

# AN ANNOTATED CHECKLIST OF GOBIOID FISHES FROM THE MANGROVE ESTUARY OF MATANG, MALAY PENINSULA, WITH COMMENTS ON A NEW *Pseudogobius* (TELEOSTEI: GOBIIDAE) SPECIES

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Key words: Malaysia, Gobiidae, Eleotridae, mangrove.

## ABSTRACT

A series of field collections of fishes were made in the Matang mangrove, Malay Peninsula in April 2011. At least 23 genera and 27 species of gobioid fishes including a new *Pseudogobius* species were collected and recorded in this region during the expedition. The checklist of gobioid fauna and available materials are provided herein, and the formal description of a new goby species, *Pseudogobius fulvicaudus* Huang, Shao & Chen, new species will be provided and discussed in this paper.

## I. INTRODUCTION

Gobioid fishes are the most species-rich group of marine teleost fishes [1, 16, 20, 24]. In tropical regions, many groups of gobioid fishes are well adapted to mangrove and estuarine habitats, which have high species diversity [44, 47, 48]. Yet, goby fauna has not been well surveyed in many tropical mangroves.

Sasekumar and Chong [63] published the book "Ecology of Klang Strait," which reported some important gobies and documented local species of mangrove gobioid fishes around the Strait of Malacca, including more comprehensive faunistic survey data of different varieties of so-called "mudskippers"

around the Strait. Larson *et al.* [47] released a comprehensive faunistic list of gobioid fishes collected from the marine habitat of Singapore, which provided useful fish data for the southern tip of the Malay Peninsula.

However, except for the research work mentioned above, few field survey data have been published for the small-sized mangrove gobies, especially in the Indian Ocean side of the Strait of Malacca. The mangrove of Matang is the largest mangrove forest of the Malay Peninsula. Situated at the northern region of the Peninsula, with over forty thousand hectares of coverage, this productive area is the subject of our 2011 fish collecting expedition. Despite the difficulty in reaching the muddy habitats around the mangrove of Matang in the northern region of the Strait of Malacca, our research team employed local fishing boats to go further into small river channels and the banks of estuarine mangrove habitats and we successfully conducted both hand netting and trawling for our fish collections. The detailed checklist and available materials are provided in this paper. Our expedition will contribute data to the benthic fish fauna around the mangrove region of the tropical Malay Peninsula.

About the taxonomic study of *Hemigobius* generic group, present study reveals *Pseudogobius gastrospilos* (Bleeker, 1853) [8] should be considered as senior synonym of *Pseudogobius melanostictus* [22, 36], and present study supporting that *Mugilogobius polylepis* Wu and Ni, 1985 [69], which is distributed in Taiwan and southern China should be a new genus based on specific morphological features and strongly molecular evidence [35]. For the taxonomic study of new species during our expedition in Malay Peninsula, there are two species of *Pseudogobius* were collected in this region during the expedition, including *Pseudogobius avicennia* (Herre, 1940) [31] and another smaller size of *Pseudogobius* species, which one has been recognized as an undescribed species after examination and comparison of related species.

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The comparison of this new *Pseudogobius* species and related species will be provided in this paper.

## II. MATERIALS AND METHODS

All gobioid fish specimens were collected either by hand net from intertidal pools or small drainages at low tide, or by trawling the main reaches of estuaries in local fishing boats. All counts and measurements were made from specimens preserved in 70% ethanol. Morphometric methods follow Miller [54] and meristic methods follow Akihito *et al.*, Chen and Shao, Chen *et al.*, Chen and Kottelat, Chen and Miller and Huang and Chen [1, 17-20, 34]. Terminology of cephalic sensory canals and free neuromast organs (sensory papillae) is from Wongrat and Miller [68], based on Sanzo [62]. Fish specimens as well as assigned type material are deposited at the Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan (NTOUP).

Meristic abbreviations are as follows: A, anal fin; C, caudal fin; D1 and D2, first and second dorsal fins, respectively; LR, longitudinal scale series; P, pectoral fin; PreD, predorsal scales; SDP, scale series from origin of first dorsal fin to upper pectoral origin; TR, transverse scale series from second dorsal to anal fin; V, pelvic fin; VC, vertebral count. All fish lengths are standard length (SL).

## III. TAXONOMY

### FAMILY Eleotridae

#### *Bostrychus scalaris* Larson, 2008

(Fig. 1a)

*Bostrychus scalaris* Larson, 2008: 148 (Mangrove pool at Sementa River, 3°04.84'N, 101°21.35'E, near Klang, Selangor State, Malaysia) [44].

#### Material examined:

NTOUP 2011-05-013, 3 specimens, 40.2-63.7 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

#### *Butis butis* (Hamilton, 1822)

(Fig. 1b)

*Cheilodipoterus butis* Hamilton, 1822: 57 (Ganges river, below Calcutta, India) [29].

*Eleotris butis*, Martens, 1876: 392 [53].

*Butis melanopterus* Bleeker, 1877:62 (Singapore); Fowler, 1931: 448 [13, 26].

*Butis butis*, Lason, 2005: 50 [43].

#### Material examined:

NTOUP 2011-05-040, 80.1 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 21 April, 2011.

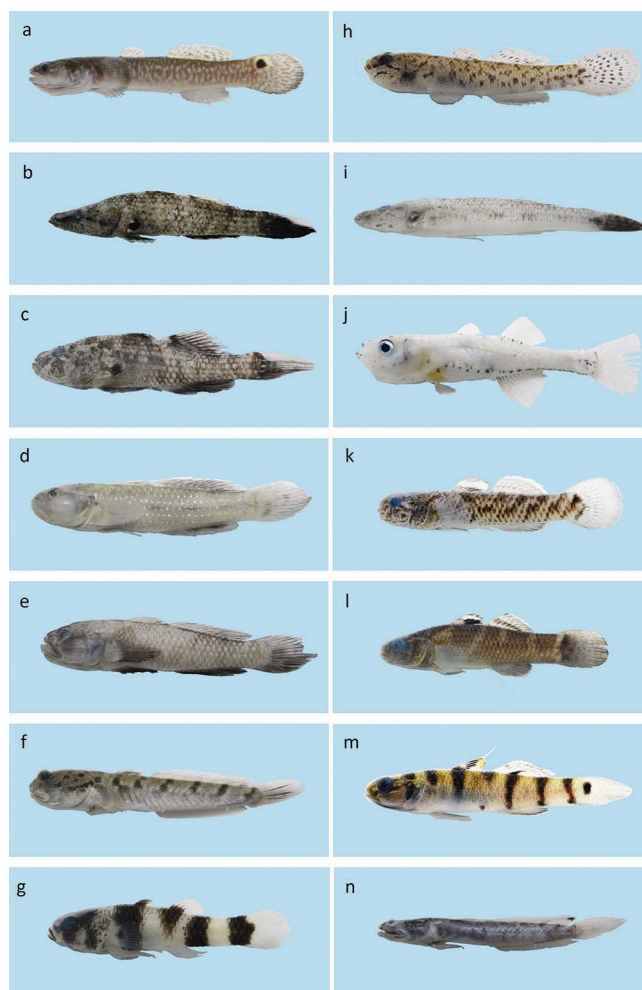


Fig. 1. Specimen photographs of a, *Bostrychus scalaris*, NTOUP 2011-05-013, 63.7 mm SL; b, *Butis butis*, NTOUP 2011-05-040, 80.1 mm SL; c, *Butis koilomatodon*, NTOUP 2011-05-035, 51.5 mm SL; d, *Acentrogobius cyanomos*, NTOUP 2011-05-039, 67.9 mm SL; e, *Acentrogobius* sp., NTOUP 2011-05-034, 53.3 mm SL; f, *Boleophthalmus boddarti*, NTOUP 2011-05-026, 30.7 mm SL; g, *Brachyogobius kabiliensis*, NTOUP 2011-05-014, 14.8 mm SL; h, *Calamiana variegata*, NTOUP 2011-05-015, 26.3 mm SL; i, *Glossogobius sparsipapillus*, NTOUP 2011-05-036, 72.3 mm SL; j, *Gobiopterus brachypterus*, NTOUP 2011-05-017, 20.7 mm SL; k, *Hemigobius hoeverii*, NTOUP 2011-05-003, 23.2 mm SL; l, *Hemigobius mingi*, NTOUP 2011-05-008, 28.6 mm SL; m, *Mugilogobius tigrinus*, NTOUP 2011-05-002, 26.4 mm SL; n, *Oxudercus dentatus*, NTOUP 2011-05-025, 37.9 mm SL.

#### *Butis koilomatodon* (Bleeker, 1849)

(Fig. 1c)

*Eleotris koilomatodon* Bleeker, 1849: 21 (Freto Madurae, prope Surabaya and Damal) [5].

*Eleotris caperatus* Cantor, 1849: 1179 (Pinang, Malaysia) [15].

*Eleotris caperata*, Martens, 1876: 392 [53].

*Prionobutis koilomatodon*, Bleeker, 1877: 73; Here and Myer, 1937: 38; Hoese, 1986: 810 [13, 32, 33].

*Butis koilomatodon*, Bleeker, 1861: 32; Lim and Larson, 1994: 258; Chen and Fang, 1999: 193; Randall and Lim, 2000: 636 [11, 16, 50, 60].

**Material examined:**

NTOUP 2011-05-035, 5 specimens, 43.4-58.9 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang *et al.*, 20 April, 2011. NTOUP 2011-05-038, 3 specimens, 37.4-41.7 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang *et al.*, 21 April, 2011.

**FAMILY Gobiidae**

***Acentrogobius cyanomos* (Bleeker, 1849)**

(Fig. 1d)

*Gobius cyanomos* Bleeker, 1849: 25 (Java, Surabaya); Bleeker, 1861: 56; Karoli, 1882: 164 [5, 11, 38].

*Aulopareia cyanomos*, Lim and Larson, 1994: 258 [50].

*Acentrogobius cyanomos*, Fowler, 1938: 211; Koumans, 1953: 64; Gomez, 1980: 95; Tan and Yeo, 2003: 154 [27, 28, 40, 65].

**Material examined:**

NTOUP 2011-05-039, 67.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Acentrogobius* sp.**

(Fig. 1e)

**Material examined:**

NTOUP 2011-05-034, 11 specimens, 49.3-64.2 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 20 April, 2011. NTOUP 2011-05-037, 2 specimens, 48.5-54.7 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 21 April, 2011.

**Remarks**

This species should be revised with further research work for detailed comparison with recognized members of the *Acentrogobius* generic group.

***Boleophthalmus boddarti* (Pallas, 1770)**

(Fig. 1f)

*Gobius boddarti* Pallas, 1770: 11 (Indian Ocean) [58].

*Boleophthalmus boddaerti*, Karoli, 1882: 166; Bleeker, 1861: 57; Fowler, 1938: 213 [11, 27, 38].

*Boleophthalmus boddarti*, Koumans, 1953: 259; Murdy, 1989: 14; Lim and Larson, 1994: 258; Larson and Lim, 2005: 73 [40, 48, 50, 55].

**Material examined:**

NTOUP 2011-05-026, 30.7 mm SL, coast of Sungai Haji Dorani, Malaysia, coll. S. P. Huang and H. M. Huang, 22 April, 2011.

***Brachygobius kabiliensis* (Inger, 1958)**

(Fig. 1g)

*Brachygobius kabiliensis* Inger, 1958: 110 (Kabili River, Sandakan District, East Coast Residency, North Borneo); Lim and Larson, 1994: 258; Ng and Sivasothi, 1999: 136; Larson and Lim, 2005: 75 [37, 48, 50, 57].

**Material examined:**

NTOUP 2011-05-014, 30 specimens, 10.5-15.1 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Calamiana variegata* (Peters, 1868)**

(Fig. 1h)

*Apocryptes variegatus* Peters, 1868: 267 (Singapore) [59].

*Tamanka ubinensis* Herre in Herre and Myers, 1937: 41 (Pulau Ubin); Koumans, 1940: 153; Koumans, 1953: 157; Gomez, 1980: 95 [28, 32, 39, 40].

*Gobiopterus variegatus*, Koumans, 1953: 244; Gomez, 1980: 95 [28, 40].

*Pseudogobius variegatus*, Lim and Larson, 1994: 260 [50].

*Eugnathogobius variegatus*, Larson, 2009: 128 [45].

*Calamiana variegata*, Larson, 1999: 260; Larson and Lim, 2005: 78; Huang, Zeehan and Chen, 2013: 146 [35, 41, 48].

**Material examined:**

NTOUP 2011-05-015, 13 specimens, 17.0-26.2 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Glossogobius sparsipapillus* (Akihito and Meguro, 1976)**

(Fig. 1i)

*Glossogobius sparsipapillus* Akihito and Meguro, 1976: 9 (Branch of Can Tho River, vicinity of Can Tho City, Vietnam); Lim and Larson, 1994: 259; Larson and Lim, 2005: 102 [2, 48, 50].

**Material examined:**

NTOUP 2011-05-033, 7 specimens, 34.7-71.7 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 20 April, 2011. NTOUP 2011-05-036, 4 specimens, 51.3-72.9 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 21 April, 2011.

***Gobiopterus brachypterus* (Bleeker, 1855)**

(Fig. 1j)

*Apocryptes brachypterus* Bleeker, 1855: 401 (Lacus Grati, Pasuruan Province, Java); Karoli, 1882: 166; Fowler, 1938: 212 [9, 27, 38].

*Gobiopterus brachypterus*, Lim and Larson, 1994: 259; Larson and Lim, 2005: 108 [48, 50].

**Material examined:**

NTOUP 2011-05-017, 60 specimens, 13.3-20.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011. NTOUP 2011-05-041, 9 specimens, 15.4-20.7 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

***Hemigobius hoevenii* (Bleeker, 1851)**

(Fig. 1k)

*Gobius hoevenii* Bleeker, 1851: 426 (Sambas, in river, Borneo) [6].

*Hemigobius hoevenii*, Lim and Larson, 1994: 259; Lim and Low, 1998: 141; Larson, 2001: 74; Larson and Lim, 2005: 109 [42, 48, 50, 51].

**Material examined:**

NTOUP 2011-05-003, 23 specimens, 19.3-26.2 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011. NTOUP 2011-05-016, 7 specimens, 14.4-22.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Hemigobius mingi* (Herre, 1936)**

(Fig. 1l)

*Gnatholepis mingi* Herre, 1936: 8 (Pulau Ubin); Herre and Myers, 1937: 40; Fowler, 1938: 266 [27, 30, 32].

*Stigmatogobius mingi*, Koumans, 1953: 118 [40].

*Hemigobius mingi*, Lim and Larson, 1994: 259; Larson, 2001: 74; Larson and Lim, 2005: 110 [42, 48, 50].

**Material examined:**

NTOUP 2011-05-008, 5 specimens, 25.9-28.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

***Mugilogobius tigrinus* Larson, 2001**

(Fig. 1m)

*Mugilogobius tigrinus* Larson, 2001: 189 (Sungei Pandan, Singapore); Larson and Lim, 2005: 121 [42, 48].

**Material examined:**

NTOUP 2011-05-008, 5 specimens, 14.4-19.6 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

***Oxuderces dentatus* Eydoux and Souleyet, 1848**

(Fig. 1n)

*Oxuderes dentatus* Eydoux and Souleyet, 1848: 182 (Macao); Lim and Larson, 1994: 260 [25, 50].

*Apocryptes dentatus*, Martens, 1876: 392; Fowler, 1938: 212 [27, 53].

**Material examined:**

NTOUP 2011-05-010, 91.0 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011. NTOUP 2011-05-025, 2 specimens, 35.0-37.9 mm SL, Sungai Haji Dorani, Malaysia, coll. S. P. Huang and H. M. Huang, 22 April, 2011.

***Oxyurichthys microlepis* (Bleeker, 1849)**

(Fig. 2a)

*Gobius microlepis* Bleeker, 1849: 35 (Freto Madurae prope Surabaya et Sumanap) [5].

*Oxyurichthys microlepis*, Bleeker, 1861: 32; Koumans, 1953: 41; Gomez, 1980: 95; Lim and Larson, 1994: 260; Larson and Lim, 2005: 125 [11, 28, 40, 48, 50].

**Material examined:**

NTOUP 2011-05-031, 58.2 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 20 April, 2011.

***Periophthalmus novemradiatus* (Hamilton, 1822)**

(Fig. 2b)

*Gobius novemradiatus* Hamilton, 1822: 47 (Uttabhad, Ganges Delta, India) [29].

*Periophthalmus novemradiatus*, Lim and Larson, 1994: 260; Lim and Low, 1998: 140; Larson and Lim, 2005: 133 [48, 50, 51].

**Material examined:**

NTOUP 2011-05-009, 2 specimens, 66.3-66.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

***Pseudoapocryptes elongatus* (Cuvier, 1816)**

(Fig. 2c)

*Gobius elongatus* Cuvier, 1816: 255 (Tranquebar) [21].

*Apocryptes lanceolatus* Cantor, 1849: 1169 (Singapore); Bleeker, 1861: 56; Martens, 1876: 392; Duncker, 1905: 160 [11, 15, 23, 53].

*Apocryptes changua* Bleeker, 1852: 53 (Singapore) [7].

*Pseudoapocryptes lanceolatus*, Herre and Myer, 1937: 46; Fowler, 1938: 220; Koumans, 1953: 248; Gomez, 1980: 95; Murdy, 1989: 48; Lim and Larson, 1994: 260 [27, 32, 40, 50, 55].

*Pseudoapocryptes elongatus*, Larson and Lim, 2005: 139 [48].

**Material examined:**

NTOUP 2011-05-011, 5 specimens, 62.7-73.8 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011. NTOUP 2011-05-023, 5 specimens, 37.6-66.5 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011. NTOUP 2011-05-030, 93.6 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang,

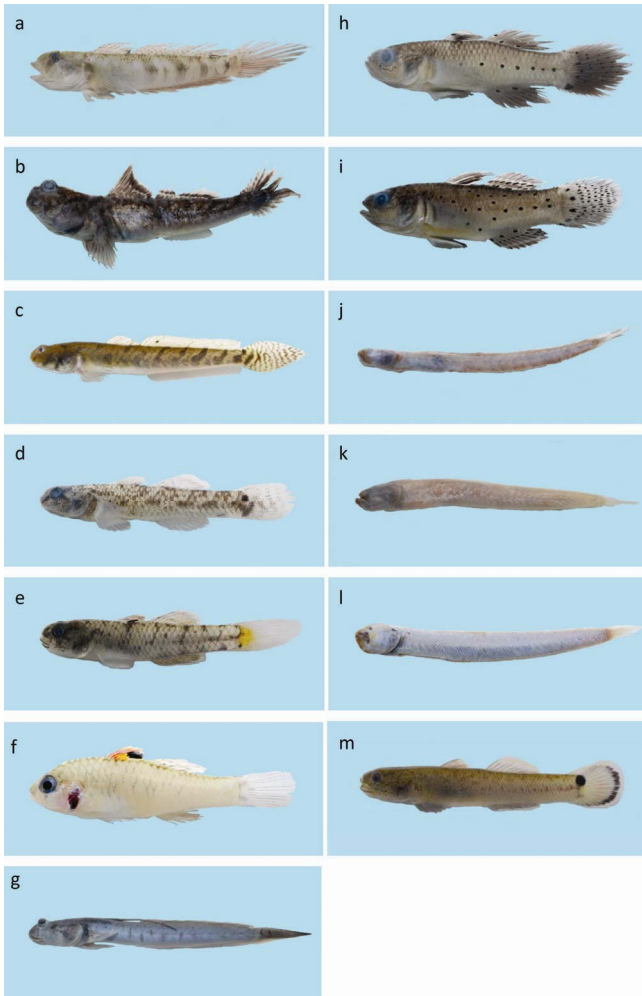


Fig. 2. Specimen photographs of a, *Oxyrichthys microlepis*, NTOUP 2011-05-031, 58.2 mm SL; b, *Periophthalmus novemradiatus*, NTOUP 2011-05-009, 66.9 mm SL; c, *Pseudapocryptes elongates*, NTOUP 2011-05-032, 71.9 mm SL; d, *Pseudogobius avicennia*, NTOUP 2011-05-020, 22.5 mm SL; e, *Pseudogobius fulvicaudus* n. sp., NTOUP 2011-05-006, holotype, male, 16.3 mm SL; f, *Redigobius chryosomus*, NTOUP 2011-05-018, 25.4 mm SL; g, *Scartelaos histophorus*, NTOUP 2011-05-024, 54.2 mm SL; h, *Stigmatogobius pleurostigma*, NTOUP 2011-05-004, 35.5 mm SL; i, *Stigmatogobius sadanundio*, NTOUP 2011-05-005, 48.8 mm SL; j, *Taenioides gracilis*, NTOUP 2011-05-042, 115.7 mm SL; k, *Trypauchen pelaeos*, NTOUP 2011-05-045, 96.1 mm SL; l, *Trypauchen vagina*, NTOUP 2011-05-046, 138.8 mm SL; m, *Wuhanlinigobius malayensis*, NTOUP 2012-05-151, male, 31.3 mm SL.

20 April, 2011. NTOUP 2011-05-032, 22 specimens, 36.0-72.8 mm SL, Sungai Haji Dorani, Malaysia, coll. S. P. Huang and H. M. Huang, 22 April, 2011.

***Pseudogobius avicennia* (Herre, 1940)**

(Fig. 2d)

*Vaimosa avicennia* Herre, 1940: 17 (mangrove swamp, Kranji River, Singapore); Koumans, 1953: 386 [31, 40].

*Pseudogobius avicernnia*, Lim and Larson, 1994: 260; Larson and Lim, 2005: 140 [48, 50].

**Material examined:**

NTOUP 2011-05-020, 12 specimens, 22.0-25.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Pseudogobius fulvicaudus* Huang,**

**Shao & Chen, new species**

(Tables 1, 2, Figs. 2e, 3)

**Material examined:**

**Holotype:** NTOUP 2011-05-006, 15.8 mm SL, male, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

**Paratypes:** Data same as holotype. ASIZP 0072334, 5 specimens, 15.9-17.1 mm SL; data same as holotype. NTOUP 2011-05-007, 20 specimens, 15.1-19.0 mm SL; data same as holotype. NTOUP 2011-05-021, 12 specimens, 15.3-17.4 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

**Diagnosis**

*Pseudogobius fulvicaudus* n. sp. is well distinguished from other congeners by the unique combinations of the following features: (1) fin rays: D2 I/7, A I/6-7 (modally 7), P 14-15 (modally 15) and first dorsal fin lacking filaments; (2) squamation: lateral body with large ctenoid scales, longitudinal scale rows 25-26, predorsal scales 6; (3) specific coloration: body with 4-5 main oblique black bars, caudal fin base with 2 black spots; first dorsal fin with a rear black blotch, and caudal fin base with a large semicircular bright yellow mark.

**Description**

Body elongate, subcylindrical anteriorly and compressed posteriorly. Head large. Snout more prominent than upper lip. Eyes rather large. Mouth small, maxillary extending to the vertical of anterior margin of eye. Anterior nasal as short tube, posterior nasal as round hole. Gill-opening restricted, extending ventrally slightly beyond the middle vertical line of opercle. VC 10 + 16 = 26 (in 7).

**Fins**

D1 VI; D2 I/7; A I/6-7 (modally 7); P 14-16 (modally 15). First dorsal fin lacking any filamentous rays. Anal fin inserted below first branched rays of second dorsal fin. Pelvic fin large and rounded. Rear margin of caudal fin rounded.

**Scales**

LR 25-26; TR 7; PreD 6; SDP 5. Body covered with rather large ctenoid scales. Predorsal region with cycloid scales. Belly with smaller cycloid scales. Cheek naked. One row of cycloid scales on upper region of opercle.

**Table 1. Morphometric measurements of *Pseudogobius fulvicaudus* n. sp. from Matang mangrove, Malaysia.**

Characters	<i>Pseudogobius fulvicaudus</i> n. sp.								
	n	Male				Female			
		6				6			
Percent standard length (%)									
Head length	26.4	–	27.9	(27.2)	24.7	–	26.1	(25.4)	
Predorsal length	34.2	–	35.1	(34.6)	34.3	–	36.2	(35.1)	
Snout to 2nd dorsal origin	51.8	–	53.8	(52.9)	51.8	–	53.1	(52.4)	
Snout to anus	45.0	–	47.1	(46.0)	49.5	–	52.9	(51.2)	
Snout to anal fin origin	53.1	–	56.1	(54.9)	53.9	–	56.9	(55.7)	
Prepelvic length	23.5	–	25.3	(24.6)	24.6	–	26.9	(26.0)	
Caudal peduncle length	30.5	–	32.0	(31.1)	30.9	–	31.6	(31.1)	
Caudal peduncle depth	10.0	–	11.9	(10.9)	10.6	–	11.4	(11.0)	
1st dorsal fin base	12.5	–	13.4	(12.7)	11.3	–	12.2	(11.9)	
2nd dorsal fin base	15.6	–	17.3	(16.6)	14.4	–	16.1	(15.1)	
Anal fin base	15.0	–	16.9	(15.9)	14.0	–	15.4	(14.8)	
Caudal fin length	29.5	–	32.1	(30.7)	25.5	–	27.9	(26.8)	
Pectoral fin length	21.3	–	23.8	(23.0)	20.4	–	21.8	(21.2)	
Pelvic fin length	19.5	–	20.9	(20.4)	17.1	–	18.1	(17.8)	
Body depth at pelvic fin origin	15.6	–	17.4	(16.5)	16.4	–	17.7	(16.9)	
Body depth at anal fin origin	14.0	–	15.4	(14.8)	15.8	–	16.6	(16.2)	
Body width at anal fin origin	8.2	–	9.1	(8.7)	11.5	–	12.0	(11.7)	
Pelvic fin origin to anus	24.3	–	26.7	(25.4)	27.0	–	28.9	(27.7)	
Percent head length (%)									
Snout length	26.0	–	28.0	(27.1)	24.9	–	26.5	(25.9)	
Eye diameter	28.1	–	29.3	(28.8)	30.2	–	32.1	(30.8)	
Cheek depth	25.7	–	26.8	(26.4)	23.3	–	24.6	(24.0)	
Postorbital length	47.3	–	50.6	(49.2)	46.7	–	49.9	(48.2)	
Head width in maximum	72.2	–	74.8	(73.7)	72.4	–	75.7	(74.3)	
Head width in upper gill	48.2	–	50.7	(49.8)	52.8	–	55.6	(53.8)	
Bony interorbital width	12.2	–	13.7	(12.8)	11.0	–	12.4	(11.8)	
Fleshy interorbital width	28.1	–	30.5	(29.5)	30.6	–	32.2	(31.3)	
Lower jaw length	38.6	–	41.9	(40.6)	37.5	–	39.9	(38.8)	

### Head lateral-line system

**Head canals-** Anterior oculoscapular canal present, anterior termination with paired pores  $\lambda$ , a median interorbital pore  $\kappa$ ; paired postorbital pores  $\omega$ , lateral termination with paired pores  $\alpha$ . Posterior oculoscapular and preopercular canals entirely absent.

**Sensory papillae-** Row *a* short, about two third of eye diameter. Row *b* short with densely-set papillae, starting from the vertical of posterior margin of pupil. Single *c* papilla. Row *cp* with 3 papillae. Opercular rows with rows *os*, *oi* and *ot*. Rows *oi* and *ot* well separated. Row *f* with 4 papillae.

### Coloration in life

Head and body generally creamy yellow, middle lateral with 5 mainly grayish brown blotches. Dorsal half with 4-5 oblique blackish brown bars, first oblique bar below middle

of first dorsal fin base. Lateral scales with blackish brown margin. Belly creamy white. Two conspicuous infraorbital blackish brown bars on cheek. Caudal fin base with 2 blackish brown bars vertical to each other. Pectoral fin base with a blackish brown blotch. First dorsal fin with a rounded black mark at rear, and a longitudinal orange to orange red bar above the dark mark. Anal fin pale white. Caudal fin creamy yellow to bright yellow, the yellow mark larger on adult males than on females. All other fins translucent and lacking deep marks.

### Habitat

This new species can be found in the shallow tidal pools of the mangrove region of Matang, Malay Peninsula, muddy intertidal habitat.

### Etymology

The specific name, *fulvicaudus*, is derived from Latin *fulvus* (meaning yellow) and *caudal* (meaning caudal fin), and is

**Table 2. Frequency distribution of meristic features of *Pseudogobius fulvicaudus* n. sp. and other compared nominal species.**

	D1			D2				A				P				
	V	VI	x	I/6	I/7	I/8	x	I/6	I/7	I/8	x	14	15	16	17	x
<i>P. avicennia</i>	–	12	6.0	–	12	–	7.0	1	11	–	6.9	–	2	16	4	16.1
<i>P. gastrospilos</i>	–	20	6.0	–	20	–	7.0	–	20	–	7.0	3	31	4	–	15.0
<i>P. masago</i>	1	19	6.0	–	19	1	7.1	–	18	2	7.1	2	24	13	1	15.3
<i>P. javanicus</i>	–	28	6.0	–	28	–	7.0	–	28	–	7.0	–	35	27	1	15.5
<i>P. fulvicaudus</i> n. sp.	–	25	6.0	3	22	–	6.9	1	22	2	7.0	14	31	–	–	14.7

	LR						TR					PreD					
	25	26	27	28	29	x	7	8	9	10	x	6	7	8	9	10	x
<i>P. avicennia</i>	–	–	–	19	5	28.2	–	–	–	12	10.0	–	–	–	11	1	9.1
<i>P. gastrospilos</i>	–	–	22	18	–	27.5	–	13	7	–	8.4	–	20	–	–	–	7.0
<i>P. masago</i>	–	–	–	31	8	28.2	–	20	–	–	8.0	–	–	3	16	1	8.9
<i>P. javanicus</i>	–	–	–	41	25	28.4	–	17	16	–	8.5	4	24	4	–	–	7.0
<i>P. fulvicaudus</i> n. sp.	16	34	–	–	–	25.7	25	–	–	–	7.0	25	–	–	–	–	6

	SDP					VC		
	5	6	7	8	x	25	26	x
<i>P. avicennia</i>	–	–	12	–	7.0	–	3	26.0
<i>P. gastrospilos</i>	2	18	–	–	5.9	–	11	26.0
<i>P. masago</i>	–	3	11	6	7.2	4	2	25.3
<i>P. javanicus</i>	1	23	9	–	6.2	1	7	25.9
<i>P. fulvicaudus</i> n. sp.	25	–	–	–	5.0	–	7	26.0

referring to the diagnostic character of a brilliant yellow mark on the caudal fin base in adult males.

### Remarks

Previous study [42] reveals 6 species of *Pseudogobius* as valid as follows: *Pseudogobius poicilosoma* (Bleeker, 1849), *Pseudogobius javanicus* (Bleeker, 1856), *Pseudogobius melanostictus* (Day, 1876), *Pseudogobius olorum* (Sauvage, 1880), *Pseudogobius masago* (Tomiyama, 1936) and *Pseudogobius avicennia* (Herre, 1940) [5, 10, 22, 31, 64, 66]. Present study reveals *Pseudogobius gastrospilos* (Bleeker, 1853) should be considered as senior synonym of *Pseudogobius melanostictus* (Day, 1876) [36].

The new species, *Pseudogobius fulvicaudus* n. sp. can be easily separated from *Pseudogobius gastrospilos*, by the absence of any filamentous rays of first dorsal fin in adult males vs. the presence of 2<sup>nd</sup> and 3<sup>rd</sup> filamentous rays of first dorsal fin in adult males. *P. fulvicaudus* n. sp. can be easily distinguished from *Pseudogobius javanicus* by following features: (1) fewer counts of longitudinal scale rows 25-26 vs. 28-29; (2) absence of any filamentous rays of first dorsal fin in adult males vs. the presence of 2<sup>nd</sup> and 3<sup>rd</sup> filamentous rays of first dorsal fin in adult males.

*P. fulvicaudus* n. sp. can be easily distinguished from *Pseudogobius poicilosoma*, by following features: (1) fewer counts of second dorsal fin rays I/6-7 vs. I/8; (2) more counts of pectoral fin rays 14-15 (modally 15) vs. 12.

*P. fulvicaudus* n. sp. can be easily distinguished from *Pseu-*

*dogobius olorum*, by following features: (1) fewer counts of second dorsal fin rays I/6-7 vs. I/8; (2) fewer counts of longitudinal scale rows 25-26 vs. 32.

*P. fulvicaudus* n. sp. is similar to the two remaining congeneric species, *Pseudogobius masago* and *Pseudogobius avicennia*, in the lacking of filamentous rays of first dorsal fin in males and having almost spotless caudal fin.

However, *P. fulvicaudus* n. sp. can be distinguished from *Pseudogobius avicennia* by the following features: (1) larger body scales representing fewer counts of longitudinal scale rows 25-26 vs. 28-29; fewer counts of predorsal scales 6 vs. 9-10; (2) fin rays counts: pectoral fin modally 15 vs. 16; and (3) specific coloration pattern: presence of orange red longitudinal band on first dorsal fin vs. absence of any orange mark on first dorsal fin; absence of thin white margin on second dorsal and caudal fins vs. presence of thin white or creamy yellow distal margin on second dorsal and caudal fins; and two blackish brown spots on caudal fin base vs. one large blackish brown spot on caudal fin base.

*P. fulvicaudus* n. sp. can be distinguished from *Pseudogobius masago*, another small-sized fish (always less than 20 mm SL) by the following features: (1) larger body scales representing fewer counts of longitudinal scale rows 25-26 vs. 28-29; fewer counts of predorsal scales 6 vs. 8-10; (2) vertebral counts: modally 26 vs. 25; and (3) specific coloration: presence of horizontal orange red band as well as a large black blotch at rear vs. none of the above markings; a conspicuous, oblique blackish brown bar below first dorsal fin vs.

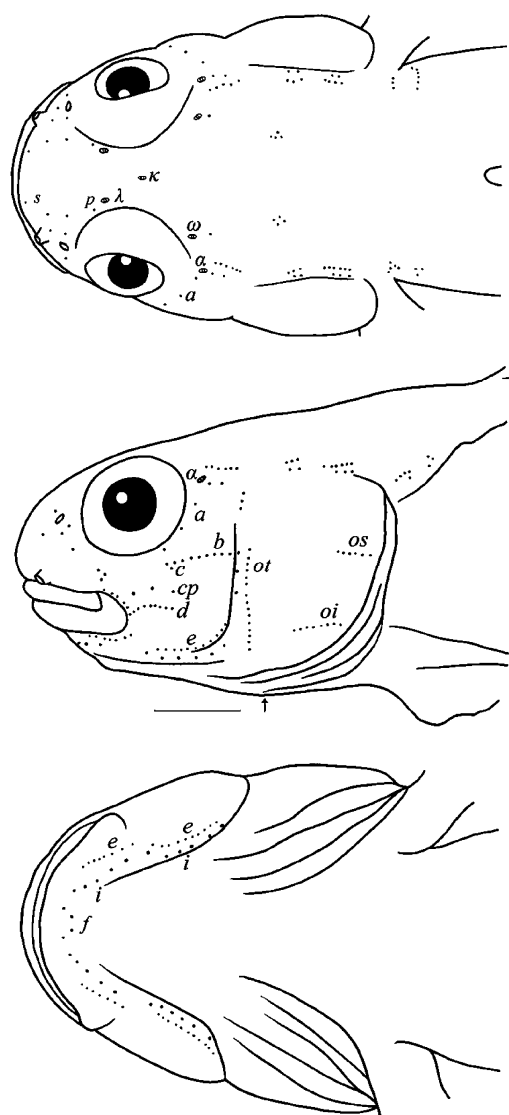


Fig. 3. Head lateral-line system of *Pseudogobius fulvicaudus* n. sp., NTOUP 2011-05-006, holotype, male, 15.8 mm SL. Bar = 1 mm.

absence of any distinct dark cross bars; and two blackish brown spots on caudal fin base vs. one large blackish brown spot on caudal fin base. This new species is of the smaller-sized fish in *Pseudogobius*; the record of its mature females with ripe eggs in ovary is 15.5 mm, minimum SL.

#### Other compared materials of nominal species of *Pseudogobius*

##### *Pseudogobius avicennia* (Herre, 1940)

NTOUP 2011-05-020, 12 specimens, 22.0-25.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

##### *Pseudogobius gastropilos* (Bleeker, 1853)

Holotype-LEIDEN 4676, 29.7 mm SL, Batavia, Java, Indonesia.

NTOUP 2011-05-049, 20 specimens, 16.8-33.3 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 15 January, 2010; NTOUP 2011-05-050, 15 specimens, 21.5-34.6 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 22 March, 2010; NTOUP 2012-02-120, 15 specimens, 28.3-36.2 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang, 22 April, 2010; NTOUP 2012-02-123, 10 specimens, 20.1-30.5 mm SL, mangrove of Palau, coll. I-S. Chen and J. T. Chen, 17 November, 2006; NTOUP 2012-11-165, 3 specimens, 18.6-32.4 mm SL, Sai Yuan, Phuket Island, Thailand, coll. S. P. Huang, 23 November, 2012; NTOUP 2012-11-168, 8 specimens, 18.3-30.3 mm SL, Cherngtalay, Phuket Island, Thailand, coll. S. P. Huang, 23 November, 2012.

##### *Pseudogobius javanicus* (Bleeker, 1856)

NTOUP 2011-05-052, 12 specimens, 20.8-32.1 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 29 October, 2009; NTOUP 2011-05-054, 18 specimens, 19.3-29.1 mm SL, Beimen Township, Tainan County, Taiwan, coll. S. P. Huang and H. M. Huang, 2 March, 2010; NTOUP 2012-02-126, 20 specimens, 19.9-26.6 mm SL, mangrove of Liehyu Island, Taiwan, coll. S. P. Huang and N. H. Jang-Liaw, 24 November, 2011; NTOUP 2012-02-127, 8 specimens, 14.6-23.7 mm SL, mangrove of Hong Kong, coll. I-S. Chen, 22 November, 2011; NTOUP 2011-05-056, 52 specimens, 15.9-32.4 mm SL, Sungei Buloh mangroves, Singapore, coll. I-S. Chen, July, 2001; NTOUP 2012-11-164, 22.7 mm SL, Sai Yuan, Phuket Island, Thailand, coll. S. P. Huang, 23 November, 2012.

##### *Pseudogobius masago* (Tomiyama, 1936)

NTOUP 2010-11-568, 28 specimens, 17.1-21.0 mm SL, estuary of Puzi River, Dongshi Township, Chiayi County, Taiwan, coll. S. P. Huang and H. M. Huang, 2 March, 2010; NTOUP 2010-11-595, 30 specimens, 14.0-18.6 mm SL, estuary of Xiaofanli River, Guanyin Township, Taoyuan County, Taiwan, coll. S. P. Huang and H. M. Huang, 9 July, 2010; NTOUP 2012-02-119, 5 specimens, 21.9-24.5 mm SL, estuary of Jinsha River, Kinmen Island, Taiwan, coll. S. P. Huang, 19 May, 2010.

##### *Redigobius chrysosomus* (Bleeker, 1875)

(Fig. 2f)

*Lophogobius chrysosoma* Bleeker, 1875: 114 (Bandjermasin, Borneo; Ambon Island, Moluccas Islands, Indonesia) [12].

*Redigobius chrysosoma*, Allen, 1991: 192; Larson and Murdy, 2001: 3601 [3, 49].

*Redigobius chrysosomus*, Allen *et al.*, 2001: 284; Hoese and Larson, 2006: 1681; Larson 2010: 142 [4, 33, 46].

#### Material examined:

NTOUP 2011-05-018, 25.7 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.



***Scartelaos histophorus* (Valenciennes, 1837)**

(Fig. 2g)

*Beleophthalmus histophorus* Valenciennes, 1837: 210 (Bombay and Ganges River) [67].

*Boleophthalmus aequipetorius* Richardson, 1845: 148 (Woo-sung and Canton, China) [61].

*Scartelaos histophorus*, Murdy, 1989: 51; Chen and Fang, 1999: 243; Lim and Larson, 1994: 261; Larson and Lim, 2005: 147 [16, 48, 50, 55].

**Material examined:**

NTOUP 2011-05-024, 54.2 mm SL, Sungai Haji Dorani, Malaysia, coll. S. P. Huang and H. M. Huang, 22 April, 2011.

***Stigmatogobius pleurostigma* (Bleeker, 1849)**

(Fig. 2h)

*Gobius pleurostigma* Bleeker, 1849: 28 (Surabaya, Java) [5].

*Stigmatogobius pleurostigma*, Lim and Larson, 1994: 261; Larson and Lim, 2005: 150; Larson, 2005: 358 [43, 48, 50].

**Material examined:**

NTOUP 2011-05-004, 5 specimens, 27.2-35.8 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011.

***Stigmatogobius sadanundio* (Hamilton, 1822)**

(Fig. 2i)

*Gobius sadanundio* Hamilton, 1822: 52 (estuaries near Calcutta); Herre and Myers, 1937: 38; Fowler, 1931: 448; Fowler, 1938: 218 [29, 26, 27, 32].

*Stigmatogobius sadanundio*, Koumans, 1953: 111; Lim and Ng, 1990: 116; Lim and Larson, 1994: 261; Lim and Low, 1998: 141; Larson, 2005: 361 [40, 43, 50, 51, 52].

**Material examined:**

NTOUP 2011-05-005, 25 specimens, 33.1-47.5 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011. NTOUP 2011-05-019, 29.8 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Taenoides gracilis* (Valenciennes, 1837)**

(Fig. 2j)

*Amblyopus gracilis* Valenciennes, 1837: 166 (Pondicherry, India) [67].

*Amblyopus hermannianus* Bleeker, 1861: 32 (Singapore) [11].

*Taenoides coeculus* Fowler, 1938: 222 (Singapore) [27].

*Taenoides gracilis* Fowler, 1938: 222; Lim and Larson, 1994: 261; Lim and Low, 1998: 142; Larson and Lim, 2005: 153 [27, 48, 50, 51].

**Material examined:**

NTOUP 2011-05-042, 115.8 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 20 April, 2011. NTOUP 2011-05-043, 104.6 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 21 April, 2011.

***Trypauchen pelaeos* Murdy, 2006**

(Fig. 2k)

*Trypauchen pelaeos* Murdy, 2006: 65 (South of Penang, south of Pu Kendi Island, 5°11'N, 100°10'E, Strait of Malacca, eastern Indian Ocean, Malaysia) [56].

**Material examined:**

NTOUP 2011-05-044, 50.2 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 20 April, 2011. NTOUP 2011-05-045, 4 specimens, 69.3-126.6 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 21 April, 2011.

***Trypauchen vagina* (Bloch and Schneider, 1801)**

(Fig. 2l)

*Gobius vagina* Bloch and Schneider, 1801: 73 (Tranquebar, India) [14].

*Trypauchen vagina*, Lim and Larson, 1994: 261; Larson and Lim, 2005: 154 [48, 50].

**Material examined:**

NTOUP 2011-05-029, 65.1 mm SL, Sungai Haji Dorani, Malaysia, coll. S. P. Huang and H. M. Huang, 22 April, 2011. NTOUP 2011-05-046, 7 specimens, 58.6-144.9 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 20 April, 2011. NTOUP 2011-05-047, 3 specimens, 94.6-112.1 mm SL, river mouth of Matang mangrove, Malaysia, coll. H. M. Huang, 21 April, 2011.

***Wuhanlinigobius malayensis* Huang, Zeehan & Chen, 2013**

(Figs. 2m)

*Wuhanlinigobius malayensis* Huang, Zeehan & Chen, 2013: 152 (Matang, Malaysia) [35].

**Material examined:**

NTOUP 2012-05-151, 31.3 mm SL, male, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011. NTOUP 2011-05-012, 8 specimens, 20.9-30.5 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 20 April, 2011. NTOUP 2011-05-022, 8 specimens, 17.9-31.1 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011. NTOUP 2011-05-027, 7 specimens, 13.0-25.0 mm SL, Sungai Haji Dorani, Malaysia, coll. S. P. Huang and H. M. Huang, 22 April, 2011.

## Remarks

This species has been recognized a new species, the detailed taxonomic treatment and description can be seen in Huang *et al.* [35].

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## REFERENCES

- Akihito, Prince, Hayashi, M., and Yoshino, T., "Suborder Gobioidi," in: Masuda, H., Amaoka, K., Araga, C., Uyeno, T., and Yoshino, T. (Eds.), *The Fishes of the Japanese Archipelago*, Tokai University Press, Tokyo (1984).
- Akihito, Prince and Meguro, K., "*Glossogobius sparsipapillus*, a new species of goby from Vietnam," *Japanese Journal of Ichthyology*, Vol. 23, No. 1, pp. 9-11 (1976).
- Allen, G. R., *Field Guide to the Freshwater Fishes of New Guinea*, Christensen Research Institute, Madang, Papua New Guinea (1991).
- Allen, G. R., Midgley, H., and Allen, M., *Field Guide to the Freshwater Fishes of Australia*, Western Australian Museum (2001).
- Bleeker, P., "Bijdrage tot de kennis der Blennioïden en Gobioiden van der Soenda-Molukschen Archipel, met beschrijving van 42 nieuwe soorten," *Verhandelingen van het Bataviaasch Genootschap van Kunsten en Wetenschappen*, Vol. 22, No. 6, pp. 1-40 (1849).
- Bleeker, P., "Vijfde bijdrage tot de kennis der ichthyologische fauna van Borneo met beschrijving van eenige nieuwe soorten van zoetwatervissen," *Natuurkundig Tijdschrift voor Nederlandsch-Indie*, Vol. 2, pp. 415-442 (1851).
- Bleeker, P., "Bijdrage tot de kennis der ichthyologische fauna van Singapore," *Natuurkundig Tijdschrift voor Nederlandsche-Indie*, Vol. 3, pp. 51-86 (1852).
- Bleeker, P., "Diagnostische beschrijvingen van nieuwe of weinig bekende vischsoorten van Batavia. Tiental I-VI," *Natuurkundig Tijdschrift voor Nederlandsch Indië*, Vol. 4, pp. 451-516 (1853).
- Bleeker, P., "Verslag van eenige vischverzamelingen van Oost-Java," *Natuurkundig Tijdschrift voor Nederlandsch-Indie*, Vol. 9, pp. 391-414 (1855).
- Bleeker, P., "Verslag omtrent eenige vischsoorten gevangen aan de Zuidkust van Malang in Oost-Java," *Natuurkundig Tijdschrift voor Nederlandsche-Indie*, Vol. 11, pp. 81-92 (1856).
- Bleeker, P., "Mededeeling omtrent vischsoorten, nieuw voor de kennis der fauna van Singpoera," *Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Letterkunde, en Schoone Kunsten te Amsterdam*, Vol. 12, No. 1, pp. 28-63 (1861).
- Bleeker, P., "Gobioidorum species insulindicae novae," *Archives Neerlandaises des Sciences Exactes et Naturelles*, Vol. 10, pp. 113-134 (1875).
- Bleeker, P., "Revision des especes insulindiennes de la sousfamille des Eleotriiformes," *Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Letterkunde, en Schoone Kunsten te Amsterdam*, Vol. 11, No. 2, pp. 13-110 (1877).
- Bloch, M. E. and Schneider, J. G., *Systema Ichthyologiae. Iconibus ex illustratum. Post obitum auctoris opus inchoatum Absolvit. Correxit, interpolavit Jo. Gottlob Schneider*, Berlin. Facsimile, Cramer & Swann: Codicote (1801).
- Cantor, T. E., "Catalogue of Malayan fishes," *Journal of the Asiatic Society of Bengal*, Vol. No. 18, No. 2, pp. 983-1443 (1849).
- Chen, I. S. and Fang, L. S., "The Freshwater and Estuarine Fishes of Taiwan," *National Museum of Marine Biology & Aquarium*, Pintung (1999).
- Chen, I-S. and Kottelat, M., "Three new species of genus *Rhinogobius* (Teleostei: Gobiidae) from northern Laos," *The Raffles Bulletin of Zoology*, Vol. 51, pp. 87-95 (2003).
- Chen, I-S. and Miller, P. J., "Two new freshwater gobies of genus *Rhinogobius* (Teleostei: Gobiidae) in southern China, around northern region of the South China Sea," *The Raffles Bulletin of Zoology*, Supplement, No. 19, pp. 225-232 (2008).
- Chen, I. S. and Shao, K. T., "A taxonomic review of the gobiid fish genus *Rhinogobius* Gill, 1859, from Taiwan, with description of three new species," *Zoological Studies*, Vol. 35, No. 3, pp. 200-214 (1996).
- Chen, I. S., Wu, H. L., and Shao, K. T., "A new species of *Rhinogobius* (Teleostei: Gobiidae) from Fujian Province, China," *Ichthyological Research*, Vol. 46, No. 2, pp. 171-178 (1999).
- Cuvier, G. L., *Le Regne Animal Distribue D'apres Son Organisation. Poissons*, First Edition, Fortin, Masson et Co., Paris, Vol. 2, pp. 104-351 (1816).
- Day, F., *The Fishes of India; Being a Natural History of the Fishes Known to Inhabit the Seas and Freshwaters of India, Burma and Ceylo*, Volume I, Bernard Quaritch, London, pp. 281-320 (1876).
- Duncker, G., "Die fische der malayischen Halbinsel," *Mittelungen aus dem Naturhistorischen Museum in Hamburg*, Vol. 21, pp. 135-207 (1905).
- Eschmeyer, W. N., Fricke, R., Fong, J. D., and Polack, D. A., "Marine fish diversity: history of knowledge and discovery," *Zootaxa*, Vol. 2525, pp. 19-50 (2010).
- Eydoux, J. F. T. and Souleyet, F. L. A., "Voyage autour du monde execute pendant les annees 1836 et 1837 sur la corvette La Bonite commandee par M. Vaillant," *Poissons*, Vol. 1, No. 2, pp. 155-216 (1848).
- Fowler, H. W., "A small collection of fishes from Singapore," *Proceedings of the Academy of Natural Sciences*, Vol. 83, pp. 443-448 (1931).
- Fowler, H. W., "A list of fishes from Malaya," *Fisheries Bulletin*, Vol. 1, pp. 1-268 (1938).
- Gomez, E. D., "The present state of mangrove ecosystems in Southeast Asia and the impact of pollution - a regional synopsis," *FAO South China Sea Fisheries Development & Coordinating Programme*, SCS/80/WP/94: vii, pp. 1-97 (1980).
- Hamilton, F., *An Account of the Fishes Found in the River Ganges and Its Branches*, Archibald Constable, Edinburgh (1822).
- Herre, A. W., "Eleven new fishes from the Malay Peninsula," *Bulletin of the Raffles Museum, Singapore*, Vol. 12, pp. 5-16 (1936).
- Herre, A. W., "New species of fishes from the Malay peninsula and Borneo," *Bulletin of the Raffles Museum, Singapore*, Vol. 16, pp. 5-26 (1940).
- Herre, A. W. and Myers, G., "A contribution to the ichthyology of the Malay Peninsula," *Bulletin of the Raffles Museum, Singapore*, Vol. 13, pp. 5-75 (1937).
- Hoese, D. F., "Gobiidae, Eleotridae, Kraemeriidae," in: Smith, M. M. and Heemstra, P. C. (Eds.), *Smith's Sea Fishes, Struik*, pp. 774-811 (1986).
- Huang, S. P. and Chen, I-S., "Three new species of *Rhinogobius* Gill, 1859 (Teleostei: Gobiidae) from the Hanjiang Basin, southern China," *The Raffles Bulletin of Zoology*, Supplement, No. 14, pp. 101-110 (2007).
- Huang, S. P., Zeehan, J., and Chen, I-S., "A new genus of *Hemigobius* generic group goby based on morphological and molecular evidence," *Journal of Marine Science and Technology*, Vol. 21, Supplement, pp. 146-155 (2013).
- Huang, S. P. and Chen, I-S., "Redescription of *Gobius gastrospilus* Bleeker, 1853 with comments of four newly recorded species of brackish gobies from Taiwan," *Journal of Marine Science and Technology*, Vol. 21, Supplement, pp. 94-105 (2013).

37. Inger, R. F., "Notes on fishes of the genus *Brachygobius*," *Fieldiana Zoology*, Vol. 39, No. 14, pp. 107-117 (1958).
38. Karoli, J., "Prodromus piscium Asiae orientalis a Domine Xantus annis 1868-70 collectorum," *Termesztudományi Füzetek*, Vol. 5, pp. 147-187 (1882).
39. Koumans, F. P., "Results of a reexamination of types and specimens of gobioid fishes, with notes on the fish fauna of the surroundings of Batavia," *Zoologische Mededeelingen*, Vol. 22, pp. 121-210 (1940).
40. Koumans, F. P., "X. Gobioida," in: Weber, M. and de Beaufort, L. F. (Eds.), *The Fishes of the Indo-Australian Archipelago*, E. J. Brill, Leiden (1953).
41. Larson, H. K., "Allocation to *Calamiana* and redescription of the fish species *Apocryptes variegatus* and *Vaimosa mindora* (Gobioidae: Gobiionellinae), with description of a new species," *Raffles Bulletin of Zoology*, Vol. 47, No. 1, pp. 257-281 (1999).
42. Larson, H. K., "A revision of the gobiid fish genus *Mugilogobius* (Teleostei: Gobioidae), with discussion of its systematic placement," *Records of the Western Australian Museum*, Supplement, No. 62, pp. 1-233 (2001).
43. Larson, H. K., "A revision of the gobiid fish genus *Stigmatogobius* (Teleostei: Gobiidae), with descriptions of two new species," *Ichthyological Exploration of Freshwaters*, Vol. 16, No. 4, pp. 347-370 (2005).
44. Larson, H. K., "A new species of the gudgeon *Bostrychus* (Teleostei: Gobioidae: Eleotridae), from peninsular Malaysia," *The Beagle, Records of the Museums and Art Galleries of the Northern Territory*, Vol. 24, pp. 147-150 (2008).
45. Larson, H. K., "Review of the gobiid fish genera *Eugnathogobius* and *Pseudogobiopsis* (Gobioidae: Gobiidae: Gobiionellinae), with descriptions of three new species," *The Raffles Bulletin of Zoology*, Vol. 57, No. 1, pp. 127-181 (2009).
46. Larson, H. K., "A review of the gobiid fish genus *Redigobius* (Teleostei: Gobiionellinae), with description of two new species," *Ichthyological Exploration of Freshwaters*, Vol. 21, No. 2, pp. 123-191 (2010).
47. Larson, H. K., Jaafar, Z., and Lim, K. K. P., "An annotated checklist of the gobioid fishes of Singapore," *The Raffles Bulletin of Zoology*, Vol. 56, No. 1, pp. 135-155 (2008).
48. Larson, H. K. and Lim, K. K. P., *A guide to gobies of Singapore*, Singapore Science Centre, Singapore (2005).
49. Larson, H. K. and Murdy, E. O., "Families Eleotridae, Gobiidae," in: Carpenter, K. E. and Niem, V. H. (Eds.), *Species Identification Guide for Fishery Purposes, Bony Fishes*, Part 4, Vol. 6, pp. 3574-3603 (2001).
50. Lim, K. K. P. and Larson, H. K., "A preliminary checklist of the gobiid fishes of Singapore," in: Sudara, S., Wilkinson, C. R., and Chou, L. M. (Eds.), *Proceedings, Third ASEAN-Australian Symposium on Living Coastal Resources, Vol. 2: Research Papers*, Chulalongkorn University, Bangkok (1994).
51. Lim, K. K. P. and Low, J. K. Y., *A Guide to the Common Marine Fishes of Singapore*, Singapore Science Centre (1998).
52. Lim, K. K. P. and Ng, P. K. L., *A Guide to the Freshwater Fishes of Singapore*, Singapore Science Centre (1990).
53. Martens, E. von, "Die Preussische Expedition nach Ost-Asien," *Zoologische Abtheilung*, Vol. 2, pp. 193-412 (1876).
54. Miller, P. J., "New species of *Corcyrogobius*, *Thorogobius* and *Wheelerigobius* from west Africa (Teleostei: Gobiidae)," *Journal of Natural History*, Vol. 22, No. 5, pp. 1245-1262 (1988).
55. Murdy, E. O., "A taxonomic revision and cladistic analysis of the oxudercine gobies (Gobiidae: Oxudercinae)," *Records of the Australian Museum, Supplement*, Vol. 11, pp. 1-93 (1989).
56. Murdy, E. O., "A revision of the gobiid fish genus *Trypauchen* (Gobiidae: Amblyopinae)," *Zootaxa*, Vol. 1343, pp. 55-68 (2006).
57. Ng, P. K. L. and Sivasothi, N. (Eds.), *A Guide to the Mangroves of Singapore II*, Singapore Science Centre (1999).
58. Pallas, P. S., *Spicilegia Zoologica: quibus novae imprimis et obscurae animalium species iconibus, descriptionibus atque commentariis illustrantur, Fasciculus septimus*, Berlin, Fascicle, Vol. 7, pp. 1-42 (1770).
59. Peters, W. C. H., "Über die von Hrn. Dr. F. Jagor in dem ostindischen Archipel gesammelten und dem Königl. zoologischen Museum Uebergebenen Fische," *Monatsberichte der Königlich Preussischen Akademie Wissenschaften Berlin*, Vol. 1868, pp. 254-281 (1868).
60. Randall, J. E. and Lim, K. K. P. (Eds.), "A checklist of the fishes of the South China Sea," *The Raffles Bulletin of Zoology, Supplement*, Vol. 8, pp. 569-667 (2000).
61. Richardson, J., "Ichthyology.-- Part I. In R. B. Hinds (eds.). 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," *London: Smith, Elder & Co. Ichthyology*, Vol. 9, pp. 99-150 (1845).
62. Sanzo, L., "Distribuzione delle papille cutanee (organi ciatiforme) e suo valore sistematico nei gobi," *Mitteilungen aus der Zoologischen Station zu Neapel*, Vol. 20, pp. 249-328 (1911).
63. Sasekumar, A. and Chong, V. C., *Ecology of Klang Strait*, Faculty of Science University of Malaya Kuala Lumpur (2005).
64. Sauvage, H. E., "Description des Gobioides nouveaux ou peu connus de la collection du Muséum d'histoire naturelle," *Bulletin de la Société philomathique de Paris*, Vol. 4, pp. 40-58 (1880).
65. Tan, R. and Yeo, A., *Chek Jawa Guidebook*, Simply Green, Singapore (2003).
66. Tomiyama, I., "Gobiidae of Japan," *Japanese Journal of Zoology*, Vol. 7, No. 1, pp. 37-112 (1936).
67. Valenciennes, A. and Cuvier, G. L., *Histoire Naturelle des Poissons*, Levrault, Paris, Vol. 12, p. 508 (1837).
68. Wongrat, P. and Miller, P. J., "The innervation of head neuromast rows in eleotridine gobies (Teleostei: Gobiidae)," *Journal of Zoology*, London, Vol. 225, pp. 27-42 (1991).
69. Wu, H. L. and Ni, Y., "On two new species of *Mugilogobius* Smitt (Perciformes: Gobiidae) from China," *Zoological Research*, Vol. 6, No. 4, pp. 93-98 (1985). (in Chinese and English)