HATCHERY TECHNIQUES FOR A CONTROLLED ENVIRONMENT MOLLUSCAN MARICULTURAL SYSTEM.

by

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ABSTRACT.

The hatchery operation which is part of the Delaware controlled environment system is reliable and trouble free. An abundant supply of quality food is necessary to operate a successful hatchery. The broodstock, larvae, spat and juveniles all receive the same two-part algal diet. The temperature for all except the broodstock is 27\(^\circ\)C to 29\(^\circ\)C. Sexually mature 16 week oysters are being considered as broodstock. "Astroturf" is being considered as a setting substrate. No assurance exist that our hatchery product which excels within the system would succeed in natural planting.

RESUME.

L'écloserie, qui forme l'un des éléments du système d'élevage de mollusques en environnement contrôlé de l'Université de Delaware, est fiable et fonctionne sans problème. Un succès en matière d'écloserie nécessite un approvisionnement abondant en nourriture de bonne qualité. Le stock de reproduiteurs, le naissain, et les juvéniles reçoivent tous le même régime algal, en deux éléments. La température, sauf pour les reproduiteurs, est fixée entre 27 et 29\(^\circ\)C. Des huîtres de 16 semaines, à maturité sexuelle, sont considérées comme des reproduiteurs. Le substrat de fixation employé est de l'"astroturf". Il n'est cependant pas prouvé que notre produit, parfait dans le cadre du système employé, le serait aussi dans les conditions naturelles.

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INTRODUCTION.

Scientists and engineers of the University of Delaware are developing a controlled environment system for rearing commercially desirable bivalve molluscs from egg to marketable size (PRUDER et al., 1976, 1977; PRICE et al., 1976). Included within the system is a modest hatchery operation involving the maintenance and conditioning of broodstock, spawning, rearing of larvae, and the setting, rearing, and harvest of spat. We utilize the basic procedures and hardware of DUPUY (1971) with some modification, and provide for the project needs on a routine and practically trouble-free basis. An abundant supply of high quality food is essential to the success of the controlled environment system including the hatchery. This paper describes our procedures and experience with Crassostrea virginica (Gmelin), the American oyster.

BROODSTOCK.

Our current broodstock comprise about thirty 40-50 gram oysters held at 18°C in 400 l flume tank. The water is changed and the tank and animals washed every other day. These oysters are fed a two part algal diet of Thalassiosira pseudonana (3H) and Isochrysis galbana in equal parts by cell count. The quantity of algal cells fed is given by the following expression (figure 1).

![Figure 1: Relationship between number of algal cells cleared and oyster weight for laboratory spawned and reared oysters.](image-url)
Algae are added to the broodstock in two or three feedings per day. Tank algal concentration is in excess of $0.25 \times 10^6$ cells/L. We have not been successful with continuous feeding at low alga concentrations.

Recently we have produced sexually mature oysters at sixteen weeks of age from setting. Utilizing much smaller brood animals will greatly increase the number that can be supported on a given food supply. It has direct implication in breeding and genetic work with three generations per year a real possibility. The use of T. pseudonana as the sole food appears to increase the rate of gonadal development and decrease the rate of shell elaboration. Both phenomena offer advantages to broodstock.

It has been our experience that well fed oysters condition easily and hold their ripeness. Lack of good food supply will cause inconsistency in hatchery operations.

**SPAWNING.**

The spawning techniques in our laboratory for Crassostrea virginica are quite routine. The oysters are taken from the broodstock tank and placed in running seawater (27 - 29°C). Spawning usually will occur within one hour. If necessary stripped sperm are presented to the oyster which triggers spawning. Spawning males and females are separated and sperm and eggs are collected. We have experienced little if any difficulty with polyspermy, and therefore the sperm and eggs are not counted nor mixed with precision. The fertilization of eggs is confirmed by microscope within thirty minutes. The fertilized eggs are transferred into larval rearing cones. Since our needs are small the fertilized eggs produced from a single pair of oysters are sufficient for a given spawn. We spawn oysters about once a month on a year round basis.

**REARING OF LARVAE.**

The fertilized eggs are added to 400 1 larval cones at a concentration of approximately 60 larvae per milliliter. The seawater, filtered thru a 5 μ bag, is held at 27° C to 29° C. No food is added to the cone the first twenty-four hours. After that 4 liters of an algal mix of T. pseudonana and I. galbana, three to five million cells/ml, are added to the cone each day. The water and larvae are removed from the cone every other day. The larvae are separated from the water by fine mesh screen suspended in a breaker box.

In eleven to eighteen days the larvae that will not pass thru a 212 μ screen and have developed a black spot "eye" are transferred to setting trays. The free swimming larvae are thinned throughout the larval growth period so that by setting time the concentration is down to 2 larvae/ml. Note that the broodstock and larvae share identical diets and both do very nicely.
SETTING.

The "eyed" larvae are transferred to setting trays developed by DUPUY. The trays measure 45 cm to 57 cm x 10 cm deep. The larvae attach to the matte side of the polyester film. We use commercially available drafting film from Hercules, Inc. The number of spat per sheet range from 2,000 to 10,000 depending upon the application. The temperature is held at 27-29° C, same as for the larvae. The setting sheet ("cultch") is horizontal with gravity moving the larvae in the direction of the setting surface. Usually the larvae are added to the setting tray late in the afternoon and the polyester film is removed in the morning. The film sheets are mounted back in frames and suspended vertically in spat tanks.

Recently we have floated "astroturf" material in the water in the setting trays. A heavy set was achieved and this method may replace the polyester film procedures since excellent oyster growth and easy harvesting were experienced with "astroturf".

Commercial hatcheries in the United States general utilize only the fastest growing larvae for set. The slower growing larvae are disposed of. This is based upon the presumption that fast growing larvae yield fast growing juveniles and slow growing larvae yield slow growing juveniles.

REARING SPAT.

Whether the spat were set on polyester film or "astroturf" they are transferred to 400 liter spat tanks with the water temperature maintained at 27 - 29° C. The spat, like the broodstock and the larvae, are fed a mixed diet of T. pseudonana and I. galbana at concentrations of up to 1 x 10^6 cells/ml. The growth is very rapid with oysters reaching 2.0 cm in four weeks. The water is changed every other day and the tank and animals washed.

Initially the "astroturf" must be weighted to keep it submerged. However, the oysters soon provide sufficient weight and the external weight can be removed.

The spat in our laboratory are used solely in controlled environment systems. Whether or not they would succeed in natural planting has not been determined. We have shown that slow growing larvae grow well in our system and in 8 weeks after setting are indistinguishable from the fast growing larvae of the same spawn. This may not be the case with oysters subjected to stress and selective pressures of the natural environment.

Oysters can be left on the sheet until they reach marketable size. However they have an undesirable flat shape. If an oyster is removed from the sheet and placed on a tray cupping will occur and a deep oyster will be produced. We suggest that cupping of oysters can be encouraged or discouraged depending upon the physical environmental condition to which they are subjected.
SPAT HARVEST.

The harvest technique for spat on polyester film involves the folding of the film over a sharp edge. The oysters can be forced off the sheet. Commonly considerable fracture of the flat valve occurs. However, the oyster repairs the damage very rapidly in our system. Very seldom have mortalities occurred after spat harvest. If the spat set has been heavy the individuals will be attached to each other and must be separated.

The "astroturf" spat harvest is much simpler and causes little if any damage to the oysters. The young oysters cup while attached to the turf. The natural adhesive does not hold tightly to this material.

ACKNOWLEDGEMENTS.

We wish to express our appreciation to Mr. Earl GREENHAUGH for his considerable technical assistance in this development effort, to Mr. Jan SICK for preparing the figures, and Ms. Lena WATTS for typing. This work is the result of research sponsored by NOAA Office of Sea Grant, Department of Commerce, and by the State of Delaware.

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