PROCEEDINGS OF THE SYMPOSIUM ON COASTAL AQUACULTURE

Held at Cochin

From January 12 to 18, 1980

PART 2 : MOLLUSCAN CULTURE

(Issued on 31st December 1983)

MARINE BIOLOGICAL ASSOCIATION OF INDIA

POST BOX NO. 1023, COCHIN 682011, INDIA

Price : Rs. 350.00

MARINE BIOLOGICAL ASSOCIATION OF INDIA

COCHIN-682 011, INDIA

SYMPOSIUM SERIES 6

Abbreviation

Proc. Symp. Coastal Aquaculture, Pt. 2

PRINTED IN INDIA BY K. G. JOHN AT THE DIOCESAN PRESS, MADRAS 7 AND PUBLISHED BY E. G. SILAS ON BEHALF OF THE MARINE BIOLOGICAL ASSOCIATION OF INDIA, COCHIN-682 011.

Proc. Symp. Coastal Aquaculture, 1983, **2** : 513-518

A PLAN FOR MOLLUSCAN EXPERIMENTAL HATCHERY AT TUTICORIN, INDIA

K. NAGAPPAN NAYAR* AND D. C. V. EASTERSON

Central Marine Fisheries Research Institute, Cochin-682 108

ABSTRACT

The Central Marine Fisheries Research Institute has developed techniques of oyster culture aimed at production for marketing. At present it is a semiculture depending on nature for collection of spat. Reliance on wild spat has to be reduced since it does not guarantee seed supply at all times. A plan has been evolved for hatchery production of oyster seeds. The paper describes the hatchery system being developed at Tuticorin. The layout with green house, sea water filtration, purification and temperature control systems has been so designed as to achieve tangible results.

INTRODUCTION

THE CENTRAL MARINE FISHERIES RESEARCH INSTITUTE has been actively engaged in researches on pearl culture with the species *Pinctada fucata* (Gould) from 1972 at Tuticorin situated on the Gulf of Mannar along the southeast coast of India. In 1976 the culture of edible oyster *Crassostrea madrasensis* (Preston) was taken up at the centre. The pearl culture technology has been fairly well established, so also the techniques of oyster culture. The two systems rely on spat or juveniles collected from nature by diving with SCUBA for pearl oyster and setting spat collectors for edible oyster. Natural spatfalls are seasonal and erratic and the areas of spat collection also vary. An organism cannot be considered a serious candidate for large-scale culture unless the juveniles are made available economically in large numbers. This implies human control over spawning and the ability to bring high percentage of healthy larvae through the post-larval stages. A hatchery can supply healthy spat uniformly round the year. To meet this demand, a shellfish hatchery was designed at Tuticorin.

The authors express their deep gratitude to Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute for providing the necessary facilities and encouragement.

Layout Plan

The hatchery comprises of two green houses, two nurseries, a breeding laboratory, a nutrition laboratory, a phytoplankton culture room, a general laboratory and other infrastructures such as stores, air compressor room and a standby power generator plant (Fig. 1).

The green houses are of 20 × 10.8 m each with translucent roofing of corrugated fibreglass material with a maximum transmittance of 70% light fixed on tubular truss work. To have proper ventilation heavy duty exhaust fans have been installed. The phytoplankton culture room and the breeding-cum-larval rearing laboratory have been air-conditioned.

Sea water supply

Sea water is pumped from the adjoining bay. The process of collection, sedimentation, filtration, etc, has been described by Nayar *et al.*

* Present address: Tuticorin Research Centre of Central Marine Fisheries Research Institute, Tuticorin, Tamil Nadu.

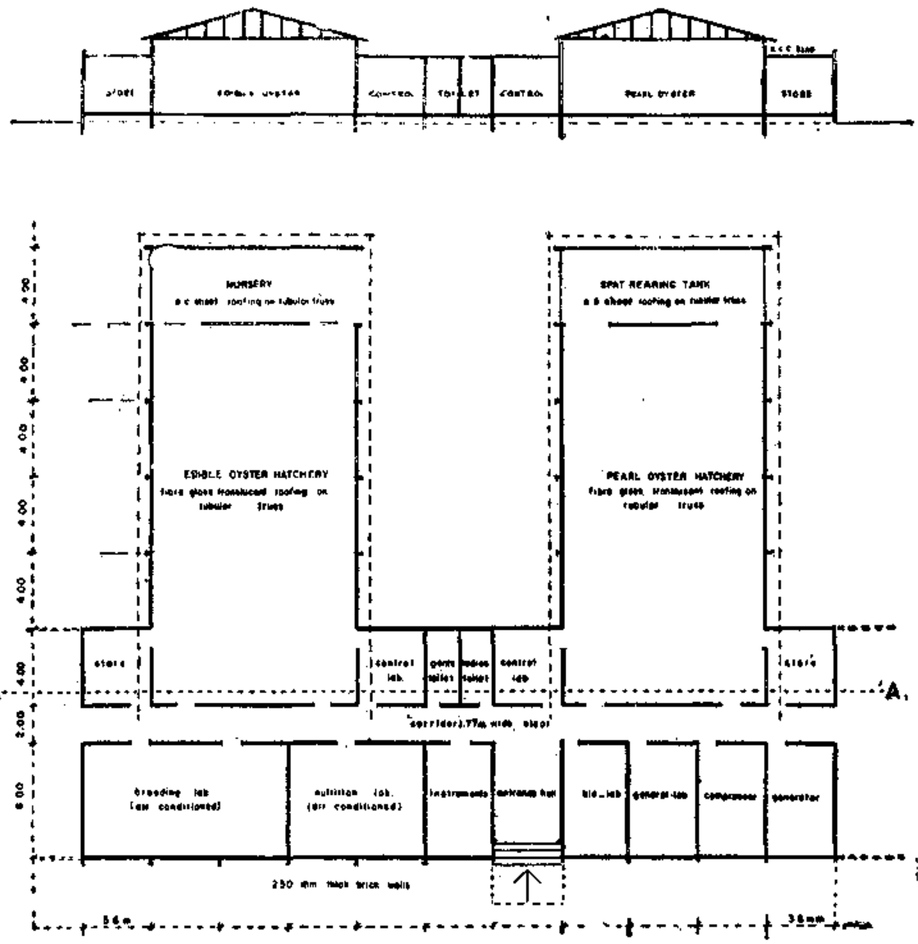
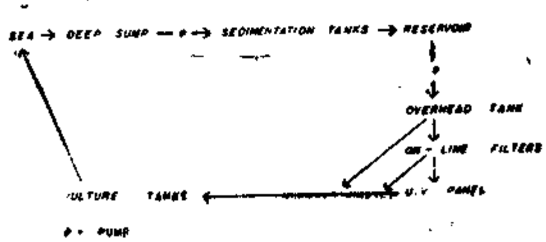


FIG. 1. Hatchery building layout plan (cross section through A-A at the top).

(1980). The hydrological factors of the Gulf of Mannar show a yearly bimodal cycle, due to the influence of southwest (May-June) and northeast (October-December) monsoons. The monthly mean salinity varies from 35.5‰ in March to 31.0‰ in July. Dissolved oxygen ranges from 4.4 ml/l in July to 3.1 ml/l in March. The water is rich in oxygen during January to July and May to September (Marichamy and Siraimeetan, 1979 ; Easterson and Mahadevan, 1980).

The sea water circulation is as given below. Only heavy duty P.V.C. conduits are being used throughout.



In all the pumps used the impeller is of polypropylene with no metals coming into contact with sea water. For the maintenance of breeders and to the nursery tanks, sea water is supplied straight from the overhead tank. To the breeding and larval tanks the water is passed through on-line sintered glass filters of numbers 1 (90-150 μm), 2 (40-90 μm) and 4 (5-15 μm) porosity, and afterwards through a series of cartridge filters in the order of 5, 3, 1, 0.4 and 0.2 μm effective size retention (Fig. 2). Periodically filtered water is back pumped and the glass filters auto-claved. U. V. panel of similar design as stated by Shelbourne (1964) is used. The ultra-violet tubes are 30 W each and water passes through a distance of 2.5 m in each panel through a series of baffles.

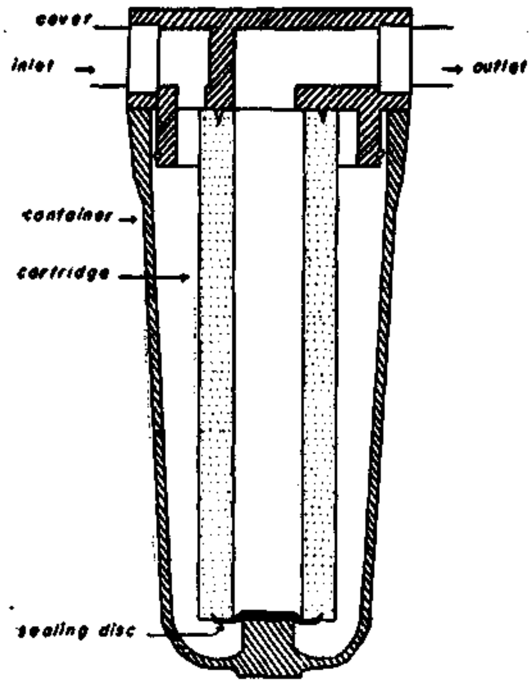


FIG. 2. The details of the cartridge filter used.

Aeration

An air compressor of 5 H.P. with a provision for a storage pressure tank is used. The air is passed through John-Fowler type of air filters and dry, dust-free air is passed through G.I. pipes with a series of control valves. The air before being used in the larval rearing tanks is passed through on-line sintered glass filter of bacteriological grade. In addition an air pump coupled with oxygen analyser is also available to maintain dissolved oxygen at any desired level above ambient.

Temperature control system

Two types of temperature control systems are available. The first type can be used only to maintain temperature above the ambient. This is done using a silica-cased immersion heater in conjunction with a JUMO contact mercury thermometer and an electrical relay. Here an air pump also serves as a stirrer. This system is simple and can be installed in any type of aquarium tank.

The second type has provision for both cooling and heating (Fig. 3). This embodies two units. The culture tank unit is comprised of three chambers one within the other. The outer and the middle chambers are of anodised aluminium while the innermost is of stainless steel. As required, hot or cold freshwater is circulated in between the innermost and the middle tank. The space between the middle and outer compartments, is stuffed with glass wool for insulation. The JUMO contact thermometer is positioned in a corner of the stainless steel tank wherein oysters are kept. This is covered with a transparent lid to aid visual observation and the water is stirred by means of an aerator. The necessary electrical instruments are in the second unit. It has a two-layered aluminium tank of which the inner sheet is perforated throughout and the copper cooling coil is fixed in-between. A 1000 W heating element has been fixed projecting inside the aluminium tank to avoid cooling coils coming into contact with the heater. Through an opening, freshwater can be poured inside upto 2/3 level, so that copper coils and the heating element are always kept immersed. The aluminium tank is insulated. A 1/3 HP air cooled compressor similar to the one used in refrigerators is kept below. All these are enclosed within a steel framed anodised aluminium cabinet. At the top towards one side a 1/20 HP water pump, relay and control switches with pilot lamps have been fixed within a metal case. The temperature is set by the JUMO contact thermometer. The pump is connected with the aluminium tank through a P.V.C. pipe and foot-valve, and with the culture tank through asbestos insulated P.V.C. tubes, and operates in synchronisation with the heating and cooling elements. The culture tank is kept a few centimetres above the instrument unit.

Operational plan

The programme is as follows :

Quarantine tanks :

Sexually ripe oyster-Brushed, washed, cleaned in 3 ppm chlorine for 10 minutes-Washed out and kept in growing tanks for conditioning.

Breeding tanks :

Inducement of spawning by thermal stimulation-Transferred to filtered 'bacteria-free' sea water-Releases spawn and eggs fertilized-Oysters transferred to sea.

—Larvae grown in 'bacteria-free' sea water upto eye-spot stage.

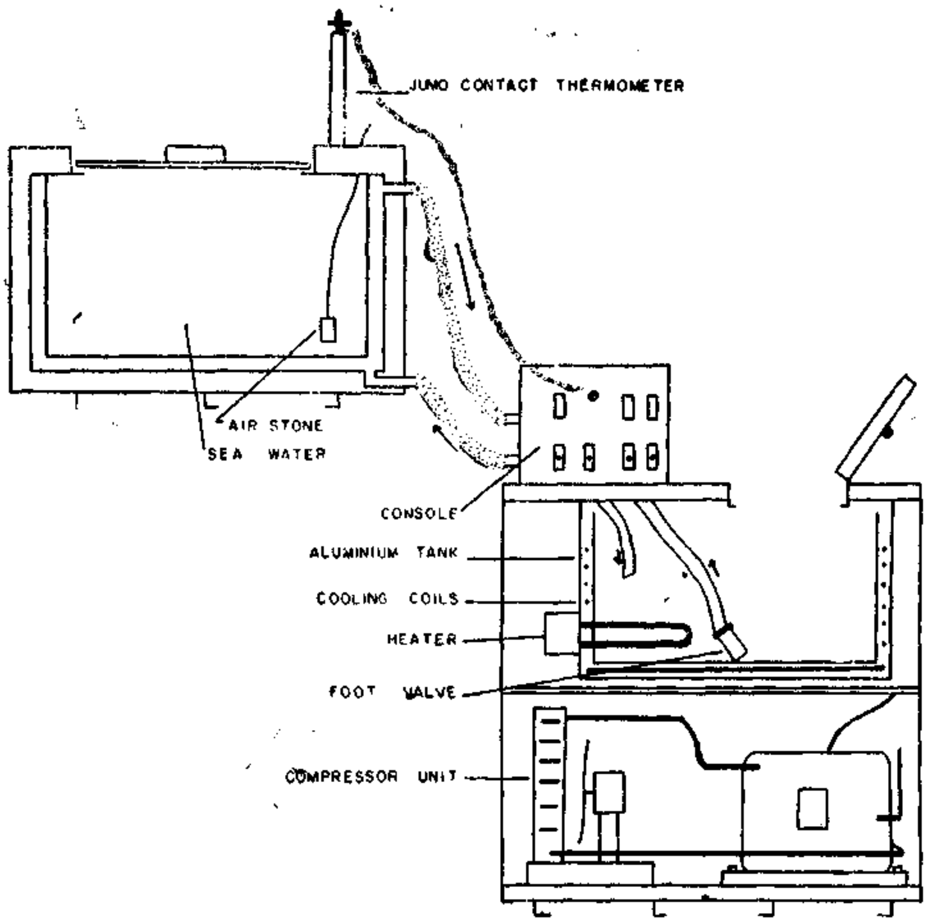


FIG. 3. Details of the temperature control system with provision for both cooling and heating.

Settling tanks :

Kept upto thumb nail stage

Nursery :

Grown— Spat collected—Transplanted to farm.

The tanks used are of fibreglass. Powdered oyster shell and black coloured high density polyethylene sheets are used as spat collectors. Below the thumb-nail stage the spat are removed and grown in tanks wherein seawater along with micro-algae are passed so as to upwell from the bottom. From these nursery tanks the spat are transplanted to the sea farm.

Food

The phytoplankters — *Isochrysis galbana, Pavlova lutheri, Synechocystis salina, Chlorella ovalis, Tetraselmis gracilis* and *T. chui* — are cultured in an airconditioned laboratory at 23° ± 2°C. Clear glass jars of 25 litre capacity are used for mass culture. Widemouth Erlenmeyer flasks of 250 ml capacity and 4 lit Haffkine culture flasks are used for subcultures. The culture flasks are illuminated with day light fluorescent strip lamps. The photoperiod is controlled by means of an automatic switch clock. Enriched Miquel's medium is used. The pH is adjusted to 7.5 — 8.0 using 1 N HCl and 1 N NaOH and the salinity is maintained at 30-32‰ by adding boiled and cooled distilled water. The composition of modified Miquel's medium is as follows :

i. *Miquel's fluid-A*

Potassium nitrate	20.2 g
Distilled water	100 ml.

ii. *Fluid-B*

Di-sodium monophosphate	4.0 g
Calcium chloride	4.0 g
Hydrochloric acid	2 ml
Distilled water	80 ml

(slight warming is required to dissolve the salts)

iii. *Mineral mix*

Sodium salt of EDTA	300 mg
Ferric chloride	8 mg
Manganese chloride	12 mg
Zinc chloride	1.5 mg
Cobalt chloride	0.3 mg
Copper sulphate	0.12 mg
Boric acid	60 mg
Distilled water	100 ml

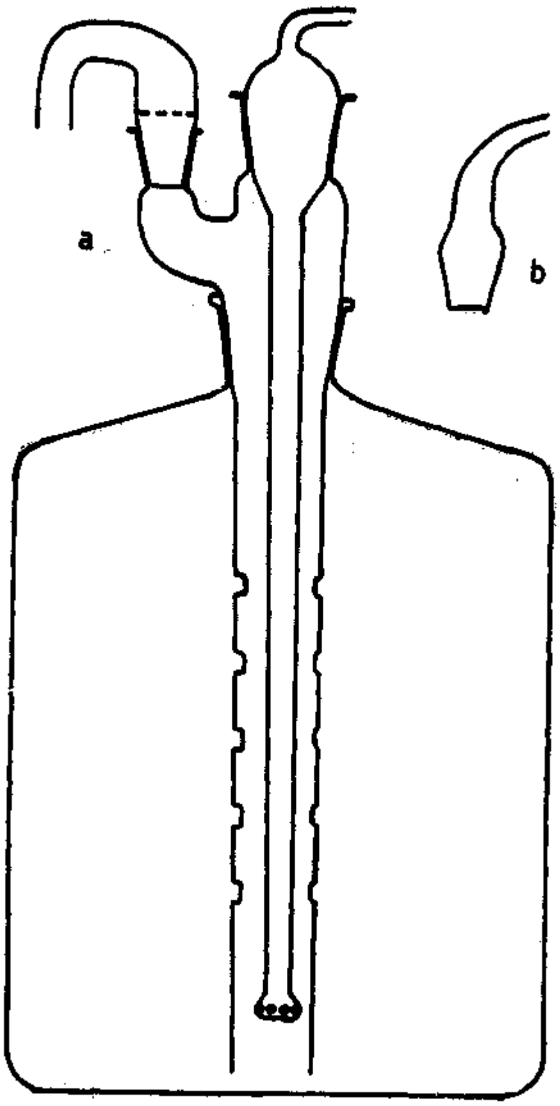


Fig. 4. Bacteria-free algal culture jar.

iv. *Vitamin mix*

Cyanocobalamin	0.1 mg
Thiamine hydrochloride	10.0 mg
Biotin	1.0 mg
Distilled water	100 ml

To one litre of filtered and autoclaved sea water 2 ml and 1 ml of Miquel's fluids A and B respectively are added and to this, 2 ml of mineral mix, is added and checked for pH and salinity. Later 1 ml of vitamin mix is added. Walne's medium (Walne, 1974) is also used in the hatchery.

Large scale bacteria free continuous cultures are grown in a series of 25 lit glass jars designed for the purpose (Fig. 4 a). The air filtered through a on-line sinted filter of 0.1 μm pore size is passed through the vertical tube. The air thus passed is also used to stir the culture continuously following the principle of air-lift. The side arm with a sintered filter serves as air outlet while the filter prevents any possible entry of particles. Nutrients and sea water are added through this side arm after removing the filter assembly. While removing the culture the air supply is disconnected from the vertical tube and coupled through the side arm using the unit shown in *Fig.* 4 b. A siphon is connected to the vertical arm. The air pressure built-up inside the flask and the siphon facilitate the removal of culture. At a time only 3/4 of the culture is removed and the remainder is used to maintain the culture. After removing the culture fresh enriched sea water is poured and the system is operated in its grow out mode. Periodically the system needs to be sterilized.

References

EASTERSON, D. C. V. AND S. MAHADEVAN 1980. Review of open sea environmental conditions along Indian Coast. *In*: Coastal Aquaculture: Mussel farming, Progress and Prospects. *Bull. Cent. Mar. Fish., Res., Inst.*, 29 : 17-21.

MARICHAMY, R. AND PON. SIRAIMEETAN 1979. Hydrobiological studies in the coastal waters of Tuticorin, Gulf of Mannar. *J. mar. biol. Ass. India*, 21 (1 & 2) (in press).

NAYAR, K. N., M. E. RAJAPANDIAN AND D. C. V. EASTERSON 1980. A plan for the purification of farm grown oysters before marketing. *Proc. Symp. Coastal Aquaculture*, MBAI, 2 : 505-508.

SHELBOURNE, J. E. 1964. The artificial propagation of marine fish. *Adv. Mar. Biol.*, 2 : 1-85.

WALNE, P. R. 1974. *Culture of bivalve molluscs*: 50 years' experience at Conway. Fishing News (Books), Survey, England. 173 pp.