



Taxonomy and Fishery of Flatfishes

STATUS OF THE FLATFISHES OF THE WORLD

According to Nelson (2016), 772 extant species of flatfishes are recognized worldwide in 14 families with 129 genera; about 10 species (six achirids, one soleid, and three cynoglossids) are said to be fresh water. The first mention of flatfishes in Ichthyology was in 1686 by Willughby in L'Historia piscium where flatfishes were placed as Ossei Plani (Flat bony). Broussonet (1782) described a single flatfish *Pleuronectes mancus* in his work "Ichthyologia." Artedi (1792) placed all flatfishes in the one genus *Pleuronectes* in the group *Malacopterygii* based on "laterally compressed body, single continuous dorsal fin, and pelvic fin thoracic in position." The name "Pleuronectes" was introduced in zoology for the first time by Artedi and Linnaeus followed his example. in *Genera Piscium* described genus *Pleuronectes* as "fish with dextral eyes, oblong body," and included 29 species. Lacepede (1801) in his "Histoire Naturelle des Poissons" placed flatfishes in genus *Pleuronectus* with 4 subgenera without assigning them any names and described 29 species in them. Later, Russell (1803) recorded eight species of flatfish from the Coramendal coast – *Hippoglossus erumei*, *Rhombus marginatus*, *R. triocellatus*, *Synaptura Russellii*, *Synaptura lata* Blkr (*Solea lata*, Hass), *Synaptura cornuta* Blkr (*Solea cornuta* Cuv), *Plagusia potous* Cuv, and *Plagusia Blochii* Blkr. This was followed by Dumeril (1804) who raised flatfishes to family status and gave the name Heterosomes. Quensel (1806) further divided the genus *Pleuronectes* into two – *Pleuronectes* and *Solea*. Hamilton (1822) in his account of the fishes in the River Ganges described two genera *Pleuronectes* and *Achirus* with 4 species *Pleuronectes nauphala*, *Pleuronectes arsius*, *Pleuronectes pan*, and *Achirus cynoglossus*. Richardson (1843), in contributions to the Ichthyology of Australia, Vol. XI of "The Annals and Magazine of Natural History" described a new species of flatfish *Rhombus lentiginosus*. In 1843, Temminck and Schlegel published "Fauna Japonica" wherein four species were described. Later, Muller in 1846 erected a new order Anacanthinii to include *Pleuronectoids*, *Gadoids*, and *Ophidioids*. Cantor (1849) in his Catalogue of Malayan Fishes described Family *Pleuronectidae* in Order *Anacanthini* with 14 species in 7 genera; fishes were grouped based on presence of eye and color patterns on right or left side. Bleeker in "Sur quelque genre de la Famille des *Pleuronectoides*" placed flatfishes in genera in the family *Pleuronectoides*. The main character of differentiation between genus *Psetto* and the remaining were "presence/absence of teeth on palatine, presence/absence of anal spine, lateral line with a curve anteriorly and sinistral eyes." Bleeker (1852) reported 19 species of flatfishes from Java and Amboina, 2 from Madura, 1 from Bali, 6 from Sumatra, 1 from Banka, 6 from Borneo, 2 from Celebes, 1 from Moluccan

Islands, and 9 from Indo-Archipelago; three families were collected from Amboina – Pleuronectoidei, Soleidae and Plagusioidei – Psettodes was placed along with Pseudorhombus and Platophrys in Family Pleuronectoidei. Later in 1853, Bleeker recorded 5 genera and 17 species of Pleuronectoidei from 1339 nominal species of flatfishes were described, named or recognised, 716 species are considered valid (e.g. recognised by taxonomic authorities), while another 670 names are regarded as synonyms for pleuronectiform fishes.

However, according to Munroe's (2005), compilation of all published and personal queries, of the 1,339 nominal species of flatfishes described, named, or recognized, 716 species are considered valid, while another 670 names are regarded as synonyms for pleuronectiform fishes. A review of Eschmeyer (2012 online) shows that species are also not uniformly distributed among families. Families with low species diversity include the monotypic Paralichthodidae, Psettodidae (2 species each), Achiropsettidae (6 species), Citharidae (7 species), Scopthalmidae (9 species), with moderate diversity Rhombosoleidae (19 species), Samaridae (28 species), Poecilopsettidae (30), Achiridae (31), Pleuronectidae (60) and with high diversity Paralichthyidae (95), Soleidae (139), and finally Cynoglossidae and Bothidae (145 species each).

Table 1. Present status of Flatfishes of the world

Taxon	Nominal species	Valid species	Names in synonymy
Psettodidae	8	2	6
Citharidae	12	7	5
Scopthalmidae	39	9	30
Paralichthyidae	190	95	95
Bothidae	267	145	124
Pleuronectidae	177	60	117
<i>Tephrinectes</i>	4	1	3
Rhombosoleidae	48	19	29
Achiropsettidae	9	4	5
Poecilopsettidae	34	30	11
Samaridae	30	28	9
Paralichthodidae	2	1	1
Achiridae	56	31	30
Soleidae	227	139	95
Cynoglossidae	236	145	110
Totals	1339	716	670

(Source: Rekha & Gopalakrishnan, 2014)

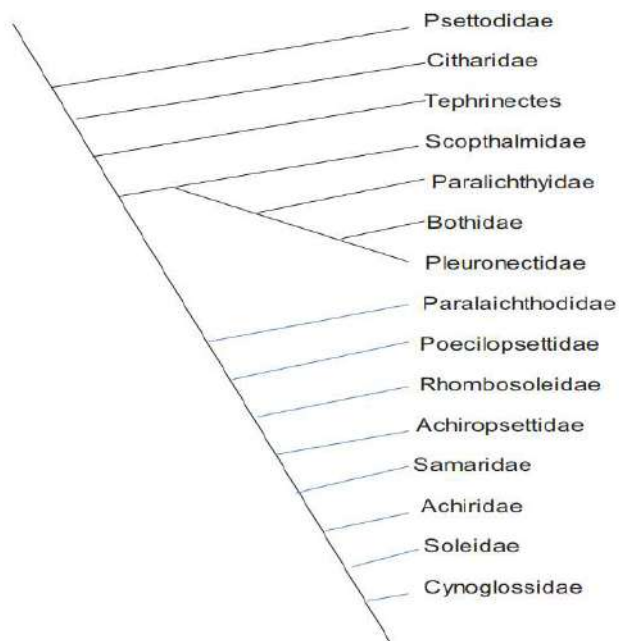


Figure 3 Phylogeny tree of the flatfish families of the world. (Source: Munroe, 2005, p. 391).

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Table 2 Family wise list of valid species in Order Pleuronectiformes

Family	Subfamily	Valid species	New species in the last 10 years (2004–2013)
Psettodidae		3	0
Citharidae		6	0
Scophthalmidae		9	0
Paralicthyidae		110	2
Bothidae		166	3
Achiropsettidae		4	0
Pleuronectidae		106	4
	Poecilopsettinae	21	3
	Rhombosoleinae	20	0
	Pleuronectinae	64	1
	Paralichthodinae	1	0
Samaridae		27	7
Achiridae		36	2
Soleidae		179	39
Cynoglossidae		145	7
	Symphurinae	78	6
	Cynoglossinae	67	1

Source: Data taken from Catalog of Fishes (2013 version).

Suborder Psettoidae. Body elliptical, dorsal fin arising above the maxillary, not extending onto front region of head, anterior rays spinous; first two rays of anal fin spinous; eyes either sinistral or dextral; nostrils placed in front of interorbital space. Mouth large, teeth on jaws barbed, palatine toothed with a single row; anus on mid-ventral line of body.

The suborder has only **one Family with one genus** – Family **Psettodidae** and Genus ***Psettodes***.

Genus *Psettodes*

Characters

These large flatfishes with both sinistral and dextral individuals

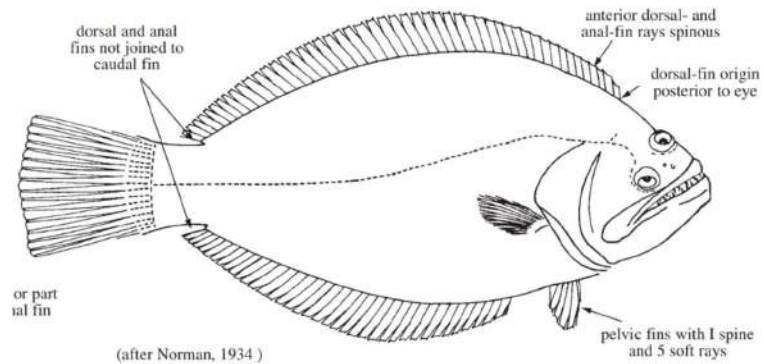
Externally, these fishes are easily recognized by such pleisomorphic characters as the posterior location of the dorsal fin, which does not advance onto the cranium anterior to the eyes,

- occurrence of spines in dorsal and anal fins,
- large mouth with specialized teeth,
- Oval to round bodies without the obvious bilateral symmetry in lateral musculature development evident in other flatfishes
- palatine with teeth;
- basisphenoid present;
- supramaxilla large; 24 or 25 vertebrae.
- Body oval-shaped, flat but fairly thick; caudal peduncle deeper than long.
- Head length 3.2 to 3.6 times in standard length.
- Both eyes on right or left side of head; upper eye on dorsal surface of head.
- Supramaxillary bone well developed. Mouth large, extending well beyond posteriormargin of lower eye; lower jaw projecting. Teeth large canines, many with barbed tips. Vomer and palatines with teeth.
- Preopercular margin easily seen, not hidden by skin or scales. Gill rakers tooth-like.
- Dorsal fin not extending onto head (to or past eye); anterior dorsal and anal rays spinous; Dorsal-fin origin well posterior to upper eye; dorsal-fin rays 48 to 56; anal-fin rays 34 to 44;
- Urinary papilla and anus on midventral line anterior to origin of anal fin;
- Caudal fin free from dorsal and anal fins, with truncate or double truncate posterior margin with 24 or 25 rays; pectoral fins on eyed and blind sides nearly equal in length, both with 13 to 16 rays; pelvic fins with spine and 5 soft rays, and nearly symmetrically placed on each side of midventral line.
- Scales small, weakly ctenoid on both sides of body; lateral line present on both sides of body, only slightly curved above pectoral fin, with 61 to 77 scales, with no supratemporal branch, branch present below lower eye; scales around caudal peduncle 32 to 38. Epipleural and pleural ribs present

***Psettodes erumei* (Bloch and Schneider, 1801)**

Pelvic fins nearly symmetrical, with one spine and five soft rays; mouth large; jaw teeth barbed; gill arches with groups of teeth; eyes sinistral or dextral; preopercular margin distinct, not covered with skin; 15 branched caudal-fin rays.

Maximum length about 60 cm.



IUCN Status: Data Deficient ver 3.1

Source: FAO, WCP

Body oval-shaped, flat but fairly thick; caudal peduncle deeper than long. Head length 3.2 to 3.6 times in standard length. Both eyes on right or left side of head; upper eye on dorsal surface of head. Supra maxillary bone well developed. Mouth large, extending well beyond posterior margin of lower eye; lower jaw projecting. Teeth large canines, many with barbed tips. Vomer and palatines with teeth. Preopercular margin easily seen, not hidden by skin or scales.

Suborder Pleuronectoidei

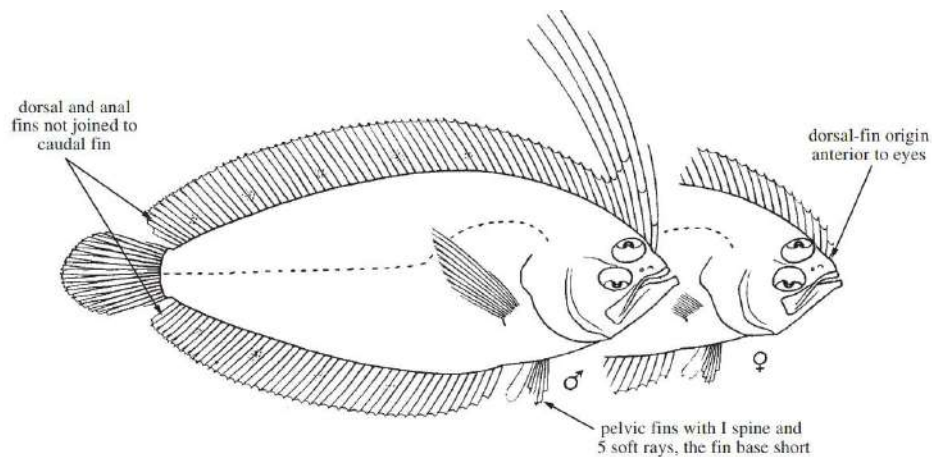
Body elliptical, dorsal and anal fins not confluent with caudal. Dorsal origin above eyes, anal fins without spines, palatine without teeth.

The suborder is further divided into three superfamilies; fourteen families are recognized in these superfamilies. Hensley and Ahlstrom (1988) considered this suborder to comprise all fishes except the Psettodidae and soleoid taxa (Cynoglossidae, Achiridae and Soleidae).

Chapleau and Keast (1988) suggested the suborder described by Hensley and Ahlstrom (1988) as paraphyletic and also recommended that the Pleuronectinae, Poecilopsettinae, Rhombosoleinae and Samarinae be raised to family rank.

Family : Citharidae - large-scale flounders

Erected by Hubbs (1945) by regrouping two genera (sinistral) Bothidae (taxa) and (dextral taxa) from Pleuronectidae. Four genera and seven small to medium-sized species collectively referred to as ‘large scale flounders’

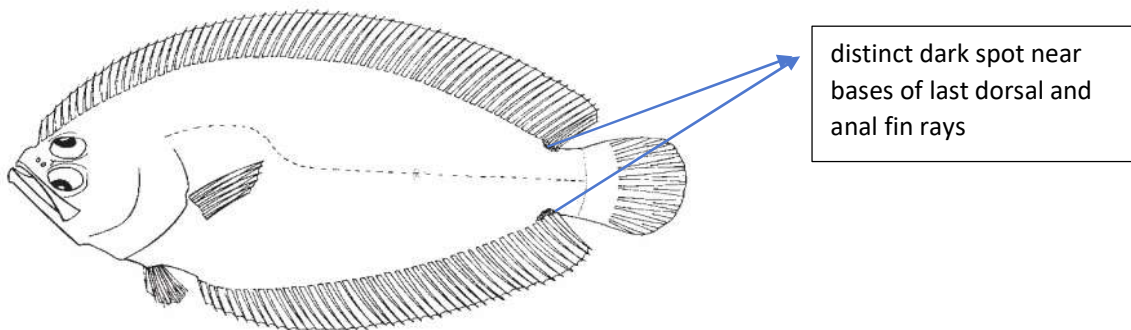


Source: FAO, WCP

Four genera: *Brachypleura* (1), *Citharoides*, *Citharus*, *Lepidoblepharon*, with about six species

Populations feature both sinistral and dextral individuals

Genus *Citharoides*: Sinistral with eyes normally on left side of head; fins rays of dorsal, anal, and pelvic fin branched; distinct dark spot near bases of last dorsal and anal fin rays



Citharoides macrolepidotes

Eyes on right side of head; only posterior dorsal- and anal-fin rays branched, at least anterior pelvic-fin rays unbranched; no distinct dark spot near bases of last dorsal and anal fin rays

Brachypleura* and *Lepidoblepharon

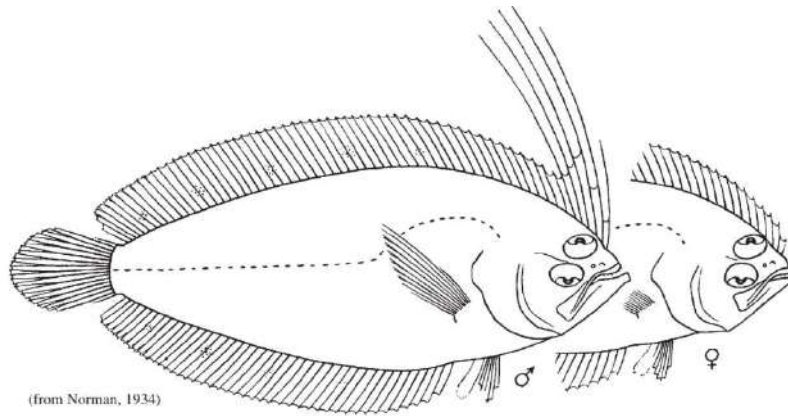
Lepidoblepharon : Known from depths of 310 to 435 m on mud bottoms.

- Anterior margins of both eyes at about same level;
- more than 50 scales in lateral line;
- eyes, interorbital area, snout, and jaws scaly;
- caudal fin with 15 branched rays

***Brachypleura*:**

- Both eyes on right side of head,

- front margin of upper eye anterior to front margin of lower eye.
- Sexual dimorphism noticed -males with anterior rays of dorsal fin prolonged, females short
- Dorsal-fin rays 65 to 77, all rays except a few at posterior end of fin unbranched
- Anal-fin rays 41 to 50, all rays except a few at posterior end of fin unbranched;
- caudal fin with 13 or 14 branched rays
- pelvic fins with 1 spine, 1 unbranched ray, and 4 branched rays



Brachypleura novaezeelandiae

Family Scophthalmidae: Commonly called **Turbots**.

A small family consisting of four genera with about nine species of small to large-sized sinistral flatfishes

- Relatively large mouth and large eyes
- Two elongated pelvic fin bases (slightly asymmetrical) extending anteriorly to the urohyal,
- An elongated supra-occipital process forming a bridge with the dorsal margin of the blind-side frontal bone,
- Caudal vertebrae with asymmetrical transverse apophyses
- Larger species have commercial importance and some are used in aquaculture

Four genera, *Lepidorhombus* (2), *Phrynorhombus* (1), *Scophthalmus* (4, synonym *Psetta*; see Bailly and Chanet, 2010), and *Zeugopterus* (2), with about nine species

Lepidorhombus

native to the northeastern Atlantic Ocean.



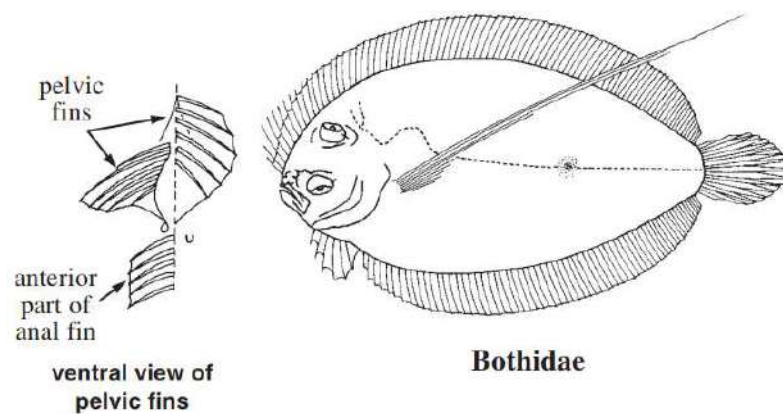
Family Bothidae : Large, diverse monophyletic family of sinistral flatfishes

23 genera, *Arnoglossus*, *Asterorhombus*, *Bothus*, *Chascanopsetta* (synonym *Pelecanichthys*), *Crossorhombus*, *Engyprosopon*, *Engyophrys*, *Grammatobothus*, *Japonolaeops*, *Kamoharaia*, *Laeops*, *Lophonectes*, *Monolene*, *Neolaeops*, *Parabothus*, *Perissias*, *Psettina*, *Taeniopsetta*, *Tosarhombus*, and *Trichopsetta*, with about 163 species

- No fin spines.
- Eyes on left side of head.
- Left pelvic fin with long base on midventral line with origin anterior to origin of pelvic fin of right side;
- Right pelvic fin with short base above midventral line

Genus *Arnoglossus* Bleeker, 1862

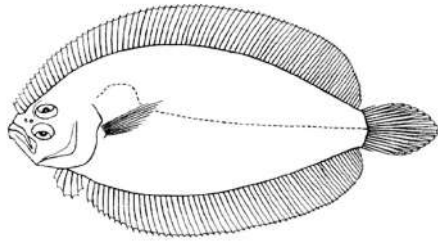
Mouth of moderate size. Interorbital region narrow, bony ridge forms the interorbital area. Males without rostral spines. Scales on eyed side with short ctenii or scales cycloid.



(Source: FAO, WCP)

***Arnoglossus aspilos* (Bleeker, 1851)**

- Dorsal-fin rays 80–95, anterior rays not prolonged.
- Small sized teeth in both jaws, closely spaced.
- Gill rakers not serrate.
- Lateral-line scales 46–53.
- Body depth 1.9 to 2.9 times in SL.
- No dark spot on distal portion of pectoral fin.

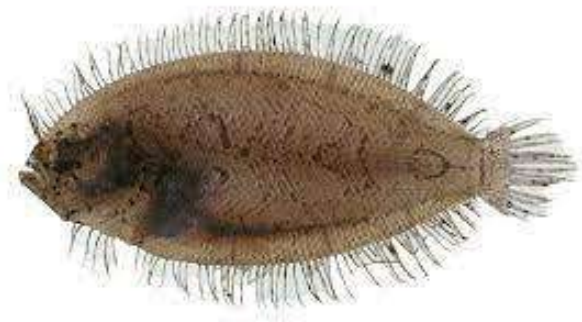


FAO



Genus *Asterorhombus* Tanaka, 1915

- Mouth small.
- Interorbital region concave, narrow in both sexes,
- no rostral or orbital spines.
- Gill rakers palmate with small tooth-like structures on margins.
- First dorsal-fin ray elongate 1.4 to 3.1 times in head length, longer than second ray. Both eyes usually with one unbranched tentacle, rarely missing or branched.



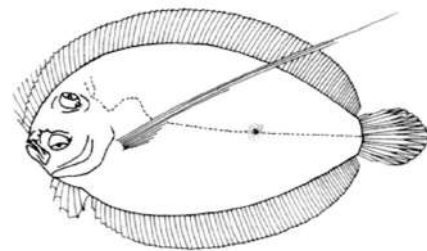
Genus *Bothus* Rafinesque, 1810

- Mouth small.
- Interorbital region broad and concave, broader in males than females.

Bothus myriaster (Temminck and Schlegel, 1846). -Indo Pacific oval flounder



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- Clear sexual dimorphism seen in adult fishes;
- Males are generally bigger in size compared to females.
- Rostral spine prominent in males and interorbital area is more concave.
- Pectoral fin is longer in males with the first fin highly elongated
- Males have a prominent spine on the snout, another at the junction of lower and upper jaw, several small spines around orbit
- Colour pattern on the ventral side which progresses with maturity



***Bothus pantherinus* (Ruppell, 1821)**

Both eyes with 2 or 3 ocular tentacles in males, females usually with 2 ocular tentacles on each eye, less frequently with 0 or 1.

Dorsal-fin rays 81–97, anal-fin rays 61–73,

pectoral fin on eyed side with 9–12 rays, greatly elongate in males larger.

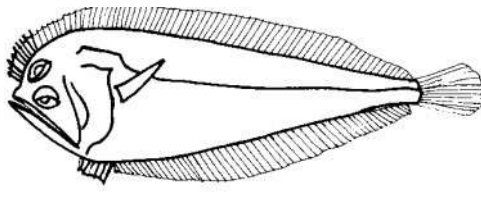
Scales ctenoid on eyed side, cycloid on blind side.

Eyed side with numerous dark spots, blotches, and rings on body and median fins, one distinct dark blotch on middle of straight section of lateral line, pectoral fin on eyed side usually with narrow dark cross bars.

Blind side tan or whitish, without distinctive markings

Genus *Chascanopsetta*

Chascanopsetta lugubris Alcock, 1894 -Pelican flounder



Keys:

1. Lower jaw projecting slightly in front of upper jaw, its length 0.9-1.4 in head length; upper-jaw length 1.1-1.7 in head*Chascanopsetta lugubris*
(Indo-West Pacific and eastern and western Atlantic)

Lower jaw projecting well beyond upper jaw, its length 0.6-0.8 in head;
upper-jaw length 0.9-1.0 in head
Dorsal-fin rays 111-118; anal-fin rays 71-81; caudal vertebrae 36-39
.....*Chascanopsetta megagnatha*
(seamounts of Sala-y-Gomez Ridge, eastern Pacific)

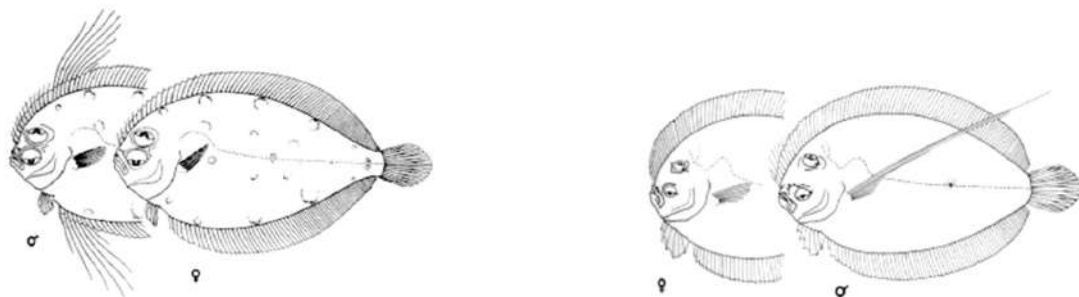
Dorsal-fin rays 119-133; anal-fin rays 84-93; caudal vertebrae 39-44
Lateral-line scales 185-196; lower-jaw length ca. 0.8 in head length,
less than 18% of lower-jaw length projecting anterior to symphysis of
upper jaw; caudal vertebrae 42-44..... *Chascanopsetta prognatha*
(Sagami Bay, Japan, Okinawa Trough, Maldives Islands area)

Lateral-line scales 171-181; body depth 3.6-4.7 in SL;
 upper-jaw length 1.4-1.6 in head; maxilla extending a short distance posterior to lower eye; no
 conspicuous dark blotches on lateral line,,, *Chascanopsetta kenyaensis*
 (coasts of Kenya and southern Somalia)

Lateral-line scales 190-241; lower-jaw length 0.6-0.8 in head length,
 ca. 28% of lower-jaw length projecting anterior to symphysis of upper jaw;
 caudal vertebrae 39-41,,, *Chascanopsetta crumenalis*
 (Hawaiian Archipelago)

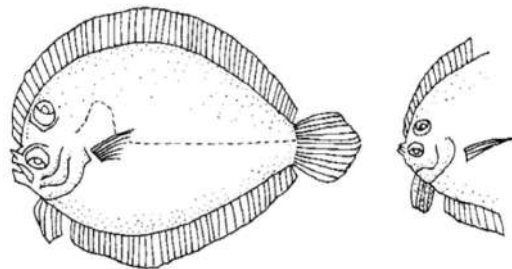
***Crossorhombus* -Left eye flounders**

Five species of the bothid genus *Crossorhombus*,
Crossorhombus azureus,
C. valderostratus,
C. kobensis,
C. kanekonis
C. howensis are currently recognised worldwide.



examples of deep-bodied lefteye flounder species showing various combinations of sexually dimorphic characters

***Crossorhombus azureus* (Alcock, 1889) - Blue spotted Flounder)**



Male

Female

- ✓ Males present with ocular flaps.
- ✓ Snout projects out and bears a short orbital spine in males; Shorter than eye diameter.

- ✓ Bony ridge present in front of orbit, inner margins of orbit very sharp; inter orbital area very concave and wider in males.

Genus *Engyprosopon* Günther, 1862

- Mouth small.
- Interorbital region clearly concave, increasing in relative width with size
- Sexual dimorphism- wider in males than females.
- First ray of pelvic fin of eyed side below posterior margin of lower eye.
- Lateral-line scales 36–63.
- The caudal bones with deep clefts.

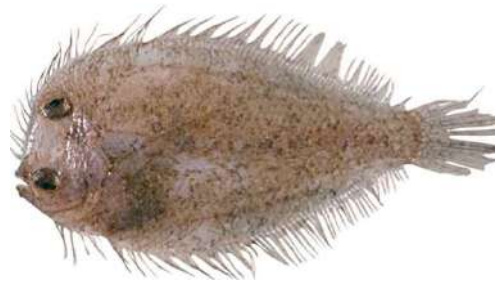
Engyprosopon grandisquama



2 prominent spots at the widest parts of the caudal fin

E. maldivensis

- A strong rostral spine in males, absent in females.
- Gill rakers not serrate, less than 10 on lower limb.
- Teeth biserial in upper jaw
- Pectoral fin on eyed side longer than head length.
- Caudal fin with no blotches
- Blind side of males dark brown except pale yellowish-white head

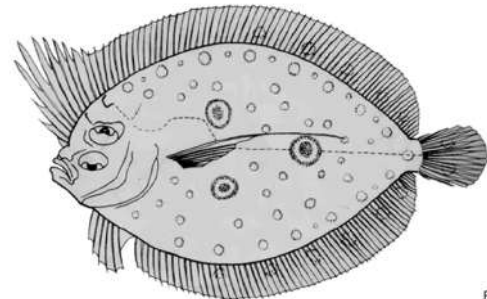


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Genus *Grammatobothus*

Grammatobothus polyophthalmus

- ✓ **sexually dimorphic** features in the ocular-side pectoral-fin length,
- ✓ anterior dorsal-fin ray length, and cephalic blotches (Amaoka et al., 1992)



FAO

Genus *Laeops* Günther, 1880

small lefteye flounders from the Indo-Pacific.

- Mouth small, teeth present mostly on blind side (teeth present on both sides of jaws in all other bothid genera).
- First pelvic-fin ray on eyed side on or near isthmus,
- first pelvic-fin ray on blind side opposite third or fourth ray of pelvic fin on eyed side.
- Lateral line absent on blind side.

Genus *Neolaeops*

Genus *Parabothus*

Family PARALICHTHYIDAE (347)—sand flounders/ largetooth flounders.

Marine, rarely freshwater;

Atlantic, Indian, and Pacific.

14 genera, *Ancylosetta*, *Cephalopsetta*, *Citharichthys*, *Cyclopsetta*, *Etropus*, *Gastropsetta*, *Hippoglossina*, *Paralichthys*, *Pseudorhombus*, *Syacium*, *Tarphops*, *Tephrinectes*, *Thysanopsetta*, and *Xystreurys*, and about 111 species

No fin spines. Eyes on left side of head. Pelvic fins short-based, subequal and subsymmetrical in position.

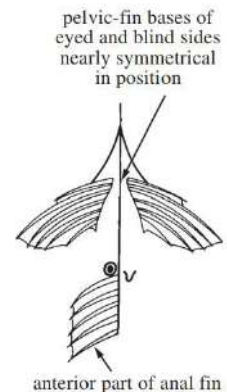
Genus *Cephalopsetta*



***Cephalopsetta ventrocellatus* Dutt & Hanumanta Rao**

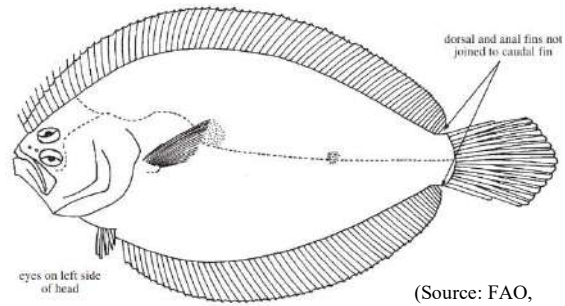
Genus *Pseudorhombus*

- Body oval, large in size upto 40 cm,
- Two nostrils on each side of head, the anterior nostril with a flap covering the aperture posteriorly.
- Mouth large, teeth villiform in a single row in both jaws.
- Gill rakers palmate, with posterior serrations.
- Dorsal and anal fins not joined to anal fins
- Caudal fin double truncate; pectoral fins not elongated, middle 6 to 9 rays branched on eyed side, but all rays unbranched on blind side;
- pelvic fins short-based, posterior 3 - 4 rays branched.
- 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.
- Commercially important



Species available in India:

- ✓ *Pseudorhombus argus* Weber, 1913
- ✓ *Pseudorhombus arsius* (Hamilton, 1822)
- ✓ *Pseudorhombus cinnamoneus* (Temminck and Schlegel, 1846)
- ✓ *Pseudorhombus diplospilus* Norman, 1926
- ✓ *Pseudorhombus dupliciocellatus* Regan, 1905
- ✓ *Pseudorhombus elevatus* Ogilby, 1912
- ✓ *Pseudorhombus javanicus* (Bleeker, 1853)
- ✓ *Pseudorhombus jenynsii* (Bleeker, 1855)
- ✓ *Pseudorhombus malayanus* Bleeker, 1866
- ✓ *Pseudorhombus megalops* Fowler, 1934
- ✓ *Pseudorhombus neglectus* Bleeker, 1866
- ✓ *Pseudorhombus oligodon* (Bleeker, 1854)
- ✓ *Pseudorhombus pentophthalmus* Günther, 1862
- ✓ *Pseudorhombus quinquocellatus* Weber and Beaufort, 1929
- ✓ *Pseudorhombus spinosus* McCulloch, 1914
- ✓ *Pseudorhombus tenuirastrum* (Waite, 1899)
- ✓ *Pseudorhombus triocellatus* (Schneider, 1801)



Genus *Tephrinectes* (Lacepède, 1802)

- Monotypic genus of uncertain taxonomic status. This genus contains only one species, the flower flounder, *Tephrinectes sinensis*, which occurs in coastal seas off China
- Eyes on left or right side of head.
- Dorsal-fin origin above middle of upper eye, its anterior rays much more widely separated than those which follow, all the rays branched, not scaled

Family PLEURONECTIDAE - Righteye flounders.

- Marine mostly distributed in the Arctic, Atlantic, Indian, and Pacific Oceans
- Margin of preopercle distinct, not covered by skin and scales.
- Eyes on right side of head; reversals rare.
- Mouth and teeth small
- Dorsal fin origin anterior to posterior margin of upper eye; no fin spines; urinary papilla on eyed side; caudal fin not attached to dorsal and anal fins; pectoral fin on blind side smaller than fin on eyed side or missing; pelvic-fin bases short or somewhat elongate, fin on eyed side slightly anterior to that of blind side and closer to or on midventral line. Scales small; lateral line weakly developed or missing on blind side of body.
- Dextral eyes
- Dorsal fin origin above eyes
- Well developed lateral line on both sides
- Symmetrical pelvic fins.

23 genera with about 56 species.

Following Nelson (2016)

SUBFAMILY HIPPOGLOSSINAE. Five genera, *Atheresthes* (2), *Clidoderma* (1), *Hippoglossus* (2), *Reinhardtius* (1), and *Verasper* (2), with eight species

SUBFAMILY EOPSETTINAE. One genus, *Eopsetta*, with two species (Cooper and Chapleau, 1998).

SUBFAMILY LYOPSETTINAE. One monotypic genus, *Lyopsetta* (Cooper and Chapleau, 1998).

SUBFAMILY HIPPOGLOSSOIDINAE. Three genera, *Acanthopsetta* (1), *Cleisthenes* (2), and *Hippoglossoides* (4), with seven species (Cooper and Chapleau, 1998b).

SUBFAMILY PLEURONECTINAE. Thirteen genera and 38 species.

TRIBE PSETTICHTHYINI. One monotypic genus, *Psettichthys*.

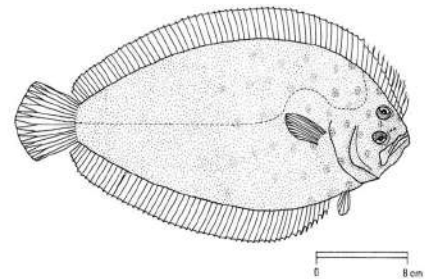
TRIBE ISOPSETTINI. One monotypic genus, *Isopsetta*. Garrett (2005) reported hybrids between *Isopsetta* and *Parophrys* (in tribe Pleuronectini, below).

TRIBE MICROSTOMINI. Six genera, *Dexistes*, *Embassichthys*, *Glyptocephalus*, *Lepidopsetta*, *Microstomus* and *Pleuronichthys* with 19 species

Superfamily Soleoidea. Eight families.

Family PARALICHTHODIDAE—Measles or peppered flounders.

- ✓ Reportedly Marine from southern Africa.
- ✓ One species reported from *Paralichthodes algoensis* of southern Africa (Heemstra in Smith and Heemstra, 1986:864; Evseenko, 2004
- ✓ Dorsal fin origin before the eyes; mouth asymmetrical, prominent curve of lateral line over pectoral fin; vertebrae 30–31;
- ✓ eyed side brownish grey with small dark spots. peppered
- ✓ Considered a subfamily of Pleuronectidae in Nelson (1994) and Evseenko (2004).



(Source: FAO, WIO)

Family POECILOPSETTIDAE

- ✓ Commonly called bigeye flounders.
- ✓ Distributed primarily in deep water waters in the Marine habitat of the Atlantic, Indian, and Pacific Oceans;
- ✓ Dorsal fin origin above the eyes;
- ✓ Lateral line rudimentary on eyeless side;
- ✓ Pelvic fins symmetrical; vertebrae 36–43.
- ✓ Three genera, *Marleyella*, *Nematops*, and *Poecilopsetta*, with 20 species

Genus *Poecilopsetta*:

The counts of dorsal and anal fin rays and lateral line scales are considered as key features for diagnosing species of *Poecilopsetta*

Bigeye flounders of the genus *Poecilopsetta* Günther, 1880 include 15 currently recognized. Seven species of *Poecilopsetta* occur in the Indian Ocean -

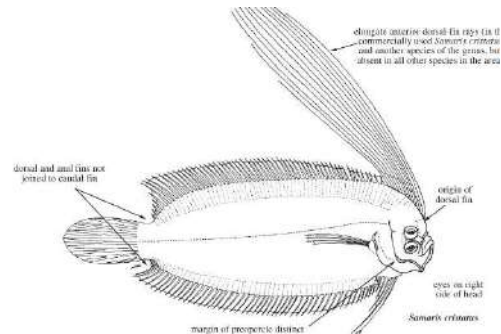
- P. albomaculata* Norman, 1939,
- P. colorata* Günther, 1880,
- P. natalensis* Norman, 1931,
- P. macrocephala* Hoshino, Amaoka and Last, 2001,
- P. normani* Foroshchuk & Fedorov, 1992,
- P. praelonga* Alcock, 1894,
- P. vaynei* Quéro et al., 1988, and
- P. zanzibarensis* Norman, 1939)

Family RHOMBOSOLEIDAE

- ✓ Predominantly marine; primarily a South Pacific group, occurring mostly around Australia and New Zealand, with one species in the southwestern Atlantic.
- ✓ Pelvic fins asymmetrical (one on the eyed side may be joined to anal fin);
- ✓ Lateral line equally developed on both sides; pectoral radials absent;
- ✓ vertebrae 30–46.
- ✓ Only *Oncopterus darwini* occurs in the southwestern Atlantic.
- ✓ Two species of *Rhombosolea* enter fresh water in New Zealand (McDowall, 1990).
- ✓ Some of the species resemble the Soleidae.

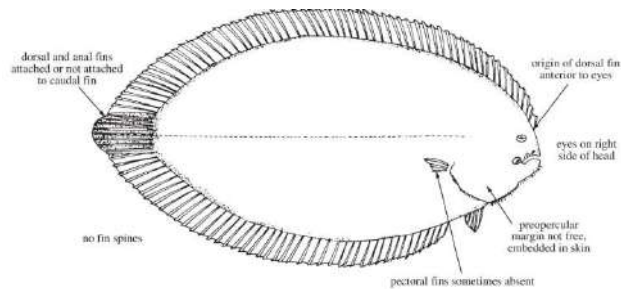
Family SAMARIDAE

- ✓ They are also called **crested flounders**.
- ✓ Reported from marine tropical and subtropical waters of the Indo – Pacific mainly from deep waters.
- ✓ Dorsal fin origin is in front of the eyes; lateral line well developed, pelvic fins symmetrical



Family SOLEIDAE

- ✓ Soles have eyes dextral in position, margin of the preoperculum concealed completely,
- ✓ Dorsal and anal fins not contiguous with caudal in some, in some contiguous.
- ✓ Pelvic fins free and not attached to anal fin.
- ✓ Preopercle without free margin, embedded in skin. Eyed-side lips not fringed with labial papillae.



Key to the genera of Soleidae occurring in the area

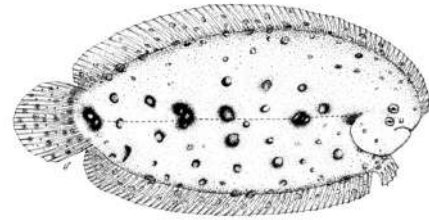
Genus *Heteromycteris*

Snout with a distinct hook inferior mouth; markedly contorted; caudal fin completely free separate from dorsal and anal fins; branchial septum perforated; ocular lips not fringed with labial papillae; branchial septum perforated by a foramen in its dorsal region; posterior nostril of ocular placed close to anterior edge of lower eye



Genus *Pardachirus*

- ✓ Snout not forming a distinct hook;
- ✓ mouth only slightly contorted;
- ✓ caudal fin separate or joined to dorsal and anal fins;
- ✓ branchial septum entire
- ✓ every fin ray of dorsal and anal fins with a pore at base of each fin ray (eyed and blind side)

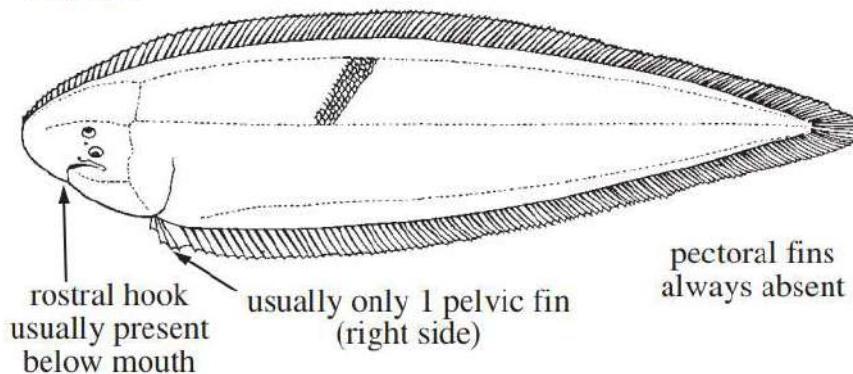


FAO

Family CYNOGLOSSIDAE

- ✓ Commonly called tonguefishes; they have eyes sinistral.
- ✓ Preopercular margin concealed by skin and scales;
- ✓ dorsal and anal fins contiguous with caudal, caudal pointed in most cases.
- ✓ Pelvic fin may/may not be attached to anal fin.
- ✓ Pectoral fin absent; eyes very small, placed close together,
- ✓ Mouth assymetrical.
- ✓ Three genera with about 143 species

eyes on
left side



Source: FAO, WCP

The family is divided into two subfamilies – Symphurinae and Cynoglossinae. Three genera with 127 species reported; in the present study, 2 genera with 12 species were collected in subfamily Cynoglossinae.

SUBFAMILY CYNOGLOSSINAE

- ✓ Snout hooked,
- ✓ inferior mouth assymetrical,.
- ✓ Lateral lines well developed on the ocular side.

- ✓ Lips fringed in *Paraplagusia*, plain in *Cynoglossus*.
- ✓ Most of the species occur in sandy beds and are burrowing forms, some are collected from brackish and freshwaters.

SUBFAMILY SYMPHURINAE.

- ✓ Snout not hooked;
- ✓ mouth terminal mostly straight;
- ✓ lateral line absent on both sides;
- ✓ pelvic fin free from anal fin.
- ✓ Deepwater species

PRESENT STATUS OF FLATFISH PHYLOGENY

Eschmeyer (2013) mentions of 75 new species of flatfish records during the period 2004–2013. The Order is now classified into two suborders – Psettoidoidei and Pleuronectoidei; the former with one family Psettodidae and the latter with 13 families in three superfamilies Citharoidea, Pleuronectoidea, and Soleoidea. Around 1042 valid species have been recorded in the Order at present. Taxonomic relations especially within the subfamily Pleuronectinae remain uncertain in spite of numerous investigations into the biology and systematic of the flatfish.

Proper identification of organisms is necessary to monitor biodiversity at any level (Vecchione and Collette 1996). Furthermore, if decisions are to be made about preserving species, then relationships among species must be known to determine the evolutionary uniqueness of the species. Flatfish resources require more attention as these are a mixture of highly valuable table fish as well as export items; besides many species are dwindling in the landings. A study on the taxonomy and diversity of the flatfishes available in the Indian waters is a requisite for successful management of the fishery as well as accurate documentation and maintenance of biodiversity.

Further Reading

- Nair, Rekha J and Gopalakrishnan, A (2015) Taxonomic note on *Crossorhombus azureus* (Alcock 1889) (Family: Bothidae, Order: Pleuronectiformes) from the south-west coast of India. *Indian Journal of Fisheries*, 62 (2). pp. 87-91.
- Nair, Rekha J and Gopalakrishnan, A (2016) Studies on Flatfishes of India as a Step Towards Conservation of Resources. Other. International Agrobiodiversity Congress, New Delhi.
- Nair, Rekha J and Gopalakrishnan, A (2014) Review on the Fisheries, Taxonomy, and Status of the Flatfishes in Tropical Waters. *Reviews in Fisheries Science & Aquaculture*, 22. pp. 175-183.
- Munroe, T.A., Weerts, S.P. & Nair, R. (2020). *Psettodes erumei*. *The IUCN Red List of Threatened Species* 2020: e.T166996A1161449. <https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T166996A1161449.en>. Downloaded on 09 December 2021.
- Nair, Rekha J and Dinesh Kumar, S (2018) Overview of the Fish Diversity of Indian Waters. In: DBT sponsored Three Months National Training in Molecular Biology and Biotechnology for Fisheries Professionals, 2nd February 2015 - 31st March 2018, Kochi.
- Weerts, S P and Munroe, T A and Nair, Rekha J (2020) *Heteromycteris capensis*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Heteromycteris oculus*, Eyed Sole. The IUCN Red List of Threatened Species 2020.

- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Liachirus melanospilos*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Pardachirus balius*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Pardachirus marmoratus*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Pardachirus morrowi*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Plagiopsetta biocellata*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samaris costae*, Costa's Crested Flounder. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samaris macrolepis*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samariscus desoutterae*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samariscus inornatus*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samariscus leopardus*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samariscus longimanus*, Longfinned Flounder. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samariscus nielsenii*, Nielsen's Righteye Flounder. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Samariscus triocellatus*, Three-spot Righteye Flounder. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Solea elongata*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Solea heinii*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Solea ovata*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Solea turbynei*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Soleichthys dori*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Soleichthys tubiferus*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Symphurus monostigmus*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Zebrias altipinnis*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Zebrias annandalei*, Annular Sole. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Zebrias cochinchinensis*. The IUCN Red List of Threatened Species 2020.

- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Zebrias keralensis*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Zebrias maculosus*. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Weerts, S P and Nair, Rekha J (2020) *Zebrias quagga*. The IUCN Red List of Threatened Species 2020. ISSN 2307-8235 (online)
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Zebrias regani*, South African Zebra Sole. The IUCN Red List of Threatened Species 2020.
- Munroe, T A and Nair, Rekha J and Weerts, S P (2020) *Zebrias synapturoides*, Indian Zebra Sole. The IUCN Red List of Threatened Species 2020.

