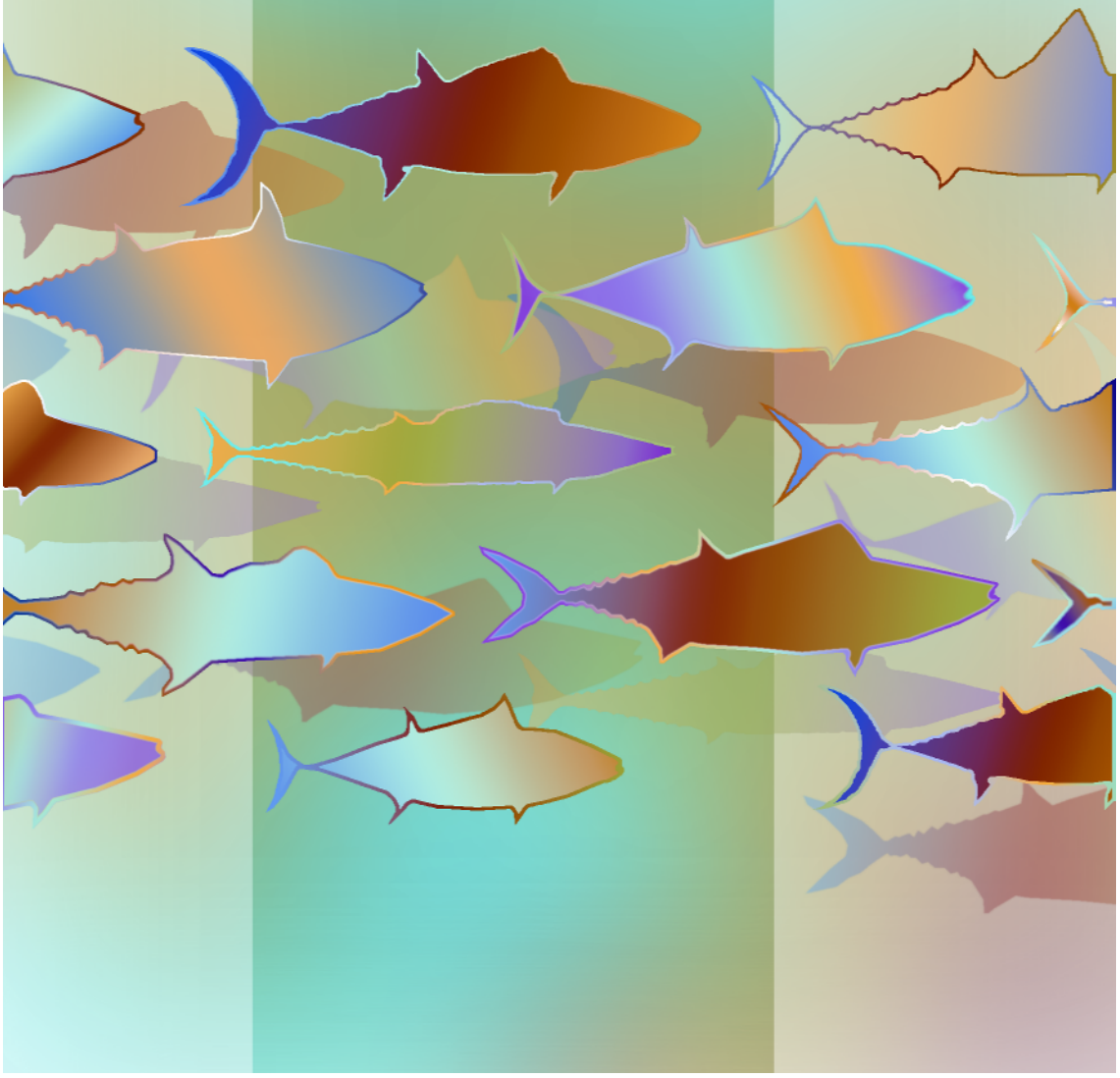
Status of Exploited Marine Fishery Resources of India



STATUS OF EXPLOITED MARINE FISHERY RESOURCES OF INDIA

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19

Goatfishes

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1. Introduction

Goatfishes (family: Mullidae) are easily distinguishable by their bright colour with shades of red or yellow predominating, and distinctive dark, yellow, orange or brown bands or stripes; and the presence of two long, unbranched barbels on the chin. They are usually found on sandy or muddy bottom, whereas a few species are often associated with coral reefs. They inhabit shallow coastal waters and their concentration is generally restricted to a depth of 40 m or less and they rarely occur beyond 60 m depth. Upeneus sulphureus often enters estuaries. U.sulphureus, U.vittatus and U.bensasi form small schools whereas other species such as U.tragula are solitary.

The goatfishes are small sized fishes and their maximum size in the fisheries rarely exceeds 30 cm TL. The flesh of the goatfishes is of good quality but due to their small size, they are priced low and contribute to the diet of poor people. The goatfishes are also called red mullets. It is known as ratamachala in Gujarat, chiri or rani in Maharashtra, hoovu menu in Karnataka, keerimeenu or killivarandu in Kerala, navarai in Tamil Nadu, wallibori in Orissa and borai in West Bengal.

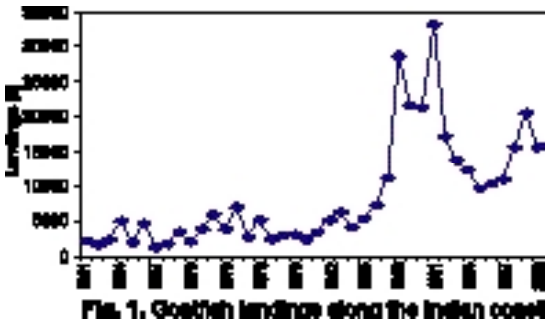

Fig. 1. Goatfish landings along the Indian coast

2. Production trends

The goatfish landings along the Indian coast fluctuated between 1,344 t and 7,297 t during 1961-86 (Fig. 1). Since 1986, the landings increased and reached a peak of 33,132 t in 1991. Subsequently, the landings decreased to 15,642 t in 2000. In the year 2000, the goatfishes contributed to 0.6% of the total marine fish landings of India.

Regional trends

The maximum landing of the goatfishes was along the southeast coast. During 1961-2000, the annual average landings along the northwest (Gujarat and Maharashtra), southwest (Goa, Karnataka and Kerala), southeast (Tamil Nadu & Pondicherry and Andhra Pradesh) and northeast (Orissa and West Bengal) regions were 1,628 t, 1,946 t, 4,674 t and 238 t, respectively (Table 1). The southeast (SE) coast contributed to 55.1% of the goatfish landings in India. During the past four decades, the increase in the landings was more pronounced along the SE coast compared to the other regions and the annual average decadal landings along the SE coast increased from 988 t (1961-70) to 9,262 t (1991-2000).

Table 1. Annual average decadal landings (t) of goatfishes

Year	Northwest	Southwest	Southeast	Northeast	All India
1961-1970	936	712	988	10	2646
1971-1980	724	1357	1817	36	3933
1981-1990	1994	2638	6628	192	11451
1991-2000	2856	3080	9262	717	15914
Average	1628	1946	4674	238	8486
%	19	23	55	3	

Gearwise landings

As the goatfishes are demersal in habitat, mostly the bottom trawlers exploit them. The trawlers contributed to 84% of the goatfish landings during 1998-2000 (Table 2). Drift gill nets, bottom set gill nets and hooks & lines contributed to 13.3%, 0.7% and 0.3% of the landings, respectively.

Table 2. Contribution of gears (%) to the goatfish landings during 1998-2000

State	Trawl	Bottom set gill net	Drift gill net	Hooks & line	Boat seine	Others
Gujarat	99.8	0.0	0.0	0.0	0.0	0.2
Maharashtra	93.6	0.0	6.4	0.0	0.0	0.0
Karnataka	100.0	0.0	0.0	0.0	0.0	0.0
Kerala	96.8	0.0	3.2	0.0	0.0	0.0
TN&Pondy	75.4	1.2	19.3	0.5	0.0	3.7
AP	80.2	0.0	19.4	0.5	0.2	0.0
Orissa	96.3	1.8	2.0	0.0	0.0	0.0
WB	100.0	0.0	0.0	0.0	0.0	0
Total	84.1	0.7	13.3	0.3	0.0	1.6

Species composition

Sixteen species of goatfishes belonging to three genera are reported to occur along the Indian coast. They are Mulloides flavolineatus, M.vanicolensis, Parupeneus bifasciatus, P.indicus, P.barberinus, P.macronema, P.cinnabarinus, P.cyclostomus, Upeneus moluccensis, U.sulphureus, U.vittatus, U.oligospilus, U.bensasi, U.sundaicus, U.tragula and U.taeniopterus (Fig.2). Of these, the eight species of the genus Upeneus contribute to the bulk of the fishery. There is distinct demarcation of the area of abundance of different species of the goatfishes. During 1998-2000, U.sundaicus (41.8%) dominated the landings at Rameswaram and Pamban, U.sulphureus (41.2%) at Mandapam, U.sulphureus (31.9%) and U.moluccensis (30.4%) at Chennai and U.vittatus (70.0%) at Visakhapatnam (Table 3). U.vittatus, which constituted 12.3% of the fishery at Chennai during 1991-93 was totally absent in the landings during 1998-2000.

Fig. 2. Upeneus taeniopterus

Table 3. Species composition of goatfishes during 1998-2000

Species	Rameswaram & Pamban	Mandapam	Chennai		Visakha-patnam
			1991-93	1998-2000	
U. sundaicus	41.8	31.3	0.0	0.0	0.0
U.oligospilus	8.3	6.6	0.0	0.0	0.0
U.vittatus	23.9	14.6	12.3	0.0	70.0
U.sulphureus	15.4	41.2	24.7	31.9	20.7
U.tragula	6.6	2.3	0.0	0.0	0.0
U.moluccensis	2.8	2.8	21.3	30.0	9.3
U.taeniopterus	0.0	0.0	17.2	11.4	0.0
U.bensasi	0.0	0.0	24.5	26.7	0.0
Parupeneus indicus	1.2	1.2	0.0	0.0	0.0

Length composition

The length range and mean length of the exploited populations of the goatfishes off Chennai did not indicate any specific trend during the last one decade. The total length of U.sulphureus, for instance, ranged from 90 to 159 mm, 80-179 mm and 80-179 mm during 1991-93, 1995-96 and 1998-2001, respectively (Table 4); the mean length during the corresponding period were 123 mm, 147 mm and 135 mm. The length of U.sundaicus landed at Rameswaram ranged from 60-200 mm and the mean length from 123 mm to 137 mm during 1997-2000 (Table 5). At Visakhapatnam, U.vittatus indicated a size range of 60-219 mm and mean length 122 mm to 142 mm during 1994-2000. The length composition in these centres also did not indicate any specific trend over the time scale.

Table 4. Length range and mean length of goatfishes off Chennai

Species	Length range (mm)			Modal length (mm)			Mean length (mm)		
	1991-93	1995-96	1998-01	1991-93	1995-96	1998-01	1991-93	1995-96	1998-01
U.sulphureus	90-159	80-179	80-179	120-129	140-149	130-139	123	147	135
U.bensasi	80-169	70-179	80-179	130-139	130-139	130-139	131	134	133
U.taeniopterus	80-249	110-249	90-259	120-129	120-129	110-119	129	130	125
U.moluccensis	90-179	90-189	80-189	130-139	120-129	140-149	133	129	141

Table 5. Length range (mm) and mean length (mm) of goatfishes off Rameswaram and Visakhapatnam

Year	Rameswaram U.sundaicus			Visakhapatnam U.vittatus		
	Range	Mode	Mean	Range	Mode	Mean
1994	-	-	-	90-189	140-149	142
1995	-	-	-	90-179	130-139	140
1996	-	-	-	90-189	130-139	133
1997	60-189	130-139	135	90-189	120-129	122
1998	60-189	120-129	129	70-179	120-129	127
1999	70-194	120-124	123	60-219	120-129	124
2000	85-200	140-149	137	70-179	130-139	134

Contribution of juveniles to the landings

Juveniles contributed sizable quantities to the landings of the goatfishes. In terms of number, 20.3% to 43.2% of the landings of U.vittatus consisted of juveniles at Visakhapatnam during 1995-2000 (Table 6). At Chennai, 34.7% to 61.2% of the landings of U.sulphureus, 22.7% to 52.9% of U.bensasi, 24.9% to 50.8% of U.taeniopterus and 16.4% to 31.8% of U.moluccensis were juveniles during 1994-2000. The contribution of juveniles was high in Mandapam also and exclusively the trawlers were responsible for their exploitation.

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

Year	Visakhapatnam			Chennai		Mandapam	Rameswaram
	U.vittatus	U.sulphureus	U.bensasi	U.taeniopterus	U.moluccensis	U.sulphureus	U.sundaicus
1994	5.6	40.0	52.9	24.9	22.4	NA	NA
1995	43.2	37.3	43.6	35.9	31.6	NA	NA
1996	35.0	NA	NA	NA	NA	NA	NA
1997	20.3	NA	NA	NA	NA	NA	NA
1998	38.2	34.7	46.5	27.3	31.8	22.3	34.3
1999	23.8	61.2	51.0	47.1	16.4	47.7	49.9
2000	33.2	48.0	22.7	50.8	22.7	17.1	18.2

NA: Not Available

Utilization of the landings

The goatfishes are consumed in fresh condition. The juveniles are sundried for human consumption.

3. Biology

Spawning periods

The goatfishes have prolonged spawning periods. The spawning period of U.vittatus extends from February to October off Visakhapatnam (peak spawning: July and October), that of U.sulphureus during March-May and August off Chennai (peak: May), and during March-November off Mandapam (peak: June-August), and that of U.sundaicus during March-August and October-November off Rameswaram (peak: June-August; Table 7). The peak spawning is during the summer months and the southwest monsoon season and not during the northeast monsoon period of October-December when most parts of the southeast coast receive copious rainfall.

Table 7. Spawning period in goatfishes and recruitment of juveniles during 1998-2001

Centre	Species	Spawning period	Peak spawning period	Peak recruitment
Visakhapatnam	U.vittatus	February to October	July & October	November
Chennai	U.sulphureus	March-May, August	May	June-July
Chennai	U.taeniopterus	April-July, September	April-May	June-July, Sep-Oct
Mandapam	U.sulphureus	March-November	June-August	May
Rameswaram	U.sundaicus	March-August,Oct-Nov	June-August	March-April

Recruitment

Peak recruitment of U.vittatus occurred in November off Visakhapatnam, during June and July for U.sulphureus off Chennai, during May for U.sulphureus off Mandapam and during March and April for U.sundaicus off Rameswaram (Table 7).

Food

The mouth of the goatfishes is low, the lower jaw inferior, and the dentition variable between species. However, the teeth are never enlarged as canines. These characteristics indicate that the goatfishes are mid-level carnivores. The barbels on the chin have chemosensory receptors and are actively moved over or into the sediment to locate food organisms. These fishes often root with their snouts into the sediment searching for food. They feed almost exclusively on crustaceans, especially penaeid shrimps and crabs, and small fishes. In turn, the goatfishes are predated by large demersals such as the major perches, lizardfishes and ribbonfishes. Being midlevel carnivores, the goatfishes occupy an important position in the marine ecosystem and transfer the energy from the detritivores and omnivores to high level predators.

Growth and lifespan

U.taeniopterus attains 162 mm and 270 mm at the end of I and II year, respectively off Chennai and U.vittatus attains 139 mm and 194 mm off Visakhapatnam. The longevity of these species is about 3 years. Comparison of their growth and the mean length in the fishery indicates that the 0-year group dominates the exploited population.

4. Stock assessment

Stock estimates for U.taeniopterus off Chennai for the years 1997-2000 indicated a total stock of 1,215 t and MSY of 952 t against the yield of 711 t. The exploitation rate was 0.48. Stock estimates for U.vittatus off Visakhapatnam for the years 1994-99 indicated very high exploitation rate of 0.79, suggesting overexploitation of the stock.

5. Management

Considering the large-scale exploitation of juveniles and very high exploitation rate (especially off Visakhapatnam) of goatfishes, it is necessary to implement management measures to sustain the fishery. There is no target fishing for goatfishes. However, they are one of the dominant components in the by-catch of the trawls. Hence, it may not be possible to implement management measures exclusively for the goatfishes. Ecosystem based management measures may be appropriate (see articles on whitefish and flatfish fishery in this volume).

6. Suggested reading

Mohanraj, G. 2000. Studies on the biology and population dynamics of the goatfishes (Pisces: Mullidae), Upeneus bensasi and Upeneus moluccensis of Madras coast. Ph.D. Thesis, University of Madras, Madras, 181pp.

Reuben, S., K. Vijayakumaran and K. Chittibabu. 1994. Growth, maturity and mortality of Upeneus sulphureus from Andhra-Orissa coast. Indian J.Fish., 41: 87-91.

Thomas, P.A.1969. The goatfishes (Family-Mullidae) of the Indian seas. Memoir III. Marine Biological Association of India, 174pp.