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Marine Fisheries Information Service

PUBLISHED BY

Dr. A. Gopalakrishnan
Director
ICAR-Central Marine Fisheries Research Institute, Kochi

Front Cover : *An installation art created from discarded plastic bottles*

Back Cover : *A ghost net with entangled marine debris*

The Marine Fisheries Information Service *Technical and Extension Series* envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

From the Editorial Board.......

Warm greetings to all

Globally, marine pollution which is caused by the discharge of harmful substances like oil, plastic, industrial and domestic wastes into the sea has risen manifold over the last few decades. Considering the sheer vastness of the oceans, exact statistics on the extent to which this phenomenon of marine pollution is affecting the ecosystem may be difficult to quantify but experts agree that addressing it is a serious challenge. Beyond doubt, oceans are to be kept clean to protect the marine ecosystem and humans who depend on the seas for their food, trade, tourism, recreation and several other needs. The lead article takes a look at the scenario in India and suggests what can be done at various levels to prevent further damage to the marine environment. This issue also includes a few articles related to emerging fishery resources as fishers move beyond conventional fishing grounds and also on aquaculture and fish health.

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A National Marine Debris Management Strategy to conserve marine ecosystems

V. Kripa, P. Kaladharan, D. Prema, R. Jeyabaskaran, P. S. Anil Kumar, G. Shylaja, K. K. Sajikumar, A. Anasu Koya, Preetha G. Nair, K. S. Abhilash, A. M. Dhanya, John Bose, T. V. Ambrose, N. D. Divya P. G. Vishnu and Jishnu Mohan

ICAR-Central Marine Fisheries Research Institute, Kochi

Introduction

Marine debris which is defined as any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment is one of the most pervasive, yet potentially solvable, pollution affecting the world's oceans, coastal ecosystems and rivers. Whereas impacts of most anthropogenic activities are usually found near the point source, marine debris has been found to impact even distant locations, often affecting uninhabited areas also. According to United Nations Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), 60 to 80%, of the global litter found in the coastal and marine ecosystems has originated from land and only the rest from sea based activities. The slow degradable nature of marine litter and the potential to pollute all spheres of oceans irrespective of point source has raised the alarm bells. The UNEP has recently initiated a special program 'Global Initiative on Marine Litter'. Three main industries which are affected by marine debris are fisheries, shipping and tourism and the estimated damage to these sectors in Asia-Pacific Economic Co-operation (APEC) region is US$1.265 million annually. In India, occurrence of marine debris along the Indian coast has been studied by the ICAR-Central Marine Fisheries Research Institute, since 2007. The study indicates that marine debris has affected the ecosystem and livelihood of fishers. In this article, the impacts of marine debris on the ecosystem are explained briefly followed by the possible solutions for controlling and reducing marine debris in the country and the need for a Nation at Marine Debris Management Strategy.

Types of marine debris

Since the major source of marine debris is land, an evaluation of the solid waste generated on land and the effectiveness of waste management can indicate the threat to the coastal ecosystem of the specific area. In most cities, there is no complete waste management system in place and the threat to coastal and riverine ecosystem from marine debris is evident. Indiscriminate dumping of solid waste on land reaches the drains, rivers and estuaries and finally ends up in the sea. During this process, these may sink and spread on the river bed or estuaries, can clog small canals and ultimately affect the aquatic habitats and its functioning which supports the local fauna. From the coastal waters, they are also transported to distant places by wind and water currents. They may either remain floating, trapped in gyres or eddies or sink and settle or become washed ashore as beach litter. For wastes originating at sea, usually from ships, the fate of the litter is the same. Studies have shown that debris can also lead to water stagnation thereby creating a breeding ground for mosquitoes and flies that spread diseases to humans. Discarded litter has thus become a concern for human life and health.

In India, estimates of Municipal Sewage Waste (MSW) in 2008 was about 48134 ton per day from 299 cities across the country with the per capita production being 0.376 kg per day. In a report on Municipal Solid Wastes in India based on the data from CPCB, it is stated that the major MSW is compostable waste (43 %) followed by ash and fine sand (41%). Paper which is degradable forms 5.7%. The other items which are non-degradable and semi-degradable were plastics, leather, glass, metal and

Solid wastes dumped in the Cochin Backwater

Clogged canals impacting local biodiversity

textile. Of these, plastics consisted of 32% followed by textile (28.7%) glass (17.2%), metal (15.6%) and leather (6.6%). The dominance of semi-degradable material which can be recycled clearly indicates the potential we have to move towards a zero-waste situation with proper waste management. Also, in the marine and coastal areas there are large biomass of floating weeds and sea grasses which are degradable and can be readily composted, but very little effort is currently made to effectively manage these.

The UNEP guidelines for assessing litter, list seven types of materials such as plastics, foamed plastics, cloth, glass and ceramics, metal, rubber, wood and others (electronic items, paraffin wax, etc) with a total of 77 individual codes for items coming under these categories (*UNEP Regional Seas Reports and Studies, No. 186; IOC Technical Series No. 83*:). This is mainly meant for uniformity in data collection and comparison of data under the Regional Sea Programme. The non- degradable and semi-degradable items commonly found in India are varieties of plastics (hard / foamed), rubber, metal, thermocol, textile and glass. In India, the quantity of litter on the beaches has been found to vary (*CMFRI Annual Reports in Eprints.cmfri.org.in*) with plastics being the major pollutants.

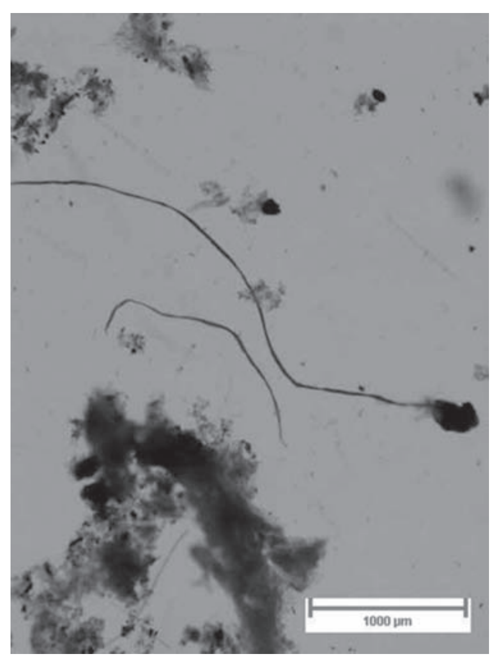
Though the percentage occurrences of glass, ceramics and metal debris are much lower compared to plastics, broken glass pieces and other sharp objects lying on the beach pose a threat to fishers and beach goers. In bivalve fishing areas of Vembanad Lake, especially where the clams are handpicked from intertidal/subtidal areas, fishers have indicated that broken glass pieces are a threat to their health and plastic covers and other debris have led to low catch per hour of fishing.

Foamed plastics that include thermocol are commonly used in packaging industry and as use-and- throw plates. Being light, the thermocol debris floats and is carried away by wind and currents and was one of the most common litter item in all surveys conducted by CMFRI in beaches and fishing areas. Tyres, footwear, bags and toys made of rubber, semi degradable textile material and mattresses are also common in the marine debris in almost all beaches and waterways. These actually degrade the habitats and reduce the functions of the ecosystems. Apart from this, these macro items soak and settle on the bottom affecting the benthic substrate and impacting the breeding and nursery grounds in critical habitats like mangroves, sea grasses and coral reefs. E-waste like used CDs, parts of computer and mobiles are also found in the marine debris but comparatively less.

Abandoned, lost, or otherwise discarded fishing gear (ALDFG) is one of the most dangerous types of marine debris. These nets called 'Ghost nets' can go on fishing, trapping, or entangling other fauna and act as a collecting entity of other debris thereby degrading habitats and reducing functional values of ecosystem services. Increased use of synthetic material in fishing gear manufacture and range extension of fishing activities have led to presence of ghost nets in the oceanic and coastal ecosystems. In India, ghost nets sometimes get washed ashore. There is a need to create awareness among fishermen on the harmful effects of ghost nets on the marine fauna as well as navigators and other users of the marine ecosystem like divers and tourists. Countries like Australia which had severe problems due to ghost nets have devised several methods to tackle the problem. GhostNets Australia is an alliance of 22 indigenous communities from coastal northern Australia established in 2004. This program has trained and supported indigenous groups in removing ghost nets on shore and at sea. Such exercises are strenuous and these groups undertake cleanups of fishing gear and other debris at sea for periods extending to three weeks. Discarded lobster and other fishing traps are also a major concern in Australia and it is mandatory that traps are made with rot cord that decays in approximately six months.

Several reports on seabirds, turtles, seals, sea lions, whales and fishes that have suffered from entanglement or ingestion of marine debris are available. Plastic bags are mistaken by sea turtles for jellyfish, their prey and when they try to feed on it, the bag gets entangled and most often the turtle moves around with this. Recent studies show that plastics can act as a source of toxic substances which can affect the fauna when ingested, bio-accumulate and then be transported up the food web to humans. Studies suggest that 70% of marine litter sinks to the seabed, 15% continues to drift within the water column and 15% ends up on beaches. The benthic ecosystem is one of the most productive areas which support the demersal fishes, shrimps and several invertebrates like the octopuses, sea cucumbers, gastropods and bivalves. They depend on benthic substrate for all their major life cycle activities like foraging and breeding and hence are more vulnerable to impacts of marine litter. In Cochin backwaters and adjoining canals, spread of litter on the bottom has been found to affect breeding of shrimps and pearl spot (*Etroplus suratensis*) which are the major fishery resources there.

Plastic products ranging from small ice cream spoons to large sheets and crates are dumped as litter on the beaches and obtained along with fish catch in gears like bag nets and trawls. In the estuaries, these occur in gill nets and drift nets. Even critical habitats like coral reefs of Lakshadweep have plastic litter. In a survey conducted the mean litter density was estimated as 7.71 g m^{-2} and in the 4 inhabited islands the litter density ranged from 2 to 11 g m^{-2}. Similar situation occurred in the ecologically sensitive, sea grass beds at Mandapam, Kilakkarai, Erwadi and Periyapattinam, which are habitats of dugong. Plastics are a transport vector of persistent organic pollutants (POP) and heavy metals as well as a source of chemical pollutants themselves such as phthalate plasticisers, polybrominated diphenyl ether flame retardants (PBDE; which are known to cause infertility in human beings) and bisphenols (endocrine disrupter). Depending on the size, plastics are classified into macro(>5mm) and micro plastics (<5mm) that includes particles as small as 10 nanometers. Micro-plastics are used as abrasive



Plastic strands in the gut of oil sardine scrubbers in domestic cleaning products and industrial cleaning applications. Microplastics formed by the physical, chemical and biological fragmentation of larger items on exposure to UV light or due to abrasion are called 'secondary' microplastics. These have an increased risk due to their larger surface to volume ratio which results in higher adsorption capacities which, in combination with higher bioavailability makes them a potential carrier of pollutants into the food web. Plastic strands have been observed in the gut of sardine, anchovies and mackerel, while larger pieces were observed in higher trophic level fishes like dolphin fish and tunas besides sea birds. Analysis of zooplankton samples along Kerala has shown that nylon threads occur at densities of 3 to 4 per m^3 and this is comparatively very low (*CMFRI Annual Report 2015 -16*). This is a positive indicator that further deterioration of our coastal ecosystem can be prevented through proper management.

Estimates of litter in Vembanad Lake

Observation on seasonal occurrence of plastic wastes in beaches of Central Kerala indicate decline in plastic over the years (Fig. 1). One of the reasons for this decline is the frequent cleaning activities by various agencies as part of awareness programmes. Different types of surveys including transect / quadrant and participatory surveys were conducted in the marine and estuarine regions to assess the quantity of litter on the surface, column and bottom. The litter collected per unit area and time (for floating litter) were sorted and identified and their number and weight noted.

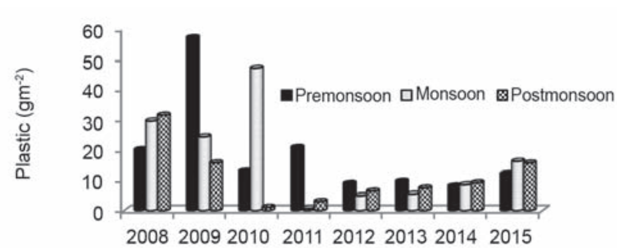


Fig. 1. Seasonal occurrence of plastic wastes in central Kerala beaches during 2008-2015

Bottom litter

All through the Vembanad Lake, litter is present on the substrate, but highest quantity is in Cochin backwaters and bar mouth region. Along the sides the spread of litter is to the height of 50 cm and more.

Column litter

It has been estimated that during low tide, about 135 tonnes of litter pass though the columns in a year towards the bar mouth. Some of these can also be flushed back during high tide. The survey has indicated that plastic flex, cloth, bottles, plastic coated sacks, thermocol pieces/ sheets, footwear etc are common.

Floating litter

About 75 to 100 kg of litter (wet weight) floats on the surface waters (less than half meter) and passes through the Cochin backwaters to the Arabian Sea during low tide per day. This can settle near the bar mouth region or float away from the coast.

Impacts of marine debris on three major sectors

Tourism : This is one of the largest business sectors of the world economy contributing significantly to the GDP and employment generation. The accumulation of marine litter on the beaches and in the coastal areas can affect natural aesthetic beauty thereby reducing their recreational value and affect the tourism based on these ecosystems. In India, the travel and tourism sector is a fast growing industry which provides significant socio economic benefits. If we don't act fast enough to reduce our litter outputs and have proper litter management plans it will adversely affect the sector.

Shipping industry : Marine debris are known to cause navigational hazard for the shipping industry as reflected in the increasing number of coast guard rescues to vessels with impacted propellers. Apart from this, accidents in the sea due to collision with marine debris have been cited as reason for human fatalities.

Fishermen and fisheries : The trapping of assorted type and size debris in fishing nets has been found to affect fishermen as removing these from the nets is time consuming. In small stake nets where shrimp is the major catch, fishermen have to engage extra labour to remove the debris from the catch. In a study conducted on stake nets in Vembanad Lake, shrimp catch in the net ranged from 0.525 to 1.36 kg while the average weight of litter in these nets ranged between 1.87 to 13.8 kg per day per net. Experimental fishing conducted along Central Kerala has clearly indicated the growing threat to fisheries with the material collected in the nets from near shore areas having huge quantities of trash especially plastics and pieces of nets. Entanglement of debris including fabrics and ghost nets on the propellers and blocking of intake pipes of the fishing vessels have considerable impacts on fishing time and maintenance costs.

Plastic collected from stake nets

Plastic waste collected during experimental trawl fishing operations

International agreements and initiatives

Initially, considering the importance of marine environment in global economy, the Inter governmental Oceanographic Commission (IOC) and the United Nations Development Programme (UNDP) initiated programs to conserve the resources and maintain the health of the marine environment. However these rules and guidelines did not directly target marine debris, though there were instructions that wastes should not be dumped and environment should be clean and healthy. The subsequent alarming rate of increase of marine debris in all regions and its ecological, social and economic impacts led to major global initiatives such as listed below.

Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA) of UNEP was established in 1995 and is the only inter-governmental mechanism which addresses the impacts of land-based sources and activities on coastal and marine environments and human well-being. Its goal is to prevent, reduce, control or eliminate and/or recover from the impacts of the degradation of the marine environment from land-based activities by facilitating the duty of States to preserve and protect the marine environment. The 'Global Partnership on Marine Litter' (GPML) was launched in June 2012 at Rio + 20 in Brazil. It seeks to protect human health and the global environment by the reduction and management of marine litter as its main goal, through several specific objectives. 'The Future We Want' an outcome document of Rio+20 (2012) supports the sustainable management of wastes through waste minimisation activities by the 3 R's (Reduce, Reuse and Recycle) and also through energy recovery. It also calls for the development and enforcement of comprehensive national waste management policies, strategies, laws and regulations.The 'London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter' an international treaty limits the discharge of wastes generated on land and disposed of at sea, is one of the first global conventions to protect the marine environment from human activities. The FAO Code of Conduct for Responsible Fisheries was adopted in 1995, and its Principle 6.7 states that the management of fish harvesting processes should be carried out in a manner which reduces waste and Principle 6.8 promotes the protection of critical habitats from destruction, degradation and pollution from human activities. The 'UN Fish Stocks Agreement' (UNFSA) adopted in 1995 and enforced in 2001 is based on the general provisions of the UNCLOS which states that fishing should be conducted in a manner that will protect the marine environment and prevent loss of fishing gear. The 'Honolulu Strategy' created in 2011 is a framework for a comprehensive and global effort to reduce the amount and impact of land-based and ocean-based sources of marine debris introduced into the sea and accumulated marine debris on shorelines. The International Convention for the Prevention of Pollution from Ships MARPOL 73/78 – seeks to prevent and reduce the amount of debris being discharged into the sea from ships.

Awareness Campaigns

The program 'International Coastal Cleanup Day' held on 17th September every year where thousands of volunteers join together to clean the beaches and coastal areas completed 25 years in 2011. In India, the program is organised by the Indian Coast Guard. About 99 tonnes (t), 116 t and 71 t were collected by 22458, 19935 and 19600 number of participants with an average collection rate of 4.4, 5.8 and 3.7 kg per participant during 2012, 2013 and 2014 respectively. This indicates that about 70 to 116 tonnes of debris are spread along Indian coasts which can enter the coastal waters and then spread to the Indian Ocean.

ICAR- CMFRI has also initiated several programmes to create awareness on marine litter. In 2012, on World Environment Day, an installation Art of an 'Octopus' was created on Cherai beach. The impressive 3 m tall sculpture was created using 125 kg of plastic bottles and carry bags collected from the beach. Similarly a crab ('Mad Crab') installation which occupied a ground area of 400 sq.ft and was 17 feet in height and 19 feet in width was erected on Fort Kochi beach on 30th December, 2013 using discarded plastics on the beach by involving the local communities and visitors to beach in the campaign. A short movie titled 'Ocean or plocean?' with a message to reduce littering produced by ICAR-CMFRI won the Beaver Bronze award under the science documentary section in *Rashtriya Vigyan Chalachitra Mela* and Competition, 2014 (National Science Film Festival,) organised by Vigyan Prasar, National Institute of Science and Technology Communication, Noida and National Council of Science Museums, Kolkata, held at Bengaluru in February, 2014. Apart from this,

Mad crab installation Art using discarded plastic bottles competitions for school children on impacts of litter on ecosystems and several lectures on Marine litter by staff involved in this project have helped to make public aware of the impacts of litter. However this alone cannot solve the problem unless there are facilities to deposit the litter and destroy it properly without causing additional problems. In Kozhikode, fishermen who used to take a share of the fish catch in plastic carry bags for domestic use have shifted to using small buckets for own use thereby reducing use and discard of plastic bags which are small welcome initiatives.

Remediation Operations

Fishermen are directly impacted by the increase in litter in the coastal areas and attempts have been made by fishermen themselves to remove litter in the past. In 2012, members of 12 Kayal Samraksha Samithy with technical support from Asoka Trust for Research in Ecology and Environment (ATREE) and Vembanad Nature Club collected about 40 bags of plastics and used this for levelling about 150 m of the Muhamma –Kalyanasseri Road in association with the local Panchayat (New Indian Express, May 16, 2012). Recently another local attempt to remove the solid waste accumulated in Cochin backwaters was initiated by the youth belonging to Dheevara Sabha. The litter accumulated in the shore line area is in layers and intermingled with silt, making it heavy and difficult to remove. Using a hired canoe they are using pumps to splash water over the substrate during low tide to loosen the settled litter, followed by manual removal of the litter with rakes. The program was inaugurated on 2nd October, 2016 and during the period from October 4th to 21st they have removed about 9.1 tonnes from the shore line area. The collected litter packed in bags was removed by Cochin Corporation. Analysis of the litter component in all the surveys conducted by ICAR-CMFRI has indicated the dominance of plastics, thermocol, cloth, rubber and other synthetic articles. Since most of these items can be recycled and reused, proper management measures to segregate and process the waste at the production /collection level will solve the problem to a large extent. A district level committee can be constituted to draft an action plan to solve the problem. Funds for this activity also should be provided.

Wastes collected during cleaning of Cochin Backwaters

Need for National Marine Debris Management Strategy

Though the UNEP was established in 1972, a targeted program for marine debris control was initiated only since 2003. The problem of marine litter was recognized by the UN General Assembly (UNGA), which in its Resolution A/60/L.22 (November 2005) calls for national, regional and global actions to address the problem of marine litter. Now apart from Regional Seas programs, each nation is implementing its own strategy for marine debris reduction and control. ICAR- CMFRI has been organising stakeholders meeting every year in all maritime states. Marine litter is one of the major problems identified by fishermen and they have demanded a solution for this. Considering the growing threat to resources sustainability and reduction in ecosystem functional services leading to loss of livelihood in fisheries sector, we strongly recommend that there should be a National Marine Debris Management Strategy with specific goals for Prevention and Control of debris accumulating, spreading and in coastal and marine ecosystems affecting the fish production. The Ministry of Environment and Forest (MoEF) has issued MSW management and handling rules –but this has not targeted marine debris. Considering the global importance of plastics, we have to develop a responsible method of disposing used plastics instead of making it a "litter". The long term solution lies in proper development and utilization of waste management facilities in all villages, municipalities and corporations so that it does not become a regional and global issue. Few suggestions for reduction marine debris are given below.

1. Prevent/reduce generation of waste that contributes to the marine litter (First identification of major component in the litter then measures to reduce)
2. Prevent/reduce litter reaching the marine environment : Proper segregation of litter which can be recycled and reused (Eg: Korea, US)
3. Collect litter from the marine environment through incentives
4. Provide Incentives to fisher for marine litter collection (n the Republic of Korea, fishing boats are provided with large bags to collect litter and an economic incentive of US$10 per 100 litre bag is provided to fishermen)
5. Development of Environment-friendly design in packaging (Eg Japan)
6. Extended producer responsibility (EPR) makes a producer financially and/or logistically responsible for the post-consumer (i.e. waste) stage of a product's life cycle (Eg EU states)
7. Provision of adequate low-cost or free and easy-to-use collection facilities in ports
8. Incentive schemes to promote proper disposal of discarded gear
9. Improvements in waste management infrastructure in tourist areas (e.g. placing suitable bins on beaches, followed by regular clearing)
10. There is a need for greater producer responsibility and more widespread application of the polluter pays principle.
11. Marine litter clean-ups (costly but necessary downstream actions)
12. The development of new recycled plastic products

Integrated Approach

Marine debris management should be an integrated approach involving even the smallest unit like households and village governing bodies.

- **Funding** is required from central governments or international agency to develop waste management infrastructure and provide incentives.
- **Municipalities/local governments** upstream and downstream should invest further in waste and wastewater treatment infrastructure and in managing these effectively. This can help to prevent marine litter at source.
- **Private and public sectors** should try to develop new packaging design with improved durability, recyclability and green chemistry.
- **NGOs and voluntary organisations** should plan and organize programs to motivate changes in consumer habits and norms and encourage producer responsibility.
- **Local communities** without age and gender bars should engage in awareness and clean-up activities.
- **All categories of consumers** including tourists should make responsible choices regarding purchases and take responsible actions regarding waste disposal.

Seasonal culture of *Pseudapocryptes elongates* (Cuvier, 1816) in West Godavari and Krishna Districts of Andhra Pradesh

Sekar Megarajan[1], Ritesh Ranjan[1], Biji Xavier[1], Loveson Edward[1], Shiva Ponnaganti[1], Imelda Joseph[2] and Shubhadeep Ghosh[1]

[1]*Visakhapatnam Regional Centre of ICAR-Central Marine Fisheries Research Institute, Visakhapatnam*

[2]*ICAR-Central Marine Fisheries Research Institute, Kochi*

The gobi, *Pseudapocryptes elongates* (*Ramulu* in telugu) is an air-breathing fish belonging to the family Gobiidae. A bottom dwelling fish, it is mostly observed in canals and creeks of estuaries. Besides India, it is found in countries like Bangladesh, Cambodia, China, Indonesia, Japan, Malaysia, Singapore, Taiwan, China, Thailand and Vietnam. In India, it is mostly distributed along east coast. Life history of the fish is different from other fishes in the family Gobiidae. After it completes its planktonic stage in the coastal waters the larvae enter the intertidal zone, where it metamorphoses into juveniles which enters creeks and mangrove areas. Here, they grow for 8-9 months and become adults. After sexual maturation, the adult fish goes back into the sea for breeding. Highly euryhaline, it can tolerate salinities ranging from 0 to 50 ppt. It is omnivorous and feeds mainly on phytoplankton and invertebrates (epibenthic diatoms, cyanobacteria, filamentous algae, juvenile shrimps and small worms). Important characters like tolerance to wide salinity, omnivorous feeding behaviour and good local market demand play a major role in selection of this fish for pond culture.

Fig. 1. *Ramulu* seeds collected for stocking

Considered a delicacy in countries like Japan, Taiwan and Vietnam, the market demand is leading to semi-intensive and intensive culture of the fish in these countries using wild collected seeds. In the last few years, culture of this fish is picking up in India, especially in West Godavari and Krishna districts of Andhra Pradesh. Cultured seasonally in shrimp ponds or paddy fields, it is being considered as an alternate to shrimp farming by many small-scale farmers.

Since the West Godavari and Krishna districts have numerous creeks and mangrove areas the juveniles are abundant here, especially during April to June. During low tide, the fingerlings are collected using scoop nets from the water filled mud pits in the mangrove areas. Presently, cultivable area of the fish in both these districts is more than 500 acres. About half of this area is in the paddy fields and the remaining in existing shrimp ponds. Paddy culture commences in January and is harvested in April. After paddy harvest, the lands are ploughed, filled with water to about 2 feet and stocked with the fingerlings collected from the wild. In shrimp ponds, seeds are stocked after the summer harvest of shrimps. Wild collected fingerlings of about 2-5 cm in length are stocked at the rate of around 25 numbers/m^2. About 6-7 months later, when they become adults having weight around 40g each, they are harvested. Average survival is around

70%. Generally, fishes are harvested during October to November and the fish bearing ripe gonads fetch higher price in the local markets. Inputs like feed and fertilisers are not needed during culture and only water exchange is performed at every 5-6 days intervals. During culture, water salinity generally ranges between 5-10 ppt. At harvest, water is released from the pond and fishes are harvested by hand picking from the burrows made by the fish. These are sold in local markets at Bhimavaram and Machilipatnam while some are transported to Hyderabad also.

The culture is gaining popularity among aqua-farmers, especially among small scale shrimp farmers, as no extra inputs are required during the culture. Farmers buy seed at ₹ 1 per piece and the average selling price of the harvested fish is around ₹ 15 per piece, with the minimum selling price being ₹ 10 per piece. Expenses on feed are not incurred as it feeds on naturally available worms and algae in the pond. At harvest, ₹ 1 per piece is paid as labour charges for hand picking of the fish from the pond bottom. Therefore, seed price and cost incurred at harvest are the only major expenditures. Thus, farmers get a minimum profit of ₹ 4-5 lakhs per acre per year from fish culture, apart from the income earned through paddy culture. Unlike other fishes and shrimps, diseases have not been encountered till date. The magnitude of profit is attracting an increasing number of farmers to venture into culture of *Ramulu* in the last three years. However, scarcity for seeds leading to increasing seed costs, widening of culture area which leads to higher volumes of harvest causing decrease in selling prices are emerging issues.


Harvested adult fish

Suitability of bigeye trevally for cage aquaculture in coastal waters of Karnataka

K.M. Rajesh, Prathibha Rohit, A.P. Dineshbabu, Sujitha Thomas and G.D. Nataraja
Mangalore Research Centre of ICAR-Central Marine Fisheries Research Institute, Mangaluru

Capture Based Aquaculture (CBA) in small estuarine cages, an intervention initiated to beneficially use juveniles of commercially important fishes which are otherwise generally discarded, has transformed the concept of family based fish farming ventures in coastal Karnataka. Even though many species of fish are generally suitable for cage culture, selecting the locally available fish species that will do well in cages in the particular location is very important. Currently the small scale estuarine finfish cage farming in Karnataka is mainly restricted to the seabass (barramundi) and red snappers. Most of the barramundi faming relies on hatchery-reared seeds while red snapper production relies on the collection of the seeds from the wild. The difficulty in transportation of seabass seeds from the hatcheries situated along the east coast to Karnataka is the major bottleneck for the expansion of its culture. On the other hand availability of wild red snapper seeds is insufficient for sustainable large scale cage culture. Hence, continuous efforts to identify other suitable fishes for cage culture were made. In the present study, the suitability of bigeye trevally for aquaculture in estuaries was evaluated.

Fish seed surveys conducted revealed abundant availability of bigeye trevally (*Caranx sexfasciatus*) seeds during post monsoon season (September–January) in the estuaries of Karnataka. They form a by-catch in the small inshore gears as well as the shore-seines operated by local fishermen. These seeds are live when landed. Due to their small size they do not have a market value and are discarded on the beach by the fishers. As a positive impact of the awareness created by the Mangalore Research Centre, the fishermen practising cage farming of fishes started collecting these juveniles for stocking in the cages. The small sized (50 to 85 g) live seeds of bigeye trevally collected by fishermen at Uppunda were stocked @ 300 numbers per cage in two cages of 4×2×2m diamention made of netlon lined with nylon net, during December-January. The fishes were fed with low value fishes @ 6-8% of their body weight. Cages were cleaned fortnightly to remove biofouling organisms that reduce the water flow and also increase the weight of the net. After a culture period of 150-180 days, the big eye trevally reached an average size of 300–450 g. At the end of six months about 125 to 150 kg of fish were harvested from two cages with a survival rate of 80-90%. The growth rate observed for the period of six months was very encouraging. Further, there is good market demand for this species and it fetches ₹ 350-400/kg.

This study has clearly indicated that the culture of bigeye trevally in cages is successful and remunerative. The availability of seeds in good numbers in the wild, fast growth and the good market price makes the bigeye trevally a suitable species to be considered for mariculture in cages in inshore areas in Karnataka. In addition, it also results in diversification of species that can be cultured and reduces the pressure that now exists to procure seeds of seabass and snappers from hatcheries as well as from the wild.

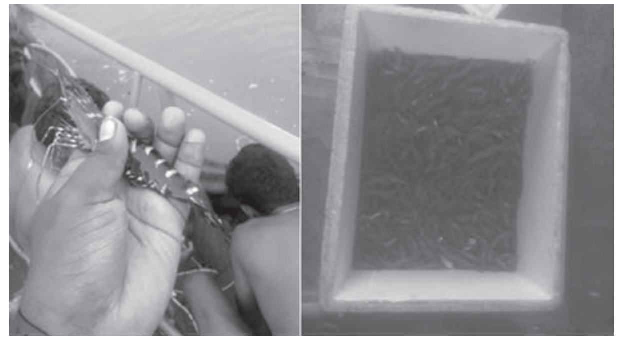
Observations on auto stocking of black tiger shrimp into finfish cages in creeks

Sekar Megarajan, Shubhadeep Ghosh, Ritesh Ranjan, Biji Xavier and Vamsi Balla
Visakhapatnam Regional Centre of ICAR- Central Marine Fisheries Research Institute, Visakhapatnam

Finfish culture in both sea and brackish water cages is gaining popularity in different states of India. The West Godavari and Krishna districts of Andhra Pradesh are bestowed with vast brackish water area formed by the Godavari and Krishna rivers. Finfish culture in cages was initiated in the brackish water creek at Kruthivennu, Krishna District, Andhra Pradesh to observe and understand the feasibility of fish culture in creeks. Two square shaped GI (Galvanised Iron) cages of 6 x 6 m size were used in this study. Cages were installed with the help of air filled barrels for floatation and

Cage culture site at Kruthivennu

anchors (iron) and palm tree for mooring. Inner and outer knotted HDPE nets with 4 - 5 mm mesh size were used to hold the fish with an average water depth of 2.5 m. The site has plenty of finfish and shellfish seeds and preliminary survey conducted revealed the availability of seeds of black tiger shrimp, white shrimp, mullet, milk fish and sea bass during different seasons. Both cages were stocked with onsite collected wild mullet fingerlings of 8 - 10 cm size at density of 20 numbers/m^3. Stocked fishes were fed with floating and slow sinking artificial feed containing 32% protein. Cages were stocked with mullets in the last week of March, 2016, and after a week, nets were lifted to monitor the stocked fishes. Interestingly, seeds (post larvae) of black tiger shrimp about 25 days old, were also observed along with the stocked fishes in both the cages. Thereafter, the fishes were regularly fed and monitored. Cage nets were changed after 55 days of culture, and during this time many numbers of black tiger shrimp were observed in both the cages with an average weight ranging from 9 to 11 g. A total of 22 kg of black tiger shrimp were finally harvested from both the cages. The above interesting observation indicates the abundant availability of shrimp seeds in the creek. Observed growth of shrimps is comparable to their growth rate in commercial shrimp culture ponds. The present observation revealed that creeks in the region have huge potential for shrimp seeds and it also implies that shrimps can be cultured successfully in cages in the creeks. This will be helpful for the rural, landless communities practising fish farming in creeks who can improve their livelihoods by culturing locally available shrimp seeds in cages.



Shrimp harvested from cages

Heavy landing of lesser sardines juveniles

S. Surya, M. Rajkumar, L. Remya, A. Gandhi and A. K. Abdul Nazar
Mandapam Regional Centre of ICAR- Central Marine Fisheries Research Institute, Mandapam

The juveniles of lesser sardines *(Sardinella gibbosa* and *Sardinella albella)* locally known as ‘chala’ were landed heavily at Soliakudi Landing Centre by trawl net after the seasonal fishing ban (April 16 – May 31) ended. Landings of juvenile lesser sardines were noticed during entire month of June 2016 in shrimp trawlers (OAL 10–11 m with 110–188 hp engine) operating at Soliakudi, fishing upto 14 m depths and covering a distance of 8-12 km from the shore. The trawl net has a head rope of length 350 m with a stretched mesh size of 40, 25 and 15 mm at the wings, belly and cod end respectively. They start from shore by 16 00 hours and return next day morning by 07 00 hours with landings continuing upto 10 00 hours. About 3 to 3.5 tonnes (t) of juveniles were landed by each trawler. Around 30–35 trawlers were operating from the base. During June 2016, an estimated 120 t of juveniles of lesser sardines of 32–85 mm size was landed along with shrimp and other commercial fishes. Almost 80% of the juvenile sardine catch was 30-50 mm sized which were sold at the rate of ₹ 10–15 per kg. The catch was packed off to a fish meal factory after drying. The same sardine species landed by gillnets are bigger (125–155 mm sized) and sold at the rate of ₹ 50-60 per kg. Any excessive exploitation of juvenile sardine will be detrimental to the fishery in the long run.

Responsible sourcing of wild-seeds for aquaculture: spat collection in natural mussel beds along Karnataka coast

Geetha Sasikumar[1], G. D. Nataraja[1], S. P. Karamathulla[1], K. S. Mohamed[2], Prathibha Rohit[1] and P. K. Asokan[3]

[1]Mangalore Research Centre of ICAR- Central Marine Fisheries Research Institute, Mangaluru
[2]ICAR-Central Marine Fisheries Research Institute, Kochi
[3]Calicut Research Centre of ICAR- Central Marine Fisheries Research Institute, Kozhikode

Mussel farming is a rapidly expanding coastal mariculture enterprise, being widely adopted by fish farmers in India. Unlike other mariculture practices, mussel farming is less capital intensive and hence offers great potential for creating livelihood and employment opportunities to the coastal communities. During the year 2015, the mussel farming sector contributed 68% of the farmed bivalve production of 11,435 tonnes in the country.

The most widely adopted mussel farming practice is suspended farming on ropes. It involves the collection of young mussels (spat) from natural mussel beds, seeding them onto ropes, and growing in shallow, unpolluted coastal or estuarine waters with moderate flow. The mussel farming sector at present is entirely reliant on spat collected from natural mussel beds (wild), where the density and time of spat settlement is largely dependent on the biological spawning processes and environmental parameters. The farmers collect wild-spat that are settled on hard substratum by manual scrapping directly from the intertidal and sub-tidal zones of natural mussel beds in coastal areas during low-tide. Though the hatchery technology of mussels is established, mussel farmers mostly resort to wild collected spat, since hatchery produced spat is relatively expensive. With the rapid growth of the farming activities, hatcheries that produce mussel spat on a large scale is expected to become increasingly important. In China, mussel farming largely depends on blue mussel spats produced in hatcheries.

Collection of wild spat

Successful spat collection in an area relies on the information on the reproductive cycle of the local mussel population and knowledge on their larval development and settlement process. Along Karnataka coast, the settlement of wild spat follows the reproductive cycle commencing primarily during post-monsoon from August to September followed by a secondary spawning spell from March to April. Collection of wild-spat from sub-tidal mussel beds by skin-diving is considered perilous during the latter part of the southwest monsoon (August to September). A viable option for meeting the increasing seed requirements of the mussel industry from the wild is deployment of spat collectors in the natural mussel beds. Such artificial spat-collectors are effectively employed in temperate waters. Collectors which comprise of a variety of artificial substrates are placed in, 'Mussel Parks' (protected farming areas where mussels breed and grow) during peak spat-fall period. The spat collectors are later retrieved and the attached spat stripped off and used for seeding on ropes for growing. In some instances, seed collection and grow-out is carried out on the same collector with the mussels being left there itself for the entire duration of the grow-out period.

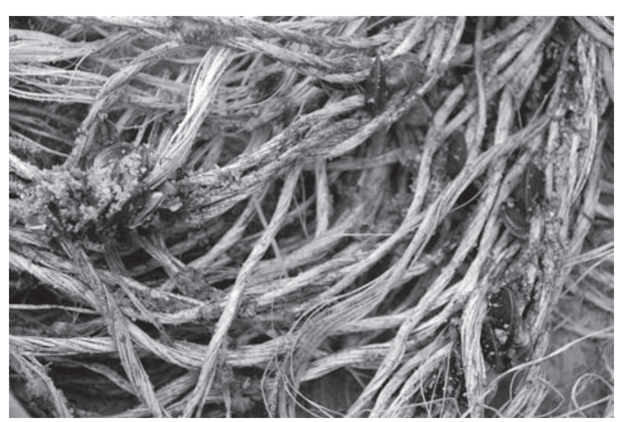
The intertidal and sub-tidal coastal waters off Karnataka are important fishing areas for the green mussel, *Perna viridis* during the period from October-May. Enclosed shallow lagoons suitable for mussel mariculture are limited along the Karnataka coast and hence most of the mussel farming is in protected estuarine habitats adjoining the sea. Though there will be good spat fall in the region during post-monsoon months, the collection of wild spat is difficult as the mussel beds in the intertidal and subtidal areas are exposed to rough wave action. Skin-diving and scrapping mussel spat from subtidal mussel beds at 2-5 m water depth is risky and requires exceedingly skilled labour. Besides, the difficulty in retaining the scrapped tiny and fragile spat under water reduces the efficiency of operation. Further, fishing of wild-spat from mussel beds in large quantities for commercial farming operations has created resentment within the local fishermen groups. This is due to the possible physical damage of mussel beds by the wild-spat harvest from subtidal areas.

Wild-spat collection trials

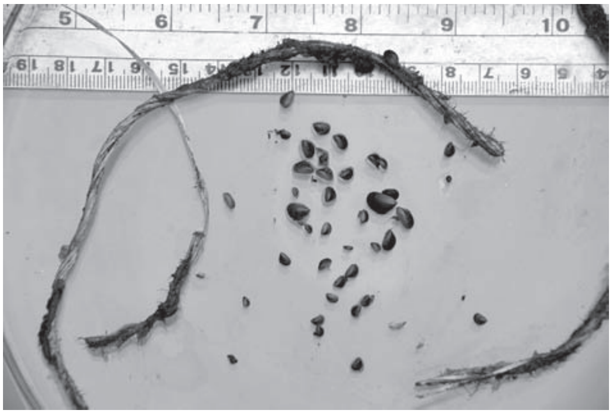
Experiments for collecting wild-spat using artificial collectors were initiated along Karnataka coast. The sub-tidal zones off Someshwara, Gangolli, Byndoor and Karwar with dense settlement of mussel spat in the mussel beds were selected. Various types of spat collectors of different construction were tested to identify the most suitable material and construction for effective spat collection. The spat-collectors were placed above the natural mussel beds during spat-fall from September. Initially, panels comprising of mussel grow-out ropes fastened to bamboo frames were used off Someshwara, with little success. The major problem encountered with this type of construction was its floatation. Mussel spat collectors were subsequently fabricated using Poly Propylene (PP) ropes of 16 mm diameter and untwisted strands from a PP rope of 32-36 mm diameter. The untwisted strands (30 cm length and 2-3 mm width) were arranged in length and tied in the middle, parting 15 cm on either side of the knot. Each bundle was fastened to thinner PP ropes of 8 mm diameter at 50 cm intervals to form a 3m long spat collector (6 bundles). They were vertically suspended from long-lines with 500 g weight at distal end. The long-lines were moored in the natural mussel beds at 6 m water depth during low-tide using floats and anchors. The uppermost bundle was place 50 cm below the water surface. Such artificial spat collectors were suspended from long lines off Someshwara, Gangolli and Byndoor. However, the spat-collectors placed off Gangolli and Byndoor were washed away in heavy rains and turbulence developed due to inclement weather during the experiment period.

In Someshwara, mussel spat settlement was observed from October on untwisted PP ropes and twisted PP ropes. By first week of November, the average spat-settlement density on untwisted strands was 17 mussel-spat/m whereas, good settlement of 5,640 mussel-spat/m was observed on the twisted ropes of 16 mm diameter. The spat size varied between 2 and 5 mm, with 48% measuring about 2 mm in November (Fig. 1). The average weight of the mussel spat was 6.45 mg.

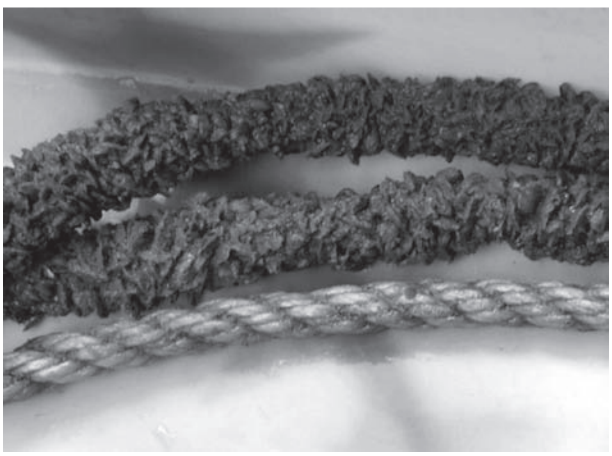
Spat collector deployment (untwisted PP rope)



Mussel spat on untwisted PP rope



Mussel spat separated from PP rope strands



Spat settlement on twisted collector ropes

The depth-wise spat-settlement on the untwisted PP ropes was monitored. The average spat settlement ranged from 7 to 94 numbers/ untwisted PP rope bundle in different depths. The highest settlement was observed at 2.5m (48%) from the surface (Fig. 2). 84% of the spat settlement was between 1.5 and 2.5 m depth. While there was

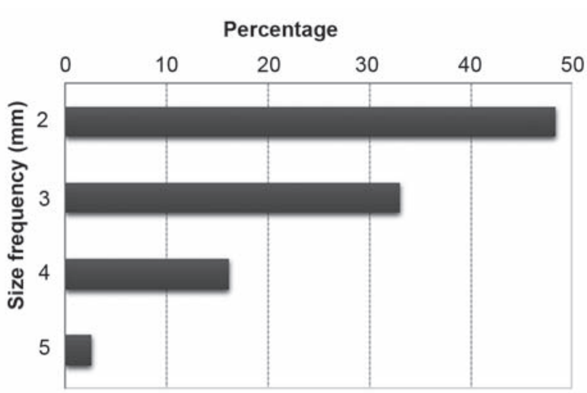


Fig. 1 Mussel-spat size in spat collector

depth-wise difference in spat settlement on untwisted strands, the spat settlement on twisted ropes were uniform.

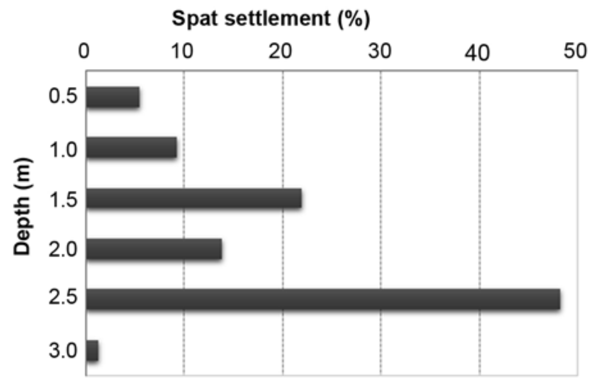


Fig. 2. Mussel-spat settlement percentage on untwisted rope strands at different depth

The surface area of the two types of collectors are not comparable for a given length since the twisted rope provides a greater surface area than an untwisted PP rope strand. While the spat attached to the loose untwisted strands were subjected to water movements and resulting changes in the collector, those attached to the stretched twisted strands were relatively stable. In natural mussel beds, the spat prefer firm substratum, allowing the mussels to get a safe foothold, having potential to reduce post-settlement dislodgment due to physical disturbances. Though, further studies are necessary it was observed that spat settlement on untwisted unfastened rope strands have higher potential of post-settlement mortality due to physical disturbances/ dislodgments.

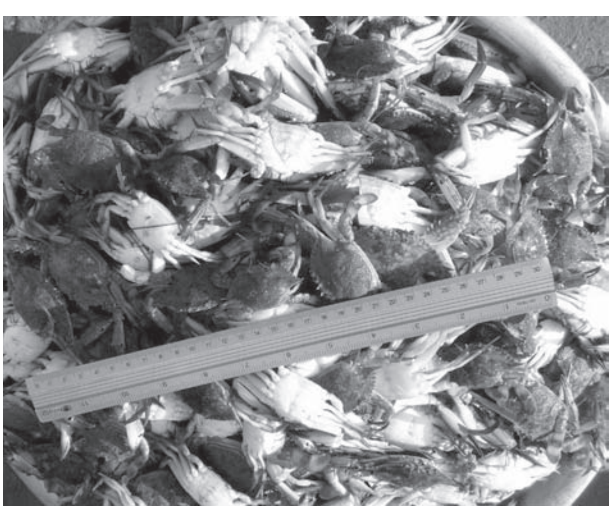
Conclusion

The mussel spat settle on a substrate and attach themselves using byssus threads, on clean, silt-free irregular surfaces that range from filamentous algae stone, wood, concrete, dead shell and shells of their own species. Deployment of artificial collectors are considered as the most practical, economical and sustainable method to collect spat. Artificial substrates have the advantage over natural materials in possessing a relatively constant surface area and textural composition. This facilitates easy retrieval of spat from the collectors with minimal stress on the seeding material. The twisted PP ropes were successful in collecting large numbers of spat of green mussels, from open-sea waters off Someshwara. Such artificial substrates can be effectively utilized in open-sea for sourcing spats from mussel beds without relying on physical harvesting techniques. The collectors placed in other mussel beds were lost due to failure to withstand rough weather. Therefore, such protocols need to be fine-tuned further for their feasibility based on engineering, environmental and economical perspectives.

Note on the landings of crab juveniles by mini trawl net

M. Rajkumar, Raju Saravanan, S.Surya and L.Remya
Mandapam Regional Centre of ICAR- Central Marine Fisheries Research Institute, Mandapam

Landings of juveniles of *Portunus pelagicus* locally known as *olaikkal nandu* by mini trawl net were noticed at Devipattinam Landing Centre during March-April 2016 period. Commonly called flower crab, it is fished heavily being in high demand in domestic and foreign markets. The traditional crafts operating a gear locally known as *Thalluvalai* (mini trawl net) that fish upto 4 m depths were routinely landing the juvenile crabs during the period season. An estimated 300 kg of juvenile crabs were landed every day by the mini trawl nets operated off Devipattinam coast. Plank built boats, (OAL 25 to 30 feet) operated with sail have a group of 3-5 fishermen were involved in fishing. The gear is made of high-density nylon filament with a stretched mesh of 20 mm with an overall length of 20 m. The net is operated in the inshore waters of Palk Bay with rich sea grass beds which serves as a nursery ground for the species. The catch comprised three different size groups of crabs of 30-60, 60-90 and 90-120 mm Carapace Wiedth (CW). Almost 80% of the catch was 30-60 mm CW sized and sold at the rate of ₹ 60 -70 per kg. The exploitation of juvenile crabs would invariably influence the landing of the big sized adult crabs that support the commercial fishery in this region. The growth overfishing of *P. pelagicus* by the mini trawl net in the Palk Bay needs to be studied for assessing its stock.



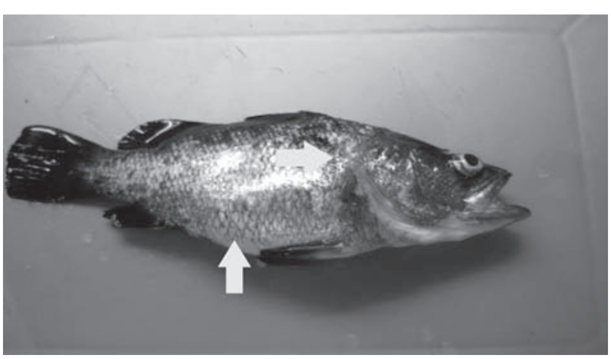
Juveniles of flower crab

First report of *Photobacterium damselae* sub sp. *damselae* infection associated with VNN in cage farmed Asian seabass

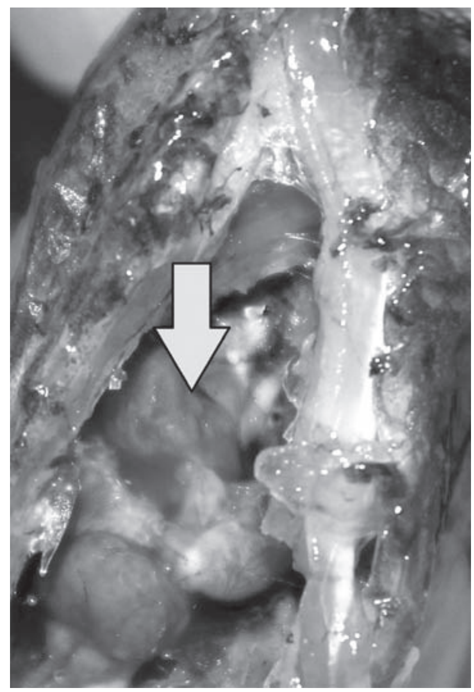
S. R. Krupesha Sharma[1], Praveen N. Dube[1], Sreedevi Hakkimane[1], M. A. Pradeep, Sanjeev Deshpande[1], N. K. Sanil[2] and K. K. Philipose[1]
[1]*Karwar Research Centre of ICAR- Central Marine Fisheries Research Institute, Karwar*
[2]*ICAR-Central Marine Fisheries Research Institute, Kochi*

Photobacterium damselae sub sp. *damselae,* earlier known as *Vibrio damselae,* is a halophilic marine bacterium causing diseases in a variety of marine animals and humans. Mortality due to this pathogen has been reported in cultured Asian seabass in Thailand (Kanchanopas-Barnette *et al.*, 2009 *Fish Pathology* 44, 47–50). So far there are no reports on infection and mortality of Asian seabass caused by this pathogen from India. Viral nervous necrosis (VNN) is a fatal disease caused by betanodavirus in Asian seabass (*Lates calcarifer).* This virus can cause 100% mortality in juvenile fish.

During May 2016, 60% mortality was observed in cage farmed Asian seabass (20-25 cm) in the Marine fish farm of the Central Marine Fisheries Research Institute, Karwar. The diseased fish showed presence of haemorrhagic patches on the body with swollen abdomen which was filled with gelatinous fluid. Bacterial isolates from different organs of diseased fish was identified as *Photobacterium damselae* sub sp. *damselae* by biochemical and molecular methods. Diseased fish also exhibited neurological disorders like frequent surfacing with vertical and circular swimming. Brain was highly congested. Brain samples were tested for betanodavirus using β-nodadetect kit developed by ICAR-CMFRI and were found positive for betanodavirus. Currently, there are no efficient treatments for VNN. Surviving fish remains carrier of the virus leading to vertical and horizontal transmission. Since *P. damselae* sub sp. *damselae* is a normal inhabitant of marine environment causing infection in fish during increased water temperatures and betanodavirus being highly virulent for Asian seabass, the dual infection caused by these pathogens should merit further research interest for developing strategies to reduce mortalities during cage farming.



Swollen abdomen and haemorrhagic patches on the body of sea bass



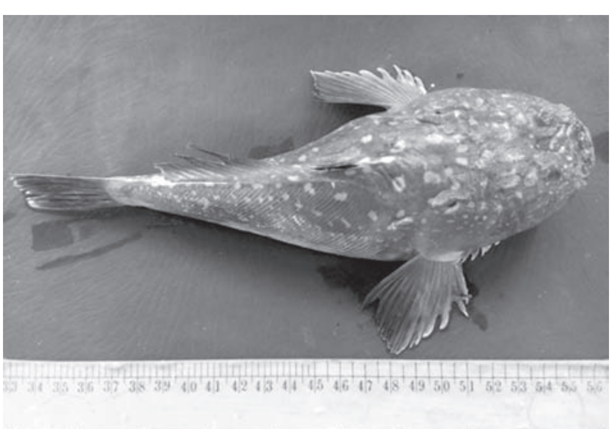
Congested brain of the infected seabass

Emerging fishery for stargazers

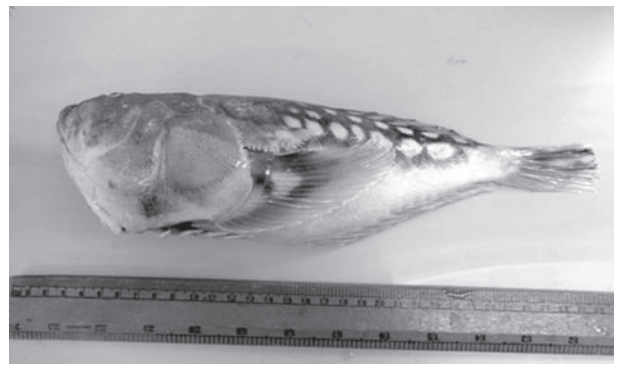
S. Surya, R. Saravanan, A. K Abdul Nazar, N. Bhoominathan, R. Selvakumar, K. Shanmughanathan and K. Thangavel
Mandapam Regional Centre of ICAR- Central Marine Fisheries Research Institute, Mandapam

Fishes commonly known as stargazers, of the family Uranoscopidae, is emerging as a lucrative fishery along the Pamban coast of Tamil Nadu. The fish is generally characterized by large head, dorso laterally directed eyes placed on the large flattened head, dark brownish body and head with or without irregular whitish blotches on the back. The fishes were landed at Pamban Light House landing centre by fibre boats having an overall length (OAL) of 8 m, fitted with a 60 hp engine with a speed capacity

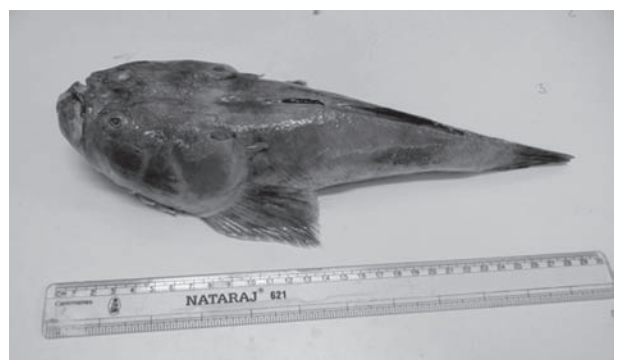
Ichthyoscopus lebeck



Uranoscopus marmoratus



Ichthyoscopus sp.



Uranoscopus sulphureus

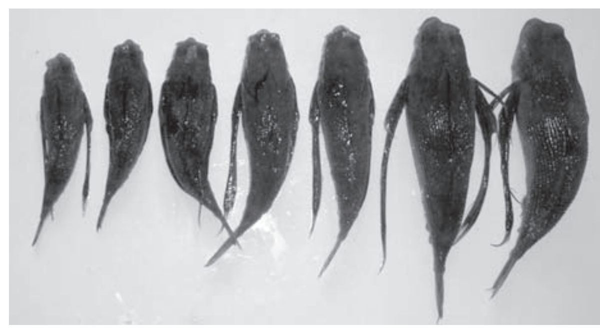
of about 20 knots. The No.4 gillnet, characterised by 105 mm mesh size, having about 1000 m length is utilized for the particular fishery. The fishery started from October 2015 and initially the traders were not ready to auction the catch. However, after knowing the demand for these fishes which are served in hotels in the neighbouring districts, they started marketing it after proper skinning. Three species of stargazers were identified from the catch that includes *Ichthyoscopus lebeck*, *Uranoscopus marmoratus* and *Uranoscopus sulphureus*. The fishes were sold as individual pieces which cost ₹ 40 - 240 depending upon the weight of the fishes which varied from 250 g to 1.5 kg each.

Unusual heavy landings of flying gurnards at Munambam Fishing Harbour

Subal Kumar Roul, T. B. Retheesh, R. Gireesh, D. Prakasan and E. M. Abdussamad
ICAR- Central Marine Fisheries Research Institute, Kochi

Flying gurnards belongs to the family Dactylopteridae, distributed in tropical Indo-Pacific and Atlantic oceans. From the 7 species representing two genera, *Dactylopterus* and *Dactyloptena* only four species such as *Dactyloptena gilberti*, *D. macracantha*, *D. orientalis* and *D. peterseni* are found in the western Indian Ocean. These are small to moderate sized marine bottom dwelling fish and mostly caught by bottom trawls as by-catch in the near shore waters and not having much commercial value.

On 21st January 2016, during regular fishery observations at the Munambam Fishing Harbour, an unusual heavy landing of about 12 tonnes (t) of flying gurnards as by-catch was noted. The fishes were caught by bottom trawls operated off Kochi at depths of 70-100 m depth. The flying gurnards were sorted from the rest of the by-catches estimated at about 40 t and packed separately. As per our observation, the flying gurnards contributed nearly 30-35 % of total by-catch landings of that day. The other species in the by-catch were lizardfish, flatfish, puffer fish, porcupine fish, pink perch, silver bellies, trigger fish, cardinal fish, deep sea shrimp, crabs, eel, scorpion fish, goat fish, red cornet fish, Indian flathead etc. The fishes were identified as oriental flying gurnard, *Dactyloptena orientalis* and their biology was studied. The specimens ranged from 14.6 – 25.1 cm total length each weighing between 38–194 g. Most of the stomachs were in full condition. Gut content analysis of 32 samples clearly indicated that it had exclusively fed on paste shrimps (*Acetes* spp.). Females dominated in the samples and were of larger size, in various stages of maturity as compared to males. The sorted by-catch of flying gurnads was mostly transported to the fish meal industry of Tamil Nadu, Karnataka and Gujarat in iced condition. Earlier such catches were discarded,



Various sized Oriental flying gurnard landed

Huge by-catch landed at Munambam Fishing Harbour

Sorted and packed flying gurnards

but presently due to increasing demand from the fish meal industry they are marketed. On the present occassion catch was sold at the rate of ₹ 22 per kg at the landing centre. Flying gurnads although not used as a food fish, are an important link in the transfer of energy through the marine food chain ensuring food availability to the valuable fishery resources in the higher trophic levels.

Report of an Indo-Pacific humpback dolphin washed ashore

M. Sakthivel[1], A. Devaki[2], G. Tamilmani[1], P. Rameshkumar[1], R. Jayakumar[1] and A.K. Abdul Nazar[1]
[1]Mandapam Regional Centre of ICAR- Central Marine Fisheries Research Institute, Mandapam
[2]Veterinary Assistant Surgeon, Dept. of Animal Husbandry, Govt. of Tamil Nadu

A dead female Indo-pacific humpback dolphin, *Sousa chinensis* was washed ashore at Chathiram near Mandapam, Gulf of Mannar on 26 June 2016. Morphological features including teeth pattern were recorded (Table 1). Necropsy findings did not reveal any abnormalities. As the animal was lean and emaciated with a blubber thickness of only 2.0 cm, the cause of death might be related nutritional or disease factors.

Fig. 1. Stranded Indo-Pacific humpback dolphin

Table 1. Morphometric measurements of the dolphin

Morphometric parameters	Measurement (cm)
Length, snout to melon	17
Length, snout to angle of mouth	33
Length, snout to blowhole	44
Length, snout to center of eye	42
Length, snout to anterior insertion of dorsal fin	84
Length, snout to tip of dorsal fin	101
Length, snout to fluke notch (total length)	202
Length, snout to anterior insertion of flipper	62
Length, snout to center of umbilicus	112
Length, snout to center of genital aperture	138
Length, snout to center of anus	147
Length, notch of flukes to center of anus	57
Length of flipper: anterior insertion to tip	33
Length of flipper: axilla to tip	23
Width of flipper: Maximum	13
Fluke span	51
Width of flukes	23
Depth of fluke notch	5
Height of dorsal fin	16
Width of dorsal fin	31
Base of dorsal fin	42
Girth: axillary	86
Girth: maximum (at anterior insertion of dorsal fin)	110
Girth: at level of anus	56
Blubber thickness: ventral	2
Total number of teeth on one side of upper jaw	36
Total number of teeth on one side of lower jaw	32

On the rare occurrence of the blacksaddled coral grouper

Miriam Paul Sreeram, K. M. Sreekumar, Thobias P. Antony, M. Sethulakshmi, K. A. Divya, Varsha Shaji and Aju K. Raju
ICAR-Central Marine Fisheries Research Institute, Kochi

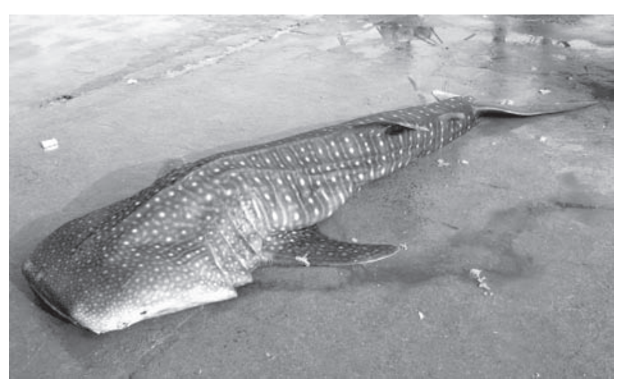
The blacksaddled coral grouper *Plectropomus laevis* (Lacepède, 1801) is a member of the family Serranidae and is usually found associated with coral reefs. It occurs in the Indian ocean and tropical Western and Central Pacific, but is considered to be uncommon to rare, except in coral reef environs, throughout its range. It is classified as Vulnerable in the IUCN Red List owing to its natural rarity in coastal seas and substantial decline in populations wherever it is fished in coral reef regions. A single specimen of *P. laevis* measuring 695 mm in total length and weighing 4.9 kg was landed at Cochin Fisheries Harbour, Kochi on 30.03.16 (Fig. 1). It was caught by hook and line fishers along with a catch of *Lutjanus argentimaculatus*. It was collected and deposited in the National Designated Repository, CMFRI, Kochi with Accession No. GB.31.139.44.1.

Fig. 1. *Plectropomus laevis* landed at Cochin Fisheries Harbour

Accidental catch of whale shark landed at Munambam Fisheries Harbour

K. M Sreekumar, Thobias P. Antony and Aju K. Raju
ICAR-Central Marine Fisheries Research Institute, Kochi

A whale shark, *Rhincodon typus* measuring 2.5 m in length and weighing approximately 250 kg was landed at Munambam Fisheries Harbour, Kochi on 28.04.2016. The shark was accidentally caught in a gill net set by local fishermen and was brought to the harbour. The whale shark is protected under schedule I of Indian Wildlife Protection Act, 1972, Appendix II of CITES and is listed as vulnerable in the IUCN Red List. The local fishermen who caught the shark probably were unaware of its protected status. The incident shows the relevance of awareness campaigns and sensitisation among fishermen regarding protected species like whale sharks.



Whale shark landed at Munambam

Release of Indian black turtle from ghost net

Divya Viswambharan, Prathibha Rohit and S. Sreenath
Mangalore Research Centre of ICAR-Central Marine Fisheries Research Institute, Mangaluru

Discarded fishing gear which continue to catch target and non-target species are called ghost nets. It has been estimated that each year, around 640,000 tons of ghost nets are generated globally, accounting for around 10 percent of the world's marine debris (Macfadyen *et al.*, 2009, *FAO Fisheries and Aquaculture Technical Paper No. 523*). In India, the use of gillnets of very thin polyamide monofilament yarn of 0.12 to 0.16 mm diameter with a lifespan of 3 to 6 months is common both in the marine as well as inland water bodies. The seriousness of ghost fishing problem in the coming years is evident as these nets are not repaired and tonnes of monofilament nets are abandoned in the sea and reservoirs (Thomas *et al.*2005, *Gillnets in the Marine Fisheries of India, Monograph*, ICAR-Central Institute of Fisheries Technology, Kochi, 45 p). Ghost fishing gear thus represents a major challenge to our attempts to manage the aquatic ecosystems sustainably and humanely. A juvenile Indian black turtle (*Melanochelys trijuga coronata)* was seen entangled in a discarded polyamide monofilament net of 45mm mesh size and a yarn thickness of 0.13 mm net in a creek near Someshwara Beach, Mangaluru. The creek which is near the fish landing area on the beach is used as a site for discarding waste by local fishermen. The turtle was released and local fishers were made aware of the importance of the species and the problems caused by the discarded nets in water bodies. The Indian black turtle is included in the "Near threatened" category of the IUCN Red list.

Turtle rescued from the net

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