

An Account of the Flatfishes of the Mangalore Coast and Notes on their Fishery

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Abstract

The composition and fishery of flatfishes belonging to Order Pleuronectiformes have been studied along the Mangalore coast during a twelve month period from August 1989 to July 1990.

Order Pleuronectiformes is represented by four families, eight genera and seventeen species along the Mangalore coast. Taxonomic characters of the 17 species viz., *Psettodes erumei*, *Pseudorhombus arsius*, *P. triocellatus*, *P. javanicus*, *Euryglossa orientalis*, *Synaptura commersoniana*, *S. albamaculata*, *Solea ovata*, *Aesopia cornuta*, *Paraplagusia bilineata*, *Cynoglossus cynoglossus*, *C. dubius*, *C. lida*, *C. macrolepidotus*, *C. macrostomus*, *C. puncticeps* and *C. bilineatus* were examined and compared with earlier descriptions.

The percentage of flatfishes in the total landings showed seasonal variations, being highest in October and lowest in April. The species composition showed highest diversity in December (12 spp.) and lowest in March (8 spp.). *C. macrostomus* contributed to more than 80% of the landings. Estuarine fishery for flatfishes dominate the post-monsoon months of September and October. The cast net *Beesu Bale* was the principal gear employed in the estuarine while in sea it was the trawl net operated from mechanised vessels.

Introduction

The order pleuronectiforms comprises of flatfishes such as flounders, turbot, plaices, halibuts, soles and tongue soles. The world catch of flat fishes amounted to 1308330 metric tonnes (FAO 1986 data) while in India, halibuts, flounders and soles contributed to 33385 and 29887 metric tonnes in 1989 and 1990 forming 3.78 and 3.15% of demersal catches respectively (Anon, 1992). Thus, members of pleuronectiforms form a moderately important group in the marine landings of this area. Yet there has not been any comprehensive study of the fishery or biology of flatfishes of the Karnataka coast. Rao (1967) and Seshappa (1973) have given a general account of the fishery for flatfishes along the west coast. Seshappa (1970) studied the morphometry of 5 species of *Cynoglossus* from the west coast. The present report forms part of a comprehensive study carried out during 1989-90, on the systematics, fishery and biology of flatfishes occurring along the Mangalore coast.

Materials and Methods

The study area was restricted to the Dakshina Kannada coast extending over 150 km. Important landing centres for marine and estuarine fish along the coast were visited at weekly intervals during the period extending from August 1989 to July 1990. Representative samples of flatfishes belonging to various genera were collected from each centre, brought to the laboratory and preserved in 5% formalin for further morphological and meristic studies. Data on catch composition, gear and effort were collected wherever available. Samples for feeding habits, growth and maturation were collected separately. In the laboratory morphological characters and meristic counts were recorded and the data thus gathered were tabulated, analysed and compared with earlier records.

Results and Discussion

Seventeen species of flatfishes belonging to eight genera and four families were recorded during the study. Details of these are given below with notes on morphological characters or meristic counts and compared with those from earlier reports.

| | |
|--|---|
| Family | : Psettodidae |
| Genus and species | : <i>Psettodes erumei</i> (Schneider) |
| Synonyms | : <i>Pleuronectes erumei</i> Schneider, 1801 <i>Pettodes erumei</i> Day 1877 |
| Common name | : Indian halibut |
| D. 48-53, P. 15, V 6, A. 35-40, L.I. 69-75 | |

Length of head 3.55-3.87 in total length. Height of head 1.04 - 1.14 in head length. Height of body 2.56-2.91 in total length. Eye diameter 5.26-6.66 in length of head, 2.00-2.57 in snout length. Interocular space divided by a bony ridge. Lower jaw longer. Maxilla 0.60-0.78 of head length. Strong canine teeth in irregular multiple rows. Teeth barbed. Body oval, flat and thicker than in other flat fishes. Either right eyed or left eyed. Dorsal fin does not extend on head. Dorsal, anal and caudal truncate. Pectorals shorter than post orbital length of head. Two nostrils, anterior and posterior, close together and in front of inter-orbital space. Body purplish black, dorsal and anal fins dark coloured with the tips of fins being white. Young specimens with 4 vertical dark cross bands.

12 specimens were studied for morphological and meristic characters. Most characters agreed with earlier descriptions. Dorsal and anal fins were tipped white unlike black as reported by Fischer and Bianchi (1984). Maximum length recorded was 540 mm. Details of meristic counts are presented in Table 1.

Table 1. Comparison of morphometric measurements and meristic counts of *Psettodes erumei* with earlier reports.

| Source | Character | D | P | V | A | L.I | HL in TL | BH in TL | ED in HL | ML in HL |
|--------------------------|-----------|-------|-------|---|-------|-------|-----------|-----------|-----------|-----------|
| Day (1878) | | 47-56 | 16 | 6 | 35-41 | 70-75 | 4.16 | 2.67 | 6.00 | 0.80 |
| Weber and Beufort (1929) | | 49-54 | 14-15 | - | 36-44 | 72-77 | 3.50-4.00 | 2.50-3.30 | 5.20-8.40 | - |
| Munro (1955) | | 50-56 | - | - | 34-43 | 68-76 | - | - | - | - |
| Menezes (1980) | | 47-52 | 13-16 | 6 | 35-39 | 71-78 | 3.60-4.00 | 2.40-2.80 | 6.00-7.00 | - |
| Talwar and Kacker (1984) | | - | - | - | - | 70-75 | - | - | - | - |
| Present study | | 48-53 | 15 | 6 | 35-40 | 69-75 | 3.55-3.87 | 2.56-2.91 | 5.26-6.66 | 0.60-0.78 |

D = Dorsal finray count, P = Pectoral finray count, V = Pelvic finray count, A = Anal finray count, L.I = Lateral line scales, HL = Head length, TL = Total length, BH = Body heights, E = Eye diameter, ML = Maxilla length

Family : Bothidae
 Genus and species : *Pseudorhombus arsius* (Hamilton-Buchanan)
 Synonyms : *Pleuronectes arsius* Hamilton-Buchanan 1822
Pleuronectes polypilus Bleeker, 1853
Pseudorhombus arsius Day 1877
 Common name : Large-toothed flounder
 D. 65-77, P. 10-12, V. 6, A. 54-61, C. 14-18, L.I. 70-81

Length of head 3.62-4.69 in total length. Height of body 2.04-2.36 in total length. Eye diameter 4.00-6.46 in head length, 1.11-1.88 in snout length and 0.3-0.66 in length of gill raker. Body oval and flat. Both eyes on left side, close together and separated by a narrow bony ridge. Dorsal profile of head almost

straight. Dorsal fin starts on head. Dorsal and anal fins not continuous with caudal. Caudal double truncate, the central rays of the caudal being longest. Lateral line smooth, the anterior prolongation of lateral line goes to the base of either 9th, 10th or 11th dorsal ray. Scales ctenoid on occular side and cycloid on blind side. Scales larger at the posterior part of body. The base of dorsal and anal (nearly 1/3rd) covered by scales. Ocular side reddish brown. Two conspicuous dark ocellii present on straight portion of lateral line, one at the beginning of lateral line and the other near caudal peduncle. Various types of spots and rings are present on the body. Caudal, anal and dorsal are also coloured with brown spots.

25 specimens were studied. Table 2 shows the comparison of the meristic characteristics of *P. arsius* and two related species, *P. triocellatus* and *P. javanicus* with earlier records. In *P. arsius*, the anterior prolongation of lateralline

Table 2. Comparison of morphometric measurements and meristic counts of *Pseudorhombus arsius*, *P. triocellatus* and *P. javanicus* with earlier records.

| Source | Meristic and morphometric charactes | D. | P. (dextral) | P. (sinistral) | V. | A. | C. | L.I | HL in TL | BH in TL | ED in HL |
|----------------------------|-------------------------------------|-------|--------------|----------------|----|-------|-------|-----------|-----------|-----------|-----------|
| (1) <i>P. arsius</i> | | | | | | | | | | | |
| Day (1878) | | 71-79 | - | 10 | 6 | 54-61 | 17 | 75-85 | 4.25-4.33 | 2.33-2.50 | 5.00 |
| Weber and Beufort (1929) | | 71-76 | - | - | - | 54-56 | - | 75-80 | 3.70-4.70 | 2.10-2.60 | 4.10-5.20 |
| Munro (1955) | | 72-80 | - | - | - | 56-61 | - | 67-78 | - | 1.75-2.20 | - |
| Menezes (1980) | | 69-75 | - | 11 | 6 | 52-58 | - | 69-82 | 4.10-4.70 | 2.10-2.60 | 4.10-5.20 |
| Present study | | 65-77 | - | 10-12 | 6 | 54-61 | 14-18 | 70-81 | 3.62-4.69 | 2.04-2.36 | 4.00-6.46 |
| (2) <i>P. triocellatus</i> | | | | | | | | | | | |
| Day (1878) | | 66-79 | - | - | 5 | 49-51 | - | 65-70 | 4.25-4.50 | 2.00 | 4.00 |
| Weber and Beufort (1929) | | 67-69 | - | - | - | 47-51 | - | 65-70 | 4.10 | - | 4.00 |
| Munro (1955) | | 65-70 | - | - | - | 49-52 | - | 63-68 | - | 1.50-1.75 | - |
| Present study | | 65-71 | 11 | 9-10 | 6 | 47-54 | 15-17 | 3.86-4.86 | 1.63-1.95 | 2.83-4.00 | - |
| (3) <i>P. javanicus</i> | | | | | | | | | | | |
| Day (1878) | | 69 | - | 12 | 6 | 52-55 | 16 | 68-74 | 4.06-4.39 | 2.17-2.30 | 3.64-4.80 |
| Weber and Beufort (1929) | | 69-73 | - | - | - | 50-56 | - | 67-74 | 3.70-4.10 | 2.50-2.90 | 3.40-4.50 |
| Munro (1955) | | 69-72 | - | - | - | 54-55 | - | 68-72 | - | 2.10-2.25 | - |
| Present study | | 66-72 | - | 12 | 6 | 52-55 | 16 | 68-74 | 4.06-4.39 | 2.17-2.30 | 3.64-4.80 |

ende at the base of 9th, 10th or 11th dorsal ray while Fisher and Bianchi (1984) reported them ending between 8th and 12th dorsal ray. The maximum recorded size was 311 mm.

Genus and species : *Pseudorhombus triocellatus* (Bloch)
Synonyms : *Pleuronectes triocellatus* Bloch, 1801
Pseudorhombus triocellatus
Bleeker, 1870

Common name : Three spot flounder

D. 65-71, P. dextral 11, Sinistral 9-10, V. 6, A. 47-54, C. 15-17, L.I. 63-70

Length of head 3.86-4.86 in total length. Height of body 1.63- 1.95 in total length. Eye diameter 2.83-4.00 in head length, 1.05-1.71 in snout length. Body oval, flat and much thinner than in other species of Bothidae. Mouth oblique, the lower jaw slightly in advance of the upper jaw. A single row of minute teeth present on both jaws. Two eyes separated by a bony ridge. Dorsal profile much arched in front of eyes. Posterior nostril patent (round) and anterior nostril tubular with a barbel like prolongation. Origin of dorsal above the anterior nostril. The maxilla on coloured side scaly, reaches below the middle of lower eye and 0.36-0.49 of head length. Dorsal and anal fin rays simple. Anterior part of dorsal fin and posterior part of anal fin have the longest rays. Dorsal and anal not confluent with caudal. Left pectoral longer than the post orbital part of head. Ventrals comparatively smaller. Right pectoral shorter than eye and snout length. Caudal fin rounder. Anterior prolongation of the lateral line of blind side reaches the dorsal base at 11th, 12th or 13th ray. Scales ctenoid on coloured side and cycloid on blind side except the peripheral region. Body brownish red. 3 conspicuous dark ocellii arranged in a triangular fashion, one above and 2 below the lateral line. Whole body and vertical and caudal fins with dark spots and markings.

25 specimens were examined. The anterior prolongation of lateral line ended between 11th and 13th dorsal ray. Talwar and Kacker (1984) reported ending of the lateral line prolongation between 10th and 13th dorsal ray. The maximum recorded length was 128 mm. Other details are given in Table 2.

Genus and species : *Pseudorhombus javanicus* (Bleeker)
Synonyms : *Rhombus javanicus* Bleeker 1853
Pseudorhombus javanicus Bleeker 1870

Common name : Javanese flounder

D. 66-72, P. 12, V. 6, A. 52-55, C.16, L.I. 68-75

Length of head 4.06-4.39 in total length. Height of body 2.17- 2.30 in total length. Length of head 1.32-1.59 in head height. Snouth length 2.69-3.70 in head length. Eye diameter 3.64-4.80 in head length, 2.69-3.70 in snout length. Body oval and flat, teeth small, sharp, conical and subequal in length and present in both jaws. Maxillary scaly, reaches below the middle

of lower eye and 0.41-0.44 of head length. Eyes close together, the upper one in advance of the lower one. Separated by a body ridge. Dorsal profile in front of eyes arched. Origin of dorsal in advance of anterior nostril. Dorsal and anal ending close to caudal. Left pectoral longer than the right pectoral. The anterior prolongation of the lateral line on blind side goes to 10th or 11th dorsal ray. Scales of eyed side mostly ctenoid on the anterior half and mostly cycloid on posterior half; scales of blind side cycloid. Body purplish brown. Numerous ocellii and spots scattered all over the body which extend on to the unpaired fins.

10 specimens were examined. The anterior prolongation ended at 10th or 11th ray. Fischer and Bianchi (1984) reported this to be between 9th and 11th dorsal ray. The maximum observed length was 195 mm.

Family : Soleidae

Genus and species : *Euryglossa orientalis*

Bloch and Schneider

Synonyms : *Brachirus orientalis*

Bloch and Schneider 1801

Synaptura orientalis

Bloch and Schneider 1801

Common name : Oriental sole

D. 60-67, P. 6-8 (dextral), 5-8 (Sinistral), V. 5, A. 44-53, C. 14-18, L.I. 75-85

Head length 4.24-5.63 in total length, 1.55 to 2.29 in head height. Height of the body 1.87-2.20 in total length. Snout length 2.31-3.57 in head length. Eye diameter 3.71-6.86 in head length. Body oblong, both dorsal and ventral profiles equally arched. Upper eye in advance of the lower eye. The interorbital space scaly and concave, Mouth curved, upper jaw slightly prominent, without distinct hook. No teeth on both jaws, origin of dorsal fin on head and horizontal to the margins of upper eye. Scales ctenoid on both sides. All fin bases covered nearly $\frac{2}{3}$ rd by scales. Scales of head of blind side with fringes. A series of fringes are present along the opercular border. Dorsal and anal rays branched at their tips. Posterior rays of dorsal and anal completely joined with caudal. Caudal round. Nostril on coloured side tube like and covered by fringes of scales on blind side. Colour of body either greyish or brownish. Black transverse bands are present on the body which extend to fins. Numerous dark spots or blotches also present on the body. Vertical fins dark in colour. Outer half of the pectoral fin black.

25 specimens were examined. The comparison of characteristics is presented in table 3 along with those of *Synaptura commersoniana*, *S. albamaculata*, *Aesopia cornuta* and *Solea ovata*. Maximum recorded size of *E. orientalis* at Mangalore was 245 mm against 175 mm reported by Munro (1955) and 175 mm by Fischer and Bianchi (1984).

Genus and species : *Synaptura commersoniana* (Lacepede)
Synonyms : *Pleuronectes commersonianus*
Lacepede 1802
Synaptura commersoniana Day 1877
Common name : Commerson's sole
D. 70-83, P. 7-9, V. 2-4, A. 60-66, C. 12-13, L.I. 140-170.

Length of head 5.13-6.00 in total length, 1.19-1.60 in height of head. Height of body 3.18-3.75 in total length. Diameter of the eye 5.25-8.25 in head length, 1.80-2.80 in snout length. Body elongate and somewhat thick. The angle of mouth (mouth cleft) curved, ending behind the middle of lower eye. Snout hooked. The upper eye is entirely in advance of the lower eye. Eyes separated by scaly interorbital space. Lower lip fringe with a row of fleshy tentacles. Scales ctenoid on the coloured side and cycloid on the blind side. Scales on head and opercular region longer than the scale of the other parts of body. On coloured side, 2 tubular nostrils in front of the lower eye. On blind side, the nostrils are concealed by skin. At the posterior end, the dorsal and anal are joined with the caudal. Caudal obtusely pointed. Body reddish brown, vertical fins blackish in colour with a white border. The rays of vertical fin branches at their tip. Both pectorals are black in colour.

12 specimens were examined. Both pectorals of a specimens examined were black. Fischer and Bianchi (1984) state that only the right pectoral is blackish. Maximum recorded size was 248 mm.

Genus and species : *Synaptura albamaculata* Kaup
Synonyms : -
Common name : Kaup's sole
D. 69-76, P. 6-9, V. 3, A. 54-60, C. 16, L.I. 114-128

Length of head 5.00-5.95 in total length 1.17-1.55 in head height. Height of body 2.96-3.86 in total length. Eye diameter 5.33-5.71 in head length, 1.50-2.29 in snout length. Body elongate. The upper eye in advance of the lower eye. Mouth curved, reaching beyond the middle of lower eye. Snout hooked. Lower lip fringed and with a row of fleshy tentacles. 2 tubular nostrils on coloured side with a short barbel in between. Nostril on blind side covered by cutaneous folds. Cutaneous folds are present in head portion. Scales ctenoid on coloured side and cycloid on blind side. Pectoral on ocular side longer than that on blind side. Pelvic fin rudimentary, united with each other at their base. The vertical fins blackish with a white border, divided at their tips. Body dark brown, with white spots arranged in 3 rows longitudinally, the middle one along the lateral line. The right pectoral is blackish.

Of the 15 specimens examined, only the right pectoral was found to be blackish. Maximum recorded length was 262 mm. Other details are given in Table 3.

Genus and species : *Aesopia cornuta* Kaup
Synonyms : *Synaptura cornuta* Day 1877
Common name : Horned sole
D. 69-70, P.17, V. 4, A. 58-59, V. 17, L.I. 90-91

Length of head 5.95-6.26 in total length. Body height 3.20-3.31 in total length. Diameter of eye 6.67-7.67 in head length, 1.67- 2.00 in snout length. Body elongate and compressed. Eyes contiguous. Angle of mouth below the middle of lower eye. Two nostrils on the coloured side, a round one in front of lower eye and an anterior tubular one. A single lateral line on both sides. Scales cycloid on both sides. First dorsal ray thickened and free from the rest of the dorsal. Dorsal and anal fins confluent with caudal fin. Both pectorals short. Pectoral on coloured side longer than that of blind side. Caudal round. Body colour pale brown, 13 chestnut brown cross vertical bands on body, starting on snout and extending even to fins. Dorsal fin has white edge caudal fin dark brown and irregularly marked with whitish yellow marks.

2 specimens were examined. Dorsal ray count was 69-70 as against 69-75 by Day (1878) and 69-75 by Munro (1955). Anal ray was 58-59 as against 61-62 by Day (1878) and 61-66 by Munro (1955) it was 87-98. In the present study the number was 90-91. Maximum observed length was 144 mm. The details are presented in Table 3.

Genus and species : *Soleas ovata* Richardson
Synonyms : -
Common name : Ovate sole
D. 57-67, P. 6-8 (sinistral), 4-5 (dextral), V. 4-5, A. 42-47, C. 14-16, L.I. 93-109.

Length of head 4.12-5.07 in total length, 1.20-1.79 in head height. Height of the body 2.05-2.85 in total length. Eye diameter 4.25-6.33 in head length, 1.25-2.17 in snout length. Body ovate and flat. Mouth small and curved. The upper eye in advance of the lower eye, both separated from each other by a scaly depression. Upper jaw little longer than the lower jaw. Snout obtusely pointed and with numerous tentacles on blind side. Lips not fringed. Two nostrils, the round one in front of lower eye and the tubular one anterior to it. Scales ctenoid on both sides. Scales present in dorsal and anal fin base. Length of highest dorsal ray 3.67-5.71 in body height. Dorsal and anal fin rays unbranched except the few posterior rays. pectoral fin on ocular side about thrice as long as that of blind side. Brownish body with dark spots and blotches, which extend even to fins. Deep black blotches on outer two-thirds of pectoral fins.

25 specimens were examined, Day (1857) recorded 9 dorsal rays while in the present study it was only 4-5. Caudal ranged from 14 to 16 as against 12 by Day (1857). L. lat ranged from 93 to 109 as against 110 by Day (1857). Maximum observed length was 85 mm. The details are given in Table 3.

Table 3. Comparison of morphometric measurements and meristic counts of *Euryglossa orientalis*, *Synaptura commersoniana*, *S. albamaculata*, *Aesopia cornuta* and *Solea ovata* with earlier records.

| Source | Meristic and morphometric characters | D. | P. (dextral) | P. (sinistral) | V. | A. | C. | L.1 | HL in TL | BH in TL | ED in HL |
|-----------------------------|--------------------------------------|-------|--------------|----------------|-----|-------|-------|---------|-----------|-----------|-----------|
| (1) <i>E. orientalis</i> | | | | | | | | | | | |
| Day (1878) | | 62-65 | 7 | - | 5 | 47-50 | 16 | 70-85 | 5.00-5.17 | 2.13-2.17 | - |
| Weber and Beufort (1929) | | 61-65 | 7-8 | 5 | - | 44-48 | - | 75-85 | 4.80-5.30 | 2.20 | 6.0-6.8 |
| Munro (1955) | | 62-72 | - | - | - | 47-57 | - | 63-74 | - | 2.00-2.25 | - |
| Menon and Joglakar (1978) | | 59-73 | 7-10 | 6-10 | 5 | 46-56 | 18-20 | 64-83 | - | - | - |
| Talwar and Kacker (1984) | | 62-72 | - | - | - | 47-57 | - | - | - | - | - |
| Present study | | 60-67 | 6-8 | 5-8 | 5 | 44-53 | 14-18 | 75-85 | 4.25-5.63 | 1.87-2.20 | 3.71-6.86 |
| (2) <i>S. commersoniana</i> | | | | | | | | | | | |
| Day (1878) | | 70-81 | 9 | - | 4 | 60-63 | 12 | 155-160 | 6.00-6.50 | 3.67-4.00 | 7.50 |
| Weber and Beufort (1929) | | 71-81 | 8-9 | 6-8 | 2-4 | 57-63 | - | 156-170 | 6.20 | 3.70 | 7.50 |
| Munro (1955) | | 70-81 | - | - | - | 58-66 | - | 160 | - | - | - |
| Menon and Joglakar (1978) | | 72-81 | 6-8 | 1-7 | 2 | 57-68 | 12-14 | 109-146 | - | - | - |
| Talwar and Kacker (1985) | | 72-81 | - | - | - | 57-68 | - | - | - | - | - |
| Present study | | 70-83 | 7-9 | - | 2-4 | 60-66 | 12-13 | 140-170 | 5.13-6.00 | 3.18-3.75 | 5.25-8.85 |
| (3) <i>S. albamaculata</i> | | | | | | | | | | | |
| Day (1878) | | 72-74 | 7-8 | - | 4 | 56-59 | 16 | 110-120 | 5.50-6.00 | 3.33-3.67 | - |
| Weber and Beufort (1929) | | 71-74 | 9 | 7 | 3-4 | 56-59 | - | 110-140 | 5.80 | 3.50 | 6.00 |
| Menon and Joglakar (1978) | | 72-80 | 8-10 | 7-8 | 4 | 57-63 | 17 | 111-134 | - | - | - |
| Talwar and Kacker (1984) | | 72-80 | - | - | - | 57-63 | - | - | - | - | - |
| Present study | | 69-76 | 6-9 | - | 3 | 54-60 | 16 | 114-118 | 5.00-5.95 | 2.96-3.86 | 5.33-5.71 |
| (4) <i>Aesopia cornuta</i> | | | | | | | | | | | |
| Day (1878) | | 69-75 | 17 | - | 3-4 | 61-62 | 17 | 90-100 | 6.00 | 3.33 | 4.00-4.50 |
| Munro (1955) | | 69-79 | - | - | - | 61-66 | - | 87-98 | - | 3.00 | - |
| Present study | | 69-70 | 17 | - | 4 | 58-59 | 17 | 90-91 | 5.95-6.26 | 3.20-3.31 | 6.67-7.67 |
| (5) <i>Solea ovata</i> | | | | | | | | | | | |
| Day (1857) | | 60-66 | 9 | - | 5 | 42-49 | 12 | 110 | 5.00-5.25 | 2.25 | 5.00 |
| Talwar and Kacker (1984) | | 58-67 | - | - | - | 41-51 | - | - | - | 2.00-2.20 | - |
| Present study | | 57-67 | 4-5 | 6-8 | 4-5 | 42-47 | 14-16 | 93-109 | 4.12-5.07 | 2.05-2.85 | 4.25-6.33 |

Family : Cynoglossidae
 Genus and species : *Paraplagusia bilineata* (Bloch)
 Synonyms : *Pleuronectes bilineata* Bloch, 1784
 Plagusia marmorata Bleeker, 1851
 Paraplagusia bilineata Norman, 1928

Common name : Double lined tongue - sole

D. 103-114, V. 4, A. 75-89, C. 10, L.1. 90-107

Length of head 4.12-4.90 in total length. Head height 0.94-1.00 in head length. Body height 3.54-4.37 in total length.

Eye diameter 7.20-9.60 in head length. Body flat and elongate. Snout rounded. Rostral hook long, reaches beyond the posterior part of the lower eye. Eyes very small, the upper eye in advance of the lower eye. Angle of the mouth below the hind edge of the lower eye, nearer to gill opening than to snout. Lips fringed. A tubular nostril present in front of lower eye. A small developed tubular nostril present even on blind side. Scales ctenoid on both sides. A single ventral present which is somewhat whitish in colour. Two lateral lines on the coloured side separated at their greatest distance by 16-18 rows of scales. Body brownish in

colour. In fresh specimens star shaped blotches could be seen. Yellowish band present along the dorsal and anal on blind side.

15 specimens were examined. Maximum observed length was 219 mm. Differences in characteristics of *P. bilineata* in comparison to earlier records are presented in Table 4.

Genus and species : *Cynoglossus bilineatus* (Lacepede)
Synonyms : *Achirus bilineatus* Lacepede 1802
Cynoglossus quadrilineatus Bleeker, 1851
Cynoglossus sindensis Day, 1877

Common name : Four lined tongue - sole
D. 103-115, V. 4, A. 84-88, C. 12, L.I. 84-100.

Length of head 4.12-5.17 in total length, 1.0-1.10 in head height. Body height 3.56-4.33 in total length. Snout length 2.14-2.50 in head length. Eye diameter 7.50-10.25 in head length, 3.20-4.44 in snout length. Body flat and elongate. Snout rounded. Rostral hook short, covers the mandibular symphysis but does not extend below the front eye. Angle of mouth below the hind edge of lower eye and mid way between snout and gill opening. Two nostrils on coloured side, an open one between the orbits and a tubular one in front of lower eye. Scales ctenoid on coloured side and cycloid on blind side. Two lateral lines on either side. On coloured side, the two lateral lines separated at their greatest distance by 14-17 rows of scales. Body dark brown, fins light brown. Fin tips white. A dark blotch on opercle.

10 specimens were examined. Maximum length of the specimen observed 350 mm. Table 4 given details of the differing meristic characteristics.

Genus and species : *Cynoglossus cynoglossus*
(Hamilton-Buchanan)

Synonyms : *Achirus cynoglossus*
Hamilton-Buchanan, 1822
Cynoglossus bengalensis Day, 1877
Cynoglossus deltae Jenkins, 1910

Common name : Gangetic tongue - sole
D. 93-100, V. 4, A. 70-78, C. 11, L.I. 77-95

Head length 4.72-5.77 in total length, 0.93-1.27 in head height. Height of the body 3.28-4.00 in total length. Snout length 2.60- 3.20 in head length. Eye diameter 8.33-11.60 in head length, 2.67-4.00 in snout length. Length of highest dorsal ray 4.20-5.22 in body height. Body flat and elongate. Snout obtusely pointed, Rostral hook short, not extending below the eye, nearer to snout than to gill opening. Two nostrils; the round one in between the eyes and the tubular one in front of the lower eye. Scales ctenoid on both sides. 2 lateral lines on coloured side separated at their greatest distance by 15-17 rows of scales. No

lateral line on blind side. Body reddish brown with irregular scattered dark spots. The body colour is extended to fins also.

15 specimens were examined. Differences in dorsal, anal and ventral finray counts were observed. Maximum length of the specimen observed, 197 mm. Details are presented in Table 4.

Genus and species : *Cynoglossus dubius* Day
Synonyms : -
Common name : Large tongue - sole
D. 106-115, V. 4, A. 83-89, C. 12, L.I. 100-108

Head length 3.83-4.22 in total length. Head height 1.0-1.24 in head length. Height of the body 3.56-4.30 in total length. Snout length 2.03-2.29 in head length. Eye diameter 9.40-13.80 in head length, 4.38-6.60 in snout length. Body flat and elongate. Eyes large, interorbital space pronounced. Snout obtusely pointed. Rostral hook short, reaches to the front edge of the upper eye. Angle of mouth beyond the hind edge of lower eye, nearer to gill opening than to snout. Two nostrils on coloured side, a patent one in between the eyes and a tubular one in front of the lower eye. Scales cycloid on both sides, except along both dorsal and anal fins towards the posterior of ocular side where scales are ctenoid. Two lateral lines on the coloured side separated at their greatest distance by 18-19 rows of scales. A single lateral line on blind side. Body uniformly brown coloured. A dark blotch on the opercle.

12 specimens were examined. Several deviations in meristic counts were noticed in the present study. Maximum length of the specimen observed, 324 mm. The details are presented in Table 4.

Genus and species : *Cynoglossus lida* (Bleeker)
Synonyms : *Plagusia lida* Bleeker, 1851
Cynoglossus lida Day, 1877
Cynoglossus intermedius Alcock, 1890.

Common name : Shoulder spot tongue - sole
D. 105-111, V. 4, A. 82-87, C. 10, L.I. 85-94.

Length of the head 4.33-4.89 in total length. Head height 1.06- 1.10 in head length. Body height 4.04-4.49 in total length. Snout length 2.18-2.42 in head length. Eye diameter 8.75-11.43 in head length, 4.00-4.86 in snout length. The length of highest dorsal ray 4.00-4.86 in body height. Body flat and elongate. Rostral hook moderate, extends upto the front edge of the lower eye. Angle to mouth well beyond the hind edge of the lower eye, nearer to gill opening than to snout. Two nostrils on coloured side, a patent one in between the eyes and a tubular one in front of the lower eye. Scales ctenoid on both sides. Two lateral lines on the coloured side separated at their greatest distance by 13-14 rows of scales. No lateral line on the blind side. Body light brownish. A dark patch on the opercular region.

Table 4. Comparison of morphometric measurements and meristic counts of *Paraplagusia bilineata*, *Cynoglossus bilineatus*, *C. cynoglossus* and *C. dubius* with earlier records.

| Meristic and morphometric characters Source | D. | V. | A. | C. | L.I. | HL in TL | BH in TL | Sn.L in HL | ED in HL | ED in Sn.L | SbLt |
|--|---------|----|-------|----|---------|-----------|-----------|------------|-------------|------------|-------|
| (1) <i>P. bilineata</i> | | | | | | | | | | | |
| Day (1878) | 96-102 | 4 | 70-74 | 8 | 84-94 | 4.17 | 3.67 | - | 8.00-12.00 | - | 13-14 |
| Weber and Beufort (1929) | 96-119 | - | 75-90 | - | 90-106 | 4.00-4.60 | 3.60-3.90 | - | 10 or more | - | 16-18 |
| Munro (1955) | 106-118 | - | 86-98 | - | 98-114 | - | - | - | - | - | 16-19 |
| Mussain and Alikhan (1981) | 104-108 | - | 89-92 | 15 | 98-114 | - | 4.20-4.50 | 2.20-2.50 | 10.50-12.00 | - | 16-19 |
| Talwar and Kacker (1984) | 100-114 | - | 72-89 | - | - | - | - | - | - | - | 16-19 |
| Present study | 103-114 | 4 | 75-89 | 10 | 90-107 | 4.12-4.90 | 3.54-4.37 | - | 7.20-9.60 | - | 16-18 |
| (2) <i>C. bilineatus</i> | | | | | | | | | | | |
| Day (1878) | 106-116 | 4 | 83 | 12 | 108 | 5.00 | 3.75-4.00 | - | 8.50-9.50 | 4.00 | 19-20 |
| Weber and Beufort (1929) | 102-112 | 4 | 82-97 | - | 86-98 | - | - | - | 9.00-10.00 | - | 15-16 |
| Munro (1955) | 104-114 | - | 84-95 | - | 85-96 | - | - | - | - | - | 15-18 |
| Seshappa (1970) | 108-112 | - | 86-89 | - | 96-102 | 4.57-5.14 | 3.95-4.69 | 2.33-2.80 | 10.25-13.91 | 4.00-5.41 | - |
| Mussain and Alikhan (1981) | 105-118 | 4 | 81-91 | 12 | 84-95 | 4.80-5.00 | 3.70-4.20 | - | 10.00-15.00 | - | - |
| Fischer and Bianchi (1984) | - | - | - | - | - | - | - | - | - | - | 13-16 |
| Talwar and Kacker (1984) | 107-113 | - | 80-88 | 12 | 88-96 | - | - | - | - | - | 13-16 |
| Present study | 103-115 | 4 | 84-88 | 12 | 84-100 | 4.12-5.17 | 3.56-4.33 | 2.14-2.50 | 7.50-10.25 | 3.20-4.44 | 14-17 |
| (3) <i>C. cynoglossus</i> | | | | | | | | | | | |
| Day (1878) | 101-103 | 4 | 78-80 | 12 | 90-95 | 5.00 | 3.50-3.75 | - | 10.00-11.00 | 3.00-3.50 | 13-14 |
| Weber and Beufort (1929) | 100-102 | 4 | 76-78 | - | 105 | - | - | - | 15.00 | - | 15-16 |
| Munro (1955) | 98-106 | - | 78-83 | - | 80-89 | - | - | - | - | - | 13-15 |
| Mussain and Alikhan (1981) | 102-107 | - | 76-82 | 10 | 82-90 | 1.30-2.30 | 4.00-4.20 | 3.00-3.50 | 10.00-12.00 | - | 13-15 |
| Talwar and Kacker (1984) | 95-102 | - | 72-78 | 10 | 70-90 | - | - | - | - | - | 12-14 |
| Present study | 93-100 | 4 | 70-78 | 11 | 77-95 | 4.72-5.77 | 3.28-4.00 | 2.60-3.20 | 8.33-11.60 | 2.67-4.00 | 15-17 |
| (4) <i>C. dubius</i> | | | | | | | | | | | |
| Day (1878) | 110 | 4 | 88 | 12 | 104 | 4.00 | 3.33 | - | 20.00 | 8.50 | 21 |
| Seshappa (1970) | 107-116 | - | 83-91 | - | 109-119 | 3.50-4.67 | 3.92-5.18 | 2.05-2.44 | 11.67-21.76 | 5.36-9.47 | - |
| Mussain and Alikhan (1981) | 118-120 | - | 89-91 | 12 | 103-106 | 4.40-4.60 | 4.20 | 2.20-3.30 | 13.30-16.00 | - | 17-21 |
| Fischer and Bianchi (1964) | - | - | - | - | - | - | - | - | - | - | 17-21 |
| Talwar and Kacker (1984) | 111-114 | - | 88-91 | 12 | 98-104 | - | - | - | - | - | 17-21 |
| Present study | 106-115 | 4 | 83-89 | 12 | 100-108 | 3.83-4.22 | 3.56-4.30 | 2.03-2.29 | 9.40-15.80 | 4.38-6.60 | 18-19 |

Sn.L = Snout length; SbLt = Scales between lateral lines

7 specimens were examined. Maximum length of the specimen observed, 193 mm. Variations in meristic characteristics in comparison to earlier reports are presented in Table 5.

Common name : Large scale tongue - sole

D. 115-120, V. 4, A. 84-90, C. 11, L.I. 50-59.

Head length 3.65-4.80 in total length. Head height 1.06-1.21 in head length. Body height 3.60-5.12 in total length. Snout length 2.07-2.52 in head length. Eye diameter 7.38-11.67 in head length, 3.25-4.80 in snout length. Snout somewhat rounded. Rostral hook short, not extending upto the front edge

Genus and species : *Cynoglossus macrolepidotus* Bleeker
Synonyms : *Plagusia macrolepidata* Bleeker, 1870

Table 5. Comparison of morphometric measurements and meristic counts of *Cynoglossus lida*, *C. macrolepidotus*, *C. punticeps* and *C. macrostomus* with earlier records.

| Meristic and morphometric characters Source | D. | V. | A. | C. | L.I. | HL in TL | BH in TL | Sn.L in HL | ED in HL | ED in Sn.L | SbLt |
|--|---------|----|-------|------|--------|-----------|-----------|------------|-------------|------------|-------|
| (1) <i>C. lida</i> | | | | | | | | | | | |
| Day (1978) | 99-104 | 4 | 75-83 | 12 | 90 | 5.00 | 4.00-4.67 | - | 13.00 | 4.50 | 13 |
| Weber and Beufort (1929) | 100-110 | 4 | 77-86 | - | 90 | 4.50-5.00 | 4.00-4.60 | - | 10.00 | - | 13-14 |
| Munro (1955) | 99-112 | - | 75-87 | - | 82-95 | - | - | - | - | - | 13-15 |
| Seshappa (1970) | 104-110 | - | 81-86 | - | 93-102 | 4.34-4.90 | 4.24-4.84 | 2.14-2.42 | 10.52-14.29 | 4.59-6.29 | - |
| Hussain and Alikhan (1981) | 104-188 | - | 80-91 | 10 | 82-86 | 4.00-4.60 | 4.00-4.70 | - | 9.00-10.00 | - | 12-15 |
| Talwar and Kacker (1984) | 99-108 | - | 77-85 | 10 | 72-90 | - | - | - | - | - | 12-15 |
| Present study | 105-111 | 4 | 82-87 | 10 | 85-94 | 4.33-4.89 | 4.04-4.49 | 2.18-2.42 | 8.75-11.43 | 4.00-4.86 | 13-14 |
| (2) <i>C. macrolepidotus</i> | | | | | | | | | | | |
| Day (1978) | 116-118 | 4 | 86-90 | 11 | 50-55 | 4.33-4.67 | 4.50-4.75 | - | 14.00-15.00 | 4.00-4.50 | 6-7 |
| Weber and Beufort (1929) | 107-118 | 4 | 82-89 | - | 48-55 | 4.30-4.50 | 4.20-4.30 | - | 11.00-15.00 | - | 6-7 |
| Munro (1955) | 105-130 | - | 80-96 | - | 56-66 | - | - | - | - | - | 7-9 |
| Present study | 115-120 | 4 | 84-90 | 11 | 50-59 | 3.65-4.80 | 3.60-5.12 | 2.07-2.52 | 7.38-11.67 | 3.25-4.80 | 6-8 |
| (3) <i>C. punticeps</i> | | | | | | | | | | | |
| Day (1978) | 94-100 | 4 | 74-80 | 12 | 95-100 | 5.25-5.47 | 3.50-4.00 | - | 8.50 | 3.00 | 16-17 |
| Weber and Beufort (1929) | 92-100 | 4 | 70-77 | - | 89-97 | 4.80-5.40 | 3.40-3.80 | - | 8.00-10.00 | - | 15-18 |
| Munro (1955) | 92-107 | - | 70-83 | - | 91-110 | - | - | - | - | - | 16-21 |
| Seshappa (1970) | 96-103 | - | 75-81 | - | 95-108 | 5.25-6.10 | 3.53-4.08 | 3.04-3.81 | 9.50-13.64 | 2.75-3.95 | - |
| Hussain and Alikhan (1981) | 100-109 | - | 79-84 | 10 | - | 4.50-5.20 | 3.60-4.00 | 2.60-3.60 | 9.40-13.00 | - | 15-17 |
| Fischer and Bianchi (1984) | - | - | - | - | - | - | - | - | - | - | 15-19 |
| Talwar and Kacker (1984) | 90-100 | - | 72-78 | 10 | 78-99 | - | - | - | - | - | 15-19 |
| Present study | 98-106 | 4 | 74-84 | 12 | 90-98 | 4.87-5.71 | 3.54-4.28 | 2.09-2.67 | 6.80-10.00 | 2.80-4.00 | 17-19 |
| (4) <i>C. macrostomus</i> | | | | | | | | | | | |
| Seshappa (1970) | 102-107 | - | 79-82 | - | 95-98 | 3.74-5.79 | 3.78-4.96 | 3.06-4.35 | 10.67-17.58 | 2.79-5.00 | - |
| Fischer and Bianchi (1984) | 10 | - | - | - | - | - | - | - | - | - | 14-16 |
| Talwar and Kacker (1984) | 100-106 | - | 78-84 | 10 | 80-92 | - | - | - | - | 14-16 | 14-16 |
| Present study | 97-108 | 4 | 74-81 | 7-10 | 74-88 | 4.00-4.68 | 4.00-4.87 | 2.55-4.00 | 10.40-14.50 | 3.20-5.50 | 13-16 |

Sn.L = Snout length; SbLt = Scales between lateral lines

of upper eye. Angle of mouth behind the lower eye, midway between the snout and the gill opening. Interorbital space equals or less than the eye diameter. Two nostrils on coloured side, a patent one in between the eyes and a tubular one in front of the lower eye. Scales ctenoid on coloured side and cycloid on blind side. Two lateral lines on the coloured side separated at their greatest distance by 6-8 rows of scales. No lateral line on the blind side. Uniform brownish on coloured side. Bluish band at the base of anal and dorsal fin. A bluish line present along the opercular border.

15 specimens were examined. Maximum length of the specimen observed, 338 mm. Variations were observed in dorsal, anal and caudal ray numbers. Table 5 presents the details.

Genus and species : *Cynoglossus puncticeps* Richardson
Synonyms : *Cynoglossus puncticeps* Day, 1877
Cynoglossus brachyrhynchus
(Bleeker), Day 1877
Cynoglossus brevis (Gunther)
Day, 1877

Common name : Spotted tongue - sole
D. 98-106, V. 4, A. 74-84, C. as, L.I. 90-98,

Head length 4.87-5.71 in total length, 1.06-1.24 in head height. Body height 3.54-4.28 in total length. Snout length 2.09-2.67 in head length. Eye diameter 6.80-10.00 in head length, 2.80-4.00 in snout length. Length of highest dorsal ray 3.70-4.70 in body height. Body flat and elongate. Snout somewhat pointed. Rostral hook short and just covers mandibular symphysis. The angle of mouth below the middle of lower eye, nearer to snout than to gill opening. Eyes close together, upper eye in advance of the lower eye. Two nostrils on coloured side, one in between the eyes and tubular one in front of lower eye. Scales ctenoid on both sides. Two lateral lines on the coloured side separated at their greatest distance by 17-19 rows of scales. No lateral line on blind side. Anal and dorsal fin rays low. Body bright reddish brown. Dark blotches on head and body united to form irregular vertical cross bands. Body colour is extended to fins also.

13 specimens were examined. Maximum length of the specimen observed, 186 mm. Several differences were observed in and meristic characteristics. Details are presented in Table 5.

Genus and species : *Cynoglossus macrostomus* Norman
Synonyms : *Cynoglossus luctosus* Chabanaud, 1947
Cynoglossus semifasciatus (Day), 1877

Common name : Malabar sole
D. 97-108, V. 4, A. 74-81, V. 7-10, L.I. 74-88.

Head length 4.00-4.68 in total length. Head height 1.00-1.13 in head length. Height of the body 4.00-4.87 in total

length. Snout length 2.55-4.00 in head length. Eye diameter 10.4-14.50 in head length 3.20-5.50 in snout length. Body flat and very elongate. Snout rounded. Rostral hook short, extends to the front edge of upper eye. Angle of mouth very much behind the blind edge of the lower eye, nearer to snout than to gill opening. Eyes very small, close together, the upper one slightly in advance of the lower one. Two nostrils on the coloured side, one in between the eye and tubular one in front of the lower eye. Scales ctenoid on both sides. Two lateral line on the coloured side separated at their greatest distance by 13-16 rows of scales. No lateral line on blind side. Ocular side brownish with irregular incomplete vertical bands. Fins brownish green in colour.

25 specimens were examined. Maximum length of the specimen observed, 135 mm. Meristic differences in comparison to earlier records are presented in Table 5.

From the above results, it is clear that while morphological differences noticed in the present study in comparison with earlier records are only few, there are a good number of meristic differences in almost all species studied. Evidently, in earlier studies less importance was given to meristic characters which has resulted in this inadequacy in information.

An examination of the data on the quantity of flatfishes landed in Mangalore during the study period showed that the highest landings were in December and the lowest in September. The percentage of flatfishes in the total landings ranged from 4.75 (April) to 39.47 (October). *Psettodes erumei* landings were the highest in April and the lowest in February. All other flatfishes together showed the highest landing in December and the lowest in September.

Species composition of flatfishes showed some temporal variability. *Psettodes erumei* was landed from December to May. Among Bothids, *Pseudorhombus arsius*, *P. javanicus* and *P. triocellatus* were the species caught. *P. arsius* was observed in all the months in small numbers. *P. javanicus* was observed in September and December. *P. triocellatus* was noticed in all months except March and April. *P. arsius* was noticed only in marine landings and *P. triocellatus* only in estuarine catches. Among Soleids, *Euroglossa orientalis* was recorded throughout the year. *Synaptusa commersoniana* was noticed from August to January and in May to June. *S. albamaculata* was recorded in June, August and December. *Aesopia cornuta* was recorded only in April, while *Solea ovata* was recorded from May to November. All soleids were noticed only in estuarine catches. Among tongue-soles, *Paraplagusia bilineata* was noticed from August to January, *Cynoglossus bilineatus* was recorded in December, January, April and May. *C. dubius* was noticed in May and June, and *C. lida* in April and May. *C. macrolepidotus* was recorded from June to September, *C. macrostomus* was recorded in all months except July, *C. macrostomus* contribute in all months except July, *C. macrostomus* contributed to more than 80%

of the monthly sole landings. Among tongue-soles, *P. bilineata*, *C. cynoglossus* and *C. punticeps* were noticed only in estuarine landings.

The three important species/groups of flatfishes which form commercially sizeable proportions in the fishery are the tongue soles especially the Malabar sole *Cynoglossus macrostomus*, the Indian Halibut *Psettodes erumei* and the Large-toothed Flounder *Pseudorhombus arsius*. Rao (1967) studied the fishery of soles along the west coast of India and stated that the Malabar sole, *C. semifasciatus* (= *C. macrostomus*) was the only species of commercial importance. The sudden appearance and disappearance of soles was attributed to their offshore-inshore migrations for breeding and feeding purposes. Jhingran (1974) stated that most flatfishes occur in small numbers except the Malabar sole which supports an important fishery from Quilon in Kerala to Mulki in South Kanara.

Species composition of flatfishes revealed that in December, the species composition was the highest (12 spp.) while the lowest was in March (5 spp.). Eleven species were recorded in September, May and June. In general, the species diversity was the highest during August-January and April-June. During February, March and July it was low. Rajagopal *et al.* (1978) recorded 15 species of flatfishes from the Karnataka coast while in the present study a total of 17 species have been recorded. Of these, *Pseudorhombus javanicus*, *Synaptura albamaculata*, *Solea ovata*, *Paraplagusia bilineata* and *Cynoglossus cynoglossus* are new records for Karnataka coast. *Cynoglossus quinquelineatus*, *C. lingua* and *C. dispar* recorded by Rajagopal *et al.* (1978) were not recorded in the present study in spite of a vigorous sampling strategy. The variations in the species composition in different months of the year could be attributed to the migration pattern of fish, availability of food, maturation cycle, environmental factors, variations in fishing intensity, accessibility and selectivity of gear employed in addition to shifting of the fishing effort from estuarine to marine waters during the post monsoon period.

Flatfishes form an important fishery in the Mangalore region. During the south-west monsoon period from June to September, there is intensive estuarine fishing using cast net *Beesu Bale*, seine nets and hand-drag nets. Marine fishery commences after the cessation of the monsoon in September when trawl nets and purse seines are operated from mechanised fishing vessels landing large quantities of tongue-soles. Rao (1967) reported that the capture of soles was mainly done by gears like boat seines (*Thattam Vala* and *Paiithu Vala*), cast nets (*Veechu Vala*) and shore seine (*Noona Vala*). The present observation shows that along the Mangalore coast, the chief gears are the cast net *Beesu bale* in the estuarines and trawl net in the sea.

References

- Anon, 1989. Marine fish production in India. Mar. Fish. Infor. Serv. T&E. Ser. 91: 1-32.
- Anon, 1992. Annual report, 1990-91. Central Marine Fisheries Research Institute, Cochin.
- Day, F., 1877. The fishes of India. Taylor and Francis, London, 778 pp.
- Fischer, W. and Bianchi, G., 1984. FAO species identification sheets for fishery purposes. Western Indian Ocean. (Fishing area 51) Vol. I, II, III and IV. Food and Agricultural Organisation of the United Nations, Rome.
- Hussain, S. M. and Alikhan, J. 1981. Fishes of the family Cynoglossidae from Pakistan coast. Indian J. Fish., 28(1-2): 128-142.
- Jhingran, V. G., 1974. Fish and Fisheries of India, Hindustan Publishing Corporation, India, pp. 882.
- Menon, A. G. K. and Joglekar, A., 1978. Taxonomic status of the genera *Synaptura* (Cantor, 1850) and *Euryglossa* (Kaup, 1858) with descriptions of the species referable to those occurring in seas of India. J. Mar. Biol. Ass. India., 20 (1-2): 10-21.
- Menzes, M. R., 1980. Some observations on the morphometry and biology of *Psettodes erumei* (Bloch) and *Pseudorhombus arsius* (Ham.-Buchanan) from the Goa region. Mahasagar, 13(4): 377-381.
- Munro, I. S. R., 1955. The marine and freshwater fishes of Ceylon. Department of external affairs, Canberra, 349 pp.
- Rajagopal, K. V., Mohan Joseph, M. and James, P. S. B. R., 1978. A list of fishes of Karnataka. University of Agricultural Sciences, Bangalore.
- Rao, K. V. N., 1967. The flatfishes. Souvenir, 20th Anniversary, Central Marine Fisheries Research Institute, Cochin.
- Seshappa, G., 1970. Some morphometric studies in five species of *Cynoglossus* from the west coast. Indian Jour. Fish., 17(1&2): 149-158.
- Seshappa, G., 1973. Flat fish resources of the west coast of India. In: Proceedings of the Symposium on Living Resources of the Seas around India. p. 470-482.
- Talwar, P. K. and Kacker, R. K., 1984. Commercial sea fishes of India. Ed. by the Director, Zoological Survey of India, 997 pp.
- Weber, M. and De Beaufort, L. F., 1929. Fishes of the Indo-Australian archipelago. Part, V., Leiden. (*Salmon salar*): gross, histological and biochemical deficiency signs. J. Nutr., 106: 892-904.