Technical Manual for Farming the Southern Quahog, *Mercenaria campechiensis*, in estuaries characteristic of coastal Georgia and the South Atlantic Bight

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Introduction

Currently, the northern quahog, *Mercenaria mercenaria*, stands alone as the single most economically valuable commercially farmed bivalve species in Georgia. Research evaluating hard clam mariculture began in the early 1980's, (Walker and Tenore, 1984) resulting in diversification of the clam industry from wild harvest into small and medium -scale farms in the early to mid-1990's. Since Georgia's transition from wild harvest to a mariculture-based industry, clam landings have increased in both total pounds landed and dollar value. In 1992, 4,815 pounds of hard clams were harvested in Georgia at a dock value of $25,995 compared to 2018 landings reports of 337,612 pounds harvested at a value of $2,246,769 (NMFS, 2020). State landing statistics ranked Georgia's clam industry as both the 3rd greatest in pounds harvested and value during 2018. Over the past decade clams rank as the 4th largest fishery by value and 3rd by landings in Georgia (GA DNR CRD, 2020). Significant economic benefits could be achieved with minimal change to farming practices, gear requirements, and techniques by evaluating other clam species. The southern quahog, *Mercenaria campechiensis*, is an ideal candidate for diversifying clam farming operations in Georgia, and with some modification, can be cultured using industry methods and practices that are successful on a large scale.

M. campechiensis is distributed from the Chesapeake Bay to Florida (both coasts) and west to the Yucatán Peninsula (Abbot, 1974) and co-occurs with the northern quahog throughout the southern range of *M. mercenaria* (Harte, 2001) where hybridization between both species occurs (Arnold et al., 2009; Hargrove et al. 2015). There is commercial interest in culture of southern quahogs within Georgia to reduce the timeframe between planting and marketing of clams versus what is observed with northern quahog culture. It has been speculated that southern quahogs would have higher growth and survival rates than northern quahogs at warmer water temperatures (Haven and Andrews, 1957; Saloman and Taylor, 1969; Jones et al. 1990; Walker and Heffernan, 1990; Broderick, 2012; Sturmer et al., 2012) which could be advantageous for clam production.

Shelf-life concerns have been raised regarding the tendency of *M. campechiensis* to gape under cold storage (Sturmer, 2012) but may be less of a concern if the endpoint product is individual quick freeze (IQF). Market benefits associated with farming southern quahogs is that it looks and tastes similar to its congener and may grow faster. Faster growth, smaller harvest size, and IQF technology are advantages that potentially provide economic opportunities for businesses to diversify into southern quahog production.

The purpose of this publication is to provide technical guidance regarding how southern quahogs were farmed under NOAA Saltonstall-Kennedy (SK) grant award #NA21NMF4270355. The research associated with this SK award was focused on performance outcomes between both southern and northern quahogs based on farming methodology and strategies currently employed by Sapelo Sea Farms L.L.C. (SSF), the largest and oldest clam farms in Georgia. This manual will include necessary aspects of structuring an intertidal clam farm in regions similar to the South Atlantic Bight, particularly coastal Georgia, and will cover equipment, stocking density of nursery and grow-out clams, siting and deployment of clams, and clam harvest.

Physiological and Habitat Requirements for Hard Clam for Farming

Southern quahogs (and northern quahogs) are distributed intertidally and subtidally throughout their native range and can thrive in multiple sediment types including soft mud, sand, shell, and gravel (Abbot, 1974; Harte, 2001; Kraeuter and Castagna, 2001). The broad geographical and tidal distribution range associated with both northern and southern hard clam species is indicative of their adaptability to a broad range of environments with respect to temperature, salinity, sediment type and air exposure regime. Tides in Georgia are semidiurnal (two low tides and two high tides over approximately a 24-hour period) with a 3-meter range resulting in clam grow-out locations that are predominantly intertidal. Although, some clam farm leases do have substantial portions of water bottom that extend into the lower intertidal range, where air exposure is minimal and only occurs during low spring tides. Therefore, the amount of air exposure that clams experience within any farm site in coastal Georgia must be considered due to seasonal temperature extremes associated with the local subtropical climate. Since temperature, salinity regime, and sediment characteristics are similar between commercial shellfish leases in coastal Georgia, availability of intertidal mud flat at or below the mean low water (MLW) mark is important to consider when acquiring a lease site.

Hard clams grow at temperatures ranging from 8–31°C with optimal growth occurring between 16–27°C (Kraeuter and Castagna, 2001; Weber et al., 2010). Above and below this range hard clams exhibit signs of physiological stress including reduced pumping and growth. Thus, prolonged exposure to extreme low (below freezing) or high temperatures that are outside of the physiological tolerance range can result in increased mortality rates. Therefore, site selection that reduces temperature extremes associated with low tide air exposure is critical (Weber et al., 2010). Summertime seawater temperatures in coastal Georgia commonly exceed 32°C (~90°F) for several days with intertidal exposure placing additional stress on farmed clams since sediment surface temperatures can exceed 40°C (~104°F) during low tide (figures 1, 2, and 3). Additionally, wintertime low tide exposure temperatures periodically dip below freezing for several hours as was observed at all three field sites associated with this project during December 2022 (-3°C/27°F) (figures

1, 2, and 3). Average seasonal exposure and water temperatures combined at all three field sites were observed to vary minimally between sites and ranged from approximately 17°C to 30°C (figure 4) which is typical for coastal Georgia. Thus, to reduce heat stress on intertidally farmed clams it is important to maximize clam submergence time by exploiting available water bottom at or below the MLW mark.

Salinity is also an essential component of site selection for farming hard clams. The optimal salinity range for hard clams is 20–30 ppt where pumping, feeding, and growth are at their maximum (Kraeuter and Castagna, 2001; Baker et al., 2010). Though hard clams are able to osmoconform (maintain an internal ionic environment that is isotonic to the external conditions) (Baker et al., 2010), prolonged exposure to salinities outside the optimal range will result in signs of gross stress such as gaping, retracted mantle, protruding mantle, failure to bury, and mortality. Salinity stress is exacerbated with extreme temperature, for instance, prolonged high temperature (above 30°C) and low salinity (below 15 ppt) can result in high clam mortality rates (Baker et al., 2010). Average salinity at each of the three sites associated with this project fell within the optimal range (24–30 ppt) or above optimal (34 ppt) (figure 5). Daily salinity periodically trended substantially higher (~36 ppt) during events of onshore water piling (December 2022) associated with seasonal weather patterns (figures 1, 2, and 3). Though salinities exceeded the upper end of the optimal salinity range during this project, mean salinity remained within the physiological tolerance range for hard clams (Kraeuter and Castagna, 2001) indicating salinity stress was not a concern regarding clam survival. Approved commercial shellfish leases located in Georgia typically trend towards the upper end of the optimal salinity range for hard clams and generally provide ideal conditions for clam farming with respect to salinity.

Ecologically, hard clams are classified as benthic infauna and sediment is an important habitat requirement (Kraeuter and Castagna, 2001). Assessing sediment composition for a prospective clam farming site is important because it will affect clam burial efficiency, survival, and grow-out performance. Sites operated by SSF, were sandy loam sediments, which is ideal for farming hard clams (Castagna and Kraeuter, 1981), and characteristic of intertidal shellfish leases in Georgia. Areas to avoid are portions of the estuary characterized by high organic sediment content, “pluff mud” (soft sediments that tend to have anoxic characteristics), and shifting sands that are typically associated with greater wave activity.

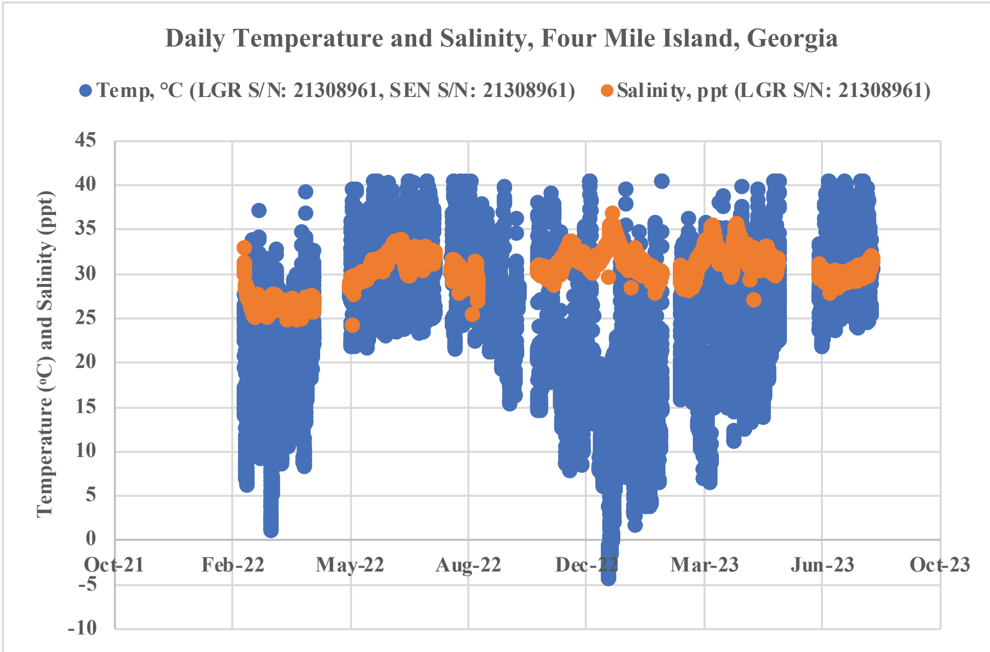


Figure 1. Daily temperature (ºC) and salinity (ppt) at Four Mile Island adjacent to the Julienton River from February 2022–August 2023. Date points were collected via HOBO loggers at every 15 minutes. Gaps in water quality data were due to servicing and re-deployment of loggers.

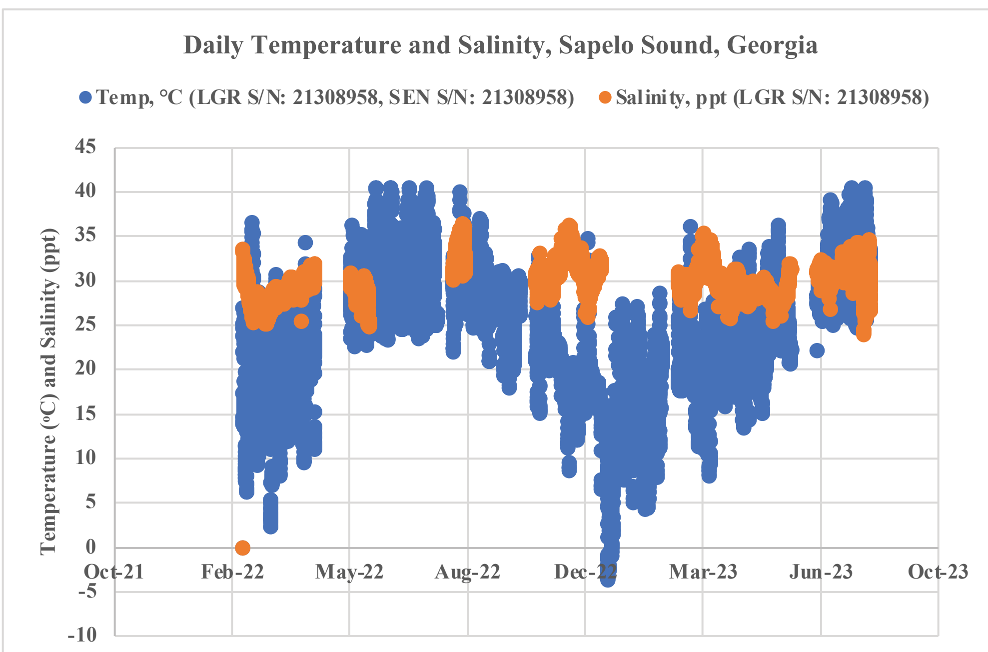


Figure 2. Daily temperature (ºC) and salinity (ppt) in Sapelo Sound from February 2022–August 2023. Date points were collected via HOBO loggers at every 15 minutes. Gaps in water quality data were due to servicing and re-deployment of loggers.

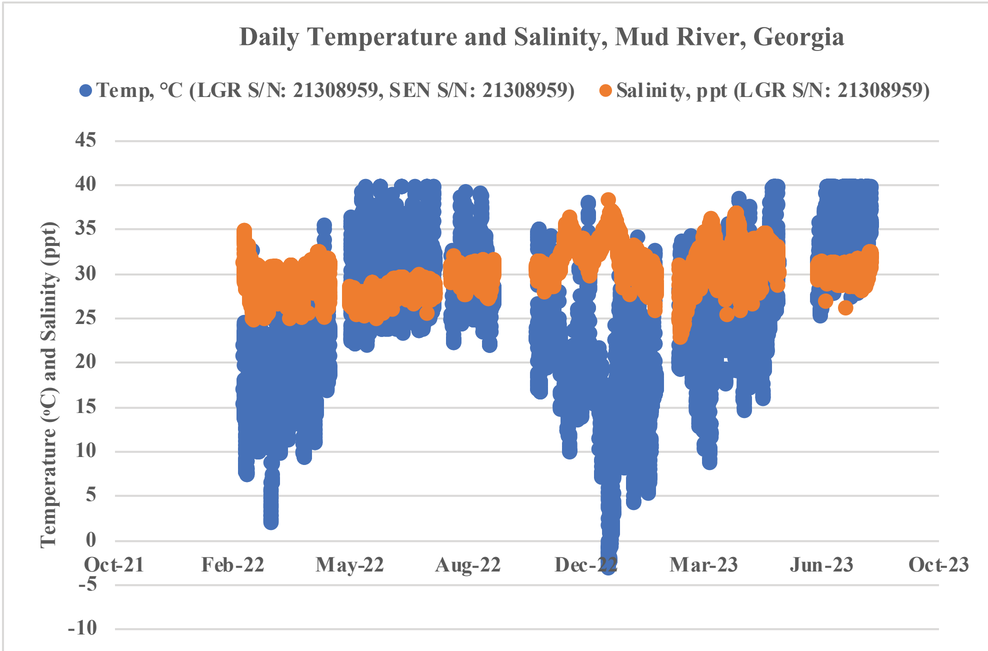


Figure 3. Daily temperature (°C) and salinity (ppt) at Mud River from February 2022–August 2023. Date points were collected via HOBO loggers at every 15 minutes. Gaps in water quality data were due to servicing and re-deployment of loggers.

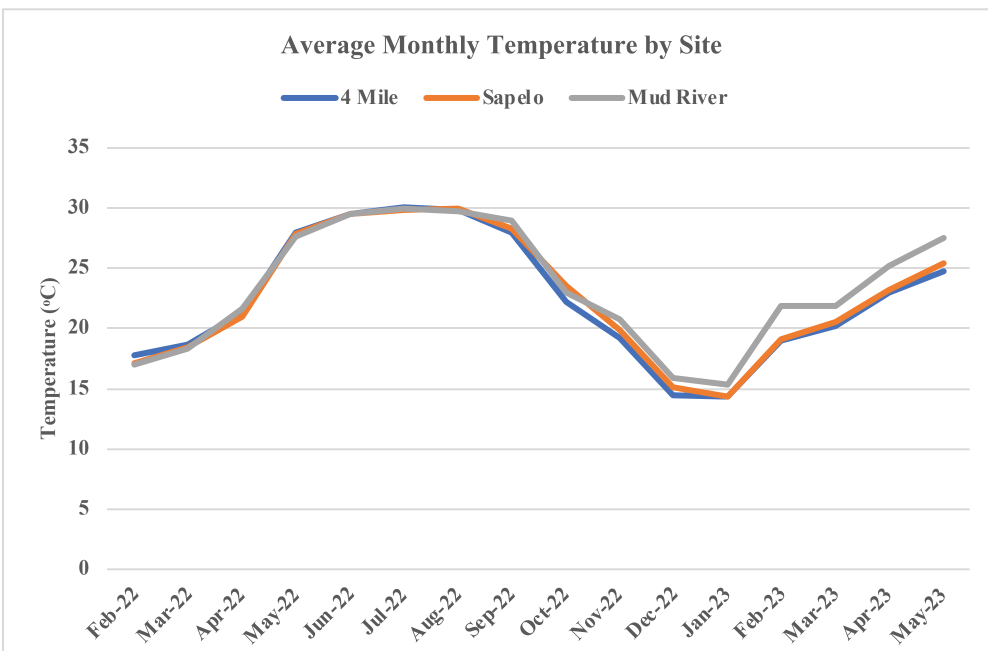


Figure 4. Average monthly temperature (°C) at Four Mile Island, Sapelo Sound, and Mud River field sites from February 2022–May 2023. Monthly averages were calculated from daily HOBO logger data.

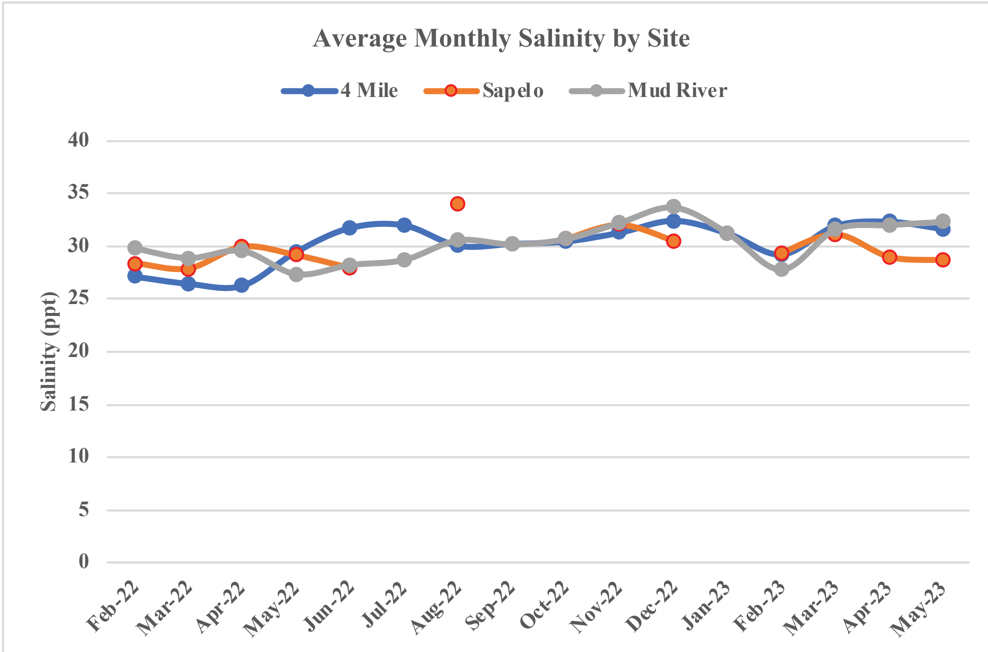


Figure 5. Average monthly salinity (ppt) at Four Mile Island, Sapelo Sound, and Mud River field sites from February 2022–May 2023. Monthly averages were calculated from daily HOBO logger data. Gaps in data from the Sapelo Sound site were due to biofouling of the HOBO logger at this particular site between servicing events.

Farming Gear and Methodology

SSF cultivates clams using soft mesh polyester bags. Though other equipment and materials exist for predator exclusion and clam harvest, (Whetstone et al., 2005), SSF has determined that using soft mesh bags deployed in belts is the most economical and efficient method given the scale of this particular company's production output. Therefore, farming hard clams using polyester mesh bags is the focus of this manual.

Soft mesh clam bags are coated (usually submerged then air dried) prior to use in a compound that is a latex, alkyd, or acrylic polymer–based coating to stiffen the mesh, prevent clam predation, and protect the bag from UV damage to increase lifespan. Once coated clam bags last several cycles. Soft bags used have a mesh size of either 4 mm or 9 mm and are 1m^2 (figure 6 and 7). The 4 mm mesh bags are used to stock nursery clam seed (figure 8) retained on 6 mm mesh grading screens and 9 mm mesh bags are used for the restocking of final grow-out clams (figure 9) once the clams are mechanically graded (figure 10) on screens/tumbler pipes of 12 mm or greater.


Figures 6 and 7. Field grow-out bags for growing both nursery *(left)* and harvest size clams *(right).*


Figures 8 and 9. Clam seed at sizes typically stocked in nursery bags *(left)* and final grow-out bags *(right)*.

Figure 10. Mechanical grader used to separate large from small clam seed for final grow-out as well as to remove dead shell from final harvest clams destined for sorting and packing.

In preparation to stock 6 mm nursery seed, 4 mm nursery bags are belted together for deployment in rows of six. To belt clam bags together, soft mesh bags are laid flat on a broad and long table adjacent to each other with a 1-meter-long piece of quarter inch (0.63 cm) rebar as a spacer (figures 11 and 12). Spacers are placed between sets of bags within the row and on the outer portion of end bags (figure 12). Openings on clam bags are oriented so opposing bags have openings that face each other for ease of stocking clams with the openings on end bags typically facing outward. Bag openings are constructed of an unsewn corner (open flaps of bag) that is rolled tight and sealed with cable ties once bags are stocked with seed. To properly seal each opening, a cable tie is looped through both bag flaps and loosely fastened, then the flaps are rolled until both sides of the opening meet the seamed portion of the bag. Then two long cable ties are looped through the bag and around the rolled flaps at opposite ends of the now closed opening and fastened tightly. Three to five 12-inch UV resistant cable ties are tightly fastened at evenly spaced intervals along the length of each rebar spacer. Rebar spacers have a dual purpose of both binding bags together in a row formation and providing weight to anchor bags, which can be light when stocked with small clam seed, to prevent waves/currents from flipping bags over top of each other or washing bags away. The end spacers of nursery bags are often gently pressed into the mud to keep the bags in place until the bags "pillow up" and fill with sediment. Once assembly of clam bag belts are completed, they are stocked, sealed, and rolled into bundles (figure 13) for loading onto the deployment vessel (figure 14). Preparation and deployment of clams for final grow-out is virtually identical with a couple exceptions. Instead of 4 mm nursery bags, 9 mm grow-out bags are used and clams are stocked at a much lower density for final grow-out.

Figures 11 and 12. Clam bags laid out in rows of six to prepare stocked clam belts using rebar spacers and zip ties.

Figures 13 and 14. Stocked and rolled clam belts ready for loading on the airboat for field deployment.

Stocking densities for clam seed range from 5,000–10,000 clams m^{-2} (500–1,000 clams ft^{-2}) and 500–1,000 clams m^{-2} (50–100 clams ft^{-2}) during final grow-out, (Whetstone et al., 2005). SSF reported having consistent performance when stocking nursery sized clams at 10,000 per bag and 1,000 per bag for grow-out. These were the stocking densities also used for southern quahogs on this project. Hand counting clams is not practical, therefore, bags are stocked using weight or volume estimates. Estimates are achieved by taking several sub-samples (figure 15) of clams and getting an average count by weight or volume to determine the average number of clams per unit (gram, kilogram, milliliter liter, etc.) (example 1). Once the number of clams is determined per unit, the clams are measured out (figure 16) and stocked into the bags. Once the bags in each belt are stocked and sealed, the belt is neatly rolled up and loaded onto the boat to transport clams to the field grow-out location.

Figures 15 and 16. Counting station for calculating average clams per gram to determine the total weight of clam to be stocked in final grow-out bags.

Example 1: Seed Clams (using count by weight)

Multiple samples to determine number of clams per gram:

150 Clams ÷ 7 grams = 21.4 clams g^{-1}

138 Clams ÷ 5 grams = 27.6 clams g^{-1}

160 Clams ÷ 8 grams = 20.0 clams g^{-1}

Mean = 23 clams g^{-1}

Determine the weight of clams needed in grams to stock 10,000 nursery clams per bag:

10,000 nursery clams ÷ 23 clams g^{-1} = 434.7 grams of clam seed stocked per nursery bag.

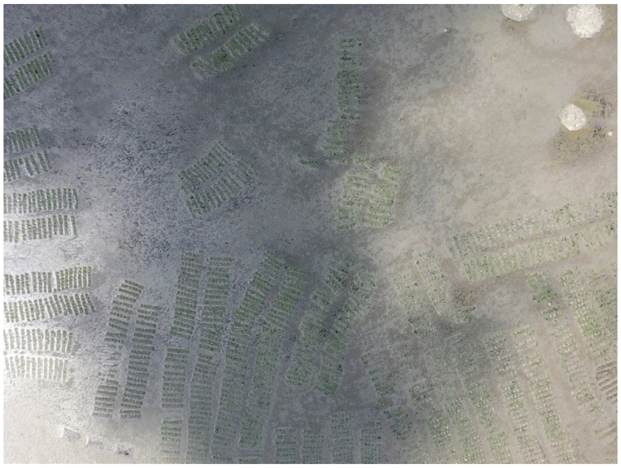
Define Planting Zone

Once site selection is complete, it is advantageous to physically define clam planting zones prior to deployment of bagged clams in an effort to ensure that clams are distributed within the optimal intertidal range to maximize clam harvest yield. In Georgia, clams are deployed in the intertidal zone at an elevation range of -0.61m to 0.31m relative to mean low water (MLW). Surveying a potential site over the course of a monthly tidal cycle can be helpful. Websites that provide tidal prediction information such as NOAA Tides and Currents (https://tidesandcurrents.noaa.gov/map/index.html) amongst many other sources are useful to determining when to deploy markers at the upper and lower limits of the intended intertidal distribution zone. To establish a planting zone, monitor predicted tides and deploy markers at slack low water during both spring and neap tide to establish the lower and upper limits of your planting zone. This will maximize the area of intertidal water bottom available for the planting of clams and help minimize air exposure time during the warmer months of the year. At slack spring and neap tides it is possible to walk the waterline and place markers (figure 17) (such as two-meter lengths of 1.9 cm PVC pipe or 0.63 cm rebar) parallel to the channel at intervals for both the upper and lower limits of the desired planting zone with the area between the upper and lower limits representing where stocked belts of clam bags will be placed. The total number of belts planted will depend on the total bottom area available within a given planting zone. Thus, it is important for new shellfish lease holders that are interested in clam farming to survey their leased water bottom in total to establish the total area available for planting clams since it will directly affect farm production capacity and revenue.

Figure 17. Clam planting area with PVC markers delineating the upper planting limits for the site.

Deployment

During deployment, belts of stocked clam bags that are rolled into bundles are typically laid about 7 meters apart before being unrolled in rows that are parallel to the channel of the adjacent waterbody (figures 18–19). The number of rows at a site depends on available intertidal bottom area and the dimensions of the area within planting zone. Rows can range from a couple of very long rows to several short rows placed in close proximity (figure 19). Spacing between rows will vary between farms (the higher the row density, the closer together the rows are) but always leave enough space between rows for workers to navigate unencumbered.



Photos 18 and 19. Both onsite and aerial *(courtesy of Charlie Phillips)* photographs of field deployed clam bags in high density in coastal Georgia.

Generally, seed clams are deployed by farms between early spring and late fall months, in conjunction with seed availability from commercial clam hatcheries. If possible, it is best to deploy seed during the cooler parts of the season, such as March-April in the spring and October-November in the fall. Established clam hatcheries are skilled at timing production windows, but clam seed production is still dependent on many factors (broodstock condition, post settlement survival rates, etc.) that can affect seed supply. This may, at times, require clam deployment by farms during peak summer temperatures. Should this situation arise, it is best to deploy clam seed during early morning or early evening low tides if the timing of the tide allows. This will help reduce stress on clam seed that is already dealing with the stress of transport from the hatchery to the farm. Should the timing of a clam seed require midday deployment during peak summer temperatures due to monthly tidal patterns, it is best to deploy clams at slack low tide to limit exposure time. Once deployed, seed clam bags are checked weekly for maintenance purposes after storms to make sure bags have not been buried or flipped. The repairing of holes caused by predators such as crabs and rays typically occurs between deployments. The sampling of bags to determine when seed clams have reached a size to be restocked into final grow-out bags begins approximately at four months post-deployment, with most nursey bags typically harvested at six months post deployment.

Once the majority of clams are within the size range required for re-deployment in final grow-out bags, a random number of bags are haphazardly harvested, clams are loaded into a mechanical grader, and an average size distribution is determined. If the majority of clams is ready for re-distribution then the remaining bags are harvested, clams stocked into final grow-out bags (9mm mesh) at 1,000 clams per bag in belts, and belts are deployed at the final grow-out location. Clams in final grow-out bags remain in place until final harvest. The timeframe from deployment at the final grow-out site to harvest ranges from 8 to 12 months depending upon location and the size of clams at re-deployment.

Field Harvest and Landing of Clams

Clams harvested for market are retrieved from a grow-out location, graded, sorted by size, packaged, and sold. Crews of three to five employees will depart on harvest vessels during the mid-ebb tide and anchor in the channel adjacent to the harvest location until the site is accessible (figure 20). When the tide recedes and the water is chest deep, all but one harvest crew member (the captain) will get into the water and locate the target rows of clam belts. Once the belts are located, the captain will motor up to the crew members (water crew) and hand them a fire hose that is attached to a trash pump for cleaning sediment and debris out of the clam bags (figure 21). Once the hose is handed over to the water crew, the pump is started, and two of the three water crew members will pull and clean the clam bags while the third crew member runs the cleaned bags to the captain for loading onto the deck of the boat. This is a labor-intensive process and continues until the required number of clams is harvested or the distance between the water crew and the boat increases beyond a reasonable walking distance. It is important that the boat remains afloat and the pump intake submerged during the entire harvest process (figures 20 and 21). If the bags can't be cleaned of sediment, then the bags are too heavy to manage by hand and harvest ceases. For large orders, the SSF clam fleet will maximize site accessibility associated with semi-diurnal tides in Georgia, and accomplish both morning and afternoon harvests as was conducted during our associated research.

Figures 20 and 21. The harvest crew begins work at mid-ebb and completes clam harvest near slack low tide. The hoses in each picture are color coded to indicate saltwater intake *(green)* and output *(red)*.

Once bags are cleaned and loaded on harvest boats, they are landed at the SSF dock to be pre-graded. During the pre-grading process, the contents of each bag are rough sorted through a mechanical grader (figure 10) to remove all dead clams and shell fragments. Remaining live clams are stocked into bushel baskets (Figure 22) and moved into the cold sorting and packing facility or to a commercial storage cooler. Clams held overnight in the cooler are typically sorted, packaged, and shipped the next business day.

Figure 22. Cleaned and rough-graded clams ready for transport to the SSF cold packing facility.

Sorting and Packing for Shipment

Bushels of cleaned and rough-graded clams are transported to the cold packing facility on the SSF premises and sorted using mechanical sorters (figures 23 and 24). Clams are placed in the loading tray of the sorting machine and hand fed to the sorter (figure 23), which is comprised of a series of metal rollers that segregate clams by size into specific packaging bins that funnel the clams into mesh bags by count (figure 24). Specific size grades generally include pasta, button, little neck, mid neck, and top neck size classes. Each sorter can be pre-programmed to allow a specific number of clams by size grade to enter each of six bins to achieve an exact clam count per bag by size. Sorted clams are packaged in color-coded plastic mesh bagging that indicates grade (figure 24). Once clams are sorted and packaged into bags, bags are packed into wax-coated boxes, and stored in a commercial cooler until shipped.

Figures 23 and 24. Clams are being loaded and sorted by size grade into 100 count color-coded bags on the mechanical sorter.

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Literature Cited

Abbott, R.T. 1974. American seashells: the marine mollusca of the Atlantic and Pacific coasts of North America, second edition, Van Nostrand Reinhold, New York.

Arnold, W.S., S.P. Geiger, and S.P. Stephenson. 2009. *Mercenaria mercenaria* introductions into Florida, USA, waters: duration, not size of introduction, influences genetic outcomes. Aquatic Biology 5:49-62.

Baker, S., E. Hoover, and L. Sturmer. 2010. The role of salinity in hard clam aquaculture. University of Florida IFAS Extension, Publication No. CIR1500, 10pp.

Broderick, M.A. 2012. Determination of temperature thresholds for the northern hard clam and evaluation of backcrossed F1 hybrids (*Mercenaria mercenaria* x *Mercenaria campechiensis*). Graduate Thesis, University of Florida. 56 pp.

Castagna, M. and J. Kraeuter. 1981. Manual for growing the hard clam *Mercenaria*. Virginia Institue of Marine Science, Wachapreague, VA, 110pp.

Folk, R.L.,and W.C.Ward. 1957. Brazos river bar: a study of significant grain size parameters. Journal of Sedimentary Petrology. 27: 3-26.

Georgia Department of Natural Resources Coastal Resources Division. 2020. https://coastalgadnr.org/sites/default/files/crd/pdf/marfish/broadhis.pdf

Hargrove, J.S, L. Sturmer, J. Scarpa, and J.D. Austin. 2015. Assessment of genetics in wild and aquaculture stocks of *Mercenaria mercenaria* in Florida. Journal of Shellfish Research 34(2):355-365.

Harte, M.E. 2001. Systematics and Taxonomy. In: Kreauter, J.N. and M. Castagna (eds) Biology of the hard clam. Elsevier, Amsterdam, Netherlands, p. 3-51.

Haven, D. and J.D. Andrews. 1957. Survival and growth of *Venus Mercenaria*, *Venus campechiensis*, and their hybrids in suspended trays and on natural bottoms. Proceedings of the National Shellfisheries Association 47:43-49.

Jones, D.S., I.R. Quitmyer, W.S. Arnold, and D.C. Marelli. 1990. Annual banding, age, and growth rate of hard clams (*Mercenaria* spp.) from Florida. Journal of Shellfish Research 9(1):215-225.

Kraeuter, J.N. and M. Castagna. 2001. Biology of the hard clam. Elsevier, Amsterdam, Netherlands, 751pp.

Malouf, R.E. and V.M. Bricelj. 1989. Comparative biology of clams: environmental tolerances, feeding, and growth. In: Clam mariculture in North America. J.J,. Manzi and M. Castagna (eds). Elsevier, Amsterdam, Netherlands, p 23-71.

National Marine Fisheries Service. 2020. http://www.st.nmfs.noaa.gov/commercial-fisheries/index

Saloman C.H. and J.L. Taylor. 1968 Age and growth of large southern quahogs from a Florida estuary. Proceedings of the National Shellfisheries Association 59:46-51.

Sturmer, L., J. Scarpa, W. White, and S. Baker. 2012. Improving hard clam production in Florida through culture of backcrossed hybrids (*Mercenaria mercenaria, M. campechiensis*). Journal of Shellfish Research 31:351.

Walker, R. L and K.R Tenore. 1984. The distribution and production of the hard clam, *Mercenaria mercenaria*, In Wassaw Sound, Georgia. Estuaries 7:19-27.

Walker, R.L. and P.B. 1990. Heffernan. Intertidal growth and survival of northern quahogs *Mercenaria mercenaria* (Linnaeus 1758) and Atlantic surf clams *Spisula solidissima* (Dillwyn 1817) in Georgia. Journal of the World Aquaculture Society 21(4):307-313.

Weber, K, L. Sturmer, E. Hoover, and S. Baker. The role of temperature in hard clam aquaculture, University of Florida IFAS Extension, Publication No. FA151, 9pp.

Whetstone, J.M., L.N. Sturmer, and M.J. Oesterling. 2005. Biology and culture of the hard clam (*Mercenaria mercenaria*). SRAC Publication No. 433, 6pp.

<u>Hatchery List</u>

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