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Marine Fisheries Information Service

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Front Cover : *In-board ring seiner loading catch to carrier units*

Back Cover : *Ring seine unit with carrier boat proceeding for fishing*

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.

Marine Fisheries Information Service

From the Editorial Board.......

Warm greetings to all

In this issue, the lead article covers the ring seine fishery of Kerala. An innovative gear, it has occasionally sparked off debates on its phenomenal increase in fishing capacity and increasing popularity *vis-à-vis* sustainable exploitation of small pelagics fishery resources like oil sardine, mackerel and anchovies for which it is mainly employed. Other articles included are regarding the assessment of the effect of clam fisheries of Ashtamudi Lake on the local biogeochemical processes and various notes on marine biodiversity, marine fisheries and aquaculture that is of contemporary interest.

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

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Ring seine fishery of Kerala: An overview

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Among the various fishing gears employed for pelagic schooling fishes along the Kerala coast, seines are the most efficient. Contribution of ring seine to total marine fish landings of Kerala has steadily increased since its introduction during the early eighties. It was 21.4 % in the nineties rising to 36.7 % during the period 2000-2004 and contributing more than 50 % since then. In recent years, about 90 % of the oil sardine and about 60 % of the mackerel landed in Kerala were caught in ring seines. Ring seines were introduced during the early eighties by traditional fishers of Alappuzha District which became highly successful. The new fishing method spread to entire Central and Northern Kerala and Kollam District towards south, replacing almost all the prevailing fishing gears for pelagic resources. However, due to consistent opposition to ring seines from traditional fishers they have not been introduced in Thiruvananthapuram district till date.

Craft and gear characters

During the initial phase of introduction, ring seines were operated from small dug-out canoes of 6.5 to 9.8 m overall length (OAL) which were manually propelled using oars. Since more time and energy was required to reach the fishing grounds and search for shoals, the fishing operations were restricted to a distance within 10 nautical miles (nmi). Since 1984 outboard engines were introduced for the propulsion of crafts. Initially 7 hp engines were used which were replaced by 25 hp engines which helped them to reach the fishing grounds and back very quickly. By 1987, almost all country crafts were fitted with out-board (OB) engines. Later, larger vessels with OAL between 13.7-18.3 m known as *Vallom* were widely introduced with fishing activities extending to areas beyond 10 nmi. These were gradually replaced with large sized plank built boats with an OAL of upto 20 m, locally known as *Thanguvallom,* with a crew of 25 or more fishermen.

The capitalization continued in the sector by using three 25 hp OB engines which increased to three 40 hp engines and became commonplace. For this, the fibreglass coated *Kettuvallam* with a transom stem made of marine plywood with facilities to fit 3 outboard engines conveniently was introduced. However, the craft had no fish hold facility and this led to introduction of carrier boat system for quick transport of catch to landing centres, while the main unit continued fishing. In early 2000, the introduction of inboard diesel engines (IB ring seiners) was a significant development and the trend has continued with increase in size of the craft and engine power. Large boats called "*Thanguvallom*" of OAL between 19.8 - 25.9 m, breadth 3.6 - 4.5 m and depth 2.1 - 3.4 m powered by inboard diesel engine became popular. Initially, most of these units used 180-225 hp IB engines. Recently, vessels with 30 m (100 feet) OAL, fitted with Chinese made high speed IB engines of over 400 hp are operating. With the introduction of large nets, purse line winches were fitted in these vessels to facilitate quick closing and hauling of the gear. Medium sized boats of 10.7 - 13.7 m OAL known as *Vallom,* fitted with OB engine of 25 hp and above are being used as carrier vessels by these fishing vessels.

Till the middle of 1960s different kinds of boat seines made up of cotton and hemp fibres, popularly known as *Ayilakollivala / Ayilachalavala / Adakkamkollivala* were used. After that a new boat seine called *Pattenkolli* made of nylon fibre was introduced, with much smaller size mesh, that dominated the fishery till mid 1980s. Ring seines first introduced in 1982 were broadly grouped into two categories, the small meshed *Choodavala/*

Discovala and large meshed *Thanguvala/Ranivala*. The *Choodavala/Discovala* is relatively smaller in size below 250 m in length, 30-70 m depth, with 8-12 mm mesh webbing and targets anchovies and perchlets. The *Thanguvala* that mainly targets oil sardine and mackerel generally is 800 to 1000 m in length, 80 to 100 m in breadth with 22 mm mesh and weighs between 1.5 to 2 tonnes (t). Several modifications have been made by the fishermen in the design of the gear to enhance its performance. However, tempo of gear modifications has been much slower compared to that of crafts.

Ring seine net being loaded on to an IBRS unit

Ring seine nets operated by IBRS units being mended

Ownership Pattern

In the ring seine sector, ownership of the fishing units is either individual or collective. The individual ownership is restricted to smaller crafts up to 40 feet OAL, which are generally non-motorised or fitted with outboard motors (OBM). For larger sized crafts, the ownership is collective with the unit being owned by a group of fishermen (share holders).

Fishing operation

The gear is operated in near shore area within the depth zone of 10-50 m and up to 12 nautical miles (nmi) from shore. Fishing units move to different areas in search of fish shoals based on sea conditions, wind and current patterns, movement of seabirds and/or sea mammals which are used as indicators of presence of fish shoals. Earlier, surface shoals were identified by experienced fishers from the shoal behaviour. Currently, SONAR with digital display is being widely used to locate and identify the shoals. If very big shoals are located, information is communicated to other units at sea or on shore and accordingly more units move to the fishing ground.

Shoals are encircled with the net towed at maximum speed to minimize fish escape. The trapped fishes are concentrated close to the craft at bunt portion and net hauled to mother boat. If the shoal is very big, partial harvest with scoop nets is done. Catch by small vessels is transported directly by the fishing units themselves to the landing centres which may return to the same ground to fish until the shoals are exhausted. Thus in a day, two to three operations are carried out by small vessels, depending on distance to the ground. In the case of larger crafts, while the vessel remains in the fishing ground and continues fishing, one or

Carrier boats landing at Thottappally Fisheries Harbour, Alappuzha District

Carrier boat with catch of anchovies

more carrier vessels associated with it are used to transport catches to the shore.

Attack by dolphins and puffer fishes are common during ring-seining usually during the time of hauling the catch on-board. This leads to heavy loss to the fishers through net damage and fish escape. It also increases labour and causes loss of time. Such incidents are more frequent in recent days, after extension of fishing activities to deeper waters. The issue is being addressed by operating Dolphin Wall Net (DWN) locally known as "*Pannivala*" around the ring seine. Once the fish shoal is encircled by the ring seine, it is surrounded by DWN operated from a dinghy/carrier vessel. DWN is made up of 300-400 mm polyethylene webbing of 1.5 mm twine and 1000 – 1500 m length framed with float line and steel rings hanging from the lower edge. Two types of DWN are in use, one with conventional plastic float with selvedge for reducing entanglement of floats to the webbings, other with thermocol blocks and oil cans as floats and without selvedges.

Trends in fishing effort

Since its introduction in 1982, effort by ring seines have increased steadily. Inboard ring seines (IBRS) first introduced in 1999 became more popular due to high catch rate and return and resulted in its wide adoption subseqently. The upward trend in effort by outboard ring seines units (OBRS) continued till 2008 after which it started declining. Total effort in active fishing time also shows similar trend (Figs. 1 & 2). The upward trend in effort from 2002 by inboard ring seines also continued till 2012 and declined thereafter due to low catch and catch rates, which made their operations economically unviable.

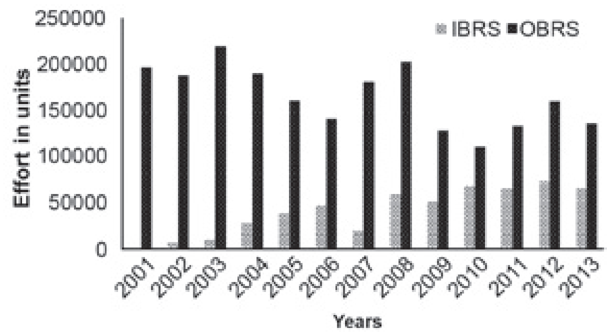

Fig. 1. Fishing effort (in units)by OBRS and IBRS units along the Kerala coast during 2001-2013

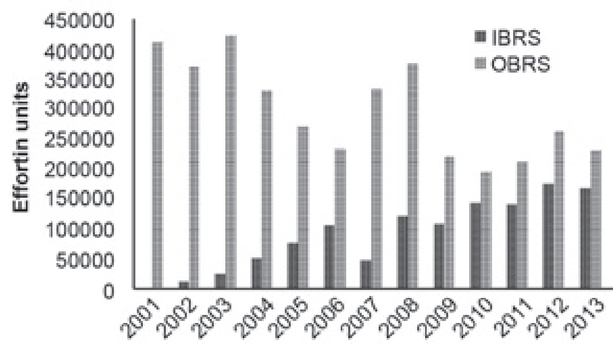

Fig. 2. Fishing effort (in hours) by OBRS and IBRS units along the Kerala coast during 2001-2013

Ring seine catch characteristics

Ring seine, which is the major gear operated along Kerala coast contributed about 51 % of the total annual landings of the state during 2008-2014. Since its introduction, there was steady increase in fish landings till early nineties followed by a steep fall in production in 1994 due to the drastic decline of the oil sardine fishery. Following the revival of the oil sardine stock, the production reached an all-time high of nearly 4 lakh t in 2012. Peak landing by outboard sector occurred in 2003 after which it has fluctuated over the years. Landings by inboard sector registered steep increase during 2009-2012 period after which it has declined sharply (Fig. 3).

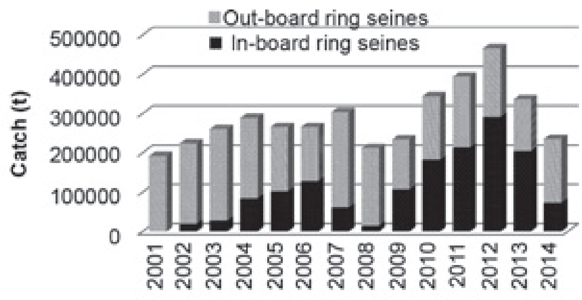

Fig. 3. Catch trend in IBRS and OBRS units off Kerala coast during 2001 - 2014

Oil sardine (*Sardinella longiceps*), Indian mackerel (*Rastrelliger kanagurta*) and white baits (*stolephorus* spp.) are the most dominant resources accounting for about 84% of the ring seine catch. Other resources caught are the lesser sardines, clupeids, coastal tunas, seerfishes, ribbonfishes, carangids and penaeid prawns (Table 1). Oil sardine is the mainstay of the marine fish landings in Kerala with average landings during 2011-2015 being 2.24 lakh t. Ring seine is the major gear used for fishing oil sardine and contributed to 94% of the total oil sardine caught in the state during the period. Oil sardine in the fishery was supported by 45-220 mm size fishes with bulk formed by 100-170 mm size groups. During 2011-2014 period oil sardines below 140 mm total length (TL) which is the Size at First Maturity (L_m-the length at which approximately fifty percent of the fishes are mature) formed about 66% of the estimated numbers landed while juveniles below Minimum Legal Size (MLS) of 100 mm formed only 12 %. Indian mackerel is the second dominant species exploited by ring seine. The average annual landing of mackerel in the ring seine during 2011-2015 was 0.28 lakh t which formed 9.8% of the total ring seine landings of Kerala. The size groups that supported the fishery was 105-260 mm with a mean size of 179 mm.

Anchovies contributed 11.3% of the total ring seine catch during the period. Fishery was supported by more than 10 species of the family Engraulidae. Lesser sardines constituted 3.8 % of the ring seine catch and generally formed a major portion of the catch by ring seines operated in the southern districts. Among lesser sardines, *Sardinella gibbosa*, *S. albella* and *S. fimbriata* dominated the catch. Catch of juveniles of other large pelagics like seer fishes, tuna and carangids also occurs occasionally. The juveniles of sardines and anchovies were more predominant during June-September period and that of mackerel throughout the monsoon and post

Table 1. Major resources landed by ring seines along the Kerala coast and their percentage contribution during 2010-14

Species/group	Mechanised ring seine (%)	Out board ring seine (%)
Major resources		
Oil sardine	63.77	62.01
Other sardines	5.75	2.89
Mackerel	17.84	6.10
Stolephorus spp.	2.22	10.58
Coastal tunas	2.56	0.02
Scads	2.41	0.52
Minor resources		
Rays	0.003	0
Wolf herring	0	0.05
Thryssa spp.	1.68	4.17
Belonids	0.01	0.32
Croakers	0.15	1.09
Ribbon fishes	0.34	0.01
Horse mackerel	0.23	0.06
Silver bellies	0.01	0.26
Big-jawed jumper	0	0.08
Barracuda	0	0.01
Sliver pomfret	0	0.03
Mullets	0	0.01
Soles	0.04	0.44
Prawns	0.42	3.95
Crabs	0	0.03
Squids	0.04	0
Other clupeids	1.80	3.70
Other perches	0.05	2.05
Other carangids	0.45	1.52

monsoon months (June-November). Catch of juvenile fishes off Kerala coast has becomes a major concern among the scientific community as well as fishers during recent years.

Summary

Ring seines fishery, since its introduction has registered steady growth both in terms of fishing effort and yield till 2012. Thereafter, due to declining catches, mainly of oil sardine, economic returns were affected adversely. Recently, the seriously dwindled catches of oil sardine along the Kerala coast has rendered the ringseine operations economically unviable. Though the oil sardine catch in the gear was supported mainly by immature fishes, major share of the catch was above the declared MLS of 100 mm total length. Moreover, spawning stock biomass was also high at 30-38% during 2010-2014, which is sufficient to sustain stock and fishery of this resilient species.The *El Nino* which set towards the end of 2012, intensified during successive years with peak impact in 2014 and 2015 as indicated by the Oceanic Nino Index (ONI). The impact of *El Nino* appeared to be highly adverse for oil sardine. The prevailing environmental conditions along the west coast especially along Kerala coast was not conducive for immediate recovery of the oil sardine fishery as indicated by the poorly fed conditions and stunted growth. Apparently unfavorable environmental conditions have resulted in migration of the oil sardine to areas with more favourable ecological conditions. Earlier studies suggest that oil sardine will come back when impact of *El Nino* subsides. The recent crisis in fishery due to drastic decline of the oil sardine fishery off Kerala coast as well as the declaration of the MLS For 14 commercially important species including oil sardine and mackerel through a government notification (GO(P) No. 40/15/F& PD dated 24th July 2015) facilitated by scientific inputs of ICAR-CMFRI has increased awareness among ringseine fishers on the adverse effects of juvenile fishing (Ramachandran and Mohamed, 2015 *Economic & Political Weekly*, Vol. 1., No. 35).

The Central Institute of Fisheries Technology (CIFT) had recommended only about 300 units of ring seines for the Kerala coast but a study by South Indian Federation of Fishermen Societies (SIFFS) in 1998 estimated 1636 ringseine units operating with an estimated 2277 numbers of nets. The overall dimensions of the gear had also grown three to four times from the design introduced by CIFT (Edwin *et al*., 2010, *Proc. National Seminar on Conservation and Sustainability of coastal living resources in India, SOFTI (India), CIFT, Cochin)*. Even now, fishers themselves are continuing to make changes in design and size of the gear according to their vessel capacity to get better catches. Studies have indicated that simple doubling of the gear length increases the effective fishing area by almost 4 fold. A combination of increased gear and vessel size, engine power etc. will therefore enhance the fishing capability several fold leading to high fishing pressure on the stock. Hence, strict measures to regulate the excessive fishing pressure is required.

Depending on the distance to fishing ground and availability of shoals, small ring-seine units are undertaking several fishing trips in a day. Larger vessel units on the other hand remain in the sea and continue fishing till the shoals are fully tapped. These intense fishing practices prevent escape of even a small part of the shoal and raise concerns of sustainability. It is advisable to enforce regulatory measures such as number of fishing trips in a day or season, number of carrier boats and trips, engine horsepower or even quantum of fish that can be caught and landed by the ring seine units to ensure sustainable exploitation of the resources. As a large number of fishermen depend on ring seine fishing for their livelihood, these conservation and regulatory measures need to be developed in consultation with the stakeholders.

Assessment of biogeochemical processes of Ashtamudi Lake ecosystem in relation to clam fishery

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Background

The Ashtamudi Lake ecosystem in Kerala (southwest coast of India) is well known for its clam resources. This estuarine system contributes approximately 80% of the total clam export trade of India besides providing livelihoods for at least 3,000 local people. Among bivalves, clams are an important source of meat for human consumption while its shells are used in the cement industry.

As part of eco-labelling the scientifically managed clam fisheries of Ashtamudi Lake, the ICAR-Central Marine Fisheries Research Institute (CMFRI) in collaboration with World Wide Fund for Nature (WWF) probed the ecosystem benefits coming out of the management initiatives. Under the clam management programme, the stock status of clams of Ashtamudi Lake is assessed every year. Five zones were identified (Mohamed *et al.,* 2013.

Fig . 1. Map of Ashtamudi Lake showing sampling zones

CMFRI Special Publication 114) of which Zone II and Zone IV were selected for the present study. Accordingly, a rapid appraisal of selected biogeochemical processes was carried out in these two zones analyzing two scenarios in Ashtamudi Lake (a) Clam bed with fishery in Zone II and (b) No clam in Zone IV respectively (Fig 1).

Methodology

The physico-chemical parameters were analysed by sampling water and sediment from these zones. The clam bed with fishery in Zone II (Scenario A) and No-clam bed (Scenario B) were compared for understanding the differences in bio-geochemical processes occurring in these two types of habitats. Samples of water, sediment, plankton and benthos were examined using standard methods. Assessment of water quality (in terms of nutrients, particulate organic matter, particulate inorganic matter, chlorophyll, Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD) etc.) and sediment quality in terms of organic carbon, oxidation reduction potential, available nutrients, texture etc. were done using standard procedures.

Results

The clam bed with fishery had marked variation in the selected biological characteristics from No-clam zone (Table 1). The observed water quality parameters are given in Table 2. The water quality remains within the optimum range in the presence of clams with fishery. The sediment quality assessment for the two scenarios is given in Table 3. The sediment quality was found to be better in the presence of clams. The role of clams in maintaining a healthy ecosystem was evaluated. These results are presented in Table 4 with probable reason for each observed effect.

Table 1. Biological characteristics of selected locations in Ashtamudi Lake

Biological Characters	Zone II Clam Bed with Fishery	Zone IV No Clam Zone
Mean Clam (Numbers)	85	0
Mean Clam weight (g)	196	0
Diatoms Count (millions ml^{-1})	3.507	3.107
Benthos Biomass, (g m^{-2})	48.44	95.16

The comparison of ecosystem processes made in the two scenarios, based on the results of water

Table 2. Water quality characteristics at selected locations

Parameters	Zone II Clam Bed	Zone IV No Clam	Optimum range
Chlorophyll a, µg l^{-1}	21.34	18.93	17-40
Temperature, ^{O}C	27.5	28.4	25-32
Salinity, PSU	30	28	2 - 48
Dissolved oxygen, mg l^{-1}	4.44	4.44	5 -10
TSS, mg l^{-1}	154.1	78.1	25-200
BOD, mg l^{-1}	0.49	0.89	<15
COD, mg l^{-1}	19	10	<70
Particulate Organic matter, mg l^{-1}	23.59	16.17	
Particulate Inorganic Matter, mg l^{-1}	130.5	61.92	
pH	7.5	7.6	7.0-8.7
Total ammonia – N, mg l^{-1}	0.094	0.03	0-0.1
Nitrite – N, mg l^{-1}	0.003	0.003	0-0.5
Nitrate – N, mg l^{-1}	0.051	0.05	0.1-3
Dissolved orthophosphate, mg l^{-1}	0.003	0.001	<0.01
Silicate, mg l^{-1}	1.68	0.303	> 5

Table 3. Selected Sediment Quality characteristics of Ashtamudi Lake

Parameters	Zone II Clam Bed	Zone IV No Clam	Optimum range
Sediment organic carbon, %	1.77	0.9	1.5 – 2.5
Oxidation – Reduction Potential, mV	-44	-97	> -200
Salinity, PSU	11.49	7.15	> 2.2
Ammoniacal – N, ppm	3.23	1.85	Together as available nitrogen, 250 - 750 ppm
Nitrite- N, ppm	0.05	0.02	
Nitrate-N, ppm	0.36	0.33	
Available Phosphorus, ppm	77.35	60.29	> 60
pH	7.22	7.65	6.5 – 7.5
Sand, %	68.6	82.1	40
Silt, %	17.0	10.9	30
Clay, %	14.1	6.8	30

Table 4. Comparative analysis of Scenario A: Clam bed with fishery versus No Clam Zone

Parameters	Scenario A : Clam Bed with fishery	Probable reason
Diatoms	Diatoms more	More nutrient release
Chlorophyll	≈1.13 times more	More nutrient release
Water temperature	≈ Same	
TSS	≈ 2 times more	May be due to clam fishing
Water salinity	≈ Same	
DO	≈ Same	
COD	≈ 1.9 times more	More oxidation due to clam bioturbation
Water pH	≈ Same	
Total ammonia-N in water	≈ 3 times more	From clam faeces
Nitrite-N in water	≈ Same	
Nitrate-N in water	≈ Same	
Dissolved orthophosphate in water	≈ 3 times more	From clam faeces
Silicate in water	≈ 5.6 times more	From clam faeces
Particulate organic matter	≈ 1.5 times more	From clam faeces
Particulate inorganic matter	≈ 2 times more	From clam faeces
Sediment organic carbon	≈ 2 times more	From clam faeces
Sediment salinity	≈ 1.6 times more	More nutrient release
Ammoniacal N in sediment	≈ 1.8 times more	From clam faeces
Nitrite N in sediment	≈ 2.5 times more	From clam faeces
Nitrate in sediment	≈ 1.09 times more	More oxidation due to clam bioturbation
Oxidation –Reduction Potential in sediment	≈ 2.2 times more oxidative	More oxidation due to clam bioturbation
Available phosphorus in sediment	≈ 1.3 times more	More oxidation due to clam bioturbation
Sediment pH	≈ Same	
Sand in sediment	≈ 1.2 times less	From clam faeces
Silt in sediment	≈ 2 times more	From clam faeces
Clay in sediment	≈ 1.6 times more	From clam faeces

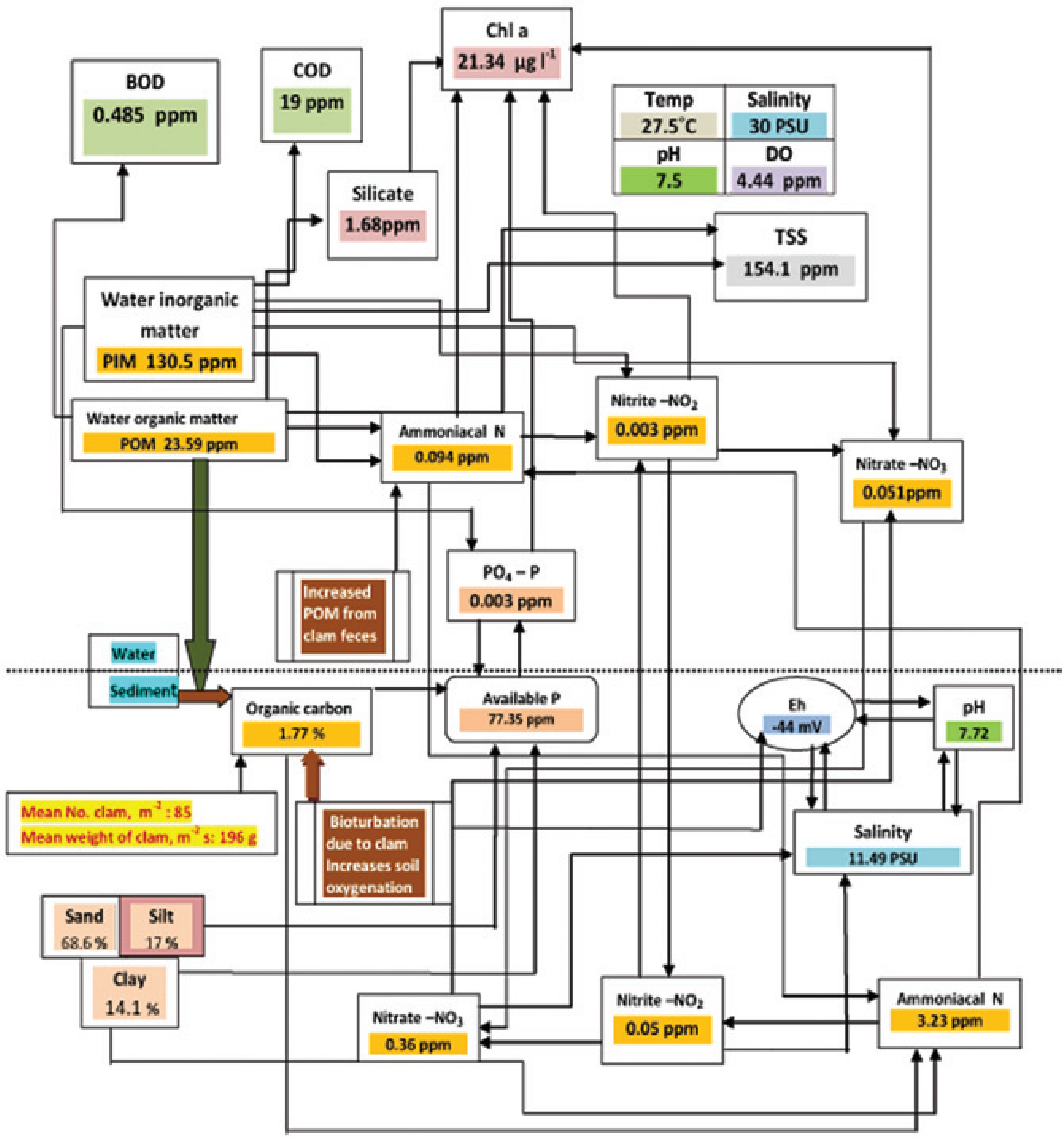

Fig. 2. Ecosystem processes in Ashtamudi Lake in clam bed with fishery (Scenario A)

and sediment quality revealed the following biogeochemical cycles as depicted in Figs. 2 and 3.

- In the Ashtamudi Lake clam bed with fishery, oxidation reduction potential of surface sediment was two times higher due to bioturbation by clams and the amount of nutrients released in the water was three fold higher, compared to the No-Clam Zone.

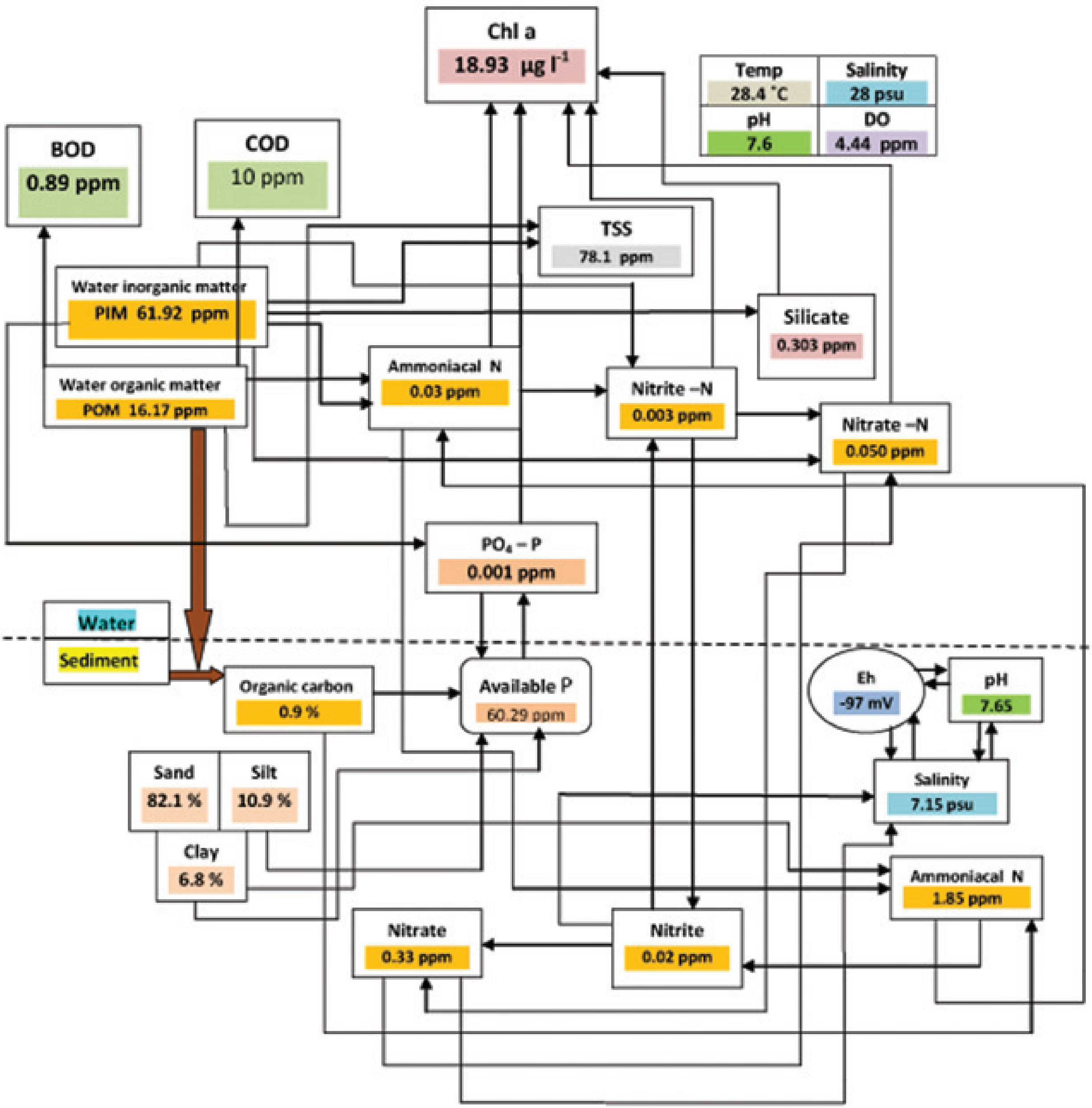

Fig. 3. Ecosystem processes in Ashtamudi Lake in No-clam region (Scenario B)

- Beneficial effects on biogeochemical processes were indicated in areas where clam resources are fished.
- The environmental quality indicators remained well within permissible levels (as per UNEP standards) in clam bed with fishery, improving the ecosystem processes simultaneously.
- Sustainable maintenance of clam beds with optimum fishery is necessary for the general ecological health of the Ashtamudi Lake

Acknowledgements

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An overview of the marine fish landings in Andhra Pradesh during 2014

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The estimated marine fish landings in Andhra Pradesh during the year 2014 was 3.41 lakh tonnes (t) as compared to 2.66 lakh t in 2013 showing an increase of 28%. The state's contribution to the all India landings during 2014 was 9.5 %. Resources such as Indian mackerel and lesser sardines constituted the maximum, being 16.3% and 12.2% of the landings respectively. Tunnies and penaeid prawns landings contributed 8% each while the other important species/ groups were ribbon fishes 5.9%, carangids 5.5%, perches 4.2%, croakers 3.8%, oil sardine 3.5%, goatfishes 2.3%, seer fishes 2.3%, *Stolephorus* spp. 2%, crabs 2%, Silverbellies 1.9% and elasmobranchs 1.6%. Landings of crabs, Indian mackerel, oil sardine, lesser sardines, seer fishes and tunnies had increased by 0.4, 0.65, 1.04, 2.32, 0.56, 1.07 times respectively when compared to 2013 landing trends. Other clupeids and silverbellies had decreased when compared to the previous year landings.

During 2014, 46% of the elasmobranchs were landed by mechanised trawl net and 23% by motorised gill nets; 87% of croakers by motorised ring seines, 81% of goatfishes and 71% of perches by mechanised trawl net. Also, 53% of silverbellies and 90% of lizard fishes caught were landed by mechanised trawl net. 74% of carangids were landed by motorised gill net while Indian mackerel was landed by motorised ring seines (46%), motorised gill net (19%) and by mechanised trawl nets (17%). 87% of oil sardines and 65% of lesser sardines were caught by motorised ring seines while 81% of ribbon fishes and 86% of *Stolephorus* were caught by mechanised trawl nets. Seer fishes were landed by mechanised trawl net (46%), motorised gill net (30%), motorised hook and lines (10%) and motorised ring seines (8%). Tunnies were landed by mechanised gill net (19%), motorised gill net (25%), motorised ring seines (29%), motorised hook and lines (24%), mechanised trawl net (2%) and traditional non-motorised gears (1%). Around 82% of penaeid prawns and 71% of crabs were landed by mechanised trawl nets.

The share of the pelagic, demersal, crustacean and molluscan resources to the total fish landings were 67%,21%,11% and 1% respectively. As compared to the trend in 2013, landings of pelagic resources increased by 54% in 2014 whereas no significant changes were observed for demersal and crustacean resources. Molluscan landings decreased by 22% when compared to year 2013.

Sector wise profile

The sector wise contributions of landings by mechanised, motorised and traditional sectors were 41%, 50% and 9% respectively. The sector wise

Table 1. Sectorwise contribution to the marine fish landings of Andhra Pradesh

Sector	2013	2014	percentage change
Mechanised sector landings (x thousand t)	140	140	0
Mechanised Units (x thousand)	60	45	-24
Motorised sector landings (x thousand t)	90	169	89
Motorised Units (x thousand)	636	857	35
Traditional sector landings (x thousand t)	37	32	-12
Traditional Units (x thousand)	560	469	-16

landings and its effort during 2013 and 2014 have been depicted in Table 1. Compared to 2013, Ther was an nincrease of 89% in landings by motorised sector.

Seasonal variations

The highest volume of marine fish landings in Andhra Pradesh was during June - September 2014, contributing 32% of the total catch. It showed an increase of 45,626 t compared to the corresponding period in 2013 (Fig. 1).

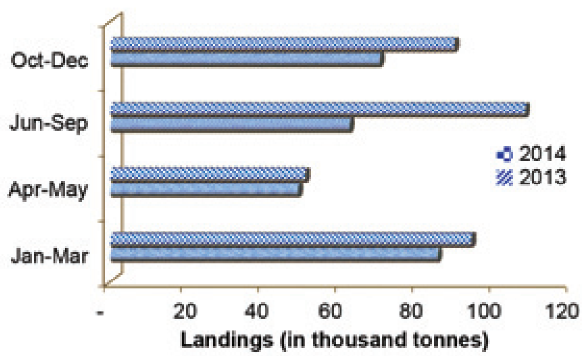

Fig. 1. Seasonal variations in marine fish landings

Gear wise profile indicated that 94% of marine fish landings were by three gears *viz*. Trawl nets (41%), gill nets (26%) and seines (27%). Of this, Mechanised trawl net constituted 39% and mechanised gill net 2%. Motorised ring seine contribtes 26%, motorised gill net 17%, motorised

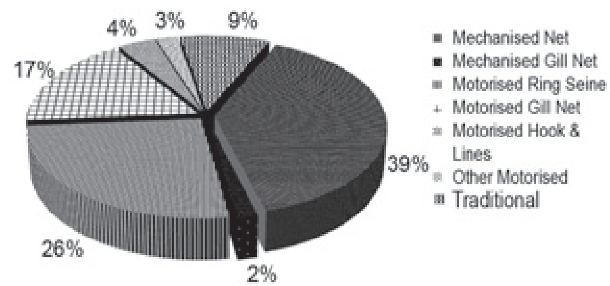

Fig. 2. Gear wise landings in Andhra Pradesh during 2014

hook & lines 4% and other motorised units 3% (Fig. 2). During 2014, multi day trawl net constituted 39% of the annual landings and 95% of the trawl fishery landings. Though the number of boats increased from 46782 during 2013 to 73030 during 2014, the catch rate (kg/h) decreased from 26 to 17 for the respective years. Motorised ring seines constituted 26% of annual landings and 96% of total seine landings. Here too, though the number of boats increased from 69957 during 2013 to 268036 during 2014, the catch rate (kg/hour) decreased from 137 in year 2013 to 119 in 2014. The share of landings by motorised gill net during 2014 was 17% which formed 67% of the total gill net landings. The number of boats during 2014 increased 2.61 times of 2013 but the catch rate (kg/h) decreased from 19 (2013) to 10 in 2014.

Impact of Pacific white shrimp culture on wild population of Tiger shrimp in Andhra Pradesh

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Andhra Pradesh is the leading producer of shrimp through aquaculture in India where production was 279727 t in 2014-2015 (MPEDA). The bulk of it (276077 t) came from the Pacific white shrimp, *Litopenaeus vannamei* production. This species is a relative new comer to the aquaculture scenario of Andhra Pradesh with official recorded production starting from 2009 onwards. By 2013 majority of the hatcheries in Andhra Pradesh were involved in seed production of the Pacific white shrimp.

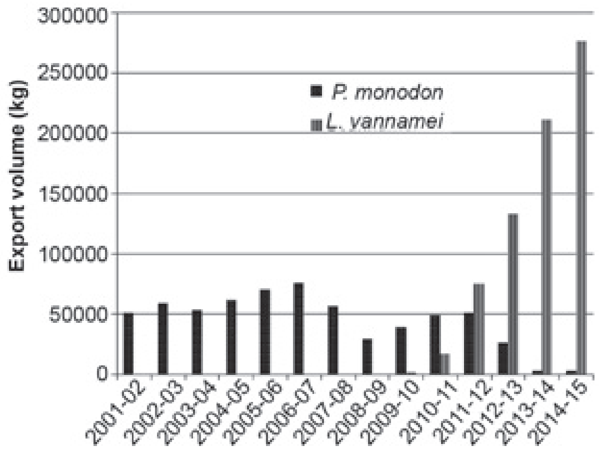

Fig. 1. Export volume (kg) of *P. monodon* and *L. vannamei* from Andhra Pradesh (Source: MPEDA)

Before the advent of the Pacific white shrimp, the bulk of Andhra Pradesh's shrimp production came from the Tiger shrimp, *Penaeus monodon*. The culture industry depended on two sources for *P. monodon* culture – broodstock collected from the wild and seed collected from the wild. During the peak culture periods of Tiger shrimp (1995-2005), targeted fishing for gravid broodstock of Tiger shrimp existed when nearly 100-150 brooders were landed daily fetching any where from ₹ 2000 to 30,000 per piece (Sreeram *et al.*, 2004, *Journal of Indian Fisheries Association* 31: 37-46). This led to concerns that rampant broodstock collection from the wild would have deleterious effects on the wild populations of Tiger shrimp.

However, the Tiger shrimp has taken the back seat in the aquaculture scenario of Andhra Pradesh presently. A survey of traders and fishermen was carried out during August 2015 in Visakhapatnam, Kakinada and Machilipatnam to understand the current status of broodstock trade of *P. monodon*. As per this information, at Visakhapatnam the demand for broodstock which was nearly 1.5 lakh pieces per year, has come down to only 5000 pieces per year with a brooder fetching only ₹ 1500 to ₹ 3000. Targeted fishing for broodstock of Tiger shrimp is being carried out only if demand exists. Presently demand for broodstock of *P. monodon* comes from some hatcheries in Odisha and West Bengal and very few hatcheries in Andhra Pradesh are working with this species currently.

It is expected that reduced fishing of Tiger shrimp brooders will have a beneficial impact on wild populations of the species. An analysis of trawl catch rates reveals this to be the case. During 2000-2005 the average annual catch rate of *P. monodon* in *Sona* boats off Visakhapatnam was 0.0656 kg/ h. Further from 2008 to 2013 there was a steady decline in the catch rate of *P. monodon* from 0.217 kg/h to 0.067 kg/h. During 2014 however the catch rate of *P. monodon* increased to 0.315 kg/h and during

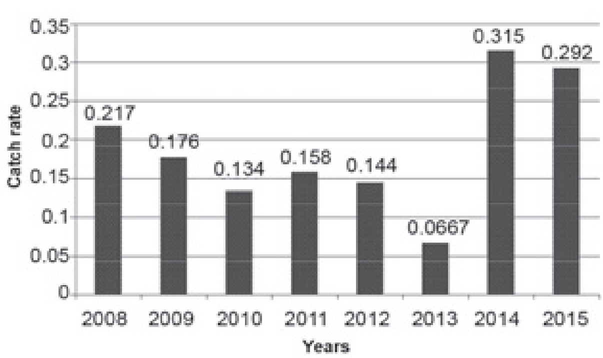

Fig. 2. Catch rate (kg/h) of *P. monodon* in trawlers operating from Visakhapatnam

January-June 2015 period it was 0.292 kg/h. The increase in catch rates is probably an indicator of increased presence of *P. monodon* in the wild. Thus the reduced demand for Tiger shrimp brooders due to *L. vannamei* culture has probably resulted in more seed production in the wild leading to higher recruitment to the fishery and consequently led to a resurgence of its catch rates in the capture fisheries sector.

Checklist of marine bivalves and gastropods off Kollam, Kerala

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Species diversity of any region can be illustrated by means of an available checklist. It provides an overview of the species that have been recorded. and can be considered to understand the local fauna. Fortnightly surveys were carried out to collect the shell-molluscs samples during 2012 - 2014 period from the by-catch of shrimp/fish trawlers landed at Sakthikulangara-Neendakara Fishing Harbour, Kollam. Collected bivalves and gastropods included both empty shells and living animals. Collected shells were brought to the laboratory and placed in freezer for 24 hours. This would liquefy the mollusc body and allowed easy extraction with a strong jet of water. For shells with flesh, freeze-defrost-freeze for two to three cycles was done. On the final cycle, it was defrosted slowly and the shell was put in a small container filled with sand to catch any exudates from decomposition. A device with hook was used to remove animal from shell. After washing shells with water, species were identified and season and magnitude of occurrence were recorded. Species were identified by following Satyamurti (1952, 1956), Dance (1974) and Sowerby (1996). Magnitude of occurrence was indicated by Abundant (A) (>10 specimens collected), Common (C) (7-9 specimens collected), Occasional (O) (4-6 specimens collected) and Rare (R) (< 3 specimens collected) as per Lee and Chao (2005). For estimating peak seasons for gastropods and bivalves, trawl landings data of 2007-2014 were analyzed.

Observations on the landings of shells indicated that 54 species of gastropods belonging to 27 families; 9 species of bivalves belonging to 5 families and one species of scaphopod were landed as by-catch of trawlers (Table 1). A total of 64 species belonging to 33 families of molluscan shells were collected during this period. Magnitude of occurrence studied for all molluscs landed in the landing centres showed that 38 species were abundant (A), 14 species were common (C), 8 species were occasional and 4 species were rare (R) (Fig. 1). The gastropods came first in number of species recorded and more abundant in the landing centres compared to others. Analysis of gastropods and bivalves landed by trawlers during 2007-2014 at Sakthikulangara-Neendakara Fisheries Harbours revealed that Single day trawl net (MTN) contributed more (>11-21%) landings compared to multiday trawl net (MDTN). Landings were more (>60%) in

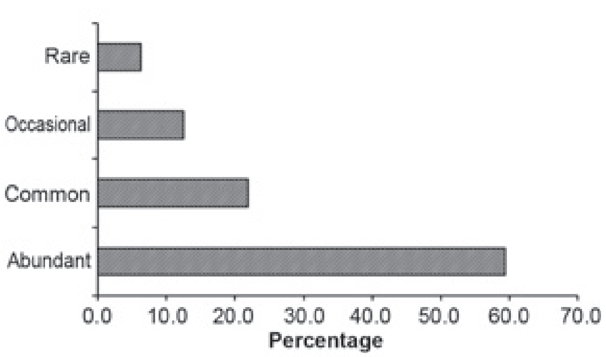

Fig. 1. Magnitude of occurrence (in %) of shell-molluscs landed in Sakthikulangara-Neendakara harbour during 2012-14

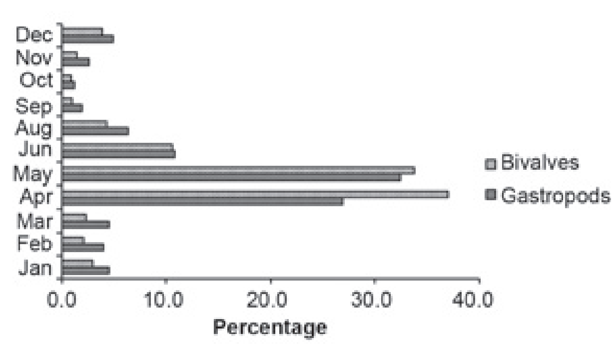

Fig. 2. Month-wise mean percentage landing of gastropods and bivalves in by-catch at Sakthikulangara - Neendakara Fisheries Harbours durng 2007-2014

Table 1. Checklist of molluscs, their magnitude and season of occurrence at Sakthikulangara- Neendakara landing centres.

Species	Common name	Magnitude of occurrence	Season of occurrence
GASTROPODA			
Turritellidae	Turret/Screw shell		
Turritella attenuata		A	Apr, May, Jun, Aug, Sep, Nov
Turritella duplicata	Duplicate turret	C	Jan, Feb, May, Aug, Sep, Oct
Terebridae	Auger shell		
Duplicaria duplicata	Duplicate auger	O	Dec, Aug, Sep
Harpidae	Harp shell		
Harpa major	Major harp	A	Mar, Apr, May, Aug, Sep
Olividae	Olive shell		
Agaronia gibbosa (*Oliva gibbosa*)	Gibbous olive	A	Dec, Jan, Feb, Mar, Nov
Ancilla acuminata	Pointed ancilla	A	Dec, Jan, Feb, Mar, April, May
Ficidae	Fig shell		
Ficus ficus	Common fig shell	A	Apr, May, Jun, Aug, Sep, Oct, Nov
Naticidae	Moon shell		
Tanea lineata (*Natica lineata*)	Lined moon shell	A	Apr, May, Jun, Aug, Sep
Natica vitellus	Calf moon shell	A	Apr, May, Jun, Aug, Sep, Nov, Dec
Polinices mammilla *(Mammilla fibrosa)*	Pear-shaped moon	A O	Mar, Apr, May, Jun, Aug, Sep Aug, Sep
Architectonicidae	Sundial shell		
Architectonica perspectiva	Perspective sundial	O	Jan, Feb, Mar, Apr, Nov
Architectonica purpurata	Purpurata sundial	R	Jan
Rostellariidae	Tibia shell		
Tibia curta	Indian tibia	A	Apr, May, Jun, Aug, Sep
Cassidae	Helmet/Bonnet shell		
Phalium glaucum	Grey bonnet	A	Mar, Apr, May, Jun, Aug, Nov
Semicassis bisulcata	Japanese bonnet	A	Apr, May, Aug, Sep
Cassis cornuta	Horned helmet	R	Aug
Tonnidae	Tun shell		
Tonna dolium	Spotted tun	A	Dec, Mar, Apr, May, Aug, Sep
Muricidae	Rock snails		
Rapana rapiformis (*Rapana bulbosa*)	Turnip shell	A	Apr, May, Jun, Aug, Sep, Oct
Murex trapa	Rare spined murex	A	Dec, Mar, Apr, May, Aug, Sep
Chicoreus virgineus (*Murex virgineus*)	Virgin murex	A	Mar, Apr, May, Jun, Aug, Sep, Oct
Haustellum haustellum (*Murex haustellum*)	Snipe's bill murex	C	Dec, Jan, Apr, Jun, Aug, Sep
Vokesimurex malabaricus (*Murex malabaricus*)	Malabar murex	O	Feb, Aug, Sep, Oct
Purpura bufo (*Thais bufo*)	Toad purpura	A	Jan, Feb, Mar, Apr, May, Jun, Nov
Strombidae	Conch shell		
Mirabilistrombus listeri (*Strombus listeri*)	Lister's conch	C	Jan, Feb, Dec
Dolomena plicata sibbaldi (*S. plicatus sibbaldi*)	Pigeon conch	O	Dec, Aug, Jan, Feb

Species	Common name	Magnitude of occurrence	Season of occurrence
Volutidae	Volutes shell		
Harpulina lapponica loroisi	Lorois's volute	C	Jan, Feb
Babyloniidae	Babylon shell		
Babylonia spirata	Spiral babylon	A	Apr, May, Jun, Aug, Sep, Oct, Nov
Babylonia zeylanica	Indian babylon	A	Apr, May, Jun, Aug, Sep, Nov
Melongenidae	Crown conch		
Volegalea cochlidium	Spiral melongena	A	Apr, May, Jun, Aug, Sep, Oct
Fasciolariidae	Spindle snails		
Fusinus colus	Distaff spindle	A	Jan, Feb, Apr, May, Aug, Sep, Oct
Fusinus forceps	Forceps spindle	A	Jan, Feb, Apr, May, Aug, Sep
Turbinellidae	chank shell		
Turbinella pyrum (*Xancus pyrum)*	Sacred chank	A	Apr, May, Jun, Aug, Sep, Oct
Bursidae	Frog shell		
Bufonaria echinata (*Bursa spinosa*)	Spiny frog shell	A	Apr, May, Jun, Aug, Sep, Oct, Nov
Bufonaria crumena *(Bursa crumena)*	Frilled frog shell	A	Apr, May, Jun, Aug, Sep, Nov
Tutufa bufo	Red-mouth frog shell	O	Jan, Aug
Ranellidae	Triton shell		
Cymatium (Lotoria) perryi (*C.(Lotoria) lotorium*)	Perry's triton	C	Apr, May, Jun, Aug
Gyrineum natator	Tuberculate gyre triton	C	Jan, Aug
Turridae	Turrid shell		
Lophiotoma indica	Indian turrid	A	Apr, May, Jun, Aug, Sep, Nov
Cypraeidae	Cowry shell		
Mauritia arabica (*Cypraea arabica*)	Arabian cowry	C	Aug, Sep, Oct
Erronea errones (*Cypraea errones*)	Wandering cowrie	C	Jan, Feb, Mar
Nassariidae	Nassa shell/Dog whelk		
Nassarius conoidalis	Cone-shaped nassa	C	Dec, Jan, Feb, Mar
Nassarius olivaceus	Olive nassa	A	Jan, Feb, Aug, Sep, Oct, Nov
Nassarius stolatus		A	Jan, Feb, Mar, Apr, May, Sep, Nov
Conidae	Cone snails		
Conus betulinus	Betuline cone	C	Jan, Feb, Apr
Conus textile	Textile cone	A	Jan, May, Jun, Aug, Sep, Oct
Conus milne edwardsi	Glory of India cone	R	Aug
Conus inscriptus	Engraved cone	C	Jan, Feb, Mar
Conus figulinus		C	Jan, Feb, Mar, Aug
Personidae	Distorsio snails		
Distorsio perdistorta	Hunchback distorsio	R	Jan, Aug
Buccinidae	Whelk shell		
Cantharus tranquebaricus	Tranquebar goblet	A	Mar, Apr, May, Jun, Aug, Sep, Oct
Ovulidae	False cowries		
Volva volva	Shuttle volva	O	Jan, Feb, Mar

Species	Common name	Magnitude of occurrence	Season of occurrence
Cancellariidae	Nutmeg snails		
Trigonostoma sp.	Scalariform nutmeg	C	Jan, Mar, Apr
Calyptraeidae	Slipper snails		
Desmaulus extinctorium	Conical slipper shell	A	Nov, Dec, Jan
BIVALVIA			
Donacidae	Wedge shells		
Donax scortum	Leather donax	A	Feb, Mar, Apr, May, Aug, sep, Nov
Arcidae	Ark shell		
Trisidos tortuosa	Propellor ark	A	Dec, Jan, Feb, Oct, Nov
Anadara inaequivalvis	Inequivalve ark	A	Feb, Mar, Apr, May, Aug, sep, Oct
Anadara formosa		A	Mar, Apr, May, Jun, Aug, Sep, Oct
Cardiidae	Heart cockles		
Vepricardium asiaticum	Asiatic cockle	A	Nov, Dec, Jan, Apr, May, Jun, Aug
Vepricardium coronatum		C	Nov, Dec, Jan, Feb, Jun, Aug
Trochidae	Top shells		
Clanculus sp.		A	Jan, Feb, Mar, Apr, May, Jun, Aug
Gibbula sp.		A	Jan, Feb, Mar, May, Jun, Aug
Veneridae	Venus shell		
Antigona lamellaris	Lamellate venus	O	Dec, Jan, Aug
SCAPHOPODA			
Dentalidae	Tusk shells		
Dentalium sp.	Elephant tusk shell	A	Jan, Feb, Mar, Apr, May, Jun, Aug

[*A = Abundant; C = Common, O = Occasional, R = Rare. Previously known species name is given in parenthesis*]

Sakthikulangara compared to Neendakara during 2007-2014 period. Month-wise mean percentage landings of gastropods and bivalves indicated that peak seasons for gastropods and bivalves are April, May, June and August at Sakthikulangara-Neendakara Fisheries Harbours (Fig. 2).

All the identified specimens were deposited in the Designated National Repository (DNR), ICAR-CMFRI, Kochi, India. Since there are no shellcraft industries located nearby, the ornamental shell materials were transported in lorries to shellcraft industries and small scale cottage industries located at Rameswaram, Tirunelveli and Cuddalore in Tamil Nadu.

Occurrence of deep sea prawns in the stomach of Yellowfin tuna

M. Sivadas, S. Mohammed Sathakkathullah, K. John James, K. Suresh Kumar and K. Kannan
Tuticorin R.C. of ICAR-Central Marine Fisheries Research Institute, Thoothukudi

The earlier studies on yellowfin tunas (*Thunnus albacares*) from Indian waters have shown that the fish is an opportunistic feeder, consuming fishes, cephalopods and crustaceans. The main crustacean component is the deep sea pelagic crab, *Charybdis smithii*. The food and feeding studies of yellowfin tuna from Thoothukudi during the period 2011-2014 were also in conformity with the results of earlier studies (Table-1). The main fishes encountered as prey were *Auxis* spp., *Katsuwonus pelamis*, *Trichiurus* sp., *Arothron stellatus* etc. The crab component was entirely comprised by *C. smithii*.

Table 1. Percentage composition of food in yellowfin tuna

Year	2011	2012	2013	2014
Fish	73.7	83.3	85.7	62.5
Crab	26.3	0	14.3	12.5
Prawn		5.6		12.5
Squid		11.1		12.5

But on 15.3.2012, out of the 8 numbers of yellowfin tuna analysed for diet studies, two stomachs contained the deep sea prawn, *Heterocarpus gibbosus*. In one stomach, there were 16 numbers (66 g) of *H. gibbosus* along with *Trichiurus* sp. In the other, 8 numbers (3.12 g) of *H. gibbosus* along with *Trichiurus* sp. and squid were observed. The sampled fishes ranged in length from 123 to 125 cm FL of which one was male and the other female. Both were in partially spent conditions. On 25.3.2014, out of the four numbers of yellowfin tuna analysed, three had empty stomachs while the fourth contained 15 numbers (60 g) of the deep sea prawn, *Solenocera hextii*. The particular fish measured 117 cm in Fork Length (FL) and was a female in partially spent condition. The sampled fishes were caught in drift gill net (120-140 mm mesh size) operated during night at 20-25 nautical miles (nmi) off Mandapam where the depth was above 300 m. Both *H. gibbosus* and *S. hextii* form part of the deep sea trawl (operated at a depth range of 250-500 m) fishery of Thoothukudi during November to March-April. Earlier, Rohit *et al*. (2010) have also reported the occurrence of *S. hextii* from the stomach of yellowfin tuna exploited at Visakhapatnam. *H. gibbosus* and *S. hextii* are benthic in the deep sea (>200m) and not yet been reported from pelagic zone. Mohamed and Suseelan (1973) have reported the occurrence of *S. hextii* from depth ranging from 250-400 m and that of *H. gibbosus* from 300-375 m. Yellowfin tuna is an epipelagic fish that inhabits the mixed surface layer of the ocean above the thermocline. They penetrates the thermocline relatively infrequently although they are capable of diving to considerable depths. The occurrence of these two species of prawns (*H. gibbosus* and *S. hextii*) in the stomach of yellowfin tuna points to the possibility of the fish feeding from deeper areas also.

Heavy landings of juveniles of Indian scad, *Decapterus russelli* at Munambam Fisheries Harbour

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Among the carangid fishes, the Indian scad, *Decapterus russelli* is an important pelagic fish and a major commercial species contributing to the marine fisheries of Kerala. The fish is locally called "kozhuchala" and it forms a regular fishery. The species is often caught as by-catch in shrimp trawl nets having cod-end mesh sizes ranging from 15 mm to 20 mm that is operated in the depth range of 55-90 m almost throughout the year. They are consumed fresh as well as sun dried form. Recently, it is also being used as a raw material for production of fish meal. Usually fish of 15 cm total length and an average weight of 50 g are represented in the commercial catches. But, unusual heavy landings of juveniles of *Decapterus russelli* were observed in the months of November and December 2014, at Munambam Fishing Harbour, Kochi. These juvenile scads had a size range of 7 - 8 cm total length and weighed between 10-15 g. Such heavy exploitation of *D. russelli* was mainly due to high demand by the fish meal industry for the preparation of fish meal. The resource is already under considerable fishing pressure and unsustainable fishing practices that are not curbed will adversely affect the fishery recruitment process. This can affect the volume of marine fish landings in the near future.

Giant Manta Ray, *Manta birostris* landed at Neendakara Fisheries Harbour

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Manta rays that belongs to the family Mobulidae occurs in tropical, sub-tropical and temperate waters of the Atlantic, Pacific and Indian Oceans. A large Giant manta ray, *Manta birostris* (Walbaum, 1792) was landed at Needakara Fisheries Harbour on 12.05.2015. The ray was 370 cm in length and weighed 1100 kg. The information collected from the fishermen indicated that it was incidentally caught in a 12 m OAL outboard (9.9 hp x 2 engines) gillnet unit. The drift gill net called *Ozhukkuvala* (70-80 mm mesh size, 200 m long) was operated at about 44 m depths. Along with the manta ray, *Coryphaena hippurus*, *Istiophorus platypterus*, *Scomberomorus commerson, Mobula* spp. and *Auxis thazard* were also landed. The ray was auctioned for ₹ 55,000. Globally, the population of *M. birostris* are reported to be declining due to overexploitation and IUCN declared the species as “Vulnerable” in its annual assessments (IUCN, 2014). However, this species is only rarely reported in fish landings along Indian coast.


Manta birostris landed at Needakara Fisheries Harbour

Landings of Giant Manta Rays at Cochin Fisheries Harbour

T. G. Kishor, C. A. Shiyas, Sijo Paul, Ambily Lalgi and P. U. Zacharia
ICAR-Central Marine Fisheries Research Institute, Kochi

Three numbers of Giant Manta ray, *Manta birostris* locally known as “Aana Thirandi” measuring 220, 291 and 285 cm in standard length and weighing 680, 1080 and 1050 kg respectively were landed at Cochin Fisheries Harbour on 27th March, 2015 (Fig.1). The rays though landed by deep sea trawler, were caught by mechanized gill net boat operated at depth of 200 m off Kochi. Due to the big size of the rays caught, the gill net fishermen had transferred them to a deep sea trawler which operated nearby. The rays were identified as *Manta birostris* due to its characteristic features of terminal mouth differentiating it from the genus *Mobula* which has its mouth on the ventral side; large cephalic horns and white shoulder markings. Belonging to the family Myliobatidae, they are found in temperate and tropical seas and are primarily plankton feeders. They take a long time to reach


Fig. 1. Manta rays landed at Cochin fisheries harbor

sexual maturity, have long gestation periods and often give birth to a single pup. *Manta birostris* is considered as "Vulnerable" by the IUCN Red List of threatened Species. In 2014, trade of fins and gill plates of manta rays was regulated by including under CITES Appendix II.

The three rays were auctioned for ₹ 130,000. Out of the three specimens landed, two were mature females and the other a mature male with long, calcified claspers. One of the mature female measuring 556 cm in disc width when cut open, had a pup which measured 62 cm in standard length, 102.5 cm disc width and weighed 7.2 kg (Fig. 2). Stomachs of all the rays were empty. There is increasing demand for the gill plates of Manta rays in southeast Asian countries for medical purpose as well as for preparation of soups. Dried filter plates of Manta rays can fetch upto ₹ 8000 per kilogram.

Fig. 2. Pup of *Manta birostris*

A new record of deep-sea caridean shrimp *Plesionika narval* (Decapoda: Pandalidae) from the south west coast of India

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Pandalid shrimp, *Plesionika narval* (Fabricius, 1787) was recorded from trawl fishing off Kochi (9°59' N 76°14'E), Kerala, south-west coast of India. The specimens were obtained from deep-sea shrimp trawlers operated at a depth range of 250-300 m. Samples were collected from the Kalamuku Landing Centre on 4th April 2014. 14 males and 12 females in good condition were segregated from the mixed deep-sea shrimp doscards and their measurements recorded (Table 1). Body was transparently pink-red in colour with a pair of sub dorsal and lateral red margined white stripes extending along almost entire body length from anterior carapace to posterior abdomen. Of the total 12 female specimens recorded, only 5 were non-berried while the rest were ovigerous. The eggs were spherical in shape with bluish green colour. The average egg diameter was found to be 0.2 mm. Voucher specimens (ED.2.4.3.4) were deposited in National Designated Repository (NDR) of ICAR-CMFRI, Kochi.

Fig. 1. *Plesionika narval* (berried female)

Table 1. Details of the specimens landed

Sex	**Total Length (mm)**	**Carapace Length (mm)**	**Weight (gm)**
Male	54-73	10-15	0.6-1.2
Female (berried)	70-73	13-14	1.1-1.4
Female (non berried)	70-75	13-15	1.1-1.4

Scale worm recorded from Lakshadweep

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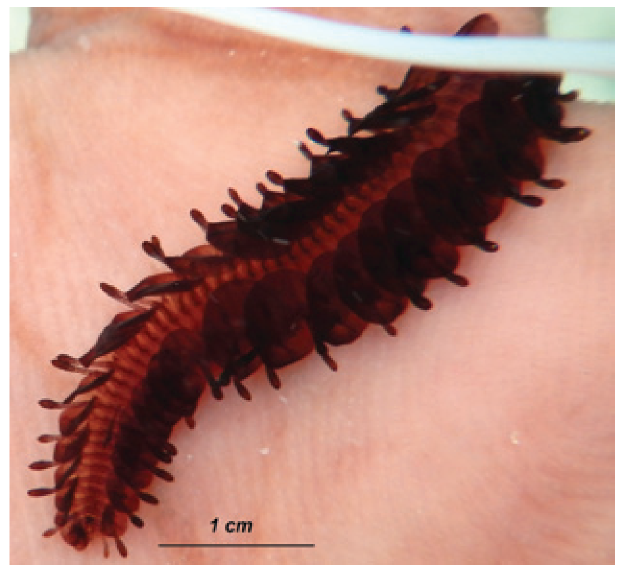
During an underwater survey in lagoon of Chetlat island Lakshdweep in 2015 a cryptic, commensalistic scale worm association on the sea cucumber *Stichopus chloronotus* was observed. This scale worm was identified as *Gastrolepidia clavigera* Schmarda, 1861 which come under polychaetes (Family:Polynoidae). These are known to inhabit the surface of holothurians in its anterior or posterior ends, and if disturbed crawl into the mouth or cloaca of the sea cucumber. The colour of the scale worm mimics the colour of the host which makes it difficult to be detected. Studies have found that this scale worm species feed on the tissue of the sea cucumber and are resistant to the toxin holothurin which is commonly released by sea cucumbers against predators. Fauvel (1941), Tampi and Rangarajan (1964), Tikader *et al*.(1986) and Marudhupandi *et al*. 2012 have reported earlier on this association of sea cucumber and scale worm from Andaman islands, Rameswaram and Agatti islands. The present report records the enhanced distributional range of this species in the Lakshadweep coral reef ecosystem.



Close-up view of scale worm

First report of Spotted reef crab off Vizhinjam coast

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Carpilius maculatus (Linnaeus, 1758), commonly known as 'Seven-eleven crab', 'Spotted reef crab', 'Dark finger coral crab', or 'Large spotted crab' is a member of the family Carpiliidae. One male specimen of the spotted reef crab *C. maculatus* measuring 130 mm in carapace width was caught by a bottom set gill net along with *Portunus sanguinolentus* from the rocky area in Vizhinjam coastal waters.

This species is reported as an active, nocturnal scavenger and known to be distributed in the Indo-west Pacific region, east coast of Africa, Hawaiian


Dorsal view of *C. maculatus*

Islands and Red sea. These crabs are not very common on the Indian coast except in certain areas such as Gulf of Mannar, Lakshadweep, Andaman and Nicobar Islands . This is the first report of this species from Vizhinjam coast. The species is known to inhabit rocky beaches or coral reefs to a maximum depth of 30 m and mostly found in 3 to 6 m depth in coral reefs.

Classification

Phylum	:	Arthropoda
Subphylum	:	Crustacea
Class	:	Malacostraca
Order	:	Decapoda
Infraorder	:	Brachyura
Family	:	Carpiliidae
Genus	:	*Carpilius*
Species	:	*Carpilius maculatus*

This crab is characterized by a beautiful creamy ground color with symmetrically disposed 11 large red spots; four in a row along posterior border, three across middle area and two behind each orbit on carapace. The carapace is smooth, convex and front with a lobate process divided into two lobules by a depression in the median. Anterolateral border entire, chelipeds very stout, unequal and smooth. It has four blunt spines between the eyes.

Sea erosion along the Andhra Pradesh coast

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Andhra Pradesh with a coastline of around 974 km has frequently been affected by cyclones and inundated by storm surges. Sea erosion is noticed at Visakhapatnam, Bhimunipatnam and in the East and West Godavari districts. Vishakhapatnam coast is facing erosion since long specially at Ramakrishna Beach. In 2013 and 2014, the cyclones 'Phailin' and 'Hudhud' further hastened erosion of the Ramakrishna Beach, severely damaging the adjacent protection wall and road. Uppada village which is 22 kilometres away from Kakinada also faces severe erosion. The Kakinada-Uppada road is gradually disappearing due to shoreline erosion. In the event of submersion of the road in sea water, the residents of 20 seashore villages will have to face many difficulties to reach Kakinada. Many buildings, temples and coconut groves in the village also face the threat of incursion by the sea. Peddamylavani Lanka of West Godavari district is another fishing village which is affected by sea erosion. Many coconut trees have got uprooted and roads damaged with the sea extending more inland. Environmentalists attribute beach erosion which has been severe in the recent times to urbanization, anthropogenic activities, construction of jetties and lack of mangrove plantation along the beaches. An annual feature since the construction of the Outer Harbour in 1970s, the Visakhapatnam Port Trust takes up the responsibility of beach nourishment by removing sediments collected in the Sand Trap built near the Dolphin's Nose and breakwater area. Dredging is being carried out for restoration of beach and for sand deposition at shore.

Sea erosion at Ramakrishna Beach

Coconut trees damaged by sea erosion at Peddamylavani Lanka

Beach restoration process by dredging


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