

A revision of the gobiid fish genus *Trypauchen* (Gobiidae: Amblyopinae)

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Abstract

The Indo-West Pacific gobiid genus *Trypauchen* is diagnosed and revised. *Trypauchen* is unique within the Amblyopinae in having the following combination of characters: 1) typically four, rarely three, anal-fin pterygiophores anterior to the first hemal spine; 2) pelvic fins small, united, and funnel-shaped with a well-developed interradiial membrane; and 3) abdomen scaled. *Trypauchen* comprises two species: *T. pelaeos* n. sp., known from Myanmar, Malaysia, Thailand, Vietnam, and China; and *T. vagina*, distributed from Kuwait, along the coasts of India, ranging eastward to the Philippines, Taiwan, and China. A key to species is provided. Figures and descriptions of each species are also given. Putative relationships of the genus are discussed.

Key words: Amblyopinae, Gobiidae, taxonomic revision, relationships

Introduction

Gobius vagina was described by Bloch and Schneider (1801) from a single specimen collected in Tranquebar, India. The original description was brief, but stated that an oval-shaped opening was present on the dorsal edge of the operculum. Because of this unusual, pouch-like structure at the dorsal margin of the operculum, Valenciennes *in* Cuvier and Valenciennes (1837) erected the genus *Trypauchen* [from the Greek *trypa* (hole) and *auchen* (neck)] for *Gobius vagina*. The function of the opercular pouch is not known, but this structure is only found in the following genera of Amblyopinae: *Amblyotrypauchen*, *Ctenotrypauchen*, *Trypauchen*, and *Trypauchenichthys*.

Trypauchen vagina is locally abundant in certain regions and is even used as a food source (Rainboth, 1996), but it has been little studied. However, records and brief descriptions of *T. vagina* are numerous: India (Day, 1878; Hora, 1924); Thailand (Fowler, 1935; H.M. Smith, 1945); Singapore (Larson and Lim, 2005); Mekong River (Rainboth, 1996); various parts of Indonesia (Bleeker, 1860; Kottelat *et al.*, 1993); China

(Richardson, 1844; Günther, 1861; Rendahl, 1924; Herre, 1927); and Taiwan (Chen and Fang, 1999).

In addition to *T. vagina*, four other species were described and assigned to *Trypauchen*: *T. microcephalus* Bleeker, 1860; *T. raha* Popta, 1922; *T. taenia* Koumans, 1953; and *T. waka* Jordan & Snyder, 1901. All were described from Indonesian specimens, except for *T. waka*, which was described from Japan.

In his major work on the gobioid fishes of the Indo-Australian Archipelago, Koumans (1953) provided the only systematic review of *Trypauchen* to date. Koumans (1953) included *T. raha*, *T. taenia*, and *T. vagina* in his treatment of *Trypauchen*. *Trypauchen waka* was likely excluded because it was only known from Japan and *T. microcephalus* was placed in *Ctenotrypauchen* by Koumans. Koumans (1953) separated the three species of *Trypauchen* by numbers of longitudinal and transverse scale rows. However, based on examination of the types and/or images of the types, differences in pelvic fin structure, scalation, and osteology between *T. vagina* and its putative congeners are evident. Consequently, I propose herein a new diagnosis for *Trypauchen* and that *Trypauchen* comprises only two species: *T. vagina* and an undescribed species from Myanmar, Malaysia, Thailand, Vietnam, and China.

The objectives of this study are (1) to define relationships within the ‘*Trypauchen*’ group using putative derived characters, (2) to revise and diagnosis *Trypauchen*, (3) provide characters for recognizing the included species and to list synonyms for all valid forms, and (4) to summarize distributional and ecological data.

Materials and methods

All measurements are straight-line distances made with dial calipers and recorded to the nearest 0.1 millimeter. Standard length (SL) is used throughout except where noted as total length (TL). Methods of measurements and counts follow Murdy (1989), and Murdy and Shibukawa (2001).

In amblyopines, the spinous elements of the dorsal and anal fins are soft and flexible. Additionally, the spinous (first) and soft (second) dorsal fins are connected by membrane; the anteriormost ray associated with two pterygiophores was determined as the first element of the “second dorsal fin” as in other gobioids, following Akihito *et al.* (1984). The vertebral count is separated into precaudal and caudal counts, the latter including the urostylar complex. Counts of axial skeletal features (i.e., vertebrae, ribs, pterygiophores, and epurals) were taken from radiographs and/or cleared and stained specimens. The methods of Birdsong *et al.* (1988) were used in describing the relationship between the spinous dorsal-fin pterygiophores and the underlying vertebrae.

Institutional abbreviations are as listed in Leviton *et al.* (1985). The total number of specimens examined and size range follow each catalog number. Data referring to type specimens, including those pertaining to synonyms, are listed by specific name and type category.

Trypauchen Valenciennes in Cuvier & Valenciennes, 1837

Trypauchen Valenciennes in Cuvier & Valenciennes, 1837: 152 (type species: *Gobius vagina* Bloch and Schneider, 1801, by original designation and monotypy)

Included species. *Trypauchen* comprises two species: *T. pelaeos* **n. sp.** and *T. vagina*

Etymology. From the Greek *trypa* (hole) and *auchen* (neck).

Diagnosis. *Trypauchen* is distinguishable from the other amblyopine genera with an opercular pouch in having: four pterygiophores anterior to the first hemal spine (rarely three); small funnel-like pelvic fin with I,4 or I,5 rays and well-developed interradiation membrane; and abdomen with scales.

Description. The following description of meristic counts (Table 1) is based on radiographs, and four cleared and stained specimens (one each of *T. vagina* removed from AMS I.43479-001 and USNM 342640 and two of *T. pelaeos* from USNM 385741).

TABLE 1. Selected meristic values for species of *Trypauchen*; value in holotype is underscored. Meristic values, except for pectoral-fin rays, are based on radiographs, and four cleared and stained specimens (AMS I. 43479-001, USNM 342640 and two from USNM 385741). The number of anal-fin pterygiophores preceding the first hemal spine is abbreviated as AP.

Dorsal-fin rays (total elements)														
	46	47	48	49	50	51	52	53	54	55	56	57	58	
<i>T. pelaeos</i>	1	1	1	3	2	3	<u>2</u>							
<i>T. vagina</i>					1		3	1	4	5	<u>12</u>	1	4	
Anal-fin rays (total elements)												AP		
	39	40	41	42	43	44	45	46	47	48	49	50	3	4
<i>T. pelaeos</i>	2	4	2	1	<u>3</u>	1								<u>13</u>
<i>T. vagina</i>					1	2	5	7	<u>7</u>	6	2	1	<u>2</u>	28
Caudal vertebrae						Pectoral-fin rays								
	19	20	21	22	23	24	15	16	17	18	19	20		
<i>T. pelaeos</i>	9	<u>6</u>						2	1	7	5	<u>8</u>		
<i>T. vagina</i>					<u>3</u>	28	3	3	2	<u>7</u>	4	<u>2</u>		

Total dorsal-fin elements 46–58; first dorsal fin with six flexible spines (one specimen of *T. vagina* with five); all second dorsal-fin rays segmented and branched; dorsal-fin base long and broadly joined with caudal fin. Total anal-fin elements 39–50, all elements segmented and branched; anal-fin height less than second dorsal-fin height; anal-fin membrane broadly joined with caudal fin. Pectoral fin with 15–20 rays, crescent-shaped or falcate with upper rays longer than lower ones; all pectoral-fin rays segmented and branched distally. Pelvic-fin rays I,4 or I,5; broad frenum present; medial rays longest and completely united by interradiation membrane; pelvic fins forming a small funnel that is

slightly pointed posteriorly. Caudal fin with 17 segmented rays including 8+7 branched rays and an upper and lower simple ray; unsegmented procurent rays 4, 2 dorsally and 2 ventrally.

Scales cycloid, present only on body, largest posteriorly, scales overlapping in caudal peduncle area. Longitudinal scale count 59–98, difficult to count with accuracy.

Typically, two rows of teeth in the upper and lower jaws; all teeth caninoid. Outer-row teeth much larger and stouter than those of inner row; lower-jaw teeth larger than upper-jaw teeth. Outer row of upper jaw with 4–16 enlarged, canine teeth; 8–15 enlarged, canine teeth in outer row of lower jaw; numerous smaller canine teeth in inner row of upper and lower jaws. When mouth closed, upper jaw overlapped by lower jaw. No palatine or vomerine teeth present.

Tongue thick, tip rounded, free from floor of mouth. Gape wide, mouth oblique; maxilla extending posteriorly to the vertical with anterior half of orbit; posteriorly, near tip of maxilla, upper lip expanded into large fold that joins similar fold of lower lip at rictus, fold completely covers posterior part of jaws even when agape. No barbels on underside of head.

Eye rudimentary and covered by skin in orbital depression, lens slightly larger than length of posterior naris. Posterior naris located on dorsoanterior rim of orbit; anterior naris at tip of small tube-like flap that slightly overhangs upper jaw. Chin, snout, and interorbital area with thickened flesh, which likely aids in burrow construction.

Cephalic sensory canals and pores absent. Sensory papillae present on head and body, but difficult to observe without use of a stain. Prominent pouch of unknown function along the dorsal margin of the opercle (Fig. 1).

Gill rakers short, blunt, and not ossified; gill opening narrow, extending only the length of pectoral-fin base or slightly more ventrally.

Genital papilla large. In males, the papilla is pointed posteriorly, in females it is slightly rounded or truncate posteriorly.

Proportional measurements are given in Table 2.

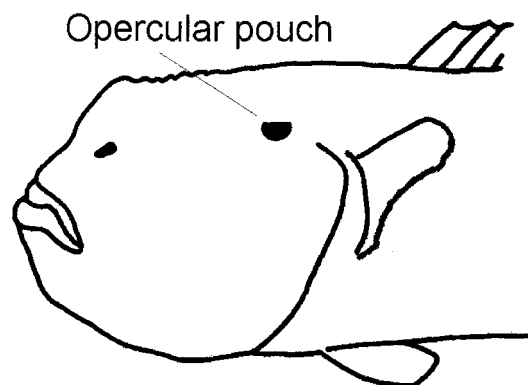


FIGURE 1. Approximate relative size and location of the opercular pouch in amblyopine gobies. (Modified from figure 313 in Kottelat *et al.*, 1993.)

TABLE 2. Ranges and means of selected morphometric measures of *Trypauchen*.

Morphometric measure	<i>T. vagina</i>			<i>T. pelaeos</i>		
	n	mean	range	n	mean	range
Standard length/TL	10	0.855	0.815–0.938	10	0.824	0.802–0.843
Head length/SL	10	0.169	0.161–0.179	10	0.201	0.179–0.220
Pelvic-fin length (PEL)/SL	10	0.060	0.042–0.072	10	0.072	0.054–0.098
Pelvic-fin length/HL	10	0.354	0.248–0.450	10	0.336	0.280–0.451
Pectoral-fin length/SL	19	0.053	0.042–0.063	19	0.067	0.056–0.081
Pectoral-fin length/HL	19	0.315	0.235–0.349	19	0.333	0.272–0.415
Pectoral-fin length/PEL	19	0.921	0.667–1.507	19	0.960	0.719–1.150
Head width/SL	10	0.084	0.077–0.100	10	0.091	0.083–0.113
Snout length/SL	10	0.048	0.034–0.077	10	0.039	0.030–0.047
Jaw length/SL	10	0.050	0.044–0.057	10	0.061	0.055–0.067
Interorbital width/SL	10	0.027	0.024–0.031	10	0.033	0.026–0.040
Nape width/SL	10	0.064	0.057–0.071	10	0.067	0.057–0.077
Body depth/SL	10	0.107	0.092–0.122	10	0.119	0.102–0.131
Predorsal length/SL	10	0.202	0.188–0.218	10	0.238	0.215–0.253
Prepelvic length/SL	10	0.165	0.157–0.175	10	0.195	0.181–0.217
Preanal length/SL	10	0.345	0.308–0.362	10	0.390	0.366–0.410

Osteology. Spinous dorsal-fin pterygiophore formula (PF) typically 3-1221 (one specimen of *T. vagina* with 3-122 and one specimen of *T. vagina* with 3-1211). Precaudal vertebrae 10, caudal vertebrae 19–20 or 23–24. Pterygiophore of the second soft dorsal-fin ray (posteriormost pterygiophore inserting in 7th interneural space) with an autogenous middle radial. Typically four anal-fin pterygiophores anterior to first hemal spine, two specimens with three. Epurals 2. Basihyal spatulate. No gap between dorsal aspect of symplectic and hyomandibula as symplectic is broadly joined to hyomandibula. An anteriorly directed laminar extension of the preopercle articulates with the ventroposterior edge of the symplectic. Frontal crest low, without serrated edge. Frontals divided by a septum anteriorly into two open canals. Atlas with well-developed parapophyses, in contact with first epineural rib. Epineurals present from 1st precaudal vertebra to at least the 14th and sometimes the 18th caudal vertebra. Well-developed pleural ribs on 3rd to 9th precaudal vertebrae.

Comparison of Trypauchen with other 'Trypauchen' group members and status of T. microcephalus, T. raha, T. taenia, and T. wakae. Based on their shared absence of an interneural gap, Birdsong et al (1988) created the monophyletic unit called the 'Trypauchen' group that comprised *Amblyotrypauchen*, *Caragobius*, *Trypauchen*, and *Trypauchenichthys*. Murdy (2002) added *Ctenotrypauchen* and a new genus (*Karsten*) to

the ‘Trypauchen’ group and provided a key to the ‘Trypauchen’ group genera. Additionally, four species currently assigned to the genus *Trypauchen* are treated separately here as members of the ‘Trypauchen’ group: *T. microcephalus*, *T. raha*, *T. taenia*, and *T. wakae*. Monophyletic subunits of the ‘Trypauchen’ group can be hypothesized based on the following characters:

Opercular pouch (Fig. 1). *Caragobius* and *Karsten* lack an opercular pouch whereas the other members of the ‘Trypauchen’ group possess an opercular pouch, a unique character not found in any other amblyopines nor in any other gobioids. Hence, the presence of an opercular pouch is considered the derived condition.

Number of anal-fin pterygiophores anterior to the first hemal spine (AP). All ‘Trypauchen’ group members with an opercular pouch typically have three or fewer AP except for *Trypauchen vagina* and *T. pelaeos* n.sp., which typically have four AP. As the sister group (*Caragobius* and *Karsten*) to those ‘Trypauchen’ group members that have an opercular pouch typically have four or more AP, the condition of typically having three or fewer AP is hypothesized as the derived condition.

Structure of the pelvic fins (Fig. 2). United pelvic fins forming a cup- or funnel-shaped disc with the medial rays joined completely by an interradiation membrane is the typical gobioid condition. This condition is considered plesiomorphic within the Gobiidae. All ‘Trypauchen’ group members with an opercular pouch have emarginate or separate pelvic fins except for *Trypauchen vagina* and *T. pelaeos* n. sp. Emarginate or separate pelvic fins are considered derived.

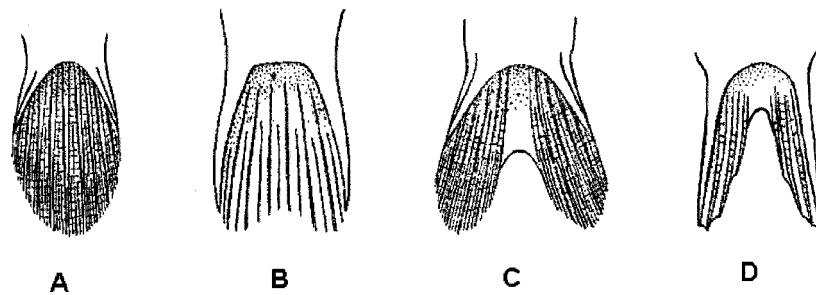


FIGURE 2. Pelvic-fin shapes of ‘Trypauchen’ group members with an opercular pouch from Hora (1924). A: *Trypauchen vagina* and *Trypauchen pelaeos*, n.sp.; B: *Ctenotrypauchen*, *Trypauchen microcephalus*, *T. raha*, *T. taenia*, and *T. wakae*; C: *Amblyotrypauchen*; and D: *Trypauchenichthys*.

Presence of scales on the abdomen. *Trypauchen vagina*, *T. pelaeos* n. sp., and all other ‘Trypauchen’ group members with an opercular pouch have scales on the abdomen except *T. microcephalus*, *T. raha*, and *T. wakae*. The absence of scales on the abdomen is hypothesized as being the derived condition.

Frontal crest. All ‘Trypauchen’ group members with an opercular pouch lack an exposed frontal crest except *Ctenotrypauchen*, *Trypauchenichthys*, and *T. taenia*, which all have an exposed, serrated frontal crest. An exposed, serrated frontal crest is considered

derived.

Presence of head scales. All 'Trypauchen' group members with an opercular pouch lack scales on the head except *Amblyotrypauchen* (Murdy, 2003). *Amblyotrypauchen* has scale patches on the head, cheek and opercle; this is considered a derived character.

Based on the character polarities described above, I hypothesize that *Trypauchen vagina* and *T. pelaeos*, n.sp. form the sister group to *Amblyotrypauchen*, *Ctenotrypauchen*, *Trypauchenichthys* and the four remaining nominal species of *Trypauchen* (*T. microcephalus*, *T. raha*, *T. taenia* and *T. wakaie*). Three nominal species of *Trypauchen* (i.e., *T. microcephalus*, *T. raha*, and *T. wakaie*) are united by synapomorphies (i.e., three or fewer AP, emarginate pelvic fins, and absence of abdominal scales) not found in combination in any other 'Trypauchen' group genus and, thus, cannot be assigned at this time. As for *T. taenia*, this species is hypothesized to be a member of the monophyletic unit containing *Ctenotrypauchen* and *Trypauchenichthys*. These four nominal species of *Trypauchen*, *T. microcephalus*, *T. raha*, *T. taenia*, and *T. wakaie*, will be treated in greater detail in forthcoming papers as revisionary studies of amblyopine gobies continue.

Key to the species of *Trypauchen*

- 1a. Total elements in dorsal fin 50–58; total elements in anal fin 43–50; caudal vertebrae 23 or 24, typically 24; SL typically 84% or more of total length; head length less than 18% of SL; predorsal length less than 22% of SL; prepelvic length less than 18% of SL; preanal length 36% or less of SL. (Kuwait, India, Thailand, Vietnam, Philippines, China)..... *T. vagina*
- 1b. Total elements in dorsal fin 46–52; total elements in anal fin 39–44; caudal vertebrae 19 or 20; SL 84% or less of total length; head length 18% or more of SL; predorsal length typically more than 22% of SL; prepelvic length 18% or more of SL; preanal length more than 36% of SL. (Myanmar, Thailand, Malaysia, Vietnam, China)
..... *T. pelaeos*, **n. sp.**

Trypauchen vagina (Bloch and Schneider, 1801)

(Figs.1–5, Tables 1–2)

Gobius vagina Bloch and Schneider, 1801: 73 (type locality, Tranquebar, India).

Gobioides ruber Hamilton-Buchanan, 1822: 38, 365 (type locality, Ganges River, India).

Trypauchen vagina: Valenciennes in Cuvier & Valenciennes, 1837: 152 (new combination).

Material examined. (Total of 33 specimens, 69.0–170.0 mm SL). **Kuwait:** BPBM 33186, 2:80.3-94.2, 29°N, 48°25' E, 15–20 m, collected by James M. Bishop aboard the R/V *Bahith*, 20 Aug 1985. **India:** AMS I.27225-001, 1:115.3, 19 Mar 1968. Bombay (Mumbai): AMS I.43479-001 (cleared & stained), 1:77.0; Bombay Harbor, collected by

Ron Baird, 1967; USNM 337796, 1:122.1, Bombay Harbor, collected by Ron Baird, 1967; USNM 342640 (cleared & stained), 1:104.4, Bombay Harbor, collected by Ron Baird, 1967. Cochin: BPBM 27544, 5:104.5-162.1, obtained from local fish catch (trawled) near Cochin landing dock, collected by John E. Randall, 1 Feb 1980. Tranquebar: ZMB 2127, holotype of *Gobius vagina* Bloch and Schneider, 154.0. Calcutta: AMS B.7988, 1:170.0, 22°30'N, 88°20'E, collected by Francis Day. **Myanmar:** Kuala Bernam, Bernam River estuary, AMS I.28984-046, 1:114.8, 03°47'N, 100°55'E, collected by D.G. Stead, 23 Feb 1922. **Thailand:** Songkhla Lake: UMMZ 233638, 2:136.0-143.6, Dec 1964. Samut Prakan, mouth of Chao Phraya River, USNM 103351, 1:137.9. Chanthaburi estuary: USNM 103350, 1:144.7. Bangpakong River: USNM 109695, 1:88.3, collected by H.M. Smith, 27 June 1933. **Vietnam:** Mekong Drainage, mouth of Song Cua Dai, UMMZ 241627, 5: 69.0-162.0, 10°13'N, 106°15'E, collected by local fishermen for Walter J. Rainboth, April, 1999. Kien Giang, Mekong Delta: UMMZ 238875, 1:147.8, 10°23'N, 104°29'E, purchased at Ha Tien market by Walter J. Rainboth, 28 Mar 1999. Vung Tai: USNM 304795, 1:155.2, 10°21'N, 107°15'E, purchased at fish market by D.P. DeSylva, 19 Jan 1973. **Philippines:** East coast of Luzon: USNM 151241, 1:109.7. **China:** Guangdong Sheng, Shantou: AMS I.38176-001, 1:131.1, 5 Mar 1954. Foochow: USNM 086958, 3:102.0-119.1, collected by A.C. Sowerby, Sept-Nov 1923. Xiamen: AMS I.28094-016, 2:117.5-141.8, fish market purchase, 13 Oct 1988.

Description. As for genus except as follows. Total elements in dorsal fin 50–58 (mean = 55.2); total elements in anal fin 43–50 (mean = 46.6); pectoral-fin rays 15–20 (mean = 17.7); anal-fin pterygiophores preceding the first hemal spine 3–4 (mean = 3.9); caudal vertebral count 23–24 (mean = 23.9). The following subset of morphometric measures from Table 2 is useful in describing *T. vagina* and differentiating *T. vagina* from *T. pelaeos*: SL/total length 0.815–0.938 (mean = 0.855); head length/SL 0.161–0.179 (mean = 0.169); predorsal length/SL 0.188–0.218 (mean = 0.202); prepelvic length/SL 0.157–0.175 (mean = 0.165); preanal length/SL 0.308–0.362 (mean = 0.345).

Four to 16 teeth (mean = 7.9) on outer row of upper jaw; 8–13 teeth (mean = 10.6) on outer row of lower jaw.

Longitudinal scale rows 69–98 (mean = 82.4).

Color when fresh. No fresh specimens were available. A photograph of a freshly dead *T. vagina* from Cochin, India (photographed by John E. Randall) is reproduced as Fig. 3 and a specimen from Vietnam (photographed by Walter Rainboth) is reproduced as Fig. 4. The specimen from India (BPBM 27544, Fig. 3) is reddish pink on the head and body, but not uniformly. The cheek is bright red as is the dorsum anteriorly. The prepeduncular area is similarly bright red. Ventral to the pectoral-fin base is dusky. All fins are translucent. The specimen from Vietnam (UMMZ 238875, Fig. 4) is almost uniformly pinkish except for a reddish band anterior to the operculum and a reddish blotch dorsal to the pectoral fin. All fins are translucent.



FIGURE 3. *Trypauchen vagina* from Cochin, India (BPBM 27544, 126.9 mm SL). Image by John E. Randall.



FIGURE 4. *Trypauchen vagina* from Mekong Delta, Vietnam (UMMZ 238875, 147.8 mm SL). Image by Walter J. Rainboth.

As described by Hamilton-Buchanan (1822), *Gobioides ruber* (= *Trypauchen vagina*) was a dirty red color. Bleeker (1860) described the body color as rosy red and the fins as transparent with a rosy tinge. According to Day (1878), *T. vagina* is white with a rosy tinge, much brighter during some seasons than at others with the distal margins of the median fins gray and the caudal, pectoral, and pelvic fins white, or tinged with yellow. Smith (1945) stated that his specimens were pinky white with minute black eyes. The photograph of a presumably freshly dead of *T. vagina* in Chen and Fang (1999) depicts a mostly blood-red head and body with black-edged fins and a solid black caudal fin. A photograph of *T. vagina* from Singapore in Larson and Lim (2005) has a reddish-orange body with the anterior part of the head and the caudal peduncular region tannish white with translucent fins.

Color in alcohol. Head and body uniformly tannish brown with translucent fins. Herre (1927) stated that preserved specimens of *T. vagina* were pinkish brown to gray or bluish brown, the head often paler, the fins yellowish or whitish.

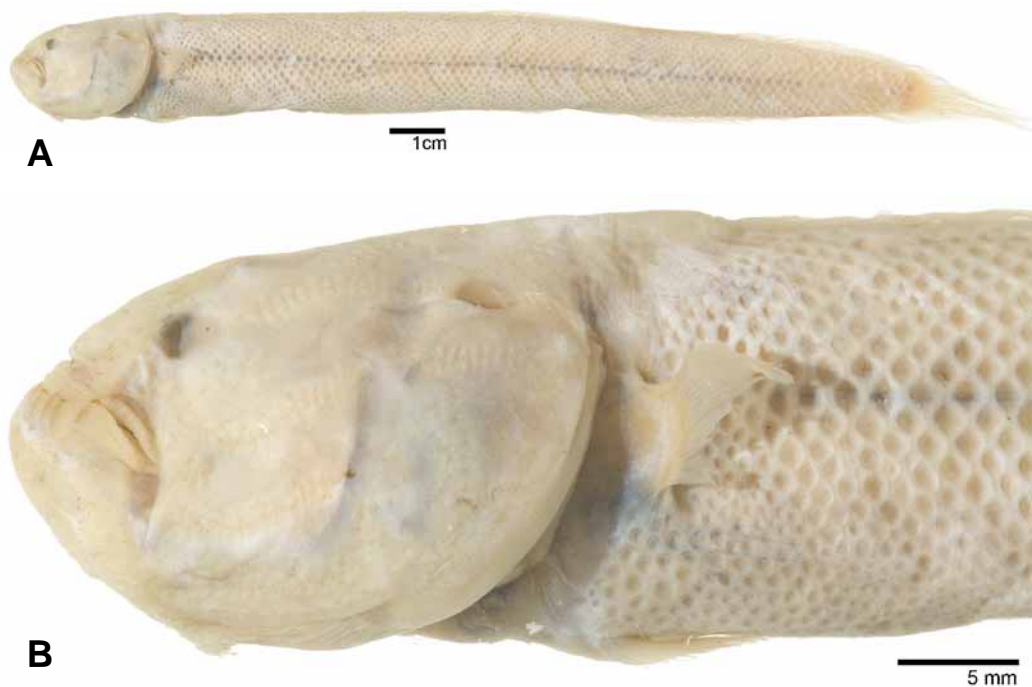


FIGURE 5. **A.** *Trypauchen vagina* from Mekong drainage, mouth of Song Cua Dai, Vietnam (UMMZ 241627, 162.0 mm SL). Image by Sandra J. Raredon. **B.** Closeup view of the head and pectoral fin area of *T. vagina* (same specimen as Fig. 5A) showing the opercular pouch, head shape, and scalation of the abdomen (left lateral view). Image by Sandra J. Raredon.

Ecology. Rainboth (1996) reported that in the Cambodian Mekong, *T. vagina* does not venture far from its burrow and preys on small crustaceans. Chen and Fang (1999) stated that *T. vagina* inhabits burrows in estuarine and coastal areas including river mouths and is an omnivorous benthic feeder. During storm seasons when salinity fluctuates greatly, *T. vagina* can be locally abundant in estuaries (Chen and Fang, 1999).

Distribution. Kuwait, east and west coasts of India, Myanmar, Thailand, Singapore (Larson and Lim, 2005), Indonesia, the Philippines, Taiwan (Chen and Fang, 1999), and China. Specimens of this species have not been examined from Singapore or Taiwan. Because *T. vagina* is found in burrows in silty mud habitats, it is difficult to collect, which may help explain its relative paucity in museum collections.

Remarks. The holotype (ZMB 2127) of *Trypauchen vagina* Bloch and Schneider (1801) could not be loaned for this study; however, a radiograph was examined. In addition, the notes and drawings of Helen K. Larson, who did examine the holotype, were made available. Based on the original description, H. K. Larson's notes and drawings, and data gleaned from the radiograph (PF=3-1221, AP=4, total dorsal-fin elements 56, total anal-fin elements 47, vertebrae 10+23), the status of this specimen is not in doubt. (The original description mistakenly lists the number of anal-fin rays as 44.)

As no types are known for *Gobioides ruber* Hamilton-Buchanan (1822), the synonymy is based on the original description. As described by Hamilton-Buchanan, the count for the dorsal fin of *Gobioides ruber* is 55 and the anal-fin ray count is 52; the former is close to the mean for this species (55.2) and the latter is two higher than for any specimen examined. This synonymy was first proposed by Bleeker (1860).

***Trypauchen pelaeos* n. sp**

(Figs. 1–2 & 6, Tables 1–2)

Holotype: USNM 339609, 134.8 mm SL, female, Malaysia, south of Penang, south of Pu Kendi Island, 05°11'N, 100°10'E, collected by Frank J. Schwartz, 06 May 1969.

Paratypes: (Total of 28 specimens, 46.4–145.6 mm SL) **Myanmar:** Kuala Bernam, Bernam River estuary, AMS I.28984-047, 3:71.1-95.4, 03°47'N, 100°55'E, collected by D.G. Stead, 23 Feb 1922. **Malaysia:** same data as holotype, USNM 389739, 1:90.9; same data as holotype, USNM 339608, 17:46.4-145.6; Strait of Malacca: AMS I.27633-016, 1:83.1, 02°14'N, 102°14'E, collected by D.G. Stead, 16 Feb 1922. **Thailand:** Bangpakong River: USNM 385738, 1:108.0, collected by H.M. Smith, 27 June 1933. **Vietnam:** Soc Trang, Bassac River: UMMZ 245453, 1:57.0, 9°32'N, 106°13'E, collected by fishermen for Walter J. Rainboth, 09 Apr 1999. **China,** Xiamen, AMS I.28094-017, 1:108.0, fish market purchase, 13 Oct 1988; Guangdong Sheng, Shantou: AMS I.38176-002, 1:98.2, 5 Mar 1954; Foochow: USNM 385741 (cleared & stained), 2:91.7-93.9.

Description. As for genus except as follows. Total elements in dorsal fin 46–52 (mean = 49.6); total elements in anal fin 39–44 (mean = 41.2); pectoral-fin rays 16–20 (mean = 18.7); anal-fin pterygiophores preceding the first hemal spine 4 (mean = 4.0); caudal vertebral count 19–20 (mean = 19.4). The following subset of morphometric measures from Table 2 is useful in describing *T. pelaeos* and differentiating *T. pelaeos* from *T. vagina*: SL/total length 0.802–0.843 (mean = 0.824); head length/SL 0.179–0.220 (mean = 0.201); predorsal length/SL 0.215–0.253 (mean = 0.238); prepelvic length/SL 0.181–0.217 (mean = 0.195); preanal length/SL 0.366–0.410 (mean = 0.390).

Four to 13 teeth (mean = 8.1) on outer row of upper jaw; 8–15 teeth (mean = 10.3) on outer row of lower jaw.

Longitudinal scale rows 59–88 (mean = 74.1).

Color when fresh. No fresh specimens or images of fresh specimens were available. Presumably, *T. pelaeos* is like its congener and is reddish when alive.

Color in alcohol. Head and body tannish; fins translucent.

Ecology. No data is available other than the collection information from individual specimens, which is meager. For USNM 339608, 339609, and 385739 (all collections from south of Pu Kendi Island, Malaysia) shrimp trawls were used. For USNM 339608, the collection was made at a depth of about 3–4m and another amblyopine (*Pseudotrypauchen multiradiatus*) was also collected. For USNM 339609 and 385739, the

collections were made at a depth of about 14–20m.

In several instances, specimens of both *T. pelaeos* and *T. vagina* were together in the same lot indicating the same or similar ecological requirements. However, some of these lots consist of specimens purchased from fish markets.

Distribution. *T. pelaeos* is known from Myanmar, Thailand, Malaysia, Vietnam, and China. As *T. vagina* is similarly known from these countries (except for Malaysia) considerable distributional overlap exists between the two species.

Etymology. The trivial name, Greek for mud-dweller, is in reference to the typical habitat for this fish.

Additional material examined. *Ctenotrypauchen chinensis*: holotype, NMW 76865 (radiograph and whole specimen images only). *Trypauchen microcephalus*: holotype, RMNH 4671. *Trypauchen raha*: holotype, SMF 17486 (radiograph and whole specimen images only). *Trypauchen taenia*: syntypes, RMNH 1950. *Trypauchen wakae*: holotype, SU 6515 (radiograph and whole specimen images only; paratypes, USNM 049868; paratype, USNM 049829. *Trypauchenichthys sumatrensis*: USNM 211295. *Trypauchenichthys typus*: syntypes, RMNH 4808.



FIGURE 6. **A.** *Trypauchen pelaeos* from south of Pu Kendi Island, Malaysia (USNM 339608, 145.6 mm SL). Image by Sandra J. Raredon. **B.** Closeup view of the head and pectoral fin area of *T. pelaeos* (same specimen as Fig. 6A) showing the opercular pouch, head shape, and scalation of the abdomen (left lateral view). Image by Sandra J. Raredon.

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References

- Akihito, Prince, Hayashi, M., Yoshino, T., Shimada, K., & Senou, H. (1984) Suborder Gobioidi, p. 236–289, pls. 235–258, 353–355. *In*: Masuda, H., Amaoka, K., Araga, C., Uyeno, T. & Yoshino, T. (Eds.), *The Fishes of the Japanese Archipelago*, Tokai University Press, Tokyo.
- Birdsong, R.S., Murdy, E.O., & Pezold, F.L. (1988) A study of the vertebral column and median fin osteology in gobioid fishes with comments on gobioid relationships. *Bulletin of Marine Science*, 42, 174–214.
- Bleeker, P. (1860) Dertiende bijdrage tot de kennis der vischfauna van Borneo. *Acta Societatis Scientiarum Indo-Neerlandicae*, 8, 1–64.
- Bloch, M.E. & Schneider, J.G. (1801). M. E. Blochii, Systema Ichthyologiae iconibus ex illustratum. Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit Jo. Gottlob Schneider, Saxo. Berolini. Sumtibus Auctoris Impressum et Bibliopolio Sanderiano Commisum. Systema Ichthyol., i–lx + 1–584, Pls. 1–110.
- Chen, I.-S. & Fang, L.-S. (1999) *The Freshwater and Estuarine Fishes of Taiwan*, National Museum of Marine Biology & Aquarium, Pingtung, 287 pp.
- Cuvier, G.L.F.C.D. & Valenciennes, A. (1837) *Histoire naturelle des poissons*. Volume 12, xiv + 507 pages, 19 plates. F.G. Levrault, Paris.
- Day, F. (1878) *The Fishes of India, Being a Natural History of the Fishes Known to Inhabit the Seas and Fresh Waters of India, Burma, and Ceylon*. Part 2, pp. 281–320. William Dawson & Sons, London.
- Fowler, H.W. (1935) Zoological results of the third De Schauensee Siamese Expedition, Part VI. — Fishes obtained in 1934. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 87, 89–163.
- Günther, A.C.L.G. (1861) *Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum*. Volume 3, xxv + 586 + x pages. British Museum, London.
- Hamilton-Buchanan, F. (1822) *An Account of the Fishes in the River Ganges and its Branches*.

- Archibald Constable and Company, Edinburgh. 405 pages.
- Herre, A.W.C.T. (1927) Gobies of the Philippines and the China Sea. *Monograph of the Bureau of Science*, Manila, 23, 352 pp.
- Hora, S.L. (1924) Notes on fishes in the Indian Museum. VI. On a new genus of gobioid fishes (subfamily Trypaucheninae) with notes on related forms. *Records of the Indian Museum, Calcutta*, 26, 155–163.
- Jordan, D.S. & Snyder, J.O. (1901) A review of the gobioid fishes of Japan. *Proceedings of the U.S. National Museum*, 24, 33–132.
- Kottelat, M., Whitten, A.J., Kartikasari, S.N., & Wirjoatmodjo, S. (1993) *Freshwater Fishes of Western Indonesia and Sulawesi*. Wildlife Heritage Trust of Sri Lanka, Colombo, 259 pp.
- Koumans, F.P. (1953) Gobioidae. In: Weber, M. de Beaufort, L.F. *Fishes of the Indo-Australian Archipelago*, vol. 10. E.J. Brill, Leiden, 423 pp.
- Larson, H.K. & Lim, K.K.P. (2005) *A Guide to Gobies of Singapore*. Singapore Science Centre, 164 pp.
- Larson, H.K. & E.O. Murdy. (2001) *Families Eleotridae, Gobiidae*. In: Carpenter & Niem 2001. *FAO Species Identification Guide*, 6, 3574–3603.
- Leviton, A.E., Gibbs, R.H., Heal, E., & Dawson, C.E. (1985) Standards in herpetology and ichthyology: part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985, 802–832.
- Lindberg, G.U. & Krasnyukova, Z.V. (1989) *Fishes of the Sea of Japan and the Adjacent Areas of the Sea of Okhotsk and the Yellow Sea. Keys to the Fauna of the USSR*. Part 4, i–xxvi + 1–602. [English translation].
- Murdy, E.O. (1989) A taxonomic revision and cladistic analysis of the oxudercine gobies (Gobiidae: Oxudercinae). *Records of the Australian Museum*, Supplement 11, 1–93.
- Murdy, E.O. (2002) *Karsten*, a new genus of eel goby (Gobiidae: Amblyopinae) with a key to “Trypauchen” group genera. *Copeia*, 2002, 787–791.
- Murdy, E.O. (2003) A review of *Amblyotrypauchen* (Teleostei: Gobiidae), a genus of blind amblyopine gobies. *Proceedings of the Biological Society of Washington*, 116(2), 330–336.
- Murdy, E.O. & Shibukawa, K. (2001) A revision of the gobiid fish genus *Odontamblyopus* (Gobiidae: Amblyopinae). *Ichthyological Research*, 48, 31–43.
- Popta, C.M.L. (1922) Vierte und letzte fortsetzung der Beschreibung von neuen Fischarten der Sunda-Expedition. *Zoologische Mededeelingen (Leiden)*, 7, 27–39.
- Rainboth, W.J. (1996) *FAO species identification field guide for fishery purposes. Fishes of the Cambodian Mekong*. Rome, FAO. 1–265, Pls. I–XXVII.
- Rendahl, H. (1924) Beiträge zur Kenntniss der Marinen Ichthyologie von China. *Arkiv for Zoologi*, Stockholm, XVI (2), pp. 1–37.
- Richardson, J. (1844) Ichthyology. — Part 1. In: Hinds, R.B. (Ed.). *The Zoology of the Voyage of H. M. S. Sulphur, Under the Command of Captain Sir Edward Belcher, R. N., C. B., F. R. G. S., etc., During the Years 1836–42, No. 5*. London: Smith, Elder & Co. Ichthy. Voyage Sulphur 1, 51–70, Pls. 35–44.
- Smith, H.M. (1945) The fresh-water fishes of Siam, or Thailand. *Bulletin of the U. S. National Museum*, 188, 1–622.
- Steindachner, F. (1867) Ichthyologische Notizen, vierte Folge. *Anzeiger der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe*, 4, 63–64.