CMFRI Special Publication

Number 1

PEARL CULTURE TRAINING

LONG-TERM AND SHORT-TERM COURSES

Central Marine Fisheries Research Institute

P. B. 1912, COCHIN - 682018, INDIA

Indian Council of Agricultural Research

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FOREWORD

For the last 30 years, Central Marine Fisheries Research Institute had been undertaking research on various aspects of marine living resources for the development of our country's marine fisheries. The subjects of investigation covered a wide field, ranging from basic taxonomy to monitoring and conservation of the exploited resources, basides the discovery of new exploitable ones. The results of these investigations were disseminated through regular publications from the Institute, namely, Indian Journal of Fisheries, CMFRI Bulletins and CMFRI Newsletters. In addition, scientific and popular articles from the Institute were published in various other journals in the country and abroad, too.

Recently, the Institute has reoriented its scientific work programme to give sufficient emphasis to those short-term projects which are need-based and industry-specific. Under this programme a series of investigations were taken up on the culture of suitable marine organisms, especially during the past couple of years, and considerable progress is achieved in this field. These achievements include the development of indigenous techniques for the culture of fish|prawns, molluscs, cultured pearls and seaweeds in different ecosystems. In order to make these research results readily available to those concerned in the field and in the industry, a new series of 'CMFRI Special Publication' is proposed to be brought out, in addition to the existing publications. The Special Publication will be issued as and when the material is available for dissemination.

The first number in this series is being devoted to the Pearl Culture Training, an industry-specific programme undertaken by the Institute. The successful development of pearl

culture based on purely indigenous techniques is one of our recent remarkable achievements. Within a short period of the past three years it has been possible to ascertain the techno-economic feasibility of pearl culture, to study the methods of developing hatchery systems for large-scale production of pearl oysters and of open-sea pearl-oyster farms, to evolve indigenous techniques for production of nuclei and methods for pre- and post-sugery care of oysters.

This Number contains the details of two training courses conducted at the Tuticorin Research Centre and Veppalodai Pearl Oyster Farm of the Institute. The first Course, meant to be a "trainers' training course", is a long-term course covering a period of six months, organised for training the officers from the different maritime States. The second, a short-term course of 4 weeks duration, is to train operative personnel in more specific fields of pearl culture.

Considerable amount of research efforts were put in for the development of pearl-culture technology. Realising the urgent need to propogate this know-how among the enterpreneurs, the ICAR has sanctioned an ad hoc scheme on pearl culture which started functioning in 1974, and training programmes to train enough personnel, so that the know-how developed at the Institute will soon form a foundation for a pearl-culture industry. The various activities connected with these research and training programmes have been ably carried out and spearheaded by Dr. K. Alagarswami and his colleagues at Tuticorin Research Centre.

It is hoped that this new series of CMFRI Special Publications will be of value to those who are engaged in the fishery-development programmes and in industry, besides the large number of research workers.

E. G. Silas
Director

INTRODUCTION

Manpower training is one of the essential prerequisites for the development of any industry. An industry which is based on a specialised technology needs the competent technical personnel for its very start. It is also imperative that the manpower requirements for the growth of the industry are met in a phased manner through organised training.

Pearl Culture is a nascent industry in India. The technical base for it was laid recently by the Central Marine Fisheries Research Institute. The Institute developed pearl-culture technology indigenously at its laboratory at Veppalodai near Tuticorin in 1973 which marked the breakthrough, placing India among the few countries in the world which has the technical know-how of pearl culture. The success was remarkable in that it was achieved within six months of starting the project, against the background of four decades of unsuccessful attempts elsewhere in India. As the pioneer in the field, the Central Marine Fisheries Research Institute has taken up further researches on every component problem of this new discipline in India.

Pearl culture is a multi-faceted field and is quite distinct from other fields of aquaculture. In the culture of fishes, shrimps, edible oysters, etc., the objective is to collect or raise the seed and grow them to marketable size and this is the end-point of culture operations. But in pearl culture the above stage forms only the starting point of a more dynamic operation, which is to produce cultured pearls in the oysters. Besides pearls for the production of which the pearl-culture industry stands, several by-products namely, the seed pearls, edible meat and shells, also result from the operations.

Pearl oyters produce pearls in nature under certain pathological conditions. The essential condition for formation of a

pearl is the coming in contact of a foreign particle, generally of a very minute size, with the outer epithelial tissue of the mantle of the oyster. Under certain circumstances the epithelial tissue at the site of contact grows over the foreign particle and forms a sac. The tissue now secretes the pearly substance (nacre) which is deposited over the foreign particle (nucleus). The process continues as the oyster lives and a lovely natural pearl is produced. But the chances of such 'accidents' are rare as the myriads of particles that enter the oyster's body, except those taken in as food, are easily passed out.

The culture techniques aim at deliberately manipulating these 'accidents' within the oyster tissue. This is accomplished through a delicate surgery when a foreign object and a graft tissue containing the outer epithelial cells of the mantle are implanted within the soft body of the pearl oyster. Spherical shell-beads of a large size (from 2mm to 8mm diameter) forms the nucleus. The graft tissue grows over the nucleus and forms the pearl-sac. The process of secretion and deposition of nacre commences and continues as in the case of a natural pearl. These gems are called cultured pearls.

The techniques of pearl culture have been standardised at the Central Marine Fisheries Research Institute and the stage has been reached for the transfer of this technology. The State sector comprising the Governments of Tamil Nadu, Gujarat and Kerala are in immediate need of this technology for the projects they have now taken up. Tamil Nadu has extensive pearl-oyster beds off its southern coast although their productivity is subject to great fluctuations. Gujarat also has natural beds of oysters, though of a lesser magnitude when compared to the former. Both Gulf of Mannar and Gulf of Kutch have traditionally been areas of pearl fishing. In Kerala, although the natural beds have not yet been charted, periodical settling of young oysters (called spat) takes place in the fishing harbour at Vizhinjam, which has been recently brought to light by the Central Marine Fisheries Research Institute. Proposals for taking up pilot projects for working out the economics of pearl culture in large scale in Tamil Nadu and Kerala with the technical collaboration of the Central Marine Fisheries Research

Institute were prepared by the Institute. The Govt. of Kerala has already taken up the pilot project and the Govt. of Tamil Nadu is actively considering the proposal. A few other States and Union Territories might be added to this list when investigations on the pearl-oyster resources off their coasts are completed.

The Central Marine Fisheries Research Institute decided to organise training programmes in pearl culture which was readily approved by the Indian Council of Agricultural Research. In pearl culture, transfer of technology could be effected in two ways, namely (1) as a package programme to include all aspects of pearl culture and (2) as a limited programme on specific aspects. The package programme would be desirable for those who have to man the establishments at senior levels and the limited programme would be sufficient at the technician level. Both types would involve organised institutional training. The requirements of qualifications and experience of the candidates and the duration and content of the courses would differ.

A package programme of six months duration was completed during 1976-77 and a limited programme was taken up in June 1977. Training programmes of both kinds will be organised by the Institute in future depending upon the needs of the situation. If the magnitude of the industry warrants, the training programmes will be organised on a regular basis.

Dr. E. G. Silas, Director, CMFR Institute, welcoming the guests at the inaugural function of the first pearl-culture Training Course, on September 24, 1976. Seated on his left is Shri R. Nagarajan, I.A.S., Director of Fisheries, Government of Tamil Nadu, who inaugurated the Course.

TRAINING COURSE IN PEARL CULTURE
(Six-month Course)

Eligibility for admission to the Course

a) *Educational qualifications*:	Degree in Zoology / Fishery Science.
b) *Age*:	Below 24 years.
c) *Desirable qualifications*:	i) Aptitude for skilled jobs and handling delicate instruments. ii) Ability for swimming.
Duration of Course:	Six months.
Batch strength:	Ten candidates.

CURRICULAM

	Duration: No. of Units (1 Unit is 6 hours of training)
I. *General information*	
Theory: Origin of pearls, molluscs producing pearls; pearl oysters of the world; pearl fishing in the world: development of cultured pearls; pearl culture in Japan and other countries; ecology of pearl culture; modern trends in pearl culture; development in India.	1
II. *Pearl oyster — its biology*	
Theory: Morphology; dimensional relationship; anatomy; systems and functions: histology of mantle; pearl-sac formation: development and growth; age; feeding; maturation and spawning; Indian pearl oysters.	3
Practical: Examination of specimens for morphological features; dissection and display of systems; observation of maturity conditions; location of potential sites for pearl production.	5
III. *Pearl oyster resources in India*	
Theory: Habitats of pearl oysters; history of pearl fisheries of the Gulf of Mannar and Gulf of Kutch; production of oysters in recent years; fishing techniques; SCUBA-diving; spat settlement in new areas and its development.	1
Practical: Boat-trips to pearl banks to observe and collect pearl oysters; collection trips to other areas; observation on spat fall; collection of spat and rearing.	15

External view of the Indian pearl oyster,
Pinctada fucata.

IV. *Mother-oyster culture*

Theory: Site selection; raft culture of pearl oysters; collapsible and rigid rafts; designs and construction of rafts; buoying and mooring; holding nets; baskets; boxes; depth of suspension; farm maintenance.

Growth of oysters in the farm; fouling and boring organisms; shell-cleaning operations; effect of fouling on the well-being of oysters; mortality of oysters.

Spat collectors; collection and rearing of spat. 3

Practical: Construction of rafts; buoying and mooring; farm work including cleaning of oysters, measurement of oysters, rearing of

oysters to suitable size and maintenance of rafts. 10

V. *Pearl-oyster surgery*

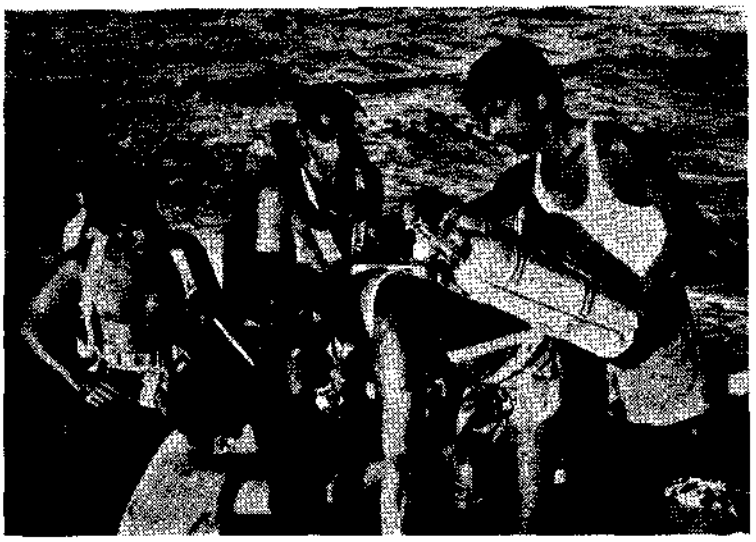
Practical: Selection of oysters for operation: acclimatisation; conditioning of oysters.

Selection of donor oysters; use of special instruments; graft-tissue preparation with correct orientation; keeping the tissues alive without deterioration.

Selection of nucleus-size according to size and physiological condition of oysters and nature of seeding.

Operation on oysters; fixing sites of implantation; decision-making on single or multiple implantation; use of special instruments; insertion of graft tissue; implantation of nuclei.

Trip carrying the trainees to the pearl bank for collecting pearl oysters.



Putting on the self-contained underwater breathing apparatus (SCUBA). To explore the underwater realm, one needs great experience. The sea though ever inviting with its beauty and grandeur, is terribly unforgiving of the carelessness and ignorance.

Convalescence of operated oysters; rate of ejection of nuclei; rate of mortality; returning the oysters to farm for postoperative culture. 80

VI. *Pearl collection*

Practical: Postoperative culture; observations on pearl-sac formation and nacre deposition; limiting duration to the requirement of maturity of cultured pearls. Rearing of oysters according to size of nucleus and nucleus load.

Beaching of oysters for harvest of pearls; opening oysters without injury to the pearls; collection and cleaning of pearls; decision-

making on re-use of oysters and proper care of oysters selected for re-use. Estimation of yield of pearls in relation to the culture techniques. Retrieving unsuccessful nuclei for further use.

Sorting of pearls according to perfection, shape, size and colour; international standards of grading; storage of pearls.

Use of by-products of pearl culture; seed pearls, edible meat and shells. 20

VII. *Management*

Theory: Scale of operation in other counteries: family scale — cooperatives — big business; Pilot-scale operation in India; preparation of projects; farm management; personnel

The diver with his SCUBA and collection kit is ready to go under water.

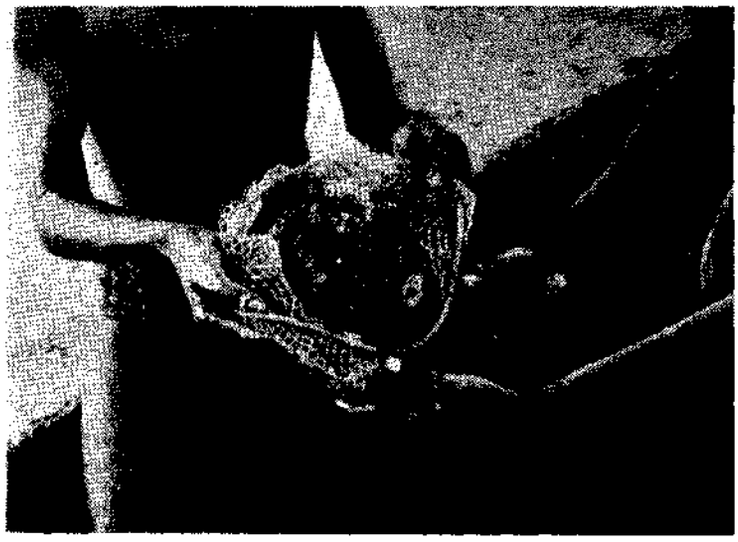
With his back first, the diver plunges in the sea. He has to descend down 20 meters or so for reaching the pearl-oyster bed, for which he needs skill and training.

management; relationship between inputs and outputs; adjusting inputs; evaluation; marketability; profitability; constrains and possible methods of overcoming them; pearl trade in India; imports and exports; consumer preference in India and abroad; scope of pearl culture in India. 2

Total duration: Theory: 10 Units

practicals; 130 Units

140 Units



The collection is brought up in a net the diver carries on his waist.

SHORT-TERM TRAINING COURSE IN PEARL CULTURE

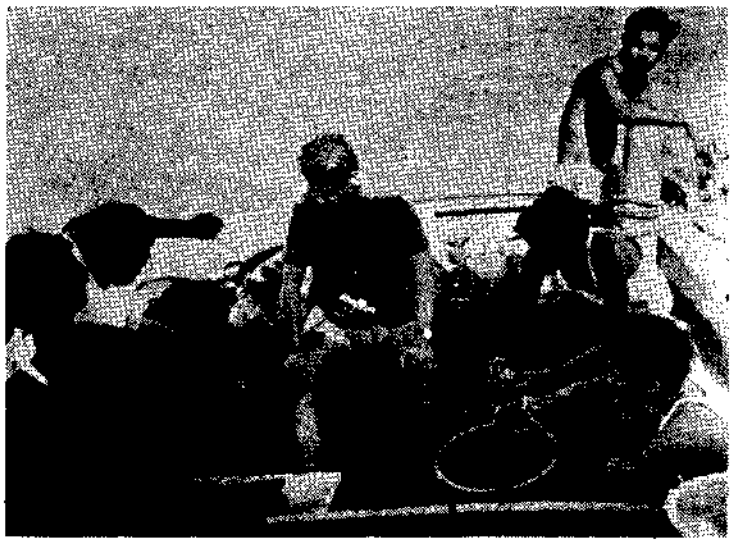
(One-month Course)

Eligibility for admission to the Course

a) *Educational qualification*:	A pass in matriculation or equivalent examination.
b) *Age*:	Below 22 years.
c) *Desirable qualifications*:	i) Aptitude for skilled jobs and handling delicate instruments.
	ii) Aptitude for swimming.

CURRICULAM

	No. of Units (1 Unit is 6 hours of training)
I. *Orientation*	
Theory: Morphology and anatomy of pearl oysters; functions of mantle; pearl-sac formation; mechanism of production of cultured pearls.	1
II. *Mother-oyster culture*	
Practical: Raft culture of oysters; construction of rafts and holding baskets; pearl-oyster collection and farming; farm maintenance; care of oysters.	9



Onboard sorting of the day's collection. The oysters are cleaned and segregated into different groups.

III. *Pearl-oyster surgery*

Practical: Handling of surgical instruments; selection and conditioning of oysters; graft-tissue preparation; nucleus implantation; postoperative care of oysters. 12

IV. *Pearl collection*

Practical: Opening of oysters and collection of pearls; cleaning of pearls; sorting of pearls. 2

Total duration 24 Units

FACILITIES PROVIDED FOR TRAINING

The Central Marine Fisheries Research Institute has facilities for the Training Courses at the Scheme on Pearl Culture at the main laboratory at Tuticorin and the field laboratory at Veppalodai. All essential requirements of training, such as oysters, surgical tools, nuclei, chemicals and glassware, and transport in connection with the training, will be provided by the Institute.

The selected oysters are measured and weighed.

Trainees performing the pearl-oyster surgery under the supervision of Dr. Alagarswami, Scientist-in-charge of the training course.

PERIODICITY OF COURSES

The training courses offered at present are of an ad hoc nature. The first training (Six-month Course) was conducted during September 1976 to March 1977. The second (One-month Course) was started in June 1977. Commencement of subsequent courses will be decided by the Central Marine Fisheries Research Institute depending upon the needs of the situation.

SPONSORING OF CANDIDATES

The efforts towards the development of pearl culture as an industry are at present limited to the State sector due to several factors. Hence the training courses are at present meant for the benefit of the organisations of the State Governments and those supported by the State Governments. These organisations may sponsor eligible candidates for training. The

actual dates of the course will be decided based on the filling up of the required strength. The Central Marine Fisheries Research Institute will not defray any expenditure to the trainees, except for providing the training facilities as specified before. Also the Institute does not take up any responsibility with regard to the employment of the trainees.

REPORT ON THE FIRST TRAINING COURSE 24-9-1976 — 23-3-1977

A "Group Discussion" on Pearl Culture was held at Tuticorin on January 24, 1974 to discuss the ways and means of commercialising the pearl-culture techniques developed at the Central Marine Fisheries Research Institute, under the auspices of the Indian Council of Agricultural Research. At this meeting, presided over by Dr M. S. Swaminathan, Director General, I.C.A.R., it was decided that a Training Programme in Pearl

A trainee implanting the nucleus in a pearl oyster.

Culture may be organised to create a cadre of technical manpower in this specialised field required for the proposed pearl-culture efforts in different parts of the country.

Subsequently, the Indian Council of Agricultural Research approved the proposal for conducting the Pearl Culture Training Course at the Central Marine Fisheries Research Institute and gave a grant of *Rs.* 58,800 for providing the required facilities for training and also for paying stipends to a few private candidates.

The first Training Course in Pearl Culture was inaugurated on September 24, 1976 at Tuticorin by Shri R. Nagarajan, I.A.S., Director of Fisheries, Government of Tamil Nadu, with Dr E. G. Silas, Director, Central Marine Fisheries Research Institute, in the chair.

Fabrication of frame nets and boxes for holding pearl oysters.

The following candidates were admitted to the Training Course:

1. Shri M. S. Nazir Ahmed, Marine Survey Officer.	Department of Fisheries, Government of Kerala.
2. Shri N. M. Patel, Senior Research Assistant.	Department of Fisheries, Government of Gujarat.
3. Shri M. A. Varghese, Senior Research Assistant.	Department of Fisheries, Government of Gujarat.
4. Shri S. M. Irulandy, Laboratory Assistant.	Department of Fisheries, Govt. of Tamil Nadu.
5. Shri S. Velpandian, Sub-Inspector of Fisheries.	Department of Fisheries, Govt. of Tamil Nadu.
6. Shri A. Srinivasan, Junior Technical Assistant.	Central Marine Fisheries Research Institute.
7. Shri A. Deivendra Gandhi, Junior Technical Assistant.	Central Marine Fisheries Research Institute.
8. Shri S. Benit Fernando, Private candidate.	Sponsored by the Department of Fisheries, Govt. of Tamil Nadu.
9. Shri J. Antony Pitchai, Private candidate.	Sponsored by the Department of Fisheries, Govt. of Tamil Nadu.

The two private candidates, who were unemployed graduates belonging to the fishermen community, were paid a monthly stipend of Rs. 150|- each by the Central Marine Fisheries Research Institute.

The classes totalling 10 units of lectures along with 10 units of practicals were completed during the first month itself. Subsequently training was given in production-oriented programmes and farm work. The trainees participated in several

Trainees constructing rafts.

sea trips for the collection of oysters. They were given intensive training in pearl-oyster surgery and production of cultured pearls. The trainees employed nuclei ranging from 3mm to 7mm diameter. They were trained in single-implantation and multiple-implantation techniques. All the trainees have successfully produced cultured pearls of bright lustre. They were given training in every aspect of pearl culture according to the Curriculum. Each candidate has gained full confidence to work independently in any pearl-culture programme he may be called upon to undertake.

The Training Course was conducted under the supervision of Dr K. Alagarswami, Officer-in-charge of the Scheme on Pearl Culture, who is responsible for the achievements on pearl culture in India. As Officer-in-charge of the Training Course, he gave 120 units of training out of a total of 140 units. Valuable support was given by Shri K. Nagappan Nayar, Officer-in-Charge of the Tuticorin Research Centre of C.M.F.R.I., and other scientists.

The Training Course was formally closed on March 14, 1977 at the Valedictory function organised at Tuticorin. The trainees were awarded certificates on completion of the Training Course by Dr R. Raghu Prasad, Assistant Director General (Fisheries), Indian Council of Agricultural Research, New Delhi.

WELCOME SPEECH

(By Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute, Cochin, at the Valedictory of the Training Course held at Tuticorin on March 14, 1977).

It gives me great pleasure to extend to you all a warm welcome this afternoon for the Valedictory function of the Pearl Culture Training Course. The Training Course which was inaugurated on 24th September, 1976, is completing six

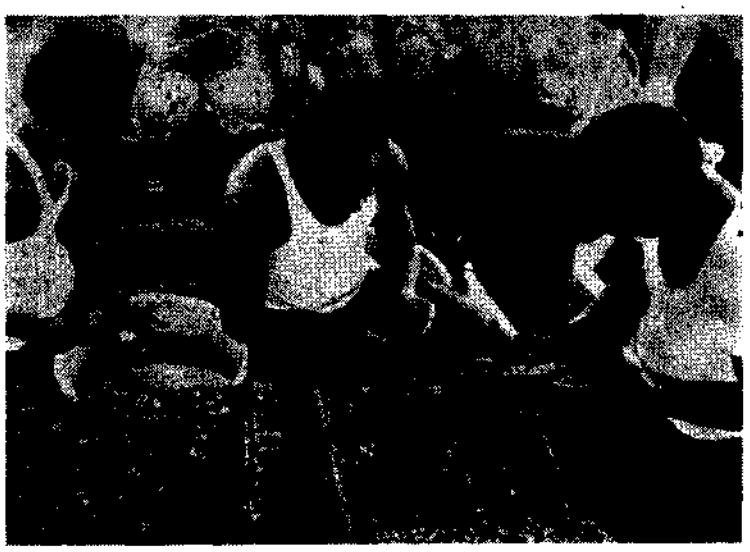
Trainees working on the raft in the sea.

The pearl oysters are examined on the raft.

months and this is the first time the Central Marine Fisheries Research Institute organised such an intensive training programme in any field-oriented work. As some of you are aware, the Institute came into the field of pearl culture only in 1972, when we first started the project on "Experiments in pearl culture" at Tuticorin. The first cultured pearl was produced on 25th July, 1973 which was a landmark in our research activities on pearl culture. I would say that this is only the beginning of an industry-oriented research and development programme. This success has led us to organise the training programme. I am glad to inform you that in this training programme we have nine candidates from Tamil Nadu, Kerala and Gujarat. In addition to the nominees from these State Governments, we have two private trainees from the fishermen community sponsored through the Department of Fisheries, Government of Tamil Nadu, and two trainees from our own Institute. Training has been given in almost all facets of pearl culture operations so that when they go back to their States their knowledge and experience as gained here could be utilised for large-scale commercial operations.

A frame net with oysters for suspension under water.

Today, in our midst, we have Dr. R. Raghu Prasad, Assistant Director General of the Indian Council of Agricultural Research, the parent organisation of C.M.F.R.I. He has been kind enough to come over here from Delhi to give the Valedictory Address and to present the certificates to the trainees. He has been associated with the C.M.F.R.I. from its very inception, though he left the Institute about 10 years back to join the headquarters of the I.C.A.R. He has played an important role in the organisational and developmental programmes of this Institute. In I.C.A.R. also he has been responsible to see that this training course was approved as early as possible so that the results could be gainfully exploited by the States which have a potential for developing pearl culture. Prof. S. Krishnaswamy of the School of Biological Sciences, Madurai University, is a Jawaharlal Nehru Fellow. It is very kind of him to have come over from Madurai to preside over this function. Mr. John Motha and Dr. Ben Motha have been very closely associated with our activities in pearl culture though peripherally. They have been immensely helpful in giving us the faci-

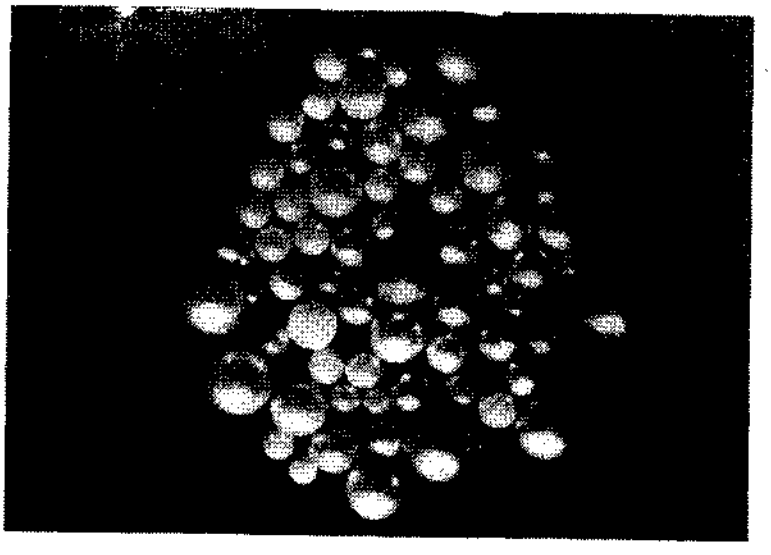


The farm oysters are examined for pearls.

lities for our field laboratory at Veppalodai. It is a valuable gesture that Dr. Motha is here to felicitate the trainees.

During the last few years, the C.M.F.R.I. has been re-orientating its research and development programmes to suit the needs of the country. In certain priority areas we have been putting more efforts and one such area is coastal aquaculture which includes the present pearl-culture programme also. We have projects on fish|prawn culture, mussel culture, edible oyster culture, sea-weed culture and various other programmes which are very closely connected with the development of the coastal areas in our country. In fact, one of the objectives of these programmes is to train as many people as possible in aquaculture. Training will be given not only to the highly educated but also to the actual fish farmers and fishermen. I may mention here that the I.C.A.R. has sanctioned a Krishi Vigyan Kendra under the Institute at Narakkal in Cochin where we intend giving training in various aspects of mariculture to fishermen and farmers who can utilise this training for obtaining higher production of fish, prawns and other culti-

The pearls are weighed in a precision balance.



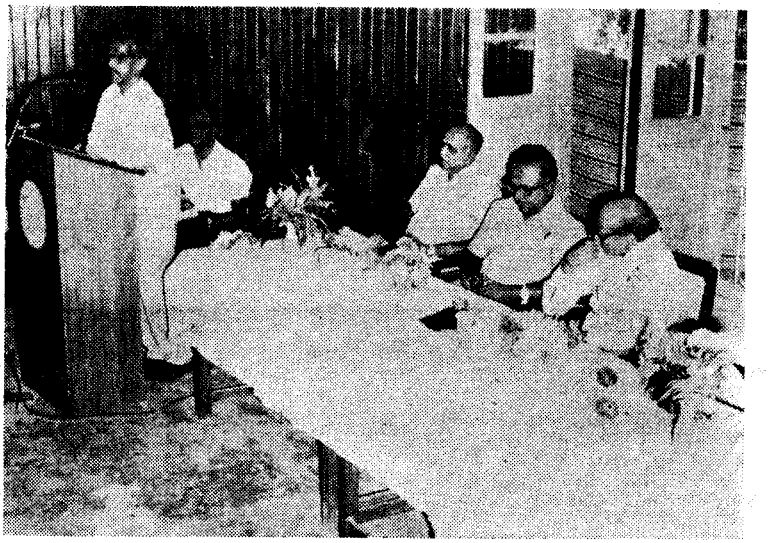
A collection of cultured pearls produced by the trainees.

vable organisms in their fields. This is a new development for the Institute, and we are very confident that this sort of liaison between the scientists and the farmers will help us a great deal in making our research useful for the common man.

In pearl culture, we have just completed the first long-term course here. This has been a trainers' training course because all of the trainees are educated people. I am sure when the candidates go back, they will be able to use the knowledge and experience they have gained here in the development programmes. We would also keep in touch with their work and give necessary further help wherever required. The C.M.F.R.I. intends following up this course by a short-term training course in pearl culture in specific areas of pearl culture. Dr. K. Alagarswami who has very ably handled the long-term course will be in charge of this programme also. Probably we may start this course in May | June 1977. We hope to take up the training as a continuing programme and training will be imparted at various levels.

Once again, on behalf of the Institute and on my own behalf, I extend a hearty welcome to all of you for this function.

Dr. Silas, Director, welcoming the guests at the valedictory function on 14 March 1977.



Dr. R. Raghu Prasad, Assistant Director General (Fisheries), I.C.A.R., New Delhi, delivering the valedictory address. Seated are (from right): Prof. S. Krishnaswamy, Jawaharlal Nehru Fellow and Dean of the Faculty of Biological Sciences, Madurai University, who presided over the function, Dr. Silas, and Dr. Ben Motha of Veppalodai Salt Corporation.

PRESIDENTIAL ADDRESS

(By Prof. S. Krishnaswamy, Jawaharlal Nehru Fellow, School of Biological Sciences, Madurai University, Madurai, at the Valedictory of the Training Course held at Tuticorin on March 14, 1977).

It gives me great pleasure to participate in this function. There is always a criticism about the industrial uses of biological sciences. I have been making a living by teaching biology for about a quarter of a century. People say that we teach things in the schools, colleges and universities which are of no relevance at all to practical life. Students have al-

A section of the audience.

most come to believe that it is a *karma* of the zoology students to cut open a frog or fish without knowing what it is all for. So, it gives me great pleasure to associate in a function like this where, it is perhaps one of the few instances, a biology-based industry is about to be launched. By and large we have not yet realised in our country that there is a vast scope for industries which are biology based. Dr. Alagarswami mentioned about the great strides made in Japan in the cultured-pearl industry and he also said that this, perhaps, is the first time that such an organised training is imparted outside Japan. Again we have to look at Japan for the other ways in which they are putting to use the knowledge of biology. A range of industries has come up on production of vitamins, enzymes, butyl alcohol, ethyl alcohol, acetic acid, etc. All these industries are based on microorganisms. I think this is the line in which India has also to develop. Of course, we are now using microorganisms in production of antibiotics, but I do not know if there is any other truly biology-based industrial development in India. It is, therefore, gratifying to note that the C.M.F.R.I. has laid the base for this biology-based industry of pearl culture.

A trainee receiving the course certificate from
Dr. R. Raghu Prasad, Assistant Director General.

The idea of training not only Government-sponsored candidates but also others is a move in the right direction. Dr. Silas has taken an extremely keen interest in putting up pens for the culture of fish and prawns. Looking at the prospects of these activities at Tuticorin, it looks as if there is a vast scope for the development of a few industries on these lines.

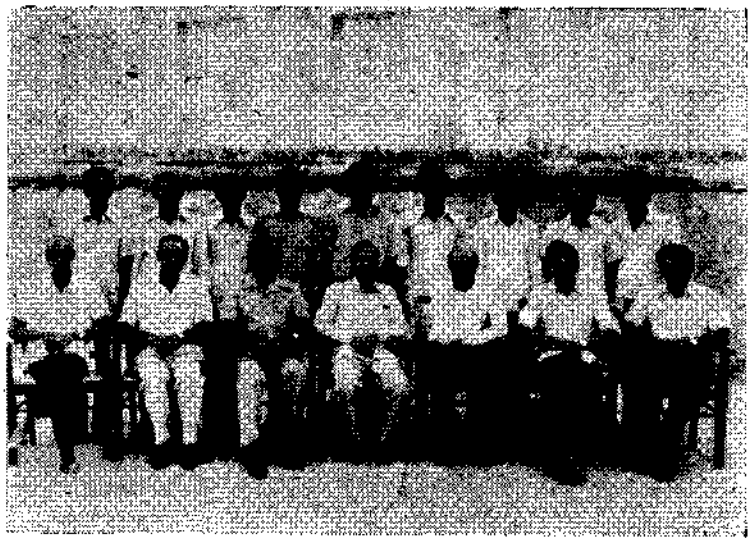
We must remember that in India we have an extreme shortage of portein. Many of you would know that unless the children are given balanced diet with proper protein when they are between the age of 1 and 5, there is retardation in the growth of brain. If that is so, there is going to be an imbalance between the poor and affluent societies. Developing countries like India will produce intellectural dwarfs. On the other hand, the developed countries where there is a lot of input of protein will produce intellectual giants. This is a point which we have to think about and take corrective measures. It was nice to see how oysters have grown here. I hope that the C.M.F.R.I. will also start a training programme on edible-oyster culture.

The present training programme on pearl culture seems to have been very well planned after obtaining all the basic information and working out the techniques. We have seen today that in about six months lovely pearls have been produced by the trainees and if they can do it here, they can certainly do it when they go back. I am hopeful that in the next decade or so, India can become one of the chief exporters of pearls. I am sure that the future historians are going to write again about the lovely pearls of Gulf of Mannar.

VALEDICTORY ADDRESS

(By Dr. R. Raghu Prasad, Assistant Director General (Fisheries), Indian Council of Agricultural Research, New Delhi, at the Valedictory of the Training Course held at Tuticorin on March 14, 1977).

This training course on pearl culture has not only been a medium for the transfer of research results to the field but also is an attempt to lay the foundation for an industry. Whether it is going to be developed as a large-scale or small-scale industry would depend on the support and enthusiasm shown by the entrepreneurs. This day, I am sure, can be considered with legitimate pride by the C.M.F.R.I., more particularly by the scientists who have been associated with this training course, for they have trained the first batch of candidates who will form the foundation for the industry. Immediately when the first pearl was produced in July 1973 by Dr. Alagarswami, the I.C.A.R. convened a group discussion in January 1974 at Tuticorin where several industrialists, research workers and bank workers were invited. Then the I.C.A.R. decided that a training course must immediately be started. Obviously this has to be in Tuticorin for many reasons. At this juncture, my thoughts go back to 30 years before when, as a student of zoology, I visited Krusadai where the Madras Fisheries Department was doing research on pearl culture. Presumably they achieved considerable amount of success but the then scientisits dealing with the techniques kept it a secret. Now it all goes to the credit of Dr. Alagarswami to come out with his techniques and to impart this knowledge to nine others.



The first batch of trainees who completed the 6-month training course, (standing L-R) Shri A. Deivendra Gandhi, Shri A. Srinivasan, Shri N. M. Patel, Shri M. S. Nazir Ahmed, Shri S. Velapandian, Shri S. Benit Fernando, Shri S. M. Irulandy, Shri M. A. Varghese and Shri J. Antony Pitchai, with (sitting L-R) Shri S. Mahadevan, Shri K. Nagappan Nair, Dr. Silas, Dr. Raghu Prasad, Dr. Krishnaswamy, Dr. Alagarswami and Shri A. Chellam.

One of the main constraints of our industries is the lack of trained personnel. I suppose this young industry, which I hope will be coming up soon, will not be handicapped for want of trained technicians. This training is a completely new venture which requires a high degree of technical skill. The present training programme, I hope, will lead to more training courses. As Dr. Silas has pointed out a proposal was made to the I.C.A.R. to continue this training, perhaps in a different form, and I am very happy to announce that it has been approved. by the Council. I would also like to say that if similar proposals for training in the culture of other organisms are made the I.C.A.R. will support them. It is my fervent hope that those

who have received this training will go back to their respective States or regions and adapt the technology to suit the local conditions. This should not be difficult for them with the background knowledge they have already gained here. It is to the credit of C.M.F.R.I. that it has been demonstrated that it is not always necessary to have a conventional place with traditional pearl fishing to start new ventures on pearl culture. Recently it has been observed that there are possibilities of starting a pearl-culture industry at Vizhijam in Kerala and the Government of Kerala has already started a Pilot Project for which the technical support and guidance are being given by C.M.F.R.I.

I will be failing in my duty if I do not mention here that the entire course was made possible by the farsightedness of Dr. M. S. Swaminathan, Director General, I.C.A.R. and the encouragement he has been giving. He has taken personal interest and very often he has been making enquiries of the progress this project was making. Similarly the interest shown by the Tamil Nadu Government and their support have been no less significant. Now the progress that has been achieved by the training course would not have been what it is today without the support of Dr. Ben Motha and his brother Shri John Motha in the Veppalodai Salt Corporation who have placed at the disposal of the Institute the necessary infrastructure facilities for carrying out the training course. Last but not the least I appreciate the keen enthusiasm demonstrated by Dr. Alagarswami and his colleagues in the entire programme and to a very great measure the success is due to Dr. Alagarswami. This only proves the dictum that scientific knowledge belongs to all and is not the private property of any particular individual. Finally, on behalf of the Council and on my own behalf, I would like to congratulate all the successful trainees and wish them all the best in their future career.

COURSE TEACHERS AND SUBJECTS DEALT WITH

Teacher	Subjects	Dates
Dr. K. Alagarswami Scientist S-2	**Lectures:**	
	Background information on pearl culture.	Sep. 27
	Introduction to anatomy of pearl oyster.	Sep 28
	Mantle: graft tissue& its role.	Oct. 5
	Pearl-oyster surgery & maintenance of records.	Oct. 29
	Pearl fisheries & culture in different parts of the world.	Feb. 15
	Structure, composition, formation,, shape & colours of pearls.	Feb. 16
	Pearl harvest, yield rate, classification and assessment of production.	Feb. 17
	Management of pearl culture	Mar. 7
	Practicals:	
	Construction of rafts.	Oct. 26, 27, Feb. 23, 24.

Teacher	Subjects	Dates
	Pearl-oyster collection from natural beds.	Nov. 17, 20, 22, 29, 30, Dec. 7, 10, 14, 27, 28.
	(Assisted by staff of Scheme on Pearl Culture).	Jan. 4, 6, 7, 10, 12, 17, 21, 22, 27, 29 Feb. 3, 5.
	Culture of oysters, farm maintenace & spat collection.(Assisted by staff of Scheme on Pearl Culture).	Sep. 30, Oct. 7, Nov. 26, Dec. 1, 2, 3, 4, 13, 17, 21, 23, 30, 31, Jan. 11, 20, Feb. 8, 9, 22, 28, Mar. 2, 8.
	Graft tissue preparation.	Oct. 6, 23, 25, 28.
	Pearl-oyster surgery.	Oct. 29, 30, Nov. 8, 9, 10, 11, 12, 15, 16, 17, 18, 19, 24, 25, 26, 27, 29, 39, Dec. 4, 7, 8, 9, 13, 15. 18, 20, 22, 25, Feb, 1, 3, 8 9, 21, Mar. 1, 3, 9.
	Pearl collection, classifications, measurement & keeping.	Nov. 23, 24, Dec. 29, Jan. 24, Feb, 7, 19, 19, 25, 26, Mar. 11, 15, 16, 17. 18, 19, 21, 22, 23.
	Data analysis/ Library/Discussion.	Oct. 20, 21, Nov.4, Dec. 16, Jan. 3, 5, 19, 28, 31, Feb, 2, 10, Mar, 5, 10.

Teacher	Subjects	Dates
	Internal aassessment.	Feb. 18, Mar. 4.
Shri K. Nagappan Nair, Scientist S-2.	**Lectures:** Morphology of pearl oyster.	Sep. 27, 28, 29, Oct. 5, 8, 11,13.
	Practicals:	
	Collection & identification of molluscan shells; shell characters of pearl oysters.	See. 29, Oct 4,5.
Shri S. Mahadevan Scientist S-1	**Lectures:** Pearl-oyster resources&collection methods.	Sep. 27, 28, Oct. 4.
	Fouling and boring problems.	Oct. 8, 14, 20.
	Demonstration by slides of above aspects.	Sept. 28, Oct. 11
Shri A. Chellam Scientist S-1	**Practicals:** Boring & fouling organisms.	Oct. 12, 15, 21.
	Fabrication of culture baskets.	Oct. 16, 18, 19, 21.
	Raft construction.	Nov. 2, 5, Feb.23. 24
Shri A.C.C.Victor Scientist S	**Lectures:** Anatomy of pearl oyster.	Sep. 29, Oct. 4, 13, 14.
	Practicals:	
	Anatomy of pearl oyster—different systems.	Oct. 11, 13, 14, 18, 19, 20.

Teacher	Subjects	Dates
Shri K. Ramadoss Scientist S	**Practicals:** Measurement of oysters	Oct. 6, 8
Shri S. Dharmaraj Technical Assistant	**Practicals:** Oyster cleaning procedures.	Sep. 30, Nov. 20, 30, Dec. 6.

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