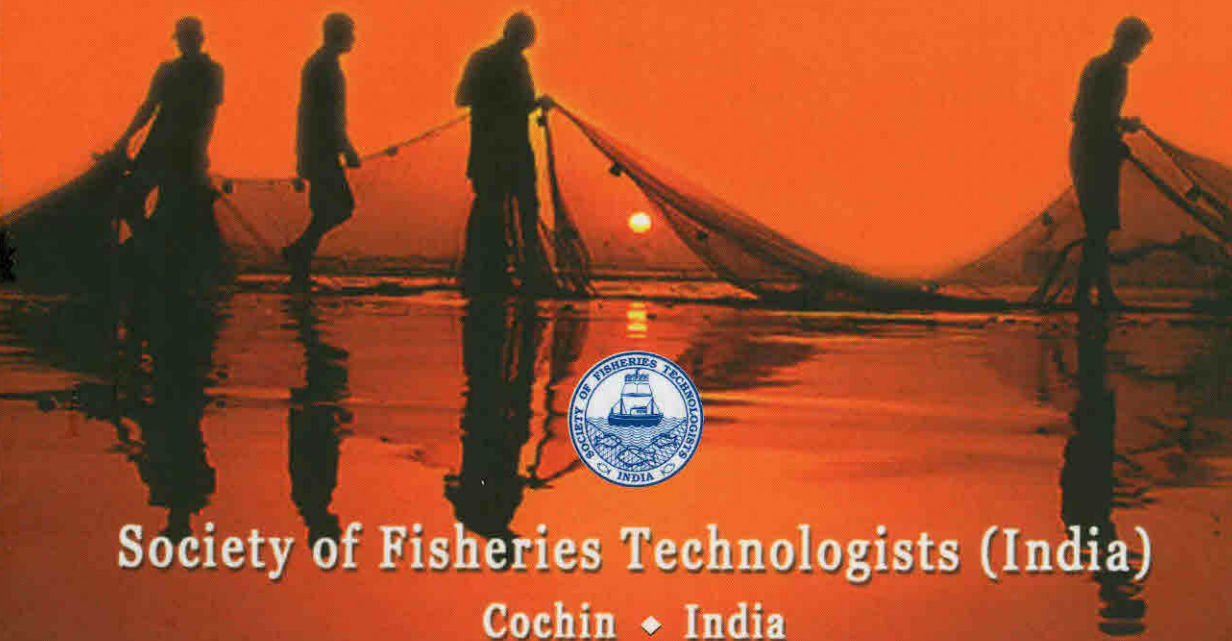


Coastal Fishery Resources of India

• Conservation and Sustainable Utilisation



Society of Fisheries Technologists (India)

Cochin ♦ India

Coastal Fishery Resources of India: Conservation and Sustainable Utilisation

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Responsible Fishing in Coastal Fisheries of India

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Introduction

Marine fishery potential of the Indian Exclusive Economic Zone (EEZ) is estimated at about 3.93 million t. About 58% of the resources is available at a depth of 0-50 m, 35% at 50-200 m and 7% from beyond 200 m depth (MoA, 2000). The marine fish landings in India has increased from 0.58 million t in 1950 to 3.2 million t in 2008, which forms about 82% of the estimated fishery potential (Fig. 1). India's exports of marine fish and fish products rose from Rs. 25 million in 1950-51 to Rs. 86079 million during 2008-09. Shrimps constitute 21% of the exports in terms of volume and 44% in terms of value (MPEDA, 2010). The export base has diversified to frozen fish, squid and cuttlefish, and dried, live and chilled fish products.

The decreasing trend evident in many of the capture fisheries resources, stresses the need for a scientifically planned resource management practices for sustainable fish harvesting in India. Improved knowledge of resources, transfer and use of new technologies aiming conservation, better handling and processing facilities to avoid wastage and improved training of the skilled personnel are required to manage and conserve the aquatic living resources effectively. The multi-species and multi-gear fishery in India needs varied and efficient management methods for its sustainability. Dynamic developments that took place in the harvest technology sector in the last few decades and the introduction of powerful and highly efficient fish harvesting systems and fish detection methods have contributed significantly to the nutritional, economic and social well being of the people in India. The fishing pressure has increased uncontrollably and at present we are facing signs of overfishing and negative impacts of fishing on the ecosystem. Responsible fishing would

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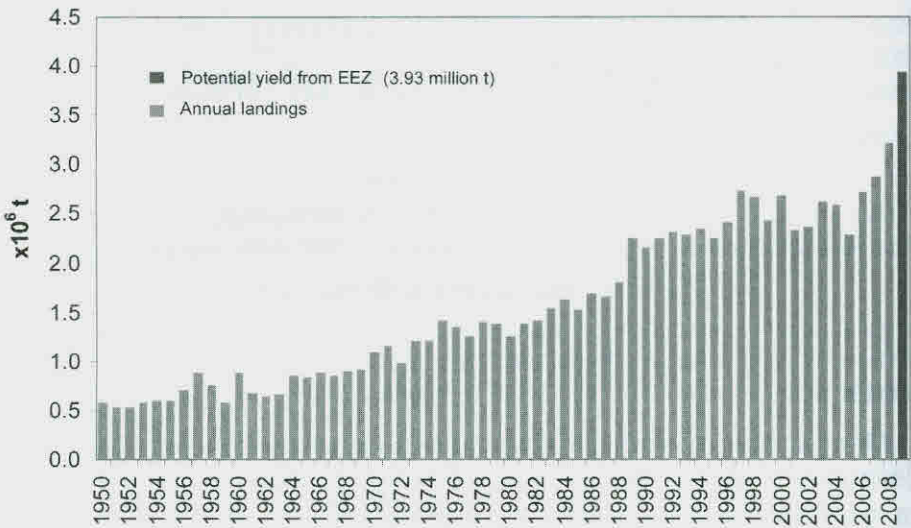


Fig.1 Marine capture fish production in India (source of data: CMFRI; MoA)

ensure the long-term sustainability of resources and its availability to future generations. The Code of Conduct for Responsible Fisheries is a voluntary agenda which sets out principles and international standards of behaviour for responsible practices to ensure sustainability of living resources.

The Comprehensive Marine Fishing Policy of Government of India (DAHD, 2004) was aimed to (i) augment marine fish production of the country up to the sustainable level in a responsible manner so as to boost export of seafood from the country and also to increase per capita fish protein intake of the masses, (ii) to ensure socio-economic security of the artisanal fishermen whose livelihood solely depends on this vocation, and (iii) ensure sustainable development of marine fisheries with due concern for ecological integrity and biodiversity.

Responsible fishing

Article 8 in the FAO Code of Conduct of Responsible Fisheries (CCRF) (FAO, 1995) is elaborated in FAO Technical Guidelines for Responsible Fisheries 1: Fishing Operations (FAO, 1996). The Article 8 include duties of all states, flag state duties, port state duties, fishing operations, fishing gear selectivity, energy optimization, protection of aquatic environment, protection of the atmosphere, harbours and landing places for fishing vessels, abandonment of structures and other materials, and artificial reefs and fish aggregation devices. FAO Code of Conduct

for Responsible Fisheries provides the following pointers for sustainable fishing operations in Indian waters (FAO, 1995; 1996; CIFT, 2007; Boopendranath, 2009):

- Evolve regionalized consensus Code of Conduct for Responsible Fishing, in close participation with all stake holders (traditional, motorized and mechanized fishermen organizations), fisheries research organizations and fisheries managers.
- Maintain registry of all fishing vessels in waters under State jurisdiction with all essential details.
- Take measures to control open access by strict enforcement of a system of licenses (authorization to fish) in traditional, motorized and mechanized sectors.
- Periodically revalidate maximum sustainable yield of resources in the existing fishing grounds and determine fishing units of specific capacity in each category, for sustainable harvesting of resources.
- Standardise the capacities, dimensions and specifications of fishing units in each category.
- Address the question of excess capacity squarely and take steps to remove excess capacity over a time schedule.
- Identify and delimit Protected Areas in marine and inland water ecosystems.
- Conduct periodic audit of fishing craft and gear combinations, their economics of operation, ecological and environmental impacts.
- Evolve regulations for mandatory survey of mechanized fishing vessels.
- Evolve a system for marking fishing vessels and fishing gears.
- Evolve regulations and promote use of life saving, fire fighting and communication equipment for safety of fishermen.
- Evolve regulations for mandatory survey of mechanized fishing vessels.
- Promote selective fishing gear and practices.
- Develop and implement National Plans of Action (NPOAs) for (i) management of fishing capacity, (ii) prevention of illegal, unreported and unregulated (IUU) fishing, (iii) conservation and management of sharks, and (iv) reducing incidental catch of seabirds in long line fisheries.
- Evolve an efficient Monitoring, Control and Surveillance (MCS) system.
- Make effective use of Geographical Information System for fisheries management; monitoring and control of fishing effort and energy use.

- Evolve and promote a package of practices for energy conservation in fish harvesting.
- Develop a Fisheries Information Portal for providing easy access to authentic information and facilitating fisheries research, management and business.
- Evolve a mandatory programme of training and certification for non-motorised, motorised and mechanised fishermen in safe navigation, responsible fishing, log keeping and reporting.

Directions related to the use and development of fishing gear and practices delineated in the CCRF focus on (i) selective fishing gear and practices, (ii) environment-friendly fishing gears (ii) energy conservation in harvesting and (iii) enhancement of resources (FAO, 1995; 1996; CIFT, 2003; Boopendranath and Pravin 2009; Boopendranath, 2009).

Optimising fishing capacity in coastal fisheries

Regulation of fishing capacity at optimal levels is an important aspect of responsible fishing (FAO, 1995; FAO, 1996; FAO, 1999; FAO, 2001; Boopendranath, 2007b; FAO, 2008a; 2008b). Most of the current fish production comes from the intensively fished shelf waters, though the depth of fishing has increased over the years. About 2,38,772 fishing crafts of various sizes and classes are under operation in marine fisheries, consisting of 58,911 mechanised boats, 75,991 motorised crafts, 104,270 non-mechanised crafts (CMFRI, 2006). Fishing capacity in the motorised and mechanised sectors of Indian fisheries has been estimated to be higher than the optimal requirements (Fig. 2) and need to be brought down through appropriate management strategies.

Selective fishing gear and practices

Selectivity is the ability to target and capture fish by species, size or sex or a combination of these during harvesting operations, allowing release of all incidental by-catch which may include undersized fish, non-targeted fish species, birds, mammals and other organisms encountered during fishing operations. Selection process begins in the proximity of the fishing gear where a proportion of the fish which is accessible escape capture. The fish caught by the gear are retained or a proportion may escape, of which some that are not traumatised or injured may survive. After retrieving the gear, the useful proportion of the catch is retained and the balance is discarded. In recent years, estimated level of discards in world fisheries has been reported to be around 7.3 million tonnes (Kelleher, 2004). Unwanted fishing mortality takes place due to stress and injury at the stage of gear avoidance and during escape after gear encounter and while discarding the non-targeted, unusable catch.

Responsible Fishing in Coastal Fisheries of India

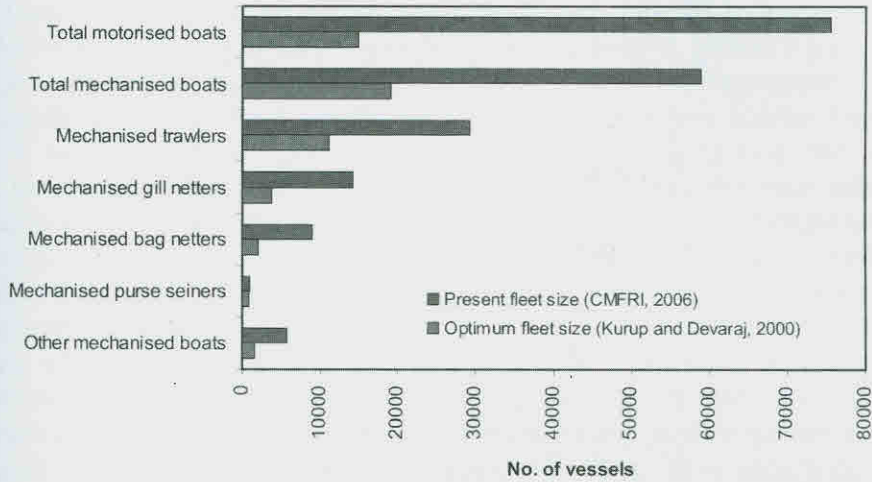


Fig. 2: Excess fishing capacity in marine fisheries of India

Bycatch includes both discarded and incidental catch, caught during the fishing operations (Alverson *et al.*, 1994). In addition to the non-targeted finfishes and invertebrates, bycatch also involve threatened and protected species like sea turtles, sea birds and cetaceans. Approaches to increase selectivity of fishing gears have been discussed by Prado (1993), Eayrs (2005), Kennelly (2007), Boopendranath (2007; 2009) and others and may include the following:

- Optimum mesh size in trawl codends
- Optimum hook size and shape for lines
- Square mesh windows in trawls
- Bycatch reduction devices in trawls
- Turtle Excluder Devices in trawls
- Juvenile Excluder Devices in trawls
- Trawl designs with improved resource specificity
- Optimum mesh size for gill nets
- Optimum mesh size for purse seines
- Escape windows for juveniles in fish and lobster traps

Bycatch reduction devices (BRDs) have been developed for reducing the catch of non-targeted and unwanted species of fish in shrimp trawling.

Various types of bycatch reduction technologies have been developed in the fishing industry around the world (Prado, 1993; Eayrs, 2005; Kennelly, 2007; Boopendranath, 2007; 2009). Hard BRDs such as fisheye and rigid oval grid device and soft BRDs such as square mesh windows, Bigeye, Sieve net and the International Award winning design Juvenile Fish Excluder cum Shrimp Sorting Device (JFE-SSD) have been developed by Central Institute of Fisheries Technology (CIFT), Cochin and recommended for adoption, after evaluation in Indian waters (Boopendranath *et al.*, 2008). Fisheye is a stainless steel escape chute and bigeye is a simple slit which are provided in the codend for the escape of actively swimming finfishes. Square mesh windows provided on the codend function in a similar way. Square mesh has the advantage that the mesh opening is not distorted while under operation, unlike diamond meshes (Broadhurst and Kennelly, 1996; Kunjipalu *et al.*, 2001; Bahamon *et al.*, 2006). Rigid oval grid device is installed in front of the trawl codend and it sorts and excludes most of the non-shrimp bycatch, while allowing the shrimps to pass through the grid bar spacing into the codend of trawl. Sieve net and JFE-SSD sorts the catch entering the trawl into two separate codends and also permits the escapement of juveniles through appropriately selected meshes. Mesh size optimisation of trawl codend is another approach to increase the selectivity of trawl system.

While BRD is a broad term used to describe any device that can be employed to eliminate or reduce the bycatch, turtle excluder device (TED), though in principle a BRD, is a specialized form of BRD designed to eliminate turtles, sharks and rays also from the trawl. These devices have been designed and developed taking into consideration the differential size and behaviour pattern of shrimp and fish inside the net. CIFT has developed an indigenous design of the turtle excluder device which is appropriate for the Indian conditions (CIFT, 2003; Dawson and Boopendranath, 2001. Boopendranath *et al.*, 2003; Boopendranath *et al.*, 2010). CIFT-TED is a single grid hard TED with top opening of 1000x800 mm grid size for use by small and medium mechanized trawlers operating in Indian waters.

Environment-friendly trawl systems

Direct and indirect impacts of bottom trawling on marine environment and benthic communities are well known (Hall, 1999; Kaiser and de Groot, 2000; Barnes and Thomas, 2005; Meenakumari *et al.*, 2009). Bottom trawls are generally non-selective and a large number of non-target species and juveniles are landed during trawling, in addition to its impact

on benthic communities. Gear modifications to achieve the objective of reduced impact on environment include lighter gear construction, semi-pelagic trawling, benthic release panels and minimising contact area of the towed gear with seabed (Valdemarsen and Suuronen, 2003; He, 2007; Valdemarsen *et al.*, 2007; Boopendranath, 2009) Resource specific trawls for semi-pelagic resources have comparatively low impact on the benthic biota (Brewer *et al.*, 1996). CIFT Semi-pelagic Trawl System (CIFT SPTS-I) has been developed as an alternative to shrimp trawling in the small-scale mechanized trawler sector, after extensive field-testing (CIFT, 2007). The system consists of an 18 m four panel semi-pelagic trawl with double bridles, front weights and vertically cambered high aspect ratio otter boards of 85 kg each. It is capable of attaining catch rates beyond 200 kg.h⁻¹ in moderately productive grounds and selectively harvest fast swimming demersal and semi-pelagic finfishes and cephalopods, which are mostly beyond the reach of conventional bottom trawls, currently used in commercial trawl fisheries in India.

Energy conservation in fishing

Modern fishing is one of the most energy intensive methods of food production. Passive fishing gear and practices such as gillnets and entangling nets, lines and traps are less energy intensive than active dragged fishing gears. Among the fishing gears, trawling utilises maximum energy in terms of energy spent per unit quantity of catch and offers greater scope for energy conservation practices (Gulbrandson, 1986; Boopendranath, 2000). Purse seining comparatively spends much less energy per unit quantity of catch landed, because of the large volumes of catch per operation. Practices for energy conservation in fishing have been discussed by Wileman (1984), Wilson (1999), Hameed and Boopendranath (2000), Boopendranath (2009) and others and may include the following:

- Low energy fishing techniques
- Low drag trawls such as large mesh trawls and rope trawls
- Pair trawling
- Economic vessel speed
- Hull design and displacement optimisation
- Anti-fouling measures
- Right selection of engines
- Right sizing of engines

- Preventive maintenance of engines
- Reduction gear, propeller size and propeller nozzle
- Sail-assisted propulsion
- Use of remote sensing (PFZ information) and advanced technology (Echosounder, GPS and GIS)
- Fleet management (Vessel Monitoring System)

Conservation of resources and protection of fisheries environment

The ecosystem approach to fisheries (FAO, 2008b) need to be adopted for conservation of coastal resources. Fishery resources which have approached or crossed the sustainable limits need to be conserved and enhanced by adopting management regimes appropriate for the area such as restriction and control over the fishing units, area and seasonal closures, gear interventions, protection of nursery grounds and promotion of selective fishing gear and practices. With improvement in the resources, energy spent per unit quantity of catch and time spent on searching will decrease.

Conclusion

Effective implementation of a fishing regime based on CCRF guidelines and an integrated monitoring, control and surveillance (MCS) system could result in enhancement of resources in the coastal waters, enhancing fishing opportunity, reducing operational costs and increasing sustainability of the coastal resources. Reduction of the overcapacity of fishing fleet, restrictions in the gear type and size, inclusion of bycatch reduction devices, restriction in the use small mesh size in different types of gears and conservation of protected and endangered species will go a long way in conserving coastal resources of India. Fuel efficiency and adoption of conservation measures like square mesh codends in trawl nets, turtle and bycatch excluder devices, use of biodegradable elements in nets and pots and use of gear with less environmental impact are to be implemented in the harvest side, and pollution of the environment has to be prevented to pave way for a responsible fishing. Measures have to be taken based on the best scientific evidence to ensure long-term sustainability of the fishery resources and to promote the objective of optimum utilisation. States need to establish mechanisms for cooperation and coordination among national authorities involved in safeguarding the coastal fishery resources, which is playing a crucial role in augmenting the protein supplies in the coming years both in domestic and export markets.

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