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Cover : *Fish landings reported at Kalamukku Fisheries Harbour*

Cover Back
Field data collection at Cochin Fisheries Harbour and Munambam Fisheries Harbour, Kochi

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

From the Editorial Board.....

Warm greetings to all

This issue of Marine Fisheries Information Service (MFIS) is with a lead article on the status of exploited marine fishery resources of India. Based on the estimate of marine fish landing data in 2013, an analysis was done to understand the state/ region/ sector and resourcewise status of marine fishery resources. There are articles on rare occurrence of fishery and associated resources at landing centres. Some interesting observations useful to marine fisheries research community are also documented by a few authors. There is an article on the effect of land use changes in the riverine influx and associated impacts on water quality of nearby coastal waters. Analysis of Marine fisheries Census data of Andhra Pradesh gives an insight into the related statistics of the state for 2005 and 2010. Most papers in this issue are capture fishery based. MFIS is providing a platform for dissemination of interesting information to researchers working in Indian Marine fisheries sector. We hope that the information provided will be used for policy level compilations which can support decision making for taking forward the sector to greater heights.

Marine Fisheries Information Service

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CONTENTS

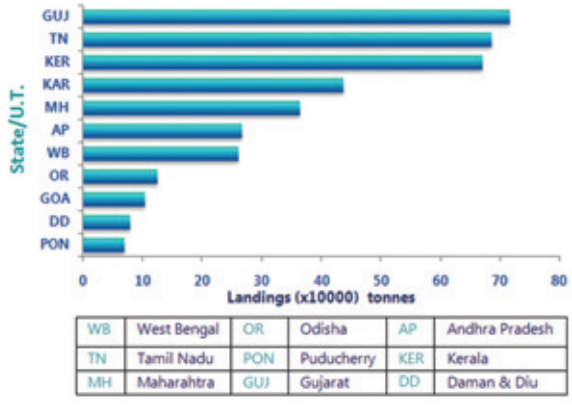
Status of India's Exploited Marine Fishery Resources in 2013

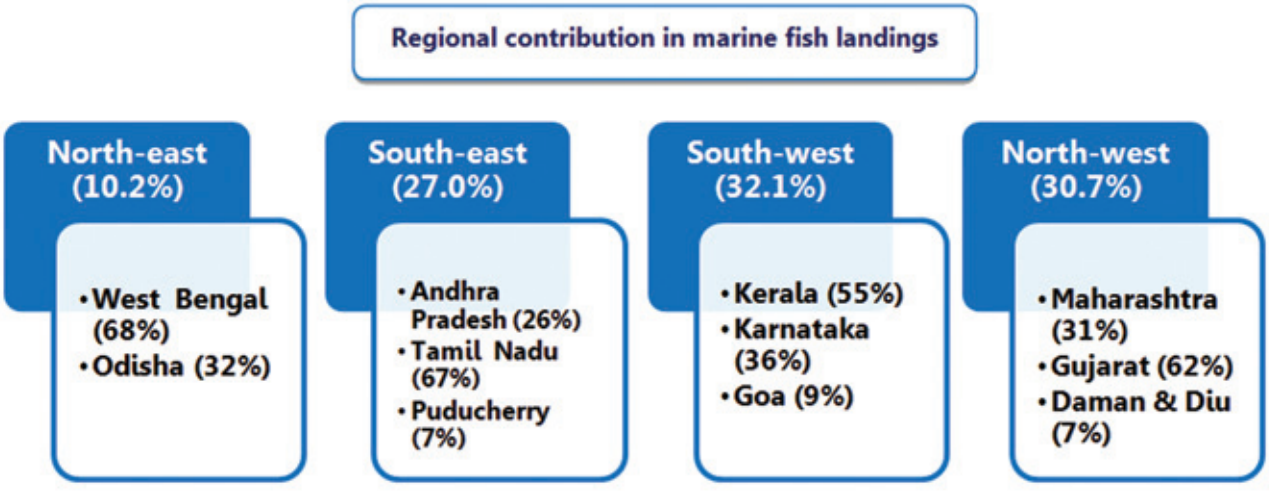
Sathianandan, T. V., Jayasankar, J., Somy Kuriakose, Mini, K. G., Grinson George, Syamala Karthireddy, Vinay Kumar Vase, Srinivasan, J., Ramani, K ., Pugazhendi, D., Seynudeen, M. B., George, K. P., Lata Khambadkar, Sindhu, K. Augustine and Manjeesh, R.
Central Marine Fisheries Research Institute, Kochi

The Central Marine Fisheries Research Institute started estimation of marine fish landings for the peninsular coast of India since its inception in 1947, based on a stratified multistage random sampling technique. This continues to date, and provides knowledge-base for many research, planning and policy initiatives in the marine fisheries sector. For the estimation of landings, stratification is done over space and time. Over space, the entire coast line is divided into 75 non-overlapping geographical regions, designated as fishing zones for which the estimates are made for each month. These zones consist of 1,511 marine fish lading centres where landings take place throughout the year by different types of fishing crafts. The estimate of all India annual marine fish landings for the year 2013 is 3.78 million tonnes (t) which has witnessed a dip of 1.56 lakh t compared to the all-time high landings of 3.94 million t in 2012.

Spatial Patterns of Landings

The north-east coast comprising the maritime states of West Bengal and Odisha contributed 10% to the all India marine fish production in 2013. The landings from this region were about 3.86 lakh t and 4% lower than the last year. West Bengal accounted for 68 % of the landings and the remaining (32 %) was from Odisha. The contribution from south-east region comprising the maritime states of Andhra Pradesh, Tamil Nadu and Puducherry was 10.2 lakh t, with Tamil Nadu being the major contributor (67 %) in this region. The south-west

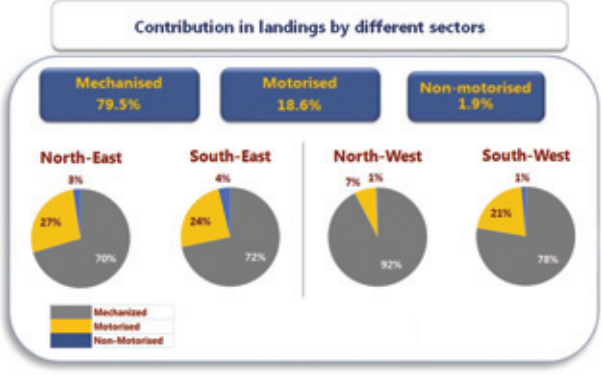




region was the most productive and the largest contributor to the total marine fish landings of the country. Marine fish production in this region during the year 2013 was estimated as 12.13 lakh t, contributing 32% to the national landings. Among the different states in this region, the maximum contribution was from Kerala, 6.71 lakh t (55%), followed by Karnataka 4.37 lakh t (36%) and the rest 1.04 lakh t (9%) from Goa. Compared to the estimate of 2012, a decrease of about 1.74 lakh t in landings was noticed in the south-west region. The contribution from north-west region comprising Maharashtra, Gujarat and UT Daman & Diu is 30.7% of the all India landings, with Gujarat leading among all maritime states with an estimate of 7.17 lakh t.

Sectoral Composition in Landings

The marine fishery resources from the Indian seas are harvested using more than 35 different types of craft-gear combinations. Among the different gears operated along the Indian coast, trawlnets accounted for nearly half of the landings followed by seinenets (20%), gillnets (13%) and dolnets (8.5%). Among the three different categories of crafts used namely mechanized, motorized and non-motorized, the contribution from mechanized sector was 79.5%, whereas contribution from motorized sector was 18.6% and that from artisanal sector was 1.9%. Mechanized sector continued to dominate the production scenario in all the regions with a major share of 20.15 lakh t from the west coast. In the north-west region, 92% of the landings were accounted by mechanized sector whereas in all other regions its contribution was between 70 - 78%. Motorized sector contributed 7 lakh t, with the south-east and south-west regions accounting for more than 5.1 lakh t. In the north-east region, it accounted for 27% of the total landings while in the north-west region it formed only 7%. Non-motorized sector as a whole contributed 1.9% with the south-east region being the major contributor.



Resource Profile

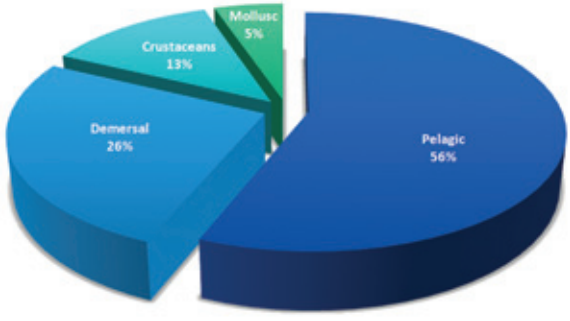
From the coastal waters of India, about 670 species were landed during 2013. Of these, 110 species, belonging to 10 major resource groups comprised 70% of the total catch. The estimated landings of major species/groups contributing to marine capture fisheries production in 2013 is given in Table 1.The contribution to the total marine fish landings by pelagic and demersal fishes are about 56% and 26% respectively, while the crustaceans accounted for 13% and molluscs accounted for less than 5%. The contribution by pelagic finfishes in 2013 was 21.23 lakh t. The pelagic fishery was mainly supported by oil sardine with a share of 28%. Mackerel landings witnessed an increase of about 30,000 t from previous year. Ribbonfishes, *Stolephorus* spp., carangids, tuna, seerfishes and Bombayduck were the other major components of the pelagic finfish production.The landings of the demersal resources showed decrease of 1.4 lakh t which is mainly due to the reduction of about 30,000t in landings of threadfin breams. lizardfishes, croakers, sole, flatfishes, pomfrets, silverbellies and catfishes which are the major demersal finfish resources. In the case of crustacean resources, a decline of about 55,000 t was noticed in the landings of penaeid prawns, while an increase of 48,000 t was noticed in the landings of non-penaeid prawns. A marginal decline was noticed in the landings of lobsters and crabs too. The landings of the molluscan resources also witnessed a decrease though there was an increase in the landings of squids during the year.

Landings of oil sardine, the major single species resource, after having peaked at about 7.2 lakh t in 2012, showed a decline with an estimate of 5.95 lakh t in 2013. About two-third of the oil sardine landings were from south-west region and the remaining from south-east and north-west regions.

Kerala, the major contributor to the oil sardine production (41.5%) witnessed a decline of about 1.5 lakh t. Tamil Nadu, second largest contributor accounting for 30% of the oil sardine production witnessed an increase of about 0.75 lakh t during 2013 while Karnataka slipped to the third position with a decrease of 21,000 t.

Table 1. Estimated landings of major resources

Resources	2012	2013
Oil sardine	720270	595392
Ribbon fishes	234766	252179
Non-penaeid prawns	164951	213474
Indian mackerel	170410	199880
Penaeid prawns	252300	196942
Cephalopods	190408	189426
Threadfin breams	211618	182541
Croakers	215824	177395
Other sardines	149022	159580
Scads	91449	127935
Bombayduck	114378	124509
Silverbellies	140843	121117



Components of marine fish landings in India during 2013

Penaeid and non-penaeid prawns together contributed over 4.10 lakh t, forming 11% of the total landings. Non-penaeid prawns formed a little over 52% with north-west region as the area of highest occurrence. Compared to 2012, this resource showed an increase of about 0.5 lakh t, while a reverse trend was noticed in the case of penaeid prawns. The major contributing states were Gujarat, Kerala, Maharashtra, Andhra Pradesh and Tamil Nadu.

In 2013, ribbonfishes production reached 2.52 lakh t and accounted for about 7% of total marine fish production in the country. Compared to 2012, an increase of 17,000 t was noticed in the landings. North-west coast alone produced 1.52 lakh t of ribbonfishes with Gujarat contributing the maximum (88%). It was mainly exploited by trawlers with peak landings during September and October. Indian mackerel formed another major fishery resource among pelagic finfishes with a production of 2 lakh t. It was exploited all along the Indian coast with bulk of the landings from the south-west and south-east regions. Nearly 50% of the landings came from Karnataka and Kerala, the other major contributor being Andhra Pradesh (17%).

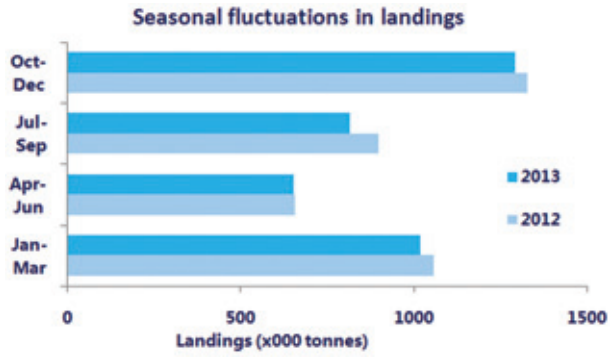
Cephalopods are an important component of the Indian marine fisheries mainly due to their commercial value.The contribution by cephalopod resources showed a marginal decline, owing to the decreased landings of cuttlefishes and octopus. However an increase of 7,700 t was noticed in the squid landings during 2013. The west-coast accounted for 85% of production with Gujarat, Kerala and Karnataka as the top producers. Likewise, most of the threadfin breams catch was netted from the west coast of India. These formed an important demersal fishery resource with estimated landing of 1.83 lakh t in 2013, accounting for 4.8% of the total marine fish landings. About 12% of the trawl landings constituted by this group. Bombayduck was an abundant resource along the north-west coast of India, contributing about 5% of all India marine fish landings. The landings have been estimated at 1.1 lakh t along the north-west (88%) and north-east (12%) coasts of India. Along the north-west coast, landings in Gujarat are showing a stabilized trend with seasonal variations, whereas in Maharashtra the landings show wide fluctuations.

Tunas which are one of the most valuable resources of the Indian marine fisheries recorded a production of 0.85 lakh t in 2013, being slightly higher than that in 2012. *Euthynnus affinis* and *Thunnus tonggol* together accounted for more than 61% of the tuna catches. The other major resources

contributing to the landings were croakers (4.7%), other sardines (4.2%), scads (3.4%) and silverbellies (3.2%).

Seasonal Sketch

Fishing is carried out throughout the year along the Indian coast except during the fishing ban period for mechanized vessels imposed by the Government of India. In 2013, the fishing ban was for 45 days during June 15 to July 31 along the west coast and April 15 to May 31 along the east coast, except for Goa where the fishing ban extended for 60 days. During 2013, October - December period was the most productive season (34%) followed by January - March (27%). Compared to 2012, except for the period July-September there was not much variation in the quarterwise percentage contributions. However there was a decline of about 81,500 t during this period in 2013 as compared to 2012.



A rare occurrence of Blackfringe bigeye *Pristigenys refulgens* (Valenciennes, 1862), off Malabar coast

Pavithran, P. P., Manojkumar, P. P. and Ramachandran, N. P.
Calicut Research Centre of CMFRI, Kozhikode

The family Priacanthidae commonly inhabit rocky areas and reefs, although a few are known to inhabit open waters. Priacanthids are typically colored bright red, but some have patterns in silver, dusky brown, or black. They have unusually large eyes, suited to their habitat in deeper waters. *Pristigenys* is one of the genera in Priacanthidae in family and comprises of 3 species.

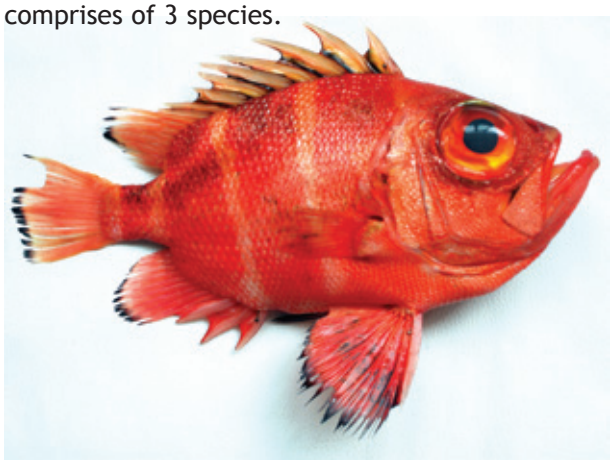


Fig. 1. Blackfringe bigeye *Pristigenys refulgens* landed at Kozhikode

On 15th October, 2013, one male *Pristigenys refulgens* specimen measuring 254 mm in total length and weighing 437 g (Fig.1) was caught by a trawler at a depth of 120-140 m off Kozhikode (11°14.600 N 74°56.424 E). Morphological characters of the species were recorded.

Morphometric characters of *Pristigenys refulgens* landed at Kozhikode

Morphometric characters	Measurement (mm)
Total length	254
Standard length	207
Head length	92
Body depth	101
Pre-orbital length	36
Post-orbital length	22
Eye diameter	34
Pre-dorsal length	84
Dorsal fin base length	103

Pectoral fin base length	16	Pre-pelvic length	75
Anal fin base length	42	Upper jaw length	37
Pelvic fin base length	40	Lower jaw length	35
Pre-anal length	141	Snout length	28

Flocking of egrets in shrimp waste drying yards of Alappuzha, Kerala

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Central Marine Fisheries Research Institute, Kochi

Coastal and sea birds form an integral part of the marine ecosystem. Though occurrence of different avian fauna has been reported sporadically, detailed information on their interactions with the ecosystem is not extensively studied. The cattle egret *Bubulcus ibis* is commonly seen in paddy fields and wetlands in association with grazing cattle to catch the insects from the grassland disturbed by the moving cattle. In a recent survey in central Kerala, these egrets were seen in big flocks on the beaches.

Shrimps form an important fishery along Kerala coast. The shrimps caught by the trawlers are initially processed in peeling sheds. The shrimp waste which accumulates forms an important raw material in poultry feed and as manure is dried on the beaches. The shrimp exoskeleton can be used for extracting chitosan having commercial importance. There are more than 24 primary processing units between Ambalapuzha and Arattupuzha stretch of Kerala coast. On 24th October, 2014 a large flock of egrets were seen in the shrimp waste drying yards of Alappuzha district feeding on the semi-dried waste as well as the flies in the drying yard (Fig. 1 and 2). Every day two to three truck loads of dry shrimp wastes, packed in gunny bags are transported from here to Salem, Tamil Nadu for making poultry feed. The egrets largely nest on the *Casuarina* trees on the beach and their droppings which are rich in phosphate and other nutrients/minerals contribute to the productivity of intertidal waters and wet lands by nutrient enrichment through run off and tidal inundations.

Figs. 1 a-c. Egrets in shrimp waste drying yards of Alappuzha district, Kerala

Land use changes and water quality of Sal River in Goa

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In the last few decades large scale development of coastal areas has accelerated world over. Several coastal areas have changed from virtual wilderness to haphazardly developed stretches full of concrete buildings and related structures leading to altered ecosystems, land use patterns and the coastal zone landscape. In Goa, this is a sensitive issue mostly with conflict between real estate developers and environmentalists who wanted to conserve areas based on ecological and environmental principles.

Based on recent reports of mortality of short-neck clam *Paphia malabarica, in-situ* observation was conducted on 1.5.2014 from four sites along river Sal. The local fishermen stated that the mortality commenced from March 2014. The site where clam mortality was reported is adjacent to Cavelossim and Mobor. Station 1 and 2 are clam bed sites, station 3 is the river mouth opening to the sea, Station 4 is the site where sewage effluent enters Sal (Fig.1). Oyster beds were observed adjacent to Station 2 which is a clam bed area. Shucked oyster shells were also observed on the river bank, on the upfront of which the hotels and restaurants were located. On the banks as well as upstream of the river, litter was observed (Fig. 2).

Fig. 1 Sampling locations along river Sal

Fig. 2. Oyster shells on river bank

Fig. 3 Litter in river Sal

Developmental activities and impact of urbanization

Cavelossim is an area of high dunes where resorts, hotels and new dwellings are being constructed. Several dune areas have been flattened; sand removed and transported elsewhere. Mobor is occupied by star hotels, resorts and other structures built on sand dunes; and also a former site of sand mining. But at present Goa government has banned sand mining.

The plankton, water and sediment samples were collected from Stations 1 & 2 while only water samples were collected from Stations 3 & 4. The results of parameters estimated are given in tables 1 and 2.

Table 1. Water quality parameters observed in river Sal

Parameters	Stn. 1	Stn. 2	Stn. 3	Stn. 4
Atmospheric temperature (°C)	34.5	32.5	31	30
Surpace water temperature (°C)	32.8	33	32.8	32.6
pH	7.24	7.25	7.26	7.07
Salinity (ppt)	34.7	34.8	34.8	6.2
Dissolved oxygen (DO) (mg/l)	5.9	6.5	6.7	5.04
Phosphate (μg-at/l)	0.226	0.726	0.171	9.104
Silicate (μg-at/l)	8.445	9.189	8.036	107.29
Nitrite (μg-at/l)	0.341	0.127	0.178	3.59
Nitrate (μg-at/l)	1.116	0.441	0.6	7.903
Ammonia (μg-at/l)	0.871	0.906	0.949	102.08
Chlorophyll a (mg/m^3)	5.307	1.769	4.004	61.55
Chlorophyll b (mg/m^3)	0.847	0.282	0.479	0
Chlorophyll c (mg/m^3)	4.73	1.599	1.873	17.153

Table 2. Water quality grading as per US EPA 2004 at the four stations

Stations	DO mg/l	Quality	DIP-mg/l	Quality	DIN-mg/l	Quality	Chlorophyll mg/m^3	Quality
Stn. 1	5.9	Good	0.007	Good	0.0323	Good	5.307	Fair
Stn. 2	6.5	Good	0.022	Fair	0.021	Good	1.769	Good
Stn. 3	6.7	Good	0.005	Good	0.024	Good	4.004	Good
Stn. 4	5.04	Good	0.282	Poor	1.59	Poor	61.55	Poor

Fig. 4 Culture pond between mangroves and coconut plantation

The water quality at station 4 which is very near to the sewage treatment plant was observed to be good. Mangroves of fringing type were observed on the banks of river. Its roots prevent litter from reaching the river and also in the stabilization of sediment. This helps in maintaining the water quality of the river. Destruction of mangrove area for culture ponds and coconut cultivation was also noticed downstream of Station 4.

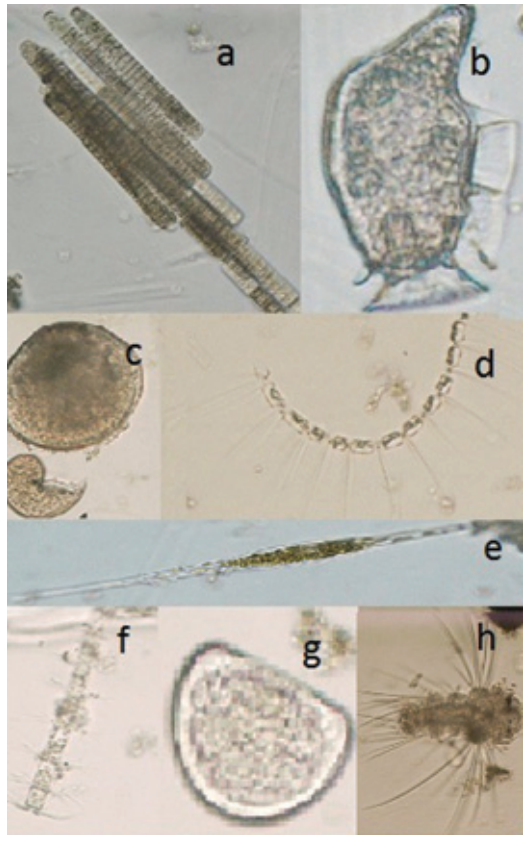

Fig. 5. Plankton specimens observed in stations 1 & 2

The plankton observed in Stations 1 and 2 is given in Table 3. The presence of estuarine and fresh water algae such as *Chaetoceros* spp., *Asterionella* spp., *Nitzschia* sp, *Oscillatoria* spp. and *Merismopedia* spp. were observed at the sampling stations, but were not abundant (Fig. 5). Benthic population included bivalves, gastropods and foraminifera at two stations. The texture of the sediment sample at Station 1 was 3.0% sand, 78.8% silt and 18.2% clay while at Station 2 it was 2.1% sand, 74.4% silt and 23.5% clay. Management of litter and sewage is essential to ensure better water quality in Sal River.

Table 3. Plankton observed at stations 1 & 2

	Nos/m³	
Plankton	**Stn. 1**	**Stn. 2**
Copepods	30000	24000
Copepod nauplii	34000	20000
Gastropods	8000	2000
Bivalve spat	26000	4000
Medusae	2000	0
Decapod larvae	24000	12000
Tintinnids	6000	4000
Polychaete larvae	6000	2000
Foraminifera	2000	2000
Biddulphia spp.	2000	2000
Psuedo-nitzshia spp.	2000	0
Nitzschia longissima	4000	12000
Asterionella spp.	2000	0
Chaetoceros spp.	44000	6000
Chaetoceros decipiens	12000	2000
Bacteriastrum spp.	24000	2000
Ditylum spp.	6000	0
Coscinodiscus spp.	6000	2000
Dinophysis spp.	2000	0
Oscillatoria spp.	12000	44000
Rhizosolenia spp.	2000	4000
Oikopleura spp.	2000	2000
Merismopedia spp.	0	2000

Occurrence of *Loliolus hardwickei* (Gray,1849) from southwest coast of India

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A single specimen of the little Indian squid *Loliolus hardwickei* was caught by trawl net by the research vessel *"F.V Silver Pompano"* on 18th March 2014. It was caught from waters off Cochin at a depth of about 20 m (09°58.30´N; 76°06.18´E). The specimen was previously described as *Loliolus investigatoris*(Goodrich,1896). But, it is now reported that it is a junior synonym of *Loliolus hardwickei*.This species is known to inhabit estuarine and coastal waters to a maximum depth of 30 m (FAO species catalogue for Fishery purposes, Cephalopods of the World No.4, Vol.2, 2010). The current specimen was 56.8mm in length and had weight of 13.39 g. The specimen was deposited to the museum of CMFRI (Acc No. DE.2.1.3.1.1). This species is known to be distributed along the east coast, north west coast and presently from the south west coast of India also.

Description

The specimen was a mature female having eggs (Stage III). Mantle short and stout; fins large and heart shaped, with a width of about 81% of the

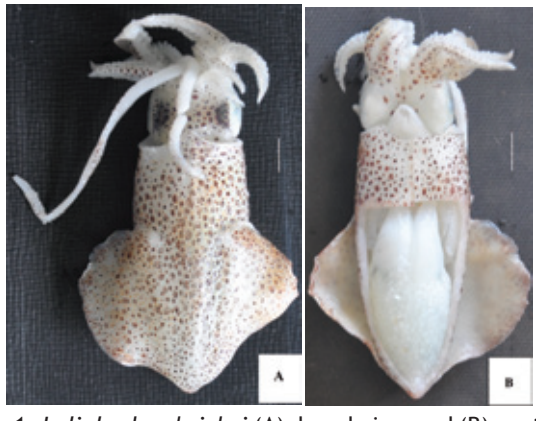

Fig. 1. *Loliolus hardwickei* (A) dorsal view and (B) ventral view with mantle cut open to show stage (ovary and nidamental glands) (Scale = 1cm)

mantle length; head and arms are short; tentacles short with small tentacular clubs; body colourless and transparent when fresh (Fig.1). On preservation the mantle turned whitish with diffused pale brown chromatophores distributed all over the body.

Table 1. Morphometric indices of *Loliolus hardwickei*

Character	Length (mm)	Indices (% of mantle length)
Dorsal mantle length	56.8	
Ventral mantle length	51.1	90.0
Mantle width	22.2	39.1
Head length	9.6	16.9
Head width	16.8	29.6
First Arm (R)	12.3	21.7
Second Arm(R)	15.8	27.8
Third Arm(R)	20.9	36.8
Ventral Arm (R)	20.7	36.4
Tentacle length	56.2	98.9
Fin length	36.4	64.1
Fin width	46.1	81.2

Very little information is available on the biology of this species probably because it has little importance for the commercial fisheries.

Risso's dolphin *Grampus griseus* (Cuvier, 1812) rescued off Aligadda Beach, Karwar, Karnataka

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On 23rd August 2013, a Risso's Dolphin was nearly stranded on the Aligadda beach, Karwar. The dolphin appeared to be under stress and it was coming towards the shore. On seeing the dolphin, the local fishermen dragged it into the deeper waters to rescue it. This dolphin is locally known as "God's fish", and hence the rescue operation was carried out by the local fishermen. Body was covered with extensive white scars, which seemed to be the marks made by the teeth of mates or rivals. There was an oval or anchor-shaped white patch on the chest and chin. No external injuries were noticed on the body. The body was deep and massive for the front two thirds, and tapered behind the dorsal fin to the narrow tail stock. There was no beak, and the head was large and blunt. It was a size of about 3 meters in length and weighing approximately around 350 - 400 kg.

Risso's Dolphins are found worldwide in temperate and tropical waters. This species has been observed near Sri Lanka, the Maldives, the Seychelles and the Horn of Africa. Earlier, a single specimen of Risso's Dolphin was captured off Madras in 1986.

Fig. 1. Risso's dolphin (G*rampus griseus*)

Occurrence of Gobi *Yongeichthys criniger* (Valenciennes, 1837) off Ratnagiri, Maharashtra

Sujit Sundaram, Dhanashree Bagade and Milind Sawant
Mumbai Research Centre of CMFRI, Mumbai

On 15th December 2013, during an experimental trawl fishing at about 20 m depth along the Ratnagiri coast (17° 03.187 N - 73° 14.092 E) a single specimen of 'Hair-finned gobi' *Yongeichthys criniger* (Fig. 1) was also caught among the catch comprised of groupers, squilla, crab, gastropods, croackers, jellyfish, sea snakes, cephalopods, bivalves etc. The length of the fish was 94 mm and weighed 10.1 g. *Y. criniger* is a tropical Indo-Pacific goby inhabiting shallow to deep coastal mud or silty sand flats.

Fig. 1. *Yongeichthys criniger* (Valenciennes 1837)

Gobies are prey species for commercially important fishes such as haddock, sea bass, and flatfish. Several gobies are also of interest as aquarium fish.

Large scale exploitation of Indian squid, *Loligo duvauceli* by jigging from nearshore waters of Ratnagiri, Maharashtra

Sujit Sundaram and David Sawant
Mumbai Research Centre of CMFRI, Mumbai

Loligo duvauceli locally called as '*Nal makul*' (Plate 1) contributes 52.8% to the cephalopod landings of Maharashtra. Large scale aggregation of squids was observed in the nearshore waters of Ratnagiri, Maharashtra during October-November 2013 which caught the attention of fishermen, who used jigs to exploit them. High catches of squids were observed daily during this period. An unprecedented catch of about 24 t of *L. duvauceli* was landed at Rajiwada landing centre on 15.11.2013 which was sent to local fish processing units.

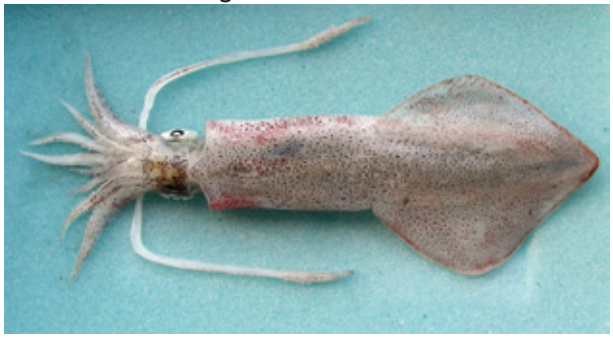

Fig. 1. *Loligo duvauceli* caught by jigging

Jigging locally termed as *'Garkadi'* is usually carried out at night. Fishermen leave shore at mid night and return with the catch at about 6 am. Big gill netters are temperature converted for squid jigging by the fishermen during this period. About 20 bulbs of 28 V are fixed on the boat including a generator. There are about 20 such functional jigging boats operated in Ratnagiri. Each boat carries 6 crew

members and fishing is carried out at a distance of around 15 - 20 miles south off Ratnagiri at a depth of about 4 - 6 m. About 60 - 80 litres of diesel is required to reach the fishing grounds. Ice slabs are carried for improving the shelf life and keeping quality of the catch.

The jigs are cylindrical in shape and coated with luminescent material, which shines in the dark. Sometimes prawn shaped jigs are also used. The jigs have pointed-recurved hooks, usually 16 to 18 in two rows which are attached in the tail region. Each jig is tied to a nylon rope with length ranging from 6-15 m which is rolled on a wooden frame reel or spindle and no baits are used for jigging. Duration of operation ranged from 5 - 30 minutes and the catch per day was about 10 - 40 kg.

The characteristic feature of this fishery was the large size of the squids caught. The Dorsal Mantle Length (DML) of the squids caught was 210-350 mm weighing 208 to 609 g. Since the catch was extremely fresh, it fetched high prices ranging from Rs.120-180/kg at the landing centre making it very remunerative.

Squids are known to make seasonal migrations, influenced by breeding activity. The species migrates shoreward and aggregates in shallow waters for spawning. The present observations are indicating migration from deeper waters to the coastal areas.

Leucism in seerfish *Scomberomorus commerson* landed at Chintapalli, Andhra Pradesh

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A narrow-barred Spanish mackerel, *Scomberomorus commerson* (Lacepède, 1800), exhibiting leucism was landed at Chinatapalli Fishing Harbour, Vijayanagaram District on 24th January, 2014. The specimen was 130 cm long and weighed 16 kg. It was caught by hook and line operated from motorized craft at a distance of 11 km from shore at a depth of 32 m. The specimen was characterized by unnatural yellow colouration on the body.

Leucism describe reptiles and amphibians with abnormal skin pigmentation and normal eye colour (Bechtel, 1995) and recently it has also been used in ichthyology (Steven, 2002; Veena *et al.*, 2011). Hence it is felt apt to use this term for partial albinism observed in the present study. The ventral part of the fish was white and dorsal portion was partly black, white and yellow. The fins and finlets

Fig. 1. Leucism in seerfish, *Scomberomorus commerson*, landed at Chinatapalli Fishing Harbour

were all white having yellowish colour at the base of the fins. There were faint yellow bands visible on the body of the fish. The eyes showed normal retinal pigmentation.

Leucism can result from genetic mutation exposure to coastal pollution, inter-breeding etc. This unnatural colouration of the fish affected it's marketability and this particular specimen was sold for ₹ 350/- per kg, which is much lesser than its normal price in the local market.

A note on the incidental catch of a whale shark

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On 21st, March, 2014, a whale shark, *Rhincodon typus* Smith, 1828 got entangled in a gill net which was brought ashore to Chinnankudi (11°05.25 N and 79°51.25 E) village by fishermen. On enquiry, a fibre glass boat fishing in the sea 20 km offshore at a depth of 35 m had found the fish entangled in their net. The fish had a total length of 4.5 m and girth of 3.0 m.

Fig. 1. Whale shark caught off the coast of Chinnankudi

Pravin (2000) reported that from 1980s till 2000, the whale sharks were commercially exploited off Saurashtra coast (Veraval) of India for meat, fins, liver, skin and cartilage. Under the Indian Wildlife (Protection) Act, Schedule I it is now a protected species.

Accidental catch of whale sharks in nets is a serious issue. The fishermen who caught the fish in Chinnankudi village were totally unaware of the protected status of the fish highlighting the need for extension programmes to create awareness among the fishermen.

Efficiency of centrifugation on harvesting of the microalgae *Nannochloropsis*

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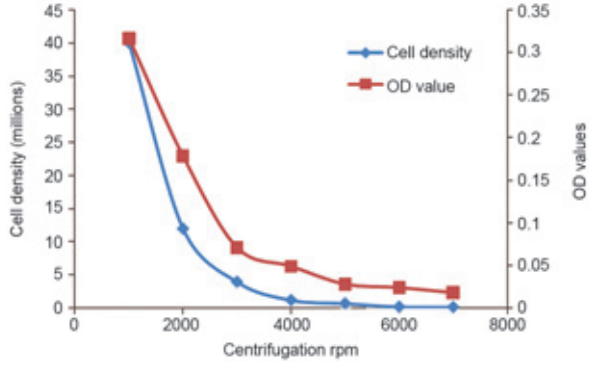
The production of small sized fish larvae like grouper requires cultivation of appropriate live organisms and is based on the establishment of an artificial food chain. This includes production of primary producers like microalgae as well as small zooplankton like rotifers to feed the fish larvae. Among the microalgae used to feed rotifers, the eustigmatophyte *Nannochloropsis* is identified as suitable and is required in large quantity to support high rates of rotifer production required in finfish hatcheries. Most of the finfish seed production is done in the summer months, as higher temperature plays a favorable role in the tropical fish seed production. However, the microalgal production in outdoor culture system is more difficult during summer months since the microalgae grow better in low temperatures. Hence, most of the efforts for micro algal production may focus on the winter



season and concentrated micro-algal paste can be produced and preserved for use in rotifer culture during the summer months of fish seed production. This offers a solution for ensuring rotifer production during summer months without the shortage of microalgae on which it feeds.

Based on this, an attempt was made to harvest *Nannochloropsis* by centrifugation at different speeds ranging from 1000-7000 rpm for 5 minutes. *Nannochloropsis* culture (log phase /exponential stage) with a cell count of 60 x 10^6 cells /ml was selected for algal paste preparation by centrifugation. The cell density as well as optical density from the supernatant was observed for determination of harvesting efficiency at different centrifugation speeds (rpm). The cell density (millions/ml) was determined using haemocytometer (Improved Neubauer, ROHEM, INDIA) and the optical density (750nm) with UV spectrophotometer (UV-VIS Spectrophotometer 118, Systronics). It was observed that the harvesting efficiency varied from 66.66 % to 99.6% and the maximum harvesting efficiency was observed with 7000 rpm (99.60%). The cell density as well as optical density values in the supernatant showed an inverse trend with increase in rpm during the centrifugation. The supernatant was collected and inoculated further to observe the reviability of the suspended cells. The concentrated paste was collected and stored by chilling as well as freezing in order to conduct further feeding trials in rotifer culture.

Landing of a sicklefin chimaera, *Neoharriotta pinnata* (Schnakenbeck, 1931), at Beypore

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A single specimen of chimaera belonging to the genus *Neoharriotta* was caught by a trawler operating at a depth of 100 m off Ponnani. The specimen was landed at Beypore on 26.9.13. The specimen measured 96 cm and weighed 6.5 kg. The fish was identified as *Neoharriotta pinnata* (Fig.1). Morphological characters of the species is reported in Table 1.

Fig. 1. Sicklefin chimaera, *Neoharriotta pinnata*

Table.1 Morphometric characters of *Neoharriotta pinnata* landed at Beypore

Morphometrics	(mm)
Total length	960
Standard length	714
First dorsal fin pre-length	296
Length to first dorsal fin base	383
First dorsal fin base length	91
Length to second dorsal fin base	710
Second dorsal fin base length	246
Inter dorsal fin length	81
Head length	288
Snout length	152
Eye diameter	36
Pectoral fin base length	42
Pectoral fin length	158
Pre pectoral fin length	306
Pre anal fin length	700
Anal fin base length	32
Anal fin legth	78
Caudal fin length	131
Caudal fin filament length	88
Pre orbit length	176
Post orbit length	81
Pelvic fin length	91
Pelvic fin base length	28
Total weight	6.5 kg

There is very limited information on biology of this species. The liver is very large, approximately 60% of its total body weight with a high oil content.

Marine Fisheries Census 2005 and 2010 of Andhra Pradesh: A comparison

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Andhra Pradesh is one of the major marine fish producing states along the east coast of India.It has a coast line of 974 km with 9 coastal districts *viz.*, Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore. There are two major fishing harbours at Visakhapatnam and Kakinada from where the bulk of trawl catch (about 70%) is landed. Socio-economic evaluation of the fisherfolk population, information on livelihood activities, education and professional status are the pre requisites for proper planning and implementation of programmes for their upliftment and social empowerment. Marine Fisheries Census 2005 and 2010 provides needed information for Government agencies, NGO's and other stakeholders.

Fisherfolk and their occupations

According to the Marine Fisheries Census 2010, there are 555 marine fishing villages and 353 landing centres in Andhra Pradesh. This is an increase of 11% in terms of fishing villages and 30% with regards to landing centres compared to the Marine Fisheries Census 2005. However, landing centres in East Godavari, West Godavari and Prakasam districts showed decrease due to disturbance to fishing activities by industrial/other activities.The marine fishermen population of the state in 2010 is around 6, 05,428. This showed a 19% increase in the marine fishermen population from 2005 to 2010. Among 1,63,427 fishermen families reported in 2010, about 98.5% belonged to traditional fishermen. The

Table 1. Comparison of landing centres, fishing villages, fisherfolk population, average family size and sex ratio details between Marine Fisheries Census 2005 and 2010.

	Landing Centres			Fishing villages			Fisher folk population			Average family size			Sex ratio (Females to 1000 males)		
District	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)
Srikakulam	54	55	1.9	107	128	19.6	81381	98450	21.0	4.3	3.9	-11.1	943	949	0.6
Vizianagaram	11	12	9.1	20	20	0.0	24543	20812	-15.2	4.6	4.1	-11.2	974	938	-3.7
Visakhapatnam	31	66	112.9	79	63	-20.3	129045	113632	-11.9	4.1	4.0	-3.7	967	923	-4.5
East Godavari	37	29	-21.6	53	97	83.0	85458	165208	93.3	4.1	3.7	-9.5	985	970	-1.5
West Godavari	9	7	-22.2	8	7	-12.5	8009	9188	14.7	3.6	3.8	4.5	931	952	2.3
Krishna	17	37	117.6	47	43	-8.5	54002	43005	-20.4	3.4	3.3	-3.5	981	955	-2.7
Guntur	6	8	33.3	34	36	5.9	28467	39333	38.2	3.4	3.3	-0.6	952	949	-0.4
Prakasam	43	39	-9.3	74	67	-9.5	51353	51511	0.3	3.8	3.4	-10.0	943	924	-2.0
Nellore	63	100	58.7	76	94	23.7	47733	64289	34.7	3.8	3.8	0.0	945	910	-3.7
Total	**271**	**353**	**30.3**	**498**	**555**	**11.4**	**509991**	**605428**	**18.7**	**4.0**	**3.7**	**-6.3**	**962**	**943**	**-2.0**

Table 2. Comparison of data on active fishermen, fishermen associated with fishing allied activities and other than fishing activities during 2005 and 2010

District	Active fishermen			Fishermen associated with fishing allied activities			Other than fishing activities			Total fishermen occupied		
	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)	2005	2010	Increase/ decrease (%)
Srikakulam	20829	23559	13.1	34361	30644	-10.8	532	1011	90.0	55722	55214	-0.9
Vizianagaram	6321	5407	-14.5	5748	6143	6.9	821	65	-92.1	12890	11615	-9.9
Visakhapatnam	35121	26351	-25.0	36027	24427	-32.2	4472	1416	-68.3	75620	52194	-31.0
East Godavari	22892	45137	97.2	8346	23501	181.6	403	2916	623.6	31641	71554	126.1
West Godavari	2247	2479	10.3	2722	1837	-32.5	0	1	0.0	4969	4317	-13.1
Krishna	14626	12932	-11.6	23556	10102	-57.1	1103	2607	136.4	39285	25641	-34.7
Guntur	11458	10305	-10.1	8687	13479	55.2	536	56	-89.6	21311	23840	11.9
Prakasam	13366	13134	-1.7	16245	9875	-39.2	170	2804	1549.4	29781	25813	-13.3
Nellore	11754	11564	-1.6	16570	20081	21.2	690	123	-82.2	29014	31768	9.5
Total	**138614**	**150868**	**8.8**	**152892**	**140089**	**-10.2**	**8727**	**10999**	**26.0**	**300233**	**301956**	**0.6**

maximum number of families were in East Godavari (44,476) and Visakhapatnam (28,779) districts. Fishermen families dependant on marine fishing have increased by 26% compared to 2005 (1,29,246 families) in Andhra Pradesh. However, the average family size has fallen from 3.95 in 2005 to 3.7 in 2010, with maximum of 4.05 in Vizianagaram district and a minimum of 3.29 in Krishna district. The sex ratio (female to male) among fisherfolk has showed declining trend. The sex ratio in 2005 was 962 females per 1000 males whereas in 2010 it was 943 females per 1000 males. In 2010, women formed 48.5 % of the total population and the female to male ratio was maximum in East Godavari district (970 females/1000 males) and minimum in Nellore district (910 females/1000 males). Decrease in female to male ratio was observed in 7 districts except in Srikakulam and West Godavari districts where it has increased (Table 1).

The active fisherfolk population involved in marine fisheries activities of Andhra Pradesh has increased by 8% from 1,38,614 in 2005 to 1,50,868 in 2010. Though active fishermen population in the state has increased, it has actually decreased in six districts (Vizianagaram, Visakhapatnam, Krishna, Guntur, Prakasam and Nellore) indicating that fishermen are moving to other professions as these districts are more urbanised/industrialised. The full time and part time fishermen recorded during 2010 are 1,27,837 and 19,373 respectively. The part time fisherfolk population showed a decline of 30% from 29,109 in 2005 to 19,373 in 2010.There was an increase in activities like marketing of fish and labour activities over the five year period from 2005 to 2010. Other associated activities like net mending, curing /processing and shrimp peeling activities recorded downward trend (Fig.1).

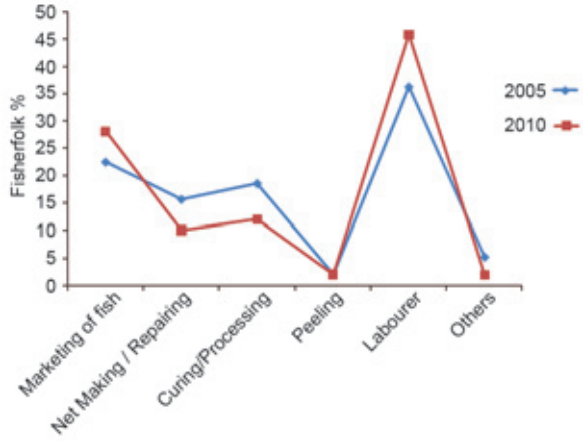

Fig. 1. Fisherfolk engaged in fishing allied activities during 2005 and 2010

Economic status

In 2010, about 97% of the total 1,63,427 fishermen families came under the Below Poverty Line (BPL) category. Vizianagaram district had highest number of below BPL families (99.9%) followed by Krishna (99.7%), Nellore (99.4%), Guntur (98.9%), Srikakulam (98.8%), Visakhapatnam (97.7%), East Godavari (96.7%), Prakasam (96.2%) and West Godavari (55%).

In 2005, only 99,374 (19.5%) fisher folk had membership in co-operatives, of which 46.5 % were in fisheries co-operatives and 53.6% in other co-operatives. In 2010, 1,20,497 (19.9%) fisherfolk had membership in co-operatives of which 31.4% were in fisheries co-operatives and 68.6 % were in other co-operatives. The decrease in membership in fisheries co-operatives from 46.5% in 2005 to 31.4% in 2010 indicate the dissatisfaction of the fisher folk with fisheries co-operatives.

Infrastructure development in fishing villages was improved due to conversion of *Kutcha* houses to *Pucca* houses. Percentage of *Pucca* houses in 2010 was around 70% in fishermen villages with an increase of 17% over the year 2005. The other infrastructure upgradation like electrification of fishing villages increased from 95% in 2005 to 99% in 2010. In 2005 about 4.4% of fishing villages had bank facility which improved to 7.2% by 2010. It is evident that government has taken up developmental activities for upgradation of living standards of the fisherfolk.

Educational status

As per 2005 marine census, about 625 educational institutions were situated in the marine fishing villages of which 82.5% were primary level schools,15.52% were secondary level schools and 0.8% were colleges. About 1,11,403 fisher folk (21.8%) had primary level of education, 45,827 had secondary level education (9%), and 8,384 had above secondary level (1.7%).According to the 2010 report, there were 688 educational institutions in the marine fishing villages, 10 % higher than that of 2005. Of these 83% were primary level, 14.4% were secondary level, 1.3% were colleges and 1.3 % were technical institutions. About 34.28% of fisherfolk population (children below 5 years excluded) were educated at different levels. Among fisherfolk, 18.33% had primary level of education, 12.75% had secondary level, 3.2% had above secondary level and the rest (65.7%) of the population were unschooled. Among maritime districts, East Godavari had highest fisherfolk with primary education (22%), followed by Krishna (21.7%), Visakhapatnam (18.6%), Nellore (18.5%), Prakasam (17.2%), Vizianagaram (16%), Srikakulam (14.2%), West Godavari (13.2%), and Guntur (12%). Proportion of unschooled fisher folk was highest in Vizianagaram district (77.6%), followed by Nellore (75.4%), Guntur (69.9%), Prakasam (68.7%), West Godavari (68%), Visakhapatnam (64.7%), Srikakulam (63.5%), East Godavari (62.3%), and Krishna (58.9%). The percentage of population having secondary and above secondary level of education has increased from 2005 to 2010. Also the percentage of population having primary level education and not educated category has declined from 2005 to 2010, indicating that fisherfolk are moving towards higher education (Fig.2).

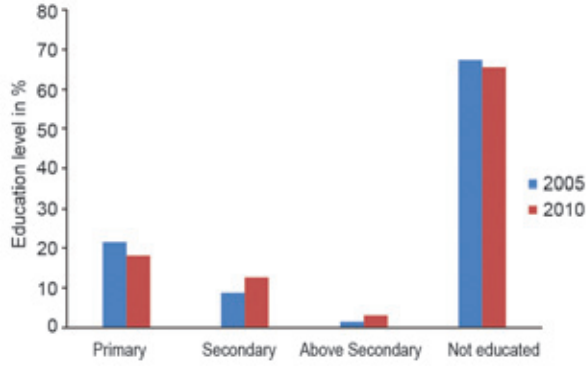

Fig. 2. Educational status of fisher folk in 2005 and 2010

Craft and Gear

Andhra Pradesh ranks fifth in contribution to the marine fish landings of the country. The average annual marine fish landing of Andhra Pradesh during 2000 - 2010 was 1.99 lakh t. Fishing effort declined by 33% and 9% in terms of fishing units and fishing hours respectively, during the 11 years period. Annual average catch shows an increasing trend over the years, with the advent of multiday fishing and

oceanic fishing for tunas by traditional and mechanised sectors. The fishery is contributed by mechanised, motorised and traditional sectors. However, the motorised and mechanised sectors are slowly and steadily replacing the traditional sectors. As per 2010 census, there are 31,741 crafts engaged in the fishery of which 3,167 were mechanized (9.9%), 10,737 motorized (33.8%) and 17,837 were non-motorized (56.2%). In the mechanized sector gillnetters, trawlers and ring seiners constitute 52%, 42% and 6% respectively of the total mechanized crafts. There were 41,039 crafts engaged in fishing in 2005, of which 2,541 were in mechanised (6.2%), 14,112 motorised (34.8%), and 24,386 non-motorised (59%) sectors. Though there was increase in number of crafts in mechanised sector by 24.6%, overall number of crafts decreased by 22.65% from 2005. This was mainly due to decrease in non-motorised (26.85%) and motorised units (23.9%) (Fig.3).

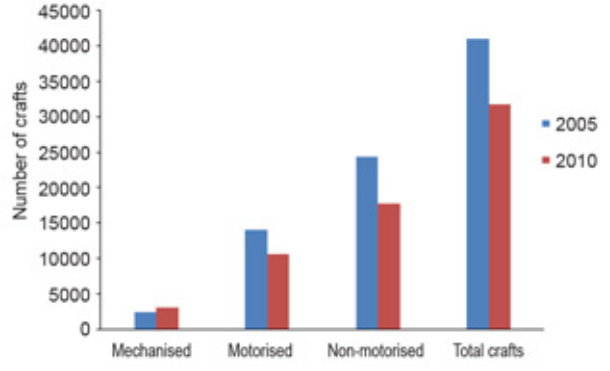

Fig. 3. Number of crafts in marine fisheries sector in 2005 and 2010

In Andhra Pradesh, there were 1,341 trawlers involved in fishing in 2010. There was 26% decline in trawlers from 1,802 in 2005 to 1,341 in 2010. Districtwise contribution was Visakhapatnam (43%) with 579 trawlers, East Godavari district (36%) with 487 trawlers, Guntur district (11%) with 150 trawlers, Krishna district (6.3%) with 85 trawlers and Prakasam district (3%) with 40 trawlers in 2010. Between 2005 and 2010, mechanized gillnetters showed tremendous growth from 424 in 2005 to 1644 in 2010. The motorized sector and artisanal sector showed decline of 27 % and 24% respectively in number of crafts operated during the same period.

In 2005, only 29,604 crafts (72.1%) were owned by the fisher folk of which 68% were traditional non-motorised, 30% were motorised and the remaining 2% were mechanised craft.

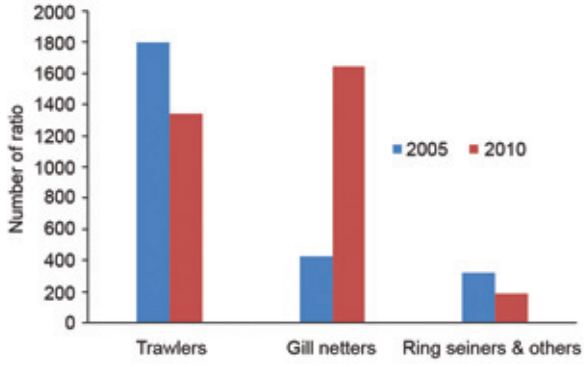

Fig. 4. Mechanised crafts in 2005 and 2010

In 2010, about 31,168 crafts (98.2%) were owned by fisherfolk of which 2,447 (7.9%) were mechanised, 3,965 (12.7%) were motorised and 24,756 (79.4%) were non-motorised.

The number of crafts owned by fisherfolk has increased from 72.1% to 98.2% during the five years period. The ownership of mechanised crafts has increased from 2% to 7.9%, while for traditional non-motorised crafts it has increased from 68% to 79.4%. However, there is decrease in ownership of motorised craft from 30% to 12.7%. The increase in

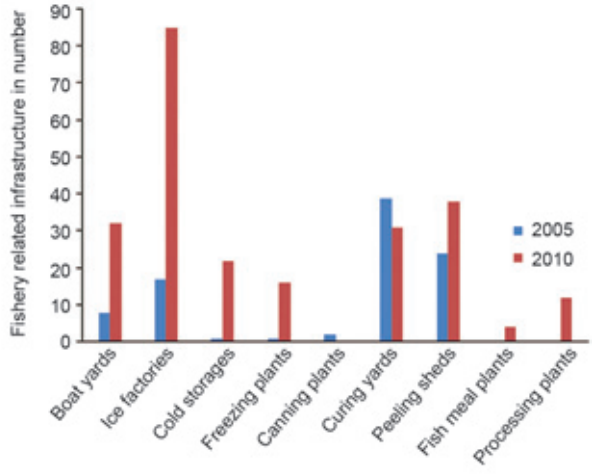

Fig. 5. Fishery related infrastructure during 2005 and 2010

mechanised and non-motorised crafts owned by fisherfolk during 2005-2010, indicates that many of non-fisherfolk who owned crafts have left the fishing industry.

Fishery related infrastructure in terms of boat yards, ice factories, cold storages, freezing plants and peeling sheds have developed during 2010 compared to 2005. Fish meal plants and processing plants were added infrastructures. However, curing yards decreased due to enhancement of a cold storages and ice factories.

Conclusion

Over the years, the marine fish landings of Andhra Pradesh have shown a considerable increase but the socioeconomic status of fisherfolk, indicate that they did not reap the benefits of the increased production. Although the basic amenities available to the fisherfolk through the developmental processes showed increasing trend, Infrastructure development in connection to fishermen livelihood options was lagging. Infrastructure greatly contributes to the processing, marketing and the quality of the produce and development of the community as a whole. This is the prerequisite for marine fisheries sector and fisherfolk development in coastal areas. Though ice factories and processing plants have increased fishermen are still losing their earnings due to post harvest losses which is considerable. The main constraints perceived by the fishermen are lack of proper road connectivity from fish landings centres to urban areas for marketing, cold storages for preservation, and electricity shortage for ice plants, lack of proper berthing facilities and minimum guaranteed price of fish. The self sufficiency and skills of the fishermen along with proper infrastructural support can directly contribute to the socioeconomic upliftment of the less privileged fishermen community of Andhra Pradesh.

MFIS