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Editors

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41 **Exploited resources of major perches in India**

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ABSTRACT

The present paper reviews the studies on the exploited resources of major perches from the Indian seas. Major perches consist of fairly large sized fishes belonging to families Serranidae, Lutjanidae and Lethrinidae, popularly known as rock cods, snappers and pigface brems respectively. They form 17% of the total perch catch. The average annual production of major perches in the country during 1990-98 is estimated as 23,800t. The highest landing of major perches is from the state of Tamilnadu (49.5%), followed by Kerala (19.74%). They inhabit the rocky and coralline grounds off the south west and south east coasts and the Wadge Bank and also in the rocky grounds off Gujarat and Maharashtra. Along the south west and south east coasts, the peak fishing season is from December to April. This resource could be exploited more efficiently by hooks and lines as well as the traps rather than trawl nets, as the grounds are often not trawlable.

Introduction

The group 'major perches', as the name implies are large sized Perciform fishes belonging mainly to the families Serranidae, Lutjanidae and Lethrinidae; commonly called as rock cods, snappers and pigface brems respectively. Most of the species belonging to this group inhabit the rocky

Exploited resources of major perches in India

grounds and the coral reef areas, while a few prefer the seagrass beds and muddy and sandy bottoms (Bensam 1993). Juveniles of many species occur in the nearshore areas, river mouths and estuaries. Major perches occur all along the Indian coast; they are particularly abundant off Kerala, Tamil Nadu, Gulf of Mannar, Gulf of Kutch, Paradeep and in the Andaman seas. The major perches constitute roughly 2% of the total marine fish production in the country, with an average total of 23,800 t during 1990-98 period. The catchable potential of all perches within the 50m depth zone is about 1,14,000 t and that beyond 50m is 1,25,000t. (Anon, 1991). Most of the grounds being not amenable to trawling operations, the major perches are exploited mainly by other gear like hooks and lines, traps and also the drift nets.

The experimental and exploratory fishing carried out by the Central Marine Fisheries Research Institute and the Fishery Survey of India, give valuable information on the abundance and distribution of major perches in the Indian EEZ. (Gopinath, 1954; Menon and Joseph, 1969; Silas, 1969; Menon *et al.*, 1977, Bapat *et al.*, 1977, Ninan *et al.*, 1984, Philip *et al.*, 1984, Joseph *et al.*, 1987; Sudarshan *et al.*, 1988 and Oommen, 1989). Hornell (1916), had pointed out the existence of rich perch fishing grounds along the south west coasts of India. A number of reports on the fishery of major perches are by Madan Mohan (1983), Mathew *et al.* (1996), Mathew and Venugopalan (1990), Vivekanandan *et al.* (1990), Mathew (1994), Bennet and Arumugham (1994), Lazarus *et al.* (1994), Kasim and Hamsa (1994) and Hamsa and Kasim (1994). A few reports available on the biology of perches are by Premalatha (1989) and Chakraborty (1994). James *et al.* (1994) has given a review of the present status of the knowledge on these resources.

Almost the entire array of species of major perches are excellent food fishes and hence have gained great demand in the export market, both in the live condition as well as in the frozen form. Of late, these are gaining importance for commercial mariculture in various countries including India.

Distribution of major perches in the Indian EEZ.

In the trawling operations carried out by *FORV Sagar Sampada* during cruises 1-90, major perches were available at depths 23 to 250 m, with an average catch rate of 121.02kg/ hr. Fairly high catch rate of 143.51kg/hr was obtained from the Andaman Sea. The average catch rate from south west region was 193.04 kg/hr. The south east coast including Gulf of Mannar a good catch rate of 130kg/hr was available. At many stations on the Wadge Bank and off Quilon, the entire catch was constituted by perches (Mathew *et al.*, 1996).

In the north western region of the Indian coast, in the survey conducted using bottom trawls from a 70m vessel at depths 55 to 360m, six species of rock cods belonging to family Serranidae viz. *Epinephelus areolatus*, *E. fasciatus*, *E. malabaricus*, *E. lanceolatus* and *E. latifasciatus* contributed to the catches (Bapat *et al.*, 1982). During the entire survey, the highest catch rate 13.3kg/ hour was obtained from 91-125 m, followed by 6.1 kg/ hour in 126-360m and 1.93 kg in 55-90m depth zone. In this survey, the catch rate of snappers was 4.6 kg /hour in the 91-125m , followed by 1.89 kg/hour in the 126-360m and 1.5 kg/ hour in the 55-90m depth zones. The highest catch rate of 32.7 kg/ hour was obtained in April-May. Chakraborty (1994) has reported that half a dozen species of *Epinephelus* occur regularly in the catch at Bombay as by-catch in shrimp trawls, of which *E. diacanthus* is the most dominant one. The results of the survey conducted at 20-23°N and 68-70°E during 1985-88 using a trawl with a 32m head rope showed that major perches constituted 4.2% of the total catch; the peak period of abundance extending from October to February. The catch rates varied between years, ranging from zero to 3 kg/ hour and the highest between 41 and 70m (Vivekanandan *et al.*, 1990). From the surveys conducted by the Fisheries Survey of India in the north west between lat. 14° and 17° N, the highest percentage composition of major perches of 28.2 was at a depth range of 80-100m, and in the 18° to 23 ° N, the highest percentage of 8.5-8.9 was at depths ranging from 60 to 100m(Sudarsan *et al.*, 1988). The survey conducted in the area between 10°-15° N and 72°-76°E at a depth ranging from 50 -500m, using 47m shrimp trawl and 27 m fish trawl, major perches were most abundant from 14° to 15°N, with catch rates up to 4.3 kg /hour (Philip *et al.*, 1984).

Exploited resources of major perches in India

Table 1. Latitudewise abundance (in kg) of perches on the Western half of Indian EEZ at different depth zones

Latitude	<i>Lutjanus</i> spp.	<i>Lethrinus</i> spp.	<i>Serranus</i> spp.	<i>Plectorhynchus</i> spp.	Other Perches	Total
Southwest coast						
7°	147	201	468	750	-	1566
8°	41	141	135	-	-	317
9°	41	-	-	2	-	2
13°	30	-	35	150	-	225
Depth 51-100 m						
7°	835	632	433	329	-	2229
8°	126	472	587	169	-	1354
9°	5	-	47	-	-	52
11°	-	-	300	-	-	300
12°	-	-	39	-	-	39
13°	25	-	35	-	-	60
14°	-	-	500	-	-	500
Depth 101-150 m						
8°	-	-	9	17	-	26
13°	18	-	6	-	-	24
15°	-	-	398	-	-	389
Northwest coast						
Depth 0-50 m						
18°	-	-	-	19	-	19
Depth 51-100 m						
15°	4	-	-	1	-	4
16°	-	-	254	1	-	255
17°	25	-	88	-	-	113
18°	-	-	241	-	-	241
19°	-	-	35	-	-	35

Marine Fisheries Research and Management

20°	-	-	-	-	47	47
21°	-	-	-	-	21	21
22°	-	-	60	-	-	60
23°	-	-	6	-	-	6

Depth 101-150 m

16°	-	-	23	-	-	23
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Latitude-wise abundance (in kg) of perches on the Eastern half of Indian EEZ at different depth zones

Latitude	<i>Lutjanus</i> spp.	<i>Lethrinus</i> spp.	<i>Serranus</i> spp.	<i>Plectorhynchus</i> spp.	Other perches	Total
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Depth 0-50 m

8°	18	10	46	1	-	74
10°	3	-	29	-	18	50
11°	70	350	40	-	-	460
12°	204	-	-	-	90	294
13°	16	25	1	30	-	72
14°	-	-	-	-	-	-

Depth 51-100 m

7°	-	-	-	200	-	200
10°	93	193	17	264	270	837
11°	-	-	-	-	50	50
13°	106	18	4	-	18	146
14°	251	102	96	-	60	509
15°	-	32	-	-	-	32

Depth 101-150 m

10°	14	-	-	-	-	14
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Northeast coast
Depth 0-50 m

15°	2	3	-	-	-	5
16°	40	-	-	12	3	55
17°	-	-	-	-	17	17
18°	-	-	-	-	4	4

Exploited resources of major perches in India

19°	120	-	-	72	-	192
20°	-	-	-	38	-	38
Depth 51-100 m						
16°	91	15	38	113	5	262
17°	16	-	-	102	-	118
18°	158	70	322	110	8	668
19°	1640	372	10	60	25	2107

On the south west coast, at latitude 7° and 8° N the catch ranged between 300 and 900 kg/ hour ; at many stations on the Wadge Bank and off Quillon Bank, the entire catch was constituted by perches (Mathew *et al.*, 1996). From the survey carried out by FORV Sagar Sampada in the 8° to 15° N along the south west, considering the depth strata 0-50m and 51-100m, the most productive perch grounds were located at 7° and 8° N (Table 1). Since 1956, the erstwhile Indo-Norwegian project conducted several fishing trips for the survey of "Kalava" grounds along the rocky patches lying in 70-150 m depth zone on the continental shelf from Trivandrum to Canannore. In the area between 8° and 13° N at depths of 60- 150m , the bottom is uneven, with rocky outcrops and coralline areas forming extensive ridges reaching upto 5m from ground level (Silas, 1969; Oommen, 1989). This area rich in rock cods, snappers and pigface breams are called "kalava grounds" According to Silas (1969), these grounds cover nearly 14000² km in the 75-100m depth range off the south west coast of India, and the handline operation trials here yielded 200-300 kg / 100 hooks / hour from 8°-9° N and near 11° N, and 180 to 190 kg /100 hooks / hour from 10-11° N. Handline trials conducted at 8° to 13° N using six vessels yielded 42 kg / hour (Oommen, 1989). Maximum catches and catch rates were obtained during January; the species caught were *Epinephelus chlorostigma*, *E. diacanthus*, *E. areolatus*, *E. tauvina*, *E. morrhua*, *Pristipomoides typus*, *E. bleekeri*, *Lutjanus gibbus*, *L. rivulatus*, *L. lutjanus*. Tholasilingam *et al.*, (1973) has given an account of the kalava resources and kalava grounds on the south west coast based on investigations of R.V.Varuna. A handline survey conducted on the shelf extending from Canannore to south west of Quillon (8° 30' to 10° 15'N) yielded @ 68 kg / hour (Menon and Joseph, 1969). *E. areolatus*, *E.*

chlorostigma, *E. diacanthus* and *P. typus* were the main species caught. Highest catch rates were obtained during February. The grounds from 11° to 12° N yielded higher catches of these species than the areas further south. Menon *et al.*, (1977) conducted experimental fishing using traps (186x86x86cm) during 1975-76 using three vessels in the area off 8°-11° N, 74°-76° E and found the area between Alleppey and Ponnani to be the richest ground for rock cods and snappers. The number of fish varied from a minimum of 5 per trap in August to a maximum of 48 per trap in April.

The 10 year trap survey described by Oommen (1989) based on the same design as that of Menon *et al.*, (1977) conducted from 8° -13°N, showed that the average catch rate was about 80 kg/ hour; and maximum catch per trap hour (166 kg) was obtained in June. Sulochanan and John (1988) have reported on perch yield of 62-96kg/ hour during October-December and 60-78 kg/ hour during March- May in the 40-50 m depth zone in the area south of 8°N. Yield was found to be better in the 51 to 100m depth zone on the south west coast. The maximum catch rate of 850 kg/ hour was observed in this depth zone on the Wadge Bank; from the Quilon Bank and from the rocky patches off Ponnani, catch rates upto 420 kg / hour and 248 kg / hour respectively were obtained from the 51 to 100m depth zone. Off Karnataka, fairly dense concentrations of 300kg/ hour of major perches were obtained from depth upto 100m (Mathew *et al.*, 1996).

On the south east coast between 7° 00' and 8° 20' N and 76° 30' and 78° 00' E, at depths extending upto 223 m on the Wadge Bank in the trawl survey conducted using a 41m vessel and 34 m two-seam bottom trawl in an area of 3600nm², where the bottom was generally of hard rock, covered with dense growth of sea fans and corals, was rich in the major perch resources. Joseph *et al.*, (1987) reports that during this survey, the rock cods, snappers and the pigface breems together constituted 37% of the total catches. The north east part of the Wadge Bank was the richest ground for major perches; a well defined perch ground was also located off 7° 40' - 8° 00' N and 77° 20' - 78° 00' E at depths between 36 and 64 m. On the Wadge Bank the abundance of these fishes decreased with increasing depth. Based on trawl survey, in the Wadge Bank, Sivaprakasm (1986) and Sudarsan *et al.*, (1988) reported that perches were more abundant at 20-50m and 100-150m depth and that their abundance decreased beyond this depth. On the Wadge Bank, the peak

period of abundance was observed to be January -February (Joseph *et al.*, 1987).

Somavanshi and Bhar (1984) in a survey conducted in the Gulf of Mannar, reported that major perches contributed 21% of the catches here, snappers being the most dominant, followed by rock cods and pig face breams. The most productive areas for perches here were in the depths upto 50m. From the studies made on board *FORV Sagar Sampada*, on the south eastern parts of the Indian EEZ, this resource was fairly abundant during the first half of the year at depths upto 50m. Fairly dense populations of perches were available during April-September period in the 51-100m depth zone. (Mathew *et al.*, 1996). Good perch grounds were located in the shallow coastal waters upto 50m depth off Cuddalore, Pondicherry and catch rates upto 350-400kg/ hour were obtained in 51-100m depths off Point Calimer and off Madras (Mathew *et al.*, 1996). In the Andaman-Nicobar sea, a total production of 3.87 tonnes of major perches were obtained during the fishing cruises of *FORV Sagar Sampada*, of which 97.5% came from the 51-100m depth zone. This resource showed an abundance during January -March and October-December months. From the north eastern region, 91% of the total perches caught were from the 51-100m. Stations with dense populations of perches were located in the depth zone 51-100m off Gopalpur and Paradeep coasts (Mathew *et al.*, 1996). In the trawl survey conducted by Ninan *et al.*, (1984) in the region off 14° 04'-17° 30'N during 1983-84 period, perches formed 4.4% of the total catch of 176 t of fish.

Fishery

The average annual production of major perches in the country during 1990-'98 period has been estimated as 23,732t forming 17% of the total perch catch (Fig 1.), and roughly 2% of the total fish production in the country. These are exploited mainly by trawl nets, hook and line, gill nets and the perch traps, though there is no targeted fishing for these resources except for the hook and line fisheries in vogue along Kerala and Tamil Nadu coasts and recently in Karnataka (Zacharia *et al.*, 1997). A perusal of the annual production statistics of major perches in the country during 1990-98 shows that it is steadily on the increase with a minimum of 11,319 tonnes in 1990 to a maximum of 35,948 tonnes in 1998.

Statewise, the highest landings occur off Tamil Nadu, followed by Kerala

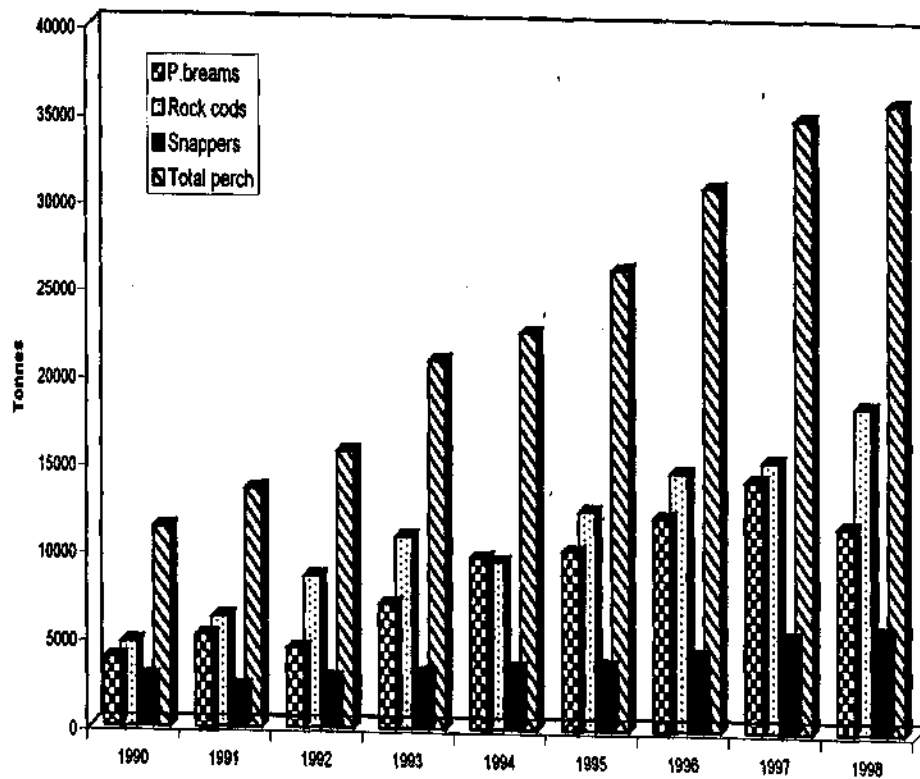


Fig 1. All India landings of Major perches.

Gujarat, Maharashtra, Karnataka and Andhra Pradesh (Table 2.). Along the coasts of Orissa and West Bengal the fishery for these resources is very negligible.

There is an organised fishery for major perches in Tamil Nadu, along the Gulf of Mannar and the Wadge Bank, using both mechanised, as well as non-mechanised traditional methods. The annual estimated catch of major perches here varying from 5114 tonnes to 17,863 tonnes during 1990-98 period, is contributed by pigface breams (63%), rock cods (23.8%) and snappers (12.3%) in the order of abundance (Fig. 2). Peak season of abundance for perch fishery along the Tamil Nadu coast is from December to April, although good catches are recorded throughout the year.

Exploited resources of major perches in India

Table 2. Statewise major perch landings.

Year	Gujarat	Mahara- shtra	Karnata- ka	Kerala	T.Nadu	Pondi- chery	Andhra Pra- desh	Orissa	W. Ben- gal
1990	1029.15	2010	416	2382	5114	21	453	8	5
1991	1354.15	2058.4	821.7	1139	8763	5	913	6	8
1992	1383.9	2544.7	605	3202	7250	10	630	4	6
1993	1803.4	2281.6	840	4093	10644	8	970	10	10
1994	2517.3	1975	1524.7	3374	12394	10	1673	5	6
1995	2651.1	2047	1602.3	5663	13245	5	1931	4	4
1996	2900.7	2187.6	2093.2	7663	15633	5	1799	6	5
1997	4546.6	1817.3	2902.2	7673	17863	2	1345	18	15
1998	6126.7	1336.1	3017	7751	15658	9	1612	10	12
Total	24327.9	16082.6	13822.2	42940	106564	65	11326	69	75
Mean	2703.1	1786.96	1535.8	4771	11840	7.2	1258	7.7	8.3
%	11.3	7.47	6.4	19.74	49.5	0.02	5.26	0.03	0.03

Kerala ranks second in the major perch landings during 1990-98 period. The average annual catch was estimated as 4771.1 t, forming 19.74%. Non-mechanised gears, especially, the hooks and lines are used in the exploitation of large perches from the well known perch grounds off Kerala coast. The deep sea trawlers as well as the commercial trawlers land perches from the grounds off Ponnani, off Cochin and Alleppey, off the Quilon Bank, off Trivandrum and the Wadge Bank in the south, and off Cannannore in the north. Perch fishery exploited by traditional gears in Kerala is mainly of seasonal nature, commencing from October and extending to April. The seasonal fishery of perches in Kerala have been studied by Mohan (1983) and Mathew (1990). Rock cods constitute the most dominant group (76.7%), followed by

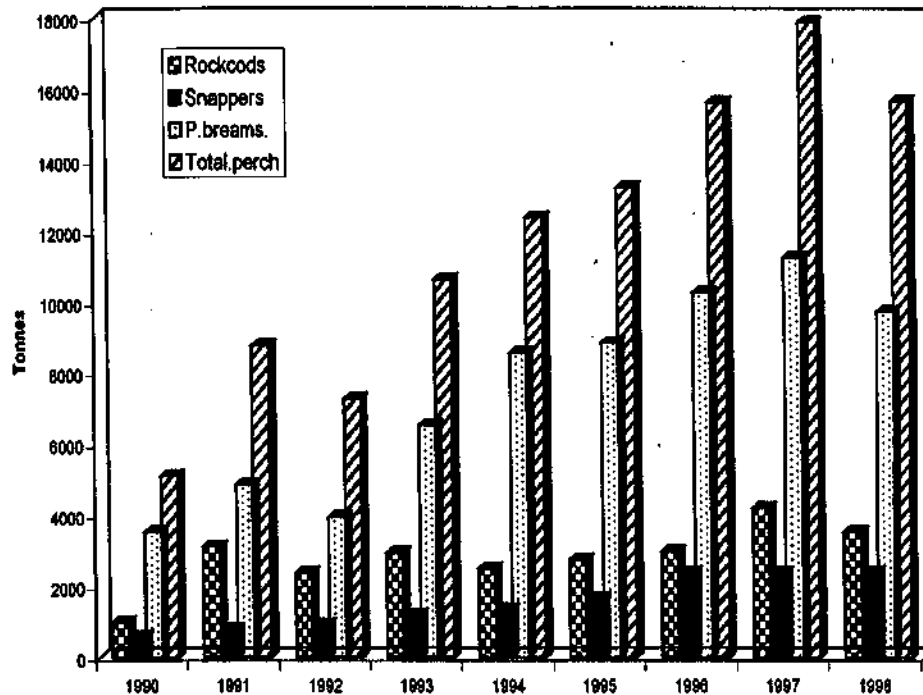


Fig2. Major perch landings-Tamilnadu.

snappers (12%) and the pigface brems (10%) (Fig 3). 75% of the year's catch was recorded during the January- March period, 20% of the production was realized during October -December period whereas May to September was the lean period.

Annual average landings of major perches from Gujarat during 1990-98 period was 2703.1 tonnes (11.3%), followed by Maharashtra (7.47%). Rock cods were the major component in the fishery in Gujarat, the fishing season extending from October to March. Along the Maharashtra coast, trawlers are the main gear used for the exploitation of major perches. Rock cods formed 65% of the catch, followed by snappers (28%) and the pig face brems contributed a very negligible quantity. Major season for perch fishery in Maharashtra was from October to December, which is the peak season for rock cods here. Karnataka contributes 6.42 % of the total perch catch in the country with average landings of 1535.79 tonnes annually. Peak season extends from October to March, rock cods being the major component in the

Exploited resources of major perches in India

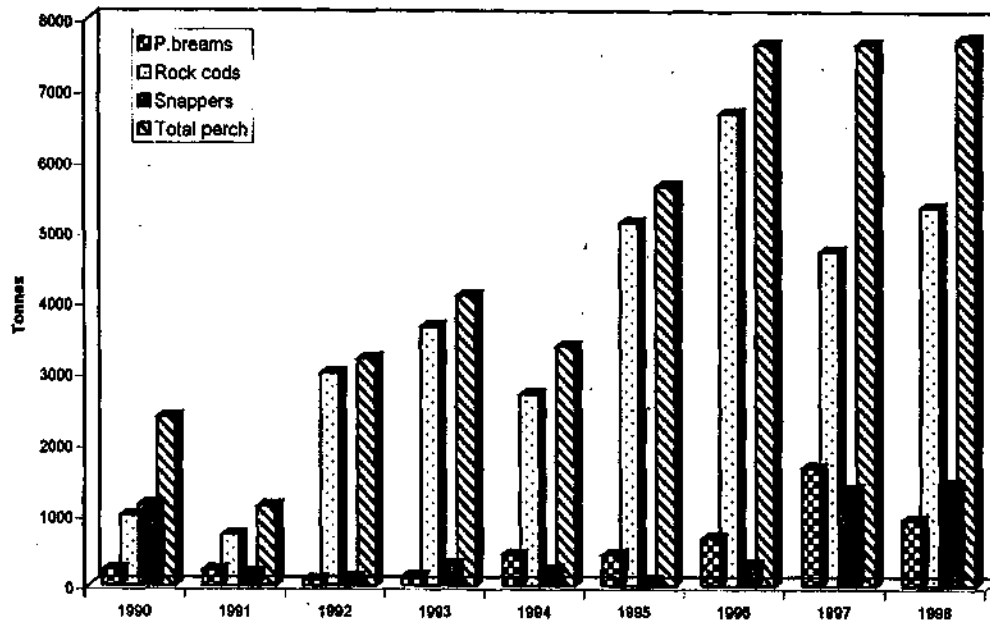


Fig 3. Major perch landings-Kerala

catch. Andhra Pradesh contributes 5.28% of the total perch catch, with an average annual catch of 1253.4 tonnes. The season of peak abundance was during January to March; the snappers form 85% of the fishery, and rock cods contribute 9.3%.

Fishery at Tuticorin: Tuticorin is one of the important centres where major perches exploited from the Gulf of Mannar, by both mechanised as well as traditional crafts, are landed. During the year 1998, the estimated total catch of major perches from this centre was 5055 tonnes, (Anon, 1999), exploited from the nearshore rocky areas and islands or 'paars' from depths extending to 50m. Perches form about 10.9% of the total marine fish landings by traditional gear at Tuticorin (Bennet and Arumugham, 1994). Except during November and December when turbulent conditions prevailed due to north east monsoon, fairly good catch of perches was recorded in all other months. Hooks and lines are the most important traditional gear, operated for fishing large sized perches, which constitute 45-50% of the total fish catch from this gear. Hooks and lines are ideally suited for fishing the perches distributed over wide areas. Long line units popularly known as 'Ayiramkal thoondil', accounted for over 45.8% of larger perches. Nearly 75% of the perch catch

landed here is from the mechanised trawlers. The gearwise fishery for perches at Tuticorin is described by Bennet and Arumugham (1994). Studies on the perch fishery at Tuticorin were made by Mathew (1994), Hamsa *et al.*, (1992), and Kasim *et al.*, (1992).

Though there is a clear cut seasonal preponderance of perches at Tuticorin, the months of peak abundance are from December to April (Bennet and Arumugham 1994). The pig face breems or *Lethrinus spp.* contribute 62% of the total perches from all the gears put together, followed by rock cods 14.7% and snappers 9.12%.

Seasonal hook and line fishery for perches at Pamban : A seasonal hook and line fishery for perches at Pamban has been reported by Jayasankar (1990). During December-March period, the Tuticorin fishermen migrate to Pamban and operate hooks and lines along the coral reefs off Dhanushkodi at depths 18-25m. *Lethrinus spp.* (34.01%), *Lutjanus spp.* (22.95%), *Epinephelus spp.* (6.87%), *Pristipomoides spp.* (4.67%) were the important species landed.

Seasonal fishery for perches using hooks and line in Kerala : Along the Kerala coast, seasonal fishery for perches is in vogue from the rocky grounds off Varkala, Trivandrum, Poovar, Pulluvilla etc. during December to April months. Mohan (1983) has analysed the seasonal fishery for perches of Pulluvilla village. A seasonal fishery for perches using hooks and lines exists at Cochin during November-April period. (Mathew and Venugopalan, 1990). The fishermen from the south west of Trivandrum migrate to Cochin; with base at this place, using the pablo type, mechanised boats of length upto 9.4m, carrying sufficient number of hooks and lines carry out fishing on the rocky grounds off Ponnani, Cochin and off Alleppey. Perches formed the most important component of the catch constituting over 90%; elasmobranchs formed 4.42%, tunas 2.85%, *Coryphaena* 0.6%, catfish 0.29% and barracuda 0.62%.

Seasonal fishery for perches off Karnataka: Off the coast of Karnataka, Zacharia *et al.*, (1997) has reported on the large scale landing of rock cods during the post monsoon month of September every year from 1994 onwards, with catch rate varying from 183.3 kg to 300.5kg / unit. The catch consisted of five species namely, *Epinephelus diacanthus* (82.65%), *E. epistictus*

Exploited resources of major perches in India

(7.71%), *E.malabaricus* (4.6%), *E.latifasciatus* (3.21%) and *E.chlorostigma*(1.9%).

Species composition of major perches: Important species belonging to the three families, contributing to the fishery are mainly: Family Serranidae (Rock cods or the groupers): *Epinephelus malabaricus*, *E.tauvina*, *E.bleekeri*, *E. areolatus*, *E. diacanthus*, *E. epistictus*, *E. fasciatus*, *E. faveatus*, *E.flavocaeruleus*, *E. latifasciatus*, *E.morhua*, *E.undulosus*, *E. merra*, *E. fuscoguttatus*, *E.chlorostigma*, *Cephalopholis sonnerati*, *C.miniata*. Family Lethrinidae(pig face breams): *Lethrinus nebulosus*, *L. ramak*, *L. mahsenoides*, *Lethrinus spp.*, *Lethrinella miniatus*, and Family Lutjanidae (snappers) are *Lutjanus argentimaculatus*, *L. bohar*, *L. rivulatus*, *L.bengalensis*, *L. biguttatus*, *L. fulviflamma*, *L. gibbus*, *L. johnii*, *L. kashmira*, *L. sebae*, *L. sanguineus*, *L. russelli*, and *Pristipomoides typus*.

Biology

Information on the biology of important species of perches is scanty, though these were exploited in the south west and the south east coasts, in varying quantities. Most of the species are large sized, though a large number have been reported, only a few occur in the commercial catches. They are predatory fishes feeding on crabs, prawns and other fishes such as *therapon*, *ambassis* etc. (Devanesan and Chidambaram, 1948). Among major perches, the rock cods or groupers are protogynous hermaphrodites, initially maturing as females, then reverting to males with advancing age and sizes. (Tan and Tan, 1974).

A few reports available on the biology of major perches are based on preliminary investigations. Oommen (1976) studied the food and feeding habits of *Pristipomoides typus* based on samples taken off the Kerala coast. Fish, cumaceans, mysids, crabs, stomatopods and cephalopods formed the important food items, but 62% of the fishes examined had everted stomachs. Length-weight relationship was calculated for *P.typus* as $\log W = -5.1002 + 3.0303 \log L$ from samples of 345 specimens in the length range 21.5 to 34.9cm. Premalatha (1989), estimated the length - weight relationship for females of same species ranging in length from 35 to 60cm as $\log W = -1.4959 + 2.7063 \log L$. The spawning season was determined to be February -June.

Bapat *et al.*, (1982) observed mature and spent adults of *Epinephelus diacanthus* during September. Silas (1969) collected juveniles of this species from 30 to 60m and 100-160m depths in June 1966. Chakraborty (1994) estimated the growth and mortality parameters for this species based on length frequency data of samples collected from commercial trawlers at Bombay as $L = 502\text{mm}$, $K=0.16$ on annual basis, $M=1.15/\text{year}$ and $F=0.79/\text{year}$. Premalatha (1989) estimated length-weight relationship for the females of this species as $\log W = -1.3056 + 2.6117 \log L$, based on specimens ranging from 20 to 55cm. The spawning period was determined as May-June. The spawning season for *E. areolatus*, along the Kerala coast was determined as June to July and length - weight relationship $\log W = -1.2521 + 2.55772 \log L$ for females and $\log W = -0.8994 + 2.3287 \log L$ for males derived, based on specimens ranging from 29 to 55 cm (Premalatha, 1989).

In *E. tauvina*, fishes of 45 to 50 cm mature as females while fish of more than 74 cm and weighing 11kg become males having ripe testes. In specimens of 66-72cm length, transitional gonads contain male as well as female tissues (Tan and Tan 1974). Ameer Hamsa and Kasim (1992) studied the growth of juveniles of *E. tauvina* in coastal cages in the Gulf of Mannar, starting with juveniles of size 4-25cm. The growth was studied for different periods. Selvaraj and Rajagopalan (1973) have presented some observations on the morphometric and meristic characteristics, and also on the fecundity and spawning habits of this species in the wild. Mathew *et al.*, *a* (in press) have studied the sex inversion and natural spawning of this species in the onshore culture system. Good growth of 775gm in 7 months was attained in *E. malabaricus* of size 10 to 15 cm in onshore culture system under controlled conditions (Mathew *et al.*, *b* in press). Length - weight relationships of *E. chlorostigma* were estimated as $\log W = -2.7115 + 3.0425 \log L$ in the case of females and $\log W = -1.7501 + 2.8497 \log L$ in males, using fishes of the length range 32-65 cm. The spawning season for this species was also found as June-July (Premalatha, 1989).

Hamsa *et al.*, (1994) estimated the length-weight relationships for the snapper *Lutjanus rivulatus* from a sample of 279 specimens, ranging in size from 110 to 760mm as $\log W = -4.682 + 2.9562 \log L$ ($r=0.9620$), exhibiting isometric growth. The relative condition factor K_n indicated that older specimens measuring above 420 mm were more healthy and robust than the

Exploited resources of major perches in India

younger ones. Rengarajan (1972b) states that *Lutjanus kashmira* spawn only once during November-March. Length at first maturity was estimated as 20cm and fecundity ranging from 42,100 to 332,620. The length-weight relationships of *Lethrinus nebulosus* has been estimated by Hamsa and Kasim (1994) as $\text{Log } W = -4.5364 + 2.9078 \text{ Log } L$ with r value 0.9672. Prabhu (1954) has described the length - weight relationships of this species by the equation $\text{Log } W = -2.0830 + 3.1901 \text{ Log } L$ from Mandapam waters.

Discussion

Considerable information is already available on the major perch resources of the south west coast of India. The earlier works of John (1948), dealing with the Kalava fishing off Anjengo and Chavara; of Gopinath (1954) on the Kalava fishing south of Alleppey and Wadge Bank, and of Sivalingam and Medcoff (1957) on the possibilities of trawling on the Wadge Bank are important. Kalava fishing from the rocky areas off Varkala, Trivandrum, Poovar, Pulluvila, has been in vogue for decades. Subsequent surveys also revealed the existence of good kalava grounds in the rocky patches, in the 70-110m depth zone from Trivandrum to Cannanore. Handline operations north west of Cochin, off Chetuway and Ponnani yielded good catch of large perches. The rocky grounds off south west coast yielded good catch of perches, using traps. Joseph and John (1987) and James *et al.*, (1987) suggest greater scope for increased exploitation of perches along both coasts particularly along south west coast and Wadge Bank.

The presently known perch grounds are rough and not suitable for trawling. By adopting diversified fishing methods and suitable techniques to suit the uneven grounds, the underexploited fraction of these resources could be exploited. Production of perches could be enhanced further by introducing traps and intensifying fishing with hooks and line in the 75-100m depth zone off the south west coast, at depths of 35-65m in the Gulf of Mannar and northeast region of the Wadge Bank, also at depths 91-125 m along the north west coast which are abundant in perches.

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