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Responsible fishing and sustainability

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Marine fishing globally has undergone significant structural transformation from artisanal focus to technology intensive and advanced fishing systems. This, however has resulted in an undesirable trend of excess capacity and overexploitation of resources. This emerging trend demands enforcement of sustainability standards as per the FAO Code of Conduct for Responsible Fisheries. While India, as a member country is keen on following the FAO standards, the concept of 'green fishing' encompassing energy conservation and minimization of environmental impact gain accelerated relevance.

Keywords: Bycatch reduction devices, Energy conservation, Green fishing, Responsible fishing, Trawl

INDIA has expanded its fish production during the last six decades with an 18-fold increase in production. With its highly productive fishing area, the country's fish production has grown from 0.74 million tonnes in 1950 to 13.42 million tonnes in 2018 with the share of marine catch at the level of 3.71 million tonnes. The structural transformation of the fishing system in India was from an exclusively artisanal sector dependent on manual labour, into a mechanized system depending on engine power for vessel propulsion and/operation of the fishing gear. The fishing systems today comprises of motorized and mechanized vessels using large versions of gears such as trawls, purse seines, gillnets, lines and traps. The artisanal non-motorized is slowly being phased out. Increase in fish production, over the years, has been the result of increased number of fleet and availability of large and more efficient gear systems, and developments in electronic, navigational and acoustic detection equipment that help to enhance overall capabilities.

Challenges of sustainability

Structural change implies negative consequences as well. At present, there are about 1,99,141 fishing vessels in India, of which nearly 72,749 are mechanized vessels (36.5%), 73,410 are motorized (36.9%) and the rest 52,982 non-motorized (26.6%). These are in excess of the optimum that the fishery system can sustain; motorized vessels thrice and mechanized vessels five times higher than the optimum. This means, over exploitation of the resources bycatch, high energy use and over capitalization especially in terms of indicators such as vessel and gear size, and engine power. Sustainability concerns, therefore demand corrective measures. As a signatory of multinational conventions, following the global codes of conduct is the best policy option that India can think of. The global thinking today is towards an integrated approach to sustainable fishing practices under the 'Responsible Fisheries' framework.

FAO Code of Conduct and Responsible Fishing Approach

A Code of Conduct for Responsible Fisheries (CCRF) came from the FAO in December 1995. It sets out the principles and international standards of behaviour for responsible practices to ensure long term sustainability of living aquatic resources, with due respect for the ecosystem, biodiversity and environment. Article 8 of the Code covers key principles including use of conservative management approaches when the effects of fishing practices are uncertain; avoiding overfishing and preventing or eliminating excess fishing capacity; minimization of bycatch and discards; prohibition of destructive fishing methods. India has been keen on adopting CCRF for sustainable exploitation of the resources. As a member country, India's responsible fishing initiatives for sustainability include, development of efficient fishing vessel designs, responsible fishing gears, measures for bycatch reduction, energy conservation and minimizing negative impact of fishing gears.

Responsible Fishing ensures sustainability of the system by using gears in a responsible way so that overfishing is reduced and fish stock is protected. At the operational level, selective fishing is the deployment of gears which capture target resources without having any adverse impact on the resources and the ecosystem. Such gears ensure selective exploitation of resources according to criteria on size, shape, age or species. Optimum mesh size and other

selectivity characteristics for different gears like trawls, purse seines and gillnets for selective exploitation of commercially important fishes. These strategies and measures would enable sustainable fishing by avoiding juveniles, bycatch etc.

Demersal trawls which contribute maximum towards the marine fish production of India are non-selective and a large number of non-target species and juveniles are landed during trawling, in addition to its impact on benthic communities. Off bottom trawl system (CIFT-OBTS) is an alternative to demersal trawl in the small-scale mechanized trawler sector. Unlike conventional demersal trawl which is dragged along the seafloor, off bottom trawl operates at a little distance above the bottom. This makes off bottom trawl an eco-friendly gear with significantly lower bottom impact than demersal trawls. Besides, it comes out as a responsible alternate trawl system for harvesting less exploited large demersal and semi-pelagic species as the shrimp and other demersal resources targeted by bottom trawls are rather over exploited.

Most fishing gears, while targeting a particular fish or group of fishes, non-targeted ones also are caught unintentionally and is termed as bycatch. Bycatch problem mostly happen when the gear used is non-selective and not designed to exclude non-targeted fish. Devices used to exclude the bycatch of non-targeted species including endangered species like turtle are collectively known as Bycatch Reduction Devices (BRDs). These devices are developed taking into consideration the variation in the size, and differential behaviour pattern of fish, shrimp and other animals inside the net.

Among the different types of fishing, shrimp trawling accounts for the highest rate of bycatch, of which a significant portion is constituted by juveniles that are generally discarded. Square mesh netting is the simplest BRD used in trawl codend as a conservation measure. Meshes in the square mesh codend remain open under tension during trawling unlike the diamond mesh codend in which the mesh lumen closes under tension. In square mesh, water flow and filtration will be efficient and resultant drag will be comparatively less which minimizes fuel consumption. As the mesh lumen remains open, it is easy for small fishes and juveniles to escape through the meshes which reduces the quantum of bycatch. Gujarat Marine Fishing Regulation Act (GMFR Act-2003) has prescribed the use of 40 mm square mesh codends in the trawl nets. Most recently the Govt. of Kerala has adopted 35 mm square mesh codend for fish trawl and 25 mm cod end for shrimp trawl through amendment of the Kerala Marine Fisheries Regulation Act.

Incidental catches of marine turtles which are endangered species have been reported in the trawl landings of India particularly from West Bengal, Odisha, Andhra Pradesh, Tamil Nadu and southern parts of Kerala. Turtle excluder device (TED) is a BRD incorporated in trawl nets to facilitate escape of turtles incidentally caught in trawl nets. Its use by small and medium mechanized trawlers operating in Indian waters ensure 100% escapement of the turtles while exclusion of fish and shrimp is at the minimum possible level.

Trawl fishermen in India and other tropical fisheries depend on both finfish catches and shrimp catches to keep the commercial operations economically viable. The sorting of the shrimp and the finfish from the catch is time consuming. A unique solution for this issue is a Juvenile Fish Excluder cum Shrimp Sorting Device (JFE-SSD), which retains mature shrimp in the bottom portion of the net while allowing juvenile shrimp to swim out through the mesh unharmed. The device also retains mature finfish in the upper codend of the device, while allowing small sized fish of low commercial value and juveniles of commercial species to be safely excluded. The sorting of the shrimp and the finfish between the lower and upper parts of the net enhances profitability by reducing the sorting time and by preventing the shrimp from becoming crushed under the weight of fish which increases the shrimp's market value.

Though not as dominant as in trawls, bycatch is an issue in other gears like gillnets, purse seines, hooks and lines, and traps. Bycatch in drift gill nets include marine mammals, sea turtles and sea birds, in addition to non-targeted fish species. Use of optimum mesh size and hanging coefficient as well as by judicious deployment of gill net considering the depth and area of operation and season would avoid gear interaction with non-targeted species and minimize bycatch in gill net fisheries.

Accidental pursing of juvenile shoals is the main reason for bycatch in purse seine. Selection of optimum mesh size, proper choice of fishing area, depth and season could lead to better selectivity and reduction of bycatch in purse seines. Use of *Medina panel*, section of fine mesh which form a type of escape panel, prevents dolphins from becoming entangled in the gear, and back down manoeuvre have been deployed to prevent capture of dolphins in purse seines. Choice of hook design and size, bait type and size, selection of space and time of fishing are approaches for mitigation of bycatch issues in hook and line fisheries and minimize gear interaction with other species. Provision of escape windows for juveniles and non-target species in the design side and appropriate choice of bait type, fishing area, fishing depth, fishing time also help to minimize juvenile catch in traps.

Green fishing

The concept of 'Green Fishing' encompasses energy conservation and minimization of environmental impact of fishing gears.

Energy conservation in fishing

Motorized and mechanized fishing operations are dependent on fossil fuels, which are non-renewable and limited. Fossil fuel produces increased levels of carbon dioxide in atmosphere contributing to green house effect and other pollutants which are detrimental to the environment and human health. Greenhouse effect leads to irreversible climatic and oceanographic changes. Moreover, spiraling oil prices may

severely affect the economic viability of fishing as a means of food production. World capture fisheries consumes about 50 billion litres of fuel annually (1.2% of the worldwide fuel consumption) releasing an estimated 134 million tonnes of CO_2 into the atmosphere at an average rate of 1.7 tonnes of CO_2 per tonne of live-weight of landed product. 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 entire fossil fuel consumption in India in 2000 (122 billion litres) releasing an estimated 3.17 million tonnes of CO_2 into the atmosphere at an average rate of 1.13 tonnes of CO_2 per tonne of live-weight of marine fish landed.

Introduction of innovative designs of fuel-efficient fishing vessels can reduce the fuel consumption by the fishing sector. By modifying the hull form and reducing vessel weight, fuel consumption can be reduced to a significant level there by reducing carbon footprint. Carbon footprint can also be reduced through introduction of new generation fishing gear materials such as Ultrahigh Molecular Weight Polyethylene (UHMWPE). Use of solar panel for navigation lights reduces the fuel burning and helps reducing pollution in the same vessel.

Utilization of solar energy in fishing is an innovative idea to curtail the increasing fuel consumption by the fishing industry and also to reduce pollution. Solar powered FRP vessels are introduced successfully in reservoirs, small rivers, and aquaculture ponds. These can also be used for recreational fishing activities. The vessels are capable of running for 2.5 to 3.0 hours after full charge and attain a speed of nearly 4.0 knots in calm waters. Considering the 240 days of fishing in a year the fuel saved compared to an equivalent diesel powered vessel is about ₹ 48,000 per year. The vessel has wider space, a canopy for protection from rain and sun, low rolling characteristics during fishing, and also has provision of navigational lights to facilitate fishing in the night.

Minimizing environmental impact of fishing gears

Dragged gears such as bottom trawls, particularly when they are heavily rigged, could cause severe damage to benthic fauna and flora, which occupy the bottom substratum and contribute to the productivity of the region. Use of off-bottom trawls reduce the impact of trawling on the bottom biota.

Plastics constitute 91% of the global marine debris of which 10% is contributed by the fishing sector. Lost fishing gears entangle and kill target and non-target organisms, damage habitats and become hazard to human navigation. Lost/derelict fishing gear include nets, lines, traps, and other recreational or commercial fishing equipment that has been abandoned, lost, or otherwise discarded (ALDFG). The first study on ALDFG relating to gillnets and trammels nets in Indian waters in 2017 showed that this is a serious problem requiring strict monitoring and control. Further to this initial assessment, detailed assessment of fish and gear loss in gillnet and trammel net sectors of India identifies a loss rate of 24.8% of the total fishing gear per gillnetter per year in the country which is quite alarming. Ghost fishing is a problem associated with lost fishing gears. Fishing net becomes 'ghost net' when the operational control of the gear is lost and a fish or an animal, is trapped in the net and mortality occurs. Ghost fishing is estimated to cause a loss of 7% of total fish catch which goes unreported and unaccounted for. Such studies have to be conducted in Indian waters.

Marking of fishing gear

Illegal, Unregulated and Unreported (IUU) fishing is a major area of concern in sustainable exploitation of fish resources. Gear marking is a possible measure to regulate both legal and illegal fisheries. FAO has brought out voluntary guidelines for gear marking. A well-marked gear with proper identification would be useful for enforcement agencies checking on illegal gear and operation. The basic purpose of gear marking is to determine ownership and to trace back information regarding the gear. ALDFG and ghost fishing are related to IUU. Gear marking enables in reducing ALDFG by avoiding interaction with other vessels and entanglement with other gears. It also helps the state to take effective action against defaulters in case of ALDFG. As far as India is concerned, there is no system to mark gears/ gear materials and accessories. For the first time in the country, marking of fishing gear is incorporated in the Marine Fishing Regulation Act amendment 2018 of Govt of Kerala.

SUMMARY

'Responsible Fishing' signifies the way forward in harnessing the potential of India's 'Blue Economy'. Research on design, development and operation of fishing vessel and fishing gear form the first stage of this strategy. India has a wide range of technologies for bycatch reduction, minimizing environmental impact and energy conservation based on FAO-CCRF. Creating awareness among stakeholders with suitable incentives will result in faster adoption of such technologies. Beyond these, policy changes and creation of appropriate legal and Institutional framework also need examination.

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Know *Krishi Unnati Yojana*

The *Krishi Unnati Yojana,* a central sector scheme, is envisaged as umbrella programme for focusing on food security, by merging schemes on Soil-health Card, Integrated Scheme on Agricultural Co-operation and Agricultural Marketing, National Mission on Agriculture Extension, Horticulture Development, Price Stabilization Fund, National Mission on Sustainable Agriculture and other programmes.