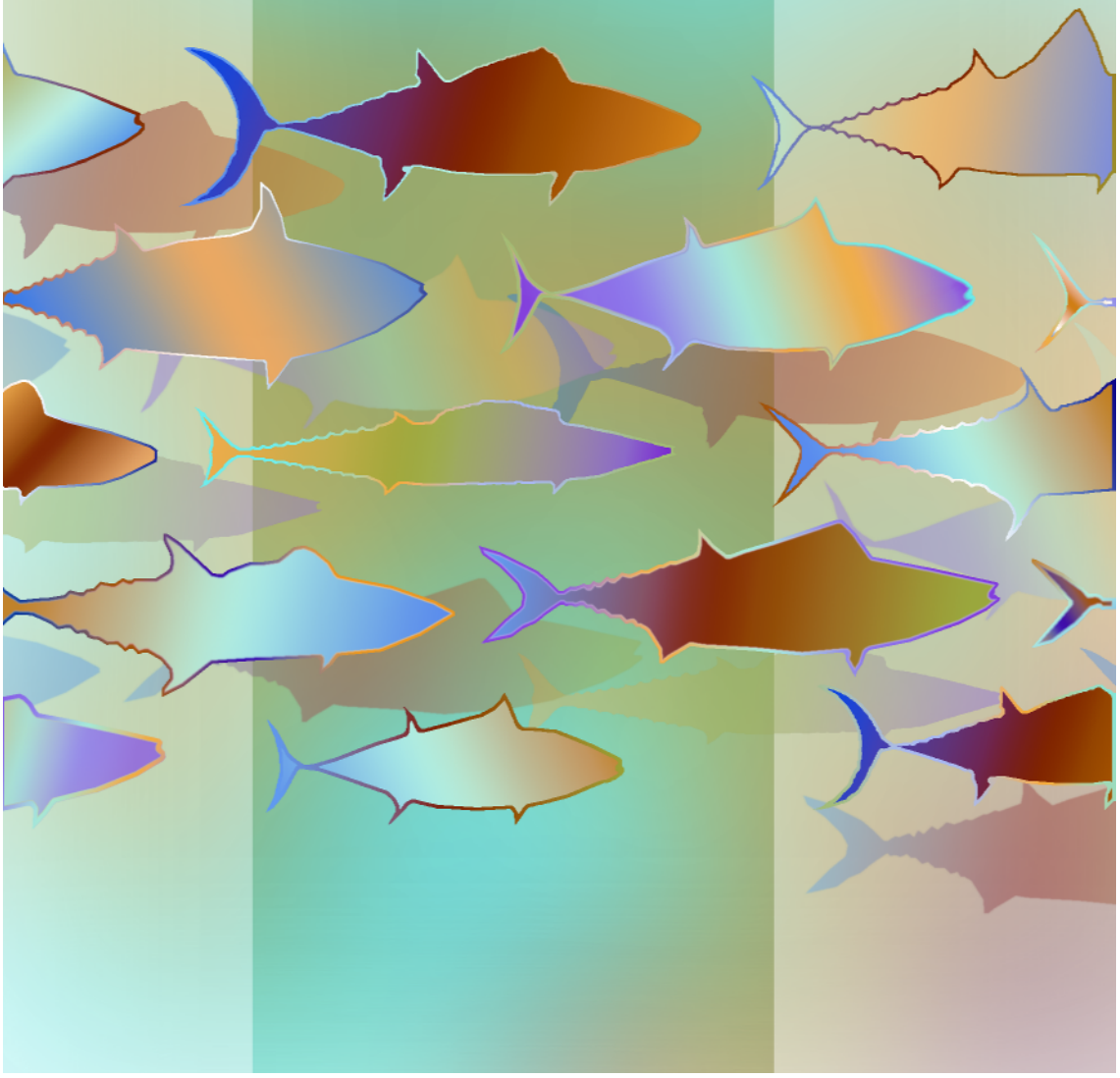
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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Flatfishes

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1. Introduction

Fishes belonging to the families Bothidae (flounders), Cynoglossidae (tongue soles), Psettodidae (Indian halibut) and Soleidae (soles) are popularly known as flatfishes. Eleven genera and 25 species of flatfishes contribute to minor or major fisheries along the Indian coast (Table 1). A compressed and asymmetrical body with both the eyes lying on one side of the head is characteristic of the flatfishes. Most of them are small to medium sized fishes barring Psettodes erumei, which attains 60 cm length. They are exclusive benthic fishes, found mainly on muddy or sandy bottom of shelf areas; most of them are restricted to shallow waters of less than 60 m depth. However, P.erumei and Cynoglossus bilineatus are known to occur up to 100 m and 400 m depth respectively.

Table 1. Characteristics of flatfishes and species occurring along the Indian coast

Bothidae (Lefteye flounders)	Cynoglossidae (Tongue soles)	Psettodidae (Indian halibut)	Soleidae (Soles)
Eyes on left side of body; mouth asymmetrical; preopercle exposed dorsal fin origin above eyes; pectoral, pelvic fins present; caudal fin free from dorsal & anal fins eyes on left/right side;	Eyes on left side of body; mouth asymmetrical; preopercle below skin; dorsal fin origin above eyes; pectoral fin absent; left pelvic present; dorsal and anal fins joined to caudal fin	Body thicker than the other flatfishes; mouth large with strong teeth; eyes on left/right side; dorsal fin origin behind eyes; caudal fin distrinct	Strongly compressed body;eyes on right side; preopercle under skin; mouth & teeth small; dorsal fin extend far forward on head; dorsal &anal fins separated/ adherent/fused with caudal fin

SPECIES

Bothus pantherinus (25)	Cynoglossus bilineatus (35)	Psettodes erumei (60)	Euryglossa orientalis (24)
B.myriaster (20)	C.arel (38)	Synaptura	Solea elongata (30)
Chascanopsetta	C.macrostomus (18)	commersoniana (32)	Zebrias quagga (15)
lugubris (40)	C.puncticeps (18)		Z.synapturoides (15)
Engyprosopon	C.carpenteri (23)		
grandisquamis(15)	C.dispar (38)		
Pseudorhombus	C.dubius (46)		
arsius (35)	C.macrolepidotus (45)		
P.elevatus (20)	Paraplagusia bilineata (30)		
P.javanicus (35)			
P.malayanus (35)			
P.natalensis (15)			
P.triocellatus (15)			

The figures in parentheses refer to maximum length in cm

2. Production trends

The flatfish landings have increased consistently from 7,879 t in 1961 to 52,197 t in 2000 (Fig. 1). The resource contributed to 1.9% of the total marine fish landings in India in the year 2000. The maximum landing of 63,353 t was in 1992. Soles and tongue soles contributed to 94.4% of the total landings of the flatfishes, followed by the Indian halibut (4.8%) and the flounders (0.8%) during 1961-2000. The substantial increase (6.6 times in 40 years) in the flatfish landings is due to the intensification of trawling, which is the most effective method of exploiting this resource. Moreover, the trawl operations are known to transform the sea bottom that is rich in vegetation and invertebrates to one of sandy wastelands, which have proved to be ideal habitat for flatfishes. In the intense trawling grounds in several temperate seas, it is reported that the flatfishes thrive well and the landings of the flatfishes such as the plaice have increased despite decline in the landings of other demersal fishes.

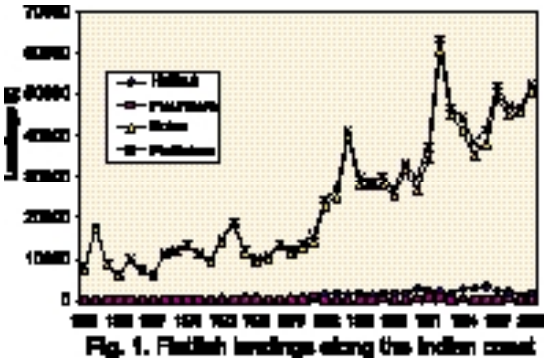

Fig. 1. Flatfish landings along the Indian coast

Regional trends

About 89% of the landing of the soles and tongue soles, which are the major constituents of the flatfish resource, was from the west coast (Table 2). Their landings increased by 3.6, 4.4, 3.4 and 41.5 times along the northeast (West Bengal and Orissa), southeast (Andhra Pradesh, Tamil Nadu & Pondicherry), southwest (Kerala, Karnataka and Goa) and northwest (Maharashtra and Gujarat) coasts, respectively.

Table 2. Annual average landings (t) of soles and tongue soles

Year	Northeast	Southeast	Southwest	Northwest	All India
1961-70	1724	8370	85505	2649	98248
1971-80	835	13832	82225	23634	120526
1981-90	4528	28048	174198	60553	267327
1991-00	6238	37221	289901	109863	443223
Average	3331	21868	157957	49175	232331
%	1.4	9.4	68.0	21.2	

Gearwise landings

Prior to mechanization, the Malabar sole Cynoglossus macrostomus was caught by cast nets, boat seines and shore seines. With the introduction of mechanization, especially the trawlers in the early 1960s, the fishing pattern changed from capturing the flatfishes during their sojourn at the surface and sub-surface waters to effective exploitation at the bottom. During 1998-2000, the trawlers contributed to 86.7% of the flatfish landings along the Indian coast (Table 3). Mini trawls (9.6%), dol nets (1.5%) and drift gill nets (1.0%) were the other gears, which contributed to the fishery.

Table 3. Contribution of gears (%) to the flatfish landings during 1998-2000

State	Trawl	Mini trawl	Dol net	Purse seine	Drift gill net	Bottomset gill net	Bag net	Others
Gujarat	84.9	0.0	12.8	0.0	2.3	0.0	0.0	0.0
Maharashtra	96.7	0.0	0.9	0.0	0.0	0.0	0.0	2.4
Goa	99.4	0.0	0.0	0.3	0.0	0.0	0.0	0.3
Karnataka	98.9	0.0	0.0	0.4	0.1	0.0	0.0	0.6
Kerala	76.3	22.8	0.0	0.0	0.0	0.0	0.9	0.0
Tamil Nadu	85.2	0.0	0.0	0.0	6.4	8.4	0.0	0.0
A. Pradesh	83.8	0.0	0.0	0.0	16.0	0.0	0.0	0.2
Orissa	96.5	0.0	0.0	0.0	2.3	0.0	0.0	1.2
West Bengal	80.7	0.0	0.0	0.0	0.0	6.7	8.9	3.7
Total	86.7	9.6	1.5	0.1	1.0	0.4	0.4	0.4

Species composition

Among all the species of flatfishes occurring along the Indian coast, it is only the Malabar sole, C.macrostomus (Fig.2) that has formed a major fishery from ancient times, especially along the soutwest coast. The area between Mulki in Karnataka and Kollam in Kerala is the important zone for the Malabar sole. There is a distinct demarcation in the area of abundance of different species of flatfishes. The Malabar

sole dominates the south Karnataka-north Kerala coast (>95% of the flatfish landings) but its intensity is reduced in the central part off Kerala (off Cochin: 48.7%); and ceased to be a fishery off the southern part of the state, where C.bilineatus (Fig.3) dominated (94%) the fishery (Table 4). In the southern part of Tamil Nadu, C.macrolepidotus (>70%) dominated the fishery.

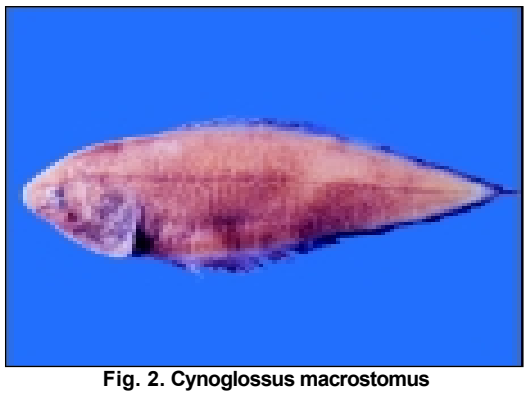

Fig. 2. Cynoglossus macrostomus

Table 4. Species composition of flatfishes during 1998-2000

Species	Mangalore	Calicut	Cochin	Vizhinjam	Rameswaram	Pamban
C.macrostomus	95.1	95.3	48.7	0.0	0.0	0.0
C.bilineatus	0.6	0.0	0.0	94.0	16.2	13.0
C.puncticeps	0.0	0.0	0.0	1.5	0.0	15.5
C.arel	0.2	0.0	2.3	0.0	0.0	0.0
C.dubius	0.0	2.6	0.0	0.0	0.0	0.0
C.macrolepidotus	0.0	2.0	38.6	0.0	76.5	71.0
Z.quagga	0.0	0.0	0.0	1.5	4.0	0.1
P.arsius	1.7	0.0	10.4	1.5	3.4	0.5
P.natalensis	0.5	0.0	0.0	0.0	0.0	0.0
B.pantherinus	0.1	0.0	0.0	0.1	0.0	0.0
P.erumei	1.8	0.1	0.0	1.5	0.0	0.0

Length composition

The length range of C.macrostomus was 40-169 mm in the trawl landings at Mangalore, Calicut and Cochin during 1998-2001 (Table 5). The annual mean length ranged from 90 to 127 mm. The length range of C.bilineatus was 111-380 mm and the mean annual length was 198-205 mm, and that of C.macrolepidotus was 90-420 mm indicating an annual mean length of 237-243 mm.

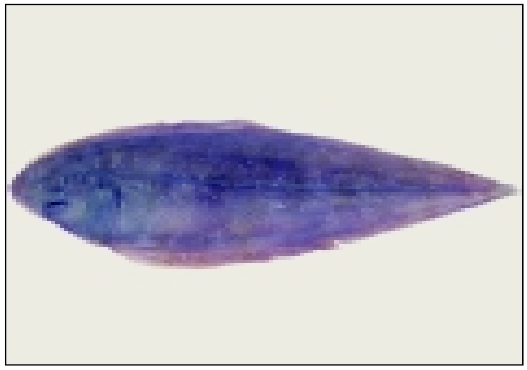

Fig. 3. Cynoglossus bilineatus

Table 5. Length range and mean length of flatfishes

Area	Species	Year	Length range (mm)	Modal length (mm)	Mean length (mm)
Mangalore	C.macrostomus	1998-99	50-169	90-99	107
		1999-00	60-169	110-119	118
		2000-01	80-169	130-139	127
Calicut	C.macrostomus	1998-99	80-149	100-104	121
		1999-00	70-149	110-114	118
		2000-01	70-159	115-119	117
Cochin	C.macrostomus	1998-99	60-169	120-129	119
		1999-00	40-169	100-109	118
		2000-01	50-159	80-89	90
Vizhinjam	C.bilineatus	1999-00	111-380	201-210	205
		2000-01	118-234	191-199	198
Rameswaram	C.macrolepidotus	1998-99	100-410	230-239	240
		1999-00	275-405	220-229	243
		2000-01	90-420	250-259	237

Contribution of juveniles to the landings

Juveniles contributed sizable quantities to the landings of Malabar sole at Mangalore, and in terms of number, nearly 33.1% to 49.1% of the landings consisted of juveniles during 1997-2001 (Table 6). At Rameswaram, 21.5% to 31.4% of the landings of C.macrolepidotus consisted of juveniles. The juveniles were caught almost exclusively by the trawlers.

Table 6. Contribution (%) of juveniles (by number) to the flatfish landings

Year	Mangalore C.macrostomus	Rameswaram C.macrolepidotus
1997-1998	46.3	24.8
1998-1999	33.1	23.1
1999-2000	49.1	21.5
2000-2001	41.8	31.4

Utilization of the landings

Barring the large-sized P.erumei, which fetches good price in the market, the small-sized soles like the Malabar sole cost only around Rs 15/kg in the local markets. Hence, about 90% of the small-sized flatfishes are salted and sundried and sold during non-fishing seasons at a rate of about Rs. 30/kg.

3. Biology

Spawning periods

The Malabar sole C.macrostomus has a prolonged spawning period extending from October to May off Mangalore and Calicut (peak spawning: October to

December), and that of C.dubius from October to December (Table 7). C.macrolepidotus spawns during January-February and August off Rameswaram. P.erumei has a short spawning period during September and October off Mumbai. The relative fecundity of C.macrostomus and P.erumei is 6,540 -19,890 and 31,380 -12,19,080 eggs, respectively.

Table 7. Spawning period and recruitment of flatfishes

Centre	Species	Spawning period	Peak spawning	Peak recruitment
Mumbai	P.erumei	Sept.-Oct.	Sept.-Oct.	
Mangalore	C.macrostomus	Oct.-May	Oct.-Dec.	Sept.-Oct.
Calicut	C.macrostomus	Oct.-May	Oct.-Dec.	Sept.-Oct.
	C.dubius	Oct.-Dec.	Oct.-Dec.	Feb.
Cochin	C.macrostomus	Jan.-Apr.; Aug.-Sep.	Jan., Sept.	
Rameswaram	C.macrolepidotus	Jan.-Feb., Aug.	Jan.-Feb., Aug.	Mar., Sept.
SE coast	P.erumei	June, July	June, July	
NE coast	P.erumei	Sept.-Dec.	Sept.-Dec.	

Recruitment

Peak recruitment of C.macrostomus occurs in September and October off Mangalore; and of C.macrolepidotus, during March and September off Rameswaram.

Food

The Malabar sole prefers a diet of polychaetes, amphipods and small bivalves. P.erumei is a carnivore, feeding predominantly on fishes and cephalopods with crustaceans and bivalves contributing the subsidiary food.

Growth and lifespan

C.macrostomus attains 110 mm and 135 mm at the end of I and II year, respectively. The longevity is about 3 years. The length at first maturity is 100 to 120 mm, which is about 51% of the L_{∞}. The length at first maturity of C.dubius is 287 mm, which is nearly 60% of the L_{∞}. P.erumei attains 220 mm, 420 mm and 550 mm at the end of I, II and III year, respectively. The life span of P.erumei is 4 years.

4. Stock assessment

Earlier studies on the meristic characteristics of the Malabar sole indicate that the stock off Cochin is different from the stock occurring between Calicut and Mulki. Stock assessment studies indicate that the exploitation rate is high (0.7) for the Malabar sole off Calicut and Mangalore. Increase in effort may yield better catches but the increase in the cost of fishing may not fetch the required quantum of additional catch.

5. Management

Though there is no evidence of overexploitation of flatfishes along the Indian coast, it is essential to adopt a precautionary approach for sustaining the stocks.

However, no fishery targets the flatfishes and they are by-catch of the trawls. Hence, it may not be possible to implement management measures exclusively for the flatfishes. The management of flatfish stocks could be a part of an ecosystem based fisheries management consideration, wherein ecosystems may be delineated based on the carrying capacity vis-à-vis exploitation, and the climatic, hydrographic and biological characteristics of each ecosystem. Ecogroups may be identified in each ecosystem based on their habitats and their trophic level; and the appropriate fisheries management option for each ecosystem, by way of closed season, mesh regulation, closed area or by demarcating no-fishing zone, may be implemented depending upon the status of exploitation of the ecogroups.

6. Suggested reading

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