



MARINE FISHERIES INFORMATION SERVICE

TECHNICAL AND
EXTENSION SERIES

No.23
September 1980

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
COCHIN, INDIA

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

WORKSHOP ON MUSSEL FARMING - AN ACTION PLAN FOR R & D PROGRAMMES*

A 3-day Workshop on "Mussel Farming" was held at Madras in September, 1980 under the auspices of the Centre of Advanced Studies in Mariculture, Central Marine Fisheries Research Institute (CMFRI). The intention of the workshop was to encounter and exchange information/views on the present status of research and development and to identify the lacunae and constraints in advancing the mussel culture technology in India. Against this background, the Workshop considered the ways and means of enhancing the production, transfer of technology and establishment of a viable industry for mussel culture fisheries in the country.

The Workshop was organised under eight Technical Sessions and a Plenary Session. It was attended by 46 participants representing the National and State Fisheries Organisations, Agricultural Universities and Fisheries Development Corporations.

The Technical Sessions covered specific subjects on biology, physiology and genetics of mussels; culture technology; production and economics; diseases of mussels and their control; post-harvest technology and marketing, besides the general areas on the present status of mussel culture, its socio-economic and legal aspects, training and extension. Twenty-three background papers prepared and presented by the experts in the concerned fields formed the lead material for discussion. Besides, the CMFRI bulletin (No.29) entitled "*Mussel Farming: progress and prospects*" which contained the results of research carried out so far by the Scientists of the Institute also served as reference material. The discussions were mainly directed/lead by Prof. P. N. Ganapati, Dr. R. Raghu Prasad, Dr. R. Natarajan, Dr. E. G. Silas, Dr. H.P.C. Shetty, Shri K. Virabhadra Rao, Shri M. R. Nair and Shri K. Nagappan Nayar. The Workshop brought out a wealth of information on mussel farming carried out at different centres along our coasts during the last decade.

Following the deliberations on both technical and non-technical aspects on mussel farming and the field visit to open sea mussel farming site at Kovalam near Madras, the participants noted in the Plenary Session several areas which need increased research inputs to solve the basic as well as applied problems in mussel culture and indicated many gaps where R & D

efforts have to go in. Outlining an 'Action Plan' the Workshop identified the following areas for organising intensive research as well as joint programmes for the accelerated development of mussel culture in India.

I. AREAS WHICH NEED BASIC RESEARCH

The areas identified for basic research pertain to mussel culture environment, biology, nutrition, physiology and genetics of mussels.

1. Environment

Detailed studies for the physico-chemical sea conditions, bottom contour, sedimentation, movements of water and light penetration in the farm sites are essential to evolve appropriate methods of farming in different eco-systems. Similarly, information on productivity of water, distribution pattern of suspended materials, organic detritus and their nutritional value, availability of nutrients and trace elements at stratified depth levels should be obtained for sustained mussel culture.

There is also need for understanding the mechanism of the formation, growth and dissipation of blooms of plankton, the effects of blooms on the crop; monitoring of heavy metals, pollutants and also bacterial load particularly in respect of coliforms and *Vibrio*.

2. Biology

An important aspect of mussel biology which is directly relevant to culture operations is the repro-



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ductive behaviour of the mussel. Size at first maturity, maturation, spawning, reproductive potential in different environments, factors accelerating/inhibiting spawning, and environmental and neurosecretory/endocrine control of spawning are some of the areas which need detailed studies (studies in progress).

It is also necessary to have information on the growth of mussels under different conditions and their longevity (in progress).

3. Nutrition

One of the priority areas for research in mussel culture is larval nutrition and growth efficiency. It is also necessary to have information on the food and feeding habits of the adult mussels.

4. Physiology

In rope culture of mussels, byssus formation plays an important role in attachment and there is need for understanding the mechanism of secretion of byssus under different environmental conditions. Tolerance limits to environmental parameters such as temperature, salinity and oxygen should be understood. Protein, lipid and carbohydrate metabolism and their inter-relationship at different conditions of culture should be studied.

5. Genetics

Very little information is available on the genetics of bivalves in general, and mussels in particular. The areas which need attention are cytotaxonomy, karyological studies, biochemical genetics and population genetics.

II. AREAS WHICH NEED APPLIED RESEARCH

The applied aspects of mussel culture where considerable research inputs are required relate mainly to design and construction of the farm base; seed collection, transport and conditioning; hatchery production of seed optimal conditions of mussel for harvest, production, biofouling; predation and control; parasites and diseases; possibilities of polyculture; harvesting technology; post-harvest technology and product development; utilisation of by-products and market research/survey.

1. Design and construction of farm base

Considerable experimental work involving engineering aspects, and selection and treatment of material

is necessary to develop standard system designs for mussel culture suitable for different eco-systems and scale of operations. Optimal size of raft or other structures, anchoring devices in open sea for rafts, carrying capacity of ropes on rafts and production capacity will have to be investigated under different sea conditions.

2. Seed collection, transport and conditioning

A major constraint for large scale mussel farming would be the availability of good quality seed for culture. It is necessary to identify the seed resources, and study the conditions favouring or inhibiting spatfall in the wild beds as well as culture farms, methods of transportation, conditioning of seed and seeding operations in relation to production. All or any one of the above factors could play a vital role in mussel production.

3. Hatchery production of seed

Taking into account the limitations of seed availability for large-scale culture operations, priority should be given for developing a low-cost technology for hatchery production of mussel seed.

4. Optimal conditions of mussel for harvesting

It has been established that on the east and west coast of India, both the green and the brown mussels, reach harvestable size under culture conditions in about five months time. However, the meat content and quality of mussels, vary from centre to centre at the end of the above period. It is necessary to study the optimal conditions of the mussel in terms of quality and value of meat at different periods of culture to take advantage of the meat weight and value factors at harvest. This should also take into account the size and meat content requirement for the diversified product use.

5. Production

The data available on mussel production show variations at different centres and also variations in different years at the same centre. While this could be expected as there is no control of environmental factors in the mussel farms, it would be necessary to obtain more reliable data on average production rates (in progress).

6. Biofouling, predation and control

These factors affect production in the culture farms. Fouling also poses problems at post-harvest

treatments. Experimental work is required for the control of predators and pests (in progress).

7. Parasites and diseases

Very little information is available on these aspects. In intensive culture we are bound to face disease problems which would affect the production and consumption. It is, therefore, necessary to work on these problems (in progress).

8. Possibilities of polyculture

The farming infrastructure should also be made use of for rearing other organisms such as quality finfishes and lobsters as a step towards developing polyculture technology for maximum economic advantage.

9. Harvesting technology

Harvesting mussels from the rafts is a labour intensive and time consuming work. It is necessary to develop methods for mechanical harvest of mussels with a view to reducing the cost of operation.

10. Post-harvest technology and product development

As at present, mussel has only a limited market potential. In order to take care of the anticipated increased production and for enlarging the consumer sector appropriate post-harvest technology should be developed for processing and product development (work under way). The purification of mussels is also an important component of this aspect and a low-cost process within the reach of the farmer should be followed.

11. Utilisation of byproducts

Large scale production of mussels would lead to accumulation of enormous quantities of shells. It is necessary to develop processes for by-product development from the mussel shells.

12. Market research and survey

There is an urgent need for carrying out a study on the market potential both within and outside the country to ensure the marketing of mussels and mussel products. This is one of the important constraints of mussel culture and would need concerted efforts of the Fisheries Departments, Corporations and the Marine Products Export Development Authority.

III. EXTENSION AND TRANSFER OF TECHNOLOGY

Besides the basic and applied aspects of research mentioned above, the Workshop also considered the requirement for extension and transfer of technology. It was felt that the CMFRI may intensify its efforts for training scientists, technical and operative personnel, and farmers in mussel culture as the Institute has the necessary infrastructure for the purpose.

Extension proper of mussel culture may be done by the Fisheries Departments of the maritime states with necessary technical assistance for the transfer of technology from the CMFRI.

Wherever transfer of technology and large-scale mussel culture operations are to be taken up, the desirability of carrying out benchmark surveys for later socio-economic impact analysis was stressed.

A streamlining of the distribution and marketing system within the country combined with massive extension programmes for enlarging the acceptability of mussels as food by the Central and State Extension wings was suggested.

Large-scale extension programmes, as the one envisaged in Kerala, may be adequately supported by research and training along with proper post-harvest technology and marketing programmes.

IV. SOCIO-ECONOMIC AND LEGAL ASPECTS

The Workshop also discussed certain fundamental issues such as legal aspects involved in mussel farming and socio-economics in relation to large scale adoption of mussel farming by the coastal fishermen, and enlargement of acceptability of mussel as food.

As regards the legal aspects in sea farming, it was felt that suitable areas may be demarcated for culture operations taking into account navigational and water use problems.

In conclusion, the Workshop appreciated the achievements and continuing efforts of the Central Marine Fisheries Research Institute on mussel culture, and the steps taken on transfer of technology through training programmes, Operational Research Project and Lab-to-Land Programme. Although the lacunae in the R & D base for large-scale mussel culture have been identified, the Workshop felt that there must be simultaneous production-oriented development pro-

grammes which would also provide the necessary feedback to the research system. Further, it was also appreciated that a single Institute will not be able to discharge all the responsibilities related to R & D programme in mussel farming. There are several areas which will have to be dealt with at inter-institutional levels and through a multidisciplinary approach.

The Workshop desired that the necessary development support may come from the Government of India as well as the State Governments for mussel culture which possesses great potential for increasing production and for providing employment opportunities in the coastal sector.

