CMFRI

WORKSHOP ON

MUSSEL FARMING

25 - 27 SEPTEMBER, 1980
MADRAS

CENTRE OF ADVANCED STUDIES IN MARICULTURE

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

P. B. No. 1912, COCHIN-682 018, INDIA

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
COCHIN - 682 018
CENTRE OF ADVANCED STUDIES IN MARICULTURE
WORKSHOP ON MUSSEL FARMING
MADRAS 25-27 SEPTEMBER 1980

TECHNICAL SESSION I PRESENT STATUS OF MUSSEL CULTURE	CMFRI-CAS/MF/80/BP -3

PRESENT STATUS OF MUSSEL CULTURE IN INDIA

K. NAGAPPAN NAYAR
Central Marine Fisheries Research Institute, Cochin - 18

INTRODUCTION

The technique of raft culture of mussels developed and practised in Spain and followed by other European nations is a stimulating example of the higher efficiency of resource use, technically feasible to achieve several-fold increase over the level of natural bed production. This motivated the efforts in India too to develop mussel production in a manner quite different from the conventional path in which we have moved so far. This was all the more made easy since all along our coastal regions there are large unexploited or not yet fully utilised mussel population. Further, the most promising way of converting marine phytoplankton into animal protein is to culture shellfishes as they feed on products which are only one step down in the food chain. The great resilence, rapid growth and easy harvesting of mussels together with the additional plus factors in our waters with regards absence of pollution and /to

.....2.

high productivity of waters warranted the mariculture attempts on mussels. This culture attempt by CMFRI commenced less than a decade ago, in 1971 at Vizhinjam where seeds of the brown mussel Perna indica were collected from nearby natural beds and seeded on to ropes of different lengths and suspended from rafts. Success was achieved by obtaining a five-fold greater production, in a shorter duration when compared to natural bed yield. This paved way for extending the rope culture technique for green mussel culture at Calicut and Madras too so as to evolve appropriate technique of culture depending on respective local conditions. The effort at Calicut was by and large a great success since the yield of green mussel here was as much as eight times the seed weight in a very short period of 150 days. Several obstacles encountered here and there during the course of farming experiments are being studied and solved so that standardisation of techniques in all aspects can be done in a few years time from now.

In addition to the work that is being done by CMFRI, attempts are also being made to study the various problems connected with mussel culture by the Konkan Krishi Vidyapeeth at Ratnagiri and also by the National Institute of Oceanography at Goa. The success obtained at Vizhinjam on mussel culture helped the Fisheries Department of the Government of Kerala to take up a Pilot Project on mussel culture at Vizhinjam in 1975.

REVIEW OF THE MUSSEL CULTURE WORK IN THE WEST AND EAST COAST

I. West coast:

a) Vizhinjam: Culture of the brown mussel Perna indica at

....3.

Vizhinjam is a semi-culture in the sense the seeds are collected from the natural setting grounds and grown on floating rafts till they attain marketable size. The initial experiments were conducted inside the bay area, which is well protected from the strong wave action during the monsoon season. Seeded ropes suspended from the rafts showed very good growth. Based on interesting preliminary results obtained, attempts were made from 1978 onwards to carry out mussel culture in the open sea. Rafts of different sizes, ranging from 6 x 6 m to 10 x 10 m were fabricated with teak and bamboo poles lashed together by coir or nylon ropes were tried. Oil barrels of 200 litre capacity treated with anticorrosive paint, were used as floats to give the required buoyancy for the rafts. The rafts were individually moored by anchors using the required length of anchor chain. In the bay area it was possible to keep the raft in position throughout the year, but in the open sea it was possible only during December to May when the sea is fairly calm. The experiments in the open sea were carried out 1-2 km away from shore at a depth of about 20 m. The brown mussel at Vizhinjam area normally spawns during the month of May, prolonging till September. As it was found that seed mussels of 20-35 mm size are better suited for seeding purposes, the collection of seed from the natural rocky beds is best done during September-November period. Different types of spat collectors were also tried inside the bay for the collection of spat. Split ropes suspended from the rafts gave good results.

Seeding technique:

The seeds were wrapped around coir or nylon rope and secured by cotton netting or bandage cloth. It was observed

...4.

that as the seed attach well and grow on nylon ropes it will be more economical to use nylon ropes. For seeding purposes 1.4 to 2 kg of seed were used per meter length of rope. In the open sea about 10 m. long rope were seeded depending on depth of the water. The seeded mussels suspended from the raft attach very soon to the rope and the outer cloth used for keeping them in position disintegrate. In the Bay area it was observed that the mussels reach marketable size of 55-60 mm in a period of 8 months showing a rate of growth of 2.9 to 3.5 mm per month giving a meat value of 41% at the time of harvest. In the open sea, 60-65 mm size was attained in 5 months and the rate of growth was about 5.5 mm per month. It was also seen that the production was 10-12 kg of mussel per metre length of rope in the bay area in 7 months, whereas in the open sea it was 15 kg for a 5 month-period.

(b) Calicut: Mussel culture work is being done at Calicut for the past 5 years. The technology of culture of the green mussel P.viridis that was being tried was basically the same as that of Vizhinjam with slight modifications to suit the local conditions. Rafts of surface area of 275 sq. meters were cloated in the open sea at a depth of 8 metres. Mussel seed (10 to 20 mm size) collected from the local natural mussel beds were used for seeding ropes. These seeded ropes were suspended from each raft and 750 gm. of seed were used per length of rope. Usually 7 metre of rope was seeded since the depth where the rafts were moored was only 8 m. The mussels grew at the rate of 14 mm per month and attained a size of 85.5 mm in a period of 5 months. The rate of growth of the mussels in the natural bed was slower being only 6.5mm per month. The initial average

....5.

weight of .85 gm/per mussel increased to 29 g. during this period. While harvesting, an average weight of 82 kg of mussel was achieved on single rope thus showing an average production rate of 12.3 kg of mussel per metre of rope. Instead of each raft being separately anchored, a few of them were serially connected for easy management. Following the success of the experiments, a demonstration project was started in 1978.

c) Goa: Work was initiated by the National Institute of Oceanography at Goa in April 1974 (Qasam et al, 1977) and the raft method of culture was followed. Based on the experiments conducted it was observed that a raft of 2.5 x 2.5 m could accommodate 40-60 mussel ropes of 3 m length with 2.5 m seeded portion. The seeded mussels grew to a size of 85 mm in all month period recording an average growth of 8 mm/month. In the natural bed at Goa it was observed to be only 5 mm/month. In the farm the harvestable size of 60-64 mm was attained in 5 months time. Based on the observation carried out for a peiod of 1 year from 2 rafts having about 120 ropes of mussels the economics have been worked out (Qasim et al, op.cit) which gives a return of 181% of the capital amount within a period of one year. As most of the materials could be used again for another one or two years with slight expenditure on maintenance of the raft, it was assumed that the yield for the next two years would be much higher although the same has not been mentioned by them.

Rao et al (1976) carried out experiments on spawning, fertilization and larval development of the green mussel at Goa. They were able to study the early developmental stages only up to the setting stage. Efforts to achieve complete

.....6.

weight of .85 gm/per mussel increased to 29 g. during this period. While harvesting, an average weight of 82 kg of mussel was achieved on single rope thus showing an average production rate of 12.3 kg of mussel per metre of rope. Instead of each raft being separately anchored, a few of them were serially connected for easy management. Following the success of the experiments, a demonstration project was started in 1978.

c) Goa: Work was initiated by the National Institute of Oceanography at Goa in April 1974 (Qasam et al, 1977) and the raft method of culture was followed. Based on the experiments conducted it was observed that a raft of 2.5 x 2.5 m could accommodate 40-60 mussel ropes of 3 m length with 2.5 m seeded portion. The seeded mussels grew to a size of 85 mm in all month period recording an average growth of 8 mm/month. In the natural bed at Goa it was observed to be only 5 mm/month. In the farm the harvestable size of 60-64 mm was attained in 5 months time. Based on the observation carried out for a peiod of 1 year from 2 rafts having about 120 ropes of mussels the economics have been worked out (Qasim et al, op.cit) which gives a return of 181% of the capital amount within a period of one year. As most of the materials could be used again for another one or two years with slight expenditure on maintenance of the raft, it was assumed that the yield for the next two years would be much higher although the same has not been mentioned by them.

Rao et al (1976) carried out experiments on spawning, fertilization and larval development of the green mussel at Goa. They were able to study the early developmental stages only up to the setting stage. Efforts to achieve complete

.....6.

success up to spat settling stage and spat growth are necessary to evolve a sound seed production technique under controlled conditions. Attempts are being made at present at Madras and Vizhinjam by the CMFRI to perfect the hatchery technique where some initial success has been achieved but the technology is yet to be perfected.

II. East coast:

a) Madras: At Madras also the technology of green mussel culture is more or less the same as done at Calicut and Vizhinjam. This work was initiated by CMFRI in January 1973 at Ennore estuary where the depth of water was about 2 m. Being a shallow area fixed rafts were constructed by means of wooden poles and mussel seed collected from the nearby natural beds were used in preparing the usual type of mussel ropes and were suspended from the raft. Although the mussel seed got attached to the ropes and grow very well within a short period the silting in that area appeared to be very heavy gradually resulting in total mortality of mussels in the farm. A growth rate of 9 mm per month was observed. As the site appeared to be unsuitable for mussel culture, the work was shifted to Kovalam bay where the conditions appeared to be more favourable. At Kovalam instead of having fixed raft system the rafts were floated by means of suitable oil barrels and moored by anchors and anchor chains. Seed were collected from Kovalam natural beds and also from Ennore. The rate of growth at Kovalam appeared to be rapid and within a period of 4 months the mussels attained a marketable size of 70-75 mm, registering a growth rate of 13 mm/month. A raft with 50 ropes of 6 m length each gave a 2 ton production within a period of

....7.

4 months. As Madras coastal zone is a cyclone-prone area affecting the coast during May-June and or October-December, it was felt necessary to evolve a stable raft system like submersible rafts. Such rafts with conical floats are at present being tried, so that the rafts could withstand any type of rough sea.

An attempt was also made at Kovalam, Madras to follow 'Bouchot' method of mussel culture (Stake culture on intertidal flats). But this method had to be abandoned as the posts could not be kept in position in the sea bed on account of wave action and intense fouling.

b) Waltair: Although attempts to culture green mussels were made at Waltair they did not give any encouraging results. The rafts which were floated there could not withstand the strong wave action most of the months with the result that there has been always difficulty in mooring the rafts in position.

c) Tuticorin: During 1975 and 1976 experimental culture of mussels brought from Cape Comorin and Cuddalore was attempted in the Harbour basin at Tuticorin by suspending seeded ropes from 5 x 5 m raft. The growth was poor and the seed falling off the ropes was one of the main problems. Even after 9-10 months the mussels did not attain sexual maturity and the meat content was very low. It was thought the general paucity of phytoplankton might be one of the controlling factors. The experiments had to be discontinued as the area was considered unsuitable. Transplanting seeds on granite boulders also met with little success since the predation by perches like Gaterin sp. Teuthis spp wiped out the stock.

....8.

PROBLEMS AND PROSPECTS

Although different methods like bottom culture, bouchot culture, raft culture, rack culture and pole culture are being followed in different countries only 'raft culture' technique was tried in India considering the high yield known from this three dimensional culture environment. In France, it takes 2 years for cultured mussels to reach the marketable size of 40-50 mm. In Yugoslavia it takes 15-18 months for the harvest size of 70 mm to be attained. Culture experiments at Calicut and Vizhinjam have shown that the green mussels reach 75 mm size in less than 6 months and the brown mussels grow to 55-60 mm in 8 months. Comparatively this is a very rapid growth. The spanish raft system can yield 50-60 tons (Andrew, 1968) per raft which is a very good production rate. But under Indian environmental conditions the indications are that the production may over-reach the achievement recorded in Spain. Per hectare production has been calculated to be as high as 450 tons at Calicut.

Weighed against these advantages some of the difficulties and bottlenecks encountered during the course of experiments remain to be satisfactorily solved before culture industry can be established on profitable lines. The first of these concerns fabrication of an all-weather proof raft to stand against the fury of the monsoon winds and waves during June-August in the west coast and November-December in the east coast. Year after year rafts had been lost alongwith the growing stock of mussel because of this factor. To overcome this difficulty attempts are being made

.....9.

at Madras to find out the suitability of a sumbersible raft system floated at sub surface level. This can minimise the stress on the raft. An alternate method which is being thought of is the use of synthetic pliable poles for the raft frame work which will offer very little resistance to riding waves and swells. Long-line culture, as is done for oysters in Japan, might also help to solve the problem. But this requires selection and identification of areas clear of navigation and traditional fishing activities. This is yet to be attempted in India.

Problems of sewage and industrial contamination in the coastal areas do not at present hold out serious problems. But this has to be kept in view while future expansion is planned. Monitoring the environmental conditions and studying the physico-chemical characteristics of the farm areas is absolutely essential to keep track of the changes in the quality of water. Mussels can accumulate fairly high concentration of metals like zinc, copper and mercury in the tissue. Though these are not lethal to the mussels, human consumption of mussel meat in which these are stored might have serious consequences.

Very often mussel seed fall off the ropes due to some unknown reasons and studying the interaction of invironmental variables, mussel physiology and behaviour thus seems desirable to devise methods to avoid this.

Problems of processing technology and marketing are also to be properly studied and standardised. Purification of mussels after harvest appears feasible to reduce the bacterial load. It is known that some bacteria in the flesh

.....10.

can survive prolonged refrigeration and under normal storage conditions may multiply also. The usual cooking methods may destroy some of the bacteria but thorough studies are needed to gain precise knowledge on the above aspects. Sanitary control of mussel farm area is also desirable for which regulations and norms are to be stipulated based on the above studies.

Unlike oyster meat, mussel meat enjoys popularity amongst different sections of Indian people. Consumer preference and demands should be ascertained through market surveys. Extension wing remains to be developed to popularise mussel farming techniques among fishermen and mussel eating habit among people who are not aware of the nutritional richness of its meat. Creating a stable internal and export market depends on the standardisation of the quality of products and the cheapness of the material offered to the market. Priority attention should be given to efforts to achieve the above objectives. Although our culture experiments have established the feasibility of farming, the above problems are to be satisfactorily solved to put industry on economically viable lines.

REFERENCES

ANDREU, B. 1968. Fishery and culture of mussels and oysters in Spain. Proc. Symp. Mol. 3: 835-46.

QASIM, S.Z., A.H. PARULEKAR, S.N. HARKANTRA, Z.A. ANSARI AND AYYAPPAN NAIR, 1977. Aquaculture of Green Mussel Mytilus viridis L.: Cultivation on ropes from floating rafts. Indian Journal of Marine Sciences, Vol.6, June 1977: pp.15-25.

VIRABHADRA RAO, K., L. KRISHNA KUMARI AND S.Z. QASIM, 1976. Aquaculture of Green Mussel Mytilus viridis L.: Spawning, Fertilization and Larval Development. Indian Journal of Marine Sciences Vol. 5, June, 1976; pp. 113-116.

.....