Charleston

RESULTS OF PRELIMINARY AQUARIUM STUDIES WITH RAZOR CLAMS

Introduction

A lack of knowledge about the early life of the razor clam and the environmental factors which affect them prompted the construction of a small tank to do exploratory work. Artificial spawning, survival of planted clams, tagging, siphon regeneration, and relative plankton density were explored. The tank was set up in the Seaside Aquarium, and the studies were continued from May 29, 1961, to September 11, 1962, at which time proposed expansion of the aquarium necessitated the removal of the tank.

Materials and Methods

The tank used in the experiments had a capacity of 12-cubic feet and was constructed from 3/4-inch marine plywood covered with 2 coats of fiber-glass resin (Figure 1). All joints were sealed with a waterproof caulking compound and nailed.

A back-flushing system to periodically stir the sand was made from 3/4-inch black plastic pipe and placed inside the tank on the bottom. A high pressure hose connected to the system forced water through slits on top of the pipe to provide the back-flushing action. A 2-inch overflow pipe was located near the top of the tank which maintained 6 inches of water over the sand.

The water supply for the tank was through a 3/4-inch black plastic pipe and areator which permitted a flow of 1,050 gallons per 24 hours. The pipe was connected to the aquarium's first settling tank which maintained a head of 5-9 feet. Sea water was pumped from the surf daily into the aquarium which provided a good supply of fresh ocean water for these studies.

Water was circulated through the tank for 2 weeks, then 18 inches of sand were added and allowed to stand 1 week before planting clams.

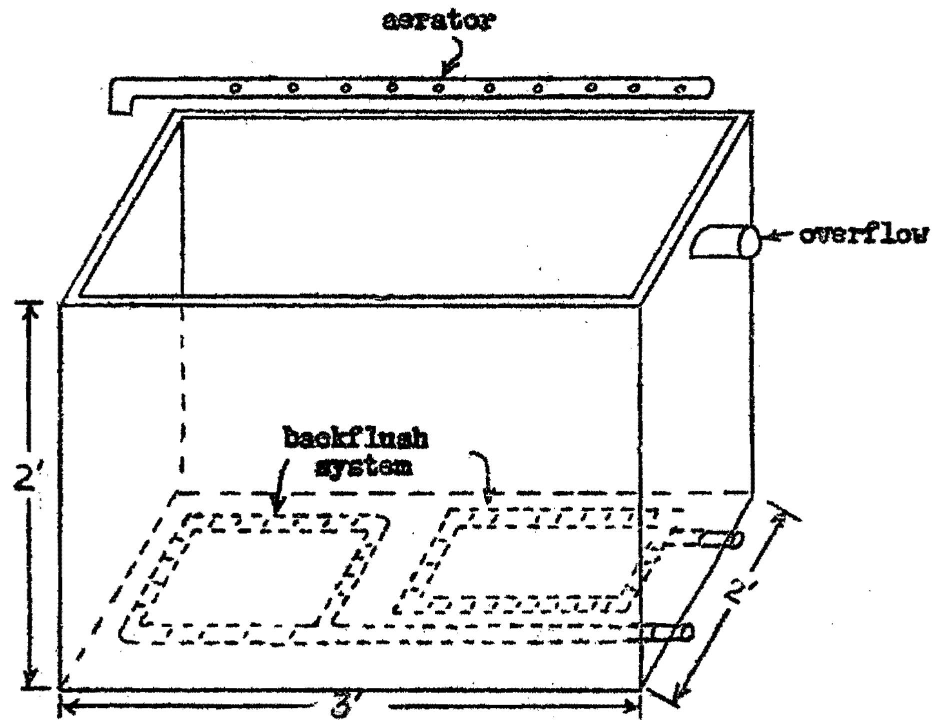

Figure 1. Diagrammatic sketch of the tank used in the studies, showing aerator and back-flush system.

After the tank was in operation the sand was stirred, once each week at first then twice each month. Frequent checks were made for dead clams, pollution, leaks, fouling in the water supply, and any other problems that might arise.

Results of Experiments

Artificial Spawning

The original purpose of the clam tank was to artificially spawn razor clams and record the various stages of development. Carl Sims[1] was conducting the experiment, but was unsuccessful. Because of the inadequacy of the equipment, this phase of the study was discontinued and other studies were initiated.

Tagging

The plant of 24 clams on May 4, 1962 was tagged by attaching a length of monofilament line to the shell and a small cork float on the free end. A small hole was drilled in the shell near the posterior margin, the line run through, and a tiny bead tied to the line. Earlier experiments on the open beach with this method of tagging were successful. Essentially, the tagging allows individual clams to be checked with a minimum of disturbance to the others and was helpful in the following experiment.

Siphon Regeneration

A clam with less than a complete siphon had not been seen by the author on the beach during 2 years of razor clam work. Yet, a number of siphons only are seen in the sport catch. It was reasoned that the damage either caused a mortality or was repaired. To test this hypothesis, about 1/2 inch of the siphon tip of 6 clams was cut off with a rusty knife. Two of the clams

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1/ Former biologist in charge of razor clam investigations.

soon died, but the other 4 regenerated new tips. Unfortunately, photographs of the process were not taken, but sketches were made and are reproduced in Figure 2. The time element is approximate, but by the end of 2 weeks, the first signs of the rosette appeared near the outside edge of the siphon. By 21 days, the rosette was filling out and it appeared normal in 28 days.

Figure 2. Drawing of Siphon Regeneration Process. Approximately X1.

Relative Plankton Density

Since razor clams are indiscriminate plankton feeders, a knowledge of the relative plankton density in sea water could shed some light on the general condition of the clams and possibly show some relationship between amount of food available and growth and survival.

Dry weight of total solids was first used to determine the planktonic density, but sand particles in the water and the amount of time required to filter and dry the samples were undesirable.

A photoelectric colorimeter was then tried and the following method was developed. A stock sample of water was shaken thoroughly and then allowed to stand for 2 minutes. Tests showed that most of the finest sand particles had settled out. Five 30 cc samples were pipeted from the stock sample and put into clean test tubes. The tubes were previously checked in the colorimeter with distilled water and a correction factor was determined for each tube. Each tube was inverted twice before taking the reading to insure thorough mixing. An average of 5 readings was used for the final reading.

This method could not be applied to the growth or survival rates of the clams used in this study because of other factors involved, but, the method could be of practical value in other studies and can be easily adapted to specific planktonic forms.

Miscellaneous Observations

The following are some noteworthy observations made during the study. At each inspection, a light was beamed into the tank without any disturbance to the tank. On some occasions, most of the clams were showing, but on others, there were no shows whatsoever. A clam tended to retract its siphon when the light was trained on it, which suggests that the clam is heat or light sensitive or both.

Another observation was that the shells turn black at the posterior end, similar to a condition that exists on the northern extremity of Clatsop beach and in the Cove at Seaside. The north end of the beach contains much black iron-bearing sand and in the Cove, a black coarse material is mixed in the sand. Both areas are near rocks. It appears that the shell is reacting to something in the sand, but this has not been demonstrated. In ionic form, calcium and various ferric compounds react to form a black precipitate, but shells held in the same solutions gave no reaction.

Clams that died undetected were soon noticed by the foul smell of the water. If left in the tank for a few days, the clams were consumed by a profusion of small marine organisms and the odor soon disappeared.

The clams remaining in the tank were, upon final removal, inspected and cleaned. All the clams exhibited dark reddish-brown gills and all had spent gonads except one which was fully developed. The clams dressed out at 35%, compared to 50% for wild clams, and were in generally poor condition.

The sand from the tank was screened and a set of 19 razor clams, 24 softshell, and 3 littlenecks was found. The razor clam set had either been spawned in the tank or came in with the water supply. The softshell and littleneck set had to enter through the water supply. The nearest softshell bed is in the Neawana River about 1 1/2 miles from the intake. The razor clam set measured 3-23 mm, the softshell 4-24 mm, and the littlenecks 2-11 mm.

The tank was also a home for many other forms, especially barnacles which completely covered the sides of the tank between the water line and the sand within 30 days of its operation.

Discussion and Conclusions

Although this preliminary study was exploratory, some knowledge was gained and several important questions arose. The handling of the clams prior to planting in the tank is obviously important, but in the early operation of the facility, oxygen deprivation may also have been an important factor. Knowing the O_2 requirements of the clam would be of value in defining the seaward extent of the clam beds.

Further work is also needed regarding siphon regeneration. Similar studies in Washington 2/ resulted in total mortality. It would appear that there is a limit to how much of the siphon can be removed and the clam still survive. The practical application here is to the wastage problem which claims some 85 to 400 thousand clams annually.

It is difficult to believe that razor clams are short of food in the natural environment, yet this may be an important factor in growth and survival. A more detailed study on the relative plankton density could be of use in determining relative growth rates and survival.

2/ Personal communcation.

Ultimately, a knowledge of the environmental factors could perhaps lead to artificial production of razor clams. Such ventures on the east coast and in Canada have proved successful with the hardshell clam and may be applicable to razor clams.

Table 1. Survival of Planted Razor Clams.

No. of Days	No. Planted	Mortalities	Remarks
30	33	19	Heavy growth of barnacles.
60	0	2	
90	0	0	
120	8	3	Mortalities from most recent plant.
150	0	0	One 6 mm set found.
180	0	0	Water supply increased from 300 to 1,050 gallons per 24 hours.
210	0	2	
240	0	2	Tank removed for repairs - 3 clams found.
30	24	4	Tank reinstalled.
60	0	0	
90	0	2	Tagged all clams and cut off neck of 6 of which 2 died.
120	0	1	
150	0	0	Tank removed - 17 clams alive.

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