

ORDER PLEURONECTIFORMES IN GIANH ESTUARY FROM VIETNAM

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Analysis and identification of 34 specimens of Order Pleuronectiformes in Gianh estuary from Vietnam. We have classified 11 species belong to 8 genera, 4 families. In which, 10 species: *Paralichthys olivaceus* (Temminck & Schlegel, 1846); *Pseudorhombus cinnamoneus* (Temminck & Schlegel, 1846); *Pseudorhombus malayanus* Bleeker, 1865; *Engyproson longipelvis* Amaoka, 1969; *Achiroides melanorhynchus* (Bleeker, 1850); *Aseraggodes xenicus* (Matsubara & Ochiai, 1963); *Heteromycteris japonicus* (Temminck & Schlegel, 1846); *Cynoglossus cynoglossus* (Hamilton, 1822); *Cynoglossus lingua* Hamilton, 1822; *Cynoglossus puncticeps* (Richardson, 1846) were recorded for the first time distribution in Gianh estuary.

Keywords: *Paralichthyidae, Bothidae, Soleidae, Cynoglossidae, Gianh estuary, Classification, Vietnam ichthyofauna.*

ORDINUL PLEURONECTIFORMES ÎN ESTUARUL GIANH DIN VIETNAM

Articolul este axat pe analiza și identificarea a 34 specimene ale ordinului Pleuronectiformes în estuarul Gianh din Vietnam. Noi am clasificat 11 specii aparținând la 8 genuri, 4 familii. Dintre acestea, 10 specii: *Paralichthys olivaceus* (Temminck & Schlegel, 1846); *Pseudorhombus cinnamoneus* (Temminck & Schlegel, 1846); *Pseudorhombus malayanus* Bleeker, 1865; *Engyproson longipelvis* Amaoka, 1969; *Achiroides melanorhynchus* (Bleeker, 1850); *Aseraggodes xenicus* (Matsubara & Ochiai, 1963); *Heteromycteris japonicus* (Temminck & Schlegel, 1846); *Cynoglossus cynoglossus* (Hamilton, 1822); *Cynoglossus lingua* Hamilton, 1822; *Cynoglossus puncticeps* (Richardson, 1846) sunt înregistrate pentru prima dată în estuarul Gianh.

Cuvinte-cheie: *Paralichthyidae, Bothidae, Soleidae, Cynoglossidae, Estuar Gianh, Clasificare, ihtiofauna Vietnamului.*

Introduction

The most obvious characteristic of the flatfish is its asymmetry, with both eyes lying on the same side of the head in the adult fish. In some families, the eyes are usually on the right side of the body, and in others, they are usually on the left. The primitive spiny turbot include equal numbers of right- and left-sided individuals, and are generally less asymmetrical than the other families. Other distinguishing features of the order are the presence of protrusible eyes, another adaptation to living on the seabed, and the extension of the dorsal fin onto the head. The surface of the fish facing away from the sea floor is pigmented, often serving to camouflage the fish, but sometimes with striking coloured patterns. Some flatfishes are also able to change their pigmentation to match the background, in a manner similar to a chameleon. The side of the body without the eyes, facing the seabed, is usually colourless or very pale. The flounders and spiny turbot eat smaller fish, and have well-developed teeth. They sometimes seek prey in the midwater, away from the bottom, and show fewer extreme adaptations than other families. The soles, by contrast, are almost exclusively bottom-dwellers, and feed on invertebrates. They show a more extreme asymmetry, and may lack teeth on one side of the jaw.

Material and methods

Fish specimens were collected mainly from fishing men in these survey regions. Fishing tools are fishnets, rackets, casting – net, multi size fishing – rods and also professional tools of fish men such as: fishing basket, fishing traps, etc. Some other specimens were bought from local people. All samples were given full information in field trip diary, sampling notes, taking pictures and fixed with formaline 8 - 10% and reserving with formaline 5% in Animal Laboratory of Department of Biology, Vinh University.

We use the following materials to Identification species: D.A. Hensley, K.Amaoka (2001); Johnson T.F. Chen, Herman T.C. Weng (1965); Keiichi Matsuura, Seishi Kimura, Ukkrit Satapoomin (2003, 2005, 2009); Mai Dinh Yen et al (1978, 1992); A.G.K. Menon (1977); Nguyen Van Hao (2005); Rainboth J. Walter (1996); Tetsji Nakabo (2002); Tran Dac Dinh et al. (2013); T.A. Munroe (2001); K.Yokogawa, H.Endo, H.Sakaji (2008) [1-16].

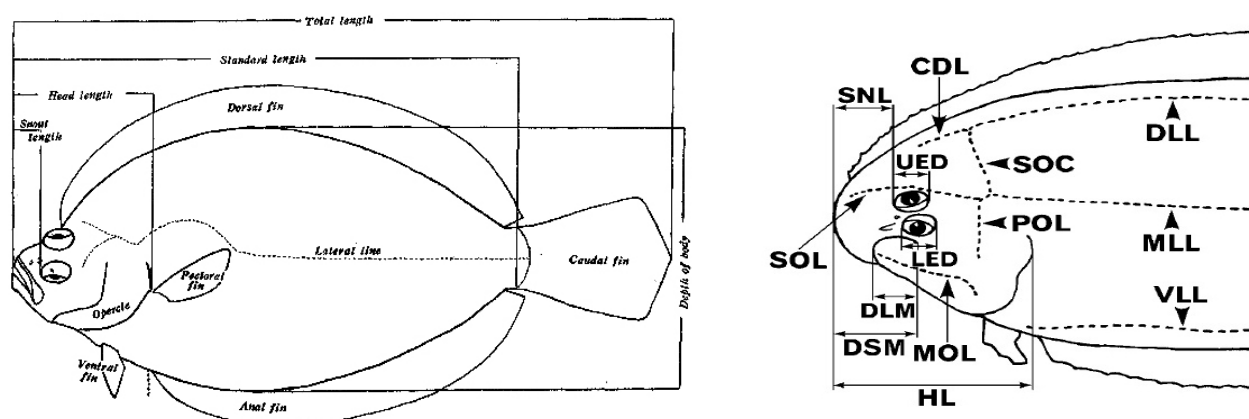


Figure 1. Diagram of a typical flatfish with terms used in the measurements by Johnson T. F. Chen, Herman T. C. Weng (1965) and Koji Yokogawa et al. (2008)

Notes: DLL: Dorsolateral line; MLL: Midlateral line; VLL: Ventrolateral line; CDL: Cephalodorsal line; SOL: Supraorbital line; MOL: Mandibulo-opercular line; SOC: Supraorbital commissure; POL: Preopercular line; HL: Lateral head length; SNL: Snout length; UED: Upper eye diameter; LED: Lower eye diameter; DSM: distance from tip of fleshy snout to angle of mouth; DLM: distance from tip of lower jaw to angle of mouth.

Results and discussion

1. Family Paralichthyidae

Diagnostic characters: Body ovate. Head large, 3 to 4.4 times in standard length. Two nostrils on each side of head, the anterior nostril with a flap posteriorly. Eyes separated by a bony ridge. Mouth rather large, teeth uniserial in both jaws. Gill rakers palmate, of moderate length or short, with posterior serrations. Caudal fin double truncate; pectoral fins not elongate, middle 6 to 9 rays branched on eyed side, but all rays unbranched on blind side; pelvic fins short-based, subequal and subsymmetrical in position. Scales cycloid or ctenoid on both sides; lateral line equally developed on both sides, with a distinct curve above pectoral fins and a supratemporal branch, running upward to anterior part of dorsal fin. Four plates of caudal skeleton with deep clefts along distal margins [2].

1.1. *Paralichthys olivaceus* (Temminck & Schlegel, 1846)

Synonyms. *Hippoglossus olivaceus* Temminck & Schlegel, 1846.

Material examined. (1 specimens)

Short description (Figure 2)

Meristics. Dorsal = 46; Pectoral = 13; Pelvic = 6; Anal = 37; Caudal = 19; Cephalodorsal line = 10; Scales of DLL to MLL = 31; Scales of MLL to VLL = 33; Lateral line = 83.

Morphometric. Proportions as % standard length (SL): Body depth = (54.09); Dorsal fin length = (12.95); Anal fin length = (14.18); Lateral head length = (31.90).

Proportions as % Lateral head length (HL): Snout length = (22.9); Upper eye diameter = (24.4); Lower eye diameter = (21.7); Interorbital width = (3.8); Distance from tip of fleshy snout to angle of mouth = (34.3); Distance from tip of lower jaw to angle of mouth = (30.7)

1.2. *Pseudorhombus cinnamoneus* (Temminck & Schlegel, 1846)

Synonyms. *Rhombus cinnamoneus* Temminck & Schlegel, 1846.

Material examined. (4 specimens)

Short description (Figure 3)

Meristics. Dorsal = 78 - 89; Pectoral = 12 - 13; Anal = 60 - 69; Caudal = 19; Lateral line = 75 - 84.

Morphometric. Proportions as % standard length (SL): Body depth = 49.50 (47.91 - 50.28); Dorsal fin length = 10.95 (9.84 - 11.85); Anal fin length = 11.13 (10.45 - 12.15); Caudal fin length = 26.98 (26.72 - 27.18); Lateral head length = 30.95 (29.80 - 32.54).

Proportions as % Lateral head length (HL): Snout length = 23.26 (22.08 - 25.25); Upper eye diameter = 22.80 (22.04 - 23.48); Lower eye diameter = 21.76 (21.09 - 22.91); Interorbital width = 4.86 (3.91 - 7.28); Distance from tip of fleshy snout to angle of mouth = 36.84 (35.55 - 37.44) = Distance from tip of lower jaw to angle of mouth = 35.22 (33.57 - 36.94)

1.3. *Pseudorhombus malayanus* Bleeker, 1865**Material examined.** (2 specimens)**Short description** (Figure 4)

Meristics. Dorsal = 73 - 74; Pectoral = 11 - 12; Pelvic = 6; Anal = 57 - 59; Caudal = 17; Cephalodorsal line = 12; Mandibulo-opercular line = 18 - 20; Scales of DLL to MLL = 28; Scales of MLL to VLL = 30; Lateral line = 75 - 79.

Morphometric. Proportions as % standard length (SL): Body depth = 48.59 (48.50 - 48.69); Dorsal fin length = 12.95 (11.74 - 14.16); Anal fin length = 12.45 (12.17 - 12.73); Caudal fin length = 25.89 (24.97 - 26.80); Lateral head length = 31.37 (30.76 - 31.98).

Proportions as % Lateral head length (HL): Snout length = 21.44 (21.02 - 21.85); Upper eye diameter = 20.91 (20.28 - 21.55); Lower eye diameter = 23.86 (23.01 - 24.70); Interorbital width = 5.24 (4.47 - 6.01); Distance from tip of fleshy snout to angle of mouth = 34.04 (32.89 - 35.19); Distance from tip of lower jaw to angle of mouth = 30.58 (30.07 - 31.09).

2. Family Bothidae

Diagnostic characters: Body shape variable, deep to elongate, compressed. Margin of preopercle distinct, not covered by skin and scales; males of some species show various combinations of sexually dimorphic characters on head such as wider interorbital areas and rostral and/or orbital spines with eyes on left side of head, reversals rare; some species with tentacles on the eyes. Dorsal-fin origin above or ahead of anterior margin of upper eye; no fin spines; urinary papilla on eyed side; caudal fin not attached to dorsal and anal fins; in some species certain fin rays are elongate in the males; pectoral fin of blind side present but shorter than pectoral fin on eyed side; pelvic fins present, pelvic fin of eyed side on midventral line with origin anterior to origin of pelvic fin of blind side; pelvic fin of blind side above midventral line. Lateral line of eyed side with high arch over pectoral fin; lateral line absent below lower eye. Five series of intermuscular bones present [1].

2.1. *Engyproson longipelvis* Amaoka, 1969**Material examined.** (3 specimens)**Short description** (Figure 5)**Meristics.** Dorsal = 84 - 85; Pectoral = 9 - 10; Pelvic = 6; Anal = 64 - 66; Caudal = 18

Morphometric. Proportions as % standard length (SL): Body depth = 59.09 (57.78 - 61.05); Dorsal fin length = 15.04 (13.59 - 15.97); Anal fin length = 12.60 (12.21 - 13.14); Caudal fin length = 25.61 (24.36 - 27.07); Lateral head length = 25.76 (25.13 - 26.17).

Proportions as % HL: Snout length = 23.90 (23.64 - 24.30); Upper eye diameter = 33.22 (32.05 - 33.83); Lower eye diameter = 33.42 (32.26 - 34.35); Interorbital width = 25.79 (25.46 - 26.21); Distance from tip of fleshy snout to angle of mouth = 32.41 (31.68 - 33.05); Distance from tip of lower jaw to angle of mouth = 28.43 (27.36 - 29.26).

3. Family Soleidae

Diagnostic characters: Oval or somewhat elongate and strongly compressed flatfishes with eyes on right side of body. Preopercle without free margin, embedded in skin. Mouth small and asymmetrical, terminal or slightly inferior; snout sometimes hook-shaped; teeth small, villiform, better developed on blind-side jaws. No spines in fins; dorsal fin extending far forward on head; dorsal and anal fins completely separate from, adherent to, or fused with caudal fin; pectoral fins sometimes absent, when present, right usually longer than left; pelvic fins sometimes asymmetrical, either free or joined to anal fin. Scales moderately large, cycloid or ctenoid, sometimes modified into skin flaps fringed with sensory filaments. Lateral line single and straight on body sometimes branched on head [13].

3.1. *Achiroides melanorhynchus* (Bleeker, 1850)

Synonyms. *Achiroides melanorhynchus* (Bleeker, 1850); *Synaptura achira* Duncker, 1904; *Plagusia melanorhynchus* Bleeker, 1850; *Eurypleura melanorhyncha* (Bleeker, 1850); *Synaptura melanorhyncha* (Bleeker, 1850)

Material examined. (5 specimens)**Short description** (Figure 6)

Meristics. Dorsal = 74 - 78; Pectoral = 12; Pelvic = 6; Anal = 58 - 59; Caudal = 17 - 18; Scales of DLL to MLL = 21; Scales of MLL to VLL = 29; Lateral line = 91.

Morphometric. Proportions as % standard length (SL): Body depth = 51.41 (49.16 - 52.63); Dorsal fin length = 12.84 (11.37 - 14.64); Anal fin length = 13.26 (11.80 - 15.20); Caudal fin length = 20.37 (18.67 - 21.74); Lateral head length = 25.40 (24.04 - 27.24).

Proportions as % HL: Snout length = 25.37 (23.91 - 26.90); Upper eye diameter = 19.23 (18.89 - 19.58); Lower eye diameter = 25.27 (24.19 - 26.85); Interorbital width = 11.64 (10.14 - 12.80); Distance from tip of fleshy snout to angle of mouth = 33.34 (31.33 - 34.91); Distance from tip of lower jaw to angle of mouth = 31.63 (29.77 - 33.48).

3.2. *Aseraggodes xenicus* (Matsubara & Ochiai, 1963)

Synonyms. *Parachirus xenicus* Matsubara & Ochiai, 1963; *Aseraggodes smithi* Woods, 1966.

Material examined. (1 specimens)

Short description (Figure 7)

Meristics. Dorsal = 61; Pelvic = 6; Anal = 39; Caudal = 17; Scales of DLL to MLL = 23; Scales of MLL to VLL = 26; Lateral line = 64.

Morphometric. Proportions as % standard length (SL): Body depth = (43.99); Dorsal fin length = (14.65); Anal fin length = (14.88); Caudal fin length = (30.77); Lateral head length = (20.79).

Proportions as % HL: Snout length = (41.02); Upper eye diameter = (29.74); Lower eye diameter = (30.54); Interorbital width = (16.77); Distance from tip of fleshy snout to angle of mouth = (41.42); Distance from tip of lower jaw to angle of mouth = (35.23).

3.3. *Heteromycteris japonicus* (Temminck & Schlegel, 1846)

Synonyms. *Achirus japonicus* Temminck & Schlegel, 1846; *Heteromycteris japonica* (Temminck & Schlegel, 1846).

Material examined. (2 specimens)

Short description (Figure 8)

Meristics. Dorsal = 93; Pelvic = 5; Anal = 63 - 64; Caudal = 19; Scales of DLL to MLL = 25; Scales of MLL to VLL = 33; Scales in longitudinal series beside VLL = 105.

Morphometric. Proportions as % standard length (SL): Body depth = 36.67 (36.14 - 37.19); Dorsal fin length = 8.70 (8.29 - 9.12); Anal fin length = 8.41 (7.97 - 8.86); Caudal fin length = 21.76 (20.94 - 22.59); Lateral head length = 25.24 (24.32 - 26.15).

Proportions as % HL: Snout length = 35.53 (34.86 - 36.19); Upper eye diameter = 15.83 (15.43 - 16.24); Lower eye diameter = 12.89 (12.64 - 13.14); Interorbital width = 9.37 (8.59 - 10.16); Distance from tip of fleshy snout to angle of mouth = 67.11 (66.40 - 67.82); Distance from tip of lower jaw to angle of mouth = 42.65 (42.03 - 43.26).

3.4. *Solea ovata* Richardson, 1846

Synonyms. *Microbuglossus ovatus* (Richardson, 1846); *Solea humilis* Cantor, 1849.

Material examined. (10 specimens)

Short description (Figure 9)

Meristics. Dorsal = 61 - 69; Pectoral = 7 - 8; Pelvic = 5 - 6; Anal = 44 - 51; Caudal = 18.

Morphometric. Proportions as % standard length (SL): Body depth = 51.5 (49.2 - 53.3); Dorsal fin length = 11.6 (10.2 - 12.6); Anal fin length = 11.9 (10.1 - 13.8); Caudal fin length = 23.5 (21.0 - 25.8); Lateral head length = 24.4 (22.4 - 26.1).

Proportions as % HL: Snout length = 31.3 (29.8 - 32.6); Upper eye diameter = 27.2 (24.9 - 28.4); Lower eye diameter = 30.8 (28.7 - 32.7); Interorbital width = 11.1 (9.4 - 14.5); Distance from tip of fleshy snout to angle of mouth = 35.7 (33.1 - 37.8); Distance from tip of lower jaw to angle of mouth = 26.3 (24.8 - 28.2).

4. Family Cynoglossidae

Diagnostic characters: Lance or tongue-shaped flatfishes with eyes on left side of body; body highly compressed and tapering to a point posterior. The eyes small and usually close together. Mouth small, subterminal, asymmetrical; reaching posterior to the point between verticals at anterior and posterior margins of lower eye or slightly posterior to lower eye; jaws moderately curved on eyed side and notably on blind side; teeth minute and usually only on blind-side jaws; lips fringed with labial papillae in Paraplagusia. Rostral hook usually present below mouth. Posterior margin of preopercle strongly attached to opercle, without free margin and covered with skin and scales. No spiny rays in dorsal, anal, and pelvic fins; dorsal fin reaching far forward onto head; dorsal and anal fins confluent with caudal fin; pectoral fins absent; usually only right pelvic fin present. Scales small, ctenoid or cycloid (smooth). The lateral lines variable [7, 14].

4.1. *Cynoglossus cynoglossus* (Hamilton, 1822)

Synonyms. *Achirus cynoglossus* Hamilton, 1822; *Plagusia oxyrhynchus* Bleeker, 1851; *Cynoglossus hamiltonii* Günther, 1862; *Cynoglossus buchmanii* Day, 1870; *Cynoglossus deltae* Jenkins, 1910.

Material examined. (2 specimens)

Short description (Figure 10)

Meristics. Dorsal = 93 - 98; Pelvic = 4; Anal = 66 - 69; Caudal = 24; Cephalodorsal line = 18; Mandibulo-opercular line = 25 - 27; Supraorbital line = 12 -13; Preopercular line = 9 -11; Dorsolateral line = 128 - 129; Midlateral line = 92 - 116; Scales of DLL to MLL = 17; Scales of MLL to VLL = 22 - 25; Scales in longitudinal series beside DLL = 98 - 121; Scales in longitudinal series beside VLL = 99 - 105

Morphometric. Proportions as % standard length (SL): Body depth = 30.95 (30.08 - 31.81); Dorsal fin length = 8.04 (6.95 - 9.13); Anal fin length = 8.48 (7.48 - 9.48); Caudal fin length = 14.08 (13.85 - 14.31); Lateral head length = 20.82 (20.58 - 21.05).

Proportions as % HL: Snout length = 30.06 (29.09 - 31.02); Upper eye diameter = 17.12 (16.72 - 17.52); Lower eye diameter = 16.04 (15.33 - 16.75); Interorbital width = 3.44 (3.39 - 3.50); Distance from tip of fleshy snout to angle of mouth = 22.26 (22.21 - 22.31); Distance from tip of lower jaw to angle of mouth = 17.93 (17.58 - 18.29).

4.2. *Cynoglossus lingua* Hamilton, 1822

Synonyms. *Areliia lingua* (Hamilton, 1822); *Pleuronectes potous* Cuvier, 1829; *Plagusia macrorhynchus* Bleeker, 1851; *Cynoglossus acinaces* Jenkins, 1910.

Material examined. (3 specimens)

Short description (Figure 11)

Meristics. Dorsal = 126 - 138; Anal = 97 - 114; Caudal = 10; MLL = 90 - 101; SOL = 11 -12.

Morphometric. Proportions as % standard length (SL): Body depth = 30.49 (29.68 - 31.77); Dorsal fin length = 10.04 (9.89 - 10.26); Anal fin length = 8.99 (8.60 - 9.57); Caudal fin length = 11.20 (10.33 - 11.65); Lateral head length = 20.95 (20.27 - 21.45).

Proportions as % HL: Snout length = 29.57 (28.03 - 30.74); Upper eye diameter = 11.17 (10.67 - 11.81); Lower eye diameter = 13.83 (13.34 - 14.52); Interorbital width = 4.91 (4.37 - 5.21); Distance from tip of fleshy snout to angle of mouth = 25.03 (24.25 - 25.58); Distance from tip of lower jaw to angle of mouth = 20.78 (18.91 - 22.07).

4.3. *Cynoglossus puncticeps* (Richardson, 1846)

Synonyms. *Plagusia puncticeps* Richardson, 1846; *Plagusia brachyrhynchus* Bleeker, 1851; *Cynoglossus brevis* Günther, 1862; *Cynoglossus puncticeps immaculata* Pellegrin & Chevey, 1940.

Material examined. (1 specimens)

Short description (Figure 12)

Meristics. Dorsal = 91; Pelvic = 4; Anal = 76; Caudal = 12; Cephalodorsal line = 12; Mandibulo-opercular line = 21; Supraorbital line = 10; Preopercular line = 14; Dorsolateral line = 98; Ventrolateral line = 16; Scales of DLL to MLL = 19.

Morphometric. Proportions as % standard length (SL): Body depth = (32.82); Dorsal fin length = (7.80); Anal fin length = (7.86); Caudal fin length = (12.65); Lateral head length = (20.46).

Proportions as % HL: Snout length = (31.9); Upper eye diameter = (15.3); Lower eye diameter = (15.2); Interorbital width = (4.9); Distance from tip of fleshy snout to angle of mouth = (26.5); Distance from tip of lower jaw to angle of mouth = (20.8).

Conclusion

The analysis and identification of 34 specimens of Order Pleuronectiformes in Gianh estuary from Vietnam. We have classified 11 species belong to 8 genera, 4 families. In which, 10 species: *Paralichthys olivaceus* (Temminck & Schlegel, 1846); *Pseudorhombus cinnamoneus* (Temminck & Schlegel, 1846); *Pseudorhombus malayanus* Bleeker, 1865; *Engyproson longipelvis* Amaoka, 1969; *Achiroides melanorhynchus* (Bleeker, 1850); *Aseraggodes xenicus* (Matsubara & Ochiai, 1963); *Heteromycteris japonicus* (Temminck & Schlegel, 1846); *Cynoglossus cynoglossus* (Hamilton, 1822); *Cynoglossus lingua* Hamilton, 1822; *Cynoglossus puncticeps* (Richardson, 1846) were recorded for the first time distribution in Gianh estuary.



Figure 2. *Paralichthys olivaceus*



Figure 3. *Pseudorhombus cinnamoneus*



Figure 4. *Pseudorhombus malayanus*



Figure 5. *Engyprosopon longipelvis*



Figure 6. *Achiroides melanorhynchus*



Figure 7. *Aseraggodes xenicus*



Figure 8. *Heteromycteris japonicus*

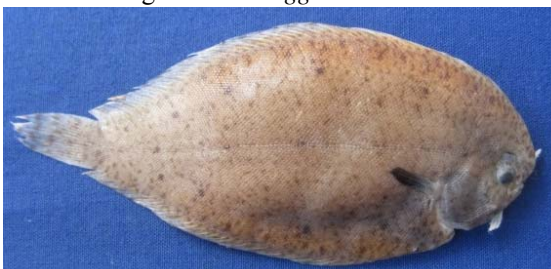


Figure 9. *Solea ovata*



Figure 10. *Cynoglossus cynoglossus*



Figure 11. *Cynoglossus lingua*



Figure 12. *Cynoglossus puncticeps*

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