9,000. The benefit-cost ratio worked out to be 3:1, which indicates that for every one rupee spent by the manufacturer he realises a return of ₹ 3.

(iv) Assessing the shell craft Industry

The magnitude of the shell craft industry in terms of procurement of shells, shell collection, processing and trade was assessed through operating cost and revenue. The total estimated quantum of trade of gastropods is 11,000 tonnes (10% is contributed by imports) and the revenue around ₹ 100 crores. According to the Federation of Sea Shell Handicrafts Merchants Association (FOSSHMA), there are around 90 active sea shell handicrafts traders in India, of which 20 are very active, 30 with minimal functioning and 40 dormant units. Around 350 containers each having a capacity of 20 t are exported annually. The traders stock around 20-25,000 t annually which are sourced either locally (30%), from other parts of India (60%) and through import (10%). Among the different gastropod species procured as raw materials 75% of them are small sized. The average cost per tonne of procurement ranged from ₹ 6,000 - 10,000 (locally), 10,000-15,000 (within India) and ₹ 18,000-35,000 (import). The economic analysis of the trade indicated the total operating cost estimated for the shell craft industry is ₹ 25 crores. The cost of the raw material ranged from ₹ 6 - 36 weighed in kilogramme or per piece and the price of the product ranged from ₹ 30-150 weighed in kilogramme or per piece. Among the total products traded to the tune of 11000 t, more than 75% of the finished products is exported, 24% is sold within the country and less than 1% of the finished products is sold in the local markets.

(v) Legal issues in gastropod trade

The Wildlife (Protection) Act, 1972 was enacted with the objective of effectively controlling poaching and illegal trade in wildlife and its derivatives. The 2002 Amendment Act which came into force in January, 2003 has made punishment and penalty for offences under the Act more stringent and also brought 24 species of molluscs in its purview. This has brought restrictions in the collection of ornamental gastropods for the trade.

The interaction with the traders revealed that the shell products were being seized by law enforcing authority even though they were abiding by the law. This problem could be linked to misidentification of gastropods by concerned authority due to lack of information. The other major threats to the resources are from tourism related activities on the beach, dumping of untreated industrial and domestic wastes into the sea, dredging operations depositing large quantities of silt which increases the turbidity of the water that result in damage to the nursing and feeding grounds of larvae and juveniles of gastropods.

Marine cage farming of Asian seabass under participatory mode - A success story


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Karwar Research Centre of ICAR-CMFRI in association with the Directorate of fisheries, Govt. of Goa identified Polem village (14° 54’ 21.12” N; 74° 04’ 32.20” E) in south Goa for the cage culture demonstration under the project ‘National Innovations on Climate Resilient Agriculture (NICRA)’. Awareness programmes were conducted for the fishermen communities in the village regarding the present status of marine fisheries resources of India and future prospects. Self Help
Groups (SHGs) were formed among the fishermen of Polem village and hands on training on various aspects of cage farming was given to the identified group at the Karwar Research Centre of ICAR-CMFRI. Site selection for the cage farm at Polem was done following a standard protocol (Philipose et al., 2012. Indian J. Fish., 59 (1) : 83-88). The seeds of Asian seabass, *Lates calcarifer* (average size 5.0 ± 0.3 cm) were procured from Rajiv Gandhi Centre for Aquaculture (RGCA) and nursery rearing was done in the marine hatchery complex of Karwar Research Centre for 30 days. A total of 8 cages of 6 metre(m) diameter were installed. Nursery reared fishes (average size 15 ± 0.2 cm) were stocked @ 14 numbers / m² in the cages in two batches. The first batch of fish was stocked in November 2015 and second batch in December 2015. The culture period lasted for six months. All the technical services such as net exchange, feeding, growth and health monitoring of fishes were given by the scientists and technical staff of the centre from the day of stocking till the harvest.

During the culture period, fishes were fed with trash fish @ 6% biomass. Nets were exchanged at monthly intervals to avoid settling of barnacles and other fouling organisms and also to maintain free flow of water into the cages. Growth parameters were monitored at monthly intervals and average growth rate was recorded. Fish health was examined every month for the presence of any external parasites. Average temperature, salinity, pH and dissolved oxygen of the water from cage site ranged between 27° C to 30.5° C, 30 to 35 ppt, 7.3 to 8.2 and 6 to 6.5 mg/l respectively. Nutrients were found
to be within the permissible limits. Total bacterial count and *Vibrio* count of sediment ranged from $2 \times 10^4 \text{cfu/g}$ to $5 \times 10^4 \text{cfu/g}$ and $2.5 \times 10^3 \text{cfu/g}$ to $8.2 \times 10^3 \text{cfu/g}$ respectively. After 6 months of culture, first batch recorded a maximum weight of 1.2 kg with 60% survival rate, while the second batch recorded a maximum weight of 0.8 kg with 58% survival rate. The SHGs got a final production of 11 kgs/m$^3$ and 9 kgs/m$^3$ of Asian seabass from two batches and benefited with a profit of ₹ 5, 00,000.

Successful cage farming of Asian seabass by Self Help Groups (SHGs) at Polem, Goa indicated that marine cage farming can play an important role in improving the livelihood and socio-economic status of the coastal communities. High density stocking was not possible for want of enough numbers of seabass seeds during the farming period. Provided the sea bass seeds are available, production at the rate of 50 kg/m$^3$ can achieved easily.

Large scale farming of green mussel in Ashtamudi Lake, Kerala

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Green mussel, *Perna viridis*, farming is spreading fast in the lower stretches of Ashtamudi Lake in Kollam district of Southern Kerala. Huge demand for green mussel in the northern part of Kerala has resulted in significant increase in its price. The price has increased to ₹ 10,000 per gunny bag of 70 kg for medium sized mussel (50-100 mm) whereas larger ones (120 -150 mm) fetch prices as high as ₹ 400 per kg (8 pieces). This has prompted local fishermen to try mussel farming using on bottom method of mussel culture which some farmers practiced earlier with locally available seed.

Seed for the farming is collected and supplied to farmers in Ashtamudi Lake from Kozhikode, Kannur and Thalaserry in North Kerala. Seeds and packed in wet jute bags are transported to Kollam by rail which takes about 12 hours and from there it is transported to Kavanad Ferryboat Jetty by van. Consequent to the large scale mussel spat settlement during this year (2016), more than 1800-2000 gunny bags of seeds of green mussel has been bought from northern Kerala, for farming. Each jute bag weighs 70 kg (contains 2.0 lakh seeds) making the total seed used from farming during this season around 140 tonnes (t). Average length of green mussel seed was 21 mm. The seed bags were conditioned in the back waters for 2-3 hours. Then bags were cut open and seeds were washed and sold to farmers according to their need. One gunny bag of seed (about 70 kg) was sold at a price of ₹ 3700. The washed seeds are transferred to the boats and covered with wet gunny bags to prevent heating and dehydration during the transport to the farming site.