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CONTINUOUS SPAT PRODUCTION OF FLAT OYSTER

Ostrea edulis IN RUNNING WATER¹

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ABSTRACT

- The breeding of bivalve larvae has up to now always been conducted in closed systems. This method requires great care and consequently much labor.

Using running water systems, we intended to exclude handling and avoid infestations and diseases without the use of antibiotics. Primarily, we used two cylindrical 20 m³ tanks, both with a filtering sand bottom and air-lift system. The flow was about 400 liters/hr. The temperature was 20 C. One tank was used as the filter, the second as our breeding unit in which circulation was maintained by adapted aeration. Newly released larvae of Ostrea edulis were introduced at four times. Larvae were fed daily at a rate of from 10 Isochrysis galbana, 10 Monochrysis lutheri and 2 Tetraselmis suecica per microliter to 25 I.g., 25 M. l. and 5 T. s. per microliter.

The best results were obtained at the end of experiment using a stocking density of 220 larvae/liter. We observed a shorter larval period than usual records. Metamorphosis took place from day 9 to day 11. Five percent of the larvae were collected as spat on plates at an early stage (24 to 48 the hours), without considering the high number of spat settled on the tank itself. Total number of settled spat was about 15 to 20% of last larval density. These preliminary results need to be studied thoroughly. Nevertheless, the experiment shows that continuous oyster spat production is feasible in running water systems. -

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INTRODUCTION

Up to now, methods for producing spat of bivalves have been managed in closed systems; larval rearing is conducted in standard and aerated water renewed at regular intervals. The repeated handlings for cleaning increase the stress placed on the cultured animals.

Nevertheless, every rearing must be operated under extremely sanitary conditions. Antibiotics are very often used in a preventive way, without stopping the bacterial proliferation. Increasing efforts have been made to develop systems for obtaining perfect sanitary conditions. This aim becomes somewhat utopist when one tries to manage large volumes for large scale seed production (Matthiessen and Toner, 1966; Walne, 1966).

Rearing of filter-feeding animals in running sea water systems appears to be a good course of action against disease and pollution, but technological points interfere with this solution, such as how to wash the detritus without losing larvae and avoiding the waste of food.

In this experiment, we have mainly considered the biotechnical aspect, using as test species the flat oyster Ostrea edulis, the size of newly released veligers being about 170 μ for this species.

MATERIALS AND METHODS

System Design

This system is based on the use of two volumes connected in series (Figure 1). The first volume is used as a filter, the second one as a rearing unit. The efficiency of this system rests on the recycling of the water by air-lift and pumping through a filtering double bottom.

The filter is made up of a cylindrical polyester and fiberglass tank of 3 m diameter and 3 m height, and capacity of 20 m³. This tank is provided with a filtering double bottom percolated by the means of 4 air-lifts of 2.7 m height and 60 mm diameter. Each air-lift is supplied with air by a polyvinyl pipe at the lower fourth of its height.

The double bottom is made up of three different layers. 1) The lower layer is composed of red bricks (40 x 20 x 20 cm) laid flat, provided with holes to increase the drainage. 2) The mid layer is made of BIDIM U 34, eliminating the escape of larvae and limiting the waste of food (phytoplanktonic algae). This layer of BIDIM is united with the wall of the tank itself. 3) The upper layer is composed of about 20 cm of fine sand.

A pump of 2 ph increases the recycling of the water through the

double bottom; a small part ($0.3-0.5 \text{ m}^3/\text{hr}$) of this water goes in the rearing tank, with the main part ($8 \text{ m}^3/\text{hr}$) going back into the filtering tank.

The rearing tank is similar to the filtering tank (capacity, shape, double bottom), but the pump is replaced by an adjustable out-flow. In addition, this tank is provided with an aeration system crossed with the air-lifts. This bubbling plays a role in maintaining an adequate homogeneity of the water. The aeration is obtained through a high pressure rubber pipe (7 kg/cm^2 , 7 mm ID), pierced by injection needles (0.8 mm ID). The space between needles is 15 cm .

Conducting the Experiment

The experimental method was chosen in view of two different aims, to obtain good conditions for a given rearing up to the metamorphosis and to test the possibility of successive rearings at constant temperature without removing the whole system.

The inflow of sea water at a constant temperature of 20 C fluctuated from 0.3 to $0.5 \text{ m}^3/\text{hr}$, the two tanks being in hydrostatic balance. Each air-lift admits $1 \text{ m}^3/\text{hr}$ of air at 1 kg/cm^2 , which gives a flow of water of about $1 \text{ m}^3/\text{hr}$. The total discharge rate of recycled water is $12 \text{ m}^3/\text{hr}$ in the filtering tank ($4 \text{ m}^3/\text{hr}$ from the air-lifts, and $8 \text{ m}^3/\text{hr}$ from the pump), and $4 \text{ m}^3/\text{hr}$ in the rearing tank.

The larvae come from adults which mature under natural conditions.

This experiment of a total duration of 40 days can be divided in two parts. The first part lasted 28 days, with three different introductions of larvae (respectively, 1.5 , 2.4 , and 0.4×10^6 larvae); the second part lasted 12 days only, with one introduction of 4.4×10^6 larvae. Concentration of larvae was always small since it never went beyond 220 larvae/liter.

Before the beginning of the experiment, the tanks were treated with permanganate; during the whole experiment, no treatment was given to the tanks (no antibiotics or hypochlorite).

The food given to the larvae was composed of three species of phytoplanktonic algae: Isochrysis galbana, Monochrysis lutheri and Tetraselmis suecica. The algae were distributed daily, the quantity given each day appearing in Figure 2 for each algal species. The average quantity of algae available to the larvae was small, especially since some of the algae were lost due to the filtering system (Figure 3).

The material used to collect the larvae was made of black PVC plates of $35 \times 33 \text{ cm}$, arranged on a frame which bears 19 plates. We have used only this type of collector which enables the collection of spat at early stage to avoid the difficulties of keeping the

collectors for long periods of time with the oysters still attached to them.

The collectors were usually treated with ground meat of adult oyster before they went in the rearing tanks. The seed was separated from the plates by shaving.

RESULTS

It was interesting to find out how larvae of different ages reared together in the same large tank behaved without any treatment or handling. The main results of the experiment appear in Table 1; they relate only to the seed collected on the plates and detached between 24 and 48 hours after the settlement. At the end of the experiment, the quantity of larvae settled on the walls of the tank and on the sand was very high, but this quantity was difficult to evaluate. The total figure of settled spat seems to fall between 15 and 20% of the number of larvae introduced.

DISCUSSION

As the experiment proceeded, a shortening of the pelagic larval stage was noted; the duration of the larval stage changed from 16-18 days to 9-11 days. The long period of larval stage observed in the first part was probably due to the shortage of food used during the first 15 days and to its quality (only the two small species, *I. galbana* and *M. lutheri*, were used at this time). Due to difficulties with the production of *T. suecica*, this species was not given before day 16 of the experiment. Nevertheless, the percentage of spat collected was about 5%.

The low percentage of spat collected from the second introduction of larvae can be related to a late immersion of the collectors treated with ground meat of adult oysters. As a matter of fact, on day 21 of the experiment (i.e. day 10 for the second introduction of larvae), the percentage of eyed larvae was 62%. At this time, untreated collectors were immersed from day 22 to day 26 without significant results. At the same time, an important attachment on the walls of the tank was observed. On day 26, a collector treated with ground oyster meat was immersed and gave 30,000 spat on day 27. This settlement proved once more the attractive action of ground meat of adult oyster.

The third part corresponds with the introduction on day 30 of the last stock of larvae. The rearing proceeded without any difficulties; the average sizes varied between 235 and 275 μ on days 35 to 37 (5th and 7th day of larval life). On the 10th day of this rearing, 90% of the larvae were eyed.

Indeed, these results are somewhat vague, and the total figure difficult to estimate, due to the size of the volume and the diffi-

culty in determining the proper time for settling. It is still necessary to demonstrate the regularity of production of such a rearing system. Special attention must be devoted to the technology that is to be used at the metamorphosis period. A screen of air bubbles near the walls of the tank could reduce the attachment of the larvae on the walls. Different types of collectors adapted to such large volumes are to be developed, and their position in depth determined for an optimal yield.

CONCLUSION

These encouraging results were obtained in July and August, a period of the year when it is very difficult to obtain with certainty production of bivalve spat (especially oyster spat). This leads to conclude that this method constitutes an interesting direction for improved research work.

Using the same basic technology, we intend to confirm these results using the same size of tanks and using different smaller units. The smaller tanks are necessary if one wants to verify the constancy of the production obtained with this method and to precisely evaluate the yield; it seems impossible to follow the evolution of the rearing at a scale of 20 m³.

LITERATURE CITED

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- Walne, P. R. 1966. Experiments in the large scale culture of the larvae of Ostrea edulis. Fishery Invest., London, Ser. 2, 25(4):1-53.

Table 1. - Number of larvae stocked, number of spat collected, percent survival, and larval period for the various stocking periods.

Day of new breeding	Number of brought larvae x 10 ⁶	Larval period in days	Spat collected at early stage	% collected
0	1.5	16 - 18	79 000	5.2
11-14	2.4 - 0.4	14 - 16	30 000	1
30	4.4	9 - 11	245 000	5.6

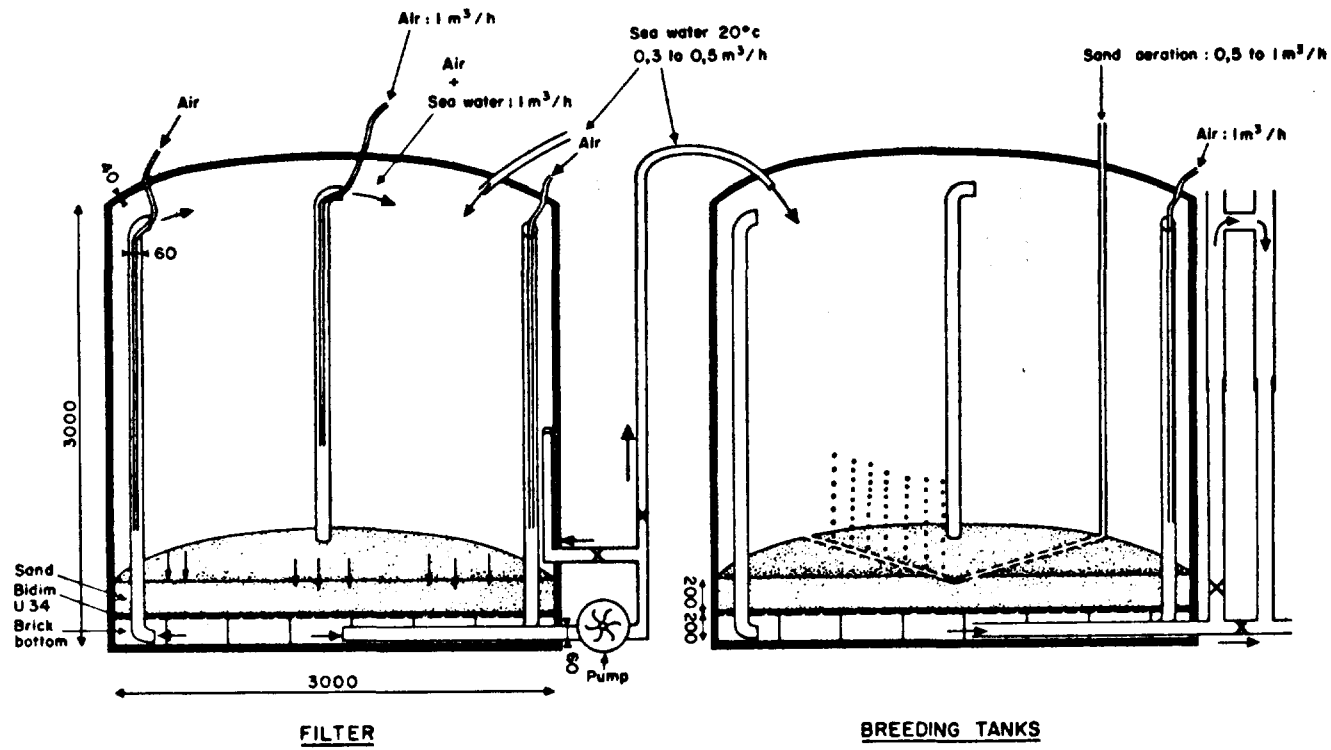


Figure 1.

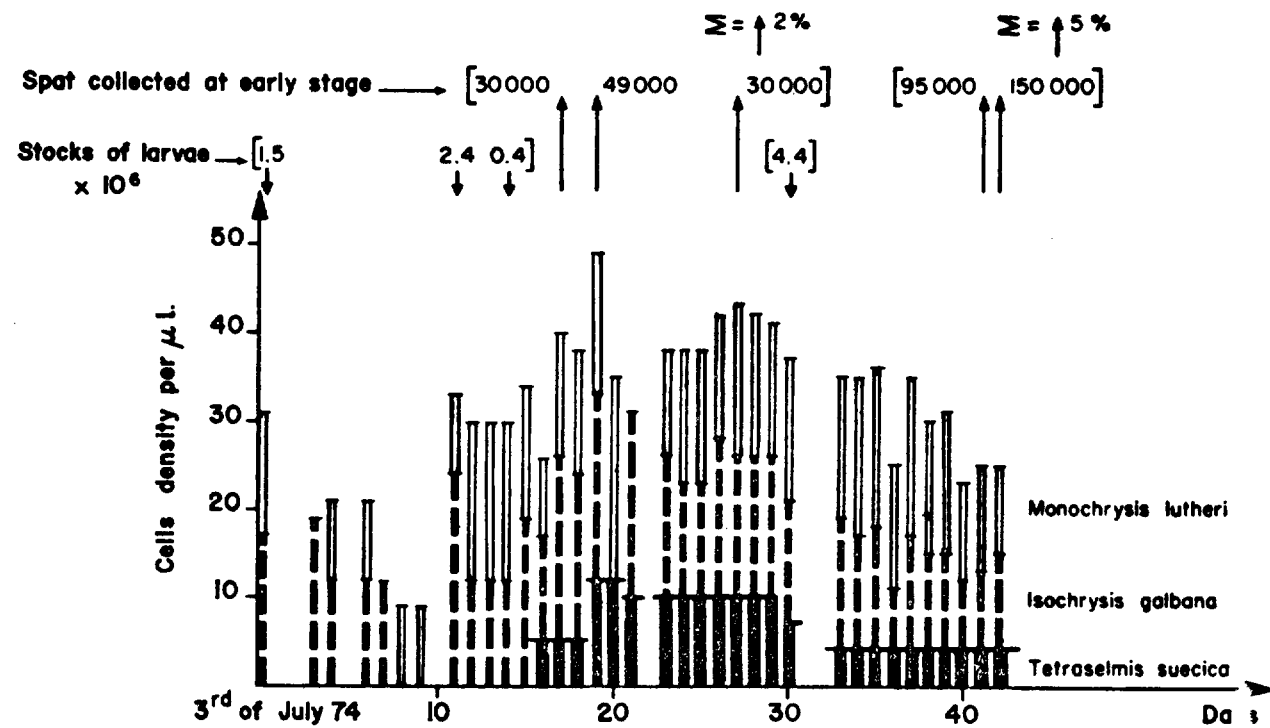


Figure 2.

