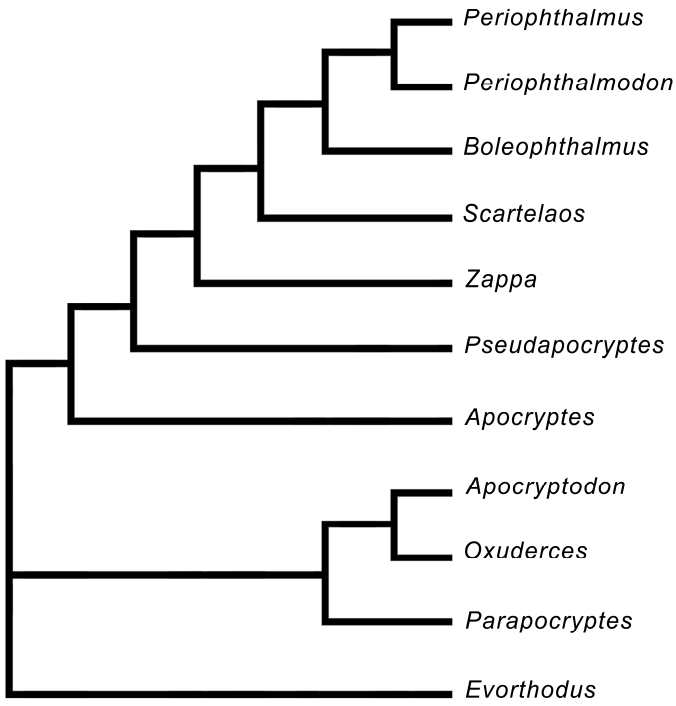
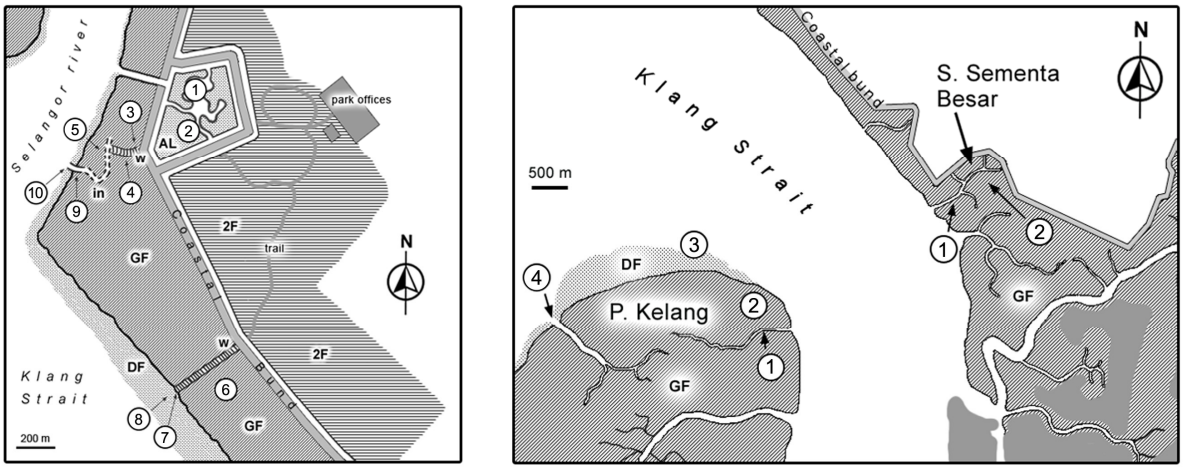
ESM – electronic supplementary material



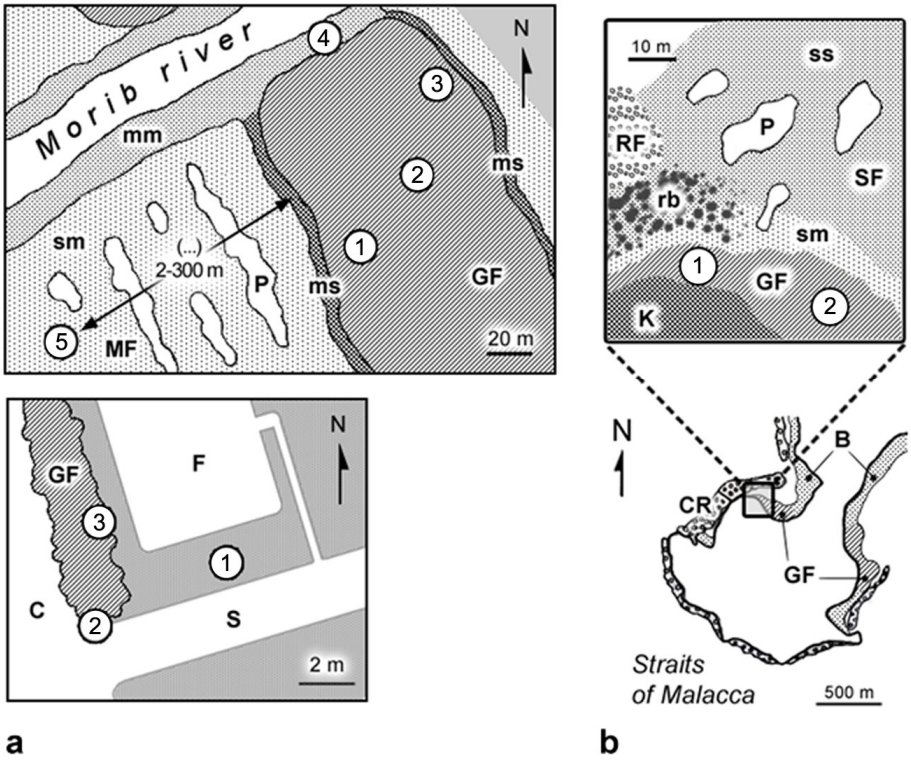
S1: cladogram of the Oxudercinae
Cladogram of the Oxudercinae (Murdy, 1989); the genus *Evorthodus* (Gobiidae: Gobionellinae) is a hypothetical sister group of the Oxudercinae. The subfamily includes two tribes: Oxudercini (*Parapocryptes*, *Oxuderces* and *Apocryptodon*), and Periophthalmini, which includes all the other genera. Within this latter tribe, the species of more derived genera present more extreme physiological and anatomical adaptations to terrestriality. The tree's topology suggests an increase of terrestriality at each cladogenetic event.



S2: study sites (K. Selangor, P. Kelang and S. Sementa Besar)

a: Kuala Selangor, study sites: 1-10= *Sel1-Sel10* (*Sel1-Sel8*: first transect; *Sel9-Sel10*: second transect). 3: landward fringe behind the reclamation bund; 4, 6: *Rhizophora* and *Bruguiera* spp. high forest; 5: bottom of an ephemeral tidal inlet inside the high forest; 7: *Avicennia* spp. pneumatophore zone in front of the pioneer mangrove marine fringe; 8: middle mudflat, a few meters from the forest marine fringe; 9: mud banks of the lower tract of a tidal inlet; 10: mud banks of the river Selangor; 1: banks of artificial brackish lake; 2: banks of an artificial creek. **AL**: artificial lake; **GF**: mangrove forest; **DF**: exposed mudflat during low tide; **2F**: secondary forest; **w**: walking boards; **in**: tidal inlet; white: water and reclaimed areas.

b: Pulau Kelang, study sites: 1-4= *Kel1-Kel4*. 1: mud banks of a tidal creek fringed by mangroves; 2: *Rhizophora* and *Bruguiera* spp. forest; 3: lower mudflat, nearby the water's edge; 4: tidal mouth of a run-off channel, nearby the water's edge. Sungai Sementa Besar, study sites: 1, 2= Sem1, Sem2. 1: mud banks of the lower tract of the creek; 2: high mangrove forest. Grey areas: urbanised areas (pier); acronyms and other graphic elements as in **a**.



S3: study sites (Morib and Tg. Tuan)

a *above*: Morib, study sites: 1-5= *Mor1-Mor5*. 1: pioneer mangrove marine fringe of a *Sonneratia alba* forest; 2: *Rhizophora* spp. zone; 3: mixed zone with *Avicennia alba* and *Rhizophora mucronata*; 4: mud banks of the river Morib; 5: mixed tidal flat. **GF**: mangrove forest; **MF**: mixed flat; **P**: tide pools; **mm**: mud (river banks); **ms**: mud-sand; **sm**: sand-mud. *Below*: Jugra, study sites: 1-3= *Jug1-Jug3* (adjacent to a shrimp farm). 1: mud banks of its waste channel; 2: mud banks of a nearby creek; 3: *Bruguiera* sp. mangrove stand along the creek banks. **C**: creek; **F**: shrimp farm; **GF**: mangrove stand; **S**: waste-channel.

b, *below*: Tanjung Tuan (Cape Rachado), topographic view; **B**: beach; **CR**: coral reef; **GF**: small mangrove stands. *Above*: Tanjung Tuan, study sites: 1, 2= *Tua1*, *Tua2*. 1: trees of *Sonneratia alba* in front of a reef flat; 2: stand of *Rhizophora mucronata*. **K**: rocks; **P**: tide pools; **RF**: reef flat; **SF**: sand flat; **rb**: boulders and pebbles; **sm**: sand-mud; **ss**: sand; other abbreviations as in **a**.

S4: examined museum material and specimens deposited at the MSNG.

Boleophthalmus birdsongi Murdy, 1989: **4** specimens from 1 locality, AUSTRALIA, Northern Territory: Millingimbi; NTM S.11362-032 (paratypes: 75-116 mm SL), 1984.

Boleophthalmus boddarti (Pallas, 1770): **15** specimens from 6 localities, INDIA, Maharashtra: Bombay (= Mumbai); ibid., Tamil Nadu: Tranquebar (= Tharangambadi); ibid., Madras (= Chennai); BANGLADESH, Khulna (Bagerhat): Mongla Upazila; MALAYSIA, Johor: Tanjung Piai; ibid., Selangor: Sementa (Sungai Sementa Besar); size range 61–128 mm SL: [f]ANSP 85017, **5** (84–99 mm SL), Bombay, 1924; [f]ZMH 19369, **3** (35–53 mm SL), Bombay, 1929; [f]ZMB 2145, **2** (syntypes of *Gobius striatus* Bloch & Schneider: 115, 128 mm SL), Tranquebar, 1800; [f]ANSP 77540, **1** (86 mm SL), Madras, 1922; MSNG 54636, **1** (95 mm SL), Mongla upazila, 2008; MSNG 54637, **2** (103, 61 mm SL), Tanjung Piai, 2006; MSNG 54124 (108 mm SL), exposed creek's mud banks, Sungai Sementa Besar, 1996.

Boleophthalmus dussumieri Valenciénnes, 1837: **7** specimens from 4 localities, IRAN, Hormozgan: Geru river; ibid., Bandar Khamir; KUWAIT: Khor Subiyah; PAKISTAN, Sind: Karachi; size range 87–122 mm SL: CMN FI 1979-0145, **1** (122 mm SL), Geru river, 1976; MSNG 54638, **1** (112 mm SL), Bandar Khamir, 2005; MSNG 54639, **2** (115, 87 mm SL), Khor Subiyah, 2006; LACM 38125-6, **1** (110 mm SL), Karachi, 1978; PMNH, uncat., **2** (116, 92 mm SL), Sind, 2008.

Boleophthalmus pectinirostris (Linnaeus, 1758): **18** specimens from 6 localities, JAPAN, Kyushu: Udo; CHINA, Guandong: Qi'ao Island; TAIWAN: Kaohsiung; INDONESIA, Sumatra: Pulau Bengkalis; MALAYSIA, Johor: Tanjung Piai; ibid., Selangor: Kampong Sungai Yu; size range 55–175 mm SL: NSMT-P 33716, **4** (55–61 mm SL), Udo, 1990; MSNG 54640, **1** (76 mm SL), Qi'ao Island, 2006; NTM S.11173-001, **2** (143, 144 mm SL), Kaohsiung, 1982; NTM S.15524-001, **5** (77–112 mm SL), Pulau Bengkalis, 1994; MSNG 54641, **2** (156, 117 mm SL), Tanjung Piai, 2006; MSNG 54642, **1** (156 mm SL), Tanjung Piai, 2007; [a]NSMT-P 54457, **3** (161–175 mm SL), Kampong Sungai Yu, 1997.

Periophthalmodon schlosseri (Pallas, 1770): **1** specimen from 1 locality, MALAYSIA, Selangor: Kuala Selangor; MSNG 54125 (159 mm SL), forested high shore: *Bruguiera* spp. zone, 1996.

Periophthalmodon septemradiatus (Hamiton, 1822): **1** specimen from 1 locality, MALAYSIA, Selangor: Kampong Kuantan; MSNG 54643 (61 mm SL), small dike inside the village, 2006.

Periophthalmus argentilineatus Valenciénnes, 1837: **1** specimen from 1 locality, MALAYSIA, Negeri Sembilan: Tanjung Tuan; MSNG 54126 (46 mm SL), *Sonneratia alba* pioneer shore, 1996.

Periophthalmus chrysospilos Bleeker, 1852: **8** specimens from 4 localities, MALAYSIA, Selangor: Morib; ibid., Pulau Kelang; INDONESIA: Banka Is.; ibid., 'Java Sea'; size range 65–88 mm SL: MSNG 54128, **2** (65, 74 mm SL), *Sonneratia alba* pioneer shore, Morib, 1996; MSNG 52024, **1** (74 mm SL), lower mudflat, northern coast of Pulau Kelang, 1996; RMNH 4760, **4** (syntypes: 74-88 mm SL), Banka Is., 1852-1859; MCZ 33228, **1** (80 mm SL), Java Sea, 1908.

Periophthalmus gracilis Eggert, 1935: **6** specimens from 4 localities, MALAYSIA, Selangor: Kuala Selangor; ibid., Pulau Kelang; ibid., Morib; ibid., Negeri Sembilan: Tanjung Tuan; size range 27–40 mm SL: MSNG 54129, **2** (27, 30 mm SL), mixed mangrove forest, inlet network, Kuala Selangor, 1996; MSNG 54130, **1** (27 mm SL), mixed mangrove forest, Pulau Kelang, 1996; MSNG 54131, **1** (33 mm SL), *Rhizophora* spp. forest, Morib, 1996; MSNG 54132, **2** (31, 40 mm SL), *Sonneratia alba* pioneer shore and *Rhizophora* spp. forest, Tanjung Tuan, 1996.

Periophthalmus novemradiatus (Hamilton, 1822): **8** specimens from 2 localities, THAILAND, Ranong: mouth of Pakchan river; INDIA, West Bengal, Kolkata: Uttarbhag; size range: 40-49 mm SL: [b]CAS 57429, **2** (40, 40 mm SL), Pakchan, 1960; [d,f]SU 34776, **1** (neotype: 49 mm SL), Uttarbhag, 1937; [d,f]SU 69060, **5** (43-49 mm SL), Uttarbhag, no date recorded.

Periophthalmus spilotus Murdy and Takita, 1999: **3** specimens from 2 localities, MALAYSIA, Selangor: Sementa; INDONESIA, Sumatra: Tebing Tinggi Is.; size range 33-53 mm SL: MSNG 54644 (53 mm SL), forested high shore: *Bruguiera* spp. zone, Sementa, 2006; NSMT-P 56864, **2** (paratypes: 33, 44 mm SL), Tebing Tinggi Is., 1997.

Periophthalmus variabilis Eggert, 1935: **39** specimens from 7 localities, THAILAND, Phang Nga (NE of Phuket Island); MALAYSIA, Selangor: Kuala Selangor; ibid.: Pulau Kelang; ibid.: Kuala Langat; ibid., Negeri Sembilan: Tanjung Tuan; ibid., Sabah; ibid., Sarawak: Kuala Samunsam; INDONESIA, Sumatra: Tebing Tinggi Is.; size range 25−65 mm SL: [d]ZMUC P.781597-1608, 1610, 1611, **14** (28-62 mm SL), mangrove forest, Phang Nga, 1971; MSNG 54133, **1** (44 mm SL), forested high shore, nearby the reclamation bund, Kuala Selangor, 1996; MSNG 54134, **2** (40, 57 mm SL), mixed mangrove forest, inlet network, Kuala Selangor, 1996; [c,f]NSMT-P 54453, **1** (47 mm SL), Kuala Selangor, 1997; MSNG 54135, **2** (40, 49 mm SL), inside and in front of a *Rhizophora* sp. stand, Pulau Kelang, 1996; [d,f]ZMA 113.702, **2** (45, 52 mm SL), Kuala Langat, 1926. MSNG 54136, **1** (52 mm SL), *Sonneratia alba* pioneer shore, Tanjung Tuan, 1996; [d,f]USNM 278470, **1** (50 mm SL), Sabah; [d,f]MCZ 54404, **10** (25-53 mm SL), Kuala Samunsam, 1979; [c,f]NSMT-P 54464, **5** (60-65 mm SL), Tebing Tinggi I., 1997.

Periophthalmus walailakae Darumas and Tantichodok, 2002: **6** specimens from 3 localities, MALAYSIA, Selangor: Kuala Selangor; THAILAND: Ao Phang Nga, Phang Nga; INDIA, Tamil Nadu: Madras (= Chennai, Ennore estuary); size range 57−124 mm SL: MSNG 51393, **1** (109 mm SL), forested high shore: *Bruguiera* spp. zone, Kuala Selangor, 1996; PMBC 19550, **1** (107 mm SL, paratype), Phang-nga, 1995; PMBC 19551, **1** (97 mm SL, paratype), Phang-nga, 1995; [b]USNM 279015, **2** (108, 124 mm SL), Ennore estuary, 1966; [b]USNM 279309, **1** (57 mm SL), Ennore estuary, 1976.

Scartelaos histophorus (Valenciénnes, 1837): **6** specimens from 3 localities, MALAYSIA: Selangor: Morib; ibid., Johor: Muar; ibid.: Parit Jawa; size range 33−62 mm SL: MSNG 54645, **1** (62 mm SL), mixed tidal flat, Morib, 2007; [e,f]USNM 278437, **1** (38 mm SL), southside of Muar river, Muar, 1985; [e,f]USNM 278453, **1** (38 mm SL), Muar, 1985; [e,f]USNM 279354, **1** (33 mm SL), Muar, 1985; [e,f]USNM 278312, **1** (45 mm SL), Parit Jawa, 1985.

[a]in Takita et al. (1999) as *Boleophthalmus dussumieri* Valenciénnes; [b]in Murdy (1989) as *Periophthalmus chrysospilos* Bleeker; [c]in Takita et al. (1999) as *Periophthalmus novemradiatus* (Hamilton); [d]in Murdy (1989) as *P. novemradiatus* (Hamilton); [e]catalogued as *Scartelaos pectinirostris*; [f]these specimens were examined as high-resolution digital images and measured by MVH image v.8 (© the Regents of the Univ. of California, USA).

Museums' abbreviations: ANSP: Academy of Natural Sciences, Philadelphia; CAS-SU: California Academy of Sciences, San Francisco; CMN: Canadian Museum of Nature, Ottawa; LACM: Los Angeles County Museum, Los Angeles; MCZ: Harvard University, Cambridge; MSNG: Museo Civico di Storia Naturale di Genova, Genoa; NSMT: National Museum of Nature and Science, Tokio; NTM: Museum of Art and Gallery of the Northern Territory, Darwin; PMBC: Phuket Marine Biological Center, Phuket; PMNH: Pakistan Museum of Natural History, Islamabad; RMNH: Rijksmuseum van Natuurlijke Historie, Leiden; USNM: National Museum of Natural History, Washington; ZMA: Zoological Museum of the University of Amsterdam, Amsterdam; ZMB: Museum fuer Naturkunde der Humboldt-

Universitaet zu Berlin, Berlin; ZMH: Biocenter Grindel und Zoological Museum University of Hamburg, Hamburg; ZMUC: Zoologisk Museum Universitetsparken, Copenhagen.

S5: matrix of environmental parameters vs. species

This matrix was obtained from Tab. 3, and used for the second MCA and the AHC (Fig. 5); abbreviations as in Tabs. 2, 3.

	bod	**pec**	**sch**	**chr**	**gra**	**var**	**his**
VC1	**1**	**1**	**1**	**1**	0	0	**1**
VC2	0	0	**1**	0	0	0	0
VC3	0	0	0	0	**1**	**1**	0
VC4	0	0	**1**	0	**1**	**1**	0
VC5	0	0	0	0	**1**	**1**	0
VC6	0	0	0	0	0	**1**	0
WB1	**1**	0	**1**	**1**	0	0	0
WB2	**1**	**1**	**1**	0	**1**	**1**	**1**
WB3	0	0	**1**	0	**1**	**1**	0
WB4	0	0	0	0	**1**	**1**	0
TI1	**1**	0	**1**	**1**	0	0	0
TI2	**1**	**1**	**1**	**1**	**1**	**1**	**1**
TI3	0	0	0	0	**1**	**1**	0
TI4	0	0	0	0	0	**1**	0
SE1	**1**	**1**	**1**	**1**	0	0	**1**
SE2	**1**	0	0	0	0	0	0
SE3	0	0	0	0	**1**	**1**	0
SE4	0	0	**1**	0	**1**	**1**	0
EM1	**1**	**1**	0	0	0	0	**1**
EM2	0	0	**1**	**1**	**1**	**1**	0

S6: notes on the field identification and previous records of the studied species

B. pectinirostris was discriminated from *B. boddarti* and *B. dussumieri* by predorsal scale counts, longitudinal scale counts and colouration patterns (Murdy 1989; this study). In the field, *B. pectinirostris* were identified by the sky blue lower portion of the eyeballs, well visible in larger specimens; and by the presence of black blotches along flanks, which never extended below the lateral midline. Instead, *B. boddarti* presented several black diagonal bars extending below the lateral midline, and eyeballs with no contrasting pigmentation. Moreover, both *B. boddarti* and *B. pectinirostris* presented flecks of colour immediately behind the upper portion of D1 spines, which contrasted with the background colour of the interradial membrane: these flecks were paler than the background in *B. boddarti* vs. darker than the background in *B. pectinirostris*. In live or freshly dead specimens, the D1 basal membrane of young Malayan *B. boddarti* was yellow, while that one of young *B. pectinirostris* was dark grey; this difference was less evident in adults, although *B. pectinirostris* usually presented darker D1 fins. The black dorsal margin of the pectoral fins of *B. boddarti*, absent in *B. pectinirostris*, was difficult to spot in the field, but diagnostic (Takita et al. 1999; pers. obs.).

B. pectinirostris was recorded by Cantor (1849) and Koumans (1953). Murdy (1989) reported a lot (USNM 139356) of *B. pectinirostris* from Sabah (Insular Malaysia), but considered it as "questionable" on the basis of the distributional range of the other lots; he also reported another lot of *B. pectinirostris* from the "East Indies" (USNM 12567), a toponym used for the Malay Archipelago. Takita et al. (1999), Khaironizam and Norma-Rashid (2005), and Polgar and Khaironizam (2008) reported *B. dussumieri* in the Malacca Straits, following Murdy's considerations (1989). The larger individuals of *Boleophthalmus* sp. which Murdy (1986) observed, but did not collect in Muar, Johor, Malaysia, may have been this same species.

Nonetheless, the examination of several Malayan and non Malayan specimens of *B. boddarti*, *B. pectinirostris* and *B. dussumieri*, including the specimens deposited by Takita et al. (1999), suggested that this species is in fact *B. pectinirostris* (Linnaeus) (ESM, S4). Further taxonomic investigations are presently being conducted: if these results will be confirmed, the distributional range of *B. pectinirostris* would extend from southern Japan to South East Asia, while *B. dussumieri* would be limited to the Persian Gulf, Pakistan and the west coasts of India.

Our record of *P. variabilis* Eggert (Jaafar and Larson 2008) was also based on several specimens collected or examined by Takita et al. (1999) and Murdy (1989) (ESM, S4). Both these authors determined these specimens as *P. novemradiatus* (Hamilton).

P. malaccensis Eggert (Koumans 1953: Kuala Langat) was not recorded during this study. Murdy (1989) reported *P. kalolo* Lesson from Phuket I., in the Andaman Sea, and from St. Barbe I. (= P. Pejantan), more than 300 km east of Singapore, approx. 200 km off west Kalimantan.