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An overview on the present status and future prospects of demersal finfish resources in India

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ABSTRACT

With the introduction of mechanized bottom trawling from the late fifties, the exploitation of demersal finfishes attained a 2.7- fold increase during late eighties (0.52 million tonnes). But the proportion of production went down from about 32% of the total in 1981 to about 22% in late eighties. The resources which were exploited to the optimum in the 0–50 m depth zone during 1985–89 were sciaenids, silver bellies, elasmobranchs, pink perch, lizard fishes, goat fishes, threadfins, eels, etc. As a result of intensive coastal trawling and introduction of gears such as purse seines, resources like catfishes, the whitefish, *dara, karkara, koth, ghol, wam* and flatheads declined in production. This was chiefly due to recruitment over - fishing resulting from the destruction of juveniles as well as the trampling of the bottom habitat. As per recent estimate, only a marginal increase in production of demersal finfishes from the presently exploited zone was possible, whereas from the deeper waters about 300 000 tonnes consisting of elasmobranchs, major perches, pink perch, catfishes, lizard fishes, etc appeared possible. For the efficient exploitation and utilization of these resources to be harvested, it is essential to develop adequate infrastructure facilities, post harvest technology, value-added products, domestic marketing and export. Since the large-scale bottom trawling has been leading to deleterious effect on certain vulnerable finfish resources, there is imminent need for imposing certain controls on fishing in the inshore waters.

When compared with pelagic resources, proper exploitation of the demersal finfishes in India has been a recent development. Prior to introduction of mechanized bottom trawling in the late fifties, the average annual demersal finfish production was only about 0.08 million tonnes. During the third Five-Year Plan period (1961–65) there was an increased effort for mechanized commercial trawling, marking a turning point in the development of demersal fishing. Ever since, the proportion of production by mechanized vessels has increased from 19% of the total in 1969 to about 81% in 1989. The demersal finfish component also has increased steadily from about 0.19 million tonnes in 1961 to 0.25 million tonnes in 1970, 0.42 million tonnes in 1977, 0.45 million tonnes in 1982 and 0.52 million tonnes during 1985–89, thus registering about 2.7 fold increase over about three decades.

However, as a result of these developments, certain problems and constraints have surfaced, both in the sphere of exploitation and of management and conservation of the resources. This paper draws attention to the need of certain control in fishing.

Brief history of exploitation

The demersal habitat is abundant in finfishes almost throughout the continental shelf, with particular dominance in the shallow waters up to about 50 m depth. The important groups are: rays, sharks, skates, flatfishes, Jew fishes, perches, catfishes, silverbellies, lizard fishes, flatheads, etc. They inhabit sandy, muddy, rocky and coral areas, from intertidal to deep abyss, throughout the geographical regions and in all seasons. The

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traditional crafts and gears were designed to suit the local sea conditions and hence varied in structure and size; non-rigid crafts along the east coast and rigid ones along the west. The traditional gears are: shore seines, bottom - set gill nets, drift nets, fixed stake nets, cast nets, traps, hand lines, long lines, etc. During 1947–48 the annual demersal finfish production amounted to about 0.08 million tonnes and during the fifties it ranged between 0.15 and 0.18 million tonnes, forming an average of about 24%, all by traditional crafts and gear.

The progress in mechanization resulted in more than 8 000 vessels in the mid seventies, 19 000 in early eighties and 23 000 in late eighties, most of them of about 7.5 – 14 m OAL and using bottom trawls, gill nets, dol nets, etc within about 50 m depth. Also, there was a notable increase in the number of indigenous crafts: from about 90 000 in early sixties to 106 500 in early seventies, 141 000 in early eighties and 170 000 in late eighties, especially plank-built boats and catamarans. Purse seines were introduced on a commercial scale in 1977, first in Karnataka and Goa and later in Kerala. Motorization of traditional crafts commenced during the seventies, with plank-built boats in Maharashtra, Gujarat and Tamil Nadu, followed by dug-out canoes and catamarans fixed with outboard motors in Kerala in the eighties; and numbering about 15 300 in late eighties. The eighties have also witnessed the introduction of beach-landing crafts made of fibreglass by the Bay of Bengal programme of the F A O, for operating in the surf- beaten coasts of Tamil Nadu and Andhra Pradesh.

Present status

As a result of the above developments, the demersal finfish production increased significantly, from 0.26 million tonnes in 1970 to 0.42 million tonnes in 1977, and their proportion varied between 21 and 35% of the total in the seventies. But, inspite of the increase in the total fish production during the eighties, reaching a peak of 2.2 million tonnes in 1989, the demersal proportion declined to 28% during late eighties. Besides, although there was a steady increase in mechanized vessel's production from 19% in 1969 to 81% in 1989, there was no marked increase in demersal finfish production. This was chiefly due to the concentration of the effort to the much more lucrative shrimps for the export markets. However, there was an initial increase in catfish yield but this was followed by a decline. There was also an emergence of new fisheries for the pink perch from early eighties and for the goat fishes from early nineties. These operations have also resulted in the decline of resources such as the whale shark, the *dara*, *karkara*, *koth*, *ghol*, *wam*, whitefish, etc.

The demersal finfishes are being exploited from within about 50–70 m depth. But during favourable conditions, the medium sized trawlers venture to 120 or even up to 150 m depth, specially for target groups with export markets, such as cephalopods. And, the present status of exploitation within the exploited zone of up to about 70 m depth may be considered as follows:-

Resources under optimum exploitation

SCIAENIDS: The Jewfishes occured up to about 90 m depth, formed the largest single group (about 20% production) and were vulnerable to trawl nets, gill nets and many artisanal gears. About 14 species contribute to the bulk with an average annual yield of 102 900 tonnes, mostly from Gujarat, Maharashtra, Tamil Nadu, Andhra Pradesh and Kerala (G.O.I.1991). The production trend indicate that the yield from the 0–50 m depth areas has become more or less stabilized. The stock assessment exercises have shown that in the inshore waters of northwest coast some reduction in effort is needed for

Otolithes cuvieri, *Johnieops macrorhynus* and *J. vogleri* whereas in Kerala and Tamil Nadu, the effort can be increased for *J. sina*. A marginal increase of about 18 000 tonnes from the presently exploited region appears possible.

SILVERBELLIES: During 1979–83, the estimated average annual landings of silverbellies were 69 000 tonnes. Exploited by trawl nets and artisanal gears, this group formed about 12% of demersal finfish production. Maximum yield was from Tamil Nadu (about 71%) followed by Andhra Pradesh (9%), Kerala (8%) and Karnataka (6%). Among 20 species, *Leiognathus bindus* and *Secutor insidiator* were the most dominant in Andhra Pradesh and northern Tamil Nadu, contributing to 64% and 55% respectively of the landings. The recent stock assessment studies on these species have shown that in Andhra Pradesh and northern Tamil Nadu the current effort may be maintained for optimum yield whereas in southern Tamil Nadu there is scope for a marginal increase.

ELASMOBRANCHS: The sharks, rays and skates, accounting for about 54 000 tonnes (10.5%) of demersal finfishes, were mostly caught in Tamil Nadu, Gujarat and Maharashtra and exploited by trawls (80%) and drift nets (19%). Sharks accounted for about 60%, rays 35% and skates 5% with the first category more dominant in the west coast but the second one more in the east. The important species were *Carcharinus sorah*, *C. limbatus*, *Rhizoprionodon acutus*, *Sphyrna blochii*, *Rhynchobatus sp*, *Dasyatus sp*, *Aetobatus sp*, *Rhinoptera* sp., etc. The fishing pressure appears to have reached the optimum, although a marginal increase is possible.

PINK PERCH: Also called threadfin breams (*Nemipterus* spp.), these were abundant in the shelf and slope waters up to 200 m depth and were exploited mostly by trawl nets. The annual production increased from an average of 22 250 tonnes during 1980–83 to 48 100 tonnes during 1984–88 and to a peak of 82 100 tonnes in 1990. Kerala contributed to the maximum (52%), followed by Maharashtra (14%), Tamil Nadu and Pondicherry (11%), etc. *N. japonicus* was most abundant in Tamil Nadu, Karnataka, Maharashtra and Gujarat and *N. mesoprion* in Andhra Pradesh and Kerala, especially from deeper areas. Stock assessment studies show that from the presently exploited 0–50 m depth zone there is no further scope for increasing the production.

MAJOR PERCHES: Belonging to the families Serranidae, Lutjanidae and Lethrinidae, this group was abundant in the rocky grounds off Kerala and Tamil Nadu and was exploited by drift nets, hooks and lines and traps. The annual average production during 1985–89 was about 30 000 tonnes (5.7%) composed of *Epinephelus diacanthus*, *E. tauvina*, *Pristipomoides typus*, *Lethrinus nebulosus*, *Lutjanus lineolatus*, *L. argentimaculatus*, etc. The rocky areas of the Wadge Bank (12 000 km^2) and Quilon Bank (3 300 km^2) harboured rich concentrations. Probably with increased effort for these resources there, the production can be increased considerably. Although accurate estimates are not available, it appeares that about 40 000 – 60 000 tonnes of additional major perches can be caught annually.

FLATFISHES: The average annual production was about 30 000 tonnes (5.7%), with particular abundance in Kerala, Karnataka, Maharashtra and Tamil Nadu. These were abundant in muddy and/or sandy bottom up to about 80 m depth belonging to genera such as *Cynoglossus*, *Psettodes*, *Pseudorhombus*, *Bothus*, *Paraplagusia*, etc. and exploited by trawl nets, gill nets and other artisanal gears. A marginal increase of about 8 000 tonnes is possible from the present fishing range.

LIZARD FISHES: This group, composed mostly of *Saurida tumbil* and *S. undosquamis*, accounted for about 21 000 tonnes (4%)

annually, mostly from Kerala, Tamil Nadu, Karnataka and Maharashtra, and was exploited by trawl nets, hooks and lines and gill nets. A further marginal increase of about 6 000 tonnes is possible.

GOATFISHES: With an annual yield of 8 000 tonnes during 1985–89, this group has three important genera in India, *Upeneus*, *Parupeneus* and *Mulloidichthys*. These were exploited by trawls and traditional gears mostly in Tamil Nadu, Andhra Pradesh, Kerala, Karnataka and Maharashtra.

THREADFINS: Two genera of polynemids, *Eleutheronema* and *Polynemus* were responsible for the bulk of threadfins, with an average annual production of 6 500 tonnes, mostly in Gujarat, Maharashtra and Andhra Pradesh.

EELS: These were particularly abundant in Gujarat and Maharashtra, the average annual production, composed of *Congresox talabanoides* and *Muraenesox cinereus* was 5 000 tonnes.

Resources currently overexploited

CATFISHES: Accounting for an annual average of 50 630 tonnes (9.8%), this group is abundant in muddy grounds of 20 – 70 m depth zone and migrates both horizontally (parallel to the coast) and vertically. Among about 23 species under three genera, *Tachysurus*, *Osteogeneiosis* and *Batrachocephalus*, only about 10 are commercially exploitable and harvested by trawls, gill nets, hooks and lines, purse seines and a wide variety of traditional gears. They migrate from north to south during southwest monsoon and south to north during the post monsoon; and are abundant in Gujarat, Maharashtra, Karnataka, Kerala and northeast coast. But, large-scale exploitation by purse seines along Karnataka has resulted in mass destruction of the brooders and to recruitment-overfishing in Karnataka and Kerala in the recent past. Since the resource is migratory and as most species have a long life span, the above impact is reflected in other parts of the country also. The average production has declined from about 8 060 tonnes during 1979–83 to only about 4 070 tonnes during 1984–87 (James *et al.* 1989). An estimate revealed that within the two months of September–October every year, on an average, more than 8 million eggs and early juveniles of *T. tenuispinis* (13 tonnes) are destroyed. This led to a considerable reduction in the recruitment to the commercial catches during 1986 and 1987.

THE WHITEFISH: Also called butterfish, *Lactarius lactarius* is another resource that has been overexploited in the inshore waters by modern trawling. Although distributed all along the coastline, it has been supporting notable fisheries along the southwest and southeast regions. On an all India basis, the fishery assumed importance from the late fifties and reached a peak production of 25 334 tonnes in 1985. Thereafter, there was a steady decline, reaching 6 685 tonnes in 1989, although slightly recovering later. The decline was so marked in the southwest coast that in a single centre, Vizhinjam alone, the production which stood at 62.4 tonnes in 1970 had fallen to a meagre 0.1 tonne in 1979 (Luther *et al.* 1982).

CERTAIN OTHER RESOURCES: Published information and unpublished data have shown that the *dara (Polydactylus indicus, Polynemus heptadactylus), karkara (Pomadasys hasta), koth (Otolithoides brunneus), ghol (Protonibea diacanthus)* and *wam (Congresox talabanoides, Muraenesox cinereus)* have dwindled in production in Gujarat and Maharashtra (Kagwade 1989, Bensam and Menon 1991). The whale shark *Rhincodon typus* found usually in Gujarat waters has been overexploited and has reached to an endangered status (James 1991). The flathead *Platycephalus maculipinna* is another species

that has been overexploited along the southwest coast. Studies have indicated that the major cause for the decrease in production is its indescriminate exploitation and mass destruction of its spawners and juveniles from the breeding and feeding grounds by coastal trawlers (Bensam and Menon 1991).

Scope for further increasing production

As per the recent reports and estimates (G.O.I. 1991), an increase of about 103 000 tonnes of elasmobranchs, 65 000 tonnes of pink perch, 63 000 tonnes of catfish, 60 000 tonnes of major perches, 21 000 tonnes of lizard fishes, 4 000 tonnes of silverbellies, goat fishes, etc is possible beyond the 50 m depth of the continental shelf. Also, considerable quantities of bull's eye (*Priacanthus* spp), black ruff (*Centrolophus niger*), drift fish (*Ariomma indica*), etc are available from within the shelf region of 50 m to still deeper waters up to 200–500 m. According to Bande *et al.*(1990), the potential yield of bull's eye from the Indian E E Z is around 79 000 tonnes. The exploratory surveys of the FORV *Sagar Sampada* have revealed that high fishable concentrations of the pink perch are available off southwest coast, amounting up to a CPUE of 2.67 tonnes during June–July, 3.5 tonnes during July–August and 8.1 tonnes during September–December in certain locations. The CPUE for bull's eye has been up to 4.9 tonnes in August, 1.5 tonnes in September; for drift fish up to 8.0 tonnes during February; and for lizard fishes up to 750 kg during June (James and Pillai 1990).

It is thus obvious that in addition to the marginal increases of certain resources from the presently exploited region up to about 50–70 m depth, the sole alternative for increasing demersal finfish production is from the region beyond the presently exploited zone. For their judicious exploitation and utilization, it is essential to identify and improve upon the designs of the crafts and gears to be used in space and time.

For optimum utilization and streamlined development of any fishing industry it is essential to pay adequate attention to post-harvest and utilization aspects, both in the domestic and export markets. This is especially so in the case of demersal finfishes which generally fetch lower prices than many other quality fishes. Modernization of the existing infrastructure strength and processing facilities have to be undertaken for landing and berthing of vessels, freezing plants, processing units, etc. One reason for the hesitation of entrepreneurs to enter into deep-sea fishing is the non-availability of reliable data on the economics of the operations, which is essential to provide specific and accurate data to ward off uncertainties. Since the operations are capital-intensive, the projects should be cleared without delays; timely funding is needed; and marketing strategies should be made viable. Similarly, for most of the demersal finfishes and their products, there is a lack of adequate storage and processing facilities, resulting in a distinct gap for their internal marketing. Also, the fish transportation system is poorly developed, resulting in very little of the fish harvested reaching the interior markets, inspite of heavy demand. Hence, the precious effort and time of the industry have not brought adequate economic returns.

The domestic marketing for demersal finfishes needs immediate attention and expansion, incorporating product - innovation and development of value-added products. The low-priced sciaenids, soles, lizard fishes, flatheads, bull's eye, drift fish, etc need attention for developing composite fish products, improving the methods of drying, etc. Unless this void is filled up, a part of the fishing efforts for demersal finfishes will remain unac-

counted for. Outlining all these aspects, the CMFRI (1991) prepared a draft document on a Technology Mission for achieving much more development of the marine fishing industry as a whole.

With the large-scale introduction of mechanized trawling, several environmental problems and stock-recruitment hazards to inshore fisheries have come up. The scrapping of the shallow bottom has trampled and damaged the juvenile population of demersal finfishes such as pomfrets, flatfishes, perches, sciaenids, lizard fishes, etc. as well as of the bottom non-edible biota (stomatopods, echiurids, sipunculids, sponges, molluscs, echinoderms, etc) which are the major basis for the food of many edible groups. Since the trawling operations are continuous throughout the year, day in and day out, these have resulted in little opportunity for the biota to reestablish and replenish at the bottom. Thus, the damage to the demersal habitat of finfishes is much more severe than what is estimated.

The destruction of juvenile demersal finfishes has been taking place without any control. According to Bensam and Menon (1991), of the estimated 10% of trash fish production of trawlers in Kerala, 70% are juveniles and subadults of commercially important demersal fishes belonging to about 60 species. As the cod end mesh size of the trawl nets is about 1.5 – 2.5 cm, the juveniles caught are also proportionately high, especially during the breeding and nursery seasons of monsoon and postmonsoon. From these facts it is quite obvious that the shallow coastal waters up to about 50 m depth are the spawning and/or nursery grounds of most demersal finfishes. A comparison of the catch data by trawlers operating in shallow and deeper localities has revealed that the juvenile abundance was higher in shallow areas up to 30 m depth and gradually decreases in the depths of 30 – 50 m and beyond. From these facts, it is obvious that one primary cause for the depletion of once thriving fisheries such as for *ghol*, *koth*, *karkara*, *wam*, whitefish, flatheads, etc is the large-scale destruction of their juveniles. The deleterious effects of large-scale purse seining on the catfish stocks is another aspect that has to be reckoned.

In view of these, it is high time that we identify the resources/species which are under threat of destruction, wherever necessary; monitor the species-wise stock - recruitment pattern, sustainable yield, spawner and juvenile components; delimit the areas and seasons of trawling and purse seining; regulate the cod end mesh size of trawl nets to about 3.5 cm; ban coastal trawling at least up to 30 m depth; encourage the use of vertical, high opening type of nets for avoiding benthic sweeping and juvenile destruction; close purse seining in certain areas and breeding seasons of the resources; wilfully avoid the capture of breeding shoals; educate the fishermen to be eco-friendly and resource-friendly; audit the environment at periodic intervals for conservation and rational management; and involve all the people concerned in these aspects.

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Stock Assessment of Exploited Marine Fisheries Resources of India

Part II - Pelagic Finfish