Bull. Fish. Sci. Hokkaido Univ.
72(2), 27–31, 2022.
DOI 10.14943/bull.fish.72.2.27

Dextral osteology of *Chascanopsetta lugubris* (Teleostei : Pleuronectiformes : Bothidae) from the eastern Indian Ocean

Kazuya KUROSHIMA[1], Kota OBATA[2] and Toshio KAWAI[3]

(Received 15 July 2022, Accepted 25 July 2022)

Abstract

A single specimen of the deep sea bothid *Chascanopsetta lugubris* Alcock, 1894 with dextral eyes was caught from off Sumatra, Indonesia, the eastern Indian Ocean. This is a very unusual specimen as all members of the bothid family known sinistral. Therefore, this is the first record of a dextral bothid specimen, viz reversed specimen. We describe osteology of this reversed specimen. As a result of our osteological comparison between dextral and sinistral specimens, we found no clear differences between them except for reversed bony elements. Also, situs inversus viscerum was not recognized in the reversed eye specimen.

Key words : Sinistral, Reversed eye, Anomaly, Deep sea

Introduction

The lefteye (=sinistral) flounder, *Chascanopsetta lugubris* Alcock, 1894 (Pleuronectiformes : Bothidae), is distributed in tropical to temperate relatively deep waters (200 m to 600 m) of the Indo-Pacific (e.g., Amaoka and Yamamoto, 1984 ; Nakabo and Doiuchi, 2013 ; Amaoka, 2016). This species is characterized in having lower jaw shorter than head (lower jaw length 1.01–1.36 in head length), tip of lower jaw projecting slightly beyond upper jaw, relative short upper jaw (length 1.29–1.69 in head length) and 0 to 4 gill rakers on the lower limb (Amaoka and Yamamoto, 1984 ; Amaoka, 2016). In 2005, a single specimen of right eye (=dextral) *Chascanopsetta lugubris* was caught from off Sumatra, Indonesia, the western Indian Ocean (Fig. 1). The position of eyes (sinistral or dextral) is stable in most flatfish species although sinistral and dextral eyes of *Psettodes* (Psettodidae) are well known (e.g., Hensley, 2001 ; Munroe, 2016). Therefore, we describe osteology of this reversed specimen.

Materials and Methods

Specimens examined in this study are deposited in the Hokkaido University Museum, Hakodate, Hokkaido (HUMZ) as follows : HUMZ 194127, 213.4 mm standard length (SL, hereafter), dextral (reversed specimen) ; HUMZ 178432, 195568, 195569, 213.2–228.9 mm SL, sinistral (normal specimens). Osteological observations were made on speci-

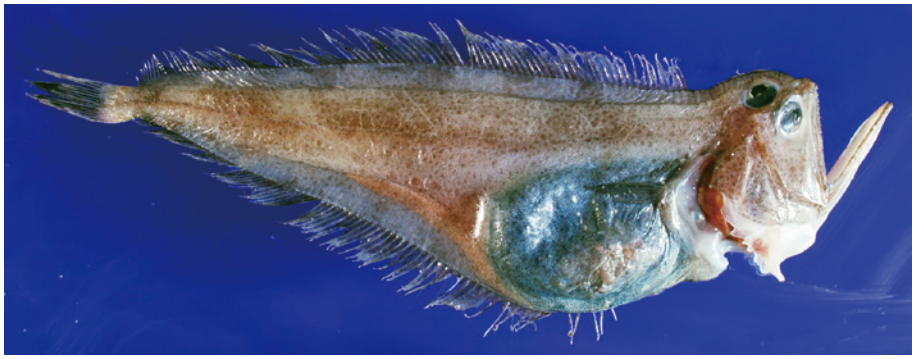

Fig. 1. The dextral specimen of *Chascanopsetta lugubris*, HUMZ 194127, 213.4 mm SL.

[1] *School of Fisheries Sciences, Hokkaido University*
（北海道大学水産学部）
[2] *Graduate School of Fisheries Sciences, Hokkaido University*
（北海道大学大学院水産科学院）
[3] *Faculty of Fisheries Sciences, Hokkaido University*
（北海道大学大学院水産科学研究院）

mens stained with Alizarin Red-S and Alcian Blue under stereo microscopes (Leica MZ 8 and MZ12). Standard length is measured from the anterior tip of the upper jaw to the end of the hypurals. The terminology follows Chapleau (1988) for general osteology, and Fujita (1990) for caudal skeleton. The description is based on HUMZ 194127 (dextral specimen).

Results

Jaws (Fig. 2) are paired. Upper jaw consists of premaxilla and maxilla, and lower jaw dentary, angulo-articular, retroarticular and coronomeckelian. Supramaxillae are absent. Teeth are present on premaxilla and dentary.

Cranium (Figs. 3, 4) consists of paired elements [nasal, lateral ethmoid, frontal, sphenotic, parietal, epioccipital (= epiotic), pterotic, intercalar, exoccipital, prootic and pterosphenoid] and unpaired elements (vomer, ethmoid, supraoccipital, basioccipital and parasphenoid). Basisphenoid and pterosphenoid on ocular side are absent. Vomerine teeth are absent.

Infraorbital bones (Fig. 5) include five elements. Lachrymal is present only on ocular side, and four infraorbitals are present only on blind side.

Suspensorium (Fig. 6) is paired. It consists of palatine, ectopterygoid, endopterygoid, quadrate, metapterygoid, symplectic, hyomandibula, preopercle, opercle, subopercle and interopercle. Palatine is toothless.

Hyoid arch (Figs. 7-9) comprises unpaired basihyal and urohyal, and paired interhyals, anterior and posterior ceratohyals, dorsal and ventral hypohyals, and seven branchiostegals.

Branchial arches (Fig. 9) contain unpaired three basibranchials, and paired three hypobranchials, five ceratobranchials, four epibranchials and four pharyngobranchials. Fifth ceratobranchial, and second to fourth pharyngobranchials have teeth. Interarcual cartilage is absent.

Pectoral girdle (Fig. 10) consists of supratemporal, posttemporal, supracleithrum, cleithrum, scapula, coracoid, four actinosts and 14 pectoral-fin rays. All elements are paired. Postcleithra are absent.

Pelvic girdle (Fig. 11) is paired. It consists of pelvic plate and six pelvic-fin soft rays.

Vertebrae consist of 17 abdominal and 38 caudal vertebrae.

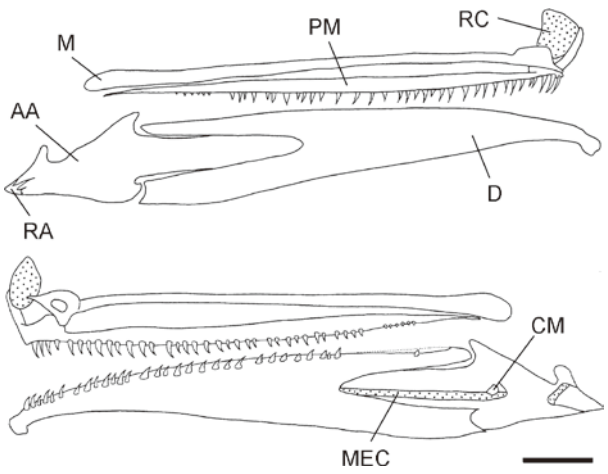

Fig. 2. Lateral (upper) and medial (lower) aspects of jaws on ocular side. AA, angulo-articular ; CM, coronomeckelian ; D, dentary ; M, maxilla ; MEC, Meckel's cartilage ; PM, premaxilla ; RA retroarticular ; RC, rostral cartilage. Bar 5 mm.

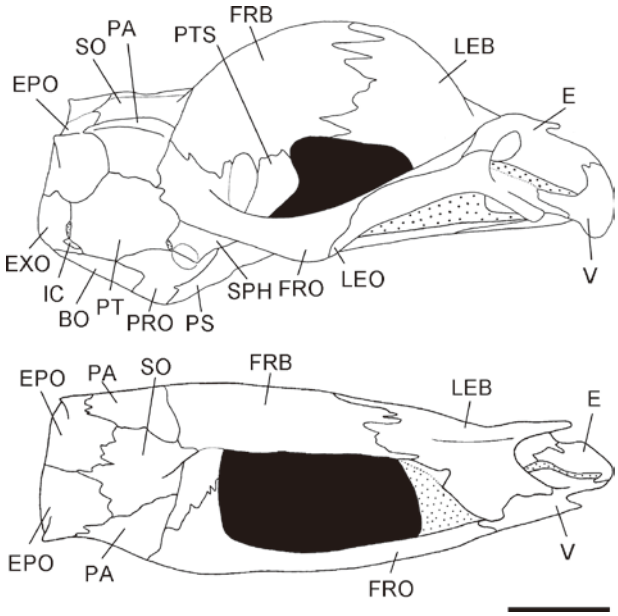

Fig. 3. Lateral (upper) and dorsal (lower) aspects of cranium. BO, basioccipital ; E, ethmoid ; EPO, epioccipital ; EXO, exoccipital ; FRB, frontal on blind side ; FRO, frontal on ocular side ; IC, intercalar ; LEB, lateral ethmoid on blind side ; LEO, lateral ethmoid on ocular side ; PA, parietal ; PRO, prootic ; PS, parasphenoid ; PT, pterotic ; PTS, pterosphenoid on blind side ; SO, supraoccipital ; SPH, sphenotic ; V, vomer. Bar 5 mm.

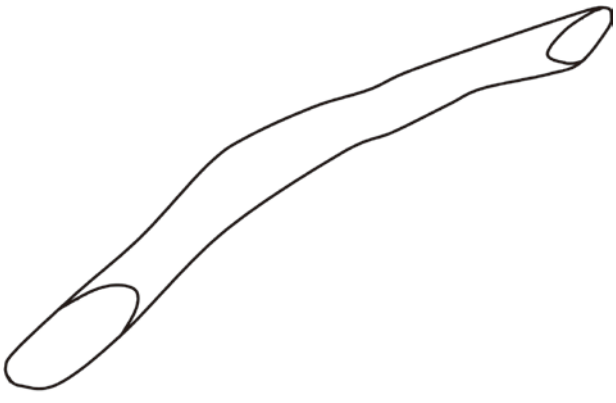

Fig. 4. Lateral aspect of nasal on ocular side. Bar 1 mm.

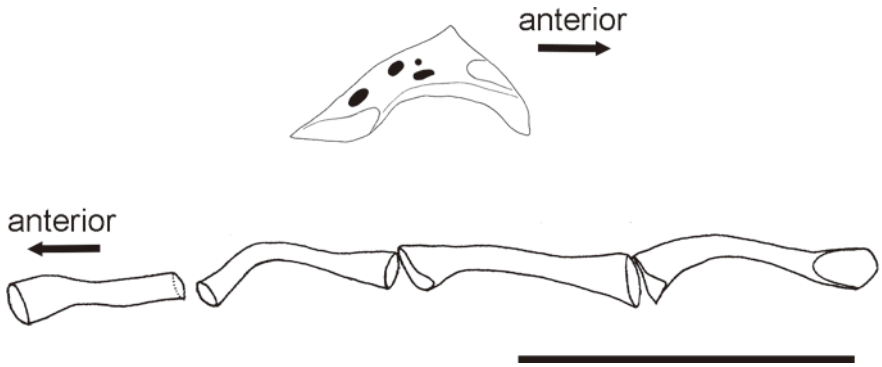

Fig. 5. Lateral aspects of lachrymal on ocular side (upper) and infraorbitals on blind side (lower). Bar 5 mm.

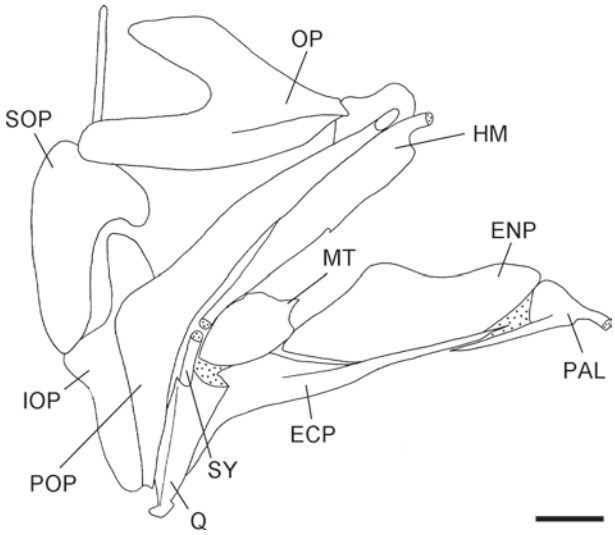

Fig. 6. Lateral aspect of suspensorium on ocular side. ECP, ectopterygoid ; ENP, endopterygoid ; HM, hyomandibula ; IOP, interopercle ; MT, metapterygoid ; OP, opercle ; PAL, palatine ; POP, preopercle ; Q, quadrate ; SOP, subopercle ; SY, symplectic. Bar 5 mm.

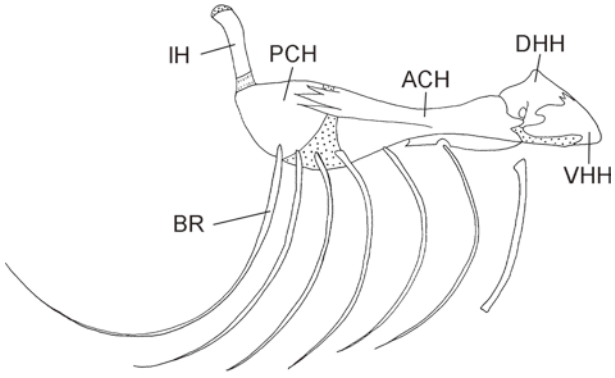

Fig. 7. Lateral aspect of hyoid arch on ocular side. ACH, anterior ceratohyal ; BR, branchiostegal ray ; DHH, dorsal hypohyal ; IH, interhyal ; PCH, posterior ceratohyal ; VHH, ventral hypohyal. Bar 5 mm.

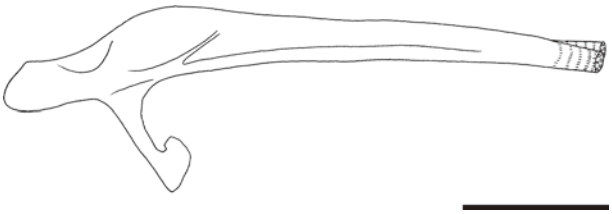

Fig. 8. Lateral aspect of urohyal. Bar 5 mm.

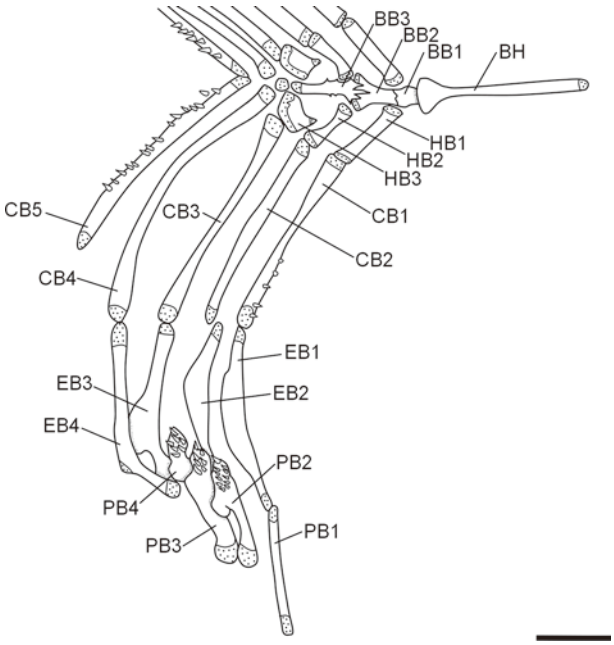

Fig. 9. Dorsal aspect of lower branchial arch and ventral aspect of upper branchial arch. BB, basibranchial ; BH, basihyal ; CB, ceratobranchial ; EB, epibranchial ; HB, hypobranchial ; PB, pharyngobranchial. Bar 5 mm.

Dorsal and anal fins are supported by distal and proximal radials, and have 115 dorsal-fin and 83 anal-fin rays.

Caudal skeleton (Fig. 12) contains of fused upper bony elements (including urostyle, and third, fourth and fifth hypurals), fused lower bony elements (first and second hypurals), parhypural, first epural and second preural centrum

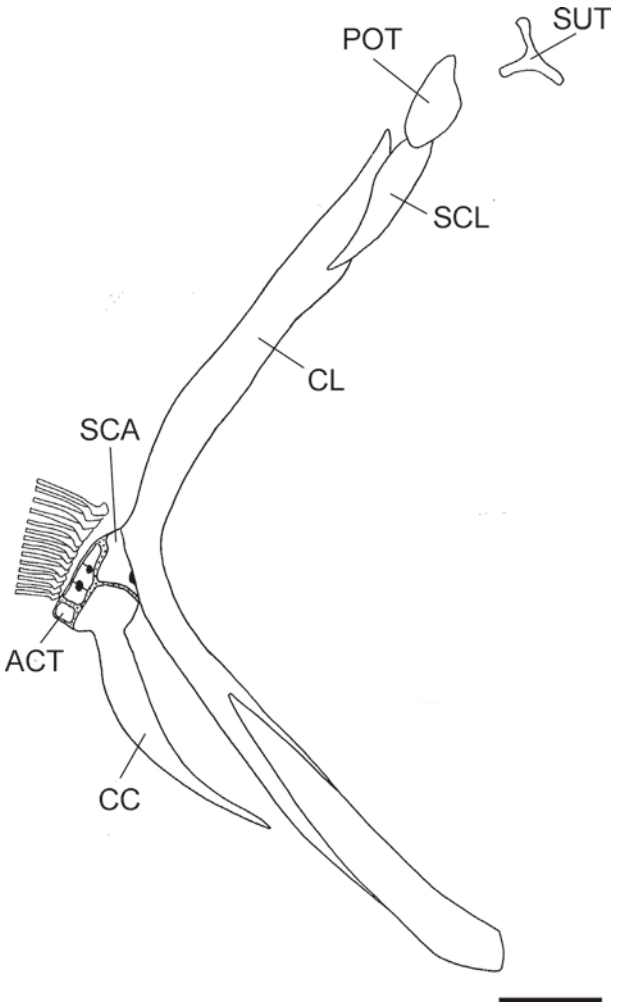

Fig. 10. Lateral aspect of pectoral girdle on ocular side. ACT, actinost; CC, coracoid; CL, cleithrum; POT, posttemporal; SCA, scapula; SCL, supracleithrum; SUT, supratemporal. Bar 5 mm.

with 9 + 8 caudal-fin rays. Parhypural lacks hypurapophysis.

Discussion

As a result of our osteological comparison between the reversed and normal specimens, we could not find clear differences between them except for reversed bony elements. Also, situs inversus viscerum was not recognized in the reversed specimen. Because eye nerves of the reversed specimen could not be examined due to bad condition of the specimen, the optic chiasma of the specimen was not clear.

Reversed specimens have been reported in many flatfish species, e.g., *Citharoides macrolepidotus* (Citharidae), *Scophtalmus maximus* (Scophthalmidae), *Paralichthys olivaceus* and *Citharichthys macrops* (Paralichthyidae), *Pseudopleuronectes yokohamae* and *Platichthys stellatus* (Pleuronectidae), *Poecilopsetta plinthus* (Poecilopsettidae), *Rhombosolea tapirina* (Rhombosoleidae), *Achirus lineatus* and *Trinectes maculatus* (Achiridae), *Solea solea* (Soleidae), *Symphurus plagiusa* and *Cynoglossus semifasciatus* (Cynoglossidae) (Amaoka, 1964; Dawson, 1964, 1966, 1971; Houde, 1971; Dawson and Heal, 1976; Kamei, 1983; Da Silva et al., 2007). However, those of species in Bothidae (sensu Nelson et al.,

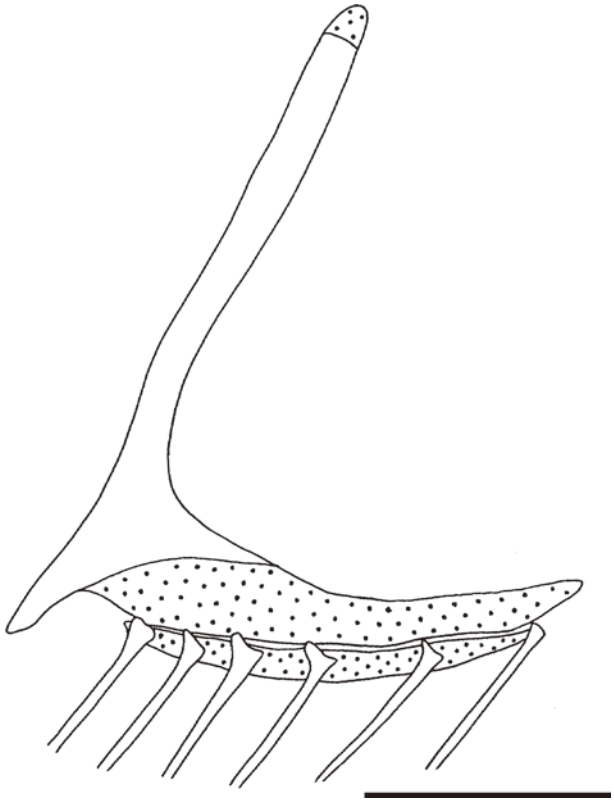

Fig. 11. Lateral aspect of pelvic girdle on ocular side. Bar 5 mm.

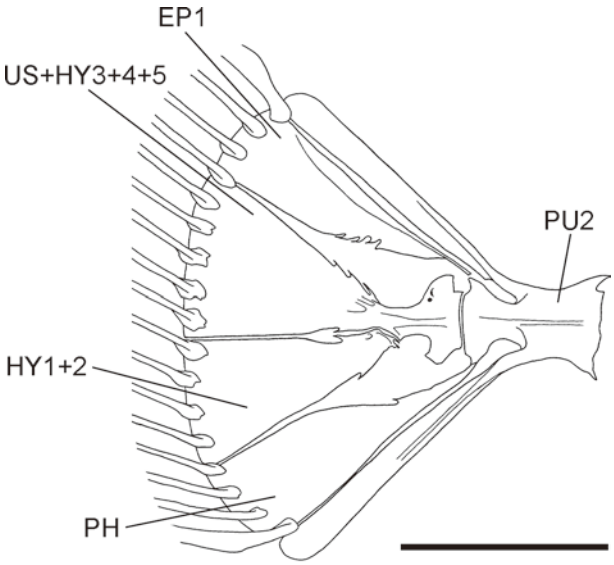

Fig. 12. Lateral aspect of caudal skeleton. EP, epural; HY, hypural; PH, parhypural; PU, preural centrum; US, urostyle. Bar 5 mm.

2016) have never been reported. Therefore, this is the first record of a dextral bothid specimen.

Acknowledgements

We are grateful to Drs. Kunio Amaoka, Mamoru Yabe, Hisashi Imamura and Fumihito Tashiro (Hokkaido University) for comments of an early draft manuscript and access to the collection. We thank Dr. William J. Richards (retired National Marine Fisheries Service scientist, Miami) for his comments on grammatical style. We thank the members of the Japan Deep Sea Trawlers Association, the Overseas Fishery Cooperation Foundation, Japan, and the Agency for Marine and Fisheries Research, Indonesia, and the crew of *R/V Baruna Jaya IV* for collecting the specimen.

References

Amaoka, K. (1964) First record of sinistrality in *Poecilopsetta plinthus* (Jordan and Starks), a pleuronectid fish of Japan. *Bull. Misaki Mar. Biol. Inst. Kyoto Univ.*, (**7**), 9–17.

Amaoka, K. (2016) *Flatfishes of Japan* (*Citharidae, Paralichthyidae, Bothidae, Pleuronectidae, Poecilopsettidae, Samaridae*). Tokai University Press, Hiratsuka. (in Japanese)

Amaoka, K. and Yamamoto, E. (1984) Review of the genus *Chascanopsetta*, with the description of a new species. *Bull. Fac. Fish. Hokkaido Univ.*, **35**, 201–224.

Chapleau, F. (1988) Comparative osteology and intergeneric relationships of the tongue soles (Pieces ; Pleuronectiformes ; Cynoglossidae). *Can. J. Zool.*, **66**, 1214–1232.

Da Silva, Jr., L.C., De Andrade, A.C., De Andrade–Tubino, M.F. and Vianna, M. (2007) Reversal and ambicoloration in two flounder species (Paralichthyidae, Pleuronectiformes). *Pan–Am. J. Aqua. Spec.*, **2**, 23–26.

Dawson, C.E. (1964) A bibliography of anomalies of fishes. *Gulf Res. Rep.*, **1**, 308–399.

Dawson, C.E. (1966) A bibliography of anomalies of fishes. Supplement 1. *Gulf Res. Rep.*, **2**, 169–176.

Dawson, C.E. (1971) A bibliography of anomalies of fishes. Supplement 2. *Gulf Res. Rep.*, **3**, 215–239.

Dawson, C.E. and Heal, E. (1976) A bibliography of anomalies of fishes : supplement 3. *Gulf Res. Rep.*, **5**, 35–41.

Fujita, K. (1990) *The caudal skeleton of teleostean fishes*. Tokai University Press, Tokyo. (in Japanese)

Hensley, D.A. (2001) Psettodidae. pp. 3792–3793, Carpenter, K.E. and Niem, V.H. (eds.), *FAO species identification guide for fishery purposes. The living marine resources of the western central Pacific. Volume 6. Bony fishes part 4 (Labridae to Latimeridae), estuarine crocodiles, sea turtles, sea snakes and marine mammals,* FAO, Rome.

Houde, E.D. (1971) Developmental abnormalities of the flatfish *Achirus lineatus* reared in the laboratory. *Fish. Bull.*, **69**, 537–544.

Kamei, M. (1983) A reversed marbled sole, *Limanda yokohamae*, found in Tokyo B*ay. Bull. Kanagawa Pref. Fish. Exp. Stn.*, (**5**), 41–44. (in Japanese)

Munroe, T.A. (2016) Psettodidae. pp. 2946–2951, Carpenter, K.E. and De Angelis, N. (eds.), *FAO species identification guide for fishery purposes. The living marine resources of the eastern central Atlantic. Volume 4. Bony fishes part 2 (Perciformes to Tetraodontiformes) and sea turtles*, FAO, Rome.

Nakabo, T. and Doiuchi, R. (2013) Bothidae. pp. 1662–1674, 2227–2229, Nakabo, T. (ed), *Fishes of Japan with pictorial keys to the species, third edition*, Tokai University Press, Hadano. (in Japanese)

Nelson, J.S., Grande, T.C. and Wilson, M.V.H. (2016) *Fishes of the world, fifth edition*. John Wiley and Sons, New York.