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SCUBA DIVING INVESTIGATIONS AND TRAINING

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Introduction

Diving activity in sports and recreation acquired great popularity during the last three decades due to the new dimension given by Cousteau-e-Gagnan in 1942 by perfecting the 'Aqua-lung'. For the first time it was possible for man to experience a three dimensional space, diving with self-contained underwater breathing apparatus, popularly called SCUBA. This method of free diving opened up a new vista for scientists exploring the under-sea world by periodically organising excursions to study, photograph and collect materials. During the past 35 years underwater technology, engineering, bio-medicine, saturation diving and automation had developed tremendously to enable man to forge to very great depths in to the oceans and stay there for extensive periods. Sea city plans, off-shore living space, habitats, sea-labs etc. have been successfully experimented upon as a result of recent advances in the technology of diving. Inspite of all these aqua-lung diving continues to be very useful for scientists searching for specific underwater details, in photography, for collections and observations in the shallow limits of ocean beds. The very nature of the cheap cost of possessing and operating the aqua-lung makes it easy for developing countries to introduce this system of diving for scientific exploration programmes.

Diving with aqua-lung for scientific investigations, however, came into the field in India only in the late 1950's due to the joint efforts of the Central Marine Fisheries Research Institute and the Tamil Nadu Fisheries Department. Necessity arose to look for a satisfactory method of exploring the sea-beds in the Gulf of Mannar for locating and charting the pearl oyster beds and chank beds towards better management of these fisheries. The age-old method of commercial exploitation of these by a section of fishermen by skin diving upto 25 m depth left much to be improved in as much as it is laborious and tiresome. It needed modification by introducing diving with aqua-lung towards greater efficiency and ease. By creating a cadre of trained personnel in this field of activity and developing adequate infrastructure facilities a phased programme of change in the old system was felt necessary. A project jointly sponsored by the Government of India and Government of Tamil Nadu sought the technical assistance for expertise and equipment from FAO, Rome in 1958. The terms of reference for this project assistance by FAO envisaged (a) selection of equipment useful for studying the sea-bottom upto 30 m depth (b) training of Indian scientists in the modern methods of diving (c) carrying out accurate diving survey of areas containing pearl oyster and chank population to obtain precise information about the location and extent of each bed and knowledge of the ecological conditions and (d) to chalk out a long range programme of training, management and development of pearl and chank fisheries in these areas.

The F A O placed the services of Dr. F. Baschieri Salvadori, an expert diving scientist for this assignment who brought with him 6 pairs of aqua-lungs, 2 portable compressors 'Nereus' 1958 with ('continental' motors, diving accessories) and a 'Rollei Marin' Camera for underwater photography. The expert started project work at Tuticorin in November 1958 and completed his first assignment in May 1959. During this period he imparted aqua-lung training to six Indian scientists and gave training to two professional divers. He also undertook a rapid inspection of 33 pearl banks and a few chank beds. However, detailed survey of only four pearl banks (Paars) was completed by him. This enabled him to outline the contours of these areas, locate their position, calculate the extent of each paar, study the faunistic and floral features of the areas covered. A report embodying the details of work done and the results of his technical programme was brought out by the FAO in Report No. 1119-EPTA (1960) submitted to the Government of India. Since much remained to be completed after his first assignment, Dr. Salvadori was reassigned to visit India again twice for short spells during November-December 1960 and December 1961 to February 1962. During his second visit he initiated survey work of sea-bottom from 10 m depth to 26 m depth. His second report to Government of India, EPTA No. 1323, published by FAO in 1961 is very brief and outlines only the plan of work and the facilities needed. During his third and last visit he comple-

ted training of two more scientists in SCUBA diving and evaluated the progress of work till 1961. These are reflected in his third report, EPTA No. 1498, published by FAO, in 1962.

SCUBA diving in CMFRI

The training given to two scientists of CMFRI and two from the Tamil Nadu Fisheries Department and the experience gained in underwater exploration made it possible for them to carry out a phased programme of sea bottom survey during the next three years 1962-1964. The CMFRI imported six pairs of aqua-lungs ('Siebe-Gorman' make), important diving accessories, and a 'Rollei Marin' Camera to supplement the FAO equipment left with the Department of Fisheries, Tamil Nadu. Later, CMFRI acquired an electrically operated air compressor (Bristol' Co.), one portable air compressor (Sachs-Bauer-Utilus) and one more underwater camera - 'Calypso'. Thus the sustained interest evinced by the Institute to promote this discipline of scientific work enabled the scientists engaged in this project not only to acquire very valuable diving experience but also facilitated collection of useful data on the pearl oysters and chank, in the study of the ecological features of the sea bed off Tuticorin and estimation of the density of chank and oyster population in different localities investigated. The results of these studies were published (ref: list of publications).

Since marine fishing industry as well as industries based on marine products need as much of authentic information as possible in all matters connected with raw material availability, seasons and areas of abundance and expert consultancy on rational exploitation possibilities the expertise available is being provided by the CMFRI within the framework of its research objectives and time availability. One such assignment was the survey of Andamans and Nicobar Islands for assessing potentialities of these areas for mariculture purposes. For the first time a pioneering attempt was made during February-April 1978 to investigate the nearby coastal areas of nearly 27 of these islands by aqua-lung diving by the scientists of this Institute. The report and recomendations are being published. Another noteworthy contribution by the diving scientists team of CMFRI was the detailed survey of 20 islands in the Gulf of Mannar during 1978-80 and exploration of the fringing coral reefs and adjacent areas (Fig. 1-20) to determine the extent of damage done to the reefs and reef fauna by human interference and destructive fishing activities. This survey helped to outline conservation measures to protect endangered species based on which the creation of a 'Marine National Park' in the Gulf of Mannar was proposed by the Institute. This objective study was fully appreciated and accepted by the Government.

Training Programme

In order to promote 'SCUBA' diving for scientific and exploratory purposes and for exploitation of marine resources the Institute decided upon a programme of training scientists and technical personnel in aqua-lung diving. Towards facilitating this, additional diving equipment and accessories have been imported recently to substitute and supplement the existing ones. This training was initiated in 1979-80 at Tuticorin under the leadership of the two experienced scientists of the Institute. Scientists and technicians are eligible for this training. Two batches of scientists and other staff were trained during 1979-1981 (Fig. 21-24).

The training course imparts theoretical and practical lessons and runs for a period of 8 weeks. Two sessions are possible in each year. Selection of candidates is done after obtaining proof of their physical fitness as certified by competent medical authority and the selected candidates are required to get their lives insured by the sponsoring authorities or institutions for the duration of the training course.

The Institute does not undertake any financial commitment. Stay, food and medical expenses of the candidates so selected for training will have to be borne by the sponsors. The expertise offered by the CMFRI is free and on the successful completion of the course a testimonial of proficiency in SCUBA diving will be given to each candidate within the limits contemplated by the project objectives.

A broad outline of training schedule is given for the benefit of those interested in the training.

Training Schedule

Theory 20 Hours

Snorkeling: Basic rules and pre-requisites-pressure and skin diver equalising middle ear pressure-Deep dive techniques.

Fig. 1. Observations and gathering materials at the sea bottom.

Fig. 2. On the look-out for warding off possible danger from barracudas passing nearby.

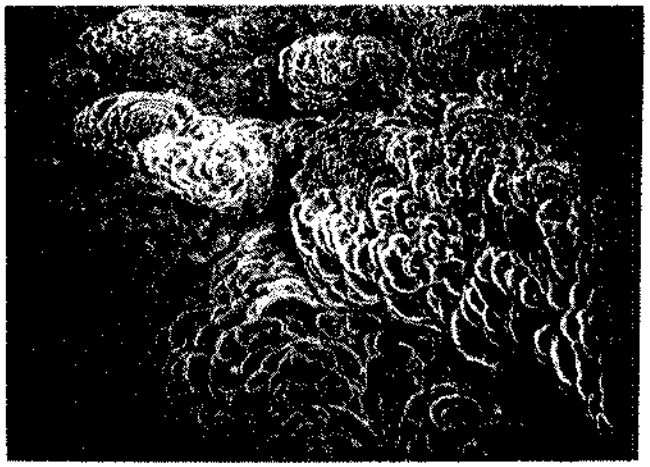

Fig. 3. An extensive Montiporan coral colony in the clear subtidal areas in the vicinity of Tuticorin shore line.

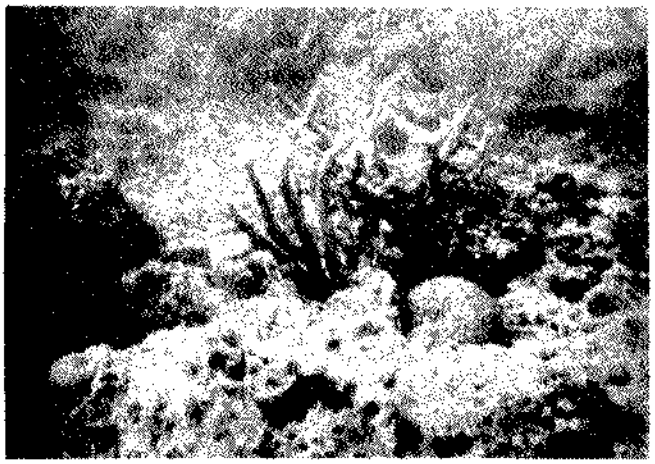

Fig. 4. Assemblage of live corals in the deeper zones.

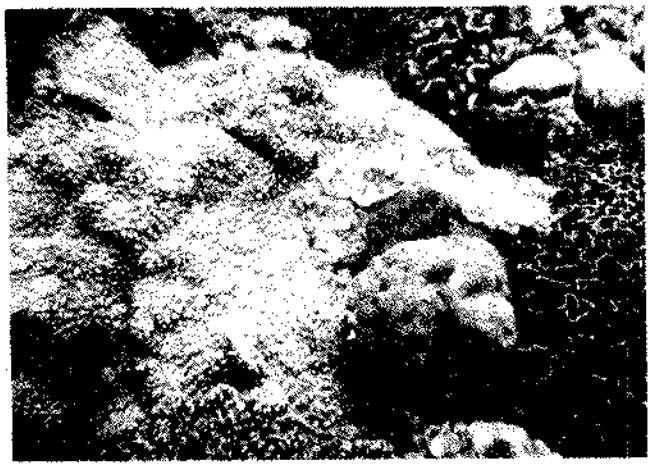

Fig. 5. Massive coral blocks and brittle coral colonies.

Fig. 6. Solitary coral, *Fungia* sp. over rocky substratum.

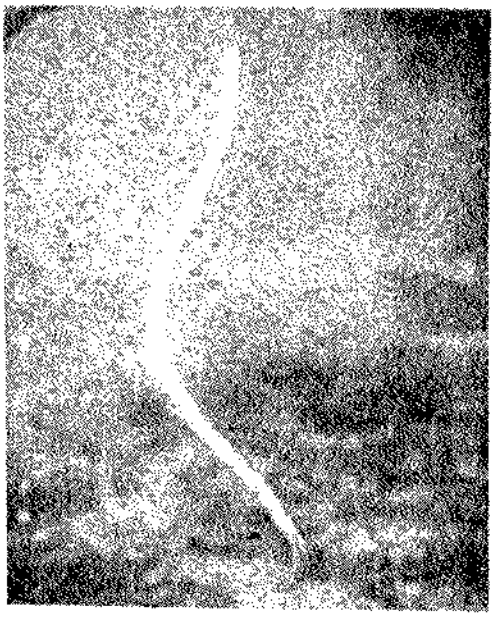

Fig. 7. Encountering sea-snakes at the bottom is a common feature.

Fig. 8. A giant rock lobster, *Panulirus* sp., caught from a ledge, being brought up.

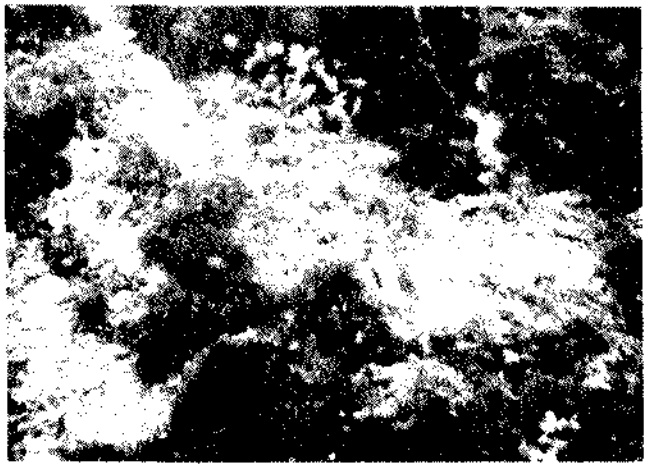

Fig. 9. A rugged sponge and seaweed covered rocky bed.

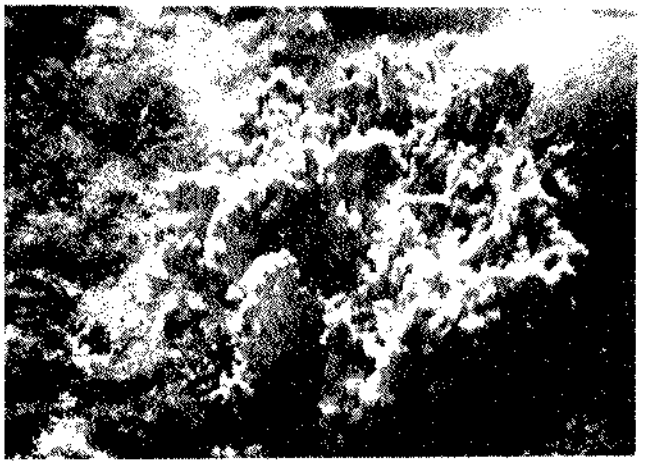

Fig. 10. Sponge colonising the rocky bottom.

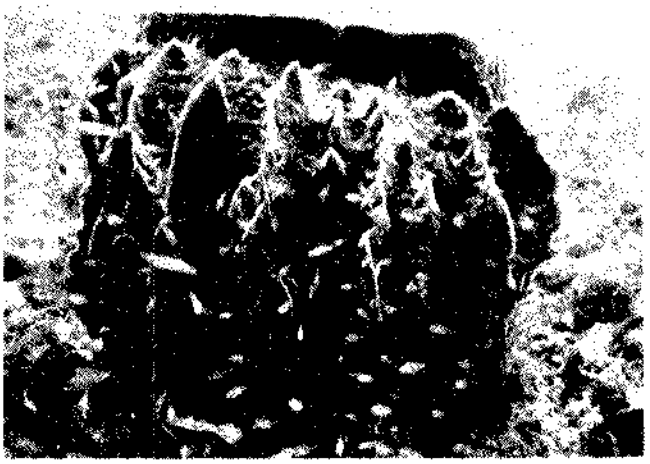

Fig. 11. Massive sponge. *Petrosia* sp. with coral fishes hovering round.

Fig. 12. Montiporan coral block providing hiding cover to *Gaterin* sp.

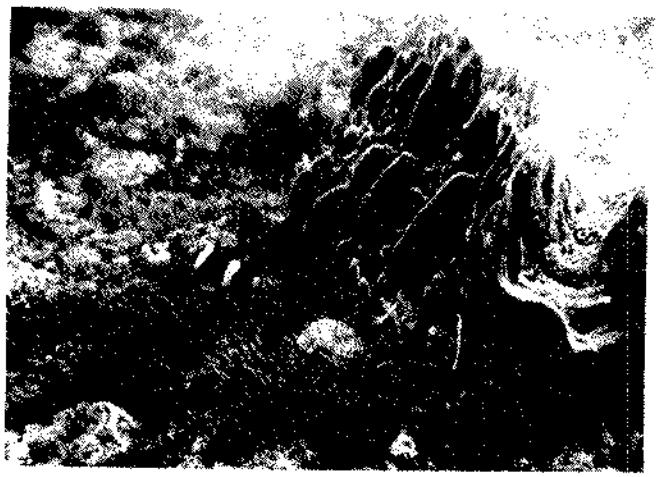

Fig. 13. A large sea anemone, *Amphiprion*, the damsel fish and *Serranus miniatus*, the red rock cod taking refuge alongside a sponge ridge.

Fig. 14. Coral reef fish community.

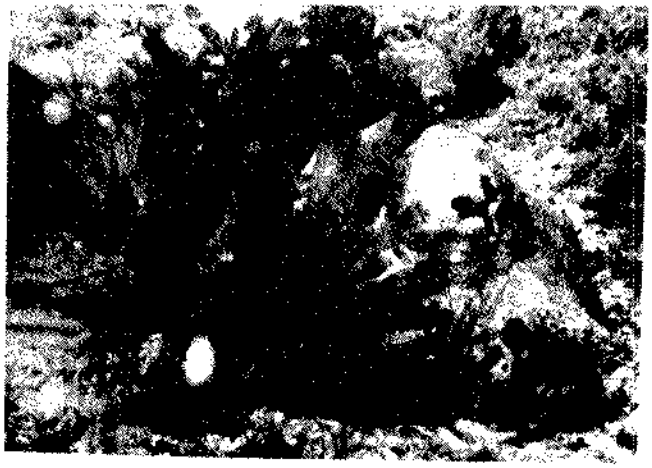

Fig. 15. Dense seaweed growths characteristic of the rocky sea floor off Tuticorin.

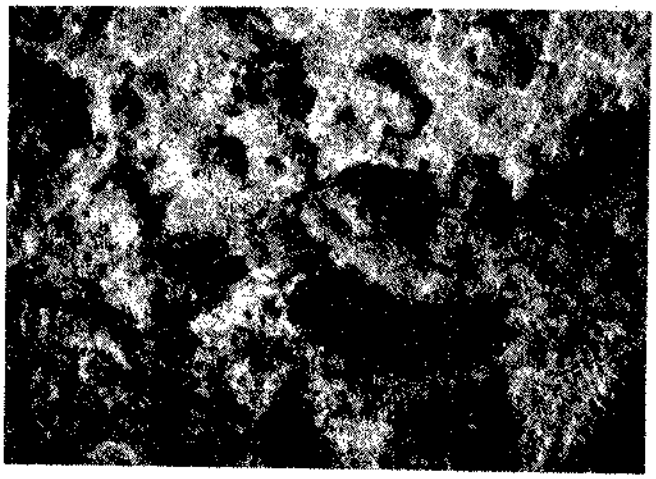

Fig. 16. Black holothurian on rocky bed.

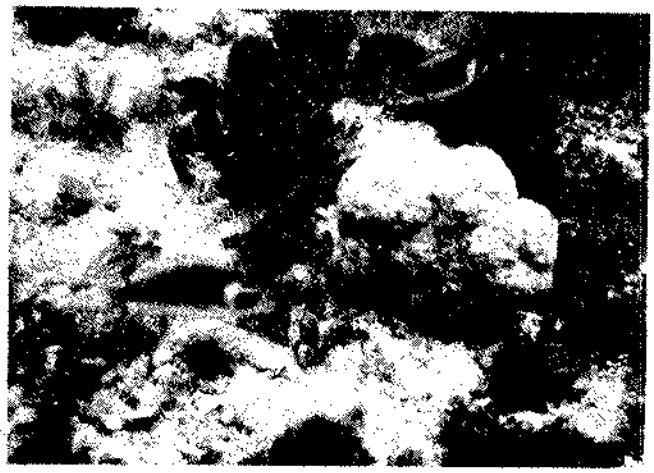

Fig. 17. *Scolopsis vasmeri*, a common fish at the pearl oyster beds.

Fig. 18. *Balistes* sp., the file fish is the most characteristic denizen of pearl oyster beds.

Fig. 19. These fishes are numerous in the pits and crevices of pearl beds.

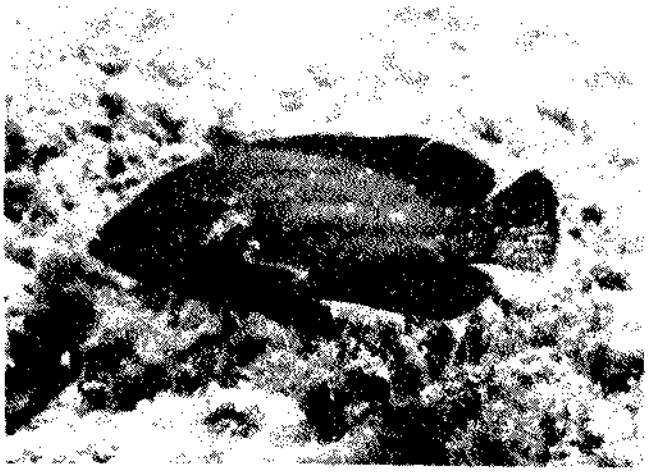

Fig. 20. The rock cod, *Serranus miniatus*, is ubiquitous from 10 m–25 m in the rocky areas.

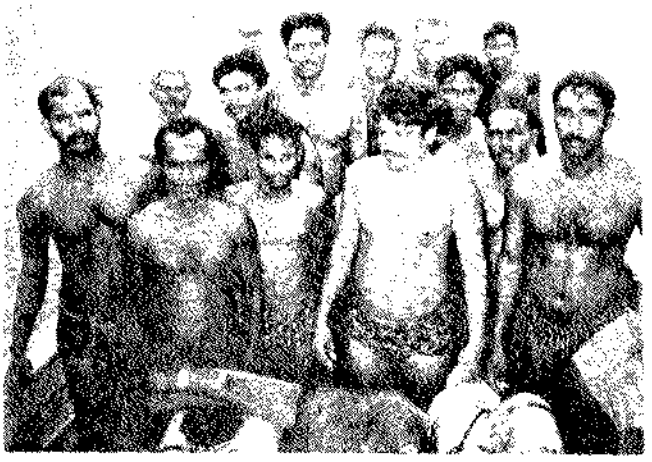

Fig. 21. 'SCUBA' diving training team with trainees from CMFRI.

Fig. 22. Training lessons in putting on Aqua-lung and positioning.

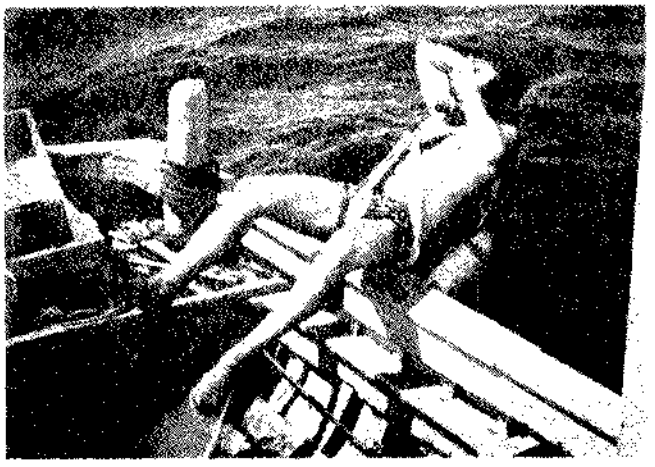

Fig. 23. The plunge into deep sea.

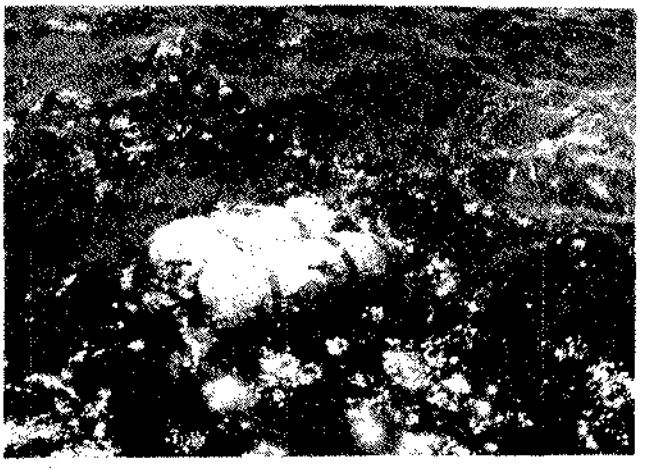

Fig. 24. 'SCUBA' diver in the process of descent.

Diving equipment: Make and selection of mask, fins, snorkel and knife-use and care of depth gauge, floats, watch, compass, suits, boats for divers-torch, camera, underwater guns, spear etc.

Diving: Where to dive-visibility-sea diving.

Aqua lung: What is aqua-lung-effect of pressure-hazards in diving-Symptoms of diving diseases-safety while diving-Decompression-Demand va lue regulator-functioning and uses-Types of regulatorr breather.

How to use aqua-lung-emergency procedures in diving-clearing of flooded mask, breathing tube, clearing mouth piece etc. Precautions with the equipment while diving.

Deep dive: Skin diving and safety-Buddy system-Diving signals-artificial respiration-do's and don'ts while diving with aqua-lung. Maintenance of aqua-lung and regulators.

Skin diver and marine life: Fish watching. Psychology of fish-senses of fish. Sharks and attacks-collection techniques at sea bottom-Dangerous marine life-Underwater photography.

Model gadgets in diving: Underwater vehicles and other recent advances in sea bottom studies by direct observation.

Practical 100 Hours.

Surface swimming with and without fins-swimming underwater with fins and mask-snorkeling in shallow areas and deeper areas-skin diving in shallow areas and slightly deeper areas-rescue operations while diving-artificial respiration.

Care of diving equipment and accessories-functioning of portable and electrical compressors-charging aqua-lungs-dismantling and assembling of lungs and regulator.

Exercises in removal of aqua-lung and replacing while diving at shallow water-clearing of flooded mask, breathing tubes-exchange of mouth piece with partner while diving-deep water diving with aqua-lung-collection of materials-use of different collection tools-confidence level diving.

Period of Training: December to April
Place : Tuticorin
No. of Trainees per Session : Eight

List of scientific publications in underwater diving observations by CMFRI

1. George, M. J., K. Nagappan Nayar and S. Mahadevan. 1967. Underwater observations. On a collection of shrimps from the Gulf of Mannar off Tuticorin. *Rec. Zool. Surv. India* **67**: 357-365.

2. Mahadevan, S. 1961. The pearl fish *Carapus margaratifera* (Rendahl), a new record for the Indian waters. *J. mar. biol. Ass. India.* **3** (1 & 2): 204-207.

3. Mahadevan, S. and K. Nagappan Nayar. 1965. Underwater ecological observations off Tuticorin in the Gulf of Mannar. Association between a fish (*Gnathonodon*) and a sea snake. *J. mar. biol. Ass. India* **7** (1): 1-3.

4. Mahadevan, S. and K. Nagappan Nayar. 1965. Underwater ecological observations off Tuticorin in the Gulf of Mannar. On the emperor bream, *Lutianus sebae* found with Pterois, the scorpion fishes. *J. mar. biol. Ass. India* **7** (2).

5. Mahadevan, S. and K. Nagappan Nayar. 1965. Note on the habitat and distribution of the file-fishes along the Tuticorin coast. *J. mar. biol. Ass. India* **7** (2). notes.

6. Mahadevan, S. and K. Nagappan Nayar. 1966. Underwater ecological observations in the Gulf of Mannar, off Tuticorin. VI. On the habitat, movements and breeding habits of the chank, *Xancus pyrum* (Linnaeus). *J. mar. biol. Ass. India* **8** (1): 213-218.

7. Mahadevan, S. and K. Nagappan Nayar. 1967. Underwater ecological observations in the Gulf of Mannar, off Tuticorin. VII. General topography and ecology of the rocky bottom. *J. mar. biol. Ass. India* **9** (1): 147-163.

8. Mahadevan, S. and K. Nagappan Nayar. 1971. Whither

pearl fishing. Souvenir Fish Exporters Chamber 181-184.

9. Mahadevan, S. 1971. Fishing for pearls in India. Sea-Food Export Jour. 3 (3): 23.

10. Mahadevan, S. and K. Nagappan Nayar. 1972. Free diving in Indian waters. Sea Food Export Jour. 4 (2): 25-27.

11. Mahadevan, S. and K. Nagappan Nayar. 1973. Pearl oyster resources of India. Proc. of the Symposium on the living resources of the seas around India: 659-671.

12. Mahadevan, S. and K. Nagappan Nayar. 1974. Ecology of the pearl oyster and chank beds. *Bull. of C.M.F.R.I.* No: 25: 106-112.

13. Mahadevan, S. and K. Nagappan Nayar. 1976. Underwater observation on the settlement of pearl oyster spat in the paars off Tuticorin. *Indian J. Fish.* 23: 105-110.

14. Mahadevan, S. 1979. Possibilities of mussel culture in Andaman Islands (ms).

15. Mahadevan, S. and D. C. V. Easterson. 1979. Topographical and ecological features of Andaman and Nicobar Islands with special reference to their suitability for mariculture activities (ms).

16. Nayar, K. Nagappan and S. Mahadevan. 1965. Underwater ecological observations off Tuticorin in the Gulf of Mannar. The occurrence of the synaptid *Chondrocloea* along with the massive sponge, *Petrosia*. *J. mar. biol. Ass. India*. 7 (1)

17. Nayar, K. Nagappan and S. Mahadevan. 1965. Underwater ecological observations off Tuticorin in the Gulf of Mannar. The occurrence of *Crinoids* (*Lamprometra* and *Comanthus*) on the gorgonid *Juncella*. *J. mar. biol. Ass. India* 7 (2).

18. Nayar, K. Nagappan and S. Mahadevan. 1965. Underwater ecological observations off Tuticorin in the Gulf of Mannar. On sea anemones and the fishes *Amphiprion* and *Dascyllus* found with them. *J. mar. biol. Ass. India* 7 (2).

19. Nayar, K. Nagappan and S. Mahadevan. 1967. The pearl and chank fisheries-A new outlook in survey and fishing. Souvenir: 20th Anniversary, Central Marine Fisheries Research Institute.

20. Nayar, K. Nagappan and S. Mahadevan. 1973. Chank resources of India. Proc. of the Symposium on the living resources of the seas around India: 672-686.

21. Nayar, K. Nagappan and S. Mahadevan. 1974. Chank fisheries and industrial uses of chanks. Bull of C.M.F.R.I. No. 25: 122-140.

22. Nayar, K. Nagappan and S. Mahadevan. 1976. On the settlement and collection of pearl oyster spat from Tuticorin area (ms). *Indian J. Fish.*

23. Silas, E. G., et al. 1977. Report on the survey of the islands in the Gulf of Mannar by C.M.F.R.I. for the setting up of a Marine National Park. C.M.F.R.I. Publication: (MS).