



Chapter 1

Capture Fisheries of India : Status and Prospects

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1.0 Introduction

India is a major maritime state and an important aquaculture country in the world endowed with 2.02 million km² of Exclusive Economic Zone, 195,210 km of rivers and canals, 2.91 million ha of reservoirs and 7.36 million ha of tanks and ponds, floodplain lakes, and derelict water bodies and brackish water areas. The fisheries sector in India has registered a commendable ten-fold growth during the last 6 decades, propelling the country to the forefront of fish producing nations in the world. Aquaculture has also taken a long leap through innovations in technologies from wild hunting in ancient days. The sector is increasingly contributing to the nutritional security of the country, with the present production of fish and shellfish from capture fisheries and aquaculture being over 8.0 million t. The country also has an important role in global fisheries as the second largest producer of fish in the world. Increase in production of finfish and shellfish from 0.75 million t in 1950-51 to 8.4 million t during 2010-11, demonstrating over 11 times growth in the last six decades, is an evidence to the contributions of the sector. The share of inland fisheries sector, which was 29% in 1950-51, has gone up to over 61% at present. While the marine sector is almost constituted by capture fisheries, aquaculture has been the principal contributor in inland fisheries sector, with a share of 78%. Besides providing livelihood security to over 14 million people, the sector has been one of the major foreign exchange earners, with revenue over Rs. 12,000 crores in 2011-12 accounting for about 18% of the agricultural export. The contribution of fisheries sector, at an overall annual growth rate of 6% (10%, if aquaculture alone is considered) during the previous five year plans is estimated around 1.10% to the GDP and 5.40% to the agricultural GDP.

2.0 Fishing Sector

2.1 Marine sector

The marine fish landings of India during the year 2010 has, been estimated as 3.07 million t. The pelagic finfishes constituted 55%, demersal fishes 26%, crustaceans 14% and molluscs 5% of the total landings. The west coast accounted for 55% of the total landings and east coast 45%. The 2010 estimates has revealed the existence of 1,94,490 fishing crafts in marine sector, of which 24.67% are mechanised, 31.66% are motorised and 43.67% are non motorised type. The sector-wise contributions during the year 2010 were mechanized 73%, motorized 25% and artisanal 2%.

The historical increase in the fish production in the marine sector has been largely due to: (i) introduction of mechanized fishing vessels and synthetic gear materials, and the development of infrastructure for preservation, processing and storage in the 1950s; (ii) expansion of trawl fleet and indigenous boat construction in the 1960s; (iii) introduction of purse-seining, diversification of fishing, development of fishing harbours and expansion of export trade in the 1970s; (iv) motorization of traditional fishing craft, introduction of ring seines and increase in the number and efficiency of craft and gear; acoustic fish detection and satellite-based remote sensing techniques and advances in electronic navigation in the 1980s; (v) substantial growth in the number and efficiency of trawlers and motorized craft, and change in the export trade from resource-based to food-engineering based industry in the 1990s.

The pattern of marine fish landings in India during the past fifty years clearly reveals that the contribution by the artisanal sector to the total production was significant up to the seventies. As a result of the popularization and consequent expansion of mechanized fishing during the subsequent periods along with the motorization of artisanal crafts, the contribution by the artisanal sector declined considerably and the contribution by the mechanized and motorized sectors accounts for 87% of the total catch while the artisanal sectors accounts for only 13% in the recent years. The growth in marine fisheries certainly has led to significant increases in the production, employment generation, domestic and export earnings. The artisanal fisheries sector has dwindled with the advent of mechanization. The contribution to the total catches decreased from an overwhelming 88% in 1960s to about 2% in 2000 and continues to show a decreasing trend.

Trawling is the major gear used to exploit marine resources from all along India's 8,129 km coastline. CMFRI census currently shows that 29,241 trawlers are registered and the states of Gujarat and Tamil Nadu have the maximum number of trawlers. The gillnet catches which ranged from 100,000 to 135,000 t during the 1980s and 1990s, increased by more than 4-times in recent years. Trend in gillnet catch during the last 5 years in India show that the share of mechanized gillnetters (MGN) is increasing as compared to outboard gillnetters (OBGN). Clupeids and croakers are mostly exploited by small meshed gillnets and large

meshed gillnets exploit mostly sharks, seerfishes, mackerels, catfishes, pomfrets, tunas and carangids. Bag nets are a major gear used by artisanal fishers along NW and NE coasts. In Gujarat and Maharashtra, the fixed bag nets called dolnets are operated up to a depth of 40 m by employing mechanized crafts and also outboard engine crafts and currently there are about 8,862 dolnetters. H&L contribute just about 2% of the all India marine fish catch. This gear mainly targets the large pelagic fishes such as sharks, tunas and barracudas. Several development schemes of the government has targeted promotion of H&L fisheries particularly the modern version of longline fishing for tunas. As longline fishing for yellowfin tunas has been proven to be lucrative the world over, and since these resources are relatively untapped from Indian waters, many idle large shrimp trawlers (>17 m LOA) in the NE coast have been recently converted to longliners.

2.2 Inland Sector

The inland water resources of the country constitute, 29,000 kms of rivers, 0.3 million ha of estuaries, 0.19 million ha of backwaters and lagoons, 3.15 million ha of reservoirs, 0.2 million ha of floodplain wetlands and 0.72 million ha of upland lakes, which contribute about 1.05 million tonnes of fish annually from capture fisheries. The capture based fisheries in the inland sector is showing declining trends for the last few years and pollution, changes in the habitat, construction of barriers that affect the migration of many species etc. are some of the causes implicated.

Fishing implements employed for inland fisheries of India are traditional and are mostly of non-selective type. Important types of fishing gears are gillnets, trammel nets, seine nets, cast nets, dragnets, stake nets, lift nets, pole and line, barrier nets, spears and traps. Traditional fish aggregating devices made using locally available materials and aquatic weeds are also in use in inland waters. Fishing with poison and explosives, though prohibited by law, are also common in several areas. Fishing crafts are dugout canoes, plank-built boats and rafts. Coracles using traditional and synthetic materials are prevalent in peninsular reservoirs. Wooden canoes and rafts are being replaced by tin canoes or fibreglass canoes in certain areas.

Opportunities for enhancing yield and production exist in open water bodies like reservoirs and floodplain wetlands. More than 3 million ha of reservoirs in India produce fish at an average of 20 kg/ha. Nearly 1.5 million ha are small reservoirs, where stocking and recapture (culture-based fisheries) can ensure yields up to 500 kg/ha from the present rate of 50 kg/ha. Similarly, enhanced capture fisheries through species and stock enhancement can increase the yield from medium and small reservoirs to 100-250 kg/ha from the present 10-12 kg/ha. A modest stocking rate of 500, 250 and 100 kg/ha/year respectively from the small, medium and large reservoirs of India, can produce nearly 1 million t of fish by adopting fisheries management norms based on scientific advice. The strategies intended to be pursued in reservoirs are: stocking with fingerlings of carps and other relevant species, provision of adequate rearing space for fingerling production, cage and pen culture, appropriate/

improved fish harvesting gear and crafts, post-harvest management (storage, transportation and marketing) and manpower development for reservoir fisheries managers and skill development among fishers.

Indiscriminate fishing, increased sedimentation of the river bed, water abstraction, environmental degradation, marked alteration in river courses have caused sharp decline in the catch rate of riverine capture fisheries. Scientific management measures are needed to prevent over-fishing and to ensure sustainability of the resources.

2.3 Coldwater Sector

The contribution of coldwater fisheries to the national fish basket is low, which is of high-value and low-volume category and the projected volume is of the order of 1%. The coldwater capture fisheries in upland water-bodies are poorly developed primarily due to low natural fish yield, difficult terrain and inaccessibility. Immediate programmes would need to be put in place with regard to establishment of small hatchery units for seed production of trouts, mahseers and snow-trouts; mid-altitude exotic carp farming; integrated fish farming with agriculture, horticulture and livestock; and development of sport fishery in streams and high altitude lake. Mixed carp farming technology involving different Chinese carps in mid-hills between an altitude of 900-1740 MSL giving a yield of 1000-2000 t/ha., has been taken up by the private sector extensively along central and North-eastern Himalayan uplands. New composite carp farming involving exotic carps namely grass, silver and common @ 3-4 fishes/m² in a combination of 40-45%, 20-25%, 35-40% and 10% either rohu or chocolate mahseer with a supplementary feed of 2-3% body weight with lime and organic fertilizer is also becoming popular along north-eastern uplands. Cold water bodies offer hotspots for establishing sports fishing as many of the most sought after game fishes are found in the cold water bodies.

3.0 Transition of the Fishing Industry

The fishing industry in the last five decades has witnessed significant developments with improvement and modernization of boats, fishing gears and other equipment, enhancing the fishing capacity, improving the working conditions and reducing the drudgery of fishermen. Timber such as teak (*Tectona grandis*) and jungle jack (*Artocarpus hirsuta*) were the most common materials used in vessel construction until the 60s. The scarcity of conventional boat building timbers pave way for development of suitable preservative treatment technologies to make alternate timber species such as rubber wood which is an agricultural byproduct of rubber plantations, suitable for construction of fishing canoes for operation in backwater and inshore areas of the sea. Non-availability of quality timbers at reasonable price, difficulties in maintenance of wooden crafts and government policy of forest conservation spurred studies by CIFT and the Bay of Bengal Programme (BOBP) on alternative materials for vessel construction such as plywood and Fibreglass Reinforced Plastic (FRP) which have emerged as viable alternatives and contributed to development of

the sector. Adoption of synthetic fibre fishing gears, development of different gears like four-seam trawl and bulged-belly trawl which could increase the catching efficiency by about 30%, methods such as stern trawling, out-rigger trawling, midwater trawling purse-seining, long lining and introduction of specialized gill nets for lobster fishing have played a significant role in the fisheries development in India. The introduction of high opening bottom trawls has reduced the dependence of trawlers on shrimps as the chief revenue earner and cuttlefishes and squids have also emerged as principal income earners. With the advent of mechanization during the 1970s, the purse seines with larger nets and power blocks became the method of choice along the SW coast. A modification to the traditional boat seine vessels to make it more efficient was the mini purse seines or locally called as the ring seine which has become the most popular seining method for the pelagics along Kerala coast. Currently there are close to 1000 purse seiners mainly in the states of Karnataka (>50%), Goa and Maharashtra and more than 2000 ring seiners mainly in the states of Kerala (>70%) and Tamil Nadu.

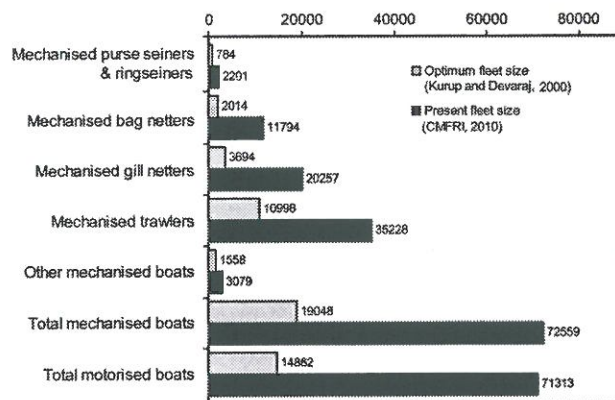
Fish detection gadgets introduced in large boats with facilities for proper gear handling for enhancing their efficiencies have also added a new dimension for enhancing the catch per unit effort of specific gear and craft. Multi-day fishing rather than daily fishing; mother ship and carrier boat operations wherever practical, are the fuel saving practices that are being implemented in fleet operations along the Indian coasts today. Recent advances in technology have also provided fishermen with equipment such as Global Positioning System (GPS) to reach the potential fishing grounds accurately; detect the presence of fish and monitor the success of capture process acoustically (echo sounder, sonar, gear monitoring systems) thereby minimizing the search time and fishing time and hence saving energy. Information on Potential Fishing Zones (PFZ) based on inputs from National Remote Sensing Agency (NRSA) for sea surface temperature (received from NOAA satellite AVHRR imageries) and ocean colour (from OCEANSAT) are being provided to fishermen by State Fisheries Departments in collaboration with research organizations like Indian National Centre for Ocean Information Services (INCOIS), CMFRI and CIFT. Fish Aggregating Devices (FAD) which have shown the potential for saving fuel and scouting time, in purse seining, hand lining, pole and line and gillnetting in different parts of the world are also becoming increasingly popular among artisanal fishermen as a way of getting better catches and saving fishing time in the face of increased competition from mechanized craft which are operating in the same fishing ground in inshore waters.

4.0 Problems and Issues

The fishing sector through its transition to the present level has brought along many problems too. Overcapitalization, excess fishing effort, declining catches, high energy use, high rate of bycatch and discards and over exploitation of resources to the level of depletion of certain species, habitat degradation, illegal, unreported and unregulated (IUU) fishing, indiscriminate fishing, increased sedimentation of the river bed, water abstraction, environmental degradation, marked alteration in river courses and poor implementation

of regulations are the major issues prevalent in the sector.

A major problem affecting the Indian marine fishing industry is the excess fishing capacity which affects long term sustainability of fishery resources and feasibility of fishing operations. Excess fishing capacity in terms of number of fishing units added to the fleet, increase in vessel and gear dimensions, increase in engine horse power, better efficiency of fishing gears and addition of sophisticated navigation and fish finding equipments caused increased fishing pressure on the resources. From 1999, the trawlers are also employed for deep sea fishing up to 400 m depth by modifying the winch drum and the trawl net. The estimated optimum fleet size in 2000 for Indian waters were 62748 consisting of 10998 mechanised trawlers, 784 mechanised purse seiners, 3694 mechanised gill netters, 2014 mechanised dolnetters, 1558 other mechanized boats and 14862 motorised crafts (Fig. 1). As per 2010 statistics there were 35228 trawlers, 20257 mechanised gillnetters, 11794 mechanised bag netters, 2201 mechanised purse seiners and ring seiners and 3079 other mechanized boats together accounting to 72559 mechanised boats besides having 71313 motorised boats against an optimum requirement of 14662. Thus at present, the trawler fleet is in excess by a factor of 3.2, purse seiners and ring seiners by a factor of 2.8, gill netters by 5.5, mechanized bag netters by 5.9, other mechanized boats by 2 and motorized boats by a factor of 4.8 of the optimum requirement. While the number of trawlers increased twice, the estimated efficiency (engine horsepower) increased by nearly 4 times, from 951,200 hp in 1980 to 3,448,570 hp in 1998.



Source: Boopendranath (2012)

Fig.1. Magnitude of excess fishing fleet in the marine fisheries of India

High rate of bycatch and discards is another major problem which has substantial economic and biological consequences in the ecosystem. The 2004 estimates of total bycatch discards in Indian fisheries was at 57 917 t, which formed 2.03% of the total landings. The 2010 estimates of the bycatch discards of Indian trawlers was at 1.2 million t.

Many of the modern fishing systems are highly energy intensive resulting in high operating

costs as well as polluting the ecosystem releasing large amounts of carbon dioxide. Annual fuel consumption by the mechanized and motorized fishing fleet of India has been estimated at 1220 million litres which formed about 1% of the total fossil fuel consumption in India in 2000 (122 billion litres) releasing an estimated 3.17 million t of CO₂ into the atmosphere at an average rate of 1.13 t of CO₂ per tonne of live-weight of marine fish landed. CO₂ emissions per kg of fish landed in India have been estimated to range from 0.3-1.02 kg in traditional motorised operations undertaking ring seining and mini-trawling, 0.17 to 0.99 kg in small-scale mechanised operations undertaking purse seining, gillnetting-cum-lining and bottom trawling, to 0.87-3.52 kg in large-scale mechanised operations undertaking aimed midwater trawling and bottom trawling.

In the inland sector, using deleterious fishing methods and very small mesh nets such as mosquito netting are reported from many pockets. The continuous operation of gill nets have put pressure on the economically important fishes in reservoirs and resulted in the proliferation of the less economic species of fishes. Mitigation measures include improving the selectivity of fishing gears, prevention of damaging fishing practices such as use of explosives, regulations such as mesh size regulation, closed seasons etc. and optimization of fishing effort in our water bodies.

5.0 Way Forward

In order to achieve the targeted 9.9 million t of fish by 2012 and 12.7 million t by 2020, concerted efforts are needed to put aquaculture on a higher growth trajectory and at the same time ensuring conformity with the norms of sustainability and equity. Major highlights of the future strategy would include value chain approach for fishing high value species with suitable consortia of private-public partnerships, where inland ecosystems will be in focus. Capacity enhancement for deep sea fishing and maximizing the benefits from the Indian EEZ, potential sites for mariculture, both open and enclosures, with due backward linkages in terms of quality seed of finfish/shellfish to harness the vast potential along the Indian coast, diversification of species in coastal aquaculture and consortia approach for production of inputs such as quality seed, feed, diagnostics and health management measures, open water fisheries management with due recognition of the potentials of inland aquatic resources, habitat restoration and fish conservation in marine and inland ecosystems, water management including pollution management, bioremediation and multiple use of waters, fish genomics and breed improvement for enhanced aquaculture productivity, assured provision of quality inputs such as seed, feed, fertilizers, drugs, integrated farming, aquaculture as a tool for treatment of domestic sewage, aquaculture in degraded systems like inland saline waters, ornamental fisheries and allied aspects like pearl culture, sport fisheries, mechanization of farming practices, aquaculture at par with agriculture, effective cold chains and market models suitable for different practices in inland fisheries and

aquaculture, customized fish product development to suit different preferences in the country, promotion of fish as health food through specially made studies and media interactions, fish and shellfish seed certification and hatchery accreditation, comprehensive fisheries policies and acts for both regulating open water fisheries and enabling productivity enhancement in culture systems and necessary capacity building and skill development.

The future of the sector would depend on a concerted management strategy for the long term sustainability of the system. This necessitates sustainability of the fishery resources, continued optimization of selective and eco-friendly fishing gear for marine, inland and the aquaculture sector, conservation of biodiversity through optimization of fishing efforts, reduction of bycatch and discards, development of harvest and post-harvest technologies for the non-conventional deep sea resources, energy conservation in fishing systems and chalking out suitable management measures for reducing the excess fishing effort.

Unconventional resources such as oceanic cephalopods and myctophids may become significant seafood resources, in the next few decades. There is a great scope for oceanic purple back oceanic squid *Sthenoteuthis oualaniensis* fisheries in India. The squid fishing grounds are identified in the Arabian Sea in depths ranging from 100 to 4,000 m. The area around the Lakshadweep Islands is a major spawning ground for oceanic squids. There is very good myctophid fishery supported by *Diaphus watasei*, *Diaphus garmani*, *Benthosema fibulatum*, *Myctophum obtusirostre* of the family Myctophidae and *Neoscopelus microchir* of the family Neoscopelidae around Indian seas. Appropriate technology for their sustainable harvesting, value addition and utilization are to be developed.

The fishing pressure in the shelf and deep seas is to be controlled by reducing the fishing capacity of individual fishing units, in the motorised and mechanised sectors, and regulating their number in tune with the potential yield estimates. Conservation technologies for minimising negative impacts of fishing on resources, biodiversity and environment through technologies for bycatch reduction, protection of vulnerable species, minimising energy use in harvest and post-harvest operations and minimising environmental impacts are to be standardized and implemented. Low impact and fuel efficient fishing systems are required to be further developed. The regionalisation and implementation of the FAO Code of Conduct for Responsible Fisheries, adoption and implementation of Ecosystem based Fisheries Management (EFM) and effective control of illegal, unreported and unregulated (IUU) fishing is essential.

Factors affecting riverine fish production such as pollution, destructive fishing and overfishing need to be addressed. Reservoirs in India are considered to be a growing resource with enormous potential for yield augmentation through capture fisheries and extensive

aquaculture. The overall production from Indian reservoirs could be substantially raised, with adequate management measures such as optimum fishing effort, responsible fishing, stocking support and mesh size regulation

6.0 Conclusion

Despite the impressive growth rates in the early 60s till the early 90s, the production from the marine capture sector started to stagnate after this period. Burgeoning of the capacity and increase in the fishing power, coupled with use of unsustainable methods of capture are some of the reasons attributed to the stagnation in the marine capture. Pollution, habitat degradation and cascading effect of dams and weirs are some of the most important issues in the capture fisheries in the Inland waters. Development and implementation of suitable policy interventions to ensure sustainability of resources like establishment of MPA, FAD, and adherence to EBFM, use of BRDs, capacity reduction, diversification of fishing methods and areas in the marine sector and developing suitable mitigation plans with EIA studies in the inland sector will help in sustaining the fish production from the marine and inland capture. Developing suitable products and utilization of by-products and converting into useful products, establishing strong market linkages, and exploring and penetrating the domestic and International markets will significantly enhance the revenue realized from the fishing operations.

7.0 Further reading

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