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Spiny lobster *Panulirus ornatus* in the fish landings at Pamban, Tamil Nadu.
(Photo credit: Jeena, N.S.)

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 the field.

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From the Editorial Board

Warm greeting to all our esteemed readers

According to the Global Marine Aquarium Database (GMAD), the worldwide marine ornamental fish trade is worth an estimated US$ 200 – 300 million catering to about 2 million people keeping marine aquaria. Among 1471 marine species traded worldwide, Damselfishes make up almost half the trade and the Three spot damselfish is among the top 10 species. While 90% of the freshwater aquaria fish are farmed, in the marine sector it is less than 2% and almost entirely sourced from the wild, giving rise to sustainability concerns. Hence, a serious focus on developing reliable and efficient hatchery protocols at least for a few species of trade significance is important. Aquaculture sector can contribute significantly to food security and economic development of nations. Production of 83 million tonnes of aquatic food by 2030 is the projected target of the United Nation's Food and Agriculture Organisation. Of this, capture based aquaculture (CBA) considered as a hybrid between capture fisheries and aquaculture, is estimated to contribute about 20% of the marine aquaculture production having an annual market value of US$1.7 billion and high value species such as lobsters, tunas and groupers occupying top slot. With these ideas in the background, some of the recent research findings are presented in this issue of MFIS.

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Successful mass production of Three spot damselfish through captive breeding

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ABSTRACT

The captive breeding technology for the Three spot damselfish *Dascyllus trimaculatus* has been developed by ICAR CMFRI. This paper reports the protocols for mass production of this species through captive breeding. The brooders were conditioned in FRP tanks fitted with a biological filter and fed on special broodstock feed prepared by ICAR-CMFRI. Spawning occurred after four months of broodstock conditioning. Larval rearing was carried out using copepod nauplii (*Parvocalanus crassirostris*) as the first feed followed by rotifers (*Brachionus plicatilis, B rotundiformis*) and *Artemia* nauplii. Adequate microalgal density (*Isochrysis galbana* and *Nannochloropsis oculata*) was maintained in the larval rearing tanks during the entire live feed stage of the larvae. Weaning to formulated feed started from 30 DPH (Day Post Hatch). The nursery rearing to marketable size was completed within 60 days. Differential growth and non-uniform size in the juveniles was observed, which calls for extra care during nursery phase, through periodic size grading so as to ensure maximum survival. This is the first report on mass production of Three spot damselfish through captive breeding.

***Key words**: Three spot damselfish, Mass production, Parvocalanus crassirostris, Rotifers*

The captive breeding technology for twenty three marine ornamental species have been developed by ICAR-CMFRI, which includes Clownfishes, Damsels, Fire fish, Dotty back, Anthias etc. The breeding and larval rearing of clownfishes is comparatively easy while the same for damselfishes is difficult because of the difference in live feed requirements. Unlike the clownfish larvae, which are comparatively big and can be initially fed on rotifers (*Brachionus rotundiformis*, *B. plicatilis*), the damselfish larvae are smaller and requires a smaller sized zooplankton such as copepod nauplii as their live food. Thus the production of suitable sized live feed is the major bottleneck in the success of larval rearing of damselfishes. Only experimental level success has been reported so far in the case of captive breeding and seed production of damselfishes and reports on mass scale seed production is scanty in the Indian context. The Three spot damselfish, *Dascyllus trimaculatus* is one of the most sought after marine ornamental fish among the traders and hobbyists and its successful seed production technology was developed by ICAR CMFRI (Gopakumar *et al,* 2009). Hence, attempts were made for the mass production of juveniles of this fish through captive breeding.

The broodstock development of Three spot damselfish, *Dascyllus trimaculatus* was carried out in FRP (Fibre Reinforced Plastic) tanks of 2 ton capacity fitted with a biological filter. The brooders were conditioned in these tanks in which sufficient hideouts and shelters were

provided by using small pieces of PVC pipes (Fig.1). The brooders were fed on special marine ornamental fish broodstock feed prepared by the Marine Biotechnology Division of the institute. The conditioning of brooders to the captive environment, pairing and consequent natural spawning could be achieved after 4 months of introduction into the tanks. The eggs were deposited on the inner surfaces of PVC pipes or on the sides of the tank where they were maintained.

After spawning and before completion of incubation period, eggs along with the substratum were transferred to larval rearing tank which was already fortified with the copepod, *Parvocalanus crassirostris.* Copepods were added into the tank one week prior to introduction of the larvae and fed with *Isochrysis galbana* at a density of 1 x 10^5 cells/ml. If the eggs are attached to the tank surface, the larval rearing was carried out in the same tank after removing the brooders. In such instances, addition of copepod was started well before hatching so as to maintain adequate copepod density. A nauplii density of around 5-8 numbers /ml was maintained during larval rearing so that the larvae could feed on copepod nauplii to satiation. As the tank was having enough quantity of nauplii and copepodites, the growing larvae got bigger sized prey (copepodites and early adults of copepods). The larval feeding was fully on copepods for the initial 20 days after which co feeding with *Artemia* nauplii started. Weaning to formulated feed started from 30 DPH (Day Post Hatch). During weaning period also co feeding with *Artemia* nauplii was continued so that the small sized larvae are not deprived of food as they cannot ingest the pellet feed. The nursery rearing to marketable size was completed within 60 days. The survival rate during this period ranged from 5 to 10%.

Another trial on larval rearing was attempted with slight modification of live feed combination (Figs. 2 & 3). Here, the larvae were fed with same copepod nauplii till 10 DPH, after which co-feeding with rotifers (*B. plicatilis* & *B. rotundiformis*) started. From 20 DPH onwards co-feeding was done with *Artemia* nauplii. The live feed stage of larval rearing was carried out under green water technique using *Isochrysis galbana* and *Nannochloropsis oculata*. The weaning to artificial feed was started from 30 DPH.

The successful mass production of Three spot damselfish, *Dascyllus trimaculatus* could be achieved by following

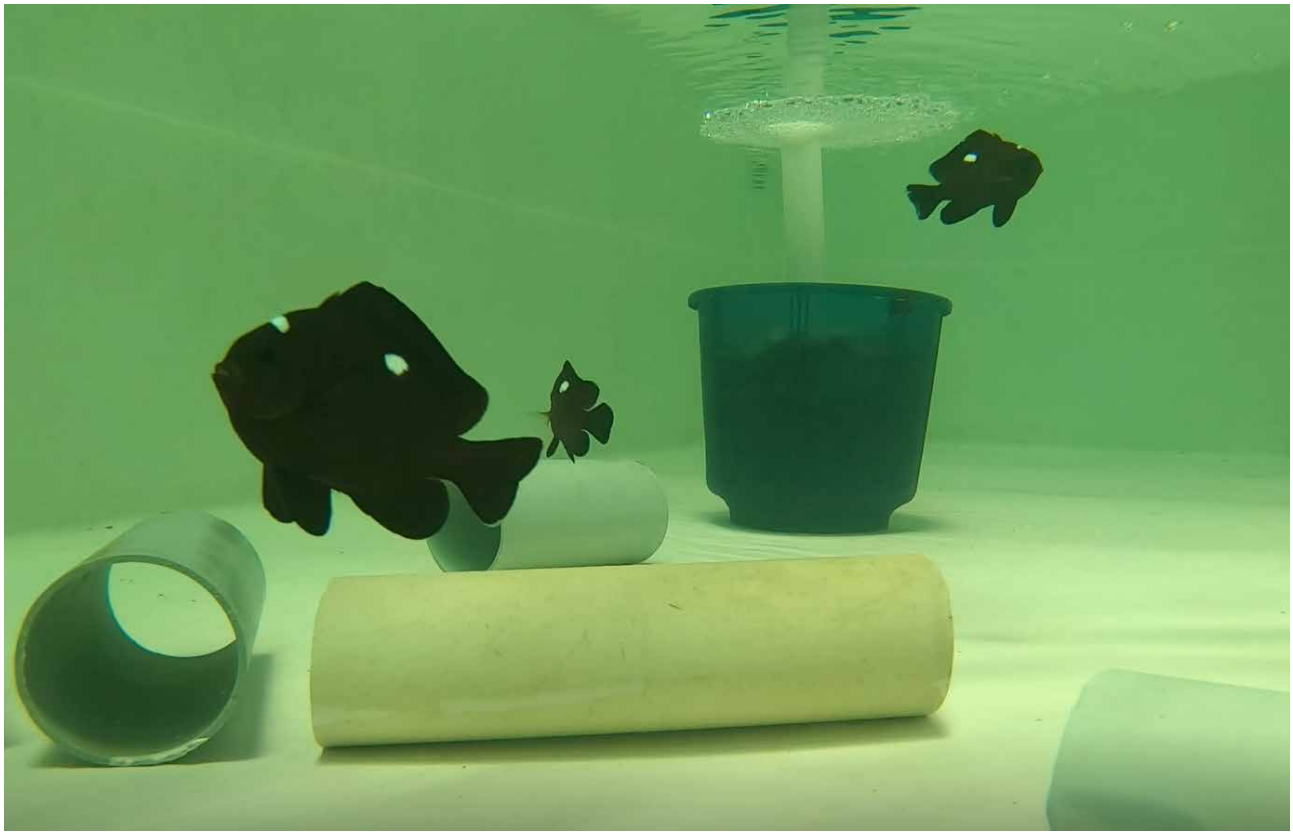

Fig.1. Brooders of *D. trimaculatus*

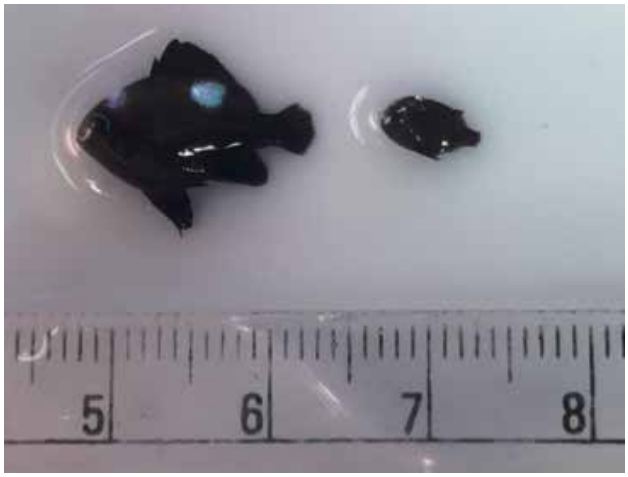

Fig.2. Size variation observed on 41 DPH; Live feed used: Copepod, Rotifer & *Artemia* naupli

Fig.3. Size variation observed on 41 DPH; Live feed used: Copepod & *Artemia* nauplii

Fig.4. Mass produced juveniles of Three spot damselfish through captive breeding

the protocols mentioned above (Fig.4). Salient features noticed during the entire life cycle was the differential growth due to which smaller juveniles were attacked by the bigger ones, thereby reducing the survival rate. Hence, size grading is very important for ensuring maximum survival. It was also observed that, co-feeding of rotifers from 10 DPH resulted in faster growth and better survival (around 30% higher) than the larvae fed on only copepod and *Artemia* nauplii.

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Status of spiny lobster fishery and farming prospects in India

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Abstract

Lobster production from capture fisheries sector in India increased from an annual average catch of 1562 t during the period 2003-2014 to 2466 t (2015-2019). The commercial fishery is comprised of spiny lobster (62%) sand lobsters (37%) and deep sea lobsters (1%). Major share of catch is contributed by multiday trawlers (54.3 %), out-board gill nets (26.9 %) and single day trawlers (11.2 %). Gujarat, Tamil Nadu, West Bengal and Maharashtra contribute bulk (95%) of the highly priced spiny lobster catch which is also having capture based aquaculture (CBA) potential. Species such as *Panulirus polyphagus* region and *Panulirus homarus* found in the northern and southern region of India respectively, are considered as potential species for sea farming due to their fast growth, availability and adaptability to captive conditions. A brief account on availability of juveniles of *P. homarus* in Thiruvananthapuram district of Kerala is also given. The availability of spiny lobsters in near shore waters indicates good prospects for sea farming activities through capture based aquaculture (CBA) which can boost the earnings of the fishermen.

***Key words**: Spiny lobster, commercial fishery, sea farming prospects, India.*

Introduction

Lobsters are luxury seafood with high nutritional value leading to great demand from national and international premium consumer sector. Lobster fishery in India is small scale and mostly the resources are harvested from shallow water. In deeper waters, lobsters are mostly incidental catch in gears targeting other fishery resources. Based on the estimated marine fish landings database of the Fishery Resource Assessment Division, ICAR-CMFRI on gearwise species composition in different maritime states for the period 2017-2019, and data gathered from live lobster holding center located in Thiruvananthapuram district of Kerala, status of lobster fishery in India is analysed and reported. Fishery trend showed that lobster catch increased from an annual average of 1562 t during the period 2003 -2014 to 2466 t during 2015-2019. Lobsters, especially live ones have a prominent place in the sea food export market in terms of both demand and price from countries such as Japan, Korea, China, Taiwan, Europe and United States of America.

Fishery status

Lobster fishing in India is mostly carried out by region specific traditional fishermen communities inhabiting the coastal belts of maritime states. Lobsters are harvested by various types of commercial crafts and gears including traps which are included as non–motorized category solely used for catching lobsters. Major share of lobster catch in India is contributed by multiday trawlers (54.3 %) followed by out-board gill nets (26.9 %) and single day trawlers (11.2 %). In general, the lobsters are grouped into three categories such as spiny or rock lobsters, sand lobsters and deep sea lobsters. Among them, highly priced spiny lobster species are found in shallow waters with species such as *Panulirus homarus*, *P. polyphagus*, *P. ornatus, P. penicillatus* and *P. versicolor,*

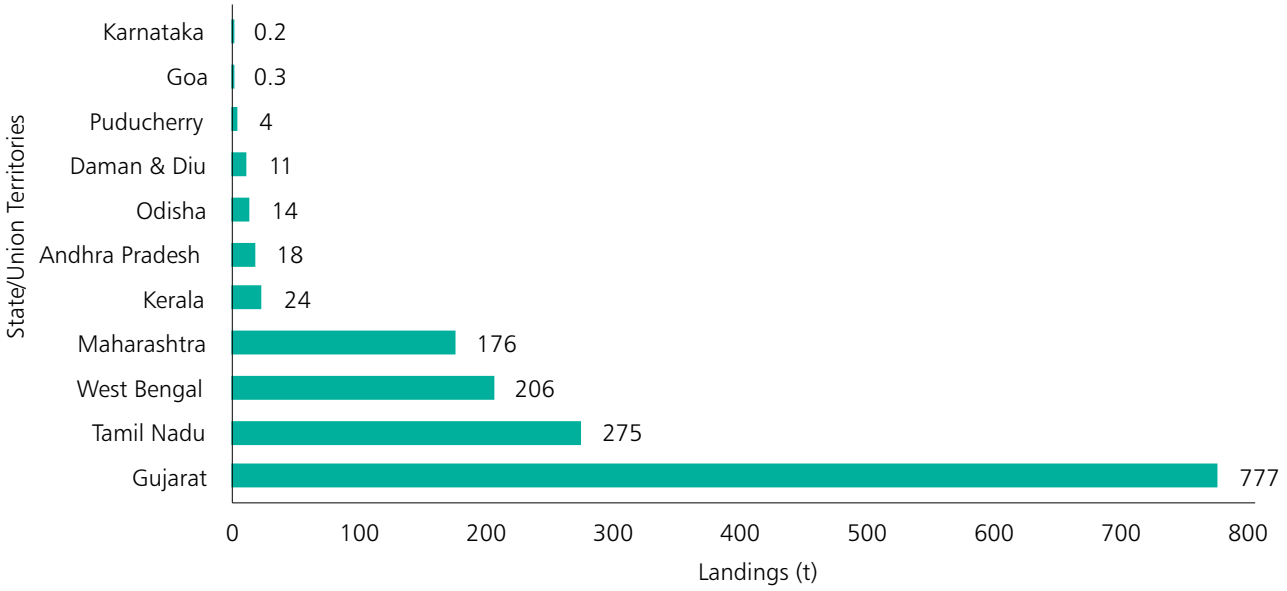

Fig.1. State wise annual average spiny lobster landings (t) in India during 2017-19

forming major portion of the fishery (62%) followed by sand lobsters (37%) and deep sea lobsters (1%).

Among the different categories of lobsters, spiny lobsters are highly suitable for sea cage culture/farming. In India, all the maritime states contribute spiny lobster resources either seasonal or year round. The lobster fisheries with varying status were scaled as rare, minor, moderate, good and very good based on landings. Thus the category 'rare' indicates incidental occurrence of lobsters ranging from few kilograms to a maximum of one ton, the 1-10 t category as 'minor', > 10 -50 t as 'moderate', > 50–100 t as 'good' and >100 t 'very good' fishery. Status of spiny lobster fishery and types of gears contributing to fishery along the Indian coast are given (Tables 1-4)

Table 1. Status of spiny lobster fishery along North-West coast of India

NORTH-WEST REGION

State	District	Lobster season	Gears landing lobsters	Fishery status
Gujarat	Valsad	Jan -Dec	MDOL, MDTN, MGN, OBGN, OBOTHS, MBN, OBBN, MTN	Minor
	Amreli, Jamnagar, Junagadh, Navsari, Porbandar	Jan-Dec	MDOL, MDTN, MGN, OBGN, OBOTHS, MBN, OBBN, MTN	Moderate
	Dwaraka, Kutch	Jan-Dec	MDOL, MDTN, MGN, OBGN, OBOTHS, MBN, OBBN, MTN	Very good
	Gir Somnath	Jan-Dec	MDOL, MDTN, MGN, OBGN, OBOTHS, MBN, OBBN, MTN	Good
Maharashtra	Sindhudurg	Jan, Mar-Apr	MTN, MDTN, OBGN	Minor
	Ratnagiri	Jan-May, Aug-Dec	MDTN, MTN, OBGN	Moderate
	Raigad	Jan-Jun, Sep-Nov	MGN, MDTN, OBGN	Moderate
	Thane	Jan-Apr, Jul, Oct-Dec	MDOL, MGN, NM	Moderate
	Palghar	Jan- Mar, May, Jul, Sep, Nov-Dec	MDOL, OBDOL, MGN, NM, OBGN	Moderate
	Mumbai	Jan-May, Aug-Dec	MDOL, MDTN, MGN, MTN, OBGN, NM	Very good
Daman & Diu Union Territory	Diu	Jan-Jun, Sept-Dec	MDOL, MDTN, MGN	Moderate

MTN: Single Day fishing trawlers; MDTN: Multi day fishing trawlers; MGN: Mechanized Gill Net; MDOL: Mechanized dol net; OBGN/OBBSGN/ NMBSGN/ NMGN: Out board gill net/Out board bottom set gill net/ Non mechanized bottom set gill net/ Non mechanized gill net; NM: Non-motorized units/Traps; OBOTHS: Other outboard nets; MBN: Mechanized bag net; OBBN: Outboard bag net; MOTHS: Other mechanized gears; OBBS: Outboard boat seines, MDTNHL: Multi day trawlers-Hooks & line.

Table 2. Status of spiny lobster fishery along southwest coast of India

State	District	Lobster season	Gears landing lobsters	Fishery status
Karnataka	North Kanara,	Oct	NM	Rare
	Udupi	Oct	NM	Rare
Goa	North Goa	Apr, Aug	OBGN	Rare
Kerala	Kozhikode	Jan-Mar, May, Sep-Dec	MDTN, MTN, OBGN	Minor
	Thiruvananthapuram	Jan-Dec	OBBSGN, NM, BSGN	Minor
	Kollam	Jan-Jun, Aug-Dec	MDTN, MTN, OBGN	Moderate

Table 3. Status of spiny lobster fishery along northeast coast of India

State	District	Lobster season	Gears landing lobsters	Fishery status
West Bengal	Midnapur	Jun-Dec	MDTN	Moderate
	South24 Parganas	Jan-Mar, Jun-Dec	MDTN	Very good
Odisha	Balasore	Feb, July, Oct	MDTN	Minor
	Bhadrak,	Jan-Feb, Jun	MDTN	Rare
	Jagatsinghpur	Jan-Apr, Jul-Dec	MDTN, MTN	Minor

Table 4. Status of spiny lobster fishery along South-East coast of India

State	District	Lobster season	Gears landing lobsters	Fishery status
Andhra Pradesh	Srikakulam	Jan, Dec	OBGN, NM	Rare
	Vizianagaram	Feb, Apr, Jul, Oct, Dec	OBGN, NM, OBBS	Minor
	Guntur	Jan-Apr, Jun-Jul, Sep-Dec	MDTN	Minor
	East Godavari	Jan	MDTN	Rare
Tamil Nadu	Thiruvalluvar	Apr, Aug-Dec	NM, OBGN	Rare
	Ramanathapuram,	Jan- Feb, Apr, Jun, Aug -Dec	MTN, OBGN	Good
	Kanyakumari	Jan-Dec	MOTHS, MDTN, OBBS, OBOTHS, MTN, NM, OBGN	Good
	Thoothukudi	Jan-Dec	MTN, NM, OBBN, OBBS, OBGN, MGN	Good
	Thirunelveli,	Jan- Dec	OBGN, NM	Moderate
	Kancheepuram	Jan- Feb, Apr, Jul, Sep	OBGN	Minor
	Nagapattinam	Jan-Apr, Jun-Dec	MDTN, MDTNHL, OBGN, MTN	Minor
	Villupuram	Oct-Nov	MTN, OBGN	Minor
	Chennai	Jan-Apr, Jul-Dec	MDTN, MTN, OBGN	Minor
	Cuddalore	Jul, Sept-Oct, Dec	MDTN, MTN	Minor
Puducherry	Puducherry	Jan-Oct, Dec	MDTN, MTN, OBGN	Minor
	Karaikal	Mar, Sep, Dec	MDTN	Rare

Among spiny lobsters, *P. homarus*, *P. polyphagus*, *P. ornatus* and *P. versicolor* can be considered as most suitable for sea farming due to their fast growth, availability in near shore waters and their adaptability to captive conditions. They are also non aggressive and less cannibalistic. Experimental studies prove that they can be fed with natural feeds such as brown/green mussels, gastropods, clams, chopped sardines or several locally available low value fishes and squids as per availability. All the four species are found throughout the coastal waters of India with varying magnitude. *P. polyphagus*, commonly known as mud spiny lobster dominates in the lobster landings of Gujarat, Maharashtra, Odisha and Goa. *P. homarus* known as rock lobster or scalloped lobsters are predominant along West Bengal, Andhra Pradesh, Tamil Nadu, Puducherry and Kerala coasts while a minor catch of *P. versicolor* occurs along Karnataka.

Prospects for spiny lobster farming in India

Spiny lobsters fetch very high price in the domestic and export market (Figs. 2 & 3). In the domestic market, categorization into different quality grades is based on their weight, as > 200 g, 100-200 g and <100 g being the first, second and third grades respectively and accordingly prices are fixed. In the domestic markets of Kerala lobsters fetched a minimum of ₹700 to ₹4000 per kg for those weighing above 100 g while prices for below 100 g body weight ranged from ₹100 to ₹1300 per kg (Figs. 3 &4). At present, domestic market for spiny lobsters is mostly centered on seafood exporting firms followed by live lobster holding centers, beach resorts, restaurants associated with the tourism Industry, and farmers engaged in sea cage culture.

In 2009, for the first time in India, ICAR-CMFRI successfully demonstrated lobster culture in large marine floating cage at Vizhinjam Bay, Kerala, (Rao *et al.,* 2010). Subsequently lobster culture in sea cages was demonstrated in different areas (Lipton *et al*., 2010, Gulshad *et al*., 2010, Divu *et al*., 2018). At present, lobster culture in India is mostly practiced on a small scale in bays or in near shore waters within 20 m depth, by stocking juveniles of *P. polyphagus* along Maharashtra and Gujarat coasts and *P. homarus* along Kerala and Tamil Nadu coasts. Lobster culture can be switched between different modes depending on the scale of local lobster capture fishery production. A series of small cages can be installed along bays or near shore waters for areas with 'minor' fishery, large single cage for areas with 'moderate' fishery and several large cages for 'good' fishery. Strong multiple sea cage enclosures for fishery with 'very good' status can be installed in offshore waters away from navigational and fishing routes. Based on the average size of the juvenile stock, lobsters can be cultured in sea cages for varying duration ranging from 3 to 4 months except during monsoon and other adverse weather prone seasons. Areas subjected to strong wind, water current and cyclones also should be avoided. The study conducted during 2017-2019 showed that huge quantities of juveniles of spiny lobsters are landed by trawl nets, dol nets and bottom set gill nets along Maharashtra coast mostly during October-November and January-April. Juveniles of *P. homarus* along Kanyakumari coast were available during November to January. Juveniles of *P. homarus, P. ornatus* and *P. versicolor* along Mandapam and Chennai coasts in Tamil Nadu were also recorded. Fishermen are in the habit of using juvenile lobsters either

Fig. 2. *Panulirus ornatus* in landings at Colachel

Fig. 3. *P. homarus* and *P. ornatus* lobsters landed

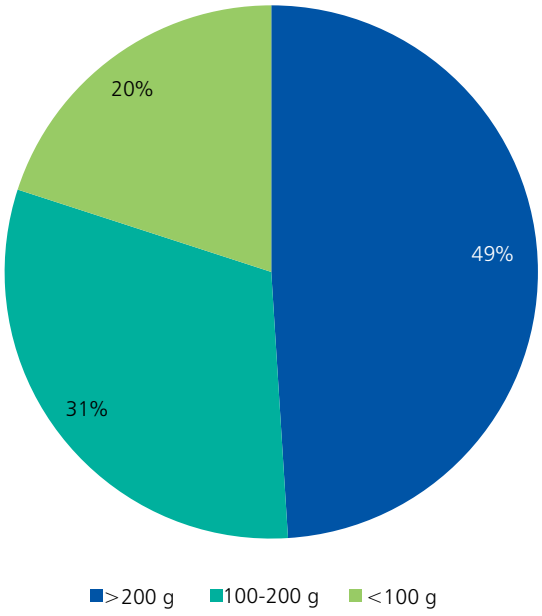

Fig.3. Graded (%) contribution of *P. homarus* in a lobster holding centre

as bait for catching cuttlefish or selling to middlemen and sometimes are even discarded when they occur as accidental catch in a few numbers. The study conducted along Thiruvananthapuram coast of Kerala showed 1.5 t of juveniles of *P. homarus* were traded during the period 2017-19. Abundance of juveniles was observed usually during September-February. The Minimum Legal Weight (MLW) for lobsters meant for exports was implemented by Marine Products Export Development Authority (MPEDA), Ministry of Commerce and Industry, Government of India as 200g for *P. homarus*, 300g for *P. polyphagus* and 500 g for *P. ornatus* and exports consignments can be legally detained if these rules are violated. The experimental lobster cage culture studies conducted at Vizhinjam Bay in Thiruvananthapuram district proved that juveniles of *P. homarus* attained an average body weight of 226 g from an initial weight of 114 g indicating an average growth rate of 0.82 g per day during a culture period of four and half months. Incidence of sizable portion of females becoming berried in sea cage during culture period

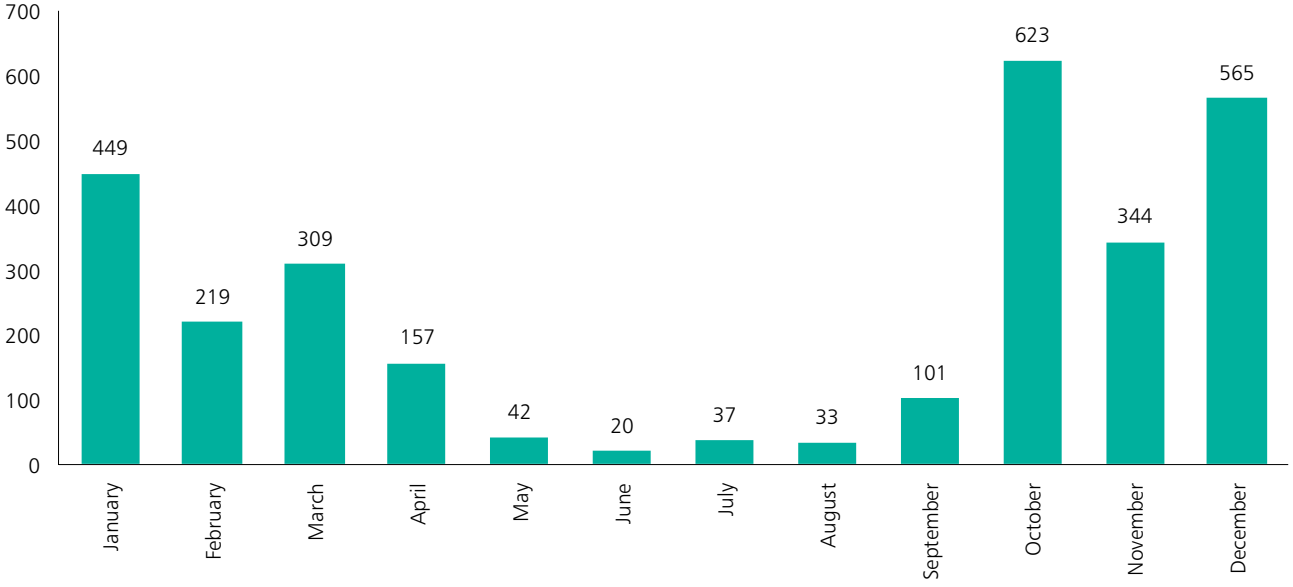

Fig.4. Month wise average stock (kg) of live *P. homarus* at holding centre in Thiruvananthapuram district during 2017-19

was also observed (Rao *et al* 2010) indicating hatching and dispersal of millions of larvae in the ecosystem as they have very high fecundity. The studies conducted at Kanyakumari coastal waters shows 1100- 2400 juvenile lobsters in the sizes 45-90 g can be fattened in 6 m diameter cages (Lipton *et al* 2010). In light of the above facts, augmenting farm/cage production of lobsters through capture based aquaculture (CBA) using lobsters thereby enabling the fishermen to earn more is desirable. Unemployed fishermen youth can also venture into farming activities as several Government agencies are providing loans with subsidies and other financial support for the establishment of sea farming units in India.

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Benefit Monitoring and Evaluation of Theeramythri Enterprises

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Abstract

Society for Assistance to Fisherwomen (SAF) had initiated 1294 activity groups which are microenterprises (full and part time) working across Kerala with an annual business turnover of more than 70 million Indian rupees. The benefit mentoring and evaluation over the period 2015-2019 indicated that the enterprises generate considerable employment of 17 man days per person month with average daily wage rate of ₹195 contributing substantially towards their monthly income. There has been considerable improvement in the empowerment levels of the activity group members after joining SAF.

***Key words**: Microenterprises, empowerment, Theeramythri*

Introduction

Society for Assistance to Fisherwomen (SAF), an agency under Department of Fisheries, Kerala focuses on the empowerment of fisherwomen across the state. The devastating *Tsunami* of December 2004 led to various *Tsunami* relief programmes initiated by the Government of Kerala. These were merged under a novel and holistic livelihood programme named '*Theeramythri*' that was specially aimed at providing livelihood support for the fisherwomen in coastal areas through social, economic and gender empowerment. Today more than 5000 fisherwomen have transformed themselves into successful micro entrepreneurs under *Theeramythri*, earning gainful self -employment and stable incomes. Over the years SAF has introduced different schemes and programs, linkages and financial aid towards up gradation and strengthening of institutional arrangements, service delivery mechanisms and marketing efficiency. The present study portrays the comprehensive picture about the performance of SAF groups in Kerala with special focus on its economic impacts - the benefit monitoring and evaluation.

Benefit Monitoring and Evaluation (BME)

The study attempted to assess the benefit monitoring of the different categories of the activity groups across the districts during the period 2015-19. The sales and employment details were collected and financial parameters such as sales ratio, employment generation, employment share and wage rate were derived. The results indicated that at present there are a total of 1294 units working across the different sectors such as Garments and tailoring, fish, food, supermarkets provisional stores etc in the coastal districts of Kerala. As indicated in Table 1, Kollam district (18.78%) has the highest number of units followed by Ernakulam (15.38%), Thrissur (13.52%) and least in Kottayam district (4.02%). Tailoring and garments sector (34.5%) has the highest number of units followed by food sector (19.3%). The least number of units is working under Supermarket sector (0.9%) as indicated in Table 2. Most of the supermarkets is running at loss and their outstanding debts were quite high. Sales turnover indicated increase by 50 per cent during the period from 2015 to 2019 (Fig.1).

Table 1: Number of units working across Kerala

Districts	Number of units
Thiruvananthapuram	122 (9.43)
Kollam	243 (18.78)
Kottayam	52 (4.02)
Alappuzha	149 (11.51)
Ernakulam	199 (15.38)
Thrissur	175 (13.52)
Malappuram	95 (7.34)
Kozhikode	146 (11.28)
Kannur	55 (4.25)
Kasaragod	58 (4.48)
Total	1294

(Figure in parenthesis indicate percentage to total)

Table 2: Number of units working under different sectors

Sectors	Number of units
Tailoring and garments	447(34.5)
Fish	181(14)
Food	250(19.3)
Supermarket	11(0.9)
Provisional store	136(10.5)
Coir	32(2.5)
other sectors	237(18.3)
Total	1294

(Figure in parenthesis indicate percentage to total)

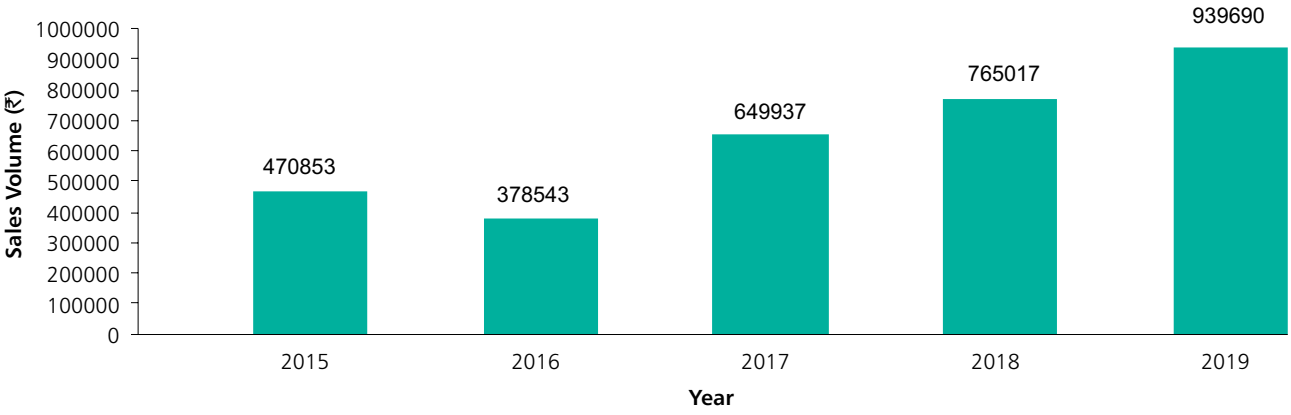

Fig.1. Trend of Sales turnovers (₹) from 2015-2019

The sales to wage ratio was highest for the tailoring and garments for the years 2016, 2017, 2018 and 2019 and food sector for the year 2015 (Fig. 2). The study thus is indicating that tailoring and garments as the long lasting, among the different activity groups. It also points out the need for suitable measures to increase the sales to wage ratio in the other sectors of Theeramythri activity groups.

Employment generation among the different sectors was assessed through the man days created across the year 2015-19. The result indicates maximum man days in supermarket sector and minimum man days in coir sector. Food sector groups have created a consistent employment and their sales turnover ratio depicts the same. Among the five years the man days are high in 2019 and a considerable increase in the employment

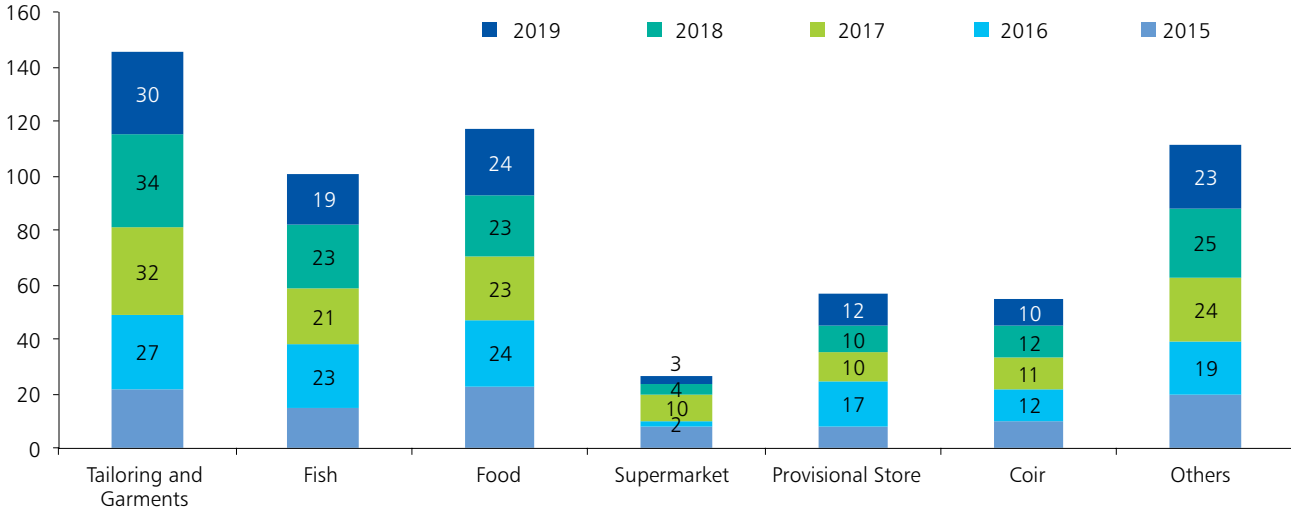

Fig. 2. Sector wise sales to wage ratio (2015-2019)

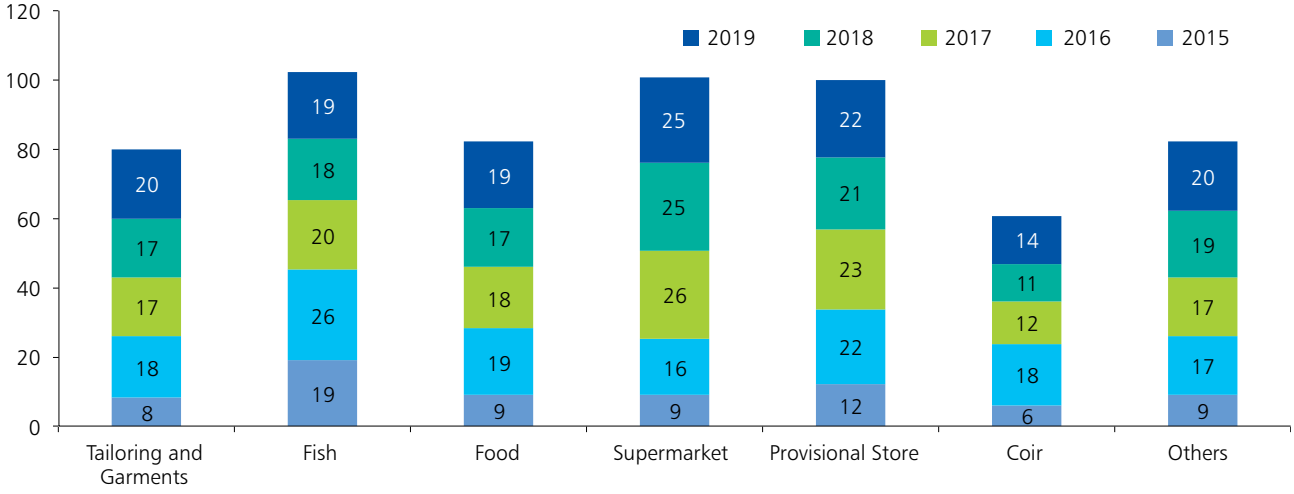

Fig. 3. Employment generation (mandays / month) in various sectors during the period 2015 -2019

generation in every sector. Employment share assess how much of the amount is drawn out from the activity groups directly as wages. These varied across different enterprises based on the amount of sales and calculated as the average wage taken. The results show that the employment share is high in tailoring and garments sector and low in supermarket sector. The wage rate was high during 2019 when compare to other years. The results depicts that average wage rate per day per group member increased over the years for services rendered in the activity group. The profit of the group is assessed after reducing the wage rate along with other cost of activities. From the figure it is clear that daily wage rate is high among fish sector (₹259 per day). This is because of the major activities they undertake diversified over the years which includes the sale of fresh fish, sale of fish value added products, clam processing, mussel farming, peeling sheds etc. Since then, their sales turnover has been increasing. Due to these multiple activities the entire amount realized in fish sales is taken as wages. However the problems in the marketing of the value added fish products and the seasonality of the fishing operations cause slight variations in the consistency of the sector. Supermarkets got the second highest wage rate (₹235 per day) followed by food (₹218 per day), others (₹181 per day), tailoring & garments (₹179 per day), and coir (₹155 per day). As a part of reviving the supermarket SAF has taken up the closed down supermarkets and have started working with the existing groups at a subsidized rate and they are given a regular wage as a part of rendering their services resulted in the increased wage rate over the years. The coir groups have a low wage

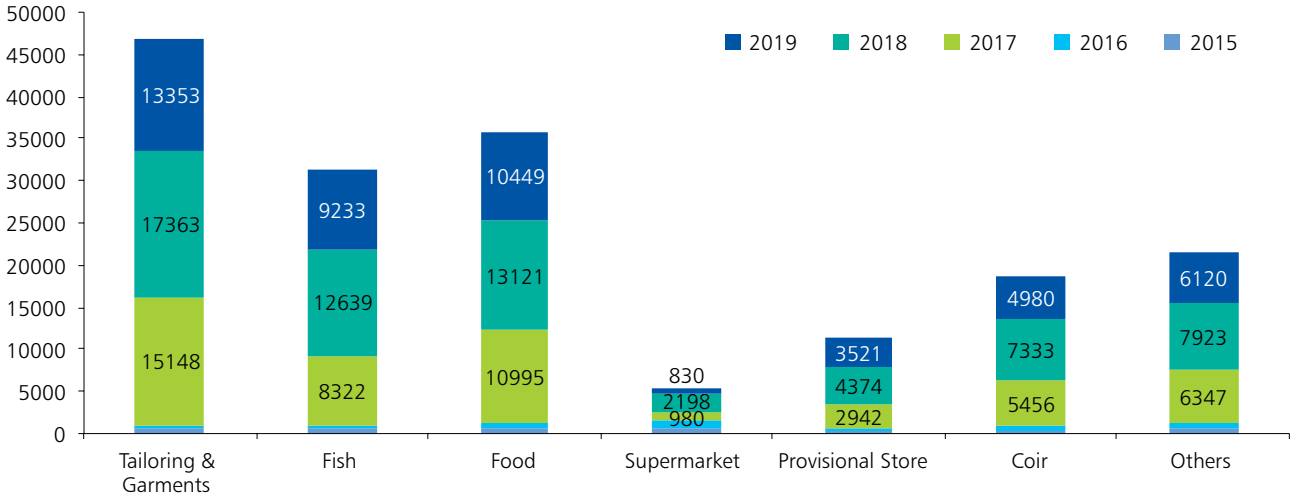

Fig. 4. Employment creation across sectors (man days)

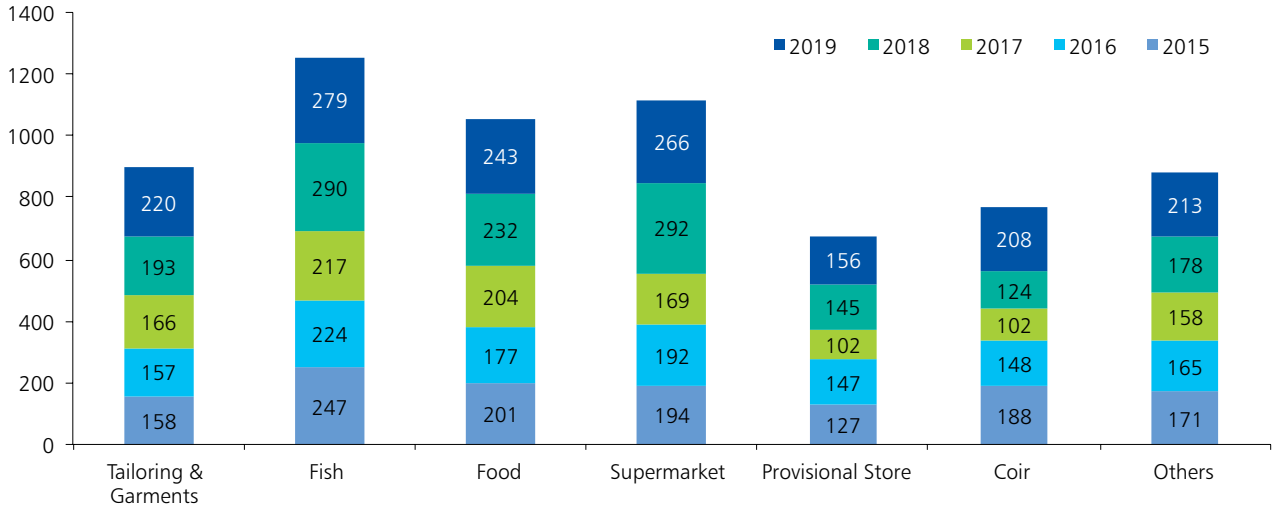

Fig.5. Wage rate across sectors during 2015 -2019

rates when compared to the other sectors because of the continuous loss in this sector. Provisional store had the lowest wage rate among the period 2015-2019 (₹141 per day). The lack of brand name, insufficient working capital, and lack of quality as well as availability of products were the major reasons for low sales leading to a reduced wage rate.

Conclusion

SAF has reached its prime goal of providing livelihood support to group members. The overall study revealed that the most effectively progressing sector among SAF groups is the tailoring and garments and 2019 was the most efficient year during the period 2015-19. The study elucidates that majority of the activity groups across the different categories registered peak business during the month of August- September. The results point outs that the man days, working hours and employment rate are at the peak and most of the group members are completely involved in their activities during this season. Moreover the group size, working hours, market demand, peak season and raw material availability have very good impact in the profit making. Moreover the study point outs a need to incorporate more financial parameters and assessing the assets created as an added advantage for the future in being self-reliant with possible external financial support for brand development and business expansion.

Seasonal and annual variations in fish and macro-crustacean fauna in the shore seine fishery of Karwar, Karnataka.

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Introduction

Karwar coast of Karnataka is known for sandy beaches, and these beaches apart from providing the aesthetic beauty, are supporting traditional fishermen of the coast for finding their livelihood avenues. Traditionally the beaches of Karwar is known for shore-seine operations, known as rampani fishery. Rampani nets were made of coir ropes and the nets were operated from October to March, exclusively targeting mackerel and sardines. With advent of introduction of synthetic fiber in net making, the traditional rampani fishery were replaced by a series of shore-seines made of synthetic materials locally known as yendi and the yendi operation became an year round practice targeting finfishes and macro-crustaceans especially prawns and crabs. The catch data from yendi is a good record of the biodiversity of the shoreline. Composition of the species available up to a depth of 6m from the shoreline is represented in the yendi catch. Present study is based on long term observation of the yendi fishery from Karwar coast of north Karnataka. It analyses the database on catch effort and species composition of yendi operated along Karwar beaches during 2013 to 2017 to understand seasonal variations in abundance and species composition of fish and macro-crustaceans. Stretches of Karwar beach 14.8904°N;74.0974°E in the north to 14.8262°N;74.1231°E in the south were surveyed for data collection. Since finfishes and macro-crustaceans like penaeid prawns and crabs determined the success of the commercial fishery, these two groups were focused in the present study.

Fishery trends

Catch and effort data and species composition were collected from the shore-seines operated along Karwar beach during June 2013 to March 2017. The length of the net varied from 400 to 1000 m. The height of the net in the middle is approximately 25-26 feet and decreases to 13 feet at both ends. The shore seines made nylon netting each weigh between 200 and 300 kg and is operated from shore upto 6m depths. After loading the net on to a small canoe (dhoni) (8.5-10.7 m overall length), it sails in a semicircular fashion, paying out the net, to a point at approximately 350-400 m from the starting point within 15-20 minutes. The net is hauled immediately after the dhoni reaches the end point with the hauling process completed within 2 hours. For seasonal analysis data of monsoon (June-September) Pre-monsoon (February-May) and post-monsoon (October-January) periods were used from 4,299 yendi operations carried out during June 2013 to March, 2017period.

During the period 970t of fishes and other fauna were caught. The yendi operations were found round the year with higher intensity during Monsoon months. The monthly average catch ranged from 4.4 t in April to 54.3 t in August (Figs.1 & 2). Fin fishes and macro-crustaceans, like penaeid prawns, crabs and stomatopods formed major commercial part of the shore seine fishery in Karwar. Among 147 macro fauna recorded, 116 species (78%) were finfishes belonging to 52 family while 17species (12%) were macro-crustaceans belonging to 7 families. The finfishes formed 729 t (75% in weight) followed by macro- crustaceans 171t (18%) with average Catch Per Unit Effort or CPUE for these two groups being 170 and 40 kg respectively. Season wise fishery group composition

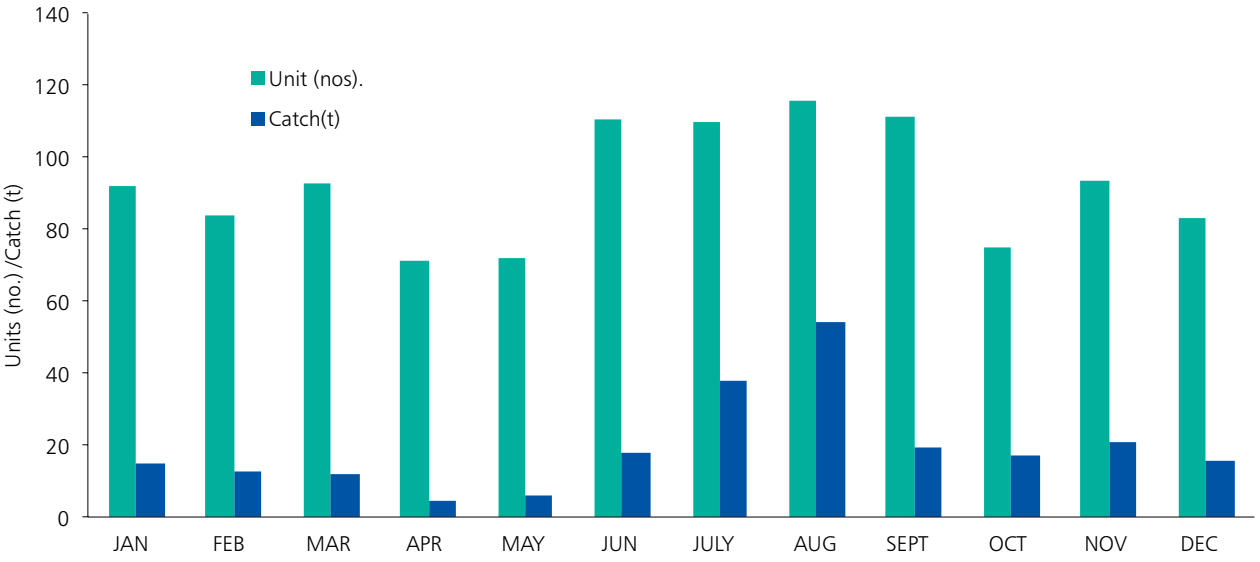

Fig.1. Average monthly effort and catch from yendi operations during 2013-2017.

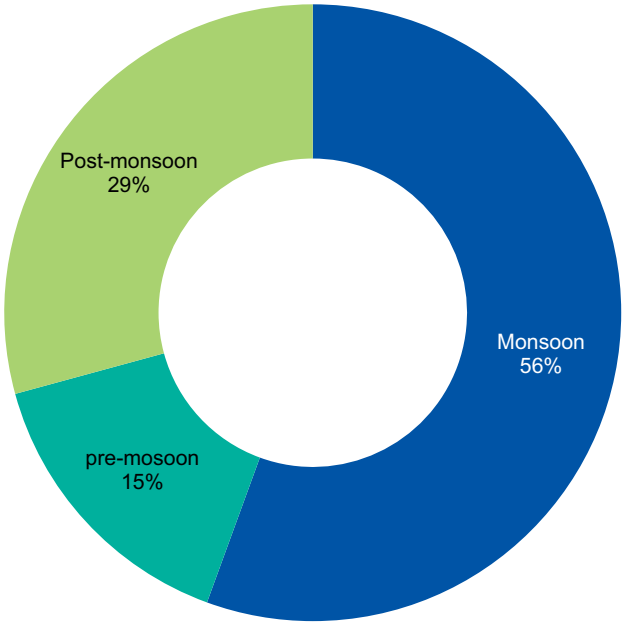

Fig.2. Seasonal catch contribution in yendi operations during 2013-2017.

indicated that during pre-monsoon months 101 species were observed in "yendi catch" of which 73 species (72%) were finfishes and 16 species (16%) were macro-crustaceans. During monsoon months of the 115 species observed in the catch, finfishes and macro-crustaceans were 91 and 13 respectively and during post- monsoon, these were 87 and 15 respectively (Fig.3).

Among 147 finfish species recorded, only 15 species contributed more than one percent to the fishery (by weight). *Trypauchen vagina, Sardinella longiceps, Rastrelliger kanagurta, S. gibbosa* and *S. fimbriata* were the major contributors in terms of quantity. The catch of *Trypauchen vagina* was mostly restricted to monsoon season during which 98% (175t) of the catch was recorded. Due to its low demand in the market, fishermen are not benefitted by the high catch of these species. This fish can however be used as a supplementary feed for culturing carnivorous fishes in marine cages. Sardines like *Sardinella gibbosa*, *S. fimbriata* and *S. longiceps* contributed to the fishery during all three seasons and *S. longiceps* dominated the fishery during pre-monsoon and post-monsoon months. Indian mackerel, *Rastrelliger kanagurta* was also available in all the seasons. Catch rates of 116 finfish species recorded during three seasons are given in the Table 1.

Penaeid prawns, *Metapenaeus dobsoni, Penaeus indicus* and *M. affinis* together contributed 68% of the crustacean fishery. Contribution of *M. dobsoni* was maximum during post monsoon-months (40t) while *P. indicus* was dominant during monsoon months (36t). Being highly valued in market, these species serves as economic backbone of the 'yendi' fishery of Karwar. Species like *Parapenaeopsis stylifera* (5%) *P. monodon* (4%), *P. merguensis*, *P. canaliculatus* and *P. semisulcatus* also formed a part of the penaeid prawn fishery while the dominant non-penaeid prawn was *Acetes* spp. Among commercial crabs, *Portunus pelagicus*, *P. sanguinolentus*

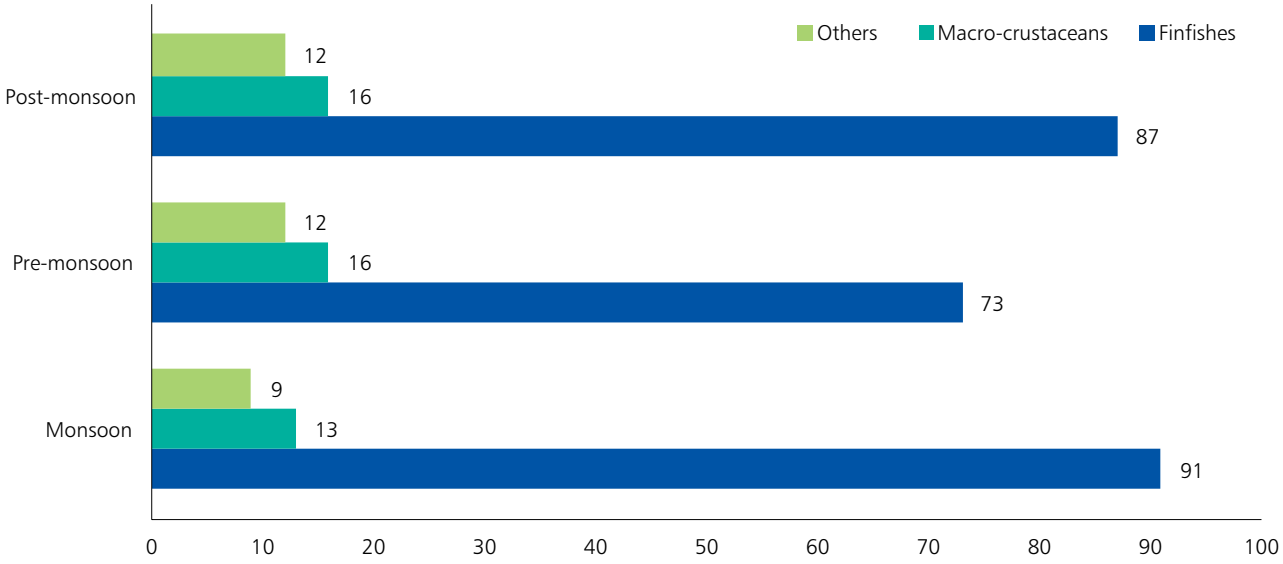

Fig.3. Average season wise fishery group composition during 2013-2017.

Table 1. Catch per unit effort of finfish species recorded in different seasons

SPECIES	PRE-MONSOON	MONSOON	POST-MONSOON
Acanthopagrus berda	0.000	0.288	0.547
Acanthopagrus latus	0.000	0.009	0.000
Alectis indicus	0.000	0.013	0.000
Alepes djeddaba	1.089	0.353	3.446
Alepes kleinii	0.738	0.370	1.517
Ambasis gymnocephalus	0.541	9.587	1.087
Ambassis urotaenia	0.856	7.466	2.681
Apogon quadrifasciatus	0.000	0.000	0.010
Anadontostoma chacunda	0.035	0.048	0.000
Arius arius	0.012	0.120	0.006
Arius jella	0.526	7.270	1.738
Atherinomorus lacunosus	0.000	0.120	0.000
Atropus atropus	0.000	0.000	0.007
Batrichthys felinus	0.035	0.035	0.022
Caranx heberi	0.252	0.000	0.018
Caranx ignobilis	1.432	1.304	0.716
Caranx sem	0.511	0.389	0.122
Congresox talabonoides	0.000	0.000	0.060
Ctenotrypauchen microcephalus	0.000	1.567	0.000
Carcharhinus melonopterus	0.060	0.000	0.000
Carcharhinus sorrah	0.056	0.000	0.000
Cynoglossus arel	0.225	0.162	0.111
Cynoglossus macrostomus	0.776	2.264	10.195
Cynoglossus puncticeps	0.419	1.534	1.625
Cypselurus poecilopterus	0.000	0.000	0.372
Decapterus russelli	0.000	0.000	5.033

SPECIES	PRE-MONSOON	MONSOON	POST-MONSOON
Diodon hystrix	0.000	0.000	0.007
Drepane punctata	0.022	0.011	0.018
Dussumieria acuta	0.063	0.016	0.025
Epinephelus diacanthus	0.046	0.000	1.284
Epinephelus malabaricus	0.000	0.002	0.000
Epinephelus tauvina	0.000	0.002	0.000
Escualosa thoracata	0.043	0.225	0.122
Fistularia petimba	0.000	0.003	0.006
Gerres filamentosus	0.226	0.947	1.293
Gerres limbatus	0.000	0.011	0.000
Gnathanodon speciosus	0.525	0.691	0.291
Gymnothorax javanicus	0.000	0.016	0.000
Gymnothorax pseudothyrsoideus	0.000	0.037	0.000
Hemiramphus lutkei	0.009	0.054	0.000
Himantura imbricata	0.009	0.004	0.000
Johnieops sina	0.000	0.027	0.000
Johnius belangeri	0.737	0.546	0.159
Johnius carutta	0.000	15.813	0.043
Johnius dussumieri	0.000	0.223	0.000
Johnius glaucus	0.041	0.845	0.006
Lactarius lactarius	0.562	3.844	0.472
Lates calcarifer	0.256	0.121	0.000
Leiognathus bindus	1.926	1.502	0.778
Leiognathus blochi	0.082	0.000	0.009
Leiognathus brevirostris	0.000	0.588	0.039
Leiognathus duara	2.327	1.371	0.545
Leiognathus splendens	0.000	0.543	0.043
Lethrinis lentjan	0.000	0.006	0.000
Liza parsia	0.000	0.031	0.009
Lutjanus johni	0.100	0.031	0.050
Lutjanus russellii	0.000	0.009	0.238
Megalaspis cordyla	0.671	0.022	0.005
Megalops cyprinoides	0.000	0.000	0.005
Monodactylus argenteus	0.027	0.013	0.030
Mugil cephalus	0.459	0.907	1.768
Muraenesox cinereus	0.000	2.064	0.225
Opistopterus tardoore	0.246	0.864	0.000
Nemipterus japonicus	0.000	0.000	0.005
Otolithes cuvieri	0.196	0.420	0.023
Otolithes ruber	0.000	0.022	0.000
Pampus argenteus	0.060	0.102	0.027
Parachaeturichthys polynema	0.049	5.125	0.000
Parastromateus niger	0.008	0.128	0.070
Pellona ditchela	0.000	0.005	0.000
Pisodonophis cancrivorus	0.000	0.583	0.041

SPECIES	PRE-MONSOON	MONSOON	POST-MONSOON
Pempheris mangula	0.020	0.000	0.000
Platycephalus crocodilus	0.116	0.666	0.025
Platycephalus indicus	0.000	0.000	0.012
Polynemus sextarius	0.000	0.004	0.005
Pomadasys maculatus	0.022	0.007	0.008
Pomadysis hasta	0.016	0.000	0.000
Psettodes erumei	0.006	0.000	0.007
Pseudorhombus javanicus	0.147	0.021	0.102
Pseudorhombus triocellatus	0.056	0.161	0.117
Pseudotriacanthus strigilifer	0.000	0.000	0.006
Rastrelliger kanagurta	28.033	8.907	55.157
Sardinella albella	0.183	0.223	0.198
Sardinella fimbriata	1.451	15.390	2.411
Sardinella gibbosa	0.000	9.889	19.403
Sardinella longiceps	64.445	1.072	55.170
Saurida tumbil	0.032	0.000	0.005
Scatophagus argus	0.018	0.054	0.082
Scomberoides lysan	0.000	0.000	0.006
Scomberoides commersonianus	0.006	0.078	0.000
Scomberoides tol	0.000	0.021	0.016
Scomberomorus commersoni	0.762	0.994	0.430
Secutor insidator	0.728	0.392	0.092
Secutor ruconius	1.183	1.098	0.287
Siganus canaliculatus	0.000	0.012	0.000
Siganus oramin	0.000	0.000	0.097
Sillago sihama	0.093	0.107	0.464
Solea elongata	0.047	0.374	0.106
Sphyreana barracuda	0.032	0.101	0.046
Stolephorus commersoni	2.297	5.654	4.116
Strogylura strongylura	0.037	0.000	0.013
Strongylura leiura	0.005	0.000	0.046
Synoptura commersonianus	0.272	0.290	0.194
Telescopium telescopium	0.005	0.000	0.000
Terapon puta	0.000	0.000	0.140
Tetraodon inermis	1.579	5.226	0.759
Terapon jarbua	0.155	0.097	0.566
Thyrsoidea macrura	0.000	0.298	0.129
Thryssa malabarica	0.491	0.816	0.013
Thryssa mystax	0.176	0.282	0.050
Thryssa setirostris	0.319	1.965	0.275
Thryssa vitirostris	0.000	0.540	0.112
Trachinotus blochi	0.033	0.000	0.020
Trichiurus lepturus	0.651	4.487	0.331
Trypauchen vagina	0.000	98.221	0.054
Upeneus moluccensis	0.000	0.019	0.000

and *Charybdis feriata* contributed 6, 5 and 4% of the crustacean fishery respectively. *Scylla serrata* also were seen during all seasons. Other crabs caught were not of commercial significance. Stomotopod, *Oratosquilla nepa* which is dried and used as fertilizer was also recorded. Season-wise catch rate of 17 species of macro-crustacean fauna is given in Table 2.

Table 2. Catch per unit effort of macro-crustaceans recorded during different seasons

SPECIES	PRE-MONSOON	MONSOON	POST-MONSOON
Acetes johni	0.490	0.000	0.000
Charybdis feriata	1.459	1.961	1.985
Charybdis lucifera	1.458	0.000	0.524
Clibanarius padavensis	0.005	0.000	0.000
Penaeus indicus	5.544	20.064	7.378
Penaeus merguiensis	0.113	0.307	0.059
Matuta lunaris	0.124	0.038	0.132
Melicertus canaliculatus	0.000	0.000	0.034
Metapenaeus affinis	0.243	4.718	3.248
Metapenaeus dobsoni	1.812	6.918	39.202
Oratosquilla nepa	2.154	0.036	4.583
Parapenaeopsis stylifera	0.638	4.065	0.404
Penaeus monodon	0.112	3.142	0.408
Penaeus semisulcatus	0.094	0.015	0.180
Portunus pelagicus	1.759	3.091	2.209
Portunus sanguinolentus	2.325	2.847	3.892
Scylla serrata	0.037	0.003	0.008

From fisheries management perspective, judicious suggestions on the fishing operations can ensure sustainability of the fishery on long term basis, thereby ensuring the livelihoods of the coastal fishermen of Karwar. In climate change perspective shore-seine fishery is highly vulnerable fishing method as extensive changes are occurring in the beach topography due to sea level rise and also by sea erosion. Hence, fishermen of the coast who are depending exclusively on shore-seine operations for their livelihood, have to be empowered with avenues of alternate vocations also.

Evolving market chains for Indian oil sardine

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Indian oil sardine, *Sardinella longiceps* forms a major catch of traditional fisherman in Kerala throughout the year. After the peak landing of nearly four lakh tonnes in 2012, catches have showed a continuous decline to less than 50000 t in 2019. This trend has adversely affected the livelihoods of thousands of traditional fishermen. Oceanographic changes associated with *El Niño* has been identified as one of the reasons for this decline in sardine catches along the Kerala coast (Rohit *et al*., 2018). With high demand for oil sardine and limited supply from local fishery, oil sardine from from Tamil Nadu is mainly entering the Kerala fish market. Until recently, oil sardine was a non-targeted fishery resource in Tamil Nadu, but with a large and sustained demand from Kerala, a targeted fishery has emerged in Tamil Nadu especially in Puducherry, Cuddalore, Mayiladuthurai, Nagapattinam and Ramanathapuram districts. Information gathered from different sources and field observations indicate gillnet as the main gear used to exploit oil sardine followed by trawls and ring seines. Earlier trucks registered in Tamil Nadu were used for transporting oil sardine to Kerala. Presently trucks registered in Kerala are directly collecting oil sardine from major landing centres of Tamil Nadu. Freshly caught oil sardines directly iced and packed in plastic boxes with a capacity of 30 - 35 kg per box are loaded in trucks with a loading capacity of 200 boxes (approximately 7 tonnes). While oil sardine price in Tamil Nadu was very low (₹10 - 30 per kg), increase in demand from Kerala has led to a sharp increase in the price (₹90 - 130 per kg). Loaded trucks reach major wholesale markets in Kerala (mainly Punnapra in Alapuzha, Vypin in Ernakulam, Chettuva in Thrissur, Ponnani in Malapuram and Chombala in Kozhikode districts of Kerala) early in the morning. These

Fig. 1 Loading of Oil sardine in trucks from Kerala at Cuddalore, Tamil Nadu

are then distributed to the wholesale dealers for a rate of ₹150 - 190 per kg. These are washed and sorted based on size and freshness and sold in the local market for a price of ₹220 - 330 per kg.

Oil sardines from Tamil Nadu look like the typical oil sardine with high oil content and rounded body that used to be harvested off Kerala coast in earlier times. This is contrary to past history when most of the oil sardine coming from Tamil Nadu were very lean and poor in oil content which had poor acceptance among the fish consumers in Kerala. Distributors now market oil sardine from Tamil Nadu as typical Kerala oil sardine, earning considerable margins as prices in Tamil Nadu are comparatively much lower due to little consumer preference there.

Reference

Rohit, P. *et al.*, 2018. *CMFRI Special Publication* No. 130, 156p.

Kaleidoscope

First report of occurrence of fouling diatom *Licmophora flabellata* from the Gulf of Mannar

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Fouling diatoms are important biofoulers on the structure made for fish culture and other aquatic activities. *Licmophora* species are a common constituent of marine, littoral, micro-epiphytic communities and generally found colonizing filamentous red, brown and green macroalgae, submerged in rock pools throughout the littoral zone. During February 2019, staff working in the sea cage farm were complaining of itching. Upon closer scrutiny bushy arborecent colony of *Pennaria disticha*, which is a stinging hydroid were found on the cage nets. *Pennaria disticha* can sting human and cause irritation. *P. disticha* is native species of Atlantic and considered as invasive in other ecosystem. Heavy fouling of this epiphytic hydroid was recorded on the cage nets for the first time. Further microscopic studies of this stinging hydroid at the laboratory revealed the presence of fouling diatom *Licmophora flabellata* (Fig.1) on its surfaces. Research on fouling diatom on the Indian coast started with Mishra (1956) reporting six species along the west coast. In the east coast of India only two species *L. ehrenbergii*, *L. abbreviata* from Visakhapatnam, Koodankulam coast and Pulicat Lake have been reported. Though the *L. flabellata* has been reported from west coast earlier no report of its occurrence along the east coast so far published. *Licmophora flabellata* is pennate diatom and the type species of this genus. The species diversity of the *Licmophora* genus from Indian waters stands at 12 species (Table.1). However many more species may be yet unrecorded as the global diversity of *Licmophora* genus exceed 90 species.

Fig.1 *Licmophora flabellata*

Table.1 Species diversity of genus Licmophora reported from India

Species	Reported area
Licmophora abbreviata C. Agardh, 1831	Gujarat (Bhadreshwar, Narara & Poshitra), Kerala (Bekal), Goa (Mandovi-Zuari estuary), Cochin, Vishakapatnam, Porbander, Koodankulam Coast (Gulf of Mannar)
Licmophora anglica (Kützing) Grunow	Mandovi estuary
Licmophora bharadwajai Misra, 1956	Dwaraka
Licmophora communis (Heiberg) Grunow, 1881	Dwarka
Licmophora dalmatica (Kützing) Grunow, 1867	Mandovi estuary
Licmophora ehrenbergii (Kützing) Grunow, 1867	Cochin, Mandovi estuary, Pulicat lake
Licmophora flabellata (Grev.)C. Agardh, 1831	Gujarat (Narara & Poshitra), Cochin, Mandovi estuary, Dwarka, Gulf of Mannar (present study)
Licmophora gracilis (Ehrenberg) Grunow, 1867	Gujarat (Bhadreswar), Goa (Zuari estuary), Mangalore (Netravati-Gurupura estuary), Cochin
Licmophora grandis (Kützing) Grunow	Porbandar
Licmophora juergensii C. Agardh, 1831	Goa (Zuari estuary& Mandovi estuary), Cochin
Licmophora lyngbyei (Kützing) Grunow	Mandovi estuary
Licmophora paradoxa (Lyngbye) C. Agardh	Goa (Zuari and Mandovi estuary), Kerala (Bekal), Cochin, Dwarka

Rare occurrence of the Torpedo shrimp

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Torpedo shrimps *Kishinouyepenaeopsis maxillipedo* (synonym of *Parapenaeopsis maxillipedo*) occur along the Indo-West Pacific, Sri Lanka, Malaya and Australia. In India, *K. maxillipedo* has been reported from Gujarat, Andhra Pradesh, Tamil Nadu, Puducherry, Andaman Islands and recently from Kerala. On 8th July 2019 seven specimens of Torpedo shrimps were found in the gill net catch at Vizhinjam, Thiruvananthapuram district, on the south west coast of Kerala. The gear was operated at 27 m depth, 5.6 km off Vizhinjam fishing Harbour and GPS point of the fishing site was recorded as 8^{0}19'37.2"N 76^0 59'48.6"E. All the specimens were identified as male with lengths ranging from 66-80 mm. Gut content analysis revealed that 4 specimens had empty gut but others had food remains identified as *Acetes indicus*.In the coastal waters off Thiruvananthapuram, penaeid shrimp fishery is mostly contributed by the Indian white prawn, *Penaeus indicus.* A strikingly close resembling species *Kishinouyepenaeopsis cornuta* (Kishinouye,1900), known as coral shrimp, has been observed in a few numbers over the years in outboard boat seines occasionally, among the shrimp landings at Vizhinjam, mostly during April. This is the first incidence of Torpedo shrimps caught in Thiruvananthapuram district.

Fig.1. Torpedo shrimp, *Kishinouyepenaeopsis maxillipedo* landed in gill net operation off Vizhinjam, Kerala

Stray occurrences of Bombay duck from the Malabar Coast of Kerala

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The Bombay duck, *Harpadon nehereus* (Hamilton, 1822) form a major single species fishery along the Northwest coast from Ratnagiri in Maharashtra to the Gulf of Kutch in Saurashtra coast. They also form a seasonal fishery along Northeast coast (West Bengal & Odisha) and the northern part of Andhra Pradesh. The fishery is usually concentrated in a comparatively narrow depth zone up to 70 m and are mainly exploited by stationary bag net known as 'Dol' which are operated entirely by tidal force. Bombay duck is insignificant or completely absent in the Southwest and Southeast coasts. In contrast, frequent/regular incidents of stray numbers of *H. nehereus* landings at Puthiyappa fishing harbour, Kozhikode were observed during October to December 2019. A few numbers were reported in December 2019 from Kannur also. All of these were landed by single day trawlers operated off the Malabar coast. The other fishes in the landings were croakers, *Ilisha* sp., shrimps, *O. tardoore*, horse mackerel, *Lactarius lactarius,* flounders*, Thryssa* spp., sardines and golden anchovy. Unusual and comparatively high landings of Silver pomfrets were also observed during October-December 2019. The three specimens collected on 16.10.2019, 03.12.2019 and 10.12.2019 measured 24.1 to 28.7 cm in total length (TL). All specimens were females having gonads in spent and spent recovery stages. Stomachs were either empty or almost full with fish remains and semi-digested matter. The earliest report of Bombay duck from Malabar region was in 1999 in which a single specimen measuring 21.5 cm TL with a standard length of 17.7 cm was caught along with carangids and crabs in a gillnet (*Chalavala*) operated off Quilandy coast using a dugout canoe (Krishnan, 2000).

Reference

Krishnan,C. K. 2000.*Mar. Fish. Infor. Serv., T & E Ser.*, 166:19

Fig. 1. *H. nehereus* of 28.7 cm TL landed

Rare occurrence of Bombay duck from Central Kerala

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The occurrence of Bombay duck along south coast of India is very rare, especially Kerala coast. On 4th December, 2019, one specimen of Bombayduck, *Harpadon nehereus* measuring 252 mm in total length and weighing 114.5 g was landed at Chellanam landing centre, Kochi (9°47'56.8"N 76°16'32.2"E) by an outboard ringseiner unit operated at a depth of 30-50 m targeting Indian oil sardine. Morphometric and meristic characters of the specimen landed were recorded (Fig.1). Measurements (in mm) were: Fork length 213, Standard length 201, Head length 45.3, Head depth 35.9, Maximum body depth 45.2, Snout length 4, Eye diameter 3.5, Lower jaw length 30.9, Upper jaw length 33.2, Post orbital length 40.5, Interorbital width 12.6, Pre dorsal length 88.7, Pre pectoral length 45.3, Pre pelvic length 91, Pre anal length 162, Pre adipose length 174, Pectoral fin length 55.6, Pelvic fin length 53.6, Dorsal fin height 49.7, Anal fin height 34.2, Adipose fin height 12.4, Caudal peduncle depth 13.8, Lower caudal fin length 41.1, Dorsal fin base length 32.2 and Anal fin base length 27.3.

Fig.1. Bombay duck collected from Chellanam fish landing centre in Central Kerala

Unusual landings of Crimson jobfish and Yellowfin tuna along Odisha coast

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The crimson jobfish *Pristipomoides filamentosus* belongs to the family Lutjanidae (Snappers) is highly valued due to its white quality meat. Usually only a few numbers, mostly of small size are landed along with other fishes in trawl and longline catches. Recently, on 5 November 2019 about one tonne of mostly large sized crimson jobfish caught by single day operation longliner unit landed at Chandravaga Landing Centre ($19^0$51'57.1572"N, $86^0$6'42.8508"E) (Fig. 1). Out-board fibre glass boat (9.6 m OAL) with 4 units (baskets) of longlines each having 250-400 number hooks (hook size: No. 9) and six crew members were involved in fishing of this species. The fishes locally called as *gulubinda* (in Telugu), were caught at a depth of about 65 m off Astarang Gangadevi river mouth, Puri. *Rastrelliger kanagurta* was used as the bait for fishing. The fishes measured 22-45 cm fork length and each were weighing 200 to 2300 g. The big sized fishes were auctioned at the price of ₹120 per kg and sent to Digha, Chennai and Kolkata in iced condition by road and a few small sized ones reached local markets for fresh consumption. Other fishes caught were kawakawa *Euthynnus affinis* and blacktip sea catfish *Plicofollis dussumieri*.

Fig. 1. Unusual landings of crimson jobfish *Pristipomoides filamentosus*

Fig. 2. Unusual landings of yellowfin tuna

On 6 December 2019, about 700 kg of yellowfin tuna caught in drift longlines (single day operations) were landed at Chandravaga Landing Centre (19^{0}51'57.1572"N, 86^{0}6'42.8508"E). Out-board fibre glass boats (9.6 m OAL) with 3-4 units (baskets) of longlines each having 250-400 number hooks (hook size: No.6-7) and six crew members were involved in fishing. The fishes locally called as *soora* (in Telugu), were caught using *Rastrelliger kanagurta* and *Sardinella longiceps* as the preferred bait. As there was no local demand for yellowfin tuna, the fishes were auctioned at a price of ₹90-100 per kg and sent to Kolkata, Bengaluru and Digha in iced condition by road. The fishes were measuring 51 - 91 cm fork length and weighing 2.7 - 11.6 kg each.

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