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Responsible Fishing - Way to Attain Eco-Friendly Sustainability in Fisheries

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Abstract

Overfishing and its impact on ecosystems have been showing increasing trends in recent years, under estimating the need for scientific management of global fishery resources to maintain their long-term sustainability for future generations. Many governments have outlawed trawling because it detrimental impact on the seabed and reduces diversity. We have to preserve the resources and protect the endangered and non-targeted species by sustainable harvesting methods.

Introduction

The introduction of advanced, efficient fish harvesting technologies and fish detection techniques, as well as an unregulated expansion in fleet size fueled by ever-increasing market demand for fish, have increased pressure on the world's fisheries resources. Responsible fishing practices would maintain the resources' long-term viability, reduce negative environmental consequences, and preserve biodiversity. With the adoption of the United Nations Convention on the Law of the Sea in 1982, coastal states gained exclusive rights and duties for resource management in Exclusive Economic Zones (EEZs) extending 200 nautical miles from the shore. The International Conference on Responsible Fisheries, held in Cancun, Mexico in 1992, emphasized the need for an international code of conduct for responsible fishing.

The FAO Code of Conduct for Responsible Fisheries

It lays forth the concepts and international norms of conduct for responsible activities that preserve the long-term viability of live aquatic resources while also taking into account of ecosystem, biodiversity, and environmental concerns. It involves conservation, fisheries management and development, fish collection, processing, commerce, aquaculture, fisheries research and fisheries integration into coastal area management. The fishing operations are covered under Article 8 of the CCRF (Boopendranath, 2010).

Key Principles of the Code

a) Management of stocks using the best available science;

b) Conservative management approaches when the effects of fishing practices are uncertain;

c) Avoiding overfishing;

d) Minimization of by catch and discards;

e) Prohibition of destructive fishing methods;

f) Restoration of depleted fish stocks;

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g) Implementation of appropriate national laws, management plans;

h) Monitoring the effects of fishing on the ecosystem;

i) Working cooperatively with other states;

j) Recognizing the importance of artisanal and small-scale fisheries and the value of traditional management practices.

Responsibilities of Fishing Industry

Bring all necessary documentation, including a fishing license, assuring that fishing is done in accordance with current standards for safety, collision avoidance, and maritime environment conservation. Make sure that damaging fishing methods like dynamiting and poisoning are forbidden. Adopt proper technologies to guarantee that the quality of the caught fish is preserved onboard itself. Encourage the creation and application of selective fishing gear and techniques. Use technology to reduce the impact of ghost fishing caused by lost or abandoned fishing gear. To safeguard the aquatic environment, follow the necessary MARPOL laws.

Bycatch Reduction Devices (BRD's)

Bycatch Reduction Devices (BRDs) are devices designed to keep endangered animals like turtles out of trawling while also reducing non-targeted species. Based on the sort of materials used in their construction, BRDs may be divided into three groups. For sorting and excluding by capture, soft BRDs employ soft materials such as nets and rope frames. Hard BRDs are those that separate and exclude by catch using rigid or semi-rigid grids and structures. Combination BRDS incorporate several BRDs into a single system, generally hard BRD in conjunction with soft BRD. In India, the bycatch issue is more complex due to the multi-species and multi-gear nature of the fisheries. Trawling remains a controversial method due to the non selectivity nature of the trawl net (Samanta *et al.*, 2018).

Bycatch Reduction in Trawls

The primary species sought in a fishery is referred to as the 'target catch'. The retained capture of non-targeted species is referred to as 'incidental catch' whereas discarded catch refers to the fraction of the catch that is returned to the sea due to low economic value, legal issues, or personal interest. Bycatch mean both discarded and non-targeted catches. The bycatch includes vulnerable and protected species like marine turtles and cetaceans, in addition non-targeted fin fishes, crustaceans, and their juveniles also harvested.

Escape Windows

Escape windows made of gigantic square mesh netting (square mesh window), parallel ropes (rope BRD), or simple slits (big eye BRD) are installed on the top panel of the trawl net cod end and they operate on the basis of differences in fish and shrimp behaviour. Fish that have gotten into the cod end prefer to swim back and escape *via* the openings towards the top of the cod end's throat.

Radial Escapement Section without Funnel

A radial section of netting with large meshes is provided between hind belly and codend. Small sized fishes, jelly fish and other bycatch components which have low swimming ability are expelled due to enhanced water flow through large mesh section but targeted and commercially important species are trapped in the cod end.

Radial Escapement Section with Funnel

Radial escapement device with funnel is positioned between hind belly and codend of trawl. A small meshed funnel accelerates water flow inside the trawl and carries the catch towards the codend. Actively swimming fishes swim back and escape through the large mesh netting section surrounding the funnel where the water flow rate is weak, while the shrimps are retained in codend.

Sieve Net

Sieve nets (sometimes called veil nets) are cone-shaped nets that are installed into regular trawls and drive undesirable bycatch through an escape hole cut into the trawl's body, leading to a second cod end. The fish are guided to a second cod end with huge diamond mesh netting by a giant mesh funnel inside the net, while shrimps flow through enormous meshes and a mass in the main cod end. Bycatch exclusion rates of 15-50 percent, with shrimp loss of 5-15 percent has been ported in sieve net setup (Meenakumari *et al*., 2009).

Fish Eye BRD

This is yet another mechanism that aids in the escape of fish, particularly little ones, from the cod end. It comprises of a stainless steel rod-supported oval or semicircular construction with a height of around 200 mm and a width of about 300 mm. This is attached at the top of the codend so as to create an escape opening. This opening allows fish swimming backwards from the end of the codend to escape.

Juvenile Fish Excluder cum Shrimp Sorting Device (JFE-SSD)

It is a bycatch reduction device with an in situ sorting mechanism, which replaces the conventional codend in a trawl. The device was designed to catch shrimps

and commercially important fish species using a specially designed oval sorting grid with appropriate bar spacing and dual codends (Boopendranath *et al*., 2013). Juveniles are responsible for 40% of the bycatch in India. The Juvenile Fish Excluder cum Shrimp Sorting Device, developed by CIFT, is a one-of-a-kind solution to this problem (JFESSD). It reduces bycatch of juveniles and small non-targeted species in commercial shrimp trawls while allowing fishermen to harvest and keep large commercially valuable fin fish and shrimp species. Improved catch quality, quicker sorting time, longer tow duration, larger catch, and cheaper fuel costs would all help fishermen economically. JFE-SSD operations off the coast of Cochin, India, have resulted in capture reductions of up to 43% and shrimp retention of 96-97% (Boopendranath *et al*., 2013).

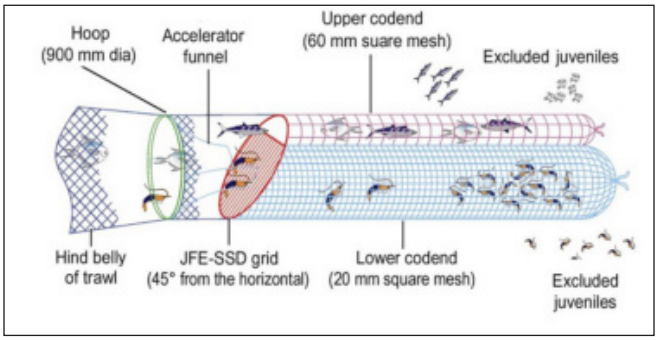

Figure 1: Juvenile Fish Excluder cum Shrimp Sorting Device

Juvenile and Trash Excluder Device (J-TED)

It is made up of three rectangular panels that are hinged together and put in the trawl codend. The structure of parallel vertical bars in the first two panels was meant to assist fish to escape the codend. A rectangular sheet of small-mesh netting served as the third panel, preventing fugitive fish from re-entering the cod end. JTED has been shown to exclude 73 percent of immature fish, 16 percent of important fish, and 8% of shrimp in the Vietnamese shrimp trawl fishery.

Turtle Excluder Devices

Marine turtles are an endangered species protected by international treaties such as the Convention on Migratory Species (CMS) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), as well as national laws. Turtle Excluder Devices (TEDs) are made up of big mesh netting panels (soft TEDs) or a frame made up of a grid of deflector bars (hard TEDs) that are set at an 45° angle before the cod end of the trawl net, going upward or downward to an escape hatch. Small animals, such as shrimp, pass through the mesh lumen of the netting panel or the gap between the deflector bars and are retained in the cod end, whereas large animals, such as turtles, large fishes, and large elasmobranches, are stopped by the netting panel or the grid of deflector panel or bars and are able to escape through the opening. The United Nations Food and Agriculture Organization, fishery scientists, and sea turtle environmentalists all recognize TEDs as a vital conservation tool. Although (BRDs) and Turtle Excluder Devices (TEDs) are now widespread in tropical shrimp trawling, information on their ability to mitigate bycatch of elasmobranchs, particularly rays (Batoidea), is scarce and limited (Willems *et al*., 2016).

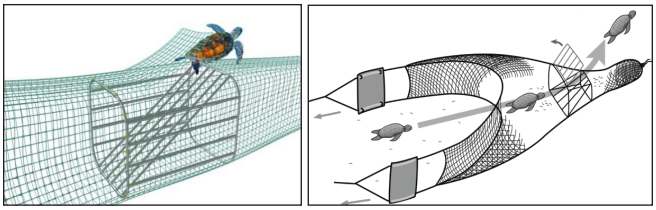

Figure 2: Turtle Excluder Device

Bycatch Reduction in Purse Seine Fisheries

Purse seines, like other nearby nets, do not discriminate. Operational selection is achievable, however, provided schools are carefully chosen after assessing the prevalence of by-catch species. To avoid dolphin capture in purse seines, special escape panels called as Medina panels, which are thin mesh pieces that prevent dolphins from being caught in the gear and back down movement, have been placed. Purse seine selectivity might also be improved by choosing the right mesh size for the target species, as well as the right fishing region, depth, and season.

Bycatch Reduction in Gill Nets

Catch mitigation strategies for gill net fisheries include optimizing gill net mesh size and hanging coefficient according to target species and size groups, fishing site, fishing depth, and season to reduce gear contact with non-targeted species. Using acoustic pingers and carefully treated netting, recent improvements have sought to make gill nets observable by marine creatures with echolocation ability. Because gill nets are non-biodegradable, they continue to gill and entangle fish and other marine animals, resulting in unintended fatality. This phenomenon, known as ghost fishing, is a drawback of contemporary gill nets. Using biodegradable natural fibre twines or time release devices to tie the netting to floats is one way to reduce ghost fishing by lost gill nets.

Bycatch Reduction in Hook and Line Fisheries

By-catch difficulties in hook and line fisheries may be mitigated by optimising hook design and size, as well as choosing the right bait type and size for the target

species and size class, as well as choosing the right fishing site, depth, and time of fishing. Using coloured bait and placing bird scaring devices (streamers) in the area where bait is laid, interaction with marine birds during long line operations is reduced. The use of circular hooks instead of traditional J-hooks has reduced sea turtle mortality in long-line operations. The use of rare earth magnets in close proximity to the hook has been observed to discourage sharks, and it has been recommended to decrease shark bycatch in pelagic long line fishing.

Technology for Bycatch Reduction in Trap Fisheries

Traps often have great species specificity and size selectivity, as well as a high possibility for non-targeted species survival and minimal operational energy needs. Trap fishing, on the other hand, has a very high loss rate during operations, as well as ghost fishing from lost traps. Optimized trap design and trap mouth configuration based on target species, as well as provision of escape windows for juveniles and non-target species in the design side, and appropriate bait type, fishing area, fishing depth, and fishing season in the operational side to minimize gear interaction with non-target species.

Conclusion

For every kilogram of fish that reaches land, up to 50 kilograms are discarded. The prohibition of trawling would be beneficial to marine ecosystems and local businesses. Trawling is responsible for half of all bycatch, while it only accounts for 20% of world fish output. When dragged gears, especially trawls, are heavily rigged, they can inflict serious harm to benthic animals and vegetation, which inhabit the bottom substratum and contribute to the region's production. Environment friendly fishing gears such as semi-pelagic trawls, benthic release panels, remote operated otter boards (smart trawling) and the use of lighter ground gear have all been beneficial to long-term fisheries viability.

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