

WAMPANOAG AQUINNAH SHELLFISH HATCHERY

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1. Project Name

Bay Scallop Aquaculture and Market Development

FNE03-463

FINAL REPORT

2. Goals

- 1) Investigate innovative bay scallop culture technologies to reduce production costs
- 2) Compare two live bay scallop packing/shipping systems to extend shelf life
- 3) Develop marketing/educational materials to educate the restaurants and customers about bay scallop aquaculture and shellfish aquaculture
- 4) Market live bay scallop product to restaurants
- 5) Provide storage and handling training to restaurant personnel to ensure maximum shelf life and quality of the product

3. Farm Profile

The Wampanoag Tribe of Gay Head Aquinnah operates the Wampanoag Aquinnah Shellfish Hatchery (WASH) and a commercial oyster aquaculture enterprise. The Hatchery is located on Menemsha Pond in Martha's Vineyard and is designed to produce oysters, clams and scallops for commercial, research, and enhancement activities. It is comprised of phytoplankton culture, larval culture, setting, and flow-through nursery culture systems with water supplied from Menemsha Pond. WASH holds license to two shellfish growing sites in Menemsha Pond totaling six+ acres. These sites are set up with permanent mooring chain systems to provide for a variety of culture techniques. This year WASH expanded its growing acreage by three acres through a cooperative arrangement with two local aquaculturists. This additional 3 acres is used for oyster culture and we presently have approximately 2.5 million oysters under production on five acres in an innovative floating bag system. (See Photo 1 showing floating (using "noodles") plastic mesh oyster bags clipped to longlines).

Commercial oyster aquaculture is the first priority of WASH. The development of culture systems and commercial sale of live bay scallops was the second priority for this past year and took place on our four acre deep water site. Both oysters and bay scallops were produced at our hatchery for the growout operations. Several bay scallop culture systems were investigated this year as detailed below.

WASH recently secured a shellfish packing/shipping facility and obtained all necessary permits to pack, ship and sell shellfish from this facility. (See Photo 2 of our packing facility) As of this writing our first sales of oysters are taking place. Once

commercial ventures are established, WASH plans to develop a bay scallop population enhancement program.

4. Participants

Dale Leavitt, Technical Advisor – Dale was extremely helpful during the formulation and proposal stage of the project. His years of experience and shellfish aquaculture knowledge helped us secure the necessary resources to undertake this project and assisted in the technical aspects of the project.

Rick Karney, Director of Martha's Vineyard Shellfish Group – Rick provided invaluable assistance during the hatchery and nursery phase of bay scallop production. Rick has been operating a shellfish hatchery on Martha's Vineyard for 25 years with a primary focus on bay scallop enhancement. As this was WASH's first year of operating its hatchery, Rick helped work out start-up issues and collaborated in broodstock spawning, larval rearing and nursery activities.

Brian Vanderhoop, Shellfish Constable Town of Aquinnah – Brian has a wealth of local knowledge about the waters and ecosystem of Menemsha Pond where we operate. During the project he helped out with general tasks and provided excellent ideas regarding culture methods for bay scallops. Most importantly, Brian offered support during conversations and meetings with community residents and government regarding the entire aquaculture operation, which is a new activity on the Pond.

Stanley Larsen, Shellfish Constable Town of Chilmark – The two towns of Aquinnah and Chilmark manage Menemsha Pond. Like Brian, Stanley has a wealth of local knowledge and contributed to community relations and the introduction of aquaculture to the Pond. As someone out on the water daily, Stanley also kept a watch on our project and informed us when there were any problems, such as gear getting blown lose after a storm.

5. Project Activities

Hatchery operations began in late April immediately after the pumps were turned on for the first time at the Hatchery. Initial activities included testing of and modifications to plumbing, heating, pumping, aeration and all other hatchery systems. Once the physical systems were operating correctly, we began hatchery culture. Rick Karney was kind enough to provide us with fertilized eggs to assist in our effort to get the project underway as soon as possible. Otherwise we may have had to condition broodstock scallops for 30 days before we could spawn and obtain the fertilized eggs. During start up of a hatchery, initial problems are common, and several attempts are usually necessary before the process of taking a fertilized egg through larval stage and to the juvenile scallop stage is successful. We experienced normal start up problems, but were able to produce 30,000 2mm juvenile scallops on our first attempt. These babies were the pride of the staff and were carefully nurtured into the raceway nursery system until they were large enough to be placed into pearl nets out on our deepwater site. As we required more scallops for the project we continued efforts to produce scallops as allowed considering

our primary focus on oyster production. By July we produced another batch of juvenile scallops that provided enough post set scallops to undertake the project.

Bay Scallop Culture System Development began in mid July. On July 10 20,000 early post set scallops (~1mm) were placed into a downwelling setting bin that had one inch wide 2mm mesh Vexar strips covering the bottom of the bin. (See Photo 3) The buoyant Vexar strips were held on the bottom using pieces of heavy aluminum wire. Another bin held 20,000 scallops using Ace 2mm nylon netting as a substrate. (See Photo 4) The scallops were allowed to attach to the substrates overnight. On July 11 the strips were sampled under a dissecting microscope to determine the number of scallops that had attached their byssal thread to the material. Each Vexar strip had approximately 100 scallops, while the Ace nylon strips held only 50 scallops per strip. We decided to begin the experiment using the Vexar as the Ace netting did not hold many scallops. The Vexar strips were stocked into Cage 1, Line 1 at a density of 100 scallops per 9mm mesh bag with the cage holding 10 bags. (See Photo 5 of a scallop culture cage) This stocking density represents final growout stocking density which is expected to yield 100 scallops at the final growout size of 50-70mm. The Vexar strips were transferred to the boat and out to the growout site in the setting bin which was in a larger container that held enough seawater to keep the scallops submerged. During the transport and stocking activity it was noticed that many of the scallops became unattached from the Vexar strips. It was decided not to stock any more cages using the Vexar.

On July 14 and 15 the original 30,000 scallops were stocked into 2mm pearl nets at a size of 3-4mm. This procedure is the normal system of scallop culture and served as a control to all the other culture systems we investigated.

On July 28 we repeated the setting bin procedure using different materials. We used pieces of Handiwipes for the smaller scallops (~1mm) and pieces of burlap for larger scallops. (See Photo 6) They were transported in the same manner and we observed that most of the scallops stayed attached to the substrate materials. (See Photo 7 Scallop seed attached to Handiwipe) On July 29 we put out 9 cages on Line 2 as follows:

- #1 100/bag Handiwipes @100/in2
- #2 300/bag Handiwipes @100/in2
- #3 500/bag Handiwipes @100/in2
- # 4 300/bag Handiwipes @100/in2
- #5 100/bag Handiwipes @100/in2
- #6 500/bag Handiwipes @100/in2
- #7 100/bag Burlap @50/in2
- #8 300/bag Burlap @50/in2
- #9 500/bag Burlap @50/in2

Each cage holds ten bags so the total number of scallops stocked on July 29 was 27,000. Different stocking densities of 100, 300 and 500 scallops per bag were used so that we could assess how many scallops remained in the bag at the end of the experiment. At the time of stocking all scallops were considerably less than 9m in size (the mesh size of the bag) and if they came unattached from the substrate before they reached 10mm in size would easily escape through the 9mm mesh.

Also on July 29 we monitored the scallops that had been stocked in pearl nets and found them clean and growing well with an average size of 10mm.

The final stocking event took place on August 11 when we put out 12 cages on Line 2 with 100 scallops per 9mm bag on burlap for a total of 12,000 scallops stocked that day. We staggered the stocking dates to determine differences in growth rate, survival, or fouling at different stocking dates.

On August 27 we monitored the pearl nets and found the scallops clean and growing well with an average size of 18mm. However, the outsides of the pearl nets were fouled with “sea grapes”, a tunicate called *Mogula manhattantensis*. (See Photo 8)

During September 15-17, two months after stocking the scallops into pearl nets, the scallops were clean and had reached the desired size of 25mm. (See Photo9) The pearl nets were heavily fouled with *Mogula*. We removed the scallops from the pearl nets and stocked them into 9mm bags in cages at the final stocking density of 100 scallops per bag. Due to the heavy fouling we observed, we also stocked approximately 2000 of these 25mm scallops into 9mm floating bags that we use for our oyster culture. (See Photo 10 Close up of floating oyster bag) This floating system is designed so that periodic flipping of the bag on the surface prevents any fouling from occurring as one side of the bag is exposed to the air every two weeks, preventing any organisms from becoming established on the bag.

During October the cages were monitored. We waited two months before disturbing the cages to allow the scallops to grow large enough so that, even when disturbed, they would not escape through the 9mm mesh of the bags. All cages were heavily fouled with *Mogula*, so much so that the scallops were completely encased in fouling and it was impossible to determine survival, growth rate or the number of scallops that had been retained in the bags. (See Photo 11 Cage fouled with *Mogula*)

The final growout activity took place during the first week of December. We had hoped that by stocking the clean scallops from the pearl nets into clean cages in mid September we could avoid any fouling by *Mogula*. This was based on an assumption that by mid September *Mogula* were finished spawning for the season. Unfortunately, heavy fouling by *Mogula* occurred after mid September and prevented the scallops from growing as well as making it impossible to determine survival rates. The scallops that were stocked in our floating bag system were also checked. They exhibited over 95% survival, but had grown only a few millimeters in two months.

Marketing/Educational Materials Development involved the design and printing of “doggie bags” with information about our scallop aquaculture, the environmental benefits of shellfish aquaculture, things to do with scallop shells, contact information, and acknowledgements of funding agencies for the project. (See Photo 12 Doggie bag)

Packaging System Development involved locating suitable materials for the two systems. The bucket system was easily procured as the author had utilized this system in previous work. With the help of the Massachusetts Department of Agriculture, a fruit packaging supplier was located that provided the critical packaging component for the box system. This was a cardboard sheet called a SpringCushion Apple Tray with depressions formed in the sheet normally used for packing fruit. An insulated Styrofoam box was located from a seafood packaging supplier that was the appropriate size for six layers of the trays. The seafood supplier also provided the Drylok pads used between the trays to keep the scallops moist.

Packaging System Comparison was undertaken with the surviving clean scallops that had been grown in the floating bag system. The two systems were compared for

maintaining the quality of the scallop (shelf life) by placing two packages of each system with scallops under refrigeration. After discussion, project participants modified the proposed comparison procedure to better reflect actual conditions at a restaurant. Once a day, in the afternoon (when restaurants would be preparing for dinner), one layer of scallops were removed from each package, photographed and observed for freshness and quality. After each removal event, the remaining scallops were recovered by the moist layering material Drylok and returned to the refrigerator.

Marketing Live Bay Scallops to restaurants did not take place due to the heavy fouling by *Mogula* that rendered all scallops too small and too fouled to market.

Training Restaurant Personnel to handle the live bay scallops did not take place due to lack of product to sell.

6. Results

The culture technology portion of this project will be evaluated for success through data comparison of the two culture strategies. Scallop retention, growth rate, survival, and labor hours will be compared to determine best method.

Adequate quantities of bay scallops were successfully produced by the hatchery to undertake the project. The traditional system of first stocking the scallops into pearl nets with a second stocking into cages was successfully accomplished to serve as a control to the new technologies being tested.

The first stage of the new technology involved testing different materials to serve as substrate for the early post set scallops to attach to before stocking into cages. Four different materials were used: Ace 2mm nylon netting, 2mm Vexar mesh, Handiwipes and burlap. Results showed that the Ace netting had the least number of scallops (50) attached to it after the overnight period for byssal attachment. Vexar had 100 scallops attached, but during transfer and stocking, many scallops detached from the Vexar and were thus able to escape through the 9m mesh of the bags. At this point participants decided to investigate two other materials as substrate to try and improve attachment performance. Burlap and Handiwipes performed markedly better during the attachment trials, transport and stocking. Either material can be used successfully to attach, transport and stock early post set scallops. The Handiwipes are appropriate for smaller scallops, while the burlap works better for scallops 1.5mm or greater in size.

The second stage of this task required monitoring of the scallops after a period of time that allowed them to grow larger than the 9mm mesh of the bags. Scallops were stocked at different seasonal intervals to investigate any difference in growth, survival or fouling. Unfortunately, *Mogula* fouling heavily impacted all scallops stocked in cages. Participants hoped that the colder water from mid-September on would prevent *Mogula* from spawning and fouling the clean oysters that were stocked into cages at that time. However, at this culture site, *Mogula* apparently spawns throughout September. This unexpected event prevented participants from completing the monitoring portion of this activity.

Certainly, labor costs will be less if scallops are immediately stocked into cages at their final growout density using Handiwipes or Burlap. However, this project was unable to determine the growth, survival or retention of the scallops using that system.

Packaging systems will also be evaluated by data comparison of cost and shelf life with each system. Packaging systems comparison tests will determine best

system by cost and performance criteria. Expected outcome is a packaging system that can maintain live scallops for a minimum of four days after airfreight shipment to Nantucket or other East Coast markets. The four-day time period assures product quality during the twice-weekly product delivery schedule. Success will be measured by the ability to accomplish the minimum goal.

Results of the packaging tests clearly showed that the bucket system was superior for maintaining shelf life of the live bay scallop product. Although the box system was far more convenient and offered better presentation to the customer, the cardboard SpringCushion Apple Trays absorbed all of the moisture inside the box, including the moisture from the saturated Drylok absorbent pads. This left the scallops dry and defeated the purpose of the packaging. To avoid the absorbance problem participants attempted to saturate the SpringCushion Apple Trays with water to avoid the absorbance problem. However, the trays were extremely heavy and tended to disintegrate. We concluded that the bucket was superior in this comparison test. Photos of the comparison test are attached. The photos show many of the scallops from the box packaging open due to the drier condition. (See Packaging Comparison Photos)

Marketing success will be evaluated directly by restaurant acceptance of the live bay scallop product, i.e. sales. If the majority of white tablecloth restaurants on Martha's Vineyard and Nantucket purchase live bay scallops the overall marketing goal of introducing this product will be accomplished. Sales figures and comments will be included in project reports. This data will show the frequency and numbers of scallops ordered by each restaurant and include comments from restaurant chefs and personnel on product quality and acceptance.

This activity did not take place due to the heavy fouling by *Mogula* that rendered all scallops too small and too fouled to market.

Training of restaurant personnel effectiveness will be measured by the restaurants' comments on product shelf life. If we have determined that the packaging system maintains product freshness for a minimum of four days, poor handling most likely causes problems with shelf life. Project personnel during delivery events will visually inspect remaining scallops, if any, from the previous delivery for freshness. Training of new personnel or retraining of existing personnel will be carried out as needed. Expected outcome is a packaging system that maintains good product quality throughout the duration of restaurants' possession.

This activity did not take place due to lack of product to sell. However, an associated activity funded through other sources did allow participants to design and print custom "doggie" bags for customer education. These materials are available and may be used by any culturists that wish to pursue live bay scallop marketing.

Project execution will be measured against a timeline, with specific activities scheduled to take place during certain periods.

Project execution was somewhat behind schedule due to normal startup problems associated with any hatchery that is first coming on line. However, participants were pleased with the success of producing scallops on the first ever attempt to produce any shellfish in the hatchery. Likewise, even though stocking activity took place behind schedule, there was adequate time to produce and market a product. Unfortunately, the heavy *Mogula* fouling completely prevented marketing any product.

7. Conditions

Clearly, the *Mogula* fouling experienced at our growout site prevents bay scallop culture for the live bay scallop market. This author's experience growing live bay scallops suggests that this is a site specific condition. Previous success growing and marketing live bay scallops on a small-scale experimental basis using the standard pearl net to cage method at another site was not impacted by fouling of *Mogula* or other fouling organisms. Although *Mogula* fouling had been experienced at this site in earlier experiments conducted by the Tribe during previous summers, it was especially surprising to see the evidence of *Mogula* spawning and subsequent quantity of fouling in late September.

The other site specific condition that impacted this project was the fact that this was the first year of operation for the hatchery and typical start up problems slightly delayed the project.

8. Economics

The inability to market any product negatively impacted income to the farm.

9. Assessment

Projects results infer that stocking early post-set scallops using substrate attachment with Handiwipes or Burlap is a viable system. . Using the early stocking system will reduce labor associated with nursery culture in raceways or other systems that require daily maintenance. It is likely that any system at our site will experience a degree of fouling during the 4 to 5 months necessary to culture a market size live bay scallop that would preclude selling the live bay scallop due to the fact that the desirability of the live bay scallop is directly related to its attractive clean shell. However, participants believe that early stocking with substrate is a viable system that can reduce labor regardless of the planned end use for the cultured scallop.

The fact that the scallops grew well and remained clean in pearl nets, even though the pearl nets were heavily fouled, indicates that small mesh prevents fouling organisms from fouling the scallops inside the mesh. Perhaps using a small mesh for the second stage of growout would produce clean, market size scallops at our site.

Regarding packaging, all participants agreed that an effort should be made to locate a plastic tray with depressions to avoid the problem of the cardboard tray as the presentation of the product using the trays and box is far superior to the bucket packaging system.

10. Adoption

WASH plans to adopt the early stocking with Handiwipes as a substrate to stock ~1mm scallops directly into 2mm mesh pearl nets for bay scallops to be raised to 25-30mm. These 25-30mm scallops will be sold to Towns or other culturists for enhancement or growout. WASH also plans to grow these large seed scallops for its own planned scallop enhancement program. Again, using the early stocking system will reduce labor associated with nursery culture in raceways or other systems that require daily maintenance.

Next year we may investigate the viability of stocking 25-30mm scallops into cages using 2mm mesh bags instead of the 9mm bags. This will test the theory that small mesh

(like the 2mm mesh of pearl nets) prevents the scallop shells from becoming fouled. This system may allow WASH to grow scallops to the market size desired for sale of large scallops to restaurants. WASH will not attempt to grow bay scallops beyond

WASH will attempt to locate plastic trays with depressions for packaging scallops.

11. Outreach

The educational materials produced as part of this project were exhibited at a joint Southeastern Massachusetts Aquaculture Center (SEMAC) and Massachusetts Aquaculture Association (MAA) meeting. Results from this project have been submitted in abstract form to the World Aquaculture Society 2004 meeting and may be presented at other meetings.

The November-December issue of Aquaculture Magazine (attached) has a general article on WASH and the national Chef's Collaborative plans to produce an article on WASH early in 2004.

Signed:


Robert D. Garrison

Date: 1-14-02