FS IN 01

Responsible deep sea fishing for sustainable fisheries

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Fishing which was purely a traditional activity has now transformed into a commercial, market driven enterprise. The technological innovations in the field of fishing have revolutionized the fisheries sector. Fishermen are now able to fish in further and deeper waters by using larger and high powered fishing vessels, efficient fishing gears, modern and sophisticated electronic equipments for navigation, fishing and communication to harvest the fishery resources in the Indian Exclusive Economic Zone more efficiently. Over the years, the fishing effort immensely increased in the coastal waters which led to overexploitation of most of the fishery resources of the country. To release the pressure of fishing effort in the coastal belt, the Government is encouraging fishing in farther and deeper waters and has introduced numerous schemes for deep sea fishing. A precautionary approach needs to be taken in introducing more number of deep sea fishing boats and highly efficient fishing gears for sustaining the deep fishery resources of the country. The critical issues and challenges in responsible deep sea fishing is discussed in this paper.

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Responsible harvesting of underutilised fishery resources

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In order to fill in the supply-demand gap for fish protein, in the context of downward trend in production from the conventional fish stocks, there is an imperative need to locate unconventional and underutilised fishery resources. Mesopelagics and Antarctic krill are considered to be promising underutilised resources, which have potential for future development. Mesopelagic fishes in the world oceans has been estimated at about 1000 million t and recent estimate of biomass based on acoustic data is reportedly between 11,000 and 15,000 million t. Myctophids which form a major component of mesopelagic resources have high prospects to become a major source of fish protein for direct human consumption and for meeting fish meal and oil requirements for the expanding aquaculture industry and in poultry and animal husbandry, when efficient harvesting and appropriate processing and value addition technologies are evolved. The decadal average (2006-2015) catch of myctophids is 8,284 t, ranging between 15 t (2006) and 21,393 t (2011) (FAO, 2017). The decadal average (2006-2015) catch of Antarctic krill (*Euphausia superba*) from the Southern Ocean is about 1,88,210 t per annum, ranging between 10,45,86 t (2007) and 3,17,615 t (2014) (FAO, 2017). The precautionary catch limits for Antarctic krill prescribed by Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) total over 8.6 million tonnes and hence it is one of ocean's largest known underexploited resources. Recent developments in harvesting technology and in products being derived from krill indicate renewed interest in exploiting this resource. An aimed midwater trawl system designed to attain large mouth area, smoothly tapering

trawl body with small meshes in the belly or a small-meshed inner lining and small mesh codend, which can be operated at low towing speeds is adjudged to be appropriate for trawling of myctophids and Antarctic krill, in view of their small size and low swimming speeds. Important factors influencing the successful performance of the trawl system for myctophids, would be size of the trawl mouth which should be maximum limited only by the towing power of the vessel; an auto-trawl system efficient and dynamic enough for positioning the trawl in alignment with the DSL, oxygen minimum zone (OMZ) and layer of availability according to diel vertical migration of the myctophid species, a stream lined trawl body with optimised body and codend mesh sizes based on selectivity analysis of the regional species, in addition to a better understanding of the spatial and seasonal abundance of the species. The possibility for developing continuous trawling system as developed and used for Antarctic krill, comprising of midwater trawl and a powerful pumping system for continuous pumping of the catch from the codend, can also be envisaged for harvesting of myctophids. The prospects, issues and challenges in operating a fishery based on myctophids and Antarctic krill from India would be discussed in this paper.

FS OR 01

Spatio-temporal habitat delineation of threadfin breams juveniles along southwest coast of India: A tool for conservation of marine resources

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Understanding distribution of fish spawning, nursery, juvenile grounds and other ecologically important territories which are critical habitats for stock replenishment is essential to provide scientific advisories for better management and conservation of fishery resources. Mapping of juvenile grounds of *Nemipterus randalli,* one of the important resources of Karnataka coast was done on a spatio-temporal scale which is first of its kind along the coast. The study was carried out using geocoded data collected from trawlers operating off Karnataka during 2012-2016. An area of 67 864 sq km (11°7.584' N to 18°47.542' N and 71°45.533' E to 75°21.158' E) from 20-200 m depth was covered. The geocoded data of the species collected was analysed and all the fishes under 12.8 cm, which is the minimum size at maturity (MSM) were considered as juveniles for *N. randalli*. Catch per hour (CPH) was estimated and the minimum and maximum abundance on spatio-temporal scale was mapped using ArcGIS. Juvenile abundance showed a peak during Nov–Dec and April-May which is corresponding to the breeding season of the fish as evidenced by the biological study. The area of maximum abundance was about 7,780 sq km (14°29.107/ N to 16°15.267' N and 73°1.416' E to 74 °10.264' E) which formed about 11% of the trawling ground. The catch showed a decline of 20% with sharp reduction in mean size to below MSM in 2016. This indicates that the fishing pressure is increasing on the resource and conservation of the species has to be initiated immediately. Spatial restrictions of trawl operations in the identified nursery grounds could be one of the possible options to conserve the fishery in sustainable level. The present study has identified and provided illustrative maps of