24.1 (23.0-25.1)	1.1	22.2 (21.5-23.4)	0.6	25.4 (23.5-31.4)	2.0
Predorsal length	24.2	25.2 (23.6-26.8)	1.1	27.3 (26.5-28.4)	1.0	25.8 (23.8-27.3)	0.9	28.6 (26.3-32.3)	1.5
Prepelvic length	18.9	21.9 (18.4-24.6)	1.8	13.6 (12.1-14.4)	1.3	17.3 (15.1-19.5)	1.2	21.6 (19.6-24.9)	1.5
In % HL									
Snout length	34.2	30.4 (27.7-33.8)	1.6	23.2 (21.6-25.0)	1.7	26.8 (22.1-30.1)	2.2	23.0 (20.5-26.5)	1.7
Eye diameter	27.9	18.4 (14.5-24.5)	2.6	29.4 (27.4-31.0)	1.8	25.5 (22.7-27.4)	1.6	27.3 (24.7-29.2)	1.3
Interorbital width	24.9	39.6 (37.1-45.0)	2.2	23.5 (21.6-25.4)	1.9	16.0 (14.7-17.4)	0.8	23.3 (20.5-26.0)	1.9
Post-orbital length	52.1	56.3 (48.4-59.3)	2.8	56.3 (53.2-59.7)	3.2	49.8 (47.1-52.2)	1.3	56.5 (50.7-62.2)	3.1
Upper-jaw length	47.4	48.9 (44.2-56.7)	3.1	48.3 (46.0-49.7)	2.0	47.5 (43.8-51.4)	2.4	52.6 (45.6-57.8)	3.5
Pelvic-fin length	77.0	87.4 (71.8-109.9)	12.6	71.9 (62.6-78.8)	8.4	119.8 (111.2-129.4)	6.2	81.6 (73.5-88.9)	5.9
Barbel length	13.3	--		20.0 (16.1-24.0)	5.6	20.6 (16.5-23.2)	1.9	20.0 (14.6-25.7)	3.4
First dorsal-fin height	93.1	32.8 (24.0-39.2)	4.9	40.5 (39.8-41.1)	0.7	54.6 (48.1-70.1)	5.9	42.2 (35.6-49.4)	4.6
In % InV-af									
InV-LO	--	39.0 (32.3-43.8)	4.0	--	--	--	--	--	--
LO	--	4.8 (2.8-5.8)	0.9	--	--	--	--	--	--
InV-anus	--	66.4 (58.2-79.2)	6.2	86.1 (81.3-91)	4.9	--	--	87.8 (84.8-91.7)	2.4

fan-shaped. Caudal peduncle slender, about equal to eye diameter in length. When preserved, uniformly blackish.

Distribution. North Pacific Ocean. In Taiwan, the only specimen was collected from southwestern region at 998 meters depth, which represents the first record of Taiwan.

Remarks. Small (1981) reviewed the genus and recognized two species. However,

the only differences between number and size of gill filaments. Our specimen has relatively long gill filaments and about 100 gill filaments and is thus recognized as *A. microlepis* by following the definition provided by Small (1981).

***Gadella jordani* (Böhlke & Mead, 1951)**

喬氏短稚鱈

Figs. 2A-B, Table 1



Fig.2. *Gadella jordani* (Böhlke and Mead, 1951). A. Lateral view, NMNB-P11965, 204 mm SL, fresh. B. Ventral view of abdominal region, NMNB-P16512, 174 mm SL, preserved. Arrows (from left to right) indicate the luminous organ, anus and origin of anal fin.

Physiculus jordani Böhlke & Mead, 1951:27 (Type locality: off Tsurugi Saki Light, Honshu Island, Japan). Chen & Yu, 1986:337.

Gadella jordani: Paulin, 1989:99. Sazonov & Shcherbachev, 2000:S71. Shen & Wu, 2011:239.

Physiculus inbarbatus: Chen & Yu, 1986:337. Shen et al., 1993:165

Material examined. NMMB-P1823 (2, 188-190 mm), 9 Sep. 2003. NMMB-P2841 (1, 175 mm), Kaohsiung, 10 Nov. 2001. NMMB-P3733 (3, 137-154 mm), Kaohsiung, 2 Aug. 2001. NMMB-P4361 (7, 192-260 mm), Tongkang, Dec. 1982. NMMB-P6247 (1, 226 mm), Tongkang, 24 Mar. 1964. NMMB-P6248 (1, 222 mm), Tongkang, 4 Jun. 1965. NMMB-P6249 (1, 220 mm), Tongkang, 7 Jun. 1964. NMMB-P6250 (1, 132 mm), Tongkang, Jan. 1979. NMMB-P7619 (1, 161 mm), Kaohsiung, 4 Jul. 2004. NMMB-P7947(1, 130+ mm), Tongkang, 11 Jun. 2004. NMMB-P7948(1, 132 mm), Tongkang, 11 Jun. 2004. NMMB-P8098 (1, 153 mm), Tongkang, 17 Jun. 2004. NMMB-P8396 (5, 86-106 mm), Tongkang, 16 Mar. 2005. NMMB-P8414 (3, 143-157 mm), Tongkang, 17 Mar. 2005. NMMB-P9131 (1, 113 mm), Tashi, 8 Aug. 2008. NMMB-P9154 (3, 152-155 mm), Tashi, 28 Aug. 2008. NMMB-P9199 (2, 153-177 mm), Tongkang, 18 Sep. 2008. NMMB-P9271 (3, 163-226 mm), Tongkang, 18 Sep. 2008. NMMB-P11965 (1, 204 mm), Tongkang, 28 Feb. 2011. NMMB-P14408 (1, 166 mm), Kaohsiung,

10 Nov. 2001. NMMB-P15550 (7, 145-276 mm), Tongkang. 28 Jan. 2012. NMMB-P16512 (1, 174 mm), Tongkang, 23 Feb. 2012. NMMB-P16567 (1, 212 mm), Tongkang, 31 Dec. 2010. NMMB-P8333 (2, 147-152 mm), Tongkang, 17 Mar. 2005.

Description: Dorsal-fin rays 7~9 (mostly 8)+63~73; anal-fin rays 62~71; pectoral-fin rays 20~22; pelvic-fin rays 5~6; gill rakers 4~5+10~11=15; scale rows between middle of first dorsal base and lateral line 12. Measurement in SL: head length 4.1~4.9; body depth 4.8~6.1; body width 7.0~10.8; predorsal length 3.7~4.2; prepelvic length 4.1~5.4; InV-anus 11.1~15.1. Measurement in HL: snout length 3.0~3.6; orbit diameter 4.1~6.9; interorbital width 2.2~2.7; post-orbital length 1.7~2.1; upper jaw 1.8~2.3; first dorsal-fin height 2.6~4.2; pelvic-fin length 0.9~1.4.

Body slender and compressed; tail compressed; head moderate and depressed anteriorly; snout broad and rounded, not protrudes beyond upper jaw; mouth large, subterminal to terminal; maxillary extending to about midpoint of orbit. Eye small; interorbital space very broad, its width more than twice of eye diameter. Teeth villiform, in broad band on both jaws; outer premaxillary teeth not enlarged; vomer and palatine toothless. Barbel on chin absent. Scale cycloid, covered on body and head, except for tip and lower portion of snout, branchiostegal membranes

and gular region. Luminous organ small, closer to anus than interventral line; anus in front of origin of anal fin. Origin of first dorsal fin behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, outermost two rays filamentous, extending well beyond origin of anal fin; origin of anal fin about opposite to that of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle slender, longer than eye diameter. When fresh, anterior 2/3 of body reddish brown dorsally and blue-tan ventrally; posterior 1/3 reddish, including dorsal and anal fins. When preserved, anterior 2/3 of body grayish dorsally and black ventrally; head and opercular region pale; posterior 1/3 pale; mouth cavity pale with tip of tongue blackish.

Distribution. Western and Central Pacific oceans. In Taiwan, this species was commonly collected by bottom trawlers at depths between 200-600 meters based on our observations.

Remark. Although another congener, *Physiculus inbarbatum* (= *Gadella edelmanni*), has been reported from Taiwanese waters occasionally (i.e. Shen, 1984; Chen & Yu, 1986; Shen et al., 1993), all of these records are considered as misidentifications of *G. jordani*. According to Paulin (1989), *Gadella jordani* differs from *G. edelmanni* in having more second dorsal-fin rays, fewer rakers on lower lobe of first gill arch, and a smaller luminous organ. Examination of our specimens indicate that all these meristic values are within the

range of *G. jordani* and not *G. edelmanni*. However, the size of luminous organ in our specimens overlaps with that of both species, which may be attributable to individual variation.

***Guttigadus nana* (Taki, 1953)**

小瘤鱈

Figs. 3A-B, Table 1

Laemonema (Guttigadus) nana Taki, 1953:205
(Type locality: Ategi-jima, Japan).

Guttigadus nana: Meléndez & Markle
1997:659.

Material examined. ASIZP 63626 (1, 68 mm), Jin-Shan, N. Taiwan, 100 m, 23 Oct. 2000. ASIZP 62398 (2, 49-54 mm), Jin-Shan, N. Taiwan, 100 m, 1 Mar. 2001.

Description. Dorsal-fin rays 6+49~52; anal-fin rays 49~53; pectoral-fin rays 22~23; pelvic-fin rays 2; scale rows between middle of first dorsal base and lateral line 8*; gill rakers 1~2+5~6=6~8. Measurement in SL: head length 4.0~4.3; body depth 5.5~6.2; body width 6.6~6.8; predorsal length 3.5~3.8; prepelvic length 6.9~8.3; InV-anus 3.3~3.8. Measurement in HL: snout length 4.0~4.6; orbit diameter 3.2~3.6; interorbital width 3.9~4.6; post-orbital length 1.7~1.9; upper jaw 2.0~2.2; first dorsal-fin height 2.4~2.5; pelvic-fin length 1.3~1.6; barbel length 4.2~6.2. (*from Meléndez & Markle, 1997)

Body short and less compressed; tail compressed; head large and depressed



Fig. 3. *Guttigadus nana* (Taki, 1953). A. ASIZP 63626, 68 mm SL, preserved, lateral view. B. ASIZP 62398, 54 mm SL, preserved, lateral view. Photo by M.-Y. Lee.

anteriorly; snout broad and rounded, protrudes slightly beyond upper jaw; mouth large, subterminal to terminal; maxillary extending to posterior margin of orbit. Eye small; interorbital space smaller than eye diameter. Teeth villiform, in narrow band on both jaws; outer premaxillary teeth not enlarged; vomerine and palatine toothless. Barbel on chin shorter than orbit diameter. Scale cycloid, covered on body and head, except for tip and lower portions of snout, branchiostegal membranes and gular region. Luminous organ absent; anus in front of origin of anal fin. Origin of first dorsal slightly behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, with two short filamentous rays, extending to

pectoral-fin base; origin of anal fin slightly behind that of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, about equal to eye diameter. When preserved, uniformly pale.

Distribution. Western North Pacific Ocean. Two specimens collected from northern Taiwan at 100 meters depth, which represent the first record of Taiwan.

Remarks. Meléndez & Markle (1997) reviewed *Laemonema* and divided it into two genera, *Laemonema* and *Guttigadus*. The former has a narrow interorbital space which is smaller than the eye diameter, whereas the later has an interorbital space broader than the eye diameter. Although the species has a relatively narrow interorbital

space and was placed in *Laemonema* by recent authors (i.e. Nakabo, 2002, Takahashi et al., 2003), here we follow Meléndez & Markle (1997) to include the species in *Guttigatus*. According to Meléndez & Markle (1997), this is a dwarf species with a maximum size 73.1-mm SL and is paedomorphic.

***Laemonema rhodochir* Gilbert, 1905**

玫紅絲鰭鱈

Fig. 4, Table 1

Laemonema rhodochir Gilbert, 1905:657 (Type locality: Off southern coast of Oahu Island, Hawaiian Islands). Okamura in Okamura et al, 1982:139.

Laemonema palauense Okamura, 1982:137 (Type locality: Kyushu-Palau Ridge). Paulin & Roberts 1997:25. Shen & Wu, 2011:240.

Material examined. ASIZP 60092 (1,

153 mm), Nan-fang-ao, 19 Nov. 1997. ASIZP 63710 (1, 122 mm), northeastern Taiwan, 1185 m, 30 May 2003. ASIZP 66282 (1, 120+ mm), South China Sea, 364 m, 17 Aug. 2005. ASIZP 71028 (1, 96 mm). NMMB-P11966 (14, 102-157 mm), Nan-fang-ao, 11 Mar. 2011. NMMB-P11967 (1, 154 mm), Nan-fang-ao, 11 Mar. 2011. NMMB-P11968 (1, 141+ mm), Nan-fang-ao, 11 Mar. 2011.

Description. Dorsal-fin rays 6+60~67; anal-fin rays 56~62; pectoral-fin rays 22~24; pelvic-fin rays 2; scale rows between middle of first dorsal base and lateral line 8~9; gill rakers 4~5+11~14=15~18. Measurement in SL: head length 4.5~4.7; body depth 5.7~6.6; body width 8.4~8.9; predorsal length 3.9~4.2; prepelvic length 5.8~6.6. Measurement in HL: snout length 3.8~4.5; orbit diameter 3.9~4.4; interorbital width 6.3~6.8; post-orbital length 2.0~2.1; upper jaw 2.1~2.3; first dorsal-fin height



Fig. 4. *Laemonema rhodochir* Gilbert, 1905, NMMB-P11966, 128 mm SL, preserved, lateral view.

1.9~2.1; pelvic-fin length 0.8~0.9; barbel length 4.9~6.1.

Body slender and compressed; tail compressed; head moderate and depressed anteriorly; snout broad and rounded, slightly protrudes beyond upper jaw; mouth large, subterminal to terminal; maxillary extending to posterior half of orbit. Eye large; interorbital space narrow, its width smaller than eye diameter. Teeth villiform, in broad band on both jaws; outer premaxillary teeth not enlarged; vomerine with a small patch of teeth; palatine toothless. Barbel on chin shorter than orbit diameter. Scale cycloid, covered on body and head, except for tip and lower portions of snout, branchiostegal membranes and gular region. Luminous organ absent; anus in front of origin of anal fin. Origin of first dorsal fin behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, with two filamentous rays, extending well beyond origin of anal fin; origin of anal fin behind that of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, about equal to eye diameter. When fresh, body pinkish with dorsal surface blackish; dorsal fin and posterior 2/3 of anal fin blackish; lips, posterior head, gular, and abdominal regions pale pink. When preserved, body pale yellow with dorsal surfaces blackish; dorsal fin and posterior 2/3 of anal fin blackish; all other regions pale; mouth cavity pale.

Distribution. Widespread in Pacific

Ocean. In Taiwan, specimens were collected from both the northeastern and southwestern regions at depths 364-1185 m.

Remarks. All specimens were originally identified as *Laemonema palauense*. Meléndez & Markle (1997) recognized that *L. palauense* is a junior synonym of *L. rhodochir*. We concur.

***Lotella tosaensis* (Kamohara, 1936)**

土佐灣鱈

Figs. 5A-B, Table 1

Physiculus tosaensis Kamohara, 1936:446 (type locality: off Kochi Prefecture, Japan). Chen & Yu, 1986:337.

Lotella tosaensis: Okamura in Masuda et al. 1984:91.

Material examined. ASIZP63676 (1, 112 mm), Tongkang, no date. NMMB-P4403 (22, 86-131 mm), Tongkang, 1 Dec. 1982. NMMB-P5128 (2, 104-112 mm), Kaohsiung, Oct. 1965. NMMB-P7096 (1, 86 mm), Shao-liu-chiu, 26 Dec. 2003. NMMB-P7119 (1, 90 mm), Tongkang, 26 Dec. 2003. NMMB-P13849 (1, 115 mm), Tongkang, 10 Aug. 2011. NMMB-P13882 (1, 119 mm), Tongkang, 01 Jul. 2011. NMMB-P15553 (1, 120 mm), Tongkang, 28 Jan. 2012.

Description: Dorsal-fin rays 6+46~50; anal-fin rays 40~45; pectoral-fin rays 19~26; pelvic-fin rays 8~9; scale rows between middle of first dorsal base and lateral line 8~10; gill rakers 2~3+5~6=7~8. Measurement in SL: head length 3.2~4.3; body depth 3.8~4.6; body width 4.3~6.9;



Fig.5. *Lotella tosaensis* (Kamohara, 1936). A. NMMB-P13882, 119 mm SL, fresh, lateral view. B. NMMB-P15553, 124 mm SL, fresh, lateral view.

predorsal length 3.1~3.8; prepelvic length 4.0~5.1; InV-anus 4.9~6.5. Mearusement in HL: snout length 3.8~4.9; orbit diameter 3.4~4.0; interorbital width 3.8~4.9; post-orbital length 1.6~2.0; upper jaw 1.7~2.2; first dorsal-fin height 2.0~2.8; pelvic-fin length 1.1~1.4; barbel length 3.9~6.8.

Body relatively short and compressed; tail compressed; head moderate and depressed anteriorly; snout broad and rounded, protrudes beyond upper jaw; mouth large, subterminal to terminal; maxillary extending to over rear margin of

orbit. Eye large; interorbital space wide, about equal to eye diameter. Teeth villiform, in broad band on both jaws; outer premaxillary teeth enlarged; vomerine and palatal toothless. Barbel on chin short, equal to or shorter than orbit diameter. Scale cycloid, covered on body and head, except for tip and lower portion of snout, branchiostegal membranes, and gular region. Luminous organ absent; anus in front of origin of anal fin. Origin of first dorsal slightly behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, two outermost rays filamentous, extending to

origin of anal fin or not; origin of anal fin slightly behind to that of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, about equal to eye diameter. When fresh, body brownish; undersides of head, abdomen region, and anal-fin base pale; margins of dorsal and anal fins blackish. When preserved, body yellowish brown; ventral surface pale; margins of dorsal and anal fins blackish; mouth cavity pale.

Distribution. Western North Pacific Ocean off Japan, Taiwan and Vietnam. In Taiwan, specimens were collected by bottom trawls at depths 200-330 meters.

Remarks. Prokofiev (2008) recognized his Vietnamese specimens as a doubtful species which has relatively long barbel and 6 dorsal-fin rays. The barbel length in our specimens is relatively short, but all have 6 dorsal-fin rays in our specimens. Moreover, our specimens also have a relatively long pored lateral line, extending to nearly half length of body. It is likely that the population in South China Sea is different from that of East China Sea. More investigations are needed to understand the geographic variations of present species.

***Physiculus chigodarana* Paulin, 1989**

絲背鬚稚鱈

Fig. 6A-C, Table 2

Physiculus chigodarana Paulin, 1989:107 (Type locality: Kagishima, Japan).

Physiculus roseus Alcock, 1891:28 (Type locality: Andaman Sea). Chen & Yu, 1986:337. Shen et al., 1993:166. Shen & Wu, 2011:240.

Material examined: ASIZP 58040 (1, 200 mm), Tongsha, 1 May 1993 ASIZP 63093 (1,205 mm), Tashi, 350-650 m, 27 Apr. 2004. NMMB-P4036 (1, 210 mm), Penhou, 17 Jul. 1960. NMMB-P9299 (1, 166 mm), Tongkang, 27 Aug. 2008. NMMB-P10305 (1, 82.4 mm), Tongkang, 15 Nov. 2008. NMMB-P11963 (1, 143 mm), Tongkang, 28 Feb. 2011. NMMB-P11964 (1, 172 mm), Tongkang, 28 Feb. 2011. NMMB-P14258 (1, 120 mm), Tongkang, 20 Oct. 2011. NMMB-P15521 (1, 182 mm), Hsio-liu-chou, 27 Jun. 2011. NMMB-P15554 (3, 127-140 mm), Tongkang, 28 Jan. 2012. NMMB-P16339 (1, 135 mm), Kaohsiung, 22 Mar. 2012. NMMB-P16401 (1, 126 mm), Tongkang, 21 Feb. 2012. NMMB-P16425 (1, 136 mm), Tongkang, 21 Feb. 2012.

Description: Dorsal-fin rays 8~10 (rarely 10)+64~70; anal-fin rays 64~75; pectoral-fin rays 22~25; pelvic-fin rays 7~8; scale rows between middle of first dorsal base and lateral line 9~10; gill rakers 3~6 (usually 4) + 8~11 (rarely 8) =12~15. Measurement in SL: head length 4.0~4.4; body depth 5.0~6.3; body width 6.0~7.8; predorsal length 3.5~4.0; prepelvic length 4.3~5.7; distance between base of pelvic and anus 9.9~14.6. Measurement in HL: snout length 3.3~4.1; orbit diameter 3.7~4.5; interorbital width 3.9~4.9;

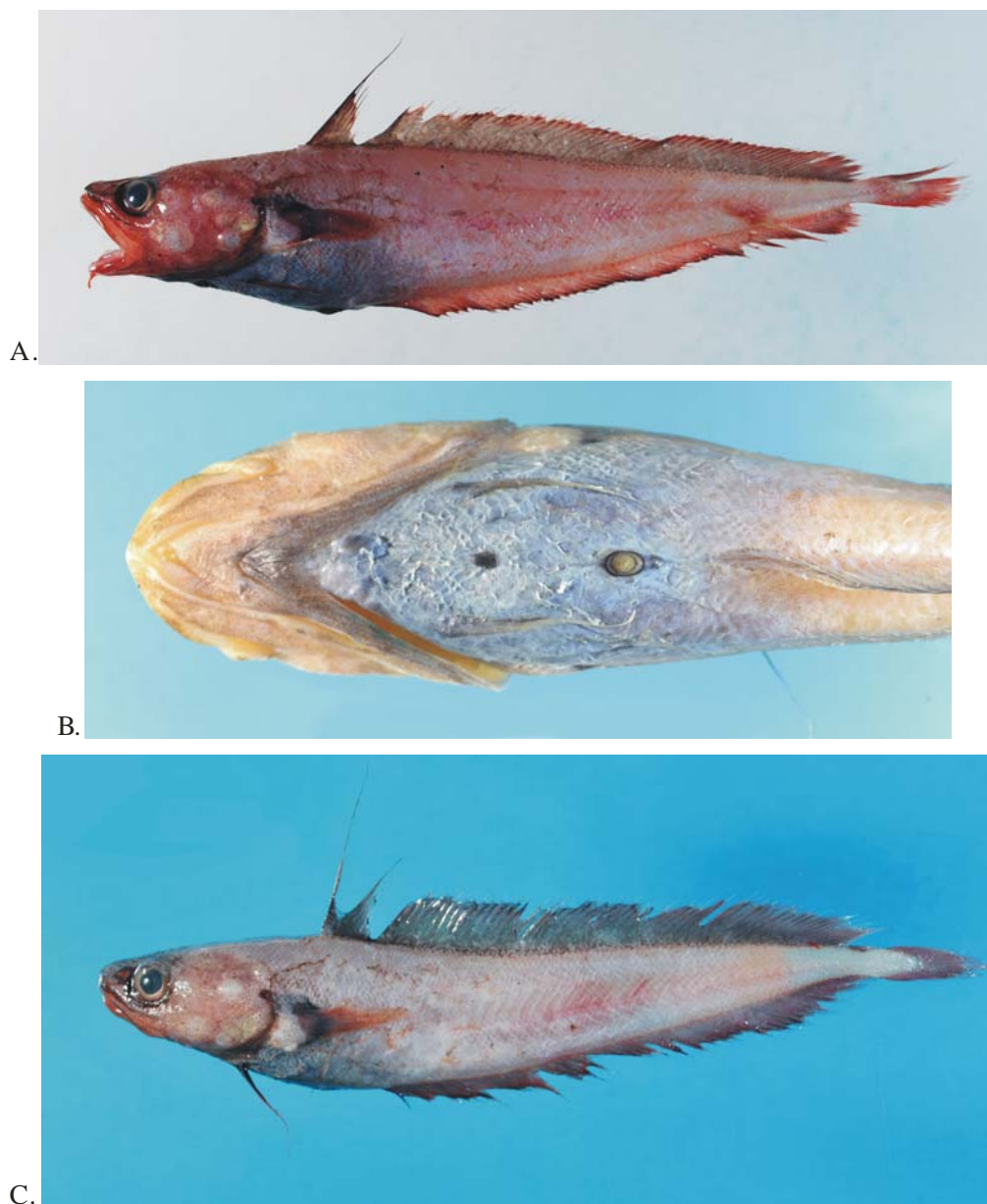


Fig. 6. *Physiculus chigodarana* Paulin, 1989. A. NMMB-P15521, 182 mm SL, fresh, lateral view. B. Ventral view of abdominal region. C NMMB-P16401, 118 mm SL, fresh, lateral view.

Tab. 2. Morphometric data of six species in *Physiculus* examined in the present study.

	<i>P. chigodarana</i>		<i>P. japonicus</i>		<i>P. longifilis</i>	<i>P. nigripinnis</i>	<i>P. rhodopinnis</i>		<i>Physiculus</i> sp.
SL (mm)	118-205 (n=14)		162-310 (n=11)		107+ (n=1)	163 (n=1)	167-188 (n=3)		210+ (n=1)
In %SL	Mean (Range)	SD	Mean (Range)	SD			Mean (Range)	SD	
Body depth	17.9 (15.9-19.9)	1.0	20.5 (18.0-23.0)	2.5	--	15.8	19.5 (17.3-21.2)	2.0	--
Body width	15.1 (12.8-16.7)	1.0	15.3 (12.6-17.7)	1.7	--	15.9	15.1 (14.1-15.8)	0.9	--
Head length	23.8 (22.8-24.8)	0.6	23.9 (21.7-26.1)	1.4	--	24.7	24.7 (23.2-25.9)	1.4	--
Predorsal length	27.1 (24.8-29.0)	1.1	27.3 (25.4-29.8)	1.3	--	27.2	28.0 (26.5-28.9)	1.3	--
Prepelvic length	19.6 (17.6-23.0)	1.5	20.3 (18.2-24.0)	1.8	--	21.5	21.5 (19.6-23.0)	1.7	--
In % HL									
Snout length	27.4 (24.7-30.8)	2.0	26.8 (24.7-28.6)	1.1	26.9	24.1	27.6 (26.9-29.0)	1.2	31.8
Eye diameter	25.3 (22.0-27.0)	1.2	23.3 (21.0-26.5)	1.7	23.8	25.3	23.9 (22.5-24.9)	1.3	25.5
Interorbital width	23.5 (20.3-25.4)	1.8	25.1 (21.9-27.9)	2.1	30.3	19.4	25.1 (22.9-26.4)	1.9	23
Post-orbital length	53.0 (49.8-55.8)	1.7	53.0 (51.2-55.8)	1.3	57.9	50.1	52.4 (50.7-54.5)	1.9	50.8
Upper-jaw length	49.1 (46.3-59.4)	3.4	45.9 (43.5-49.1)	1.6	55.5	36.0	47.8 (45.1-49.9)	2.4	48.3
Pelvic-fin length	58.0 (47.3-65.3)	5.2	60.2 (45.6-69.4)	6.5	179.3	49.9	80.8 (74.2-88.5)	7.2	109.1
Barbel length	14.8 (11.4-18.5)	2.3	19.9 (15.6-23.1)	2.5	30.0	19.1	14.7 (13.7-15.8)	1.0	15.4
First dorsal-fin height	85.2 (70.3-98.2)	8.9	38.7 (30.1-46.0)	5.0	35.5	43.2	35.9 (31.1-44.7)	7.7	35.4
in % InV-af									
InV-LO	11.6 (9.2-14.1)	1.5	20.8 (17.1-26.6)	3.3	22.4	22.0	25.3 (23.7-28.1)	2.4	23.7
LO	11.9 (8.5-14.1)	1.5	10.0 (8.6-13.0)	1.3	12.0	16.3	13.8 (13.7-14.1)	0.2	5.9
InV-anus	60.2 (51.3-68.0)	4.8	55.5 (47.5-61.4)	4.2	64.8	49.8	54.4 (51.5-56.4)	2.5	47.8

post-orbital length 1.8~2.0; upper jaw 1.7~2.2; first dorsal-fin height 1.0~1.4; pelvic-fin length 1.5~2.1; barbel length 5.4~8.8.

Body slender; tail compressed; head moderately small and depressed anteriorly; snout broad and rounded, protruding slightly beyond upper jaw; mouth large, subterminal to terminal; maxillary extending to near rear margin of orbit. Eye small; interorbital space wide, about equal to eye diameter. Teeth villiform, in broad band on both jaws; outer premaxillary teeth not enlarged; vomerine and palatine toothless. Barbel on chin short, equal to or shorter than orbit diameter. Scale cycloid, covered on body and head, except for suborbital region, lower part of snout, branchiostegal membranes, and gular region. Luminous organ large, closer to interventral line than anus; anus behind midpoint between interventral line and origin of anal fin. Origin of first dorsal behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, two outermost rays filamentous, extending to origin of anal fin; origin of anal fin approximately opposite to that of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, less than eye diameter. When fresh, body pale red; snout, abdomen, branchiostegal membranes and dorsal fin blackish; anal fin reddish. When preserved, body pale; snout, dorsal fin and abdomen blackish; mouth cavity pale.

Distribution. Western North Pacific

Ocean off Japan and Taiwan. In Taiwan, specimens were commonly collected from southwestern region by bottom trawls at depths around 200-400 meters.

Remarks. This species can be easily distinguished from other members occurring in Taiwan by the very high first dorsal fin with its second ray filamentous. Previous records of *Physiculus roseus* are proven to be misidentifications of the present species.

***Physiculus japonicus* Hilgendorf, 1879**

日本鬚稚鱈

Figs. 7A-B, Table 2

Physiculus japonicus Hilgendorf, 1879:80 (Type locality: Yokohama, Japan).

Okamura in Masuda et al., 1984:91. Shen, 1984:143. Chen & Yu, 1986:337. Paulin, 1989:112. Shen et al., 1993:165. Shen & Wu, 2011:240.

Lotella maximowiczi Herzenstein, 1896:13 (Type locality: Hakodate, Oshima Subprefecture, Hokkaido, Japan). Chen & Yu, 1986:337.

Physiculus maximowiczi: Shen, 1984:143. Shen et al., 1993:165.

Material examined. ASIZP 61413 (2, 143-193 mm), Aodi, 200 m, 15 Nov. 2000. ASIZP 63091 (3, 160-186 mm), Tashi, 350-650 m, 27 Apr. 2004. ASIZP 63093 (1, 205 mm), Tashi, 350-650 m, 27 Apr. 2004. NMMB-P1665 (1, 243 mm), Tashi, 9 Sep. 2003. NMMB-P4035 (1, 195 mm), Tongkang, 29 Mar. 1964. NMMB-P4432



Fig. 7. *Physiculus japonicus* Hilgendorf 1879. NMMB-P1665, 243 mm SL, preserved. A. Lateral view. B. Ventral view of abdominal region.

(1, 190 mm), Tongkang, 21 Mar. 1979. NMMB-P7197 (2, 247-260 mm), Tashi, 8 May 2003. NMMB-P7403 (3, 162-196 mm), Tashi, 16 Apr. 2004. NMMB-P7494 (3, 223-310 mm), Tashi, 16 Apr. 2004. NMMB-P8612 (1, 248 mm), Tashi, 18 Jun. 2005. NMMB-P9169 (1, 145 mm), Tashi, 9 Sep. 2003. NMMB-P10126 (1, 254 mm), Tashi, 8 May 2003. NMMB-P14819 (1, 213 mm), Tashi, 9 Sep. 2003.

Description. Dorsal-fin rays 9~10+65~74; anal-fin rays 70~81; pectoral-fin rays 23~26; pelvic-fin rays 5~7; scale rows between middle of first dorsal base and lateral line

11-15; gill rakers 3~4+6~9 (rarely 9) = 10~12. Measurement in SL: head length 3.8~4.6; body depth 4.4~5.6; body width 5.7~7.9; predorsal length 3.4~3.9; prepelvic length 4.2~5.5; V-anus 3.1~5.8. Measurement in HL: snout length 3.5~4.0; orbit diameter 3.8~4.8; interorbital width 3.6~4.6; post-orbital length 1.8~2.0; upper jaw 2.0~2.3; first dorsal-fin height 2.2~3.3; pelvic-fin length 1.4~2.2; barbel length 4.3~6.4.

Body robust; tail compressed; head moderately large and depressed anteriorly; snout broad and rounded, protrudes

slightly beyond upper jaw; mouth large and subterminal; maxillary extending to posterior half of orbit. Eye small; interorbital space wide, wider than eye diameter. Teeth conical, in broad band on both jaws; outer premaxillary teeth enlarged or not; vomerine and palatal toothless. Barbel on chin short, equal to or shorter than orbit diameter. Scale cycloid, covered on body and head, except for suborbital region, lower part of snout and branchiostegal membranes; gular region with scales or not. Luminous organ relatively large, closer to interventral line than anus; anus behind midpoint between interventral line and origin of anal fin. Origin of first dorsal posterior to vertical of pectoral-fin base; pelvic fin inserts before pectoral-fin base, two outermost rays filamentous, extending to origin of anal fin; origin of anal fin about opposite to that of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, less than eye diameter. When fresh, body reddish brown; undersides of head and abdomen blue-tan; margins of dorsal and anal fins blackish; rest fins reddish. When preserved, body yellowish brown; undersides of head and abdomen blackish; margins of dorsal and anal fins blackish; all other fins pale; mouth cavity pale.

Distribution. Western North Pacific Ocean off Taiwan, Japan and Hawaiian Islands. In Taiwan, specimens were commonly collected by bottom trawls at depths around 100-400 m.

Remarks: Two species, *P. japonicus* and *P. maximowiczi* were commonly recorded in Taiwan by previous authors (i.e. Shen, 1984, Chen & Yu, 1986, Shen et al., 1993). However, both species seems to be confused with each other and no diagnostic characters were provided to distinguish them. Paulin (1989) mentioned that holotype of *P. japonicus* and *P. maximowiczi* were different from each other in having outer jaw teeth enlarged and lacking scales on gular region (former) and jaw teeth equal sized and scale present on gular region (later). However, “a small number of fish (19 of 73) had equal sized or sub-equal teeth and a variable number of gular scales. The size and position of the light organ of these specimens, and all other meristic and morphometric measurements are identical to specimens of *P. japonica* examined.” Thus, *P. maximowiczi* is considered to be a junior synonym of *P. japonicus* (Paulin, 1989:113-114). We have also examined a large number of specimens in the collections and found that the presence of scales on the gular region and enlarged teeth on jaws are highly variable and not always associated with each other, which also support the results suggested by Paulin (1989).

***Physiculus longifilis* Weber, 1913**

長絲小褐鱈

Figs. 8A-C, Table 2

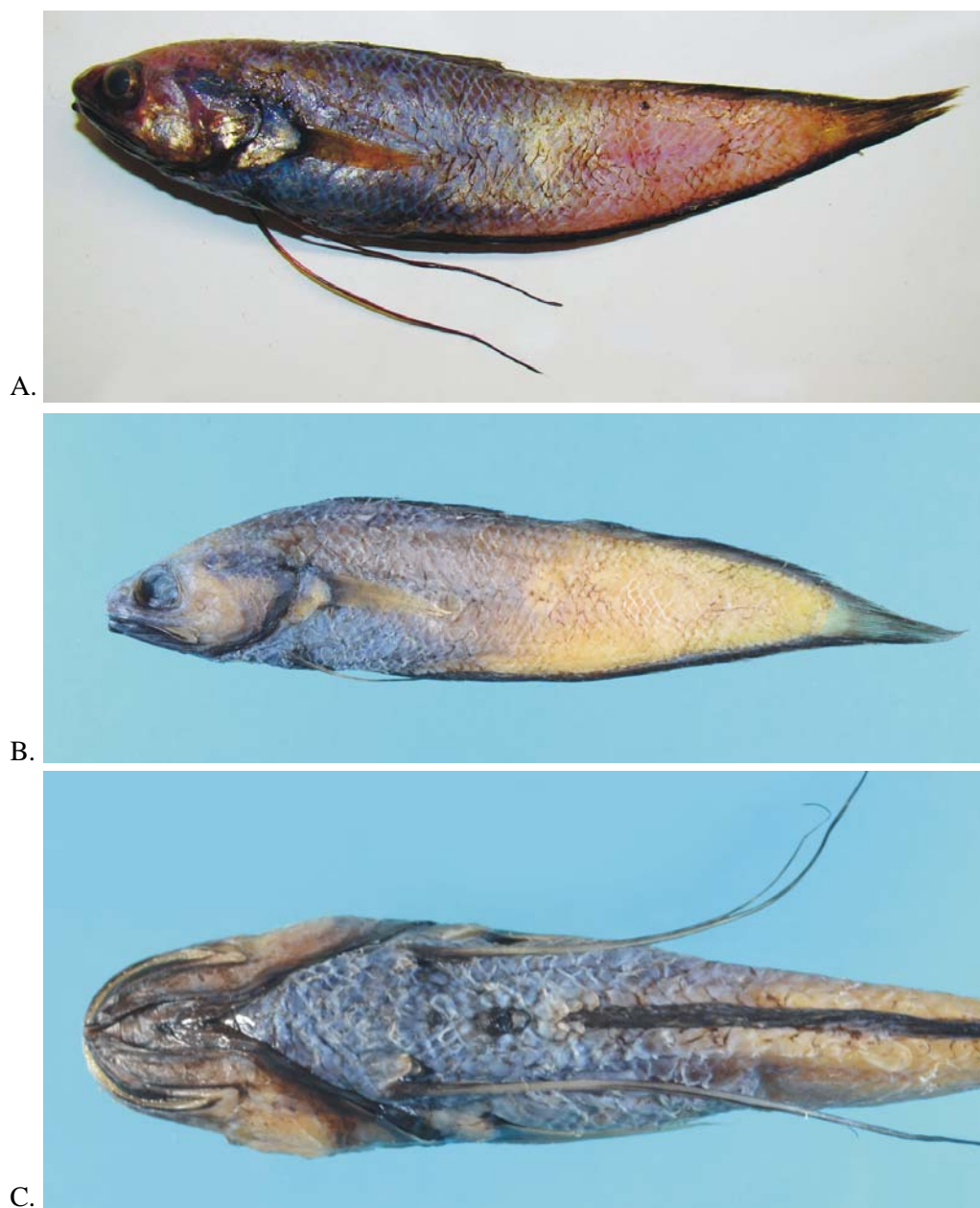


Fig. 8. *Physiculus longifilis* Weber, 1913, ASIZP 71565, 107+ mm SL. A. Lateral view, fresh. B. Lateral view, preserved. C. Ventral view of abdominal region.

Physiculus longifilis Weber, 1913:178 (Type locality: Flores Sea, Indonesia). Paulin, 1989:115. Paulin & Roberts, 1997:30. Prokofiev, 2008:863.

Material examined. ASIZP 71565 (1, 107+ mm), Tongkang, 15 Nov. 2008.

Description. Dorsal-fin rays 5+50+; anal-fin rays 49+; pectoral-fin rays 23; pelvic-fin rays 6; scale rows between middle of first dorsal base and lateral line 9; gill rakers 3+8=11. Measurement in HL: snout length 3.7; orbit diameter 4.2; interorbital width 3.3; post-orbital length 1.7; upper jaw 1.8; first dorsal-fin height 2.8; pelvic-fin length 0.6; barbel length 3.3.

Body slender, compressed posteriorly; tail compressed; head depressed anteriorly; snout broad and blunt, protrudes beyond upper jaw; mouth large and subterminal; maxillary extending to posterior margin of orbit; upper jaw slight prominent, overhanging lower jaw when mouth closed. Eye small; interorbital space flat, wider than eye diameter. Teeth villiform, in broad band on both jaws, outer rows of teeth not enlarged; vomerine and palatal toothless. Barbel on chin short, its length about equal to orbit diameter. Scale cycloid, covered on body and head, except for suborbital region, tip and lower part of snout, branchiostegal membranes and gular region. Luminous organ relatively small, closer to interventral line than anus; anus slightly behind midpoint between interventral line and origin of anal fin.

Origin of first dorsal fin behind pectoral-fin base; pelvic fin inserts before pectoral-fin base, its outer two rays filamentous, extending to the 28th ray of anal fin; origin of anal fin approximately opposite to origin of second dorsal fin. When fresh, body reddish brown; underside of head, gular region, dorsal, anal, and pelvic fin black; abdominal region bluish. When preserved, body pale brown; underside of head, gular region, abdomen, and all fins except for pectoral fin black; mouth cavity pale with tip of tongue blackish.

Distribution. Western Pacific Ocean. In Taiwan, the single specimen was collected from southwestern region at a depth around 300 m, which represents the first record of Taiwan.

***Physiculus nigripinnis* Okamura, 1982**

黑翼小褐鱈

Figs. 9A-B, Table 2

Physiculus nigripinnis Okamura, 1982:127 (Type locality: Kyushu-Palau Ridge). Okamura in Masuda et al., 1984:91. Paulin, 1989:120. Shen & Wu, 2011:240.

Material examined. NMMB-P14223 (1, 163 mm), Tongkang, 03 Nov. 2011.

Description: Dorsal-fin rays 8+62; anal-fin rays 68; pectoral-fin rays 26; pelvic-fin rays 5; scale rows between middle of first dorsal base and lateral line 10; gill rakers 3+7=10. Measurement in SL: head length 4.0; body depth 6.3; body width 6.3;



Fig. 9. *Physiculus nigripinnis* Okamura 1982, NMMB-P14223, 163 mm SL, preserved. A. Lateral view. B. Ventral view of abdominal region.

predorsal length 3.7; prepelvic length 4.6; InV-anus 3.3. Measurement in HL: snout length 4.2; eye diameter 4.0; interorbital width 5.2; post-orbital length 2.0; upper jaw 2.8; first dorsal-fin height 2.3; pelvic-fin length 2.0; barbel length 5.2.

Body slender, cylindrical anteriorly and compressed posteriorly; tail compressed; head depressed anteriorly; snout broad and blunt, barely protruding beyond upper jaw; mouth large and subterminal; maxillary extending to below posterior half orbit;

upper jaw slight prominent, overhanging lower jaw when mouth closed. Eye large; interorbital space flat, narrower than eye diameter. Teeth conical, in broad band on both jaws, outer rows of teeth not enlarged; vomerine and palatal toothless. Barbel on chin short, smaller than orbit diameter. Scale cycloid, covered on body and head, except for suborbital region, lower part of snout and branchiostegal membranes; gular region without scales. Luminous organ relatively large, closer to

anus than origin of interventral line; anus slightly behind midpoint between interventral line and origin of anal fin. Origin of first dorsal posterior to vertical of pectoral-fin base; pelvic fin inserts before pectoral-fin base, its outer two rays filamentous, extending to origin of anal fin; origin of anal fin posterior to origin of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, shorter than eye diameter. Coloration: preserved specimen pale with abdomen bluish black; all fins blackish; mouth cavity and tongue pale; peritoneum blackish dorsally and pale ventrally.

Distribution. Western North Pacific Ocean

of Taiwan and Japan. In Taiwan, the only specimen was collected from southwestern region at depth around 300 meters.

Remarks. Our specimen agrees with the original description except for the coloration being much paler than the color photo provided in the original description. However, the absence of scales on the gular region, luminous organ closer to anus than origin of interventral line and all fins being blackish provides evidence that this is identical to *P. nigripinnis*.

***Physiculus rhodopinnis* Okamura, 1982**

紅鰭小褐鱈

Figs. 10A-B, Table 2

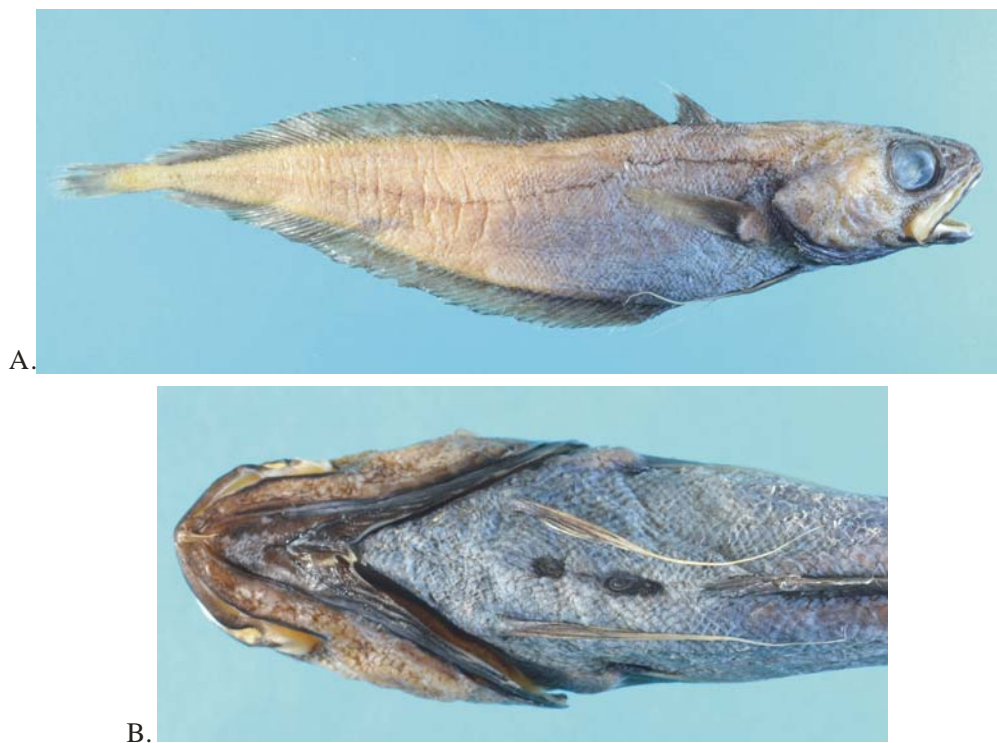


Fig. 10. *Physiculus rhodopinnis* Okamura, 1982, NMMB-P13806, 188 mm SL, preserved. A. Lateral view. B. Ventral view of abdominal region.

Physiculus rhodopinnis Okamura in Okamura et al., 1982:119 (Type locality: Kyushu-Palau Ridge). Okamura in Masuda et al., 1984:91. Paulin, 1989:122.

Material examined. NMMB-P13806 (3, 167-188 mm), Tongkang, 2 Jun. 2011.

Description: Dorsal-fin rays 8+65~72; anal-fin rays 70-72; pectoral-fin rays 23~27; pelvic-fin rays 7; 9~11 between middle of first dorsal base and lateral line. Gill rakers 3+8=11. Measurement in SL: head length 3.9~4.3; body depth 4.7~5.8; body width 6.3~7.1; predorsal length 3.5~3.8; prepelvic length 4.4~5.1; InV-anus 12.7~14.3. Measurement in HL: snout length 3.4~3.7; eye diameter 4.0~4.5; interorbital width 3.8~4.4; post-orbital length 1.8~2.0; upper jaw 2.0~2.2; first dorsal-fin height 2.2~3.2; pelvic-fin length 1.1~1.3; barbel length 6.3~7.3.

Body slender, slightly compressed; tail compressed; head depressed anteriorly; snout broad and blunt, not protruding beyond upper jaw; mouth large and subterminal; maxillary extending to below posterior half of orbit; upper jaw slightly prominent, overhanging lower jaw when mouth closed. Eye large; interorbital space flat, its width about equal to eye diameter. Teeth conical, in broad band on both jaws, outer rows of teeth not enlarged; vomerine and palatal toothless. Barbel on chin short, smaller than orbit diameter. Scale cycloid, covered on body and head, except for suborbital region,

lower part of snout and branchiostegal membranes; gular region with scales. Luminous organ relatively large, closer to interventral line than anus; anus slightly behind midpoint between interventral line and origin of anal fin. Origin of first dorsal posterior to vertical of pectoral-fin base; pelvic fin inserts before pectoral-fin base, its outer two rays filamentous, extending to at least the 8th ray of anal fin; origin of anal fin approximately opposite to the origin of second dorsal fin; caudal fin rounded, fan-shaped. Caudal peduncle short, shorter than eye diameter. Coloration: preserved specimen pale with abdomen and gular region bluish black; dorsal and anal fins blackish; anterior half of pectoral and pelvic fins blackish; oral and branchial cavities and tongue pale; peritoneum blackish dorsally and pale ventrally.

Distribution. Indo-west Pacific ocean. In Taiwan, three specimens were collected from southwestern region at depths around 300 meters, which represents the first record from Taiwan.

***Physiculus* sp.**

小褐鰭屬之一種

Figs. 11A-B, Table 2

Material examined. ASIZP 58039 (1, 210+ mm SL), Chong-chou, Kaohsiung County, SW Taiwan, 1 Dec. 1985.

Description. Dorsal fin rays 8-47+; pectoral fin ray 29; anal fin rays 47+;



Fig.11. *Physiculus* sp., ASIZ-P0058039, 210+ mm SL, preserved. A. Lateral view. B. Ventral view of abdominal region.

pelvic fin rays 7(right) and 5(left); scales in longitudinal series 105+; scale rows between base of first dorsal fin and lateral line 11; gill rakers 3+4. Measurement in HL: body depth 1.4 in HL; body width 1.8 in HL; snout length 3.1; orbit diameter 3.9; interorbital width 4.4; postorbital part of head 2.0; upper jaw 2.1 ; first dorsal-fin height 2.8; pelvic-fin length 0.9; barbel length 6.5.

Body robust, gradually compressed to tail; head large, depressed anteriorly;

eye large, wider than interorbital space; snout broad and rounded. Mouth large and terminal; maxilla extends to near rear margin of eye; upper jaw slightly overhanging the lower jaw. Teeth villiform, in wide band on both jaws; vomerine and palatine toothless. Chin barbel shorter than eye diameter. Origin of first dorsal fin slightly behind vertical of base of pectoral fin; origin of anal fin slightly behind vertical of origin of second dorsal fin; pelvic fin inserts slightly anterior to pectoral fin, the

fin extend to 21st ray of anal fin, all rays long. Scales cycloid, oval-shaped; scale patch extends anteriorly to anterior nostril and below the middle of eye; a large naked area on snout and area below middle of eye. Luminous organ very small, closer to interventral line than anus; anus large and rounded, at midpoint between interventral line and origin of anal fin; genital papilla separated from anus by approximately 2 scales. When preserved specimen lost most of its coloration; head light brown; gular region, branchiostegal membranes, naked area of snout and outer margins of dorsal and anal fins deep brownish, with all other portions of body creamy white.

Remark. The species, despite the damaged and regenerated tail, is in fairly good shape. It is unequal in having an extremely large pelvic fin. Although *P. longifilis* also has a very long pelvic fin, only the two outermost rays are elongate (vs. all rays elongate). Moreover, the lateral line in the specimen is incomplete, approximately equal to pectoral fin length. According to Cohen (1979) and Paulin (1989), only *Lotella tosaensis* and *Physiculus coheni* has an incomplete short lateral line. The specimen differs from both species in having an extremely large pelvic fin. Although the specimen seems to be an undescribed species, additional materials are required for detailed investigation.

A key to all morid species found in Taiwan

- 1A. Snout a V-shaped plate with lateral keels.....*Antimora microlepis*
- 1B. Snout short and rounded.....2
- 2A. Chin barbel absent...*Gadella jordani*
- 2B. Chin barbel present.....3
- 3A. Luminous organ absent.....4
- 3B. Luminous organ present.....
.....(*Physiculus*) 6
- 4A. Pelvic fin with 9 rays.....
.....*Lotella tosaensis*
- 4B. Pelvic fin with 2 filamentous rays....
.....5
- 5A. Pelvic fin long, extending to overhanging origin of anal fin.....
.....*Laemonema rhodochir*
- 5B. Pelvic fin short, extending to below pectoral-fin base.....*Guttigadus nana*
- 6A. Pelvic fin extremely long, the appressed fin reaches mid-length of anal fin....7
- 6B. Pelvic fin short, the appressed fin reaches only origin of anal fin.....8
- 7A. Scales large; gill rakers 3+8=11.....
.....*P. longifilis*
- 7B. Scales small; gill rakers 3+4=7.....
.....*Physiculus* sp.
- 8A. First dorsal fin rays filamentous, its height 1.0-1.4 in HL.....
.....*P. chigodarana*
- 8B. First dorsal fin rays not filamentous, its height more than 2.2 in HL.....9
- 9A. First dorsal fin rays 9-10.....
.....*P. japonicus*
- 9B. First dorsal fin rays 7-8.....
.....10
- 10A. All fins black; no scale patch on gular region; luminous organ closer

- to anus than origin of interventral line.....*P. nigripinnis*
10B. All fins reddish brown; scale patch on gular region; luminous organ closer to origin of interventral line than anus.....*P. rhodopinnis*

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台灣產稚鱈科物種重新檢視

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摘 要

本文重新檢視台灣產稚鱈科物種。共計出鑑定六屬十一種，其中細鱗擬深海鱈、小瘤鱈、長絲小褐鱈、紅鰭小褐鱈等四種為台灣首次紀錄。另發現一未鑑定之小褐鱈屬物種。過去所紀錄之紅鬚小褐鱈經證實為絲背小褐鱈之誤鑑，應自台灣魚類中移除。本文並提供所有重新檢視物種之檢索資料。

關鍵詞：分類學，魚類，硬骨魚，新紀錄，台灣。