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PRESENT STATUS AND PROBLEMS OF MUSSEL CULTURE IN INDIA

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ABSTRACT

Two species of mussels, viz., the green mussel, Perna viridis and the brown mussel, Perna indica were cultured using the seed collected from the natural beds of the east and west coats of India. The results of culture experiments are consolidated and the present status is reviewed. Although the culture experiments gave encouraging results, problems like mooring of rafts in highly turbulent coastal waters, large scale seed requirements, control of predation, legal problems and marketing of end products require urgent attention before undertaking commercial operations. Some of the major problems of mussel culture are outlined in this paper for fomulating effective management policies and their implementation for commercial mussel farming in India.

INTRODUCTION

Mussels are being exploited from the coastal intertidal rocky beds along the southwest coast of India from time immemorial for edible purpose. *Perna viridis* (green mussel) and *P. indica* (brown mussel) are the two common species occurring along Indian coast and they are exploited commercially on a sustenance level with a total production of approximately 3000 t/year. During the preindependence and postindependence period not much attention was paid to the development of the molluscan fisheries in India. However, from 1971 onwards attempts for culturing molluscs were initiated and with suitable modification, the raft culture techniques If Spain were tried in India. The Central Marine Fisheries Research Institute started work on mussel culture in order to develop a low cost technology for large-scale mussel farming. Vizhinjam was the first centre to

initiate the raft culture experiments. Later, culture works were carried out at Calicut, Karwar, Goa and Ratnagiri along the westcoast, and at Madras, Waltair and Tuticorin along the east-coast and also along the Andaman coast. Trial experiments of pole culture in lagoons and backwaters of Madras, and submerged raft culture at Kovalam, Madras were attempted to overcome some of the local problems with less success. Apart from the Central Marine Fisheries Research Institute, the National Institute of Oceanography, Goa; Konkan Krishi Vidyapeeth, Ratnagiri; Central Agricultural Research Institute, Port Blair; and Department of Fisheries, Kerala have also carried out experimental culture/pilot projects to demonstrate the possibilities of mussel farming along the Indian coast. The raft culture was basically successful in all the centres and experiments conducted so far indicated tremendous possibilities of large scale farming in India.

METHOD OF RAFT CULTURE

Rafts of different dimensions, usually square structures ranging from 4-8 m in length were used for suspending seeded ropes. The structures were made of 4-8 m long teak, bamboo or casurina poles or cheap wooden logs, lashed together by coir or nylon ropes. Empty diesel drums or barrels made of GI sheets of 200 l capacity treated with anticorrosive paints were used as floats for these structures. 2 or 3 rectangular wooden planks (3x0.5m) were fixed above the rafts as working space when the raft is floated in the sea. Depending on the size of the raft, 4-8 floats are used for the required buoyancy. The rafts were moored by iron anchors and tested anchor chains were treated with tar or anticorrosive paints. In protected bays, large granite stones tied with thick nylon ropes were found effective in mooring rafts.

Mussel seeds for the experiments were collected from natural beds near the culture centres and farm areas using artificial cultches viz., frilled nylon ropes, roof tiles and iron hapas covered with nylon netting. Fouling organisms and encrusted algae were removed before the transplantation of seed over the ropes. 20-30 mm sized seeds were found ideal for transplantation and at few centres, lesser size groups were also used for experiments. The cleaned seeds were wrapped with thick manila, nylon or coir ropes and secured by cotton netting, bandage cloth or cheap knitted cotton cloth. Nylon rope was found more economical as this could be used for repeated experiments. Weight of seed used per metre length of rope varied from 1.5 to 2 kg and the seeded length of the rope from 4-6 m depending on the depth

of the culture area. In a few experiments, 10 m long seeded ropes were used in the open sea condition, but with poor yield. Once the seed is secured the ropes were suspended from the raft. The mussel secretes a byssus thread and attachs firmly to the ropes. Meanwhile the cloth covering the rope disintegrates within 4-5 days. A raft of 6 x 6 m size can accomodate 50-60 seeded ropes and the mussels reach harvestable size within 5-8 months.

RESULT OF EXPERIMENTS ON MUSSEL CULTURE AT DIFFERENT CENTRES

Vizhinjam : Raft culture experiments initiated at Vizhinjam have shown higher yields for brown mussels compared with that of the natural beds (Qasim and Achari, 1972, Achari , 1975). Further culture studies both in the bay and open sea made by Appukuttan *et al*,1980) helped to identify problems and relative merits of mussel culture in bays and open seas. Rafts made of teak wood and bamboo poles of 6 x 6 m size were used for most of the experiments except 10 x 10 m rafts used in the open sea culture. Seeds were collected from the natural beds around Vizhinjam, and in two experiments seeds collected by artificial cultches were used. The seed size ranged from 15-30 mm and the seed length from 3-6 m. The number of ropes per raft ranged from 50 to 60. The production rate in the bay was around 10-12 kg/m and in the open sea it was 15 kg/m. The meat value was highest in May (43.3%). Mussels reached a marketable size within 5 to 7 months. Spawning of mussel commenced by the end of May and a good settlement was often observed from September onwards. Harvesting the mussel seed for large scale farming operation coincides with the traditional mussel picking in this area. Hence attempts for developing hatchery production of mussel seed are being made ed at Vizhinjam (Appukuttan *et al.*, 1980). Predation of cultured mussel by fishes was reported in certain years (Appukuttan, 1980) and the mass scale seed slipping from ropes on transplantation was observed in few experiments.

Calicut : Green mussel culture was initiated at Calicut by the Central Marine Fisheries Research Institute in 1975 in the open sea using the raft culture method. Results reveal that coir ropes of 4-8 m length could be successfully used for seeding. Rafts of sizes 6 x 5 m and 8 x 8 m, with a teak wood frame anchored at a depth of 8-10 m using iron anchors and an anchor chain were used for culture experiments in different years. Seed mussels of 20-30 mm transplanted on ropes showed faster

growth rate ranging from 10.6 to 13.5 mm/month reaching harvestable sizes within 5 months. A production rate of 4.4 kg to 12.8 kg/m length of rope was achieved. Meat content ranged from 34.82 - 40.5% (Kuriakose, 1980). It was harvested before May as the sea was becoming rouch by the end of April every year and during the monsoon period it was difficult to keep the rafts in the open sea due to heavy wave action.

Karwar : Dense seed settlement of green mussel in the Karwar area was utilised to conduct experimental raft cultures from 1981 onwards in the Karwar Bay. Seeds of 10-20 mm gained harvestable sizes within five months. Rate of production was similar to that observed at Calcicut. Maximum meat yield was 38.10% (Pai and Kuriakose, 1981). At Karwar experiments in subsequent years could not be intensified due to the non-availability of adequate quantity of mussel seed and also due to turbulent sea conditions during the monsoon period causing damage to the rafts and seeded ropes.

Ratnagiri : The occurrence of green mussel settlement in Ratnagiri area attracted the attention of the scientists of the Konkan Krishi Vidyapeeth to initiate experimental raft culture of mussels at Ratnagiri from 1977 onwards (Ranade and Ranade 1980). As there was no dense spatfall at Ratnagiri, seeds for experiments were brought from Goa and seeded ropes were suspended from 5 x 5 m rafts moored in the inshore waters. The average production per rope in 6 months was 7 kg/m and annual production per meter square was estimated to be 65.62 kg.

Goa : Green mussel culture was attempted at Goa in 1974 by rope culture on rafts (Qasim *et al.*, 1977). Seeds for experiments were collected from Velsao Bay, where there was a dense spat settlement. The observed growth rate was 8 mm/ month and the yield was approximately 480 t/ha/year. The rate of return on mussel culture at Goa was estimated to be 181% Due to the turbulent sea during the monsoon, mussels could not be cultured. Fouling of mussels by bryozoans and barnacles were found to be common. Rao *et al.* (1976) have conducted experiments on spawning, fertilization and larval development of green mussel indicating possibilities of a hatchery level production.

EAST COAST

Tuticorin : Brown mussels from Cape Comorin were used

for raft culture at Tuticorin Harbour Basin in 1975 and 1976. Growth was very poor and seed slipping was common. Predation by perches was another problem for rope culture at Tuticorin. Due to these unfavourable conditions further attempts were not made at this centre (Nayar, 1980).

Madras : Green mussel culture was initiated at Ennore and later shifted to Kovalam due to unfavourable environmental conditions prevailing at Ennore. Experiments showed that by raft culture mussels grow from 13.63 mm to 52 mm within 3 months, and 50 ropes of 3 m length can produce 2 tonnes of mussels within a period of 4 months at Kovalam (Rangarajan and Narasimham, 1980). Pole culture was tried at Kovalam but this could not be continued due to severe monsoon conditions every year during May and June. Experiments with submerged rafts were tried with partial success at Kovalam in 1979. In backwaters and lagoons of Muthukad pole and bag culture were undertaken during 1983-84, but flooding during November-December completely damaged the growing mussels. Hatchery level production of mussel seed has been tried at Kovalam with successful results (Sreenivasan *et al;* 1988) which also indicates the possibilities of large scale mussel seed production.

Waltair : Attempts to culture green mussel at Waltair was not successful due to sea conditions throughout the year. The floating rafts could not withstand the strong wave action.

Andamans : Rope culture and bag culture using velon nettings were tried in two areas in Andamans. The natural seed settlement in Sipphighat was used for experiments. Growth rate of 8-11 mm/month was observed at Sipphighat in the rope culture method, whereas the bag culture method did not give encouraging results. Total weight increased from 13 to 23 kg/m within five months. Predation and seed slipping were negligible at Sipphighat. Due to heavy predation, experiments at Pongi Balu were not successful (Sodararajan et al. 1987).

PROSPECTS AND PROBLEMS

Mussel culture practice is a recent development in India. Experiments in the seventies and eighties have evolved suitable mussel farming techniques. The high productivity of our seas, the presence of large quantity of unexploited mussel seed in natural beds high rates of yield within a short period when cultured and pollution free water are some of the favourable factors conducive for farming the mussels in India. The microscopic algae and detritus that from the food of mussel are

abundant in our waters and there is no need for artificial food required for better yield. High tolerance of environmental changes is an advantage in the cultivation mussels in the backwaters and the salt water lagoons as observed at Madras. Success in larval rearing and hatchery production of seed in Goa, Vizhinjam and Madras offer scope for mass scale production of mussel seed. Recent export figures of mussel from the westcoast is another encouraging factor for taking up mussel culture on a commercial basis. The results of experiments so far conducted on both the coasts have been encouraging and raft culture is found to be profitable. Based on the technology evolved, operational research programmes were taken up at Calicut and Karikattukuppam near Kovalam, Madras. A pilot project on brown mussel culture was undertaken by the Department of Fisheries, Kerala State and a Lab-to-Land programme was initiated at Calicut and Karwar. These programmes have indicated the possibilities of large scale farming, provided some of the problems identified are solved.

Although mussel farming was found to be successful at experimental at various centres, commercial production is yet to be demonstrated in India. The most important problems in open sea culture are technological in nature like mooring of rafts in turbulent sea conditions during the monsoon period. As suggested by Silas (1980), farming technology itself needs innovation. Availability of seed, paucity of mussel seed for large scale operation, mass scale predation and seed slipping on transplantation are some of the problems yet to be solved. Simple harvesting and processing techniques are to be evolved when large scale farming is adopted. Some of the reasons for the lack of interest shown by the fishermen in taking up commercial production of mussels are the poor demand for mussel meat at present, longer period for the realisation of revenue from farming and conflict with traditional fishermen in the coastal waters. It is felt that a multidisiplenary co-ordinating system should be developed to refine the farming technology. Mapping of ideal farm sites in the coastal waters, survey of seed resources, development of hatchery seed production, demonstration of economic feasibility of farming, development of post-harvest technology and training of fishermen are some of the essential aspects to be given due importance for initiating large-scale mussel farming in India.

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