Clam Culture: The Possibilities and the Pitfalls

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Overview

Clam culture in Virginia has recently received a great deal of attention due to the declining production of wild fishery stocks, and to the apparent success of some commercial clam farms. A 1994 survey of Virginia aquaculture by the Virginia Agricultural Statistics Service identified hard clams as the most valuable cultured product in the Commonwealth; production in 1993 exceeded $11 million in gross sales.

Be wary of reports that clam farming is easy and guarantees financial rewards. Farming clams is much more complicated than throwing clams overboard and returning a few years later to harvest them for market. The financial risks associated with aquaculture ventures can be substantial, depending upon your scale of operation and any loan equity you may have committed.

Correctly approached, clam farming can be profitable. It should be treated like any other farming enterprise that may be added to an existing operation to increase diversification, or as a new venture. Capital investment, labor, an acceptable site and some specialized equipment are required and it is not without risks. One of the biggest problems associated with clam culture results from failing to realize that one is dealing with a live animal and that the "crop" requires continual attention just like any other animal husbandry. Failure to realize this could result in total loss or reduction of the crop.

Careful preparation reduces or minimizes the chances of failure. Clam culture can be a disaster due to poor planning or lack of information. Beginners should consider starting on a small scale. Much practical and relatively inexpensive experience can be gained by initially growing a small plot of clams. As experience in production and marketing is gained, you may expand into larger and more complex operations.

The elements necessary for a successful clam culture enterprise can be divided into 4 different categories:

- Suitable site (one which has access to acceptable water).
- Management time and skills (sometimes referred to as moving up the learning curve).
- Money (it takes money to make money).
- Market (you don't make money growing clams; you make money selling clams).

These categories are important to the success of a clam farming operation and should be well understood prior to any culturing attempts.

Stages of Development

Clam culture can be viewed as occurring in three stages:

- Hatchery: Produces small seed grown from eggs through larval stages.
- Nursery: Grows larger seed for field planting.
- Grow-out: Produces marketable size clams from seed.

The hatchery stage, consists of tanks and equipment in an upland facility (including barges, trailers or other "buildings"). The purpose of this stage is

- to condition broodstock into ripeness as required.
- to induce spawning (the release of reproductive gametes).
- for embryogenic (egg hatching) and larval culture.
- for larval metamorphosis (setting).
- to accomplish the above, water modifications such as heating, cooling, filtering and chemical sterilization may be necessary and equipment to carry this out is required.
- and, if extensive water modification is used, unicellular algae culture may be needed, with its equipment requirements.

The hatchery stage techniques are standard for all areas, but are fairly complex and expensive. Standard methodology for larval cultivation has been developed and basic methods have been described. The section labelled "Sources of Information on Clam Culture" lists publications where additional information on methodology may be found.

The nursery stage takes the young clams or "set" and protects, feeds and grows them until they are large enough to plant in final growout conditions on natural bottom. This can be done by using a land-based, field-based or combination system. The land-based system holds clams in tanks or containers and

provides food by pumping natural waters or cultured algae. Many times you will hear the terms "upweller" (water flows from bottom to top within a cylinder holding small clams) or "downweller" (water flows from top to bottom) associated with these types of systems. Another land-based nursery uses long shallow tanks or troughs (raceways). Raw seawater is pumped from an adjacent source and either delivered to one end of the raceway creating a horizontal flow or sprayed over the water surface to promote good water mixing. The field-based nursery places juveniles in protected containers planted within the natural environment. Field-based nursery systems eliminate the need for pumping, but labor and equipment costs will be different from land-based systems. Nursery system design will vary in response to technical capability, equipment availability, predator abundance, cost considerations, land availability, permitting and labor limitations. Each of these must be considered for each locality when evaluating site requirements and available resources.

The grow-out stage uses larger seed clams which are planted in field conditions using natural food (phytoplankton) until harvest. Clams can be grown in trays, bags, under nets or cages designed to protect the seed from predators and to allow substantial water flow to provide food. Variables for grow-out to harvest are site specific and affected by predators, fouling, food availability, temperature and dissolved oxygen. Harvesting is often locally regulated.

Hatchery, nursery and grow-out systems may not all be needed to develop a profitable business. One or two of these may be the best initial strategy for your business plan with additions or full integration possible later. **In general, most culturing can become successful through a grow-out operation begun by purchasing large-size seed and growing them out.** Later one can add a nursery after becoming proficient at seed handling, or if availability of seed or its cost becomes a limiting factor, establishing a hatchery could be a viable consideration. Another option to be considered is entering into a "cooperative" growing agreement with an established clam grower or hatchery which will provide seed in return for the opportunity to market the final product. These types of arrangements can be beneficial to both entry-level producers and the established grower.

Production "Guidelines" And Considerations

Site selection is the most important step in establishing a clam farm. Choosing a site for bivalve culture is the first and most important step. Trial plots and experiments with equipment are recommended before a large-scale operation is established. A minimum of one year is recommended to assess the seasonal variation.

Be thorough in your examination of a site and remember that biological, environmental, sociological (primarily public perception), and operational factors all interact. These range from the effect of physical parameters to political forces. Topics to consider include water depth; bottom characteristics; protection from wave action; water quality; tidal flow and height; turbidity; predation; fouling; pollution; navigable waters; access; conflict of use; and permits.

The importance of careful site selection cannot be overemphasized. It will probably be impossible to find and gain access to a site that will be perfect in every way. Thus, your selection of a site will involve a series of trade-offs and compromises. You may find, for example, that conveniently located sites which yield excellent growth also have an overabundance of predators or tend to get buried in sand and require more net tending. Exceptional growth rates may have to be sacrificed in order to get good survival, or vice versa.

The criteria for evaluating an appropriate growout site include ecological, competing resource uses and operational factors plus the interaction of these variables. These considerations will influence clam growth and survival as well as equipment and methods.

Ecology of the site greatly affects clam growth and survival. Important factors include the living organisms that contribute to the food, fouling, predation, and disease, as well as the water characteristics of the site.

Food (algae or phytoplankton) is a major factor contributing to clam growth. This is controlled by both the quantity (density) of food as well as the quality (diversity) of food available. An easy way to evaluate the food potential of an area is to look for the presence of naturally occurring clams.

Fouling organisms can affect water and food flow through protective equipment and can inhibit growth and lower product value. Fouling can vary seasonally and greatly affect equipment and labor costs. Fouling organisms may compete for the same food organisms as the clams, thus greatly affecting clam growth rates.

Clam predators are one of the most important aspects to consider in site selection. Their type and abundance need to be assessed in deciding what equipment and methods are used for protection.

Other environmental factors include weather, wave and bottom conditions, clam survival, equipment needs, and operational constraints. These conditions include geographic and seasonal variation in salinity, temperature, water quality and flow; bottom sediment characteristics; and wind, wave and tidal action.

The optimal salinity range is between 25 and 35 parts per thousand. Salinities much above or below this range for more than short periods may result in slow growth or even death. Optimal temperature range is between 20-28°C (68-82°F). Clams can survive in higher and lower temperatures but growth rates are affected. Dissolved oxygen levels should be above 3.64 ml/l (parts per million) during most of the diurnal cycle.

Protection from wind and wave action must be considered in site selection. Areas exposed to prevailing winds can cause sediment movement and working-condition problems. Although clams can grow in most sediment types and at most depths, the latter two will affect the equipment, methods and working conditions.

Adjacent landowners and public opinion can greatly affect obtaining a lease or expanding an operation. Alternate uses by fishermen and boaters as well as residential aesthetics (sometimes referred to as scenic vista), potential sources of pollution, conflicts with other users and future development need to be considered.

Upland access and its contribution to field operations, boat launching, equipment storage, harvesting and security will affect how well a clam farm operates. Site construction constraints, abilities to expand, permitting and availability of utilities need to be evaluated for all upland facilities and their costs included in all business plans. Plans for handling security should also include upland and field sites, as well as access between them.

Economic considerations include a range of operational variables affected by environmental and biological conditions. Culture methods, equipment, labor and financial assessments may vary because of site specificity. *Adequate initial investment capital is needed to offset negative annual profits which may occur during the first four to five years of operation.* Year-to- year cash needs will be an additional financial burden during the start-up years and **you must clearly understand the timing and magnitude of all costs and earnings.**

Leasing, permitting and regulation requirements should be researched and all permits, licenses and notifications be made to proper authorities before starting your operation. Remember that water classifications, leasing and harvesting regulations may change. In Virginia, your first stop will be with the Virginia Marine Resources Commission (VMRC). VMRC is responsible for managing the leasing of state-owned bottoms. They maintain maps and charts showing areas available for leasing. This figures prominently in your site selection process. At the same time, you can inquire as to the current water classification. Based upon established bacteriological standards, waters are classified as to whether or not shellfish may be harvested for direct consumption. Those waters from which shellfish may be harvested for direct consumption are known as "approved." Other water classifications may allow for seasonal harvesting, harvest for relaying (a form of self-purification), or may prohibit shellfish harvesting at all times. While VMRC will probably be able to tell you what the classification is, it is the Division of Shellfish Sanitation (DSS), Virginia Department of Health, that actually does the classification. Once a site is chosen, it would be advisable to contact the DSS to investigate any past harvesting closures in the area or if the area is subject to seasonal restrictions. Depending upon the scale of your operation, you may also be required to obtain a permit from the Virginia Department of Environmental Quality (DEQ) for water withdrawals or discharges. All local building and business ordinances must also be satisfied prior to operation.

Market considerations should include local and national demand, seasonality and consistency of supply. It is also the time to make decisions as to how you intend to sell your product. Will you consign product to a wholesaler or direct sell? This should be an integral part of your business plan. Remember, you don't make money growing clams; you make money selling clams (if you sell them for a high enough price).

Biological background (note that it is placed 5th in order of importance) of the clam should be understood when evaluating techniques, seed sources, growth problems and conditions for enhancing growth. There is a great deal of written material available on clam biology.

Predation is a major cause of mortality in a clam operation. Sufficient exclusion techniques or planting strategies (for instance, larger sized seed) must be incorporated into farming methods to ensure profitable survival rates. For instance, in Virginia the blue crab and mud crabs are major clam predators. Most people would immediately think it is the biggest crabs that can cause the most damage. This is not necessarily true. Small crabs, just metamorphosing from megalops to first crab stage can actually settle through the mesh of protective devices and cause extensive damage as they grow and consume clam seed.

It is also important to understand what your predators will be and where or when they could impact upon your clams.

Harvesting regulations of permitted equipment or techniques, as well as shellfish sanitation surveys of harvestable waters should be researched for present and future status for your area. This aspect of clam farming will affect labor requirements for your operation.

Nursery and grow-out techniques vary in design and efficiency at each site. Experiment modifying various methods and procedures to best suit your location. What works best for your neighbor may not be your best option.

Record keeping is an important factor in effective evaluation and organization of any farm operation. Maintain accurate records to establish patterns and trends that can help you modify and improve in delinquent areas.

Security is a vital component of any clam farm venture. Be sure that you have effective methods to protect your crop from theft. While poaching and vandalism have not been serious problems in Virginia, the expansion of "opportunities" by an increase in culture activities creates the potential for problems.

Labor and Time Requirements

It cannot be stated enough, that clam culture is not just throwing small clam seed on the bottom and coming back a couple years later to reap a bountiful harvest. A great deal of hard work is involved. Besides allocating your resources (money), you need to understand the time requirements for different aspects of clam culture.

A hatchery is very technical and time consuming. Not only are you taking care of your broodstock, but you are also growing food (algae) to feed them. A lot of "busy" work is involved, but it is not mindless work. Each task must be performed at the appropriate time and in accordance with a preset schedule. Attention must be paid to the details and sanitation. You are also spawning animals and growing planktonic larvae to the setting stage, as well as culturing algae.

During the nursery phase you will be routinely cleaning and grading your small seed. Depending upon the size of your facility this could occupy a great deal of time.

Field planting begins before you actual put seed clams on your beds. You must make sure your grounds are prepared prior to going out with seed to plant. Are obstructions removed? Have you staked out your planting area? Have you decided which grounds are to be planted, and what order? Is all your equipment ready? The actual planting is straight forward and not too difficult.

Once you have planted your seed and predator protection is in place, it is not time to sit back and wait for the dollars to come rolling in. Field maintenance is a never ending task. You must continually maintain your plots. This means regularly inspecting the predator protection, removing predators from under nets, lifting the nets if they are silting (especially after wind or storm surges), cleaning or replacing nets that become fouled or torn. You may need to cull or grade your beds, depending on how you planted. In the event of unusual weather events (storms), you need to be prepared to do extensive net replacement or repairs in a short period of time. Essentially you are on call 365 days a year, to protect the well being of your investment.

If you have ever dug clams, then you know how strenuous harvesting can be. Multiple that experience by thousands of clams. If you are to be a year-round supplier, then your work schedule must include harvesting and grading or packaging time on a weekly basis. This means keeping track of tides for the most favorable time to harvest and scheduling necessary field activities in order of priorities.

Marketing may or may not be a labor problem, depending upon your initial decisions. However, do not overlook the time constraints in selling your clams. The world will not beat a path to your door to buy your clams unless you have done your marketing work in advance.

Conclusion

Clam culture is an expanding business in coastal Virginia. Approached in a logical, well-informed manner, it has the potential for returning a profit on your efforts. Likewise, done without adequate planning it is guaranteed to lose you money!

Assistance in clam culture can be obtained from the Marine Advisory Program, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA 23062.

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