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*Winter School on*  
Impact of Climate Change  
on Indian Marine Fisheries

*Lecture Notes*

Part 1

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## DEMERSAL FISHERY RESOURCES OF INDIA

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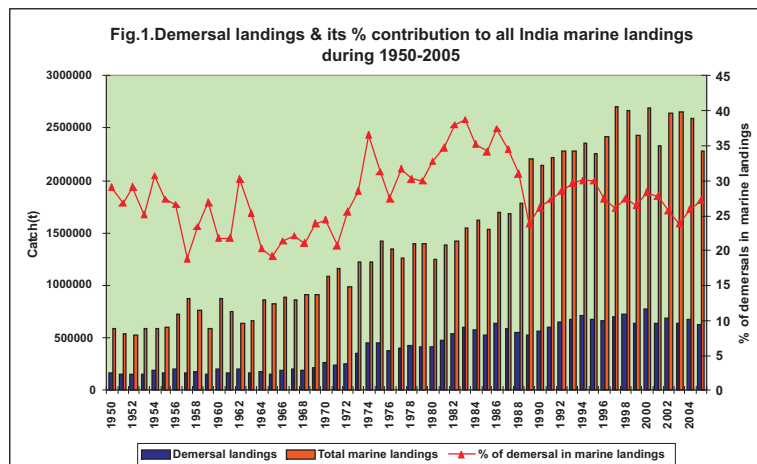
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### Introduction

The neritic waters along the continental shelf of the Indian EEZ is endowed with a rich abode of demersal finfish resources contributing to about 27.5 % of the total marine landings of the country. The demersal finfishes represented by a total of 23 groups and 71 commercially important species by virtue of their multifarious uses contribute substantially both as a protein supplement and to the revenue generation of the nation. Besides, the island ecosystems of Lakshadweep and Andaman & Nicobar have rich potential of marine ornamental fish resources, which by their aesthetic value are very much in demand for aquaculture both in India and abroad. Nevertheless, these invaluable fishery resources are subjected to wider fluctuations and/or depletion because of the adversities caused both by fishery related and non-fishery related factors. The prospects and problems of demersal finfish fishery in India are examined here with possible managerial measures so as to sustain the fishery.

### Catch

The total demersal fish production in India was 1,68,800 t during 1950, which indicated a gradual increase reaching upto 2,65,348 t in 1970 (Fig. 1). From 1971 onwards, the catch further increased reaching a high of 7,65,127 t during 2000, but declining to 6,20,469 t during 2005. Over the period 1950-2000, the demersal fish landings showed an increase of 4.5 times.



The all India marine fish landing during 1950-2005 increased from 5.8 lakh t in 1950 to 27 lakh t in 2000 which however, indicated a marginal decline during the subsequent year with 22.79 lakh t during 2005. The increase was 4.66 times during 1950-2000.

The contribution of demersal fishes to marine fish landing during 1950-2005 ranged between 29.1% in 1950 to 36.6% (4,45,650t) during 1974, the average being 27.8%.

*Coast-wise landings:* Of the Indian coastline of 8129 km length, west coast forms 41%, east coast 33% and the rest by the Andaman-Nicobar and Lakshadweep Islands. The contribution by the west coast to the demersal fish production was 65.3%, and the rest was by the east coast.

*State-wise landings:* Demersal fish production during 1981-2000 was contributed the maximum by Gujarat (29.5%), followed by Tamil Nadu (20.4%), Kerala (15.5%), Maharashtra (12.7%), Andhra Pradesh (6.6%) and Orissa (5.0%).

### **Fishery of major demersal fishes**

#### *Elasmobranchs*

In India the average landings of elasmobranchs during 1990-2003 was 63,151 t contributed by sharks (39578 t, 62.6%), skates (2323t, 3.7%) and rays (21250 t, 33.7%). Tamil Nadu (27.5%) contributed to the maximum followed by Gujarat (19.5%), Maharashtra (16.7%) and Andhra Pradesh (15.0%). Sharks were more abundant off Gujarat and Maharashtra while rays were distributed more off Tamil Nadu and Andhra Pradesh. Major species landed are *Scoliodon laticaudus*, *Carcharhinus sorrah*, *C. hemiodon*, *C. limbatus* and *Sphyrna zygaena* among the sharks; *Aetobatus narinari*, *Himantura uarnak*, *H. jenkinsii*, *H. marginata*, *H. bleekeri* and *Taeniura meyeni* among the rays; and *Rhina ancylostoma*, *Rhinobatos granulatus* and *Rhynchobatus djiddensis* among the skates.

*Stock Assessment:* Length based stock assessment of *S. laticaudus* in Maharashtra indicated that the species is over exploited. Stock assessment studies made on an all India level using Schaefer model indicated that the catch per effort declined with increase in fishing effort.

*Utilization:* Shark fin is being utilised as the central ingredient in China's most favoured dish. Shark liver oil which yields 'squalene', an acyclic hydrocarbon is used in a wide range of products from bactericides to skin moisturizers. Shark hide popularly known as "shagreen" is used to produce a variety of leather products.

*Management:* Information on the species diversity and biology of elasmobranchs is scanty. Elasmobranchs are slow growing, viviparous, low fecund fishes with long gestation period. To maintain regular fishery, management measures such as protection of females, observing their nursery ground as closed areas and protecting vulnerable species are required. Above all, a good database on the specieswise landings and trade are to be generated.

#### *Catfishes*

With an average annual landings of 46,012 t during 1990-2003, the catfish resources contributed to 7.3% of the demersal fish landings. West coast, especially Gujarat and Maharashtra contributed to 70% followed by east coast (Tamil Nadu and Andhra Pradesh) (30%). Gill net, hooks & line, purse seine, boat seine and other artisanal gears mainly exploit the resource. Until 1980, the southwest coast was the dominant catfish-producing region but from 1981-85 onwards, northwest coast produced 72.5% of the catfish production from the west coast. The decline along the southwest coast may be due to the purse seine operating along the Karnataka/Kerala region capturing large quantities of mouth-brooding male catfishes such as *Tachysurus thalassinus*, *T. tenuispinis*, *T. dussumieri* and *T. serratus*.

*Stock Assessment:* Stock assessment studies on *T. thalassinus*, *T. tenuispinis*, *T. dussumieri*, *T. serratus* and *O. militaris* indicated that the present level of exploitation of *T. tenuispinis* and *T. thalassinus* is slightly above the MSY and hence a reduction by 25% in fishing pressure especially by nonselective gears is recommended.

*Management:* The studies also recommend strengthening of hooks & line and gillnet fishing, avoidance of shoals and trawling in the grounds beyond 50 m depth.

#### *Major perches*

The average annual production of perches during 1990-2003 was 70,040 t (11%). Of these, major perches formed 28,776 t (4.3%) contributed by rockcods (14,827 t; 51.5 %), snappers (4,284 t;14.9%) and pigface breams ( 9,665 t; 33.6%). Other perches contributed to the rest.

Major perches inhabit the rocky grounds of Tamil Nadu, Gulf of Kutch, Gulf of Mannar, off Paradeep and Andaman Seas. The potential yield is estimated as 1,14,000 t within 50 m depth and 1,25,000 t beyond 50 m depth. They are caught in traps, hooks & line and dol net. The major species of groupers caught are *Epinephelus chlorostigma*, *E. diacanthus*, *E. areolatus*, *E. tauvina*, *E. morrhua* and *Pristipomoides typus*. Among snappers *Lutjanus gibbosus*, *L. rivulatus*, *L. fulviflamma* and *L. lutjanus* are the major species landed. *Lethrinus nebulosus*, *L. ramak* and *L. elongatus* are the major species landed among pigface breams.

*Management:* There is considerable scope for increase in production of major perches. Efforts have to be made to effectively exploit the stock by developing suitable fishing gears.

#### *Threadfin breams*

Popularly known as “pink perch”, the nemipterids contributed to 13.8% (86,940t) of demersal fish landings in the country during 1990-2003. The major contributors are Maharashtra (25.7%), Kerala (21.8%), Karnataka (21.0%) and Gujarat (21.0%). Fishery of threadfin breams is known to be influenced by upwelling and the stocks are known to move to inshore waters during monsoon along the west coast of India. Major species are *Nemipterus japonicus*, *N. mesoprion*, *N. delagoae* and *N. luteus*. They are fractional spawners with protracted spawning season.

*Stock Assessment:* A comprehensive study made on the stock of threadfin breams show that the fishing mortality rates of the two major species namely *N. japonicus* and *N. mesoprion* are within the permissible level. However, the studies also indicate that increase in cod end mesh size would improve the landings since the cod end mesh size of the trawl net currently under use is injurious to the stock in the long run.

*Management:* Since threadfin breams inhabit deeper waters of 100-200m depth, trawling in this depth can be increased which would fetch increased landings and provide raw material for the *surimi* plants. The potential yield is 1,28,000 t while the present maximum yield was 1,16,680 t in the year 2000.

#### *Silverbellies*

The silverbellies (Family: Leiognathidae) with an average landings of 57,823 t contributed to 9.2% of the total demersal fish landings in India. Tamil Nadu contributed to maximum of 57.3% of the landings. They are mainly shallow water fishes distributed in 0-40 depth range. The silverbellies are exploited by trawls and a variety of artisanal gears such as the shore seine, boat seine, gill net etc. Of the 21 species of silverbellies distributed along the Indian coast, *Leiognathus dussumieri*, *L. jonesi*, *L. splendens*, *L. brevirostris*, *L. equulus*, *Secutor insidiator* and *Gazza minuta* are mainly represented in the landings.

*Management:* Stock Assessment studies indicate that the management measures should be of a continuous nature taking into account changes in species composition, changes in the average length, life span, length at maturity and growth. Similarly, small scale industries such as making palmyra basket etc have to be developed for meeting the requirements of sun drying and salt cured silverbellies and transporting them to interior markets.

#### *Pomfrets*

Pomfrets are export quality food fishes distributed along the Indian coast. The annual average landings is 40,329 t (6.4%). This resource, represented by 3 species namely *Pampus argenteus* (silver pomfret), *P. chinensis* (Chinese pomfret) and *Formio niger* (black pomfret), are caught mainly by trawl, gill net and dol net. Gujarat contributed to the maximum (20.5%) followed by Maharashtra (18.4%) and West Bengal (17.2%).

#### *Sciaenids*

Sciaenids, popularly known as jewfishes or croakers are one of the major demersal fishery resources of India. The annual average landings during 1990-2003 was 1,56,280 t (24.8%). The northwest coast

represented by Gujarat and Maharashtra brought the major share of more than 50% of the total catch of this resource. Gujarat (30.0%) and Maharashtra (23.8%) contributed to the bulk of the landings. Sciaenids are caught in trawl, dol net, gill net, shore seine and hooks & line. About 20 species represented by *Otolithus cuvieri*, *O. ruber*, *Johnius* spp, *Johniops* spp, *Atrobucca nibe*, *Protonibea diacanthus*, *Otolithoides biauritus* and *Kathala axillaris* are the major species contributing to the fishery.

#### Lizardfishes

Lizardfishes belonging to the family Synodontidae forms an important bycatch in shrimp trawlers in tropical and subtropical seas. The all India lizardfish landings during 1990-2003 was 26,593 t (4.2%). Kerala contributed to the maximum (37%) followed by Gujarat (21%) and Tamil Nadu (13%). *Saurida tumbil*, *S. undosquamis*, *S. micropectoralis* and *Trachinocephalus myops* are the major species. Lizardfishes are carnivores, feeding on fishes and crustaceans and are also cannibalistic. Juvenile capture using small meshed cod end of trawlers is a major threat to the sustenance of lizardfish fishery.

*Utilisation:* In India, lizardfishes above 20 cm in length are used for human consumption while smaller ones are used as animal feeds and fertilisers. Of the species used for human consumption, *S. tumbil* has better acceptance when supplied in fresh condition. Lizardfishes in general are graded as very good for the preparation of *surimi*.

#### Flatfishes

Fishes belonging to the families Cynoglossidae (tongue soles), Psettodidae (Indian Halibut), Bothidae (flounders) and Soleidae (soles) are popularly known as flatfishes. They are bottom dwelling fishes occupying muddy or sandy bottom of shelf areas. The average annual landings of flatfishes was 44,788 t (7.1%). They contributed the maximum from southwest coast particularly Kerala (46.3%). Among all the species of flatfishes, *Cynoglossus macrostomus* is the most dominant species along the southwest coast. Other major species are *C. bileneatus*, *C. macrolepidotus*, *Psettodes erumei* and *Zebrias quagga*.

#### Goatfishes

The goatfishes (Family: Mullidae) are small sized fishes distinguishable by their bright colouration and a pair of barbels on the chin. The average annual landings was 15,432 t (2.5%). Goatfishes are landed the maximum at Andhra Pradesh (40.0%) followed by Tamil Nadu (37.2%). A total of 16 species are reported to occur along the Indian coast of which the major species contributing to the fishery are *Upeneus vittatus*, *U. bensasi*, *U. sulphureus*, *U. tragula*, *U. taeniopterus* and *Parupeneus indicus*.

#### Whitefish

The white fish (Family: Lactariidae) represented by a single species *Lactarius lactarius* is a good quality fish of consumer preference. The annual average landings amounted to 6,346 t (1%) during 1990-2003 with major contribution from northwest coast (43%) followed by southwest coast (32%) and southeast coast (24%). Stock assessment studies indicated that the current exploitation rate (0.68) is above the optimum level (0.50). Irrational bottom trawling is known to affect the whitefish stock particularly along the southeast coast.

#### Eels

The annual average catch of eels was 7,790 t (1.2%). The landings is high along the Bombay-Saurashtra coast. *Muraenosox talabonoides* (wam) is the major species represented in the catch. They are caught in trawl, bag net and long line.

#### Non-conventional fishery resources

Exploratory surveys conducted along the Indian EEZ has shown that there is abundance of non-conventional fishery resources such as bulls eye (*Priacanthus* spp), Indian drift fish (*Ariomma indica*), and

Black ruff (*Centrolophus niger*) in waters of 300-500m depth along the EEZ of India where an estimated potential of 71,200 t of these fishes is reported.

#### Harvestable Potential

The estimated potential yield and current yield of major demersal fishes along the Indian EEZ are presented in Table 1. It may be seen that most of the resources except the perches are exploited to the optimum level from waters upto 50 m depth. Beyond 50 m depth, the major potential groups are elasmobranchs (1,03,000 t), catfishes (63,000 t), sciaenids (22,000 t) and pomfrets (12,000 t).

Table 1. Yield and Potential Yield of major demersal finfishes of India

Groups/Year	Yield (000 t)		Potential Yield (000 t)		Total Potential Yield (000 t)
	2002	2003	< 50m depth	> 50 m depth	
Elasmobranchs	59.8	58.3	65	103	168
Catfishes	58	56	60	63	123
Lizardfishes	27	29	27	21	48
Perches	153	137	114	125	239
Goatfishes	12	12	20	0	20
Croakers	125	125	120	22	142
Silverbellies	62	52	82	4	86*
Pomfrets	41	40	42	12	54
Soles	40	46	38	0	38

\* Including Andaman & Nicobar Islands.

#### Ornamental fishery resources

The marine ornamental fishery resources of Lakshadweep Islands were evaluated for their species diversity and stock size. The estimated stock size for a total of 165 species was 13.7 million numbers while the maximum possible yield was 8.6 million numbers represented by damselfishes (63.0%), parrotfishes (14.5%), surgeonfishes (9.0%), wrasse (6.2%), butterfly fishes (1.2%), goatfishes (1.4%), squirrel fishes (0.9 %) and others (0.4%).

#### Impact of climate change on demersal fishes

The global phenomenon of climate change caused by the trapping of heat by the greenhouse gases tends to have an impact on fisheries and aquaculture. In the marine ecosystem, the change in climate through increase in temperature can adversely affect the major environmental factors such as current, salinity and productivity. Since each of the marine fish species has a specific temperature regime, a change in the same can alter the breeding season and migration pattern, which in turn can shift the timings and location of annual peak abundance and thus fishery catches. The increasing number of storms causes loss of seagrass and its associated species. There will be a decrease in the recruitment of benthic and demersal fishes, which will alter the food web pattern, biodiversity and status of stocks.

#### Conclusion

As may be seen from the foregoing description, the diversity of demersal fishery resources available along the productive neretic waters extending to an area of 4,49,400 km<sup>2</sup> along the continental shelf (0-200m depth) offer a very promising potential to the marine fisheries sector in the country. Moreover, most

of the demersal finfish resources are highly fecund with protracted spawning season thus making up for the loss due natural mortality of the resource. However, major resources such as elasmobranchs, catfishes, major perches, silver bellies, pomfrets and whitefish are showing signs of decreasing trend in their landings. This situation is created because of the continuous scraping of the bottom destroying the ground fish, their favorite benthic food items and the exploitation of juveniles resulting in growth overfishing and capture of brooders leading to recruitment overfishing. Therefore, it is hightime that management measures such as enforcing mesh size regulation and gear regulation, observing closed season, identifying and declaring closed areas, and minimizing bycatch/discards from the inshore waters are implemented. Added to this, the impact of climate change may be dire and hence steps such as monitoring the oceans and biodiversity be conducted and vulnerability studies on marine ecosystem and species carried out.

#### **Suggested Reading**

- Mohan Joseph, M. and A.A. Jayaprakash (Eds). 2003. Status of Exploited Marine Fishery Resources of India. Central Marine Fisheries Research Institute, Kochi, 308 pp.
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