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Draft Report

10 Assessment of Eco-labelling as Tool for Conservation and Sustainable Use of Biodiversity in Ashtamudi Lake, Kerala

THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY-INDIA INITIATIVE

COASTAL AND MARINE ECOSYSTEMS

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Indo-German Biodiversity Programme

The Ministry of Environment, Forest and Climate Change, Government of India (MoEFCC) is collaborating with the Federal Ministry for Economic Cooperation and Development (BMZ), Government of Germany and the Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB), Government of Germany. The Indo-German Biodiversity Programme comprises the following:

- The Economics of Ecosystems and Biodiversity - India Initiative (TII)
- India Business and Biodiversity Initiative (IBBI)
- Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas
- Himachal Pradesh Forest Ecosystem Services Project
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Assessment of Eco-labelling as Tool for Conservation and Sustainable Use of Biodiversity in Ashtamudi Lake, Kerala

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Project Team

Central Marine Fisheries Research Institute
Kochi | Kerala

August 2015

Consultancy Project: Assessment of Eco-labelling as Tool for Conservation and Sustainable Use of Biodiversity in Ashtamudi Lake, Kerala (Southwest coast of India)

Submitted to: GIZ, India, New Delhi

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THE ECONOMICS OF ECOSYSTEMS AND BIODIVERSITY-INDIA INITIATIVE

The Economics of Ecosystems and Biodiversity – India Initiative (TII) aims at making the values of biodiversity and linked ecosystem services explicit for consideration and mainstreaming into developmental planning. TII targets action at the policy making levels, the business decision level and awareness of citizens. TII has prioritized its focus on three ecosystems - forests, inland wetlands, and coastal and marine ecosystems - to ensure that tangible outcomes can be integrated into policy and planning for these ecosystems based on recommendations emerging from TII.

In addition to the existing knowledge, TII envisions establishing new policy-relevant evidences for ecosystems values and their relation to human well-being through field-based primary case studies in each of the three ecosystems. In response to an open call for proposals for conducting field-based case studies in the context of relevant policy or management challenges for conservation and the sustainable use of biodiversity and ecosystem services, over 200 proposals were received. A Scientific and Technical Advisory Group (STAG), comprising eminent ecologists and economists, appraised the proposals and recommended 14 case studies for commissioning under TII.

These studies in forests deal with issues such as hidden ecosystem services of forests, conflicts between humans and wildlife, and the economic consequences of species decline. In wetlands, the studies draw lessons on water resources management, community stewardship and equity, and the economics of hydrological regime changes. In coastal and marine ecosystems, the studies explore the opportunities and economic efficiency of interventions such as eco-labelling, seasonal fishing bans, mangrove regeneration, and the challenge of bycatch in marine fisheries.

The reports of these 12 case studies have been published in this TII series.

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12 Economic Valuation of Biodiversity Loss: A Study of By-Catch from Marine Fisheries in Andhra Pradesh

KEY MESSAGES

Eco-labelling through sustainable fishing practices results in premium prices and ecological gains. Short-neck clam fisheries of Ashtamudi garnered an eco-label from the Marine Stewardship Council (MSC), a first in India. Clams function as bio-filters for Ashtamudi. Understanding the value chain and a comparison between pre and post management of the fishery points to the advantages of certification. Can this be replicated in other small-scale fisheries?

FINDINGS

- The Ashtamudi estuary, a **61 sq km** Ramsar Site, provides livelihood for about **3,000 locals**.
- The estimated value of fishery resources of the lake is **₹985** million (US$ 16.4m), of which **51%** comes from clams.
- The amount of nutrients released in the water where clam beds exist was thrice as much as non-clam zones. With more clams, it takes **139 days** to filter the lake water completely, as opposed to **277 days** when clam abundance is poor.
- The estimated cost of certification is **₹3 million** (**US$ 50,000**) and fishery management is **₹161.7 million** (**US$ 2.7m**).
- A change in processing and marketing of clams can improve livelihood security for fishers and boost the export value from the present **US$ 1 million**.
- With MSC certification, it is feasible to shift to new export markets such as Europe and Japan. A change in product from clam meat to whole clams can lead to **75%** increase in revenue.

RECOMMENDATIONS

- More fishers should be made aware of eco-labelling as a tool for resource management in small-scale fisheries.
- The Central Marine Fisheries Research Institute, in tandem with WWF, should identify similar small-scale fisheries to move them towards eco-labelling.
- Seafood trade promotion agencies such as the Marine Products Exports Development Authority could take the results of this study to processors and exporters to reap the benefits of consumer preferences and target new markets.

Photo: K Sunil

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1. Background

The Ashtamudi estuary is the second largest estuarine system in Kerala with an area of 61 sq.km and located between latitudes $8^0$45' - $9^0$28' N and $76^0$28' - $77^0$17' E. This is the second largest wetland in Kerala and one of the deepest estuaries among all the other estuaries. It is a RAMSAR site and designated as a Wetland of Importance. Ashtamudi Lake in Kerala (southwest coast of India) contributes approximately 80% of the overall clam export trade in India, providing livelihood for at least 3,000 local people.

Short-neck clams (*Paphia malabarica*) in Ashtamudi Lake are collected by hand rake, diving, or handpicking by 1,000-1,500 fishers. In the late 1980s and early 1990s, the short-neck clam resource became depleted due to overexploitation caused by indiscriminate fishing practices. In response, fishers created an awareness program focused on the deleterious effects of exploiting undersized clams. The program involved active participation by the Central Marine Fisheries Research Institute (CMFRI), the District Administration, and clam pickers of the region. Based on the group's recommendations, regulations requiring nets with a minimum mesh size of 30 mm, a minimum export size of 1400 clams/kg, and a ban on fishing activity from December to February, the peak breeding season for clams were adopted by fishers as a self-regulation without formal government regulations.

Figure 1: Location of Ashtamudi Lake

These self-imposed conservation measures have shown positive effects since 1994, when production began to increase considerably, allowing fishers to sustainably exploit short- neck clams. Recent data collected by CMFRI indicate that the stock is currently being fished sustainably, with an annual catch of approximately 12,000 t which is close to the maximum sustainable yield (Mohamed et al., 2013). Fishery has a strong export market, sending frozen cooked, freeze-dried, and dehydrated clam meat to Japan, Vietnam, Thailand, Australia and United Arab Emirates.

Very recently, based on an advisory of the WWF and CMFRI, a 20 member Ashtamudi Clam Fisheries Governance Council (ACFGC) has been formed to administer and regulate the fishery (Mohamed and Malayilethu, 2013). Given their history and current successful co- management practices, fishery appears to be a well-managed resource with good community participation and ample data. Therefore, the WWF approached the Marine Stewardship Council (MSC) for eco-labelling the clam fisheries of Ashtamudi Lake. MSC's pre and full assessment of fishery has been completed, and fishery became the first certified fishery in India in November 2014, conforming to global fisheries management standards. This initiative is expected to further catalyse the interest in MSC certification and sustainability from other fisheries in the state of Kerala and throughout coastal India.

There are monetary costs ascribed to the fishery certification process and these need to be evaluated in comparison to the real and perceived benefits to the clam stock and its fishers. It is quite clear that the certification process by itself has resulted in several clam fishery management initiatives (Mohamed et al. 2013). How well this will bode for the clam stock in Ashtamudi Lake needs to be studied.

In spite of certification, a valuation on recovery of clam stocks, benthic biodiversity and livelihood improvement has not been conducted thus far. It is proposed to take up a study on the valuation of the management intervention on the recovery of clam stocks, biodiversity and livelihood in the Lake.

In addition to clam fisheries, several other artisanal finfish fisheries are practiced in Ashtamudi Lake using gillnets, castnets, stakenets and Chinese dipnets. Effective management practices of these fisheries are not in place, and consequently the fish stocks are on the decline, a situation that was witnessed in clam fishery many years ago. From the lessons learnt from clam fishery, it is proposed to evolve appropriate

management measures for sustainability of fish resources and also value potential overall ecosystem services of the Ashtamudi Lake under a management regime.

1.1. Rich Biodiversity of Ashtamudi Lake - Avian Faunal Density

The rich biodiversity of the lake is exemplified by the project-commissioned quick survey by WWF-Kerala in May and June of 2014 which showed 32 species of

Figure 2: Cast netting for shrimp

Figure 3: Chinese dipnets

Figure 4: Hand dredging for clams

Figure 5: Short-neck Clam meat

Figure 6: Short-neck clams

birds including 6 migratory birds like Red Shank, Black winged Stilt, Green Shank, Wood Sandpiper and local migrants like Grey Heron and Cattle Egret (see figure below). This observation clearly shows that some of the migratory birds are over wintering here even after most others have left for their breeding grounds by end of March. Other important resident birds found were Little Egret, Intermediate Egret, Large Egret, Common Kingfisher, etc.

The role of these birds in the ecosystem is not fully understood and there needs to be more detailed studies on their diets.

1.2. Impacts of MSC Certification – Other Studies

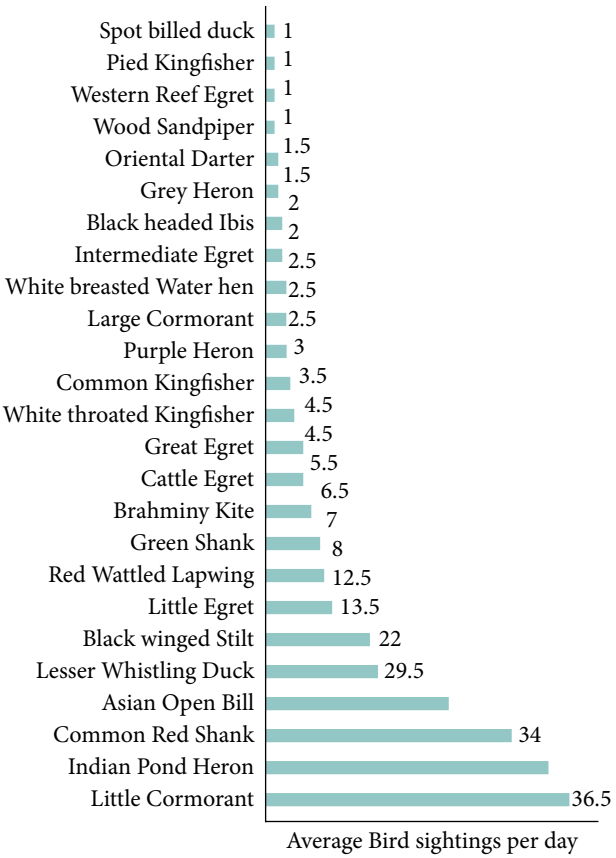
The main objective of eco-labelling programs in fisheries, such as the MSC label, is to provide market based incentives to improve sustainable fishing practices. Eco-labels can reassure consumers about the sustainability of a fishery, allowing them to make informed purchase decisions, particularly in the developed world. The premise is that environmentally concerned consumers will shift their demand towards eco-labelled fish which, in turn, generates a price premium for eco-labelled fish over non-labelled fish (Guomundsson and Wessells 2000; Sedjo and Swallow 2002).

In this way, producers are rewarded for fishing in a sustainable way. The MSC is the leading eco-label in terms of the number of fisheries certified and volume of seafood certified (Parkes et al. 2010). In 2014, more than 200 fisheries and 8 % of global wild-capture fishery tonnage was certified. There are ten developing countries where fisheries have obtained MSC certification: Argentina, Chile, Fiji, India, the Maldives, the Marshall Islands, Mexico, South Africa, Suriname and Vietnam.

A prerequisite for price premiums at the producer level is that consumers have willingness to pay for eco-labelled fish products. There is ample evidence from stated preference surveys and field experiments in the developed world showing that consumers express preference for eco-labelled seafood (e.g. Johnston et al. 2001; Jaffry et al. 2004; Johnston and Roheim 2006; Brecard et al. 2009; Uchida et al. 2013). In addition, studies estimating hedonic price models confirm the existence of price premiums in the retail market for eco-labelled fish products in the United Kingdom (Roheim et al. 2011; Sogn- Grundvag et al. 2013; Asche et al. 2013; Sogn-Grundvag et al. 2014).

The Swedish Eastern Baltic Cod fishery has been used for testing the MSC price premium at the producer level (Blomquist et al. 2014). This is because not all fishers were qualified for MSC certification. The table below shows the mean of the two price series and that there exists a price premium in the Swedish retail market for eco-labelled cod. As can be seen, there is a price premium of 3.59 SEK (around 10 %) for eco-labelled frozen cod fillets which was statistically

Figure 7: Proxy densities of marine/ brackishwater birds in Ashtamudi Lake



data collected for the project by WWF, Kerala.

Table 1: Mean retail price of ecolabelled and non-labelled fish products

Product	Mean Retail Price
Eco-labelled cod fillets	39.268
SEK Cod fillets	35.675
SEK Difference	3.593 SEK
Eco-labelled Scottish haddock	1.92 £
English haddock	1.81 £
Difference	0.11 £

significant.

However, the conclusion from this difference-in-difference model analysis of Blomquist et al. (2014) is that there is no evidence of price premium for MSC certified landings for the fishermen involved in cod fishery as evident in the retail market. The results demonstrate that a price premium at the retail level does not necessarily transmit back to the fishers. These results compare well with the statements by Washington (2008) and Washington and Ababouch (2011) that there is no firm evidence of MSC price premium at the fish production level.

Yet another recent report by Seafish (2014) also came to similar conclusions. No price premiums were identified that could be attributable to MSC certification when comparing first hand sales values for landings into Scotland of North Sea haddock by Scottish vessels (i.e. MSC certified) with English and Northern Irish vessels (i.e. not MSC certified). According to Seafish (2014) anecdotal evidence suggests that some processors and wholesalers will pay up to an additional 10% for MSC certified haddock. This increased price is transferred at the same rate to stakeholders further along the supply chain when products are branded as MSC. Other benefits of MSC explored within this report include market stability and security, product differentiation and future-proofing of fishery, improved public image and reputation including increased political credibility, improved traceability systems, and promotion of provenance and local sourcing.

Among the small-scale fisheries that have been certified the most prominent one is the Baja California Peninsula spiny lobster (*Panulirus interruptus*). The federation of fishing cooperatives, FEDECOOP, on the Pacific coast of Mexico is the first community fishery from a developing country to win MSC certification, passing the rigorous, independent review for compliance with global criteria for sustainable and well-managed fisheries. The CPUE of lobster fishery before certification ranged from 0.57 to 0.78 kg and after certification it ranged from 0.6 to 0.8 kg because of better management. There is no information on price improvements.

Recently MSC certified Maldivian skipjack have been getting a premium price in the European and other high-end markets and this is mainly because there has been a sustainable element that has been associated with it, claims officials from Maldivian Fisheries (Blackmore et al., 2015). However, clear data on price gains after certification could not be obtained.

In the case of the MSC certified Ben Tre Clam of Vietnam, there has been a documented increase in unit price from 0.4-0.8 USD/kg before certification to 1.5 USD/kg post- certification in 2012-13. However, in 2014 prices have dipped to about 1 USD/kg (Personal Communication from Mr. Thuy Dieu Nguyen, WWF Vietnam). In 2015, INFOFISH Trade News (see annexure) reports price of 1.9 USD/kg for the Lyrate white clam from Vietnam in the Portuguese market. Whether this price gain has improved fisher incomes is not known.

Some small-scale developing world fisheries have been able to fetch a premium in the market, but evidence from developed world fisheries, which is much more extensive, suggests that reports of premiums are not consistent (Blackmore et al., 2015). It is difficult to isolate the effects of the MSC label and its sustainability claims on prices from those linked to quality and/or general trends in the market. It is currently unclear to what extent MSC certification impacts the food security of small-scale fishers in developing countries (Blackmore et al., 2015).

2. The Problem

An ecolabel for a fishery is a reward for managing fisheries in a sustainable manner, ultimately leading to monetary and ecological benefits to fishers. The short-neck clam fisheries of Ashtamudi Lake in Kerala is the

The short-neck clam fisheries of Ashtamudi Lake in Kerala are India's first to receive an ecolabel sustainability certificate from the Marine Stewardship Council (MSC). Ecolabels reward sustainable fishing and lead to monetary and ecological benefits for fishers

first in India to receive such a sustainability certificate from the world renowned Marine Stewardship Council (MSC).

There are monetary costs ascribed to the fishery certification process and these need to be evaluated in comparison to the real and perceived benefits to the clam stock and its fishers. The benefit/impact assessment would include ecological and economic benefits along the supply chain of certified clams. Stakeholder analysis to understand the distributional aspects of cost as well as benefits are very important for drawing recommendations (who bears the costs and who reaps the benefits).

Fisheries certification or eco-labelling is a new concept (in India) to encourage sustainable fishing practices with the advantage of market premiums and ecological benefits. Understanding the mechanisms and advantages through the value chain is crucial to replicate this model in other small-scale fisheries.

2.1. Importance of the Topic

Improving the ecosystem of goods and services, and livelihood of small scale clam fishers of Ashtamudi Lake is of paramount importance for sustenance of the lake ecosystem, its living resources and fishers.

2.2. Approach

A complete valuation of fisheries in the lake ecosystem would take into account not only the direct revenues and costs of the fishery, but also the broader environmental and social costs and benefits that fishing and fish trade provide. Since certification of the fishery has been completed only in November, 2014, a comparison would be made on a pre-clam management and post- clam management basis.

2.3. Duration of Work

9 months from January to September, 2014. This is the final report.

2.4. Sampling & Analysis

The following are the surveys and sampling that were done from February 2014. (See Tables 2 and 3)

The data obtained from the above sampling have been fully analysed. Analysis with comparison of pre-management and post-management wherever possible focussed on the following:

1. The value of fishery resources of Ashtamudi Lake
2. Assessment of ecological services provided by clams in Ashtamudi Lake
3. Assessment of bio-geochemical services provided by clams in Ashtamudi Lake
4. Avian faunal density in Ashtamudi Lake
5. Social and economic conditions of clam fishers in the Lake
6. Estimate of actual and perceived costs of MSC certification
7. Estimating and modelling direct and indirect benefits of MSC certification

Figure 8: Sampling Work in progress

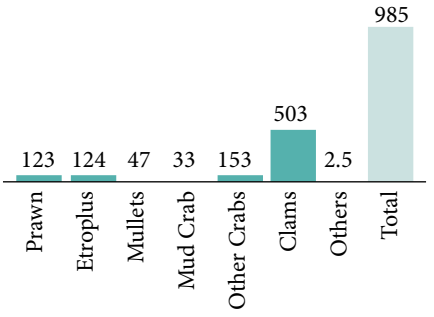
3. Value of Lake Fisheries

The stock value of lake fisheries was estimated as ₹985 million (= 98.5 crores; US$ 16.4 million). The valuation was done based on average catches over a

Table 2: Surveys and Sampling done in February 2014

No	Type	Frequency	Purpose
1	Clam biomass survey	One-off in February	To assess clam population density and biomass prior to opening of the fishery in March 2014
2	Clam catch and effort	Daily records from agents	Assessment of exploitation and estimate of catch and effort
3	Hydrography & benthic	Monthly	Assessment of water and benthos quality and benthic biomass
4	Fish catch and effort	Daily/ random 6 locations	Assessment of fish catch and effort
5	Avian faunal survey	One-off in May	Assessment of avian fauna in the lake
6	Certification costs	One-off	Estimation of MSC certification costs incurred by WWF
7	Socio-economic survey	One-off in July	Assessment of social and economic conditions of clam fishers and processors
8	WTP survey of clam fishers and tourists	One-off in July	Valuation of ecosystem services
9	Historical records/ papers/ reports		Assessment of previous conditions of lake, resources and people

Figure 9: Value of Ashtamudi Lake Fisheries



5-year period at current prices (2014). A major share of the value originated from clams (51%), followed by crabs (18%) and shrimps (13%). Among fishes, the pearl-spot, Etroplus suratensis, a highly priced local delicacy, contributed the maximum (13%). The estimated biomasses indicate that the short-neck clam, Paphia malabarica is the most dominant fishery resource making the ecosystem, a clam dominated one.

Figure 10: Percentage contribution of major resources in total value of fisheries in Ashtamudi Lake

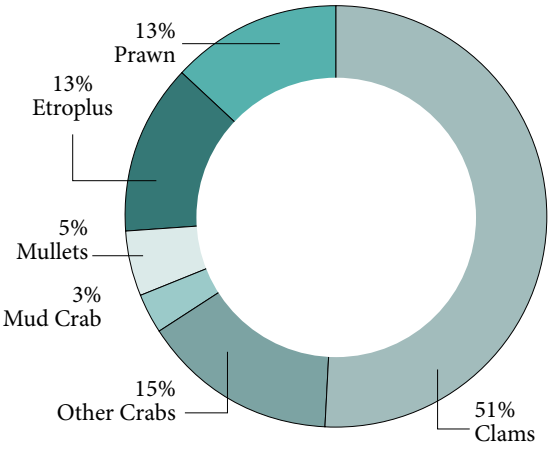
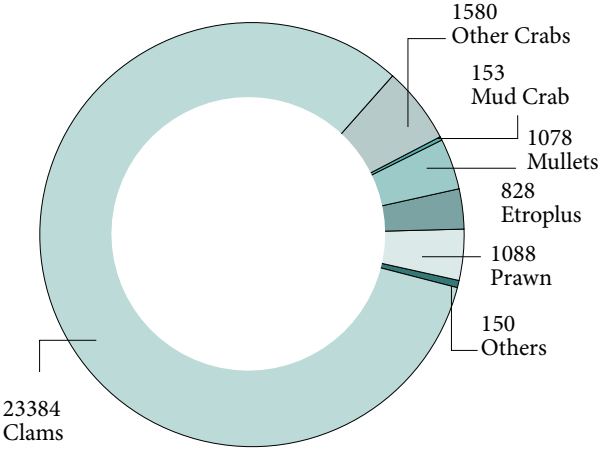


Figure 11: Biomass (in tonnes) of major fishery resource of Ashtamudi Lake



The term clam generally refers to bivalve molluscs that live buried in sand or silt, many of which are edible. Clams feed on plankton by filter feeding.

Clams filter feed by drawing in water containing food using an incurrent siphon. The food is then filtered out of the water by gills and swept toward the mouth on a layer of mucus. The water is then expelled from the animal by an ex-current siphon.

4. Assessment of Ecological Services Provided by Clams in Ashtamudi Lake

Since Ashtamudi Lake is a clam dominated estuarine ecosystem, we considered clams as the key species controlling the bio-physical processes in the system. Although clams live buried in the sediment (in-fauna) their unique filter feeding behaviour (see below) influences the productivity and the bentho-pelagic coupling in the ecosystem.

Almost all coastal water bodies in India are under threat of eutrophication because of human interferences, and Ashtamudi Lake is no exception. With input data on short-neck clam filtration rates (in litres.hour-1) and ingestion rates (no. cells.hour-1) based on previous studies (Rajesh et al. 1998), we have been able to build a hypothetical model (CLAMFIL model - see above) on how clams are able to filter out the entire ecosystem, maintaining the structural integrity of the ecosystem. The filtration and ingestion rates of clams changes with salinity and size variations. These have been inputted into the model.

Under the Clam Fisheries Management Plan (CFMP) set out by CMFRI, the target reference point (TRP) is 12,000 tonnes per annum with variability

Figure 12: How a filter feeder feeds

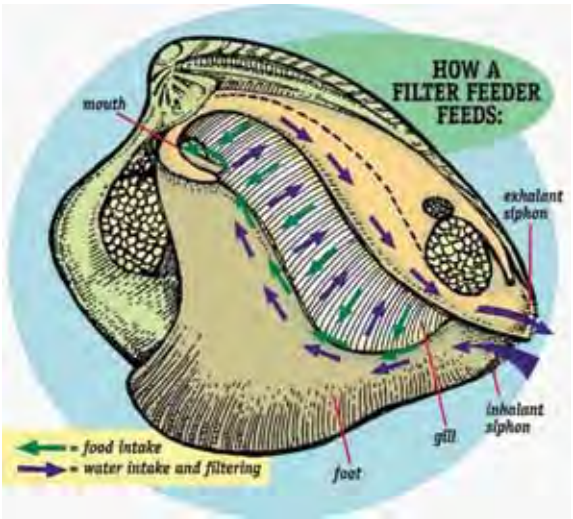
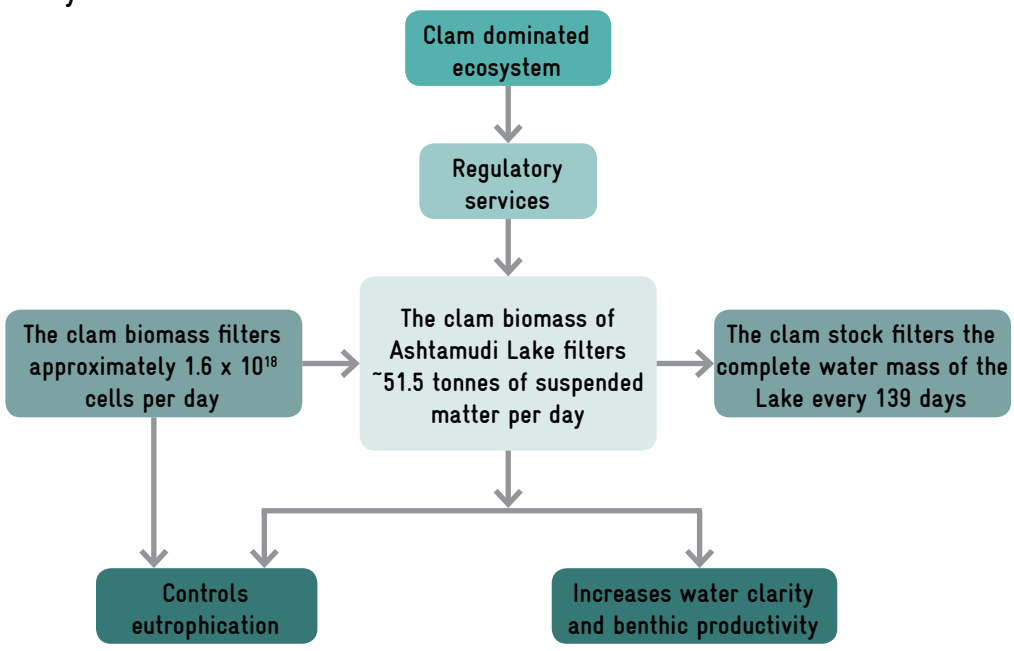


Figure 13: Systemic benefits of clams



of 20% (Mohamed et al. 2013). The TRP is set to maintain the fishery in a sustainable manner. If the yield drops below 6000 t (Limit Reference Point – LRP), more stringent regulatory measures would come into force to rebuild the clam stocks.

We used the CLAMFIL model, and made two scenarios. Scenario-1 when there is good clam fisheries management where the yields are maintained at 12,000 t ± 20%, and Scenario-2 when there is poor clam fisheries management, where yields are close to the LRP. Scenario-2 can happen due to overfishing or poor recruitment owing to adverse environmental conditions. In Scenario-2, we assumed that larger clams with higher filtration capacities are not present in the beds. The model results are as shown in the (Table 3).

Scenario-1 shows that the clams would take ~139 days to completely filter the entire lake water, while in Scenario-2 it would take almost double or 277 days. In Scenario-2 where the clam biomass is considerably reduced (halved), and also when large clams are absent, the eutrophication index of the ecosystem is likely to be considerably higher. This would seriously impair the water quality of the lake and affect all resources living in it. This in turn, would affect the livelihood of fishers.

Figure 14: Clam characteristics of selected locations in Ashtamudi Lake

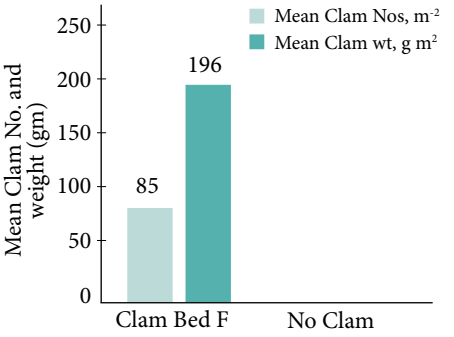


Figure 15: Phytoplankton in selected locations in Ashtamudi Lake

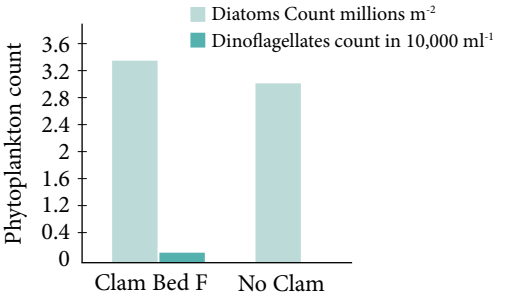


Table 3: Model Results using the CLAMFIL Model

	Scenario-1	Scenario-2
Volume filtered in tonnes by small clams per hour	7,611,141.36	11,416,712.03
Volume filtered in tonnes by large clams per hour	15,222,282.71	-
Total volume filtered per hour	22,833,424.07	11,416,712.03
Volume filtered tonnes per day	548,002,177.63	274,001,088.82
In million tonnes per day	548.00	274.00
Volume of brackish water in the lake million tonnes	76000	76000
No. of days required to filter the entire quantity of water in the lake	138.69	277.37

Table 4: Selected Biological Characteristics of Ashtamudi Lake

Scenario	A	B
Description of situation	Clam with fishery	No Clam
Parameters		
Clam (numbers)	85	-
Clam weight (g)	196	-
Ratio of Clam Weight to Nos.	2.3	-
Diatom count, millions ml^{-1}	3.51	3.11

Figure 16: Water characteristics of selected locations in Ashtamudi Lake - I

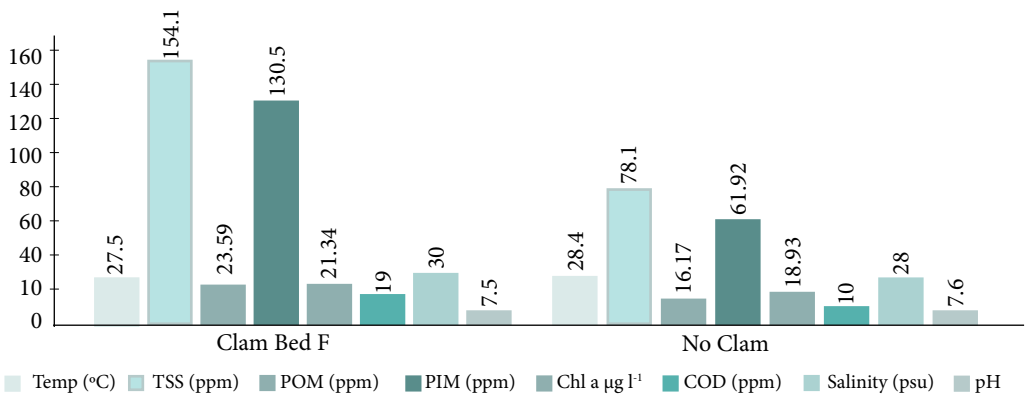


Table 5: Selected Water Quality Characteristics of Ashtamudi Lake

Scenario	A	B	Optimum range
Description of situation	Clam with fishery	No Clam	
Parameters			
Chlorophyll a, µg l^{-1}	21.34	18.93	17-40
Temperature, °C	27.5	28.4	25-32
Salinity, PSU	30	28	2 - 48
Dissolved oxygen, mg l^{-1}	4.44	4.44	5 -10
Total suspended solids, 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 6: Selected Sediment Quality Characteristics of Ashtamudi Lake

Scenario	A	B	Optimum range
Description of situation	Clam with fishery	No Clam	
Parameters			
Sediment organic carbon, per cent	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, per cent	68.6	82.1	40
Silt, per cent	17.0	10.9	30
Clay, per cent	14.1	6.8	30

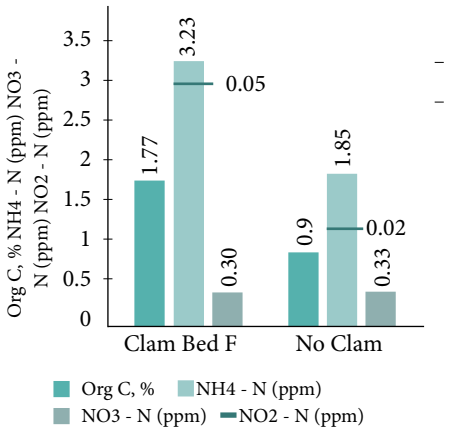
Table 7: Results - Comparison of Scenarios A and B

Scenario	A	B	Probable reason
Description of situation	Clam with fishery	No Clam	
Parameters			
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		
BOD		≈2 times more ↑	Less oxidation in non-clam
region			
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

Contd...

Scenario	A	B	Probable reason
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

Figure 17: Sediment characteristics of selected locations of Ashtamudi Lake - I



5. Assessment of Bio-geochemical Services Provided by Clams in Ashtamudi Lake

The physico-chemical parameters in the Lake where clam beds and fishery (Clam bed F) occur and where no clam beds were sampled. The clam bed with fishery (Scenario A) and non-clam bed (Scenario B) were compared for understanding the differences in bio-geochemical processes occurring in these two types of habitats. The conditions of these scenarios are different from the earlier scenario using CLAMFIL model.

Bioturbation is the reworking of soils and sediments by animals or plants. Its effects include changing texture of sediments (diagenetic), bioirrigation and displacement of microorganisms and non-living particles.

5.1. Inferences

In clam bed with fishery, oxidation reduction potential of surface sediment was double due to bioturbation of clams and the amount of nutrients released to water was thrice, compared to the non-clam zone. Beneficial effects on bio-geochemistry are indicated due to the presence of clam with fishery in Ashtamudi Lake. The environmental quality indicators remained well within permissible levels in the presence of clams with fishery, improving the ecosystem processes at the same time, compared to non-clam zone in Ashtamudi Lake. Sustainable maintenance of clam beds with optimum fishery is necessary for the general ecological health of the Ashtamudi Lake.

6. Social and Economic Conditions of Clam Fishers in the Lake

A quick assessment of the socio-economic status of clam fishers and associated workers (family processors, agents, buyers) was carried out in July 2014. The

Figure 18: Sediment characteristics of selected locations of Ashtamudi Lake - II

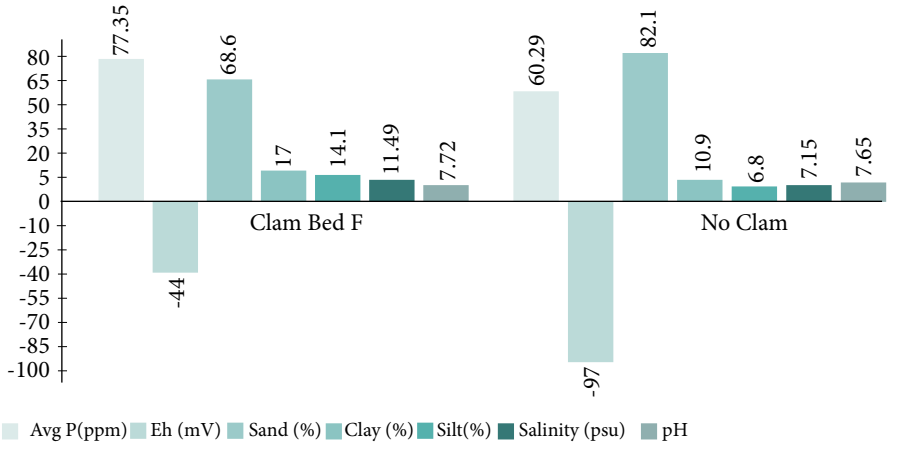
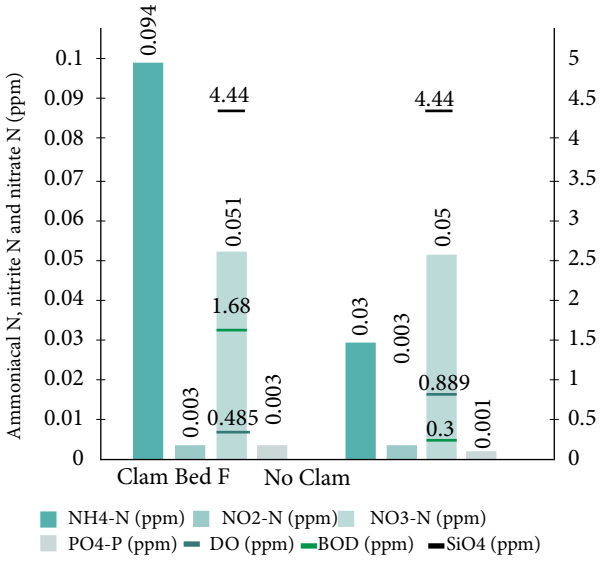


Figure 19: Water characteristics of selected locations in Ashtamudi Lake -II



sample size was 40 respondents and they were selected randomly.

6.1. Category

The stakeholders are broadly coming under three categories namely clam fishers (24 numbers, 60%), followed by clam processors and buyers-7 numbers each (17.5% each) and clam agents-2 (5%).

6.2. Age composition and family size

Age is an important socio economic indicator, which has a positive relationship with adoption of any new methods or enterprises and risk-taking ability. (Table 10)

The proportion of middle age and the old age are equal sharing about 37.5% of the total respondents. (Table 11) The strength of these two groups is their experience in clam farming or processing, which will be a guiding force for the coming generations. The average family size of the respondents was 4.0 on par with the National Marine Fishery Census (2010) estimate.

6.3. Literacy level

Literacy is an important indicator of social status, which also decides the capacity of the individuals to receive and accept new methods or practices in their profession or occupation.

About 68% of the stakeholders have studied up to primary level, followed by 22.5% at secondary level and 4% at higher secondary level. (Table 9)

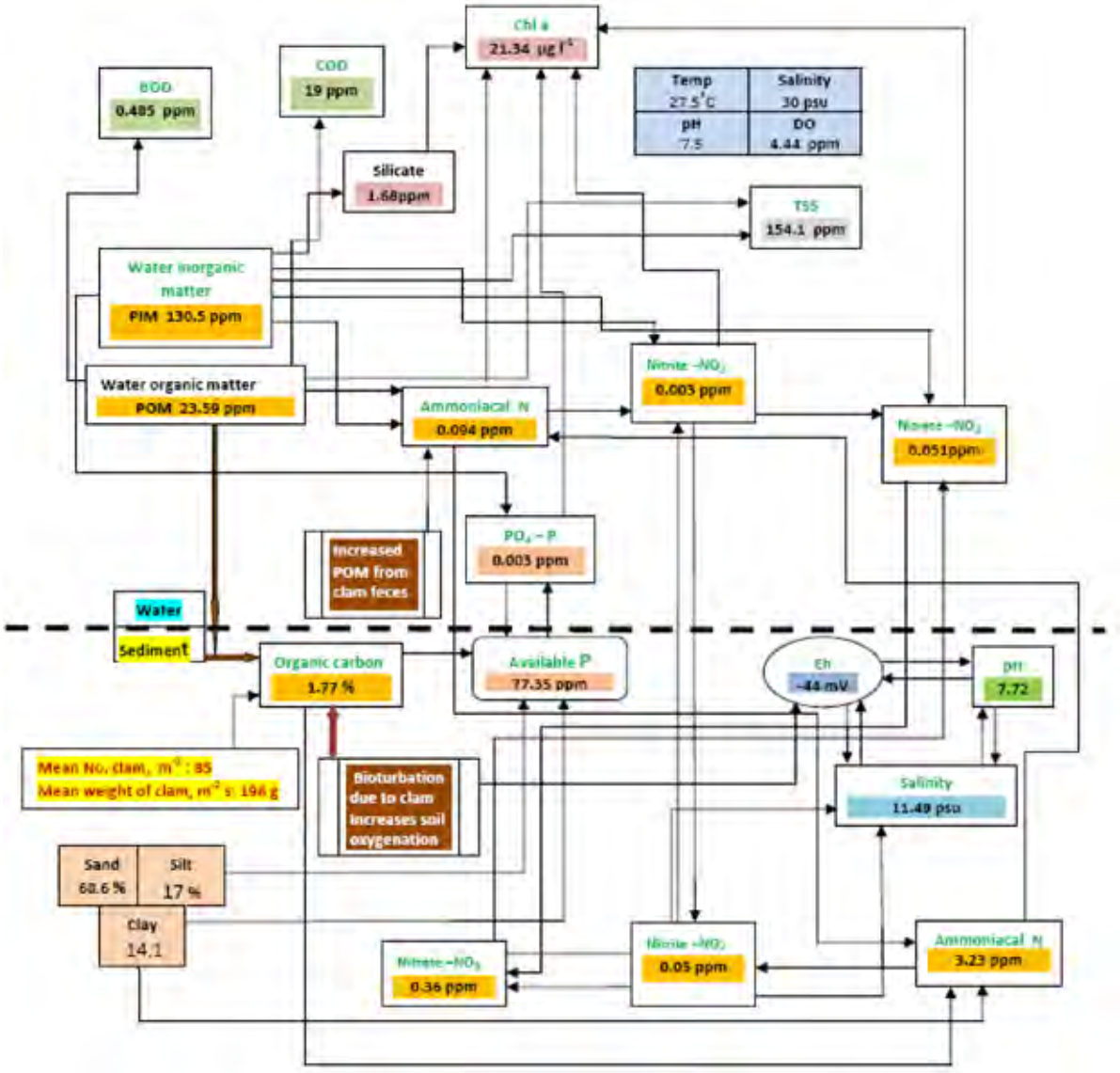
6.4. Religion

The respondents comprise stakeholders, who follow Christianity and Hinduism. It was found that 75% of the respondents (30 numbers) were followers of Christianity and 25% (10 numbers) were followers of Hinduism.

6.5. Occupational status

Among the various divisions in the clam fishery, clam

Figure 20: Ecosystems Processes in Ashtamudi Lake in Clam Bed with Fisheries (Scenario A)



fishing provides employment for the maximum number of respondents (24), sharing 60% of the stakeholders followed by Clam processing (17.5%), clam buying (17.5%) and clam agents (2%). (Table 10)

6.6. Housing pattern

Most of the respondents (87.5%) were living in owned houses, while 12.5% were living in rental houses. Among the different types of houses, the proportion of semi-pucca houses were the highest (45%) followed by concrete houses (42.5%) and katcha houses (12.5%).

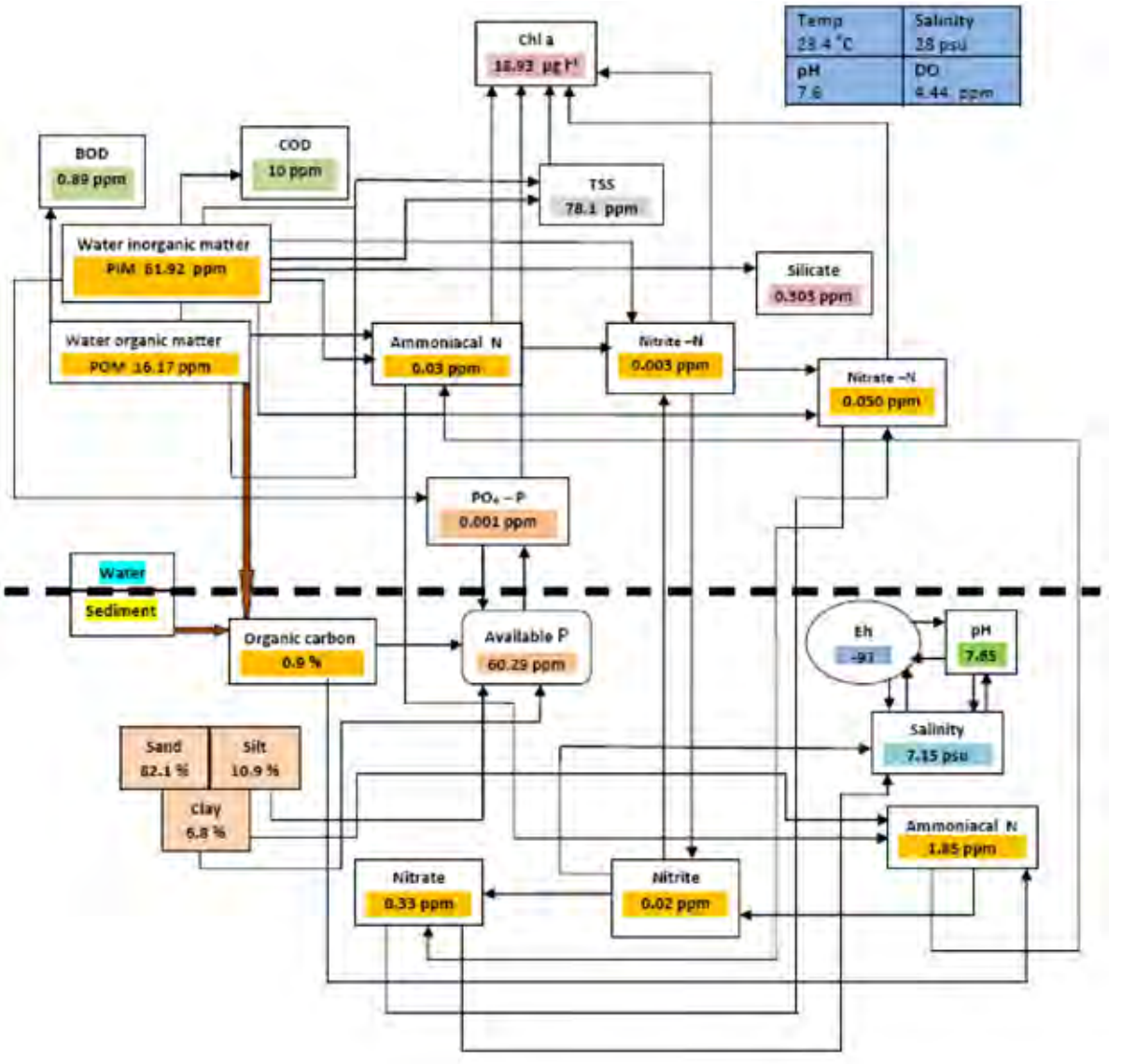
6.7. Employment and income from clam fishery

Among the various branches of clam fishery, clam collection and processing provides employment of 18 days per month on an average. The average income earned from these two branches worked out to ₹14,706 per month.

6.8. Returns from clam fishery and marketing

Clam fishery provides an average return of ₹743 per trip during the peak season (Mar-Aug) and ₹238 during the

Figure 21: Ecosystems Processes in Ashtamudi Lake in non-Clam Region (Scenario B)



lean season (Sep-Nov). The average quantity of clam marketed per day is 24.8kg per day earning revenue of ₹58.27.

6.9. Consumption and expenditure pattern

The proportion of income spent on food is the highest (29.80% of the total expenditure) followed by clothing (25.24%), health expenses (20.73%) on the higher side. The share of expenses on educational was low (4.92%). The expenditure towards maintenance of fishing implements was 7.31% and on social commitments is 6.46%. The share of expenses on food confirms one of the principles of "Engel's law of standard of living", which says that the maximum proportion of income spent on food increases with increase in income.

6.10. Indebtedness

Cooperatives are the major source of advances or loans for stakeholders. About 35% of respondents have availed loans from cooperative societies while 30% availed

Table 8: Age composition of the respondents

Sl. No.	Age group	Number	Percentage
1	Young (Less than 35)	10	25.0
2	Middle age (36-55)	15	37.5
3	Old (Above 55)	15	37.5

Table 9: Literacy level of the sample respondents

Literacy level	Number	Percentage
Primary	27	67.5
Secondary	9	22.5
Higher secondary	4	10.00
Total	40	100

from banks, followed by money lenders (25%) and self-help groups (10%). The purposes of loans availed included clam fishery, house maintenance, celebration of marriages and carrying out small entrepreneurial activities using clams. The loans availed from money lenders were mainly for domestic purpose. (Table 13)

7. Willingness to Pay (WTP) for Clam Fisheries Management

A survey was conducted to estimate the Willingness to Pay (WTP) for implementation of clam fisheries management among the clam stakeholders. Initially they were asked about the problems faced by them before introduction of CFMP. The stakeholders expressed that unregulated harvest was the serious problem (77.5% of the respondents expressed), followed by limited market for the produce (50%), reduced catch per trip (35%) and poor quality of clams (23%).

Stakeholders also listed the benefits that they obtained by adopting clam fisheries management. Most (75%)of the respondents expressed that they got sustained catch, followed by higher share of consumer rupee paid (50%), consistent market for their produce (32.5%), increase in net operating income per trip (25%), increase in domestic savings to meet their planned needs (22.5%) and premium price received for their produce (20%). About 18% expressed that they got sustainable income after adopting CFM.

It was found that stakeholders were ready to pay on an average about 16% of their surplus earnings towards CFMP. The net social benefits due to the implementation of CFMP have also been estimated provisionally at ₹13.33 lakhs.

Table 10: Occupational Status of Respondents

Primary occupation	Number	Percentage
Clam fishing	24	60.00
Clam agent	2	5.00
Clam processing	7	17.50
Clam buying	7	17.50
Total	40	100.00

Table 11: Indebtedness status

Source of credit	Number of fishers who availed loans	Percentage	Average amount of loans availed
Banks	12	30.00	2,79,167
Cooperatives	14	35.00	1,97,587
Government agencies	0	0.00	0
Self-Help Groups	4	10.00	24,375
Money lenders	10	25.00	1,92,00
Total	40	100.00	

8. Estimate of Costs of MSC Certification

Fishery and chain of custody assessment and certification costs are paid directly to the independent third party certification body. The costs may not be one-off costs because if the assessment outcome is positive, there will be ongoing compliance costs. These costs may include those associated with the implementation of certification conditions, as well as those associated with annual audits.

The main elements of the assessment and certification process that carry a cost can be summarized as:

- Pre-assessment
- Full assessment
- Annual audits (once MSC certified)
- Chain of Custody certification
- Logo licensing

As the fishery client (or applicant for fishery certification) one may not be liable for chain of custody certification (usually post-harvest companies) or logo

The cost of fishery assessment is variable and depends on the complexity of the fishery and level of controversy between stakeholders. Peer and expert review, information gathering, consultation, and objection comprise the major cost components in fishery assessment. Once certified, MSC fisheries are subject to annual audits, and may incur logo licensing and chain of custody certification fees

licensing (usually businesses who wish to place the MSC logo on certified products).

The cost of fishery assessments is variable and can depend on the complexity of the fishery and sometimes the level of controversy between stakeholders. If conditions are placed on the fishery there may be costs associated with meeting these.

8.1. Major cost components in fishery assessment

8.1.1. Scientific Experts

The MSC process calls for high calibre scientific and fishery management expertise to be brought to bear on the fishery evaluations as well as the time commitment required from high-level experts, the expertise required may mean that these costs form a significant part of the budget. The team evaluates all relevant information and determines whether the fishery meets the MSC standard. The team members also write the relevant reports.

8.1.2. Information Gathering

The assessment process does not involve primary research but the evaluation of existing information. As the client, one needs to do majority of the information gathering. If the information gathering is left to the certification body, it may become time consuming and thus costly for the client. If this information is easily accessible and collated by local organisation or agency, then these costs can be better managed.

8.1.3. Consultation

The full assessment process requires direct consultation with interested parties (including client) and stakeholders. This may require travel on more than one occasion by the certification body representative and/or members of the assessment team.

8.1.4. Peer reviewers

The MSC process requires external peer review of the draft report, by a minimum of two internationally recognised experts who are considered to be, at a minimum, the peers of the experts on the assessment team.

8.1.5. Objections

If an unsatisfied party lodges an objection there may be additional costs passed on to clients by the certification body. During the first stage of an objection (which involves a formal request to a certification body to review the decision) the certification body will charge out its time and related costs which it incurs in responding to the objection. The second stage involves continuing the objection and lodging a further objection with the MSC. To date the MSC has borne the costs of retaining experts for its part in the objections process. However, if an objections panel requires the certification body to conduct further work, these costs may also be charged out to the fishery client.

8.2. Short-neck Clam MSC Assessment Timeline

Stage 6:	Grant of certificate by MSC, London	5 November 2014
Stage 5:	Public review of the draft assessment report	
	Public comment draft report -	31 July 2014
	Stakeholder Notification: Public comment draft report released -	31 July 2014
Stage 4:	Client and peer review	
	Stakeholder Notification: Peer reviewers confirmed	24 June 2014
	Stakeholder Notification: Peer reviewers proposed	11 March 2014

Stage 3: Information gathering, stakeholder meetings and scoring
Stakeholder Notification: Site visits scheduled 25 July 2013
Stage 2: Building the Assessment Tree
Stakeholder Notification: Use of the default assessment tree with the Risk Based Framework - 23 July 2013
Use of the RBF in a fishery assessment form - 23 July 2013
Stage 1: Fishery Announcement and Assessment Team Formation
Stakeholder Notification: Assessment team confirmation - 18 July 2013
Stakeholder Notification: Assessment team nominated - 11 June 2013
Stakeholder Notification: Fishery enters full assessment - 11 June 2013

8.3. Costs of MSC Certification of Clams

The certification of clam includes costs. The costs include the actual expenses incurred towards the certification process, which are actually paid like costs of travel & subsistence, communication & fund raising, administrative costs, management fee and auditor's fee. Once the clam is certified, the re-assessment is due after five years. The re-assessment fee is also included in the direct costs. However, in the present case, the project life is considered for five years i.e. up to the validity of the first certification process and hence not included. (Table 12)

8.4. Costs of Compliance to Management

The of costs of compliance to management include wilful forfeiture of clam catch due to enforcement of ban, the loss in quality (size) factor, the transaction costs such as costs of enforcement and also the institutional charges. Here the loss of clam catch is worked out based on the annual catches of the earlier years and the remaining costs are directly estimable. The total cost of compliance to management with their components is presented in Table 13.

It is seen from the above tables that the auditor fee accounts for 78.5% of the cost of certification, while the loss of catch due to ban accounts for 93% of the cost of compliance to management.

9. Economics of Clam Production

Clam harvest is done as a family enterprise. The clam fishers leave their home at around 06.00 hours and return back at 12.00 hours. About 2 to 3 fishers go for clam picking. Once the clams are received at the landing centre, the rest is done as a family enterprise. (Timeline Figure 22)

The cost and returns from clam production for the past five years is given below. The catch rate for 2015 is worked out based on the average rate of growth (i.e., 1%). It is seen from the table that the clam harvest declined from 11,053 tonnes in 2011 to 7785 tonnes in 2014 and a marginal increase in 2015. (Table 14)

The price of processed clam meat per kg ranged from ₹37 in 2011 to ₹90 in 2015, an increase of 143% over the last five years, which shows the market potential of clam meat. Export demand for Indian clam meat is also increasing gradually. The certification obtained in 2014 is expected to further increase the price of clam in the global market. The gross revenue increased from ₹817.87 lakhs to ₹1415.37 lakhs during the last five years. The increase in price post clam certification in 2015 is assumed to be ₹20 per kg (29% increase),

Table 12: Initial Cost of Certification

Sl. no	Details	Value (in Rs. Lakhs)	Percent to respective total
1	Travel & Subsistence for experts	2.22	7.44
2	Communications & fund raising costs	0.05	0.16
3	Meeting & Training costs	1.65	5.52
4	Office running costs	0.51	1.71
5	Field running costs	0.14	0.46
6	Management Fee (12.5%)	1.86	6.22
7	MSC Auditors fee (borne by WWF USA)	23.42	78.49
	Sub-total A.1 (Total expenditure)	29.84	100.00
A.2	Re assessment fee	0	0
	Sub-total A.2	0	0
A.3	**Total costs (A.1 + A.2)**	29.84	100.00

Table 13: Cost of Compliance to Management

Sl.no	Details	Value (in Rs. Lakhs)	Percent to respective total
1	Total value of catch forfeited due to ban	1499.70	92.77
2	Total costs of replacement of gears	2.50	0.15
3	Total loss due to minimum size factor	109.08	6.75
4	Total cost of enforcement	1.98	0.12
5	Total Institutional charges per annum	2.45	0.21
	Total costs (Sum of B.1 to B.5)	1616.65	100.00

which is not much different from the annual average increase in price in the past 5 years.

10. Demand-Supply Projections and Benefit-Cost Ratio for Clams

Globally, clams are marketed in two ways, namely whole clam (fresh frozen or boiled frozen) and clam meat (frozen blocks) as shown in Annexure of global market prices sourced from INFOFISH Trade News. In the case of Ashtamudi clams, currently, the latter method is preferred for exports mainly to the Southeast Asian markets. However, borrowing from the experience of the Ben Tre Clam (*Meretrix lyrata*) fishery of Vietnam which was MSC certified in 2012, higher value and prices can be obtained for clams only if it is exported to European markets, where the preference is for whole clams. It is expected that within the next few years, the Ashtamudi Lake short-neck clam fishery would also shift to exporting whole clams. This would result in a price differential of about 4 times the current value with changes in the cost of production. Another option would be to explore the Japanese market to which Vietnam currently exports surf clams in meat form at double the price that India exports to Vietnam.

In order to favourably exploit this market situation, the method of current processing will have to undergo a radical change. Although it can do away with the current drudgery of shucking clam meats from whole clams, the live clams would have to undergo a purification process (depuration – CMFRI has already developed a protocol and pilot plant for this with NGO participation). Depuration is necessary to bring down bacterial levels to European Union standards and the current practice does not meet the standards. This development scenario needs to be proactively taken up by the ACGC and the State Fisheries department.

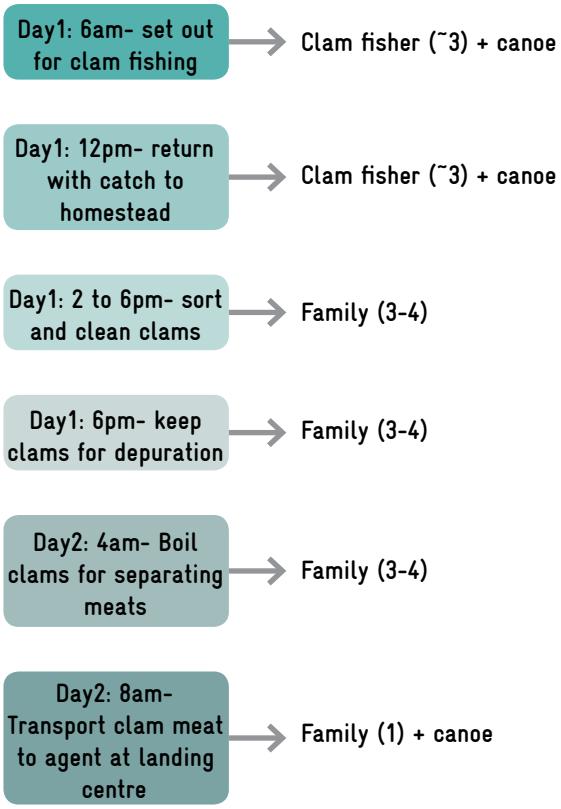
Considering the above, a benefit-cost analysis with projections until the year 2018 has been made and shown separately for clam meat and whole clams in tables below. The following assumptions have been made.

1. Clams are collected during nine months of the year (production period)
2. The clam certification was obtained in late 2014 and the benefit-cost for a five year period thence was considered for the analysis
3. The long term benefit of the clam certification can

Table 14: Economics of clam harvest, 2011-2015

Year	Total clam catch (in tonnes)	Clam meat recovery (20%)	Price of clam meat (Rs./kg)	Gross revenue (Rs. In lakhs)	Cost of production (Rs. Lakhs)	Net operating income (Rs. In lakhs)
2011	11052	2210	37	817.87	286.25	531.61
2012	11174	2235	50	1117.40	391.09	726.31
2013	10907	2181	55	1199.80	419.93	779.87
2014	7785	1557	70	1089.94	381.48	708.46
2015*	7863	1573	90	1415.37	495.38	919.99

Figure 22: Timeline of daily clam fishing in Ashtamudi Lake



be evaluated only when the chain of custody process is completed, which is expected to be done by December 2015

4. The growth rate of 4.5% was assumed for the annual increase in production
5. The increases in cost of production is compensated by the increase in price of clams over the years
6. The benefit-costs are discounted at the rate of 6% considering the small-scale status of t clam fisheries.

The major quantity produced is exported and hence the production is assumed as the demand. Clams are not highly preferred seafood in the Indian market. But there is a growing trend towards consumption of clam meats thanks to trade promotion measures.

It is seen from the table that the price per kg of the whole clam increases from ₹50,000 per tonne in 2011 to ₹65, 000 per tonne in 2015, an increase of 4.6% per annum. From 2015 a marginal increase in clam demand is anticipated due to the gradual increase in price for the whole clam in the export market.

It is also seen from the table that the price per kg of clam meat increased from ₹37,000 per tonne to ₹90,000 per tonne during 2011-2015 and there is a corresponding decline in the quantity of clam meat demanded but for a marginal increase from 2015. The INFOFISH data (yellow clam exported from Kochi to Vietnam) shows that currently clams (frozen meat blocks) from Ashtamudi fetches around US$ 2/kg. It is interesting to note that the demand for certified whole

Table 15: NPV (Net Present Value) and B-C Ratio for clams marketed as boiled shucked meat

Benefits >>						Costs >>			NPV
Year	Production (tonnes)	Price (Rs/tonne)	Gross Revenue (Rs. In lakhs)	Discount factor 6%	Discounted benefit	Total cost of production (Rs. Lakhs)*	Discount factor 6%	Discounted Cost	Net Present value 6%
2011	2210	37000	817.7	0.9434	771.42	597.56	0.9434	563.7	207.68
2012	2235	50000	1117.5	0.8900	994.57	784.36	0.8900	698.1	296.49
2013	2181	55000	1199.6	0.8396	1007.17	782.79	0.8396	657.2	349.92
2014	1557	70000	1089.9	0.7921	863.30	714.98	0.7921	566.3	296.97
2015	1573	90000	1415.7	0.7473	1057.89	922.26	0.7473	689.2	368.73
2016	1644	110000	1808.2	0.7050	1274.68	1088.76	0.7050	767.5	507.15
2017	1718	121000	2078.5	0.6651	1382.31	1197.64	0.6651	796.5	585.81
2018	1795	131000	2351.5	0.6274	1475.37	1295.11	0.6274	812.6	662.81
Ave	1864	83000	1484.8		1103.34	922.93		693.9	409.45
Average Benefit-Cost (BC) Ratio									1.59

**includes fishing costs and family processing costs*

Table 16: NPV and B-C Ratio for clams marketed as whole clams (with shell)

Benefits >>						Costs >>					NPV
Year	Production (tonnes)	Price (Rs/ tonne)	Gross Revenue (Rs. In lakhs)	Discount factor 6%	Discounted benefit	Total cost of production Fishing Labour (Rs. Lakhs)	*Cost of Depuration (Rs. Lakhs)	Total cost of production (Rs. Lakhs)	Discount factor 6%	Discounted Cost	Net Present value 6%
2011	11052	50000	5526	0.9434	5213.21	1934.1	0.6631	1935	0.9434	1825.25	3387.96
2012	11174	60000	6704	0.8900	5966.89	2346.5	0.6704	2347	0.8900	2089.01	3877.88
2013	10907	90000	9816	0.8396	8241.95	3435.7	0.6544	3436	0.8396	2885.23	5356.72
2014	7785	60000	4671	0.7921	3699.87	1634.9	0.4671	1635	0.7921	1295.32	2404.55
2015	7863	65000	5111	0.7473	3819.20	1788.8	0.6039	1789	0.7473	1337.17	2482.03
2016	8217	85000	6984	0.7050	4923.66	2444.5	0.8077	2445	0.7050	1723.85	3199.81
2017	8587	93500	8028	0.6651	5339.39	2810.0	0.9285	2811	0.6651	1869.40	3469.98
2018	8973	102850	9229	0.6274	5790.21	3230.1	1.0508	3231	0.6274	2027.23	3762.98
Ave	9320	75794	7008.8		5374.30	2453.1		2453.80		1881.56	3492.74
Average Benefit-Cost (BC) Ratio											2.86

**This cost is worked out at ₹6/tonne and is borne by the processors not producers*

clam is gradually increasing in the global market as evident from the inroads made by the Ben Tre certified clams in European markets.

The tables show that the NPV was positive during all the years for both production processes and hence these are profitable economic enterprises. A shift in the processing and marketing from the current meat processing to whole clam processing and export is recommended. This advantage is very clear from the comparison of NPV and B-C ratios for clam meat and whole clam processing. The values of gross revenue, NPV and B-C ratio are 4.7, 8.5 and 1.8 times higher in the whole clam processing as compared to meat processing.

11. Conclusions on Economic Analysis

The MSC certification of Ashtamudi clam which is the third certified fisheries in Asia was received in November 2014, hardly an year ago. Hence, the immediate economic impact of MSC certification is difficult to assess and it requires reasonable time to evaluate its impacts (or benefits) on the sector as a whole including the fishers. However, the first expected benefit from the economic point of view is increase in export price in the existing markets and establishment of new markets. Further economic benefits can be anticipated when the fishery establishes the chain of custody in the existing market chain and for new markets. This is expected to happen before the end of 2015. Although there are no clear documented studies on the benefits of price premiums for certified products reaching the producer, it is hoped that in the case of Ashtamudi short-necked clams, the clear economic advantage of making a change in the processing and marketing of clams can reach the benefits to the producer.

The silver line in this certification is that, it has created awareness on the importance of sustainability and its long term benefits in the minds of the primary stakeholders namely the fishers.

They realize that fishery management practices that they followed in the past have helped to get their product certified, and will eventually lead to sustained harvests and improved incomes. In general, the MSC certification has provided an opening for implementing sustainable management in similar small scale fisheries in India.

12. Summary & Conclusions

This brief study has brought out the following facts.

1. The value of the fishery resources of the Ashtamudi Lake was estimated as ₹985 million (= 98.5 crores; US$ 16.4 million). A major share of the value originated from clams (51%), followed by crabs (18%) and shrimps (13%).
2. Assessment of ecological services provided by clams in the Ashtamudi Lake showed that clams function

as very efficient bio-filters of the lake controlling eutrophication. When clams are abundant as when the fishery is well managed, it would take ~139 days to completely filter the entire lake water, whereas when clam abundance is poor it would take almost double or 277 days.

3. Assessment of bio-geochemical services provided by clams in Ashtamudi Lake showed that in areas of the lake where clam beds exist, oxidation reduction potential of surface sediment was double due to bioturbation of clams and the amount of nutrients released to water was thrice, compared to the non-clam zone. Beneficial effects on bio- geochemistry are indicated due to the presence of clam with fishery in Ashtamudi Lake.
4. A quick survey of avian faunal density in Ashtamudi Lake showed 32 species of birds including 6 migratory birds. The role of these birds in the ecosystem is not fully understood and there is need for more detailed studies on their diets.
5. Assessment of social and economic conditions showed that clam fishing provides employment for the maximum number of respondents (60%) followed by clam processing (17.5%), clam buying (17.5%) and clam agents (2%).
6. Estimates of costs of MSC certification showed that the auditor fee accounts for 78.5% of the total cost (₹29.84 lakhs). In the costs toward management of the resource, forfeiture of catch due to ban accounts for 93% of the total. The total cost of management has been worked out at ₹1616.6 lakhs.
7. The gross revenue of clam fishery increased from ₹817.87 to ₹1415.37 lakhs during the last five years. The increase in price post-clam certification in 2015 is assumed to be ₹20 per kg (29% increase), which is not much different from the annual average increase in price in the past 5 years.
8. The values of gross revenue, NPV and B-C ratio are 4.7, 8.5 and 1.8 times higher in the whole clam processing as compared to meat processing.
9. A shift in processing and marketing from the current meat processing to whole clam processing and export is recommended. Another quick option is for exporters to target the Japanese market for clam meat which could fetch prices which are almost double.
10. Real benefits of the certification can be assessed only after 3-4 years. However, it is presumed that a shift in the destination market to Europe or Japan and change from marketing clam meat to whole clams can lead to more than 75% increase in total revenue.

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ANNEX 1: EXTRACT FROM INFOFISH TRADE NEWS - 2/2015

FROZEN CEPHALOPODS AND MOLLUSCS — 1 February 2015

FISH SPECIES TRADE NAMES	PRODUCT FORM & GRADING	INDICATIVE PRICE in US$/KG	PRICE REFERENCE & MARKET AREA	ORIGIN
SQUID *Loligo sp.*	Whole, round, 5 x 4 kg 100% nett weight U/3 pc/kg 4.50 =	3/6 pc/kg 4.10 = 6/10 pc/kg 2.60 = 10/20 pc/kg 2.25 =	cfr Vietnam	Kochi, India
	Rings and Tentacles, blanched IQF, 10% glaze	60 pc/kg and up 3.70 Assorted 3.15	cfr Belgium	Gujarat, India
	Tubes, 3/5 inch 2.15 /lb =	5/8 inch 2.10 /lb =	Ex-warehouse NY, USA	China
	Rings, blanched, IQF, 20% glaze	60 pc/kg and up 4.00 =	cfr Belgium	Kochi, India
	Tentacles, blanched, IQF, 20% glaze	60 pc/kg and up 3.05 =	cfr Italy	Gujarat, India
SQUID *Illex argentinus*	Whole	1.16 =	fob Argentina	Argentina
	Tubes	2.08 =		
	Tentacles	2.40 =		
NEEDLE SQUID	Whole, cleaned, 10 kg poly bag with tube IQF, 20% glaze	U/3 pc/kg 3.75 = 3/6 pc/kg 3.25 = 6/10 pc/kg 2.85 =	cfr Italy	Kochi, India
	Whole, round, IQF, 10 x 1 kg poly bag with tube	10/20 pc/kg 3.30 = 20/40 pc/kg 3.00 =	cfr Spain	
	Whole, round, nett weight U/3 pc/kg 3.65 = 3/6 pc/kg 3.25 =	6/10 pc/kg 2.85 = 10/20 pc/kg 2.45 =	cfr Europe	Chennai, India
SEMI-NEEDLE	Whole, 10 kg. nett weight	3/6 pc/kg 3.30 = 6/10 pc/kg 3.00 =	cfr Vietnam	Kochi, India
	Whole, round shape, 10 x 1 kg, poly bag IQF, 20% glaze U/5 pc/kg 4.40 =	U/10 3.70 = 10/20 3.10 = 20/40 2.60 =	cfr Italy	
OCTOPUS *Octopus vulgaris*	Whole, cleaned, IQF, 20% glaze, 10 kg	100/300 gm/pc 3.50 - 300/500 gm/pc 3.50		
	Whole, cleaned, 5x4 kg, nett weight	100/500 gm/pc and up 2.85 -	cfr China	
	Whole, cleaned, 10 kg. pack, IQF, 10% glaze	100/200 gm/pc 3.00 - 200/500 gm/pc and up 3.00 -	cfr Malta	
	Whole, IQF	500/2000 gm/pc and up 4.40	cfr Italy	Medan, Indonesia
BABY OCTOPUS	Whole cleaned, IQF 20/30 3.40 -	30/50 pc/kg 3.40 - 50/80 pc/kg 3.40 -	cfr Busan, Korea	
	Whole, cleaned, IQF, 10 x 2 kg block, nett weight, 10% glaze	10/20 - 40/60 pc/kg and up 2.90	cfr Spain	Kochi, India
	Whole, cleaned, 10 x 1 kg, poly bag, IQF, 20% glaze, 10 x 1 kg	10/20 - 60 pc/kg 3.10 =	cfr Italy	
	Gutted, 12 x 2 lbs, 10% glaze 5-15 pc/lb 1.75 =	16-25 pc/lb 1.75 = 26-40 pc/lb 1.75 =	cfr USA	
OCTOPUS *(Fulpo)*	3-4 oz/pc 3.50 /lb =	4-6 oz/pc 4.50 lb = 6-8 oz/pc and up 4.00 lb =	Ex-warehouse NY, USA	Spain
MUSSELS	Half-shell	Medium 3.20 lb =		New Zealand
CLAM 'Chocolate'	Mixed sizes	4.04 -	Wholesale Mexico	Mexico
SURF CLAMS *Paphia undulata*	Meat, block 200/300 pc/kg 5.80 = 300/500 pc/kg 4.90 -	500/800 pc/kg 4.50 = 800/1000 pc/kg 4.30 = 1000/1500 pc/kg 4.00 =	cfr Japan	Vietnam
WHITE CLAM *Meretrix lusoria*	Whole, round, boiled 1 kg/10 carton IQF	60/80 pc/kg 1.90 -	cfr Portugal	
"BAIGAI" *(long type)*	Whole, 10 x 2 kg, nett weight	50/80 pc/kg 1.90 =	cfr Vietnam	Kochi, India
	Meat	100/200 gm/pc and up 8.50 =		
YELLOW CLAM	Meat, block, 10 x 2 kg glaze, nett weight	700/1000 pc/kg 2.20 = 1000/1500 pc/kg 2.05 =		
GREY CLAM	Meat, block, 10 x 2 kg glaze, nett weight	1000/2000 pc/kg 1.95 = 2000/3000 pc/kg 1.75 =		
OYSTER	In bags with water without shell	700-1000 units 5.67 -	Wholesale Mexico	Mexico
FROGLEGS	2/4 pairs NQ 4/6 pairs NQ	6/8 pairs NQ 8/12 pairs NQ	Ex-warehouse NY, USA	China
	Classic brand 6/8 pc/kg 8.10 =	8/12 pc/kg 8.00 = 31/40 pc/kg 4.25 =	cfr Europe	Medan, Indonesia
	Yogu brand 13/15 pc/kg (20 x 500g) 7.50 =	16/20 pc/kg (10x2 kg) 7.05 = 20/30 pc/kg (10 x 1 kg) 5.50 =		
	Mixed sizes	9.07 -	Wholesale Mexico	Mexico

India a biodiversity hotspot

India is one of the megadiverse countries in the world. It faces unique circumstances as well as challenges in the conservation of its rich biological heritage. With only 2.4% of the world's geographical area, her 1.2 billion people coexist with over 47,000 species of plants and 91,000 species of animals. Several among them are the keystone and charismatic species. In addition, the country supports up to one-sixth of the world's livestock population. The rapid growth of her vibrant economy, as well as conserving natural capital, are both essential to maintaining ecosystem services that support human well-being and prosperity.

To demonstrate her empathy, love and reverence for all forms of life, India has set aside 4.89% of the geographical space as Protected Areas Network. India believes in "वसुधैव कुटुम्बकम" i.e. "the world is one family".

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