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PRELIMINARY EXPERIMENTS ON THE CULTURE OF BIVALVES IN TANKS

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In recent years, many residents of the Atlantic coast of the United States have shown interest in the possibility of growing commercial marine bivalves in artificial salt water ponds. This interest has been stimulated by the rising value of marine bivalves which has brought about a great increase in the fishing pressure with the consequent reduction of the standing crops of the most desirable species. A long tradition of free public fishing below the low tide mark, and in many localities below the high tide mark, has suppressed all efforts to develop private management of most of the shellfish resources in the open waters.

The development of methods of culturing bivalves in artificial salt water ponds offers the possibilities of circumventing the public resistance to private control of the shellfish resources. It has been suggested that such ponds might have certain advantages over the normal habitat in the open waters. Complete suppression of tidal flushing offers the possibility of retaining larvae after spawning. The productivity of phytoplankton could be accelerated by the addition of nutrient salts to provide an abundance of food for optimal growth. In addition the problem of predator control would be simplified.

A series of experiments were performed to determine if either of the most valuable bivalves, Mya arenaria and Venus mercenaria, would survive and grow under conditions comparable with those in a salt water pond completely separated from the estuary or ocean. In addition the survival and growth of Pecten irradians, Mytilus edulis, and Gryphaea virginica was tested. The experiments were performed in four rectangular concrete tanks, each 9 ft. long, 4 1/2 ft. wide, and 3 1/2 ft. deep, with a capacity of 1200 gallons. One was supplied with running sea water, salinity 31-32 ‰ at a rate of two gallons per minute. The second was filled with sea water of the same salinity and allowed to remain stagnant. The third and fourth tank were filled with mixtures of sea water and fresh water which remained stagnant at salinities of 26‰ and 20‰ respectively. Leakage in the partitions permitted some mixing of the waters so that the salinity had to be adjusted at weekly intervals. However, the variation in salinit did not exceed plus or minus 1 1/2‰. The temperature varied between 20° and 22°C. during the experiment. The second, third and fourth tank were fertilized with sodium phosphate and potassium nitrate which stimulated a rich bloom of green flagellates and Chlorella.

Twenty five specimens of each species selected to average 25 mm long were placed in each of the four tanks. The two species of clam were planted in sand in separate wooden buckets, 13 inches in diameter and lowered to the bottoms of the tanks. The mussels were permitted to attach to masonite panels suspended beneath the surface of the water. The oysters and scallops were placed on the bottoms of the tanks. The experiments were run for a period of three months during the summer.

During the first month all specimens, except those of Venus mercenaria, in the second, third and fourth tank which were fertilized with nutrient salts died. All specimens survived in the first tank containing running high salinity water but exhibited no growth. The specimens of Venus showed appreciable growth in the second and third tank but did not grow in the fourth tank where the salinity was low. The salinity in the fourth tank was then raised to 24‰.

The specimens were measured at the termination of the experiment and the following results were obtained.for V.mercenaria:

Salinity	Treatment	Maximal growth mm	Average growth mm	Minimal growth mm	Mortality
31 - 32 ‰	running water	0	0	0	0
31 - 32 ‰	fertilized stagnant water	10.0	5.5	2.4	0
25 - 28 ‰	fertilized stagnant water	14.5	8.6	4.0	1
23 - 25 ‰[+)]	fertilized stagnant water	12.5	6.7	2.4	1
19 - 21 ‰[++)]	fertilized stagnant water	0	0	0	0

[+)] second two months.

[++)] first month.

It is clear from these results that V. mercenaria can survive and grow in tanks of stagnant water containing an abundance of green flagellates and Chlorella within a salinity range of 23 - 32 ‰. Better growth is obtained when the salinity is reduced to 28 ‰ or lower but growth ceases when the salinity falls below 21 ‰. Running sea water to which no phytoplankton is added does not permit growth under conditions of the experiment when supplied at a rate of 2 gallons per minute. The hardiness of V.mercenaria is demonstrated by its ability to withstand an entire month of adverse low salinity and then grow at a normal rate when the salinity is raised.

The author and his associates have determined that V.mercenaria acquires approximately 50% of its annual growth in its natural habitat during the period when the water temperature averages 21° C. There is considerable variation in the rate of growth from one locality to another. The maximal growth obtained in the experiment was comparable with that of the best growing areas at the latitude of Massachusetts and the average growth corresponded closely with that which generally prevails. It is thus apparent that there is a possibility that V. mercenaria can be grown in impounded waters at a rate comparable with that of the normal environment by maintaini the salinity within a range of 23-28 ‰ and by accelerating the production of phytoplankton by fertilization. Experiments are being planned to determine of the producti of phytoplankton can be maintained at a level sufficient to permit growth when the entire bottom is populated with specimens. Plans are also being made to determine methods of supplying calcium which would be required in considerable excess of that which is normally present in sea water by the growth of such populations.
