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Marine Fisheries Information Service

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Front Cover : *Crossbred percula clownfish*

Back Cover : *Maroon clownfish*

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

Culture of ornamental fishes is a promising avenue for generating employment and addressing livelihood concerns in fishermen communities faced with limited choices in exploiting wild fish populations. ICAR-CMFRI has developed several technologies for breeding and larval rearing of marine ornamentals and extended them to the fishermen through training programmes. The lead article looks into the various aspects of evaluating such training programmes to make them more focussed and deliver more value. Other articles include notes on bivalve resources, shifting market chains, exploitation of fishery resources and marine biodiversity that all reflect the vibrant nature of the marine fisheries sector in India.

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Analysis of training effectiveness of marine ornamental fish culture training programmes

B. Johnson, A. K. Abdul Nazar and R. Jayakumar
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In India, fisheries sector serves as an important source of employment and income generation. In a fishing household, the male member, who goes to the sea and engages himself in the actual fishing process is recognised well but role of the female member who does a lot of work after the fish is landed is often not highlighted. Today's average Indian fisherman family often finds it difficult to earn a livelihood throughout the year. Therefore, the potential of the unemployed fisherwomen needs to be tapped, by equipping them with skills to generate additional income for the household. One of such options is to start a small-scale marine ornamental fish production unit. However, for starting such enterprise they require hands-on training in marine ornamental fish production.

In recent years the marine ornamental fish trade is growing rapidly in national and international markets,for which fish are mainly collected from the coral reef habitats. This indiscriminate and often destructive collection of fishes leads to irreparable damage to the coral reef ecosystem. The establishment of a few small-scale ornamental hatcheries will pave the way for hatchery produced ornamental fish trade. The ICAR- Central Marine Fisheries Research Institute (CMFRI) has been pioneering the development of seed production technologies and commercial level production for more than a dozen species of clownfishes and damselfishes, which are in good demand in the marine ornamental fish trade. Marine ornamental fish production is a low volume, high value enterprise and hence highly lucrative. Keeping this in view, training programmes on 'Seed production of selected marine ornamental fishes to fishers in Gulf of Mannar region' was organized under Gulf of Mannar Biosphere Reserve Trust (GOMBRT) funded project at the Mandapam Regional Centre of ICAR-CMFRI for 14 groups in four batches during 2014-16 period. The technologies were mostly disseminated to fisherwomen groups, so that they could develop as small-scale entrepreneurs for production of marine ornamental fishes. Hands-on training was given in broodstock development, breeding, larval

Learning by seeing

Learning by doing

and juvenile rearing of clown fishes, grow-out techniques, livefeed culture, enrichment of live feeds, water quality and disease management. Allied topics like biodiversity of marine ornamental fishes in the Gulf of Mannar region, setting up of a small-scale hatchery for ornamental fishes and its economic analysis and familiarization with Government schemes for starting a hatchery were also covered in the training. Field visit to small scale marine ornamental fish units at Mandapam was arranged. Trainees also interacted with the buyers of marine ornamental fishes. The training was given by the scientists/technicians who were involved in the development of marine ornamental fish seed production technology. Evaluating the usefulness of the training programme in terms of Training Effectiveness is an important aspect. This provides information for decisions concerning future training programmes and is highly useful in fine-tuning the training programmes (Meena and Yadav, 2003, *Indian J. Ext. Educ.,* 49 (1 & 2): 99-102). Hence, the training effectiveness of marine ornamental fish culture training programmes organized at the Mandapam Regional Centre of ICAR-CMFRI were assessed.

Methodology

The training effectiveness was studied based on Kirkpatrick four-level Training Evaluation Model (Kirkpatrick and Kirkpatrick, 1994, *Evaluating Training Programs: The Four Levels*, *Berrett-Koehler Publishers*). The four levels are:

Level 1: Reaction - Measures how trainees reacted to the training.

Level 2: Learning – Measures the increase in knowledge as a result of the training.

Level 3: Behaviour – Evaluates how far trainees have changed their behaviour, based on the training they received and how trainees apply the information into practical use.

Level 4: Results – Analyses the final results of the training, namely, the outcomes of the training.

Level 1: Feedback was received from trainees (N=162) both in an evaluation schedule and written response conducted for each trainee at the end of the programmes. The indicators used by Koshti, 2008 (*Evaluation capacity building in rural resource management: A manual, IARI, New Delhi, India.* p.107-127) to study the effectiveness of training was modified and suitably developed for the present study. The indicators are:

1. *Relevance and utility of course content (Theory and Practical)* : Responses were taken on 11 topics on five point continuum namely, highly relevant and most useful, quite relevant and quite useful, relevant and useful, somewhat relevant and somewhat useful, not relevant and not useful by assigning numerical score of 5,4,3,2 and 1 respectively.
2. *Training organization* : Responses were taken as 9 statements on five point continuum namely, strongly agree, agree, no opinion, disagree and strongly disagree by assigning numerical score of 5,4,3,2 and 1 respectively.
3. *Impact on knowledge and skill* : Responses were taken on 11 topics on five point continuum as no change, little change, some improvement, fair improvement and great improvement by assigning numerical score of 1, 2, 3, 4 and 5 respectively.
4. *Overall usefulness of information* : It was measured on five point continuum such as poor, fair, good, very good and excellent and was given score as 1, 2, 3, 4 and 5 respectively.
5. *Fulfillment of expectations* : It was measured on five point continuum such as extremely met, fairly met, satisfactorily met, met to some extent and not met and was given score as 5, 4, 3, 2 and 1 respectively.
6. *Opinion about meeting room and facilities* : It was measured on five point continuum such as poor, fair, good, very good and excellent and was given score as 1, 2, 3, 4, and 5 respectively.

Training Effectiveness Index (TEI) was worked out taking into account all the above mentioned indicators by using the formula given below:.

$$TEI = \frac{\text{Obtained scores on all dimensions of training effectiveness}}{\text{Maximum obtainable score on all dimension of training effectiveness}}$$

Percentage analysis and Garret ranking was done to process the data and to arrive at meaningful conclusions.

Level 2: A knowledge test with a set of 15 questions was conducted before and at the end of training to ascertain their change in knowledge due to the training.

Level 3 and 4: Periodic follow-up was undertaken by observation method. Through frequent interaction with the trainees, assessment of how many trained people could apply the skills learnt on ornamental fish seed production practically was made. The immediate benefits gained by adopting the technique were documented while the long term benefits (results) were also predicted.

Results and Discussion

Level 1: Reaction

Training Effectiveness Index indicated the overall training effectiveness as perceived by the trainees was 83%. Half of the trainees indicated that the marine ornamental fish culture training programme was highly effective (>80% TEI)(Table 1).

Table 1. Distribution of marine ornamental fish culture trainees based on Training Effectiveness Index

Training Effectiveness Index	Frequency	Percentage
61 to 70%	23	14
71 to 80%	58	36
81 to 90%	49	30
91 to 100%	32	20

Among the eight indicators, trainees rated the overall usefulness of information and training organization as excellent. The trainees expressed that the relevance and utility of course for practical and theory was 'Highly Relevant' and 'Most Useful' to 'Quite Relevant' and 'Quite Useful'. At the end of the training, trainees expressed that there was a fair improvement in knowledge and skills on marine ornamental fish culture and their expectations were fairly met. The results indicated that they perceived the training given to them as effective (Table 2).

Table 2. Indicator-wise training evaluation

Indicator	Mean score	Rank
Relevance and utility of course content (Theory)	**4.18**	**V**
Relevance and utility of course content (Practical)	**4.41**	**III**
Training organization	**4.46**	**II**
Impact on knowledge	**4.05**	**VI**
Impact on Skill	**4.31**	**IV**
Overall usefulness of information	**4.60**	**I**
Fulfillment of expectations	**3.90**	**VIII**
Opinion about meeting room and facilities	**4.0**	**VII**

Reactions about the training revealed that the training has increased the awareness, knowledge and skill for most of the trainees on marine ornamental fish culture and ultimately changed their attitude towards small-scale ornamental hatchery production (Table 3)

Table 3. Reactions about organization of training

Reactions	Number of 'Yes' responses	%
Increased the awareness about ornamental fish culture	154	95
Provided the theoretical information about ornamental fish culture along with practical experience in hatchery	146	90
Provided opportunity for		

skill learning about ornamental fish culture	122	75
Acquired adequate knowledge about various aspects of ornamental fish culture	146	90
Changed the attitude towards ornamental fish culture	154	95

Before the training programme most of the trainees expressed they had no idea to start a small-scale ornamental hatchery, whereas after the training more than half of the trainees expressed that they are intended to start small scale marine ornamental hatchery unit in the near future (Table 4).

Table 4. Extent of use of practices learnt

Reactions	Number of 'Yes' responses	%
Start a small scale hatchery immediately	57	35
Intend to start small scale hatchery in the future	97	60
No plan to start	08	05

Regarding suggestions for improving the training programme it was found that majority of the trainees ranked 'Need for more practical session' first (Table 5). Some of the trainees suggested increasing the training duration by 10 days and more individual practical sessions incorporated in the programme.

Table 5. Suggestions of trainees for improving the training programme

Suggestion	Score	Rank
More practical session	75	I
To do practical individually	60	II
Field level training	43	III
Increasing the training duration by 10 days	27	IV

Level 2: Learning

While majority of trainees obtained only 10-20% score in the knowledge test conducted before the training, more than three-fourth of the trainees obtained above 70 % score in the test conducted after the training (Fig. 1).

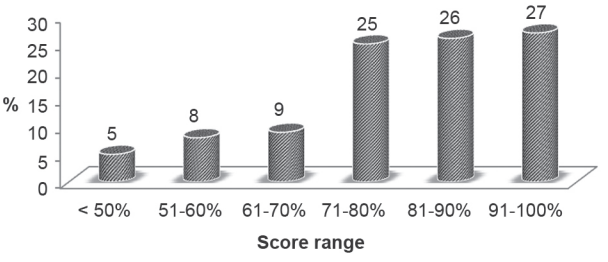

Fig. 1. Distribution of trainees based on their score in knowledge test

Level 3: Behaviour

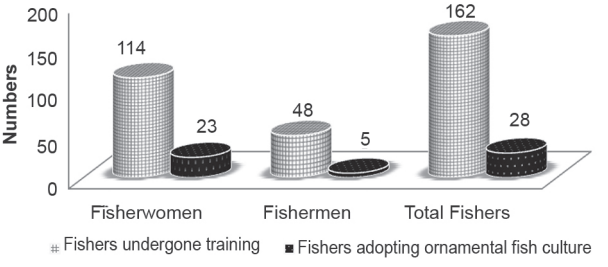

Fig. 2. Genderwise profile of trainee

Out of 162 fishers, twenty eight have initiated the small-scale ornamental fish culture unit in their respective places. Among these, 23 members from Thangachimadam village received 50 % subsidy (₹50,000) under The National Fisheries Development Board (NFDB) scheme to start ornamental fish production offered by the State Fisheries

Fisherwomen group in Thangachimdam undertaking ornamental fish culture

Ornamental fish culture unit at Mandapam

Packing of ornamental fish seed

Department, Ramanathapuram. Remaining five members from Mandapam have initiated the marine ornamental fish culture with their own investment. Evidently 20 % of the trained fishers were able to practically apply the learnt knowledge and skill on marine ornamental fish seed production.

The development of small-scale private entrepreneurship on hatchery production of marine ornamental fishes at Mandapam is detailed. Fishermen Self-Help Groups (SHG) established a small scale hatchery in 100 square feet area at Mandapam. Percula, sebae and fire clownfish brooders were handed over to the group on 24th March 2016. In addition, about 400 numbers of hatchery produced half-inch sized juveniles of percula clown, tomato clown and skunk clownfishes were supplied by the Mandapam Regional Centre of ICAR-CMFRI during first week of May 2016. The list of ornamental fish traders for marketing the produce and entire technical guidance on rearing of the juveniles, health management, water quality management and packing techniques for transportation had already been given by the scientific and technical staff of ICAR-CMFRI, Mandapam. After two months of rearing the clownfish juveniles to a size of 1.0 and 1.5 inch were sold for ₹ 75 and ₹100 per fish respectively to a fish trader at Bengaluru. The operating cost for two months of rearing was ₹17,000 with gross revenue of ₹ 30,000. The estimated capital productivity was 0.57. Owing to the good economic benefits, they have expanded the hatchery to 350 sq.ft area and are continuing with the marine ornamental fish production.

Level 4: Results

Marine fisheries sector in Palk Bay and Gulf of Mannar region is witnessing over exploitation of trawling grounds, declining catches and consequent reduction in profit for fishermen. In such a scenario, the fishers group have well understood that the marine ornamental fish seed production will be one of the best alternate livelihood options for them. One of the anticipated outcomes from the training is the economic empowerment of women and enhanced decision making ability. In the long run, marine ornamental fish seed production will pave the way for a sustainable hatchery produced, ornamental fish trade. The findings of the study suggest that though it takes longer time for establishment of large scale units, we can progress to a scenario where it is possible to substantially reduce the quantity of wild collected marine ornamentals and replace it with a hatchery produced marine ornamental fish trade.

Bivalve fishery in the Kayamkulam Lake of Kerala

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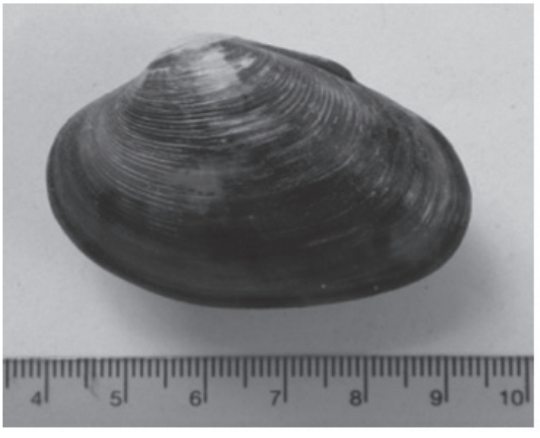
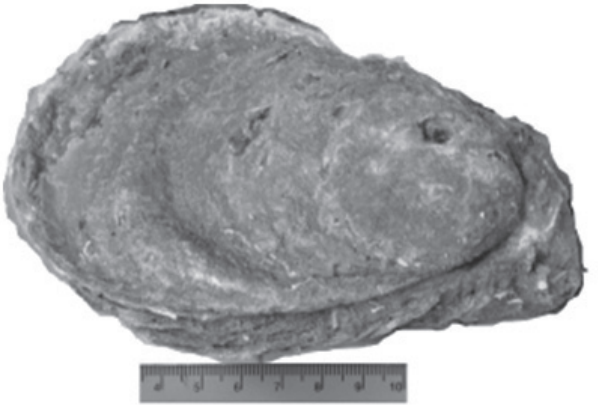
Along the Kerala coast the National Waterway 3 extends from Kollam District in the south up to Kottapuram, Thrissur in the north. A portion of this National Waterway, from north of Ayiramthengu Bridge up to Thrikkunnapuzha is called Kayamkulam Lake. The area is well known for its rich bivalve resources which is exploited by local fishers as well as those from more distant areas. The bivalves that support the artisanal fishery here are *Paphia malabarica (*short neck clam, Kalli kakka, Poovan kakka), *Meretrix casta* (backwater clam, Manja kakka, Mona kakka), *Villorita cyprinoides* (black clam, karutha kakka), *Anadara granosa (*blood cockle, Chirava kakka), *Crassostrea madrasensis* (backwater oyster, Muringa, Chippi kakka) and *Perna viridis (*green mussel, Peelikakka, Kallumaikai*)*. Among these, *P. malabarica* contributes maximum to the harvest followed by *P. viridis* and *C. madrasensis*. The data on landings of bivalves from this backwater is scanty since the catch is being auctioned and taken by local vendors as soon as it is landed. The livelihood of more than 300 fishers depend on the bivalve resources in the estuary. Therefore, a case study was conducted to the profile the bivalve fishery in Kayamkulam Lake and suggest effective management measures.

Clam fishery: There are rich resources of clams near the barrage and clam collection is entirely based on the lunar phases (locally called as 'Thakkam'). The clam catches increases during the days close to full or new moon. During 'ekadashi', period stagnant water conditions are observed when clam picking is poor and hardly two boxes (approximately 40 kg each) of clams per boat is harvested. This lunar phase is followed by a flooding and fishers schedule clam harvesting according to the flood and ebb events. Clam fishery of Kayamkulam Lake occurs throughought the year and ensures a secure source of income to the fishers.

Clam collection is done either using hand dredge or collection aided by kicking the mud rich in clams into mouth of dredge. The other method is hand picking. Two to three fishers in a canoe fix poles of 4-7 m length tightly into the mud, when they reach the fishing ground. They make sure the presence of clam both in front and back side of the pole by feeling the sediment with their legs or hands. If the site is found meagre in clam, the fishers shift to another place and repeat the process until they locate a ground with sufficient clams. The dredge



Paphia malabarica



Crassostrea madrasensis

Perna viridis

having a mesh size of 30 mm and total length of 3 m is dragged through the sediment and lifted. Some fishers prefer clam collection by kicking the mud towards the mouth of the dredge, already fastened in a suitable site of depth 1.2 m. The mouth opening of such a dredge is considerably bigger than the normal hand dredge to enable maximum entry of clams. After 2 to 5 minutes of such operation the dredge is lifted and washed to dump the clam, free of sediment into the canoe. The clam collected by such methods includes both live clams and empty shells in equal percentage in the catch. Hand picking which is the principal fishing method adopted by the women fishers is limited to 0.5 to 1 m depths. Their catch per trip is approximately one full box of clam, free of any empty shells (Table 1).

Once the flood tide starts,the fishers wind up their collection for the day. There are women group who separate the live clam and empty shells. The pricing of clam is done once it is quantified. The clams are then filled into a net sack and submerged in the shallow backwater area for transport to Goa.

Women group engaged in sorting of *P. malabarica*

The women groups start packing the live clam early in the morning at 4 am by spreading the clams on the cement floor and showering it with brackish water. Plastic sacks of 10 kg capacity are used to pack the clams followed by an outer packing using jute sack, which ensures adequate moisture for their survival during transportation. The packets are then transported to Goa by train which is about 15 hours travel time, where the live clams have good demand. The empty shells are sold to lime industries

Net sack of sorted clams

Table 1. Details of different kinds of clam collection practiced in the Kayamkulam Lake

Particulars	Hand dredging	Kicking sediment	Hand picking
Gear	Dredge	Dredge	No gear
Craft	Plank built canoe	Plank built canoe	Plank built canoe
Number of fishers & Gender	1-3, Male	1-2, Male	1-3, Female
Depth of operation (m)	5	1-1.2	0.5-1
Average catch per trip (box)	1.5-9	1-5	1
Average catch per hour (kg)	15-90	10-50	10
Price per box (1box =40 kg)	750-2000	750-2000	750-2000
Size of the clam (cm)	4.3-5.5	4-5.5	4.3-5.1

Table 2. Details of bivalve fishery existing in Kayamkulam Lake

Particulars	Clam	Oyster	Mussel
Species caught	*P.malabarica, M.casta, V.cyprinoides, A. granosa*	*C.madrasensis*	*P. viridis*
Catch per trip (kg)	60-360	6-8 (meat)	120*
Number of boat operating	50	4-5	-
Number of fishers	112	15	-
Price per kg (₹)	20-50	130-150	100-150*
Pre-processing	None	Shucking	None
Marketing	Outside the state	Local	Local and outside the slate
Average size (cm)	4-5.5	15-25	10-13
Utilisation of shell	Lime industry	Land filling	-
Estimated annual catch (t)	2000 -3000 (Shell-on)	5-6 (meat)	200-250 (Shell-on)

** There is no active mussel fishery existing currently, the data presented is based on the catch in 2014-2015*

in Tamil Nadu at the rate of ₹ 50-60 per box which weighs around 35 kg.

Mussel fishery: The fishery for *P. viridis* existed upto 2014-15, but was absent in the following year. The mussel fishery coincides with pre-monsoon (summer) period. They frequently settle on submerged empty shells, rocks and abandoned poles. Mussel fishers use underwater masks and collect mussel during the fishing season. The fishery is highly variable and in some years good spat settlement takes place. Mussels can survive and grow only when the estuary is totally marine as in the summer months while during monsoon, only few survive.

Oyster fishery: The oysters are harvested from hard bottom substratum such as rocks. Fishers dive to the bottom using masks and only experienced fishers are engaged in its collection. Oysters either as single ones or set of many are detached from its bed with a sharp knife. The meat is shucked using a knife and sold locally. The shell is widely used for land filling purpose in this area. Currently the fishers are not facing any scarcity for oysters in the areas surveyed.

Challenges to the bivalve fishery in Kayamkulam lake

1. Land reclamation and harbour construction works

The recollection of past events by the women fishers about clam harvesting reveals the rich history of the bivalve fishery in Kayamkulam Lake that sustained the livelihood of thousands of families. Clam collection by the members of each family living close to the Kayamkulam lake was quite common before the tsunami of 2004. After the tsunami, fishers report the creation of huge sand dunes in the areas where the subsistence fishery existed previously. The land reclamation and deepening of the Kayamkulam Lake at the barrage area for construction of a new harbour is another threat faced by the clam fishers.

2. Unsustainable fishing practices

Till 2015 the green mussel catch in Kayamkulam lake was good with average catches about 120 kg per day. The rich mussel bed at the estuary was exploited indiscriminately without leaving sufficient mussel stock to perpetuate for ensuring the fishery in the coming years. The local clam fishers have strong conflicts with fishermen coming from other parts of the district, who rely on the clam grounds in Kayamkulam Lake during the clam fishing ban period at Ashtamudi Lake. Unlike the local fishers, these fishers use underwater diving masks that enable them to see the clams at bottom and sediment containing clams is pushed into the dredge mouth with the help of a small metal rod, resulting in huge harvest of clams within 2 to 3 hours every day. The local fishers, who collect the clam in the

conventional way without any mask and supplementary hand tools, are apprehensive about the sustainability of the clam stock when they are subject to this kind of fishing methods.

3. Collection of juvenile bivalves

Small quantities of harvested juvenile clams which cannot be marketed in Goa due to their small size are sold locally. The harvesting of juvenile oysters is rare.

Recommendations

The clam fishery in Kayamkulam Lake was sustainable until the recently due to the vigilant and sustainable approach of the local fishers. The threats mentioned above are a matter of grave concern to the fishers and they themselves are keen to implement scientific recommendations as adopted in the Ashtamudi Lake which are as follows

1. Strict implementation of ban in clam collection for at least three months during the breeding months.
2. Regulate the day's catch by each canoe within certain limit so that the clam stocks are sustained and not over exploited.
3. Strict implementation of the Minimum Legal Size for *Paphia malabarica* (20 mm Anterior Posterior Measurement/APM)
4. Demarcation of the fishing ground for clams.
5. Promote the releasing of small sized bivalves by the fishers to rebuild the stock.

Shift in market channels for short neck clam of Ashtamudi and Kayamkulam Lakes

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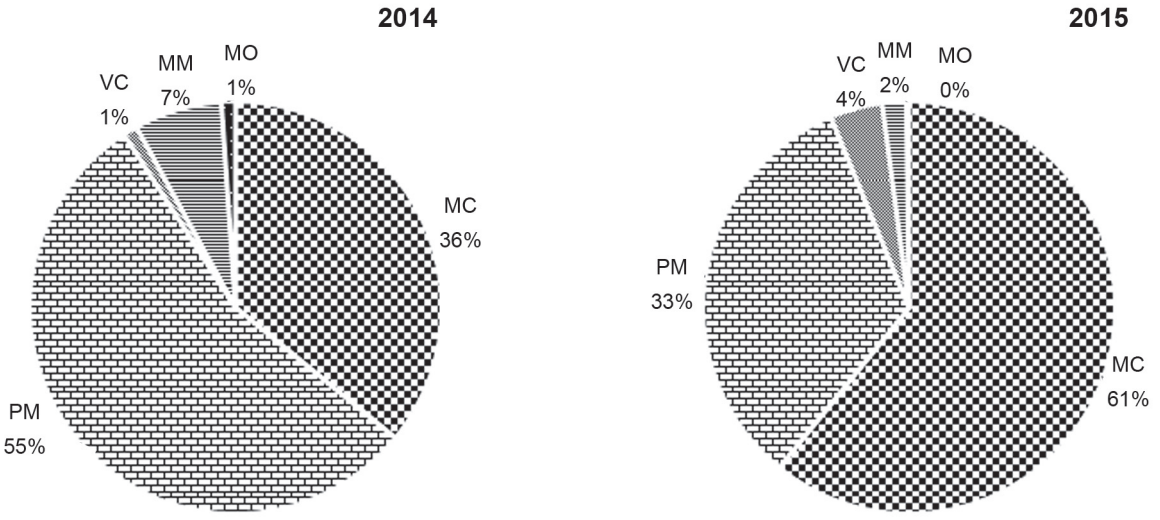
Fishery for the short neck clam *Paphia malabarica* sustains the livelihoods of around a thousand fishers in Ashtamudi Lake. Commercial fishing for *P. malabarica* in this area began 30 years ago and because of sustainable management practices adopted by the stakeholders, it became India's first Marine Stewardship Council (MSC) certified fisheries in 2014. The Kayamkulam Lake situated nearby supports a seasonal fishery of *P. malabarica* during June to September. Clam fishers have been supplying the clam meat to the nearby processing plants for exporting to Asian countries such as Vietnam, Thailand and Malaysia. For exports, fishers currently get ₹ 80-90 per kilogram (kg) of boiled, shucked meat. For getting 1 kg of such shucked meat, 10-13 kg of live clam is required.

Incidentally, during the same period, harvest of *P. malabarica* from Karnataka's estuaries decreased drastically from 4199 t (2012) to 263 t (2015) which resulted in a huge demand-supply gap for this clam in the local fish markets of Karnataka, Goa and Maharashtra. Other commercially important clams like *Meretrix casta, Meretrix meretrix, Villorita cyprinoides* and *Marcia opima* etc. in Karnataka also showed drastic decline from 5420 t (2012) to 537 t (2015). Species composition of the clams also changed between 2014 and 2015 (Fig. 1), due to which the demand for whole, short neck clams increased manifold in these states. This demand was met by the short neck clams harvested from Ashtamudi and Kayamkulam Lakes, changing their market chain from an export oriented one to a domestic oriented one.



MC - *Meretrix casta*, PM - *Paphia malabarica*, VC - *Villorita cyprinoides*, MM - *Meretrix meretrix*, MO - *Marcia opima*

Fig. 1. Species composition of clam landings in Karnataka during 2014 and 2015

The inter-state transportation of clams to Karnataka and adjacent states by road and by rail from estuaries of Kerala has a long history. Transportation in large quantities started in 2015 and the clams were sold in markets extending from Kasaragod (north Kerala) bordering Karnataka to Goa. Clam fishers sold to these places get about ₹ 200-260 per kg of whole clam which is around 2.5-3 times more than local prices and entire catches are now marketed to these states. Drastic reduction of about 57% in clam production from estuaries such as Kalinadi, Gangavalli, Aghanashini, Sharavathi, Venkatapur, Coondapur, Uppunda, Swarna-Sita, Udyavara, Mulki, Gurupur and Nethravathi in Karnataka during 2015 was mainly due to poor spat settlement during the post-monsoon months of 2014. Biomass surveys conducted during March-May and November 2015 in the shallow water clam beds in Aghanashini, Coondapur, Swarna-Sita, Udyavara, Mulki, Gurupur and Nethravathi estuaries also revealed natural mortalities of all clam species.

The estimated average annual production of short neck clam from Ashtamudi Lake is around 10,000 tonnes. Fishing is carried out for 9 months in a year with an average 24 fishing days per month, while during December-February, it is the closed fishing season. Nearly 230 kg of live-clams are harvested by two persons working in a boat per day. Around 200 fishing boats are operating in the lake, and brings approximately 46 tonnes (t) of live clam to shore every fishing day. The economics of marketing the clam was estimated as follows (Table 1). Fishers get nearly 2-3 times more profit by selling whole clam meat than shucked meat.

In Kayamkulam Lake *P. malabarica* fishery is carried out for about 9 months in a year (average 22 days per month) with estimated average monthly production of about 27 t. On an average 74 kg (range 30-120 kg) of live clams are harvested by two persons per boat per day. Number of canoes operating in this estuary daily varied from 7-20. Because of larger size of clam, fishers from Kayamkulam lake got higher prices (₹ 23-34 per kg) than fishers operating in Ashtamudi who sold whole clam (₹ 20 per kg) to the traders from neighbouring states. Every evening, entire catches are transported by 5-6 lorries to these states. Each lorry carries 150 gunny bags of 50 kg each containing live clams. By selling live shell on clams to the

Table 1. Comparison of economics of selling whole clam and shucked clam meat.

Item		Quantity / unit	Average rate (₹)	Whole clam processing	Clam meat processing
I.	Fixed cost				
	Cost of canoe (with outboard engine)	1	75000	A	A
	Cost of canoe (without outboard engine)	1	45000	A	A
	Gear(*Kuthuvala*/*Kolli*)	1	6000	A	A
II.	Operational cost for 100 kg clam				
	Fuel charge for heat shucking of clam	100 kg	75	NA	A
	Fuel cost for outboard engine	100 kg	100	A	A
	Sorting charge	100 kg	50	A	A
	Meat shucking charge	100 kg	100	NA	A
	Miscellaneous expenses		50	A	NA
	Total expense for 100 kg clam (₹)			200	325
III.	Gross revenue from 100 kg clam				
	Selling shells left after shucking	60-70 kg	50	NA	A
	Selling clam meat	8-10 kg	810	NA	A
	Selling whole clam	100 kg	1300	A	NA
	Total revenue for selling 100 kg clam (₹)			1300	860

Net profit (Gross revenue – Operational cost) for selling whole clam and clam meat were estimated as ₹ 1100 and ₹ 535 respectively.

A - applicable, NA-Not applicable

neighbouring states, fishers have benefitted by getting more profit (₹ 1110 versus ₹ 535 per 100 kg), savings in fuel cost and time otherwise required in boiling and shucking the live clams. Women have also escaped the drudgery of boiling and shucking clam meat.

The clams which are transported to Karnataka are relayed in estuaries at Coondapura. Relaying is done for minimum period of 2 days which may get extended depending on the demand. Healthy clams get buried while the stressed ones remain on top of the relayed substratum. The stressed clams are sorted, packed in small cement bags (10 kg bags) and transported immediately to Goa for marketing. The estimated survival rate of the stressed clams collected from the top layer of the estuary is 38-48%. Rest of the clams are also packed similarly and sold in Goa and more distant markets in Ratnagiri and Mumbai at ₹ 900-1000 per10 kg bag (42- 47 clams per kg). Fishers at Ashtamudi Lake get ₹ 20 per kg of whole clam which is sold at whole sale price of about ₹ 95 kg to the traders from Goa, Ratnagiri and Mumbai after it reaches Karnataka.

In conclusion, the present supply-chain of *P. malabarica* in bulk quantities from Kerala to Karnataka, Goa and Maharashtra by lorries and trains is likely to last only until the clam population in estuaries in Karnataka revive. An earlier study reported that clam beds took about 4 years for revival after mass mortalities in Tuticorin Bay through transplanting clams from other locations (Kripa *et al.*, 2012, *Mar. Fish. Infor. Ser. T&E Ser.*, 211:3-4). In the present study drastic reduction in clam landings in Karnataka was due to poor settlement of spat and natural mortalities of clams, probably due to environmental stress. If the production from Karnataka revives in future, the old export oriented marketing channel is likely to come back.

Harvest of associated wild-fish assemblages in estuarine cage farms: Implications for farm management and livelihood

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Sea-cage farms form attractive habitats for wild-fish populations as they directly provide food-chain support to the fish community through excess feed and organic wastes from the sea cages. They also support wild-fish assemblages indirectly by enhancing plankton productivity and providing substrate for biofouling communities. In cage-farming operations, the farmers realise the major share of the revenue at the end of the farming season during harvest of farmed fishes. Aqua-farmers in Karnataka engaged in farming fishes in cages effectively utilized such ichthyofaunal aggregations around net-cages. This study was conducted at Yedamavinahole, Karnataka where seabass (*Lates calcarifer)* was reared in rectangular cages. Modified shore seines known as '*Iliyabalae'*, which are commonly operated near rocky areas for finfishes and shellfishes, in the region are used for harvesting the wild-fish assemblages in the close proximity of fish cages. Details of gear, fishing operations, the composition of wild-fish around the net-cages and average income generation from the *Iliyabalae* operations are presented.

Two variants of the *Iliyabalae* including the regular seine, with single panel of net and a modified seine with three layers of net panels (covered *Iliyabalae)* are operated. The former net consists of a rectangular panel measuring 36-50 m in stretched mesh length and 2.5-6.0 m in width The netting consisted of monofilament (nylon) knotted diamond meshes (52-60 mm when stretched), having uniform twine size. Cork floats of 9.5 cm diameter, having 2 cm thickness are fixed to the head rope (polypropylene rope, 6 mm diameter) at 1.8 m intervals. The sinkers measuring 38-39 mm in length and 8.5-8.8 mm in width, having 30-49 g weight are fixed at 30 cm interval to the sinker line (2 mm polypropylene rope). The sinker line is mounted to the foot rope of 3 mm diameter (polypropylene). A flexible ring measuring 20 cm in diameter, comprised of a 16 mm polypropylene rope, wrapped with cotton ribbon, is attached to the ends of the foot rope for dragging the net.

Iliyabalae (single panelled) with rope ring attached to the foot rope

The *covered Iliyabalae* has three net panels, attached to a headrope of 2.5 mm in diameter.The inner net panel of 50 mm stretched mesh is sandwiched between two net panels consisting of 70 mm mesh on one side and 80 mm mesh on the other. The outer net panels are attached with a 1.5 mm rope on top and all the three panels are mounted together on the head rope. It is relatively smaller in dimensions due to the heaviness of the three panel-webbing and measures about 43 m in length and 4.5 m in width. The cork floats of 78 mm diameter and 21 mm thickness, are mounted to the head rope at 2 m intervals. More number of sinkers per unit of sinker lines at an interval of 15 cm are used in c*overed Iliyabalae*.

Fishing operation with '*Iliyabalae'* is a skilled activity engaging 2-3 expert skin divers. The net is encircled around the floating net-cages taking care to exclude the anchor line. Once the net is positioned in water, the floats are manually pushed

Table 1. Economics of fishing operations

Parameter	Iliyabalae (Net 1)	Covered Iliyabalae (Net 2)
Cost of Net (₹)	3,250 ± 350	4,250 ± 283
Labour cost for net fabrication (₹)	1,125 ± 177	1,900 ± 141
Yield per operation(kg)	20.0 ± 7.1	25.0 ± 7.1
Monthly income (₹)	12,500 ± 7,071	17,500 ± 4,950

below the cages by diving and dragged along with the sinkers so as to cover the entire water area beneath the installed cages. Operations are restricted to dawn or dusk, coinciding with the occurrence of low tides. The use of large meshed (>50 mm) nets inevitably avoids harvest of juveniles. However, when smaller fishes get entangled in the *covered Iliyabalae* they are salvaged live and used as stocking material (captured based aquaculture) for farming in estuarine cages during August-October and February- March. The *Iliyabalae* operations are carried out under each individual cage at fortnightly intervals.

The common fishes represented in the catch from the nets were *Lutjanus argentimaculatus, L. johnii, L. russelli, Gerres filamentosus, Sillago sihama, Liza* sp., *Etroplus suratensis*, *Caranx sexfasciatus*, *Scatophagus argus*, *Epinephelus epistictus*, *Platycephalus indicus*, *Siganus vermiculatus, Arius* sp., *Lates calcarifer* and the mud crab *Scylla serrata*. Estimates of wild-fish harvest ranged from 15 to 25 kg by single panel *Iliyabalae* (Net 1) and 20 to 30 kg by *covered Iliyabalae* (Net 2).

Since the farmed stocks were fed mainly with trash fish, the carnivorous wild-fish were

Table 2. Positive impacts of fishing operation and wild-fish attraction to cage farms on the environment and economics

	Factors	Impacts (positive)
Wild-fish assemblages (Family) involved	***Feeding activity by finfish*** • Lutjanidae • Gerreidae • Serranidae • Carangidae • Centropomidae • Platycephalidae • Ariidae • Sillaginidae • Portunidae	Reduces environmental footprint of finfish farming in cages by the removal of excess feed waste
	Scavenging by finfish • Cichlidae • Scatophagidae	Reduces organic input to the substratum/ sediment under the cages by physically increasing faecal pellet settlement time. Facilitates leaching of nutrients from feed/ faecal waste into water column.
	Feeding activity by finfish • Mugilidae	Decrease the anoxic conditions of sediments beneath farms by bioturbation while feeding.
Fishing operation	***Seining operation under the cage***	Dispersal of waste and sediment management, thus circumventing fallowing of cage culture site.Collection of undersized fishes as stocking material for cage farming and recapture of escaped fish possible.
	Economics	Additional income generation apart from cage aquaculture.

predominant in the catch, taking advantage of lost food and possibly preying on the aggregations of smaller fish. The persistent input of artificial feed in cages and the accumulated sedimented waste under fish cages can adversely affect the sediment quality by creating anoxic conditions. The potential positive impact of fishing operation and wild-fish attraction to cage farms on the environment and the economics of *Iliyabalae* is given in Table 2.

Dispersal of waste and sediment management strategies followed in cage-farming include using submerged electrically driven mixers to flush waste from beneath the cage or fallowing of cage culture sites. By adopting seining operation under the cages as described above controlling waste accumulation is possible and the additional income generated by the fish catch is an added advantage.

Indiscriminate exploitation of juvenile black pomfret by ring seines along Kerala coast

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Black pomfret, *Parastromateus niger* is an highly esteemed food fish with a very good demand in local and export markets. Unusual heavy landings of juvenile black pomfret was observed at the Kalamukku Landing Centre on 22nd and 23rd August 2016. On 22nd August, a big shoal of about 2 tonnes (t) of juvenile black pomfret was caught by one mechanised inboard (280 HP engine) ring seine unit. Similarly, on 23rd August about 1.25 t of juvenile black pomfret was landed by two mechanised inboard ring seine units with 440 HP engine power. They were reportedly caught at a depth of about 21 m off Kochi. The catch was landed by carrier boats and auctioned for ₹ 1,55,000 and 1,17,000 respectively on the two days. The fishes were having a length range of 14 - 21 cm each and weighing 55 to 140 g. Similar catches by ring seine units were also observed at Ponnani and Chettuva Landing Centres during the first week of September 2016. Information was received about 26.5 t of juvenile black pomfret in size range 9-13 cm landed at Ponani and around 22 t of pomfrets of size range 7-12 cm at Chettuva Landing Centre during the period. The Minimum Legal Size (MLS) for black pomfret along Kerala coast was recommended as 17 cm total length (Mohamed *et al.*, 2014, *Mar. Fish. Infor. Serv. T & E Ser.* 220:3-7,). In the present

Juveniles of black pomfret landed at Kalamukku, Kochi

Fish hold of carrier boat with juveniles of black pomfret

observation more than 50 % of the promfrets caught were below this MLS with gonads in indeterminate stage. Gut content analysis indicated that most of the stomachs contained semi digested, mud based food mass. This heavy landings of juvenile black pomfret may be due to their mass aggregation in the coastal waters which are productive and rich feeding grounds. Indiscriminate fishing of juveniles can lead to growth overfishing and catch declines. Heavy exploitation of juveniles of black pomfret by gill nets during 1996 and 1997 in Veraval, Gujarat has been attributed as cause for the heavy decline of black pomfret catches in 1998 and 1999 (Savaria *et al.,* 2002 *Mar. Fish. Infor. Serv. T & E Ser.*, 172:4-5). Regulations to prevent the capture of juveniles should be strictly implemented. Fishers should be educated on the importance of responsible fishing and the harmful impacts of catching undersized fishes.

Clam fishery in Chunnambar estuary of Puducherry

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Chunnambar estuary situated about 8 km from Puducherry receives its freshwater inflow during monsoon season from Varahanadhi, a tributary of Palar River and meets the Bay of Bengal. During the observation period, the water temperature and salinity in this shallow estuary ranged from 25 – 33 ^{o}C and salinity 20 – 28 ppt respectively.

This estuary is rich in the backwater clam, *Meretrix casta* which supports the livelihood of fisherfolks from Nonankuppam, Ariyankuppam, Pooranankuppam and Pudhukuppam villages nearly. The clam fishery is distributed up to a stretch about 3 km. Nearly 50 fishers are engaged in clam exploitation. They follow traditional hand picking method with female fishers working in the shallow areas while male fishers exploit clam from 2-3 feet depth. Clam fishing is carried out throughout the year except during unfavourable conditions. Generally, clam picking activities starts early in the morning and carried out for about 3-5 hours each day. Each fisher can collect about 20-30 kg of clam in a day. Harvested clams are sold in the local markets and tourist centres in Puducherry at the rate of ₹ 10 per kg. On an average the male fishers get around ₹ 250 while female fishers can earn around ₹ 175 per day. Total estimated clam exploitation from Chunnambar estuary during January to December 2015 (Fig. 1) was 243 tonnes (t). During the month of November and December, 2015 exploitation took place only for a few days due to heavy rains in this region. The estimated catch of clam in this estuary was about 789 kg per day with the estimated average monthly exploitation of clam being 20.3 t. *M. casta* of 15 to 44 mm length and 0.5-33g weight were observed.

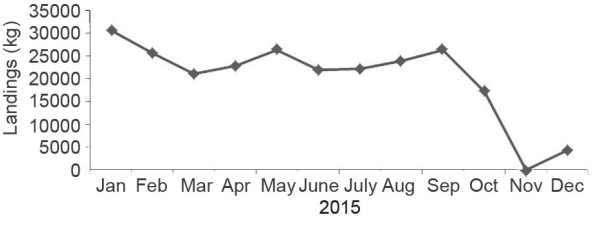

Fig. 1. Monthly estimated landings of clams at Chunnambar estuary

Marine fish landings in Andhra Pradesh during 2015-an overview

Wilson T. Mathew
ICAR-Central Marine Fisheries Research Institute, Kochi.

Andhra Pradesh with a coastline of 974 km and spread over nine districts supports a rich marine fishery constituted by several groups of fishes, crustaceans and molluscs. About 1.5 lakh fishermen are directly or indirectly involved in the marine fisheries sector.

Production trends: The annual total marine fish landings of the state during 2015 was estimated as 2.95 lakh tonnes (t) which was 13.7% less than in 2014. It constituted 8.7% of the all India marine fish landings.

Table 1. Sector wise marine resources landed and the effort expended during 2015.

Sector	Catch ('000 t)	Effort (x000)
Mechanised	87	39
Motorised	149	703
Traditional	59	388
Total	295	1131

Pelagic, demersal and crustacean resources contributed 71%, 18% and 9% respectively. As compared to 2014, there was 7%, 27% and 23% decrease in the landings of these resources respectively. The landings by finfishes, crustaceans and molluscs are depicted in Figure 1. The landings by major resources and its percentage contribution to total landings is given in Table 2.

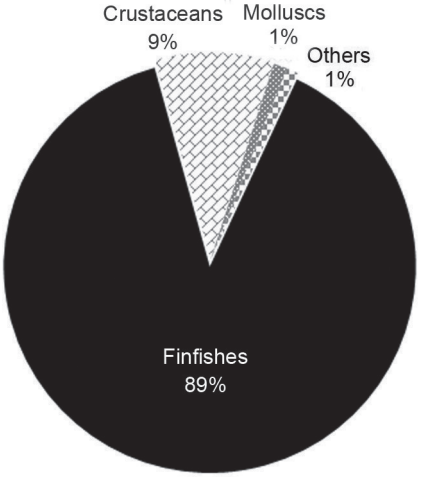

Fig. 1. Groupwise contribution to the landings

Table 2. Marine fish landings in 2015

Major Resources	Landings (t)	% contribution
Elasmobranchs	2,991	1.0
Oil sardine	23,622	8.0
Lesser sardines	75,288	25.5
Stolephorus	6,332	2.1
Other clupeids	5,743	1.9
Perches	10,294	3.5
Goatfishes	5,541	1.9
Croakers	9,106	3.1
Ribbonfishes	8,808	3.0
Carangids	16,582	5.6
Silverbellies	6,608	2.2
Black Pomfret	3,515	1.2
Indian Mackerel	28,236	9.6
Seerfishes	5,288	1.8
Penaeid prawns	19,355	6.6
Crabs	5,543	1.9

The marine fish landings during 2015 has been on the decline except for two major resources viz. oil sardine and lesser sardines which increased to the tune of 98% and 80% respectively as compared to 2014 landings. The landings of silverbellies were almost the same. The decrease in landings as compared to 2014 occurred in the following resources viz. elasmobranchs (45%), *Stolephorus* (8%), other clupeids (15%), perches (28%), goatfishes and croakers (29% each), ribbonfishes (57%), carangids (12%), black pomfret (21%), Indian mackerel (49%), seerfishes (32%), penaeid prawns (30%) and crabs (21%).

Seasonal variations in the catch volumes during the period and the contribution of major resources in each quarter is given (Fig. 2 &Table 3).

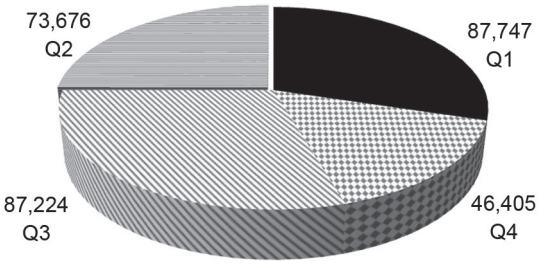

Fig. 2. Seasonal variations in marine fish landings (t) during 2015

Table 3. Quarterwise landings (t) of major resources

Name of resource	Qr 1	Qr 2	Qr 3	Qr 4
Oil sardine	3803	3779	9043	6997
Lesser sardines	16719	23267	17855	17447
Carangids	5892	1700	4335	4655
Indian Mackerel	12444	3382	8038	4372
Penaeid prawns	5388	1777	7166	5024

77% of the total landings were from East Godavari, Visakhapatnam and Srikakulam districts. 74 % of the traditional sector landings were from Srikakulam district alone. 56% of the mechanised sector landings were from Visakhapatnam district followed by 23% in East Godavari district. 39% the motorised sector landings were from East Godavari district followed by Srikakulam district (18%).

The maximum contribution of trawl landings was from Visakhapatnam district (16%) followed by East Godavari district (7%). Mechanised trawl nets were operated in East Godavari, Guntur, Krishna, Prakasam and Visakhapatnam districts whereas motorised trawl nets were operated in Guntur, Nellore and Prakasam districts. 60% of the multiday trawl nets were operated from Visakhapatnam district, 40% of motorised gill nets were operated from Srikakulam district, 38% of Hook & Lines were operated from Visakhapatnam district and 54% of the motorised ring seines were operated from East Godavari district.

Table 4. Gearwise percentage contribution of major resources of Andhra Pradesh during 2015.

Resource / Gear	Mechanised sector		Motorised sector						Traditional sector
	TN	GN	GN	HL	RS	SS	TN	others	
Elasmobranchs	48	-	27	19	1	-	4	-	1
Perches	67	-	12	9	2	-	-	-	9
Goatfishes	70	-	11	-	3	-	-	-	16
Croakers	51	-	22	2	9	1	2	-	13
Ribbon fishes	66	-	19	-	5	2	1	-	8
Carangids	28	1	24	13	12	-	-	-	23
Silverbellies	56	-	15	-	11	-	-	-	17
Pomfrets	50	-	17	-	26	-	1	1	3
Mackerel	16	-	21	-	46	-	-	-	17
Seerfishes	28	-	34	18	10	-	-	-	10
Oil sardine	-	-	2	-	85	1	-	10	2
Other sardines	1	-	26	-	26	-	-	-	47
Stolephorus	55	-	4	-	33	-	-	-	7
Other clupeids	22	-	32	-	9	1	1	-	34
Penaeid prawns	79	-	8	-	4	-	8	-	1
Crabs	54	-	28	-	1	-	4	-	13

TN: Trawl Net, GN: Gill Net, HL: Hook & Lines, RS: Ring seines, SS: Shore seines

Oil sardine from Tamil Nadu in fish markets of Kerala

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ICAR-Central Marine Fisheries Research Institute, Kochi

Oil sardine, *Sardinella longiceps* is a highly favoured fish in Kerala, due to the unique taste of locally caught sardines, as perceived by many fish consumers in the state. Normally, the oil sardine forms the major catch of traditional fisherman in Kerala almost around the year. Recently, after the peak landings in 2012, catches have showed drastic decline with the trend continuing in 2016 also (Fig. 1). It directly affected the livelihood of thousands of local ringseine fishermen. Several reasons including environmental / oceanographic changes associated with *El Niño* and the high exploitation of juvenile sardines in recent past, have been attributed to this decline in sardine catches. Demand for oil sardine is always high in Kerala and with local supply disrupted due to decline of the fishery, several tonnes of oil sardine, mainly from Tamil Nadu was transported to Kerala to meet the consumers demand. Trucks from Tamil Nadu mainly from Cudaloor, Puducherry and Nagapattinam region were regularly coming to Kerala with capacity of 200 boxes, each containing 30 kg of oil sardines in iced condition as revealed during regular surveys of landing centres. Sardines were unloaded at major landing centres based on demand from the local agents. Immediately after unloading, fishes were washed and sorted based on size and appearance (freshness); repacked in ice and sent to the local markets. The washed and repacked sardines (Chala) appearing fresh were marketed as freshly caught Kerala sardine prefixed with local landing centre names like Vypin chala, Ponnani chala, Punnpra chala to attract buyers and fetch higher prices, which varied between ₹ 80-140 per kg. Evidently the price increased heavily in this particular market chain, when oil sardine caught in Tamil Nadu reached fish markets in Kerala and the profit earned by the middlemen involved in the marketing process was higher than the fishermen themselves.

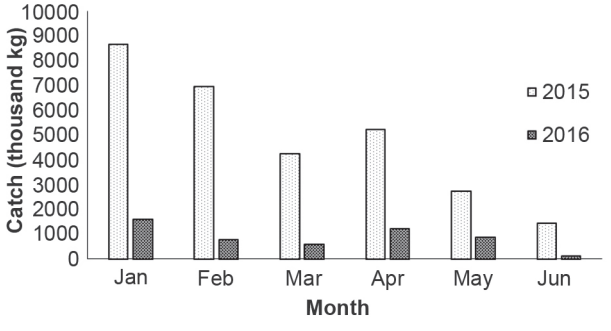
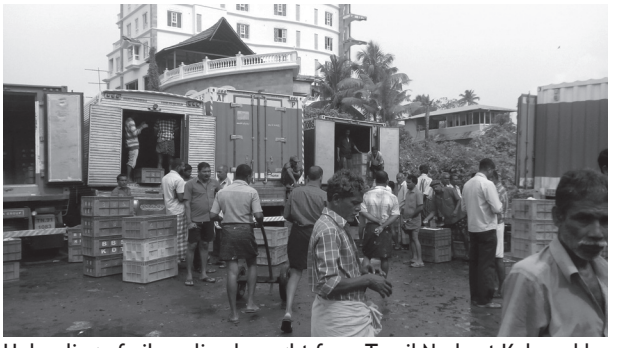


Fig. 1. Monthly landings of oil sardine in Kerala for the year 2015 and 2016



Unloading of oil sardine brought from Tamil Nadu at Kalamukku

Washing and sorting

Re-iced in boxes for local markets

A preliminary assessment on the mass mortality of fish at Rameswaram

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A massive fish kill was reported at Agnitheertham that covers an area of around 200 metre long shoreline, near Rameswaram temple on 09.11.2015. Juveniles of fishes, crabs and shrimps were seen on the sand and in between the rocky crevices. Large shoals of juveniles of many fish species were swimming in a passive manner. The dead fish assemblage at the site included finfishes like *Gerres abbreviatus, Siganus javus, Terapon jarbua, Plicofolis tenuispinis, Sardinella albella, Sardinella gibbosa, Selaroides leptolepis, Platycephalus indicus, Scatophagus argus* and crustaceans like *Portunus pelagicus* (crab) and *Penaeus latisulcatus* (shrimp). Water samples were collected from the site and analysed for Dissolved Oxygen, pH, salinity, temperature, hardness, Ammonia, Nitrite and nitrate (Table 1). Microbiological analysis revealed the dominance of bacteria belonging to the genus *Streptococci* in all the four water samples.

Table 1. Water quality parameters at the site

Parameter	Measured values (Range)
Temperature	28.5 - 29.1° C
Salinity	34 - 35 ppt
pH	7.56 - 7.82
Dissolved oxygen	0.75 - 0.98 ppm
Hardness	161.1 - 179 ppm
Ammonia	0.25 ppm
Nitrite	0.25 - 0.5 ppm
Nitrate	< 0.5 ppm

It was observed that, Dissolved Oxygen (DO) level was very low in the water and coupled with the ammonia and nitrite levels could be the reason for the fish kill. A case of mass mortality of trigger fish, *Odonus niger* were observed in 2007 near Dhanushkodi (Bindu *et.al.*, 2008 *Mar.Fish. Infor. Serv. T&E Ser*. No.197). However, in the present case it was an assemblage of different species of fishes. Most of the fishes killed in the present case were juveniles of the fishes normally seen in the near shore waters. The exact cause of this deteriorated water quality which led to the fish kill, could be traced only by a holistic investigation of all related activities of the region. The Rameswaram Fishing Harbour is located very near to the site of fish kill. The season of bumper landings of sardines locally known as *Peichalai* had commenced a week before the mortalities occurred. The heavy landings unloaded in the harbour area are taken by the trucks normally. It is inferred that heavy rains in the preceding two weeks might have affected the proper handling and transport of the bumper landings, leading to deterioration of the water quality in the nearby areas.

Landings of juvenile *Uroteuthis* (*Photololigo*) *singhalensis* in Tuticorin Fishing Harbour

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In Tuticorin Fishing Harbour about 200 trawlers operate daily from 5 am to 11 pm for single day fishing. Wooden and steel trawlers in three sizes, namely small boats (OAL 35-40 feet), medium boats (OAL 40-50 feet) and large boats (OAL up to 80 feet) operate from this harbour. During July to September

period, about 30 to 40 small and medium sized wooden trawlers are regularly engaged in the squid fishery. The major cephalopod species landed are *Uroteuthis (Photololigo) singhalensis*, *U. (P) duvaucelii*, *Sepia pharaonis* and *Sepioteuthis lessoniana*. Other species like *Sepia prabahari*, *Amphioctopus aegina, Amphioctopus neglectus* and *Octopus* sp. occur as stray catches. *Uroteuthis(P) singhalensis* is the dominant species with peak landings during July and August months. During the regular observations at Tuticorin fishing harbour, it was observed that juveniles of *U. singhalensis* were landed between September and December 2015. The squids were in the size range of 30 to 178 mm (dorsal mantle length) with an average length of 72 mm. The reported Size at First Maturity of *U. (P) singhalensis* is 118 mm (female) and 130 mm (male) dorsal mantle length. In the present observation 95% of the squids were below the size of 100 mm. Biological studies (n=240) revealed 81% of catch was immature stage specimens followed by 15% with maturing gonads and only 4% were mature. While larger size of *U. (P) singhalensis* fetches around ₹140 – 190 per kg, small sized juveniles were sold only for ₹ 8-10 per kg indicating an economic loss and it can adversely affect the cephalopod fishery.

Details of trawlers sampled and estimated catch of Juvenile squids

Date	Trawler Units sampled (in numbers)	Catch of juvenile squid (tonnes)
09.09.15	15	7.5
21.09.15	13	6.0
14.10.15	14	3.5
31.10.15	10	2.0
07.11.15	19	6.5
30.11.15	20	4.5
04.12.15	8	1.3
22.12.15	9	0.5

Rare occurrence of leatherback turtle at Visakhapatnam

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Regional Centre of ICAR - Central Marine Fisheries Research Institute, Visakhapatnam

Nesting of olive ridley turtles have been reported frequently along Visakhapatnam coast but there are few reports of leatherback turtle along this coast. On 10th September, 2016, a leatherback turtle *Dermochelys coriacea* accidentally entangled in a monofilament gill net operated by a country craft at 30 to 40 m depths at Mutyalammapalem about 50 km south of Visakhapatnam, was brought to the landing centre by fishermen. Later it was released back into the sea. The weight of turtle was 320 kg. Morphometric measurements were recorded as given below

Total length	188 cm
Carapace length	160 cm
Carapace width	76 cm
Flipper length	82 cm
Head length	28 cm

Leatherback turtle landed at Visakhapatnam

Leatherback turtles belong to the family Dermochelyidae. They are categorized as Vulnerable on the IUCN Red List (www.iucnredlist.org) and are incorporated into Schedule-I of the Indian Wildlife

(Protection) Act, 1972. They are also recorded in Appendix-I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and Appendices I and II of the Convention on Migratory Species (CMS).

Indo-Pacific humpbacked dolphin washed ashore at Karwar, Karnataka

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Karwar Research Centre of ICAR-Central Marine Fisheries Research Institute, Karwar

A dead dolphin was washed ashore at Aligadda beach, Karwar on 1.7.2016. From the external characters it was identified as Indo-Pacific humpbacked dolphin, *Sousa chinensis*. The specimen was a male, 233 cm in total length and weighed 110 kg. The animal had scratches on the skin in the head portion. Detailed morphometric measurements (in cm) of the specimen are listed below:

Total length (tip of upper jaw to deepest part of notch between flukes) : 233

Length (tip of upper jaw to centre of eye): 45

Length of snout (tip of upper jaw to apex of melon): 20.5

Length of gape (tip of upper jaw to angle of gape) : 37

Length (tip of upper jaw to external auditory meatus) : 50

Centre of eye to external auditory meatus (direct): 8

Centre of eye to angle of gape (direct) : 7

Centre of eye to centre of blowhole (direct) : 20

Length (tip of upper jaw to blow hole along midline): 41

Length (tip of upper jaw to anterior insertion of flipper) : 61

Length (tip of upper jaw to tip of dorsal fin) : 143

Length (tip of upper jaw to mid point of umbilicus): 116

Length (tip of upper jaw to mid point of genital aperture) : 131

Length (tip of upper jaw to centre of anus) : 160

Girth (on a transverse plane intersecting axilla) : 100

Girth (on a transverse plane intersecting the anus): 80

Length of (flipper (Anterior insertion to tip) : 37

Length of (flipper (Axilla to tip) : 25

Width of flipper (Maximum) : 15

Height of dorsal fin (Fin tip to base) : 19

Width of flukes (Tip to tip) : 59

Distance from nearest point on anterior border of flukes to notch:19

Number of teeth (Upper jaw): 34+34

Number of teeth (Lower jaw): 34+34

Fig. 1. Humpbacked dolphin stranded at Karwar

Two instances of the stranding of humpbacked dolphins have been reported from Aligadda beach, Karwar during October 2015 and March 2016. The present stranding is the third one in the same area within a short period.

Envenomation by box Jellyfish

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During the month of August 2016, two cases of envenomation by jellyfishes were reported from Dhanushkodi and Rameswaram. In the Dhanuskodi incident, two fishermen were stung by jellyfish tentacles attached to the gill net they were operating. Initially both these fishermen felt that the pain due to the sting would go within a few hours. However their pain started to increase with severe low back pain, excruciating muscle cramps and nausea. This kind of pain development due to jellyfish sting is characteristic of Irukandji syndrome. Enquiries with local fishermen revealed that a box jellyfish locally known as " *Naalu Moolai Sori*" was responsible. In the second incidence, a fisherman working in a trawler was stung when he handled the box jellyfish in the catch. He felt difficulty in breathing along with unbearable pain and swelling around the shoulder and throat. In both the cases the doctors at the district headquarters hospital in Ramanathapuram administered saline and pain killer but the agonizing pain started to diminish only after 24 hours and they had to be bed ridden for nearly four days.

Irukandji syndrome is a condition induced by the envenomation by the sting of a box jellyfish *Carukia barnesi*, a native of Australian marine waters. It is derived from the Australian Irukandji tribe who were often affected by stings of this box jellyfish. Many other species of box jellyfishes also sting and cause similar symptoms. All the three victims of jellyfish sting were interviewed to ascertain the variety of jelly fish involved in the incidents by showing photographs of various species to them. From the description on the concentration of the stinging cells in bands on the tentacles and photographic verification by the victims, it was concluded that a box jellyfish from the family Carybdeidae was mainly responsible for this kind of envenomation. There is no antivenom for this kind of jellyfish sting, but vinegar poured on the sting site, is reported to reduce the firing up of further nematocysts, thereby reducing further venom being injected (Fenner and Hadok, 2002, *Med. J. Aust*. 177(7): 362). Death due to the sting of *Nalu Moolai Sori* (Box Jelly fish) has been reported from Gulf of Mannar once earlier (Lal Mohan, 1971, *Current Science*, 40 (23): 637). However there may be many unreported cases also among the fishers.

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