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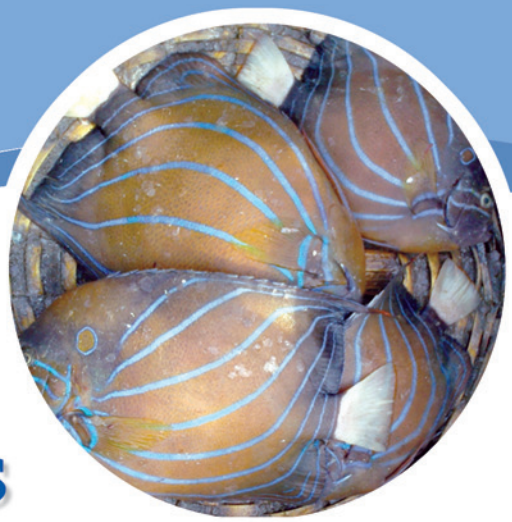

Marine Fisheries Information Service

Technical and Extension Series

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Marine Fisheries Information Service

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Olive ridley turtle

Calappa bilineata

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.....

Last quarter of the year was remarkable for Indian marine fisheries with National Marine Fisheries Database estimating a record production of 3.94 million tonnes. The improved catch statistics and the reports of mud bank fisheries along Kerala coast are positive signs in total for Indian capture fisheries, but there are also issues of concern with respect to a few species showing a decline. As cage culture is coming up as an option to enhance the marine fish production, there were few instances of new research issues related to cage farming. In this issue there is an article on "Foreign objects observed in the stomach of a cobia (*Rachycentron canadum*) reared in sea cage at Karwar". There are also a few observations on first records of certain species in the sited area, which indicate a vigilant research on the biodiversity of the landed fishes and some issues of flip in the community structure. Reports on declining *Hilsa* catch, emerging domestic night markets in Kerala and other related information make it imperative to have a more dedicated research in marine fisheries in the years to come.

With the monsoon fishing ban period in vogue at many places, there can be a change in the catch intensity and subsequent reports on marine catches in the coming quarter. The editorial board of Marine Fisheries Information Services (MFIS), would like to encourage the researchers of CMFRI to publish relevant information in MFIS for disseminating the observations and findings to its widespread readers in India and abroad.

Marine Fisheries Information Service

No. 216 * April-June, 2013

Abbreviation - *Mar. Fish. Infor. Serv., T & E Ser.*

CONTENTS

Diversity in fished taxa along the Indian coast during 2012

Sathianandan T. V., Mohamed K. S., Somy Kuriakose, Mini K. G., Grinson George and Sindhu K. Augustine
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The marine fish landings in 2012 was estimated at 3.94 million tonnes and the contribution from different maritime states and union territories are shown in table-1. From the National Marine Fisheries Data Centre information on individual species wise estimates of marine fish landings and presence/ absence data of all the species landed along the Indian coast during 2012 were used for testing species diversity in the fished taxa among different maritime states and union territories. An All India species data base was created consisting of all the species caught during 2012, with details of Genus, Family, Order, Class and Phylum for each species.

It is preferable to use biodiversity measures capturing alternatives to simple taxon richness, in the form of relatedness amongst observed taxa, for a given number of species. Such measures not only allow an exactly similar comparison to that for richness, but also permit valid biodiversity comparisons between different regions with varying sample sizes. The average taxonomic distinctness (DELTA+) and the variation in taxonomic distinctness (LAMBDA+) are two such measures, widely applied to presence/absence data, which have the unbiasedness property and are not a function of the sample size or the total species richness. These measures have been used to compare different regional faunas, and decline in DELTA+ has been suggested as a measure of stress in a system. Also, DELTA+ is the measure of mean path length through the taxonomic tree connecting every pair of species and LAMBDA+ is the variance of these pairwise path lengths which reflects the unevenness of the taxonomic tree. Primer software Version 5.2.9 was used for computing DELTA+ and LAMBDA+ and for preparing funnel plots.

Among 667 species landed in the country in 2012 only 16 species were landed in all states/UTs and 248 species landed in only one of the states/UTs during 2012 (Fig-1). Tamil Nadu is at the top with

Table 1. Marine fish landings, percentage, number of species, coastal length, FTD, DELTA+ and LAMBDA+ for different maritime states and union territories for 2012.

State / Union territory	Landings (Lakh tonnes)	%	No of species	Coastal length	FTD**	DELTA+	LAMBDA+
West Bengal	1.6	3.9	105	158	0.7	73.6	527.8
Odissa	2.5	6.3	196	480	0.4	72.4	491.9
Andhra Pradesh	3.1	7.7	250	974	0.3	72.2	467.5
Tamil Nadu	6.5	16.4	404	1076	0.4	72.6	458.8
Puducherry	0.6	1.4	110			71.1	538.0
Kerala	8.4	21.3	366	590	0.6	75.5	462.2
Karnataka	4.8	12.1	158	300	0.5	73.5	498.7
Goa	0.7	1.8	69	104	0.7	72.3	541.3
Maharashtra	3.2	8.0	247	720	0.3	75.5	503.2
Gujarat (*)	7.6	19.2	188	1600	0.1	77.1	527.8
Daman & Diu	0.8	1.9	120			75.8	525.3
All India (*)	39.4		667	6068	0.1		

(*) Provisional estimate

(**)FTD- Fished taxa diversity in terms of number of species per kilometer

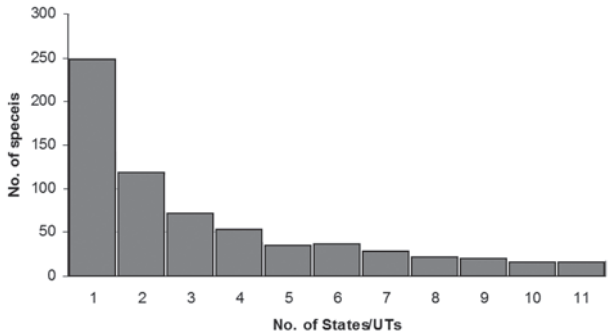

Fig 1. Bar chart showing the distribution of 667 species landed along the Indian coast during 2012 according to the number of states/UTs in which they were found landed

landings of 404 species followed by Kerala with 366 species. The least number of species landed was 69 in Goa. The Fished Taxa Diversity in terms of the number of species per kilometer coast is high for West Bengal and Goa and is the lowest for Gujarat. The average taxonomic distinctness DELTA+ was found maximum for Gujarat and minimum for Puducherry. Based on DELTA+ values we can classify the maritime states and union territories into different groups namely Gujarat having the highest value as the first group, Damen & Diu, Kerala and Maharashtra as the second group, West Bengal and Karnataka as the third group, Tamil Nadu, Odisha, Goa and Andhra Pradesh as the fourth group and Puducherry the last group. From the funnel plot of DELTA+ against number of species (Fig-2) this classification is visible and only Gujarat falls outside the funnel. This indicates that compared to other states/UTs the species that are landed in Gujarat are not closely related as may be the case with Tamil Nadu having maximum number of species landed but low DELTA+. When we examine the variation in taxonomic distinctness LAMBDA+ it can be seen that Gujarat has high LAMBDA+ value than that of Tamil Nadu which supports the above observation.

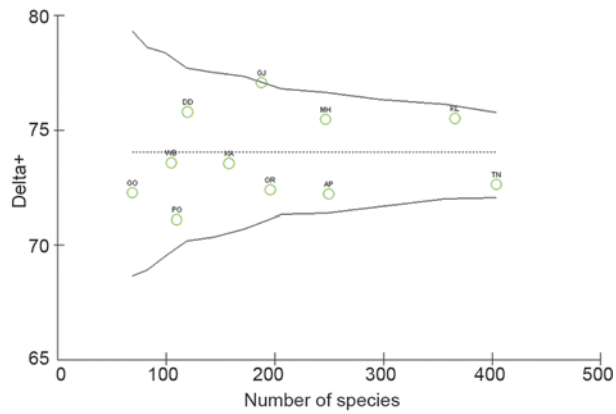

Fig 2. Funnel plot showing the taxonomic distinctness of different maritime states/UTs in India based on fished taxa in 2012 (WB: West Bengal, OR: Odisha, AP: Andhra Pradesh, TN: Tamil Nadu, PO: Puducherry, KL: Kerala, KA: Karnataka, GO: Goa, MH: Maharashtra, GJ: Gujarat and DD: Damen & Diu)

Mini purseseine operation recorded for oil sardine catch at Jiwna and Bharadhkhol-Divegar landing centres in Raigad region of Maharashtra

Ramesh B. Rao
Mumbai Research Centre of CMFRI, Mumbai

It was noticed that about 80 to 100 gillnetters from this region have been engaged for mini purse seine operation from October to February every year and 2 to 3 cylinder boats with 24 to 45 Hp are used for this operation at a depth of 8 to 15 m. Deployed towards NW direction, 8 to 15 km away from the landing centre the vessels fetch 3 to 5 tons of *S. longiceps* catch every day with 2-3 hauls in Jiwna and Bharadkhol-Divegar landing centres.

This year mini purseseine operation was noticed up to the month of April and there are still 10 to 15 mini purse seines under regular operation.

Oil sardine catch reported by mini purseseine operation at Jiwna landing centre

Since the fish catch is low while using other kind of nets, many fishermen from this region are attracted towards this type of fishing activities that fetch good income during these months. The rate at the landing centre for oil sardine was ₹ 10 to 12.

Heavy landing of barred seer fish *Scomberomorus commerson* (Lacepede, 1800) at Visakhapatnam fishing harbour, Andhra Pradesh

Satish Kumar M., Uma Mahesh V., Hanumantha Rao M. V., Shubhadeep Ghosh and Maheswarudu G.
Visakhapatnam RC of CMFRI, Visakhapatnam- 530 003

Heavy catches of barred seer fish, *Scomberomorus commerson* was observed at Chintapalli fishing village, 67 km north of Visakhapatnam on the night of 24-01-2013. The fish were caught by motorized crafts operated at depth of 50-60 m by hook and lines using sardines as bait. The total landing estimated on that day was 1200 kg. The length of the fish ranged from 85 - 153 cm FL and weight from 7.4 - 28 kg. Landings were brought to Visakhapatnam fishing harbour and being a high valued fish, fetched a price of ₹ 410/kg. Normally these fish are purchased by local middlemen, which they ice pack and transport to Chennai from where it is repacked and exported to Hong Kong, fetching a price of $ 12.5/kg. If proper infrastructure facilities are provided at subsidized rates to the fishermen/ fishermen societies for processing these high valued fish, with air connection from Vizag to Southeast Asian countries, their income may increase substantially.

Individual Seer Fish weighing 28 kg

Landing of seer fish measuring 153 cm

Landings of seer fish ready for packing

In Andhra Pradesh, *Scomberomorus commerson* locally called as 'konemu' have a high commercial value next to shrimps. With an annual landing of about 4753 t, it contributes 1.5% to the annual landings of Andhra Pradesh. Peak fishing season for *S. commerson* along Andhra Pradesh coast is from October to January. Major part of the catch is contributed by gillnets (63%) followed by hook and line (30%) and trawls (7%). Gillnets with mesh size of 80 to 150 mm are used. Around 15-20% of the juvenile catch ranging in size from 30 to 50 cm and weighing 0.350 to 1 kg are reported as by-catch in gillnets and ring seine operations targeting mackerel and sardines. This will have detrimental effect on this high value stock. Hence as a management option for protecting the seer fish resources in Andhra waters against growth and recruitment overfishing, stringent regulatory measures are required. To reduce overfishing, seasonal ban on usage of small meshed gill nets is an option. Harvesting by highly selective gear *viz.*, hooks and line will conserve the juveniles of seerfish.

Ice packing to transport to Chennai

Unusual landing of Blue ring angel fish *Pomacanthus annularis* (Bloch, 1787) at Mirkarwada landing centre,Konkan Coast, Maharashtra

Purushottama, G.B., Mainkar, K. R., Sawant, D.D and Bashir Shiledar, A.A.
Central Marine Fisheries Research Institute, Mumbai Research Centre, Mumbai

On 07.05.2013, unusual landing of the Blue ring angel fish *Pomacanthus annularis* (Bloch, 1787) was observed at Mirkarwada fish landing centre, Ratnagiri (Fig. 1). About 15-20 specimens of

Fig. 1. Unusual landing of *P. annularis* at Mirkarwada landing centre on 07.05.2013.

P. annularis were caught in the bottom set gill net (locally called Budi) with mesh size measuring 7.5 cm, while being operated for lobster fishing. The *P. annularis* locally known as "Kombda" was about 7-8 m at 4-5 km north-west caught at Ratnagiri. The total length of the specimens landed ranged from 250-400 mm weighing from 0.5-1.25 kg. The fish was sold at ₹ 10-20/- per kg. The *P. annularis* may have migrated from Angria bank, a shallow sunken atoll, on the continental shelf off the west coast of India clsoe to Ratnagiri.

The morphometric and meristic characters of the specimen were as follows, dorsal spines: 13; dorsal soft rays: 20-21; anal spines: 3; anal soft rays: 20. Juveniles black with alternating white and blue, curved well-spaced stripes on the sides. Adults golden brown or orange with well-spaced curved horizontal stripes radiating from the pectoral-fin base area, running along the sides towards the posterior portion of the dorsal fin. Two similar blue stripes run horizontally across the face, one running through the eye, from above the snout to the edge of the operculum. A blue ring is behind and slightly above the edge of the operculum. Caudal fin is white with bright yellow margin.

Earlier, fishermen from Versova fishing village at Mumbai found a live Blue-ringed angel fish, *P. annularis* in their trawl catch. The fish was caught at a depth of about 40-50 m off Versova on 15.11.2009. The fish measured about 300 mm in total length and was in a very healthy condition.

P. annularis is distributed in the Indo-West Pacific: East coast of Africa, throughout Indonesia and New Guinea to New Caledonia, north to southern Japan. They are observed mostly in coastal reefs up to the depth of 30 m with Juveniles settle in very shallow inshore habitats with short filamentous algae growth on rock or dead coral substrates (Kuiter and Tonozuka, 2001). It feeds on sponges and tunicates (Pyle, 2001) and undergoes a complete color transformation from the juvenile to adult stage. The IUCN Red List Status is "Least Concern (LC)".

Revival of short neck clam *Paphia malabarica* Chemnitz, 1782 In Kali estuary, Karwar, Karnataka

Sonali Mhaddolkar, Vaidya N. G. and Philipose K. K.
Karwar Research Centre of CMFRI, Karwar

Short neck clam *Paphia malabarica* (Chemnitz, 1782) (Class: Bivalvia, Order: Veneridae), locally called as 'Tisre' was available in Kali estuary in abundant quantity during 2005-06 and 2006-07 and the percentage contribution to catch was about 51 and 46% respectively. Later, it disappeared from the fishery but during 2012 this species was again observed in the fishery.

Fig. 1. Fishing for short neck clam, *Paphia malabarica* in Kali estuary

In the year 2011-2012 some fishermen introduced *P. malabarica* in the estuary from Tadri (Aghanashini estuary). They collected the seeds and put in the estuary for growing to marketable size. It is reported that Kadra Dam has a great influence on the clam fishery. According to the fishermen fresh water was not released into the river after August 2012, which resulted in the increased salinity in the lower reaches of the estuary and it may be the reason for revival of *P. malabarica* in the estuary.

The other clam species found along with this species are *Meretrix casta* and *M. meretrix*. *P. malabarica* contributes about 54% and *Meretrix* spp. 46% to the fishery.

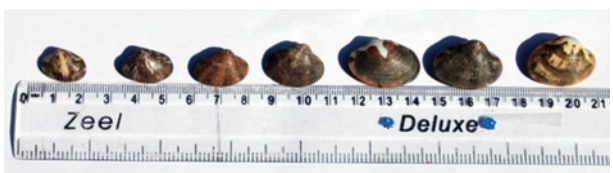

Fig. 2. Juvenile *P. malabarica*

Juvenile fishing of *P. malabarica* has started in the month of January 2013. It was noticed that juveniles with an average length of 22.55 mm and average weight of 2.90 g were available in the estuary. The size range observed was 16 mm-26 mm. Among the 800-1000 people engaged in clam fishery, 70% were women and children. Clam fishery of Kali estuary provides employment to hundreds of people and efforts to develop culture technology for these clams can provide better livelihood options for these marginalized fisherman.

The fishers collect juvenile clams for traditional farming in the near shore waters and only a small portion is marketed in local market which is either used for consumption or making dry clam meat.

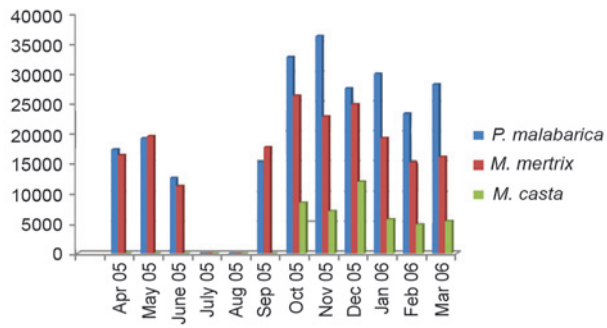

Fig. 3. Data of clams during 2005-06

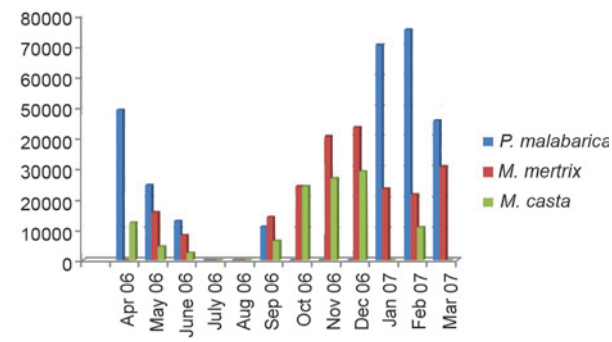

Fig. 4. Data of clams during 2006-07

From the observations of the clam fishery in Kali estuary it can be said that it has undergone tremendous changes during the last decade. The reasons may be the climate change, changing pattern of salinity, effect of dams, mines *etc.*, which need to be studied in detail.

Broodstock development of greasy grouper *Epinephelus tauvina* (Forsskal, 1775)

Biji Xavier, Ritesh Ranjan, Biswajit Dash, G. Maheswarudu, R. P. Venkatesh, M. Satishkumar and M. Murali Mohan
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Development of grouper aquaculture is one of the most important aquaculture targets in the tropics. The non- availability of sufficient quantity of seeds from the natural grounds at the right time for farming purpose is the major constraint in culture of groupers. Disease free healthy brood stock

is the most important prerequisite for successful production of seeds of any finfish or shellfish in a hatchery. The availability of high quality spawners of both the sexes in sufficient numbers and in good condition is a primary concern in broodstock development and maintenance. This involves development of male brooders and improvement of the quality of female brooders.

Attempts were made at the Visakhapatnam Regional Centre of CMFRI for broodstock development of the wild collected adult groupers (2.0 -5.0 kg). Groupers when hauled up from their habitat, gulp in air and usually are landed in a bloated condition due to the air filled in bladders. After reaching the hatchery the fishes were degassed and given prophylactic treatment with 200 ppm formalin for 30 minutes and freshwater dip for 5 minutes and then transferred to HDPE cages moored off Visakhapatnam (Fig 1). The fishes were PIT tagged and history of individual fish was maintained. The fish were fed twice a day with squid and trash fish fortified with Vitamin E, Vit-Min mix *etc*. Maturity stages of female broodstock were examined (Fig. 2) every month by intra-ovarian biopsy (IOB) and those with ova diameter >450 µ (Fig. 3) were used for induced spawning.

Fig. 1. Female broodstock of *Epinephelus tauvina* in cage

Fig. 2. Intra-ovarian biopsy (cannulation) of *Epinephelus tauvina* to assess the maturity

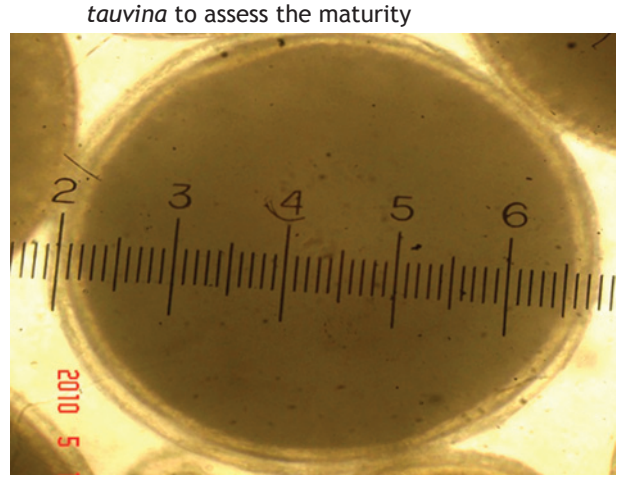

Fig. 3. Female fish with intra- ovarian ova of diameter > 450µ (10 x)

Foreign objects observed in the stomach of a cobia (*Rachycentron canadum*) reared in sea cage at Karwar

Krupesha Sharma S. R., Narasimhulu Sadu, Praveen Dube and Philipose K. K.
Karwar Research Centre of CMFRI, Karwar

A cobia (4.5 kg, 40 cm) reared in the grow-out cage of Karwar Research Centre of CMFRI was found dead on 15 March 2012. Externally, erosion on pectoral and caudal fins was found. Internally, stomach portion of the alimentary canal was enlarged. When the stomach was cut open, a betel nut (5 cm diameter) and a small plastic pouch were found inside (Fig. 1). The stomach was filled with mucus and the wall was extremely hypertrophied (Fig. 2). In the wild, cobia fish are fast swimming

carnivores that feed on a wide variety of fishes, cephalopods, and crustaceans, especially crab. Cobia often follow sharks, turtles and manta rays in hope of scavenging a meal. The present finding reveals that under confinement, the fish becomes indiscriminate eaters, feeding even on anthropogenic wastes.

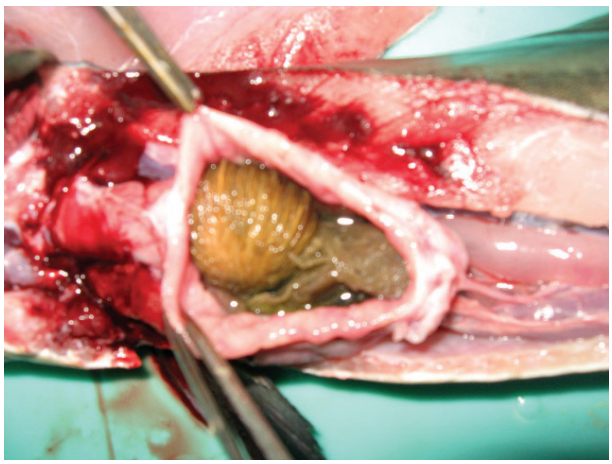

Fig. 1. Presence of a betel nut and a plastic pouch in the stomach of cobia

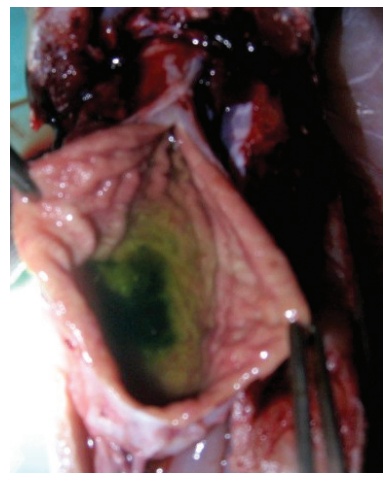

Fig. 2. Hypertrophied stomach wall of cobia

A simple and portable seawater filtering device using pipette filler

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Calicut Research Centre of CMFRI, Westhill P.O., Kozhikode -673 005

Filtration of seawater from the intertidal and coastal areas for separating chlorophyll pigments or particulate organic matter (POM) requires vacuum and for creating vacuum, a suction pump operated using AC/DC is essential. From the field or sea, large quantities of water samples have to be saved, brought to the laboratory and preserved by freezing until the filtration. Seawater filtration in remote areas with no power supply or portable suction pump is difficult but can be made possible by deploying a simple device involving filtering flask, a rubber hose and a safety pipette filler.

Requirements

1. Filtration funnels with magnetic base (300 ml, Gelman Sciences Inc)
2. Glass fibre filter paper (GF 52, Schleicher & Schuell)
3. Vacuum filtering flask with a glass hose connection- (1000 ml, Merck- 0101730)
4. Safety pipette filler (Cole - Parmer KH- 24805-10)
5. Rubber hose (10 mm dia., 25 cm long)

Procedure

Fig. 1. The arrangement of the filtration unit

Connect one end of rubber hose with the side arm of filtering flask and the other end with safety pipette filler by inserting the hose about 0.5 cm as shown in the Fig. 1. Place GF filter paper in between filter funnel and magnetic base and place it over the flask. Pour known quantity of seawater on the filtering funnel. To create vacuum for suction of seawater, press the filler bulb to expel the air and then squeeze the valve with the thumb and the index finger. Repeat this for 3-5 times until sufficient

vacuum is created inside the flask to get a steady flow of water from the funnel. Depending upon the organic load, it takes 5-7 minutes to filter 500 ml of seawater.

Landing of a tagged black marlin *Istiompax indica* (Cuvier, 1832) at Tharuvaikulam, Tuticorin

Sivadas M., Sathakkathullah S., Suresh Kumar K. and Kannan K.
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In Tharuvaikulam(8^{0}53'42"N,78^{0}09'56.6"E), Tuticorin, Tamil Nadu, India, there is a regular drift gill net (mesh size 120-140 mm) fishery targeting mainly tunas and seer fishes. The fishing trip is multiday (5 to 6 days) and the operation is only during night, with normally one haul per day. In this gear, bill fishes are also landed being entangled and not gilled. Normally four species of billfishes are landed such as *Istiophorus platypterus, Tetrapterus angustirostris, istiompax indica* and *Xiphias gladius*. On 1.2.13, two numbers *of I. indica* was landed along with other fishes. Out of this two, one was with a tag which was on the body immediately below the dorsal fin. This was actually caught on 31.1.13 off Mandapam (8^{0}30'04"N; 79^0 14'06"E) where the depth was more than 300 m.

The size of the fish was: Body length (From tip of lower jaw to fork length): 268 cm, Eye - fork length: 237 cm. The fish was released by African Billfish Foundation on 3.2.2012 at 3^0 41'S; 40^0 12'E (near Tanzania). The days at liberty was nearly one year and this is the first report of a tagged bill fish recovered from Indian waters.

Fig. 1. Black marlin with the tag

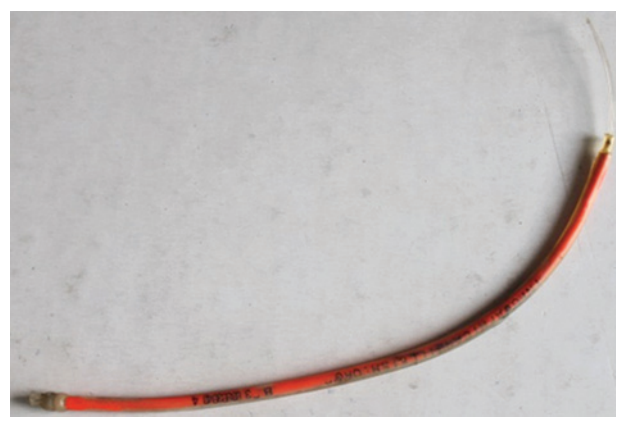

Fig. 2. The tag with the number and other details

Largest black marlin, *Istiompax indica* (Cuvier, 1832) landed at Tharuvaikulam, Tuticorin

Sivadas M., Sathakkathullah S., Suresh Kumar K. and Kannan K.
Tuticorin Research Centre of CMFRI, Tuticorin

Black marlin is a highly migratory, large oceanic apex predator that inhabits tropical and subtropical waters of the Indian and Pacific oceans. Little is known on the biology of black marlin in the Indian Ocean. In the present observation, a black marlin landed on 25.3.2013 by drift gill net operated from

Tharuvaikulam landing centre is reported. The fishing was conducted off Mandapam at a depth beyond 300 m. There is a regular landing of black marlin by drift gill net here which are actually entangled and not gilled. The fish measured 422 cm total length, 344 cm body length or Lower jaw fork length (LJFL) and 292 cm Eye-Fork length (EFL).Other size groups landed on the same day had LJFL and EFL as: 217 cm, 183 cm; 280 cm, 245 cm; 223 cm, 200 cm and 230 cm, 197 cm respectively.

In the Indian Ocean, documented maximum size for females is 306 cm LJFL and for males, it is 280 cm LJFL (IOTC-2012-SC15-20(E)).The size range of black marlin taken by commercial long line fisheries is 150 to 310 cm (mostly 170 to 210 cm) LJFL in the western Indian Ocean and 170 to 310 cm (mostly 185 to 240 cm) LJFL in the Coral Sea (FAO Fisheries synopsis No.125, Vol.5. Bill fishes of the world). It can be seen that the present specimen is larger than the recorded sizes from elsewhere.

Four species of jellyfishes recorded from Palk Bay and Gulf of Mannar

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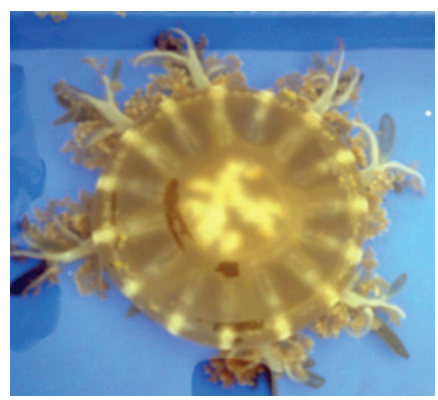
Four species of scyphozoan jellyfishes have been recorded from Palk Bay and Gulf of Mannar *viz.*, *Cassiopea cf. andromeda* (Forsskål, 1775), *Chrysaora caliparea* (Reynaud, 1830) [species *inquirenda*], *Mastigias cf. papua* (Lesson) and *Rhopilema cf. hispidum*.The species *Cassiopea cf. andromeda* has been recorded from Tuticorin coast and the remaining three species have been recorded from Mandapam and Thiruppalaikudi coast of Palk Bay. The *Rhopilema* sp. is an edible jellyfish and are commercially harvested for export market. All the species of the genus *Chrysaora* can inflict painful stings and cause severe scars.

Mastigias cf. papua (Lesson)

Chrysaora caliparea (Reynaud, 1830) *[species inquirenda]*

Rhopilema cf. hispidum



Cassiopea cf. andromeda (Forsskål, 1775)

Occurrence of near threatened tiger shark, *Galeocerdo cuvier* (Peron and Lesueur, 1822) from Tutcorin Coast, Tamil Nadu

Kannan, K., Ranjith, L., Sureshkumar, K., John James, K., Mohamed Sathakkathullah, S. and Madan, M. S.
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The Tiger shark *Galeocerdo cuvier* belonging to the Carcharhinidae family contains 12 genera and 54 valid species. The genus *Galeocerdo* represents a single species *G. cuvier*. It is a large semi-coastal-oceanic species, which populates temperate and tropical waters (Compagno, 2005). Tiger sharks feeds on sea turtles, dugongs, teleost fishes, sea snakes, sea birds, jellyfishes, rays, marine mammals and crabs and is considered as an apex predator in the marine ecosystem.

On 22nd January, 2013 a single female specimen of *G. cuvier* measuring 136 cm (total length) with a weight of 13 kg was landed which was accidently caught by Hook and Line, (locally called as Thoondil) operated from traditional fishing craft (Vallam) at Punnakayal landing centre. The gear was operated between 50 and 150 m depth, at a distance of 40 to 50 Nautical miles from the coast. For identification, photographs of the landed specimen were taken and basic measurements like total length, weight, sex and some special characters were noted.

Diagnostic characters

Body fusiform, stout forward of the first dorsal fin, snout very short and bluntly rounded.Upper labial furrows long reaching the eyes, teeth coarsely serrated, interdorsal ridge present, caudal peduncle relatively narrow.Second dorsal much smaller than first. Keel on each side caudal peduncle. Upper caudal lobe with long tapering tip (Fig. 1). Colour: Grey above with vertical black to dark grey tiger stripe and spots marking on side and fins.

Threats and protection

Tiger sharks are under the "near threatened" category in the IUCN red list and it is not usually

Fig. 1. A view of *Galeocerdo cuvieri* incidentally caught by Hook and Line

Fig. 2. Ventral view of *G. cuvier* showing serrated teeth

Fig. 3. Ventral view of *G. cuvier* showing absence of claspers between the pelvic fins

Fig. 4. A view of 1st and 2st dorsal fins & upper caudal lobe with long tapering tip

fished commercially but previously it has been targeted for the fins, liver and jaws (Randall, 1992; Simpfendorfer, 2005). The tiger shark is also one of the seven species for which there is a sport fishing world record, the biggest one being a 569 kg individual caught in Queensland in 1953. Next to the great white shark, *Carcharodon carcharias,* it is the most dangerous shark in the frequency of attack on humans in the ocean (Randall, 1992).

Occurrence of the goldband fusilier, *Pterocaesio chrysozona* (Cuvier, 1830) along Visakhapatnam, east coast of India

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Pterocaesio chrysozona (Cuvier, 1830) commonly known as goldband fusilier belongs to the family Caesionidae of Order Perciformes. The species is widely distributed in the Indo-West Pacific, from East Africa, including the Red Sea, to eastern Australia. From Indian waters, this species has been reported from south India, Lakshadweep and Andaman and Nicobar Islands. It is a valuable baitfish for tuna in the Laccadives, Maldives and the West Pacific. and also used as a food fish in some areas.

One specimen of the species was collected from trawl catch at Visakhapatnam Fishing Harbour on 6th January, 2013. The specimen was identified as *P. chrysozona* and was deposited at the Marine Museum of VRC of CMFRI, Visakhapatnam (Fig.1). This is the first report on the occurrence of *P. chrysozona* along Visakhapatnam, east coast of India. The species is easily distinguished with its fusiform, elongate and moderately compressed body. Upper body is light blue to brownish, lower body white to pinkish; with a bright yellow band directly below lateral line for most of its length from behind the eye to the base of caudal fin; axil of pectoral fin black; dorsal fin slightly dusky distally; tips of caudal lobes black. Meristic and morphometric Table 1 characters recorded are as given below :

Fig 1. Goldband fusilier, *Pterocaesio chrysozona* (Cuvier 1830)

Meristic characters: D X, 15; P 18; V I, 5; C 15; A III, 12; LI 65

Table 1. Morphometric measurements of *Pterocaesio chrysozona*

Total length	189
Standard length	155.7
Fork length	167
Preanal length	101.3
Predorsal length	55.75
Prepelvic length	51.03
Prepectoral length	43.47
Body depth	40.25
Head length	38.93
Eye diameter	14.10
Preorbital length	8.05

First record of Indian hand fish *Halieutaea indica* Annandale & Jenkins, 1910 from Gujarat

Swatipriyanka Sen Dash, Gyanaranjan Dash, Mohammed Koya K., Sreenath K. R., Pradeep P. and Kamaliya Kiran R.
Veraval Regional Centre of CMFRI

A single specimen of Indian hand fish *Halieutaea indica* Annandale & Jenkins, 1910 was collected at Veraval landing centre from a multiday trawler operated off Okha in Gujarat during 10.04.2013 to 20.04.2013.This is the first record of the species along the Gujarat coast. The fish was 8.3 cm long and weighed 14 g caught from a depth of 80-100 m. The detailed morphometric and meristic characters of the specimen has been given in Table 1.

The species belong to the family Ogcocephalidae (batfishes) under the order Lophiiformes. It identified by yellow pectorals with a white band across. The species is distributed in Indo-West Pacific: from off South Africa, Madagascar, Seychelles, Western Australia, Philippines, Indonesia, Taiwan, China and Japan. It has a typical flattened head and body like rays. The head is disc shaped with a conspicuous cavity in front (Fig. 1). Tail is slender and tapering. Body is covered with scales shaped like tubercles. The intra orbital space is narrow and is of equal size to the eye diameter.

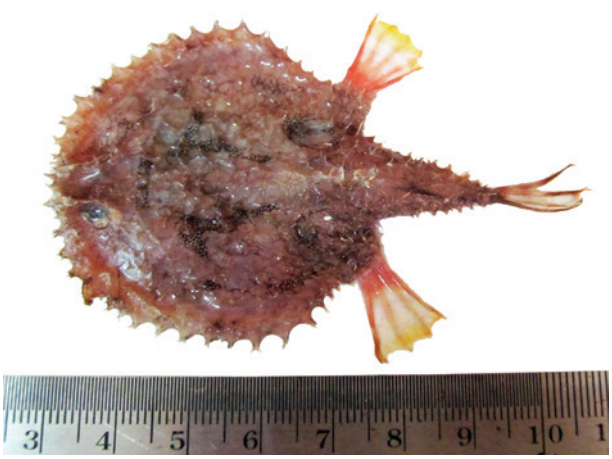

Fig. 1. Dorsal profile of *Halieutaea indica*

Fig. 2. Ventral profile of *Halieutaea indica*

Mouth is inferior and broad. Dorsal and anal fin are smaller, pelvic fin present underside of disc and is with well advanced pectorals. The body is uniform brown in colour with pinkish ventral side.

Table 1. Morphometric and meristic characters of *Halieutaea indica*

Characters	Measurements (mm)
Total length	8.3
Dorsal fin length	0.8
Pectoral fin length	1.6
Pelvic fin length	1.5
Anal fin length	1.2
Caudal fin length	2.0
Inter orbital space	0.5
Eye diameter	0.5
Disc length	4.2
Disc width	5.5
Tail length	4.1
Mouth width	2.3
Dorsal fin spine and rays	0+4
Anal spine and rays	0+4
Pectoral fin spine and rays	0+8
Caudal fin rays	6

On the occurrence of *Iniistius pavo* (Valenciennes, 1840) from Gujarat

Swatipriyanka Sen Dash, Mohammed Koya K., Gyanaranjan Dash, Sreenath K. R., Sangeeta A. Bharadiya and Kamaliya Kiran
Veraval Regional Centre of CMFRI, Veraval

Iniistius pavo (Valenciennes, 1840) commonly known as peacock wrasse belongs to the family Labridae. Distributed in Chagos, Kenya, Mozambique, Seychelles, Somalia, South Africa and lately reported from Lakshadweep, the species is not reported hitherto from the mainland of India. Most species (82%) are found in the Indo-Pacific region, with Australia having the largest labrid fish fauna (about 33% of the species and 70% of the genera). This species usually occurs solitary in lagoon and seaward reef areas with fine to loose, coarse sand bottoms at depths of 7 to 30 m. The fish can dive into the sand when threatened. Wrasses are active only during day time, burrowing in the sand and sleeping in rock or coral shelters at night. The present specimen was observed for the first time at Veraval.

Only a single specimen (Fig. 1) of the species caught by hook and line was landed on 5th January, 2013 and collected from Veraval landing centre. As per the information collected from fishermen, the fish was caught, by a multiday trawler of Veraval which was fishing for bigger size ribbon fish from the Angria bank off Ratnagiri coast which is a coral reef area and at the same time the fishermen operated the hook and line to get some fish. The species was identified by the presence of first 2 dorsal spines, which was not connected to rest of fin by a membrane, absence of scales on cheek, opercle and lower jaw and a prominent black spot above lateral line below sixth dorsal spine. Body colour was pale blue to green, with 3 or 4 poorly defined broad, green vertical bars on sides. Dorsal side of head compressed into a knife-like edge, the profile with an extreme convex curve above eyes; snout very steep, small mouth with 2 large canines situated anteriorly in each jaw and interrupted lateral line. The detailed morphometric and meristic characters are given in Table 1. The collected specimen was preserved and kept in the museum of Veraval regional centre.

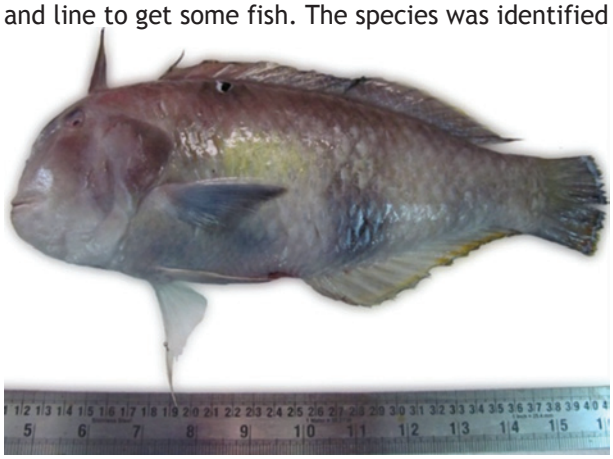

Fig 1. *Iniistius pavo* (Valenciennes, 1840) landed at Veraval

Table 1. Morphometric and meristic characters of *Iniistius pavo* (Valenciennes, 1840) collected from Veraval

Characters	Measurements (mm)
Total length	32.0
Standard length	28.0
Head length	8.5
Pectoral fin length	6.0
Pelvic fin length	5.5
Maxillary length	2.0
Eye diameter	0.8
Inter orbital length	2
Anal fin length	2.5
Base of anal fin	11
Base of pectoral fin	1.5
Base of pelvic fin	0.5
Base of dorsal fin	19.0
Body depth	11.5
Depth of caudal peduncle	4
Dorsal fin count	IX+12
Anal fin count	III+12
Pectoral fin count	0+11 (2 unbranched +10 branched)
Pelvic fin count	0+5
Caudal fin count	11
Weight (g)	598

Incidental landing of lesser devil ray *Mobula diabolus* (Shaw, 1804) at Dummulapeta and Bhairavapalem, Andhra Pradesh

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Landings of lesser devil ray, *Mobula diabolus* (Shaw, 1804) were reported at Dummulapeta and Bhairavapalem landing centers of Andhra Pradesh from 21.03.2012 to 23.03.2012. A total of 23 mobulid rays were caught incidentally in drift gill nets set in surface waters for targeting yellow fin tuna shoals by motorized gillnetters, 20 km away from the shore. The disc length of *Mobula diabolus* ranged from 62-105 cm, disc width from 97-163 cm and weighed between 40 and 110 kg. Targeted fishery for yellow fin tuna commences in September and lasts till March. During this period fishermen actively operate HDPE drift gillnets with mesh size 80-150 mm along the Kakinada coast. This incidental catch of lesser devil rays coincided with nets set during night time.

Mobula diabolus cutting

Mobula diabolus landed at Dummulapeta and Bhairavapalem landing centres

Mobula diabolus are locally called as "Deyyam teku" and occurs in both coastal and oceanic waters from the intertidal to the epipelagic zone around coral and rocky reefs, in lagoons and enclosed open bays. The catch was disposed by open auction at the Dummulapeta and Bhairavapalem landing

Mobula diabolus flesh and skin was great demand, flesh is cut into strips for salting process

Mobula diabolus removing of gill rakers and liver for oil extraction

centres. *Mobula diabolus* catch was auctioned at the rate of ₹ 35- 45/ kg. The ray was cut open to remove gill rakers and liver. Cut gill rakers were cleaned, dried and exported to Japan, Singapore, and China, as it has prime importance in traditional Chinese medicine. The liver is used for oil extraction. As there was no demand for flesh, the flesh was cut into strips for salting. The salted and dried flesh was sent to Tamil Nadu and Kerala markets. Mobulids are under IUCN Red list, as these stocks are depleting at rapid pace due to its slow growth, late maturity and low fecundity. These incidental catches because of large scale operation of drift gill nets are contributing to the increased fishing pressure on devil rays.

A note on the record of scorpion fish *Parapterois macrura*

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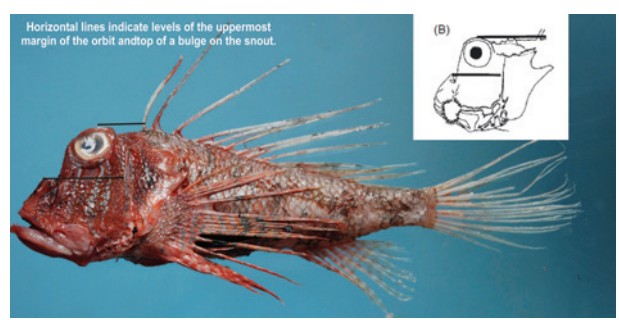
The family Scorpaenidae includes 209 species of fishes that are commonly called Scorpion fishes or rock fishes. Out of the 209 species only 18 have been described by Indian researchers so far and along Karnataka coast seven species have been recorded. The Genus *Parapterois* has two species *viz*. *P. heterura* and *P. macrura*. Though the *P. heterura* is widely distributed in the Indo-Pacific, P. *macrura* has so far been located only in the Malabar- Mangalore coast of Karnataka. Mandrytsa (2001) recorded a poorly known scorpion fish, *Pterois macrura* Alcock, 1896, originally described from the Malabar Coast off Calicut, west coast of India, as a second species of *Parapterois* and provided a key to the two species. With the exception of Mandrytsa (2001) and some type catalogs (Menon and Yazdani, 1968, Menon and Rama-Rao, 1975, Eschmeyer, 1986, Eschmeyer and Rama-Rao, 1978, Ishida, 1997), no reports of *Parapterois macrura* have been published since Alcock's (1896) original description and subsequent report (Alcock 1898). Specimens collected from India, were studied by Hiroyuki Motomura (2004) and confirmed the species validity. This is the first colour photographic record of this species, which was landed at Mangalore fishing harbour by a multiday trawler operated at a depth of 151 m, 40 km south off Mangalore during September 2010.



P. macrura differed from *P. heterura* in having the upper margin of the orbit higher than the level of the first dorsal fin spine base (vs. slightly lower in the latter), the interobital space without scales (vs. Covered with scales), a tentacle on the lacrimal not reaching the posterior margin of the maxilla (vs. Extending beyond it), and a flap with small black spots present on the tip of the first dorsal fin spine (vs. Flap absent). Mandrytsa (2001)

First report of the shortfin mako sharks *Isurus oxyrinchus* (Rafinesque, 1810) in commercial landings at Madras Fisheries Harbour

Shoba Joe Kizhakudan, Rajapackiam S., Yousuf K.S.S.M. and Vasu R.
Madras Research Centre of CMFRI, Chennai

A pair of shortfin mako sharks *Isurus oxyrinchus*, locally named "singapal sorrah" were landed at Madras Fisheries Harbour by a mechanished gillnetter on 19.07.2012. The shortfin mako is an epipelagic species found in tropical and warm-temperate seas from the surface down to at least 500 m. Although it is known to be distributed in the Bay of Bengal, it is rarely found to occur in the fishery off the north Tamil Nadu coast. The present specimens are first record of mako sharks occurrence in Chennai waters.

Shortfin mako shark *Isurus oxyrhynchus* landed at Chennai

Description: Body slender and cylindrical in shape with long and pointed snout. First dorsal long with origin above insertion of pectoral fin.Anal fin origin at middle of second dorsal fin base. Body color blue dorsally and white ventrally. Underside of snout and area around mouth white.

The maximum recorded size of shortfin mako shark is 400 cm with size ranging between 250 and 270 cm reported as common. The two sharks landed at Chennai were one male and one female, measuring 245 cm and 188 cm in total length and weighing 55 and 90 kg, respectively. These sharks were caught in gillnet operations carried out at a depth of 100 m in grounds located to the north-east of Chennai.

The morphometric measurements (in cm) of the two sharks are given below:

Morphometric measurements	Male	Female
Total length	245	188
Pre caudal length	185	130
Head length	80	65
Snout to origin of I dorsal fin dorsal	82	75
Snout to II dorsal	160	150
Snout to pectoral	65	60
Snout to pelvic	134	128
Snout to Anal fin	165	157
Snout to Anus	160	150
Snout to eye	17	16
Eye diameter	5	5
Length of upper caudal fin	48	45
Length of lower caudal fin	38	35
Length of clasper	22	-
Length of mouth	14	14

The shortfin mako shark is probably the fastest of sharks and can leap out of the water when they are hooked. They are potentially dangerous and infamous for unprovoked attacks on swimmers and boats. Fine quality meat, fins and skin of this shark fetch good value in consumer market. The specimens reported here were auctioned by the fishermen at the landing centre, for ₹13,500/- and ₹ 7700/.

Occurrence of slender threadfin bream, *Nemipterus zysron* (Bleeker, 1856) (Perciformes: Nemipteridae), from Tuticorin Coast

Kannan, K., Ranjith, L., Sureshkumar, K., Mohamed Sathakkathullah, S., John James K. and Madan, M.S.
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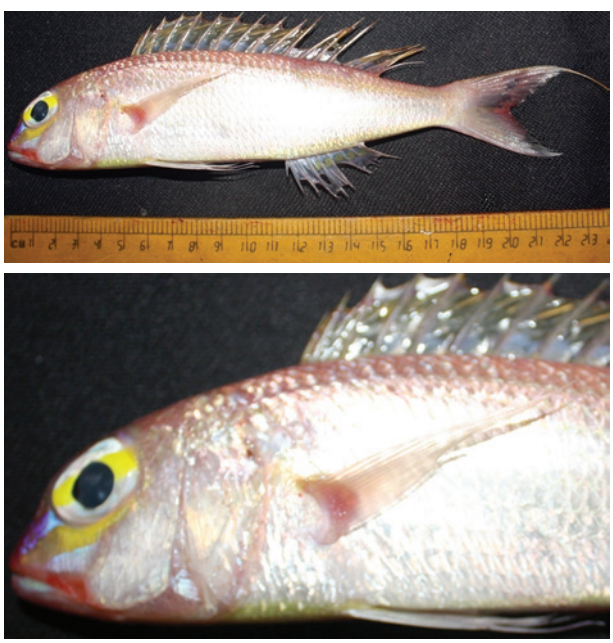
On 26thMarch, 2013 a single specimen of slender threadfin bream, *Nemipterus zysron* (Bleeker, 1856) with total length 247.4 mm was collected from Punnakayal landing centre. This specimen was caught by the gill net operated between 20 and 50 m depth at a distance of 25 to 40 nautical miles from the shore. Occurrence of *N. zysron* is reported for the first time from the Tuticorin coast. Nemipteridae family has 5 genus and 65 species. In contrast with other *Nemipterus* species, *N. zysron* was easily identified in the field by the presence of yellow stripes in front of eye through nostrils and from upper lip to beneath the eye. Body slender and elongated, body depth 3.84 times SL; snout length equal to diameter of eye; diameter of eye 3.14 times head length; lower margin of eye just above a line from tip of snout to upper base of pectoral fin; inter-orbital width 1.59 times of eye; pectoral and pelvic fins reaching up to anus; pectoral fins 1.12 times of head length, pelvic fins 1.28 times of head length; caudal fin forked, upper lobe produced into a short filament; gill rakers 13. Other diagnostic features observed were the presence of a single dorsal fin with ten spines and ten rays, anal fin with three spines and seven rays. Upper lobe of caudal fin produced into a long yellow trailing filament. Body colour is reddish in the upper part, silvery below; sides below lateral line with distinct yellow stripes along the middle of each scale row. Head pinkish and dorsal fins pale yellow with a bright yellow margin. Pelvic fins hyaline with a yellow auxiliary area and auxiliary scale. Caudal fin pinkish, upper and lower lobes light yellowish, filament yellow.



Nemipterus zysron caught off Tuticorin coast, Gulf of Mannar: left side view (A) and close view of head (B).

Table: 1 Morphometric characters of *Nemipterus zysron*

Characters	mm
Total length	244.70
Fork length	210.22
Standard length	180.13
Body depth	46.87
Body width	28.02
Pectoral length	47.84
Pelvic length	42.05
Head length	53.92
Eye diameter	17.13
Orbit diameter	8.43
Snout length	16.47
Interorbital depth	10.76
Predorsal length	59.68
Prepectoral length	57.40
Prepelvic length	60.98
Preanal length	113.22
Preanus length	102.45
Distance between pelvic and anal fin	53.28
Caudal peduncle length	33.55
Caudal Peduncle width	19.24

Occurrence of blue tile fish *Malacanthus latovittatus* (Lacepede, 1801) (Actinopterygii: Malacanthidae) in Tuticorin Coast

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Tuticorin Research Centre of CMFRI, Tuticorin

A specimen of *Malacanthus latovittatus* (Fig. 1) with standard length 330 mm and weighing 250 g was collected from the bycatch of a commercial trawler at Tuticorin fishing harbour during March 2010. The specimen was caught approximately 30 km east off Tuticorin, Gulf of Mannar at a depth ranging from 20 to 25 m. After detailed morphological examination, the specimen was photographed and fixed with 5% formalin. The morphometric measurements were taken to the nearest mm and the specimen was identified as *M. latovittatus* described in FAO (1984).

Fig. 1. *Malacanthus latovittatus* (Lacepede, 1801)

The family Malacanthidae has 5 genera and about 46 species distributed in tropical and temperate seas. The genus *Malacanthus* comprises of three valid species, *M. brevirostris* Guichenot, 1848, *M. latovittatus* (Lacepede, 1801) and *M. plumieri* (Bloch, 1786). *M. latovittatus* has elongated and compressed body, dorsal and ventral profile evenly tapering to caudal, mouth broad with fleshy lips, jaws equal, termination of upper jaw far distant from eye. Cycloid scales on opercles and nape, square on superior part of trunk. Operculum is with a strong flat spine and five branchiostegals. Teeth in jaws are canine; vomer and palatines toothless. Dorsal fin rays III, 44; Anal I, 39; Pectoral 15 and pelvic fin with 5 rays. The gill rakers 9; caudal fin truncate and its upper lobe are elongate and lateral-line scales 124.

Colour: Head blue, iris yellow; body olive-grey to violet-blue above, bluish white on belly; a broad dark band runs from opercle to tip of caudal fin, widening on tail to include most of middle and lower portion; lower portion of fin with a small white rectangular area; dorsal fin grey-brown with a pale band along upper margin; anal and pelvic fins white; pectoral fins bluish.

Table 1 Morphometric measurements of *Malacanthus latovittatus* (Lacepede, 1801)

Morphometric characters	Measurements (mm)
Total length	400
Standard length	330
Head length	95
Body depth	90
Snout length	50
Post orbital length	40
Lower jaw length	28
Upper jaw length	32
Dorsal fin length	28
Dorsal fin base length	230
Predorsal fin length	110
Pectoral fin length	58
Pectoral fin base length	20
Prepelvic fin length	100
Pelvic fin length	27
Pelvic fin base length	07
Preanal length	160
Anal fin length	25
Anal fin base length	163

On the first record of the scorpion fish, *Scorpaenopsis lactomaculata* (Herre, 1945) from inshore waters of Veraval, Gujarat

Gyanaranjan Dash, Swatipriyanka Sen Dash, Mohammed Koya K., Sreenath K. R., Suresh Kumar Mojjada, Sangita A. Bharadiya and Kiran K.
Veraval Regional centre of CMFRI, Veraval

Scorpaenopsis lactomaculata (Herre, 1945) belongs to the family Scorpaenidae and commonly known as Scorpion fish. As the name suggests, scorpion fish have a type of "sting" in the form of sharp spines coated with venomous mucus. They are widespread in tropical and temperate seas, but mostly found in the Indo-Pacific. Originally *Scorpenopsis lactomaculata* (Herre, 1945)was assigned underthe genus *Scorpaena* Herre, 1945. Later it was changed to *Scorpaenopsis* due to the presence of small minute scales in the pelvic area and absence of palatine teeth. *S. lactomaculata* is a demersal inshore species which is distributed in the western Indian ocean in between 30° E - 80° E; 45° S - 30° N. (Froese and Pauly, 2009). Earlier, it has been reported from India (shallow waters of Bombay), Iran and Pakistan (West of Karachi). Though the species (locally known as "Wekhli") is mainly caught by hook and lines, a small portion of the catch is also landed as trawl by-catch along the Saurashtra coast.

The specimens for the present study were collected during 5th to 20th November, 2012 from the boats locally called as 'Hodi'(length~20ft) which were operated in the inshore waters at a depth range of 10-20 m by artisanal fishermen. The fishes were caught along with the species of snappers *(Lutjanus johnii* and *L. russelli*), groupers (*Cephalopolis formosa* and *Epinephelus bleekerii*) and emperor breams (*Lethrinus letjan* and *L. elongatus*) by hook and line. The study is based on 5 specimens measuring 155-211 mm (TL) with a weight of 65-182 g. The morphometric measurements and meristic counts of the specimens were collected after which the specimens were preserved in 5 % formalin and kept in the museum of Veraval regional centre of CMFRI for future reference (Table 1).

Fig 1. White blotched Scorpion fish (*Scorpenopsis lactomaculata*) (Herre, 1945) from Veraval

The current species is identified following the description given by Randall and Eschmeyer, 2001. The body of the collected specimen of *S. lactomaculata* is deep, robust and reddish brown in color. The head is large and spiny with a long snout and spiny opercle. Space between opercular spines is naked. Sub orbital ridge is having a single row of three spines. Dorsal fin is reddish brown with white streaks and other fins with numerous brown spots on fin rays. Forth spine on dorsal fin is the longest spine observed in all the samples where the first dorsal spine is shorter than the second. Body was covered with ctenoid scales. Mouth was terminal with toothless palate. The specimen became uniformly pale brownish after preserving in formalin. The ratios of different morphometric measurements are: Head length 33-37 % of SL, snout length 26.6 -30.66 % of HL, eye diameter 11.1-12 % of HL, Body depth 25.8-28.4 % of TL, Inter-orbital width 6.1-7.1 % of SL, Upper jaw 44-45.6 % of HL, Lower jaw 46-49 % of HL, Pectoral fin length 22-24% of SL, Pelvic fin 14.8-19.23 % of SL, Anal fin

17.2 -19.5 % of SL, Caudal peduncle depth 30 % of body depth. The fish mainly caught and in winter seasons along with the coral associated fishes by hook and line is used for local consumption and its price varies from ₹ 30-50/ kg in the local market.

Table 1. Morphometric and meristics of *S. lactomaculata*

Paramerters	Measurement range (cm)
Total length	15.5-21.1
Standard length	13.5-18.2
Head length	4.5-7.5
Snout length	1.2-2.3
Body depth	4-6
Eye diameter	0.7-0.9
Inter-orbital width	0.9-1.3
Pre orbital- length	1.2-2.3
Post orbital length	1.5-1.8
Upper jaw length	2.0-3.5
Lower jaw length	2.1-3.7
Pectoral fin length	3-4.5
Pectoral base length	2-2.8
Pelvic fin length	2-3.5
Pelvic fin base length	1-2
Pelvic fin spine length	1.5-2
Length of longest spine (4^{th}) on dorsal fin	1.5-1.7
Anal fin length	2.3-3.5
Anal fin base length	1.4-2.1
Length of longest spine on anal fin	2.3-2.9
Caudal fin length	2.3-3
Caudal peduncle depth	1.2-1.8
Dorsal fin spine and rays	12+9
Pectoral fin spine and rays	0+17-19
Pelvic fin spine and rays	1+5
Anal fin spine and rays	3+5
Caudal fin rays	13
Vertical scale rows	58-61
Lateral line scales	42-51

First record of *Pomadasys furcatus* (Bloch & Schneider, 1801) from Saurashtra coast of Gujarat

Gyanaranjan Dash, Swatipriyanka Sen Dash, Sreenath K. R., Mohammed Koya, Suresh Kumar Mojjada, Sangita A. Bharadiya and Kiran K.
Veraval Regional Centre of CMFRI, Veraval

A single specimen of the Banded grunt, *Pomadasys furcatus* (Schneider, 1801) belonging to the family Haemulidae was collected at Bhidiya near Veraval landing centre on 22nd December, 2012. The fish was caught by a single day boat locally called as "Hodi" operated at a depth of 10-20 m near Veraval. The fish was 33.3 cm long and weighed 608 g. It is mainly a tropical reef associated fish distributed in Indo-west Pacific region. Earlier the fish has been reported from Andaman and Nicobar islands of India. Though known to be distributed in the Western Indian Ocean, hitherto it has not been reported from Gujarat.

The species was identified following the description given in Fish base (Froese and Pauly, 2000) and FAO (Fischer and Bianchi, 1984).It has an elongated and compressed body. Dorsal profile of

Fig. 1. *Pomadasys furcatus* (Schneider, 1801)

the head is convex with moderately large eyes. Mouth is small with teeth in jaws in villiform bands. The maxilla reaches up to hind nostril or eye. There are two pores and a median pit on chin. The detailed morphometric and meristic characters of the specimen has been mentioned in Table.1. Colour of the specimen is silvery white with six longitudinal dark parallel bands, the three upper ones from nape to base of soft anal fin, the fourth from upper part of eye to upper caudal rays and united with that of the other side on caudal peduncle. The fifth one extends from hind border of eye to middle of caudal fin base and the sixth one originates below eye and extends to lower caudal rays through axil of pectoral fin. With exception of the first and last band, the bands are more or less double in their anterior part. Caudal, anal and distal part of ventral fins is dark violet in colour. Pectoral fins are dusky in colour. Scales are ctenoid. The colour became reddish brown after preservation in 5% formalin. The specimen has been kept in the museum of Veraval Regional Centre of CMFRI for future reference.

Table1. Morphometric measurements of *P. furcatus*

Parameters	Measurement (cm)
Total length	33.3
Standard length	27
Body depth	13
Head length	7
Snout length	4
Eye diameter	1.5
Inter orbital	2.8
Length of the upper jaw	5.5
Length of the lower jaw	4.7
Snout to insertion of dorsal fin	11.5
Height of the dorsal fin	3.8
Base of the dorsal fin	14.5
Snout to insertion of pectoral fin	9
Length of pectoral fin	10
Base of the pectoral fin	1.6
Snout to insertion of pelvic fin	9.7
Length of pelvic fin	6.5
Base of pelvic fin	1.5
Snout to insertion of anal fin	20
Length of anal fin	4.5
Base of anal fin	4
Snout to origin of vent	18.5
Snout to insertion of caudal fin	26.8
Caudal fin length	6
Caudal peduncle depth	3.5
Dorsal fin spine and rays	XII+15
Pectoral fin spine and rays	0+15
Pelvic fin spine and rays	I+5
Anal fin spine and rays	III+8
Lateral line scales	59
Scale row between lateral line and dorsal fin origin	9

Occurrence of box crab *Calappa bilineata* (Ng, Lai & Aungtonya, 2002) from Gulf of Mannar, Southeast coast of India

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The members of the genus *Calappa* are distributed in the tropical and subtropical ocean in the shallow coral reef areas and are commonly called box crabs or Shame-faced crabs. *Calappa*, are important crab species landed by the industrial trawl fleet in Venezuela with an annual average landing of 69 tonnes. There are nearly 41 extinct species under this genus. Fossils of *Calappa protopustulosa* have been recorded at Mizoram, Northeastern India. This group of crabs can completely bury under the soft substrata in the sea. During the routine observation trips to study 'singhi valai' catches, along Mandapam large quantity of box crabs were observed as catch discards.

At Mandapam waters two species under *Calappa* genus were reported earlier and this collection differ from the two known species. On 17th October 1966 Dr. Sivalingam, former Scientist of this centre had deposited a specimen at Mandapam Marine Museum identified upto genus level as *Calappa* sp. and has been presently identified as *Calappa bilineata*. The collection made in the Gulf of Mannar region 46 years before the species description, which was based on the collection from Andaman Sea in 2002 by Peter NG, indicate the distributional range of this species.

Table 1. *Calappa* species list

Species	Presence / absence
Calappa acutispina Lai, Chan & Ng, 2006	
Calappa africana Lai & Ng, 2006	
Calappa bicornis Miers, 1884	*
Calappa bilineata Ng, Lai & Aungtonya, 2002	Present study
Calappa calappa (Linnaeus, 1758)	
Calappa capellonis Laurie, 1906	
Calappa cinerea Holthuis, 1958	
Calappa clypeata Borradaile, 1903	
Calappa conifera Galil, 1997	
Calappa convexa Saussure, 1853	
Calappa dumortieri Guinot, 1962	
Calappa flammea (Herbst, 1794)	
Calappa galloides Stimpson, 1859	
Calappa gallus (Herbst, 1803)	*
Calappa granulata (Linnaeus, 1758)	
Calappa guerini Brito Capello, 1871	
Calappa hepatica (Linnaeus, 1758)	*
Calappa japonica Ortmann, 1892	
Calappa liaoi Ng, 2002	
Calappa lophos (Herbst, 1782)	*
Calappa monilicanthus Galil, 1997	
Calappa nitida Holthuis, 1958	
Calappa ocellata Holthuis, 1958	
Calappa ocularia Ng, 2002	
Calappa pelii Herklots, 1851	
Calappa philargius (Linnaeus, 1758)	*
Calappa pokipoki Ng, 2000	
Calappa pustulosa Alcock, 1896	*
Calappa quadrimaculata Takeda & Shikatani, 1990	
Calappa rosea Jarocki, 1825	
Calappa rubroguttata Herklots, 1851	
Calappa sebastieni Galil, 1997	
Calappa springeri Rathbun, 1931	
Calappa sulcata Rathbun, 1898	
Calappa tortugae Rathbun, 1933	
Calappa torulosa Galil, 1997	
Calappa tuberculata (Fabricius, 1793)	
Calappa tuerkayana Pastore, 1995	
Calappa undulata Dai & Yang, 1991	
Calappa woodmasoni Alcock, 1896	
Calappa yamasitae Sakai, 1980	

**indicated the species presence*

Olive ridley turtle *Lepidochelys olivacea* (Eschscholtz, 1829) washed ashore at Visakhapatnam

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A dead Olive ridley turtle was found washed ashore near Bheemunipatnam, about 20- 25 km south of Visakhapatnam city, on 19th November 2012. An injury mark was present on the head of the specimen (Fig.1) and it is suspected that death was caused by incidental capture and drowning. It is a matter of concern since Olive ridley turtle are endangered and are protected as per various international agreements. They are categorized as Vulnerable on the IUCN Red List (IUCN, 2010) and are included in Schedule I of the Indian Wildlife (Protection) Act, 1972. They are listed in Annexure II of the SPAW (a Protocol Concerning Specially Protected Areas and Wildlife), Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Flora and Fauna) and Appendices I

Fig. 1. Olive ridley turtle stranded at Visakhapatnam

and II of the Convention on Migratory Species (the Bonn Convention).The curve carapace length and weight of the turtle were 70 cm and 35-40 kg respectively. Details of morphometric measurement recorded are as follows:

Table 1. Morphometric measurement (in cm) of Olive ridley turtle

Characters	Measurements
Total length	98
Curved carapace length	70
Curved carapace width	67
Plastron length	57
Plastron width	55
Head length	28
No. of prefrontal scutes	2 pair
No. of precentral scutes	1
No. of central (neural) scutes	5
No. of lateral (coastal)scutes	7
No. of marginal scutes	12
No. of postcentral scutes	1
No. of claws on flipper	1
Tail length	18 cm
Inframarginal scutes with pores	4

Strandng of dead dolphin noticed near Mondova-Saswane sea shore Raigad district, Maharashtra

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Stranding of dead dolphin was noticed near Mondova-Saswane sea shore at a depth of 5 to 6 m. Floating in the sea water the specimen was first noticed by the local fishermen. Since the species was floating in the seawater the identity of the species could not be studied. However, the local fishermen informed that the species might have got strangled in the fishing net.

The same species was not washed ashore. Strong waves must have washed away the specimen to the sea.

Stranding of dead dolphine noticed at Mondova-Saswane sea shore

Influence of river discharge on deposition of marine litter

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Marine litter refers to any manufactured or solid waste entering the marine environment through land, river or sea irrespective of the source. UNEP/ IOC has included the following items in the list of marine litter- plastic (moulded, soft, foam, nets, ropes, buoys, monofilament line and other fisheries related equipment, smoking related items such as cigarette butts or lighters, metal (drink cans, bottle caps, pull tabs), glass (buoys, light globes, fluorescent globes, bottles) processed timber (including particle board), paper rubber and cloth. The two major rivers in Mangalore are the Gurupura and the Nethravati River. Both these rivers are of immense importance to the city and it drains into the Arabian Sea. With the variability in weather due to global warming, experts have predicted that it will intensify the hydrologic cycle, resulting in increased flows in the initial few decades but substantially reduced flows thereafter. Hence, river discharge and its management are crucial for the supply of drinking water to the urban and rural population. The complex changes in water availability due to climate change are yet to be understood. An increase in mean temperatures could increase the energy flux for evapo-transpiration. This implies that there could be increased potential for evapo-transpiration in the forests which could trigger changes in the environment. For the agriculturalist this could lead to changes in crop seasons. For the fishermen it could lead to changes in the catch composition. Temperature differences drive the currents. With the winter being colder and summer hotter this influences the timing of the southwest and northeast monsoon.

The Nethravathi and Gurupur estuaries form a transition zone between river and ocean. They are subject to both marine influences, such as tides, waves, and the influx of saline water and riverine influences, such as flows of freshwater and sediment. The inflows of both seawater and freshwater provide high levels of nutrients in both the water column and sediment, making estuaries the most productive natural habitats. Studies in Gurupur River and nearby coastal beaches of Panambur, Thannerbhavi and Chithrapur have shown that with reduced freshwater flow and increasing sea level pressure, the tidal influence will prevail resulting in lesser flushing out of river water and deposition and accumulation of marine litter. This was observed in Gurupur River (Fig. 1) where large amount of litter accumulated during the high tide on the banks of the river. Changes in intensity of rainfall can lead to varying discharge of rivers and the sedimentation profile of the river. Lesser discharge from river during summer can cause more deposition of debris near the bar mouth and banks of the river. The mangroves act as excellent filter in the river banks and prevent further movement of larger debris entangled. Marine litter in the beaches was observed to be highest during monsoon.

Fig. 1. Marine litter deposited in river bank of Gurupur during high tide

Monitoring and awareness campaign conducted in and around Mangalore by CMFRI and various other organizations has brought about positive changes in the beaches of Mangalore as well as estuarine area. Beach cleaning activities were taken up at

Thanneerbhavi and Panambur beaches. At Thaneerbhavi there was a reduction of 76% in the weight /m^2/year of marine litter and 56% reduction in the number of items/ m^2/year compared to the previous year. In Panambur beach the litter from fishing nets is removed and dropped there by the fishermen. There was a reduction of 8% in the weight /m^2/year and 19% reduction in the nnumber of items/ m^2/year. But in Chithrapur there was an increase of 5% in the weight /m^2/year of marine litter and a decrease of 12% in the no: of items/ m^2/year compared to the previous year. There was not much cleaning activity in the beach and also increasing current during monsoon period brought about large amount of debris from the river. Climate change and resultant sea level rise will lead to increasing loss of the beach due to erosion. This also leads to considerable burial of marine litter and further fragmentation by mechanical action of sediment and wave force. This further transports the beach debris far out into the sea.

The gut of Common dolphinfish (*Coryphaena hippurus*) was found to contain plastic bits of milk cover and other unidentified bits (Fig. 2). Identifying the bits of litter and its origin is an important step towards management of waste. Small pelagic fish like oil sardine and mackerel were also observed to contain strands of nylon and plastic in the gut. Marine litter was also observed in the

Fig. 2. Plastic bits and partially digested fish in gut of Common dolphinfish (*Coryphaena hippurus*)

Fig. 3. Polychaete attached to nylon fragment at 6m depth off Chitrapur

fishing nets and benthos at 6m depth off Chithrapur (Fig. 3). Fish egg mass attached to nylon rope was observed in the trawl net off Mangalore (Fig.4). Litter often hits the fishing boat propeller which puts the fishermen life at risk. The highest percentage of item of debris for all the stations combined was assorted group consisting of cap, spoon, small sachets, syringe, paste tube, straw, pen assorted, plastic bits, bead, hair clips and the plastic and nylon ropes followed by thermocol and sponge. Thermocol and sponge is basically polystyrene products made from petroleum and are used as packaging material. But the biodegradation of this is very less. The plastic bags photo degrade, break into smaller more toxic polymers and could enter the food chain.

Fig. 4. Egg mass attached to nylon rope found in trawl net off Mangalore

Paid access to public places is one of the best ways to manage, as seen in Gurupur "Kudru" where now the amount of debris accumulated is very less as whatever comes from upstream is cleaned by people managing the place (Fig. 5). Rather the rivers are the veins that supply nutrients to the ocean which acts like a heart purifying the water and supplying nutrients to various life forms. Our civilizations that started around the rivers will choke to death if we continue to ignore and dump litter.

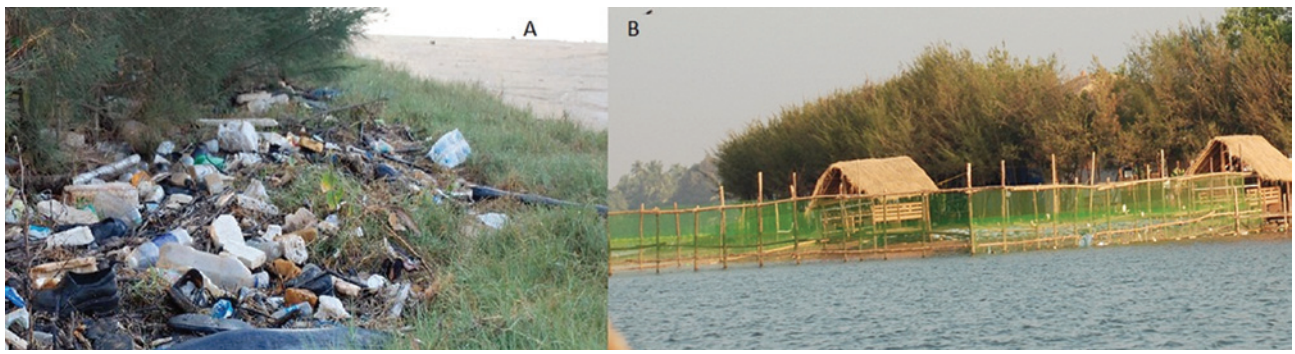

Fig. 5. Kudru in Gurupur river in 2011(A) and in 2013(B)

Window pane oyster collection - an alternative means of income for fisherwomen of Kudgaon, Raigad, Maharashtra

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Along with fisheries related activities, fisherwomen of Kudgaon, 6 km south of Dighi in Raigad district of Maharashtra, recently started collection of Mollusc shells (window pane oyster; *Placuna placenta*) from the intertidal zone. There is great demand for these shells by petroleum related industries for capping and plugging the drilled holes that are left after oil exploration surveys. These shells are also used in handicraft industry. There are about 305 fisher families staying in Kudgaon village. About 80% of the village women have started collecting these shells (Fig. 1). Each

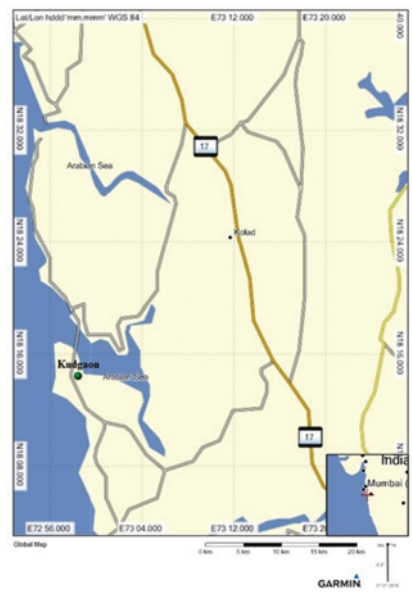
Fig. 1. Woman engrossed in sorting and cleaning of window pane oyster after collection by thermocol raft

Window pane oyster collection activity being carried at community level along eustarine area of Kudgaon

shell collector travels 5 km up and down using specially made thermocol raft and collect shells daily by hand picking. Locally these sea shells are known as "*Kachga*" (Fig. 2). The collected shells are sold to the merchants at a rate of ₹ 6/kg. Each women collect on an average about 12-15 kg shells from the shore. During lowest spring tide, they are able to collect up to 25 kg. On an average, a woman makes ₹ 60-75 per day from the shells she collects. The survey conducted under NAIP project "strategies to enhance adaptive capacity to climate change in vulnerable regions" reveals that, after Dighi port construction, the nearby area of Kudgaon village has witnessed abundance of windowpane oyster. At present, the collection of windowpane oyster has become an alternative source for income of the fisherwomen in this region.

Cleaning process of window pane oyster in the intertidal area during low tide

Fig. 2. Close view of window pane oyster



Geo-coordinated and Geo-referenced Map showing fishing village where Window Pane oyster collection activity is being carried out

Multifarious utilization of shrimp waste at Visakhapatnam

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Shrimp with 16% of the total value of internationally traded fishery products (Food and Agriculture Organization, 2009) constitute the major marine resource traded in terms of value. Frozen fish and frozen shrimp are the important marine export items. About 85 species of shrimp are known to exist in Indian waters of which 55 species are reported either as commercially important or having considerable demand in the local as well as international markets.

The recovery of biochemical compounds from seafood waste materials, which could be used in

different ways, is a promising area of research for development of methods for utilization of seafood by-products. The solid shrimp waste *viz.*, head and shell accounts approximately 40-50% of whole shrimp weight. These wastes contain protein (35-40%), chitin (10-15%), minerals (10-15%) and caroteinoids (Sachindra and Bhaskara, 2008). In India, Central Institute of Fisheries Technology (ICAR), has initiated research on chitin and chitosan. They found that dry prawn waste contained 23% and dry squilla contain 15% chitin (Madhavan and Nair, 1974). They also reported that chitinous solid waste fraction of the average annual landing of shellfish ranges from 60,000 to 80,000 tonnes. The price of chitosan, a cationic polysaccharide is $ 7.5 for 10 g.

The annual landings of both penaeid and non-penaeid prawns at Visakhapatnam ranged from 7797 t to 10636 t during 2008 - 2012 period with an annual average landing of 9717 t (Fig.1). Random samples of both high and low value shrimps were collected to estimate the amount of wastes generated. The head generally constitutes 38 to 40% in both the

Fig. 1. Visakhapatnam Fishing Harbour

types and the shell constitutes 11to 14%. In low value prawns the weight of the shell is 2 to 4%. These shrimp wastes constitute about 53% of the total waste. During the period 2008-2012 the total shrimp wastes generated ranged from 4132 t to 5637 t with an average 5150 t annually (Fig. 1).

Shrimp waste is usually dried on the beaches that results not only in environmental pollution but also reduces the recoverable components (Fig. 2). A better economic use of the shrimp head would

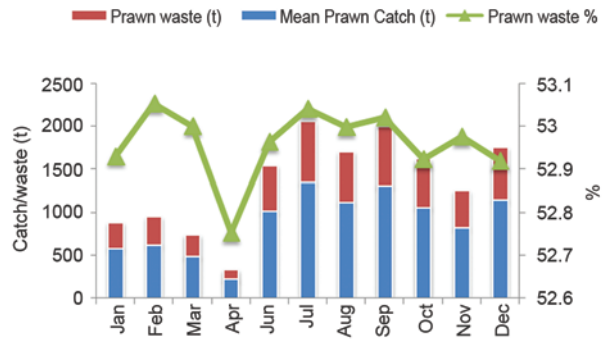

Fig. 2. Mean monthly variation in prawn catch and waste generated during 2008-2012 at Visakhapatnam

Fig. 3. Headless shrimps for transport and trade

Fig. 4. Drying of shrimp wastes at Visakhapatnam Fishing Harbour

minimize the pollution problem and at the same time maximize the profits of the processor. Shrimp heads and the smaller legs of crabs can be collected

from the landing centres and fish markets, cleaned and supplied to small restaurants, hotels and added to the common Indian recipes. Shellfish head waste can be used in production of soups, stocks and sauces for retail sale. Utilization of fermented fish/ shellfish sauces in ancient times was common in Rome and is now extremely popular in many Asian countries where they form a staple part of the diet. Autoclave treatment of shellfish waste can be done where steam is applied under pressure for a specific period of time. This produces a clean sterile material with flesh, shell and an organic liquid. The sterile shell can be separated from the liquid, sorted and treated for use in a wide range of secondary products. With further treatment the liquid can be used to produce fertilizer, or it can be anaerobically digested to produce methane for use as biofuel.

The fleshy wastes from shellfish are suitable material for baits. Fishermen at Lawsons Bay and other landing centres at Visakhapatnam have to buy the bait at ₹ 200/- per kg which adds to the total fishing cost. Fishing of yellowfin tuna *Thunnus albacares* and other tunas using hooks and line by the traditional fishermen at different landing centres of Visakhapatnam is a regular activity using shrimps as bait. Rohit (2010) reported that the crustaceans were the most abundant prey items for yellowfin tuna. 'Single species' baits and 'Mixed species' baits with low value shrimps can be tested by the fishermen to reduce the cost of baits. Shrimp wastes can also be used for preparation of compost along with equal amount of cowdung with 10% urea and applied as manure in brackishwater shrimp culture ponds.

The shrimp waste also contains useful components such as protein, lipid and astaxanthin pigment, thus making the commercial shrimp waste an attractive material for extraction of the above-mentioned components (Meyers, 1986). Astaxanthin is a natural nutritional component, an antioxidant and can be used as a food supplement. In India cod liver oil and other fish oil are given as food supplement for providing omega-3 fatty acids which have beneficial effects on cardiovascular health, inflammation, mental health, and neurodegenerative diseases. Recent studies have reported that adding the antioxidant astaxanthin to fish oil reduces its susceptibility to oxidation and makes its immunomodulatory properties more potent. Crustacean exoskeletons contain 15–20% chitin by dry weight. The production of chitin and chitosan from crustacean canning has proved environmentally attractive and economically feasible, especially when it includes the recovery of carotenoids. Shrimp waste is one of the most important natural sources of carotenoids and the head and body carapace can be used for carotenoid extraction with various organic solvents and solvent mixtures under various extraction conditions (Shahidi *et al*., 1998). The recovered carotenoids can be effectively used instead of synthetic carotenoids in aquaculture feed formulations, and the residue available after extraction may be used for the preparation of chitin/chitosan. Conventional processing methods are time consuming and expensive and therefore innovations in the processing methods will reduce time and cost. Chitosan, produced from shrimp and crab shell, has wide range of applications from cosmetic to pharmaceutical industries. Protein and pigments found in shrimp waste are excellent animal feed supplements.

Proteases are the most important group of industrial enzymes used in the world and find several applications. Proteolysis is one of the gentle methods for recovering proteins from shrimp wastes. Rich protein hydrolysates generated with low fat content can be useful for food and feed purpose. The insoluble fractions generated can be further separated and reutilized. The utilization of the shrimp wastes in a proper manner will help to make the industry environment friendly and more efficient.

Short stint night fish markets in Kerala: A case study

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Kerala's population is essentially a fish eating population with the level of fish consumption four times that of national average. The fish consumption stood at 26 kg per capita per annum (Shyam, 2012). The domestic market for fish in Kerala is governed not only by the purchasing power of the consumers but also by their tastes and preferences. The domestic market for fish in Kerala is inelastic both in terms of income and price. The marine fish consumption is predominant in coastal districts since marine fishes are prone to deterioration in quality during long distance transport to the land locked and hilly regions. However, the demand for fish in these regions was met through inland and cultured freshwater species.

Night markets of short stints (mostly one to two hours) are found to exist mostly in the landlocked regions of Kottayam and Idukki districts in Kerala. These markets offer sizeable fish trade with arrivals from different coastal states. There exist "identified" traders and possess "dedicated" roads for the timely disposal of the fish in the shortest time possible. The functioning and performance appraisal of the two prominent short stint night markets in Ernakulam district *viz.*, Perumbavoor and Muvattupuzha was studied.

Night fish market at Perumbavoor

The short stint night fish market at Perumbavoor is located 30 km away from Ernakulam railway station and 33 km from CMFRI, Cochin and has been operational since last five decades. The wholesale fish market at Perumbavoor functions between 1.30 to 2.30 am and following that, some 15 to 20 retail vendors sell the fish in the market area during the day time on all week days. The market area is under the Perumbavoor municipality and the ownership is leased to individuals through auction by the Perumbavoor municipality for an amount. The market arrivals in truck/ lorry/ van are levied rental charges of ₹125 -150. Eight per cent of the auction amount of every box traded is sought as commission by the market committee of which two per cent each for the buyers and sellers is paid back as incentive. Mostly the fishes come from adjoining states or from far-off landing centres in Karwar in Andhra Pradesh and Mangalore in Karnataka as well as from Maharashtra in addition to local arrivals from Vypeen and Munambam fishing harbour (Cochin) and from Vizhinjam (Thiruvananthapuram). The bulk of the procured fish from Perumbavoor market is sold to the High Range markets in Idukki district like Kattappana, Kallar, Munnar and Wagamon. Different market functionaries are also available in the markets in loading and unloading of baskets at the rate of ₹14/ per basket. An average of 10-15 labourers/ workers are usually engaged in these night markets with a daily remuneration of minimum of ₹ 500 (Fig. 1). The auction amount of some commercially important fish species in Perumbavoor night fish market is mentioned below:

Table 1. Auction charges of some commercially important fish species in Perumbavoor night fish market

Fishes	Weight (g)	Amount/box* (₹)
Mackerel	150-200	3000
Oil Sardine	40-60	1800
Horse mackerel	300-400	3000
Scads	100-150	800
Thread fin bream	50-70	1300
Red snapper	50-75	800
Bulls eye	70-80	1200
Barracuda	80-90	1800
Moon fish	30-40	1800
Rohu/ Cutla	200-300	2500
Tilapia	80-120	900

**On an average a box weighs 45 kg with ice ranging from 5-10 kg*

Fig. 1. Night Fish Trading in Perumbavoor market

The marine pelagics (sardine, mackerel) constitute majority of the fish trade. Different fresh waterfishes like Rohu and Mrigal were also found to be available in the market. If there are enough buyers in the markets the fish supplies moves to Thodupuzha, Muvattupuzha and Ettumaanur based on demand. The average return for a vendor on trading a box of fish was found to be ₹ 300 to 400 within a market radius of 5-6 km during the day. The quantity of ice used varied with the distance to be covered and type of van delivering the fish (Fig. 2).

Fig. 2. Fish Trading in Perumbavoor market

Night fish market at Muvattupuzha

The short stint night fish market in Muvattupuzha is located 45 km away from Ernakulam railway station and 42 km from CMFRI, Cochin. The private wholesale market owned by ten traders in Muvattupuzha was established in the year 1950 and it functions between 2.00 am to 3.30 am. Some of the markets adjacent to the Muvattupuzha night fish market are Ettumanur, Changanacherry, Payippadu, Thiruvalla, Chambakkara and Kottayam (Fig. 3).The market arrivals were from the states of Gujarat, Karnataka, Tamil Nadu, Maharashtra and Goa as well as from Vizhinjam and Munambam harbour within Kerala. Fishes were sold through auction system. Through auction, the auctioneers would get a commission of around 10 to 15% with two per cent paid back as incentives to the buyers and sellers. Around 75-100 labourers representing different trade unions are involved in the market functioning and are paid Rs.14 for loading and unloading each basket (Fig. 4).Every day around 80-100 loads each with a capacity of 3-4 tonnes arrive in the market. The auction amount of the major traded commercially important fish species at Muvattupuzha night fish market is furnished in Table 2.

Fig. 3. Night fish markets at Muvattupazha

Table 2. Auction amount of major commercially important fish species in Muvattupuzha night fish market

Fishes	Weight in gram	Amount per box*
Mackerel	200-250	3000
Horse mackerel	150-200	2000
Scads	75-90	1000
Thread fin bream	50-80	1500
Red snapper	100-150	1200
Barracuda	120-150	2100
Yellow fin tuna	35000	110
Moon fish	30-40	2400
Anchovies	8-10	2000
Oil sardine	50-75	1800
Lizard fish	100-150	1500
Yellowfin Tuna	35 kg	110/kg
Sail fish	40 kg	100/kg

**On an average a box weighs 45 kg with ice ranging from 5-10 kg*

The traded fishes are purchased by agents catering to the high ranges of Idukki district and are marketed

Fig. 4. Fish arrivals and auctions at Muvattupuzha night market

locally within 2-3 hours in places like Nedunkandam, Pulyanmala, Moolamattam, Neriamanglam, Kattapana, Kallar, Munnar and Wagamon.

Conclusions

The market structure existing at Perumbavoor and Muvattupuzha markets like infrastructure amenities, parking facilities, number of stalls operating in the market, takings of the market, number of vendors, trucks entering and exiting with load *etc*. Perumbavoor market can be graded as a 'C grade market' and Muvattupuzha market as an 'A grade market'.

Mostly trucks carrying fishes from the night fish markets at Perumbavoor and Muvattupuzha transports it to hilly areas like Idukki. As it is early morning these trucks carrying fishes from night fish markets can pass through, without any traffic or any other obstacles in their way, thus reaching the destination within a short time span, thereby supplying fresh fish at the end points. Thus quality fishes are available in high ranges like Idukki, even though it is considered as a land locked area. The traditional understanding of low marine fish demand for hilly regions and landlocked area were found to be a mismatch considering the amount of fish inflow to those areas and the quality of fish available for consumption. An important observation was the existence of dedicated roads catering to the improved time utility in fish consumption as the fish is getting transported during early morning hours. The market capitalization is around 200-300 tonnes per day amounting to an average turnover of ₹ 500- 600 crores.

Non-operational trawlers and ban on *Hilsa* export by Bangladesh adversely impacts the fish availability in West Bengal

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Fish availability in the domestic markets of West Bengal had adverse impacts owing to the recent ban on import of *Hilsa* from Bangladesh. Due to incessant rise in prices of *Hilsa*, catfish, major and minor carps in the recent past, fish loving Bengalis relied on marine fishes such as mackerel, sciaenids, seabass, Bombay-duck and flatfishes for their consumption. The marine fishes were less preferred by Bengali fish eating population earlier because of their colour and smell. However, during recent months, steep hike in the prices of marine fishes are observed. The spurt in the prices has been mostly due to the alarming decline in the supply of the fish in markets. National Marine Fishery Data Centre reports from Central Marine Fisheries Research Institute indicate that the *Hilsa* catch in West Bengal witnessed a heavy decline from 83,000 tonnes in 2010 to 20,000 tonnes in 2011. In 2012 also, the commercial landings of the fish has been dropped further and reached 9,200 tonnes. Since January 2012, the monthly estimated landings of *Hilsa* have been on decline in almost all the months as compared to same periods of the previous year except in August and September (Fig. 1).

The marine fish landings in West Bengal have shown 3.6 fold increase from 0.97 lakh tons during 2001 to 3.65 lakh tons during 2011 (Fig.2). The contribution of West Bengal to India's marine fish

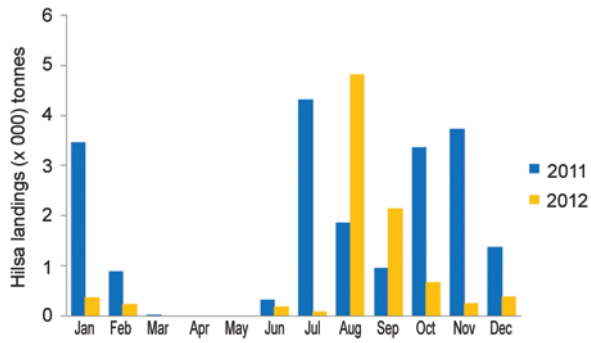


Fig. 1. Monthly *Hilsa* landings along West Bengal coast during 2012

landings was around 4.3% in 2001, which has been increased to 11.2% in 2009. The increase in number and size of fishing crafts fitted with high powered engines and efficient gears, introduction of multiday fishing and extension of fishing grounds have been the important factors which augmented fish landings.

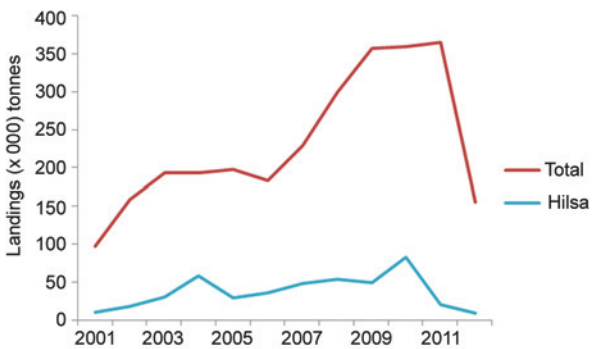


Fig. 2. Marine fish landings in West Bengal

About 85% of the marine fish landings during 2011 is contributed by mechanized sector and as in previous years, the gillnetters and trawlers were doing multiday operations during the fishing season of July to February. On the other hand, during the current year, majority of the small trawlers and boats are not venturing into sea for catching fish as they are incurring huge losses due to extremely poor catch. The estimated landings during January to October are 40% lower than that of the previous year.

Hilsa, the national fish of Bangladesh is prominently known as Padma Ilish, Kolaghat Ilish or Ganga Ilish signifying the river belts and areas of its abundance on both sides of Bengal. Significantly, this fish has played a key role in the economy of Bangladesh. Large quantum of Bangladeshi fishermen is depending on *Hilsa* for their livelihood. Bangladesh because of its recent ban on *Hilsa* export might lose out on export of this fish to India. Myanmar emerging as a potential *Hilsa* resource partner for India will also dampen the prospects of Bangladesh as a prominent exporter to India in the long run.

Bangladesh Fisheries Research Institute (BFRI) is coming up with prospective conservation plans on jatka - the juveniles of *Hilsa* to improve the stock of the fish. *Hilsa* is a migratory fish and it continues to change its course very often. A probable resolution that may help in improving the *Hilsa* stock in this region is to establish a transnational research agency, which should work towards a tri-nation agreement between Bangladesh, India and Myanmar to conserve this fish which migrates extensively. West Bengal government provide alternative employment and rice at ₹ 2 per kg for 2,00,000 fishermen in West Bengal if they abstain from catching *Hilsa* during the breeding/ migrating months of April- May, October – November as a conservation measure. Climate change may also be attributed to the decline in catch in West Bengal region as there is decline in rainfall status in Southern Bengal during the last few years. Adding to the woes in the region, there is severe choking of various creeks in Sunderbans delta due to emergence of islands. Heavy siltation is forcing the fish to take up a new migratory course. Apart from the low catch in West Bengal, even the yields in riverine tracts have been low. Madhvi Sally and Sutanuka Ghoshal in their report on soaring *Hilsa* prices in early August 2012 in *Economic Times* clearly point out the decline in the availability of *Hilsa* in the estuaries of Hoogly. Besides these, industrial effluents flushed into Ganges from many places along the riverine course destroy the quality of water. Eventually, the fisheries of *Hilsa* has declined due to recruitment failure and intensified exploitation of adults and juveniles. Hence, the declining trend of landings of *Hilsa* and reduced operations of trawlers calls for conservation and recovery of the fishery in West Bengal.

Book Review

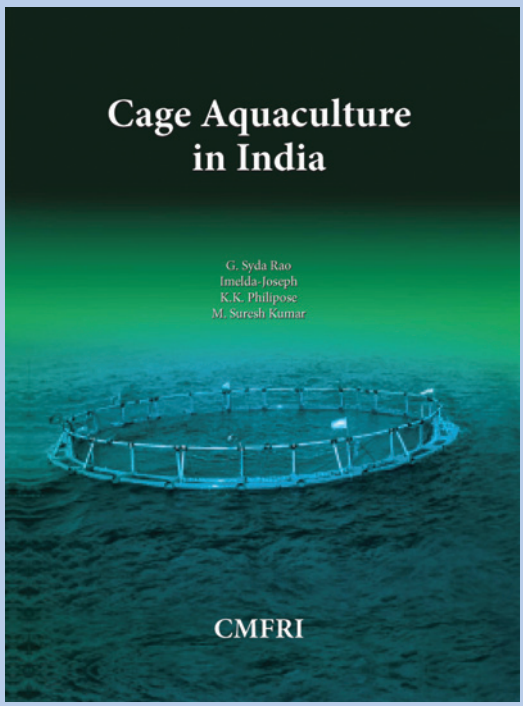
Cage Aquaculture in India, 2013

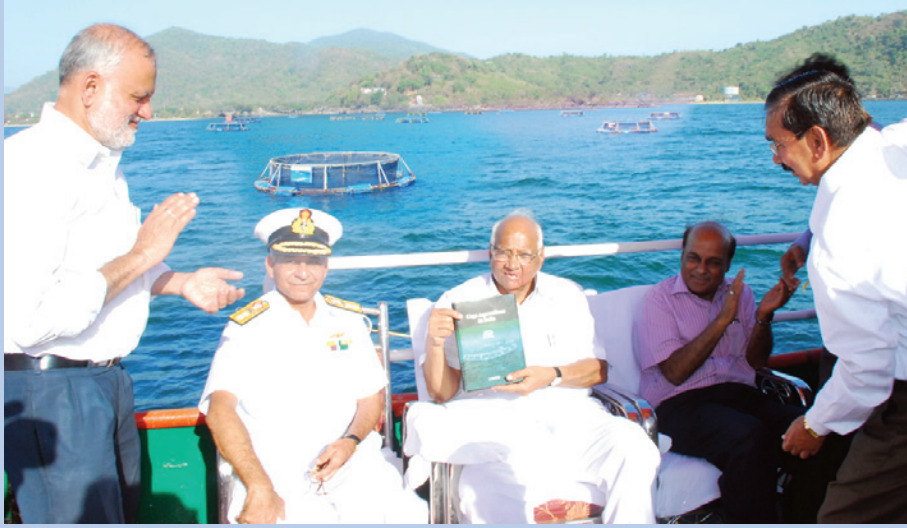
Pages 240

Price ₹ 800/- or $ 50

The book ***"Cage Aquaculture in India"*** authored by Drs. G. Syda Rao, Imelda Joseph, K.K. Philipose and M. Suresh Kumar was published by the Central Marine Fisheries Research Institute (CMFRI) is a monumental work by the authors and first comprehensive publication on the subject. Enclosed fresh and brackish water bodies such as ponds being fully or in some cases over-exploited creating environmental problems, the world is looking to farming of fish in open waters whether they be fresh or marine to meet the increasing demand for fish not only in India, but also all over the world. Cage farming of fish in freshwater fish started sometime back in India on a small-scale but for various reasons could not take off on a commercial scale.

Recent success in breeding and seed production of high value marine finfish by scientists of CMFRI and some other agencies have opened vistas for mariculture and underlined the need for development of technologies for farming of these species in marine cages that are suitable for Indian conditions and at the same time could





be sustained small farmers/fisher communities/entrepreneurs. Scientists of CMFRI have made this dream come true by developing cage farming technologies for different species of finfish and shell fish, for the first time in India.

The book divided in to 15 chapters covers a broad spectrum of aspects that need to be taken in to consideration for successful cage farming. The chapters encompass detailed accounts on site selection for installation of cages including environmental aspects; engineering aspects that have to be taken in to consideration in building cost-effective cages that could be sustained by fishing/farming communities and small entrepreneurs; installation and maintenance of cages; grow-out farming practices for high value species such as seabass (*Lates calcarifer*) , Cobia *(Rachycentron canadum*), mullets (*Mugil* sps.), Pearlspot (*Etroplus suratensis*), etc.; capture-based aquaculture for fattening spiny lobsters, snappers, etc.; suitable and cost-effective feeds and feeding regimes; precautions need to be taken for health management of cultured stock and control of diseases; socio-economic aspects that play an important role in sustainable cage farming and; offshore-cage systems. Cage fish farming in open-access waters raises issues of proprietary rights and the publication raises the need for appropriate policies.

The book also provides details on how to raise fry/fingerlings for stocking in cages. The authors provide case studies of successful demonstration of cage farming under taken by CMFRI in Andhra Pradesh, Gujarat, Karnataka, Kerala, Odisha and Tamil Nadu.

The authors have written this book based on their experience over the years in successful designing and demonstration of commercially viable cage fish farming, which makes the publication as a practical guide for those who wish to take up cage farming. The 240 page book is profusely illustrated with photographs and line drawings which makes it easy for everyone to understand and practice. The book is a must for all those who are interested in cage aquaculture.

The book does not indicate the price of publication, but those interested in getting the book can contact Director, CMFRI, Ernakulam North PO, P.B.No. 1603, Cochin 682 018, India.

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