Responsible Fishing Technology Practices for Fisheries Development in Andhra Pradesh

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Dynamic developments in harvest technologies and fish detection methods along with an uncontrolled expansion in fleet size fuelled by ever increasing market demand for fish have resulted in overfishing and negative impacts on the ecosystem. This highlighted the need for scientific management of the fishery resources in order to ensure their long term sustainability and availability for future generation. Responsible fishing would ensure the long term sustainability of the resources, minimize negative environmental impacts and protect biodiversity. The code of conduct for responsible fisheries sets out the principles and international standards of behaviour for responsible practices to ensure long term sustainability of resources with due respect for eco-system, biodiversity and environment. The paper discusses the selective fishing gear practices, environmentally friendly fishing gears and enhancement of resources. The paper also discusses the need for developing selective fishing gears in order to protect non-targeted resources and endangered species like sea turtles. Bycatch reduction devices (BRDs) used to protect endangered species and reduce the bycatch of non-targeted species in shrimp trawling are also discussed.

Key words : Responsible fishing, sustainable fishery development, bycatch reduction devices, Andhra Pradesh

In the recent years, dynamic developments have taken place in the the harvest and post-harvest technology of fish with the introduction of powerful and highly efficient fish harvesting systems and fish detection methods and an uncontrolled expansion in fleet size fuelled by ever increasing market demand for fish. This has resulted in overfishing and negative impacts on the ecosystem resulting in increasing pressure on the fishery resources. Scientific management of the world fishery resources in order to ensure their long-term sustainability and availability to the future generations is now inevitable. Adoption of responsible fishing would ensure the long-term sustainability of the resources, minimize negative environmental impacts and protect biodiversity.

In 1992, FAO Committee on Fisheries recommended for the development of concepts which would lead to the responsible fishery development. The International Conference on Responsible Fishing, held in the same year at Cancun, Mexico highlighted the need for an International Code of Conduct for Responsible Fisheries. Subsequent efforts in this direction have resulted in the adoption of Code of Conduct for Responsible Fisheries, by FAO Conference in October, 1995 (FAO, 1995; FAO, 1996a; FAO, 1996b; FAO, 1997).

The Code of Conduct for Responsible Fisheries is voluntary and global in scope and generic in nature. It sets out the principles and international standards of behavior for responsible practices to ensure long term sustainability of living aquatic resources, with due respect for the ecosystem, biodiversity and environment. It covers conservation; management and development of fisheries; capture, processing and trade of fish and fishery products; aquaculture; fisheries research; and integration of fisheries into coastal area management. The code recognizes the nutritional, economic, environmental and cultural importance of fisheries and the interests of all those concerned with fishery sector.

Present status of exploitation of resources in Andhra Pradesh

Fisheries sector of Andhra Pradesh, contributes about 10% of total fish and shrimp production in the country. The total fish and shrimp production has increased from 0.46 million t in 1998-99 to 0.58 million t in 1999-2000. Between 1985 and 1990, the production of penaeid fisheries remained stationary and there was a marked drop in the catch per unit effort. With intensive shrimp harvest, the bycatch also increased in volume. An estimated quantity of 1,30,000 t of bycatch comprising of sciaenids, silverbellies, clupeids, *Nemipterus* spp., etc., are discarded annually along the east coast of India (Gordon, 1991). Among the different constituents of bycatch, sciaenids accounted for major portion followed by other species, such as silverbellies, perches, ribbonfishes, sharks and rays, soles, anchovies, carangids, clupeids, lizardfishes, polynemids, *Lactarius* sp., pomfrets, barracuda, cephalapods and crustaceans. With the decline of shrimp catch, the bycatch constituents contribute significantly to the overall income of shrimp trawling. In order to maintian sustainability of these resources, the indiscriminate exploitation of juveniles and sub-adults must be prevented by suitable means such as adoption of bycatch reduction devices and selective fishing practices.

Responsible fishing practices - recommendations for Andhra Pradesh

Diversification in fishing practices

In Andhra Pradesh, mechnaised fishing industry has mainly concentrated on shrimp trawling. Diversification in fishing practices by adopting low impact fishing practices, would reduce the excess fishing pressure on shrimp resources. The management options for increasing production and reducing negative impacts on the ecosystem may include introduction of semi-pelagic trawling, mid-water trawling and tuna long lining.

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 bycatch, which may include undersized fish, non-targeted fish species, birds, mammals and other organisms encountered during fishing operations. In a selective fishing gear or resource-specific gear, unwanted fishing mortality is minimized by allowing separation of non-target species or size groups by utilizing differences in size or fish behavior. The shrimp trawl is a non-selective gear widely used in Andhra Pradesh that commonly has an associated catch of non-targeted organisms such as finfish and miscellaneous invertebrates. Although, emphasis is generally given on the selectivity of the trawl codend, attention is also needed in the area of whole trawl selectivity.

Approaches to improve the selectivity characteristics of trawls, may range from regulation of codend mesh size to the incorporation of bycatch reduction devices in the net (Sternin and Allsopp,1981; Mitchell *et al.*, 1995; Brewer *et al.*, 1998; Watson and Tailor, 1998; Hameed and Boopendranath, 2000). In the past, selectivity research was almost solely focused on commercial species. Recently, however, the release of non-commercial fish has become an issue of concern.

Size selectivity in gear using netting for retention of catch, can be achieved by controlling mesh sizes and mesh shapes (square mesh panels) optimized for the target species or size groups. In traps, the size and shape of the entrance and mesh size or bar space, and in long lines appropriate hook sizes are utilized to control size selectivity. Species selectivity in mobile gears such as trawls is achieved using separator panels or rigid grids, by making use of behavioral differences in species in the fishing area. Species separation of shrimp and fish can be achieved by reducing the length of trawl, adjusting the headline height and controlling the towing speed, making use of the principles of differences in swimming speed and vertical distribution (Hameed and Boopendranath, 2000).

Bycatch Reduction Devices

Bycatch reduction devices are devices that have been developed to exclude the non targeted species and reduce the non-targeted species and other unwanted catch in shrimp trawling. These devices have been developed taking into consideration the differential behavior pattern of shrimp and fish inside the net. While the fish are active and capable of swimming against the water flow inside the net and stimulated to escape at anytime if required facilities are provided, the shrimp is unable to swim against the water flow and are carried away with the flow of the water up to the codend. These differences of behavior form the basic principles in designing the selective devices so as to allow the fish and turtle to escape and to maintain the shrimp catch in the codend.

Rigid grid devices : Rigid grid device are used to separate shrimp from other non-targeted organisms (Watson *et al.*, 1993; Hameed and Boopendranath, 2000; Pillai *et al.*, 2004). A metallic grid of oval, rectangular or allied shape is attached ahead of the codend at an angle of 45-55°. Generally a funnel is provided to guide the fish towards the grid. While the small fish and shrimp pass through the grid bar spacings and each the codend, large fishes and sea turtles are guided upward or downward by the grid bars and escape through the escape chute provided at the top or bottom. The Turtle Excluder Device (TED) is a specialized form of BRD designed to exclude the sea turtles, which is a protected species (Mitchell *et al.*, 1995; Dawson and Boopendranath, 2001).

Square mesh window : This is a very simple form of bycatch reduction device. It consists of a piece of netting of appropriate dimension made of square mesh. This netting panel is attached to function as a window at the upper part of the codend. The mesh size of the square mesh is regulated according to the size and species of fish to be excluded. Unlike diamond mesh, lumen of the square mesh remains open during fishing facilitating the escapement of fish through the opening. Studies carried out with square mesh panel windows indicate its effectiveness eliminating the bycatch particularly juveniles and young ones of the fish (Pillai *et al.*, 1996; Brewer *et al.*, 1998; Kunjipalu *et al.*, 1998).

Radial Escapement Section : Radial Escapement Section (RES) developed by Watson and Taylor (1988) consists a guiding funnel made of small mesh netting, surrounded by a radial section of square mesh panel, supported by a metal ring on either side. This device is inserted before the codend. During fishing, the fish and shrimps are guided through the funnel and enter the codend. While the shrimp remain in the codend, the fish swim back and escape through the square mesh panel section (Pillai *et al.*, 2004). By regulating the mesh size in the square mesh netting between the rings, the juveniles and undersized fish could be excluded, retaining the bigger fish in the codend.

Fisheye : The fisheye facilitates the escapement of fish from the codend of a shrimp trawl. It consists of a framework made of stainless steel rods which is provided with an elliptical escape chute of appropriate dimensions (Watson *et al.*, 1993; Pillai *et al.*, 2004). This device is generally attached on the upper side of the codend. The fish which has entered the codend, have the opportunity to swim backward and escape through the opening of the fish eye.

Environment-friendly fishing gears

Depending on their impact on the environment, some fishing gears or practices are more destructive than the other. Practices of using explosives and poisoning which are generally banned, belong to the worst category. Passive fishing gears such as gillnets and traps though having less impact on the physical environment have the potential for causing unaccounted fishing mortality through ghost fishing by lost and discarded fishing gears. Dragged gears as 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. Efforts have been made to lessen the impact of bottom trawl on the substratum, where possible, by rigging them to operate a small distance above the sea bottom as in semi-pelagic trawl. Lines and large uncovered pound nets (set nets) are among the fishing gears which have minimal impact on the environment (Hameed and Boopendranath, 2000; Boopendranath, 2002a).

Energy conservation in harvesting

Passive fishing gear and practices such as gillnets and entangling gets, lines and traps are less energy intensive than active dragged fishing gears. Among the fishing gears, trawling utilizes maximum energy in terms of energy spent per unit quantity of catch and offers greater scope for energy conservation practices. Purse seining comparatively spends much less energy per unit quantity of catch landed, because of the large volumes of catch per operation. It may involve such practices as selection and promotion of low energy fishing techniques where possible; adoption of energy conservation practices and devices in energy-intensive fishing systems where they are adopted due to exigencies of the local situation; adoption of advanced technologies such as remote sensing, acoustic fish detection, global positioning systems which will bring down search time for fish and facilitate accurate location of the fishing ground; and adoption of measures for development and improvement of coastal fishing grounds, so that fishing can take place in the near shore waters rather than distant waters (Hameed and Boopendranath, 2000; Boopendranath, 2002b).

Enhancement of resources

Fishery resources 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 spend on searching decrease (Hameed and Boopendranath, 2000; Boopendranath, 2002a).

Artificial reefs are under sea structures constructed of materials such as concrete or in some cases steel to function as fish aggregating facilities and thus improve fishing potential of the area. Protection and development of nursery grounds by installation of artificial reefs, sea weed bed development and enhancement of primary production by installing artificial upwelling flow generating structures could promote marine fishery resources along the coast (Hameed and Boopendranath, 2000; Boopendranath, 2002a).

Restoration of the coastal fishing grounds from the effects of environmental degradation due to pollution, eutrophication, red tide, etc. by sludge removal and bottom quality improvement by dredging and by improving water exchange by guide wall construction, could result in enhancement of resources in the near shore waters, enhancing fishing opportunity, spending less fuel and search time for production (Hameed and Boopendranath, 2000; Boopendranath, 2002a).

Appropriate adoption of devices and approaches discussed in this paper, in the fishing practices of the state, coupled with management measures such as control of excess fishing capacity, could lead to better sustainability of the resources and profitability of fishing as an occupation in the state.

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