study and its implications are discussed in the paper.

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Role of artificial reefs in improving coastal productivity, conservation and energy efficient fisheries

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Artificial reefs are modified FADs set on the sea bed to promote habitat recovery or development and enhancement of the growth of marine benthic flora and fauna. Artificial reef technology has been used widely across the globe for both habitat and ecosystem enhancement and commercial fishery enhancement. The materials used for artificial reef construction are variable like concrete, steel and glass-reinforced plastic. In India, Tamil Nadu has, in recent years, become a major player in the practice of artificial reef deployment in coastal waters, under technical guidance from ICAR-CMFRI. Artificial reef modules made of concrete have been deployed in about 50 sites along the Tamil Nadu coast, under different schemes during the period 2009-2016. We present here, as a case study, the impact of artificial reef deployment in the coastal waters of Kovalam fishing village in Kancheepuram district of Tamil Nadu. Comparison of fish landings before and after reef deployment indicates improved catch of certain groups of fishes like perches and carangids. The direct beneficiaries are the artisanal hook & line fishers. Aggregation of breeding fishes and juvenile recruitment in the reef area is immense. The reefs also aggregate bait fishes which help the fishermen to carry out live bait fishing of economically valuable pelagic fishes slightly offshore. Underwater observations indicate aggregation of fish groups like groupers, pig-face breams, snappers, carangids, cardinal fishes, damsel fishes, angel fishes, scorpion fishes, rabbit fishes, and fusiliers. The reefs are also major settlement sites for benthic fauna including crinoids, urchins, starfishes, soft corals, acorn barnacles, mussels, giant clam, and oysters. On the economic front, while reef fishing has considerably reduced scouting and fishing time, as well as diesel consumption, the quality of the fishes caught from the reefs has induced higher demand and better price in local markets.

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Development of low drag trawls for energy efficient fishing

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Trawling is the most energy intensive fishing method and fuel cost alone constitute upto 75% of operational expenditure.It was reported that to catch one kilogram of fish, trawling requires 0.8 kg of fuel. Drag is the single most important factor contributing to the fuel consumption and thereby energy efficiency and profitability of trawl operations. Drag of trawl depends on factors like the design and rigging of the net and the operating conditions. According to Wileman (1984), the warp contributes 5%, sweeps-4%, otterboards-20%, floats-3%, foot rope-10% and netting- 58% to the total drag. Use of smaller otterboards, adoption of optimized towing speed, thinner twines and large mesh size to reduce twine surface area

and opting selective shape of the mesh can bring down the drag and fuel consumption. Similarly, drag reduction is achieved by adopting optimized trawl design with special features. Cutaway top belly shrimp trawl is an example of design improvement for drag and bycatch reduction. Estimation of drag of commercial trawls in Kerala reveal that it ranges from 1.37 to 48.94 kN and it is more for fish trawl, followed by cephalopod and least for shrimp trawl. Stronger materials will permit the use of thinner twines, leading to less twine area for trawl fabrication. Comparative trials carried out with 24.47 m fish trawls made of high density polyethylene (HDPE) and ultra-high molecular weight polyethylene (UHMWPE) revealed that the average reduction in drag of UHMWPE trawl was 17% with an average reduction in fuel consumption by 10%. The fuel consumption per kilogram of fish captured was estimated as 2.9 liters for HDPE trawls and 1.9 liters for UHMWPE trawls. It is concluded that material substitution, coupled with improvement in trawl design can help significantly in reducing the drag and fuel consumption to improve the economic feasibility of trawl operations. Besides, by reducing the fuel consumption, a drastic cut in carbon emission can be made.

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Species composition and juvenile incidence in small mesh ring seine operated off Cochin, Kerala

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Ring seine is the most important and widely used fishing gear by motorized fleets along Kerala coast. It is locally known as *ringuvala* or *kudukkuvala* or *ranivala* or *choodavala* at different regions along the Kerala. A recent development in the ring seine fishery is the use of small mesh (8-10 mm size) gear operated in the near shore area at 13-18 m depth using plank built canoes of 9.6-12 m L_{OA}. To assess the species composition and juvenile incidence in small meshed ring seine, a fishing village namely Chellanam located in southern part of Ernakulum District was selected. The village had as many as 55 small meshed ring seine units and three medium sized units. A detailed study was conducted to assess the species diversity, species composition, total catch and juvenile catch by small meshed ring seines operated in this area. Estimated total landings during the study period was 9.8 t. Of this, of 6.7 t was juveniles, *viz*., 68.21% of the estimated total landings was juveniles of which oil sardine formed 5.1 t by weight contributing to 76.11% of the juvenile catch. From the small meshed ring seine catch, 61 species were identified and recorded which include 53 species of fin fishes (belonging to 22 families), 5 shrimp species, one crab species and one cuttle fish species. Catch composition reveals that oil sardine, *Sardinella longiceps* forms 52% of the observed landings followed by Ambassids. Mesh size regulation of the gear would prevent juvenile fishery.

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Fishing using lights in coastal Karnataka – a boon or bane?

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