

Grant Completion Report

A. Project Title: Commercial potential of Northern (*Mercenaria mercenaria*) vs. hybrid (*M. mercenaria* x *M. campechiensis*) hard clams: grow-out and shelf-life potential

PI: Tom McCrudden, Great Florida Shellfish Company LLC

Subaward Number: ACQ-210-039-2020-GFSC

Date: April 5, 2021

B. Executive Summary

This project investigated commercial production performance of hybridized vs. northern *Mercenaria* clams in Florida including survival and growth rates during grow-out to market size and wholesale shelf-life. Hatchery reared seed, 500k hybrid and 500k northern, was given to three farmers located within the major commercial growing areas in Florida: Alligator Harbor, Cedar Key, and Pine Island. Each farmer is also a wholesaler who used production northern and hybrid clams planted the year prior to investigate shelf-life and consumer acceptance at the sales end of the supply chain.

C. Purpose

1. The objective of this project is to compare production performance of hybridized vs. northern clams under standard commercial farming and wholesale conditions.
2. Objectives:
 - i. Compare survival and growth rates of northern clams vs. hybrids under commercial grow-out conditions at three commercial farms operating within the major commercial clam SHA's (Shellfish Harvest Areas) in Florida: Alligator Harbor, Cedar Key, and Pine Island.
 - ii. Compare shelf-life of northern vs. hybrid clams under commercial wholesale conditions at three wholesale properators: Northern Florida Clams, Cedar Shoals, and Cutthroat Clams.

D. Approach/Methods

1. Detailed description of the work that was performed.
 - i. Objective 1: Survival
Clams were spawned and reared in the nursery by project PI Tom McCrudden under standard commercial hatchery conditions until 4 mm in size; Northern clams mated *M. mercenaria* x *M. mercenaria* and hybrids mated *M. mercenaria* (female only) x *M. campechiensis* (male only). Each of the three participating farmers was provided with 500k seed of each hard clam type, i.e. northern and hybrid, to plant out simultaneously on their lease sites- 1000 clams per bag, 500 bags per treatment. Farmers collected survival data bi-monthly through randomly pulling 10 bags of each treatment and size volumetrically through to harvest, for five data points during the project. Survival was also accessed at two major time points: (1) when clams were upgraded from the nursery bag to grow-out bag ~2-3 months post planting; and (2) Actual counts of survival in 10 bags per treatment at the time of

harvest in May & June 2019 (see job 'shelf-life comparison'). Survival was assessed with Kaplan-Meier survival analysis and growth through a multivariate growth curve analysis.

ii. Objective 2: Shelf-life

The same farmers collaborating on the first job of this project are also major wholesalers within the state. Therefore, they also assisted with obtaining data regarding shelf-life and retail acceptance of northern vs. hybrid clams. At similar size and timing, northern and hybrid clams were harvested under standard commercial procedures. Wholesalers transported the hybrid and northern simultaneously to their wholesale facility and kept 3 bags of 50 counts each under identical storage conditions (refrigerated at 45 deg F) until bags were no longer suitable for sale.. This was repeated for 3 repetitions total. The timing of this study was significantly delayed due to COVID closing most marketing channels within the food retail industry. While we had aimed to complete this work in May and June, all trials were not completed until the fall and winter 2020. Daily shelf-life, i.e. gaping, was assessed for each group. Retail customers were also asked to blindly choose which clam they would like to purchase with both clam types equally presented and preference recorded. Shelf-life will be analyzed with a Kaplan-Meier survival analysis.

2. Project management:

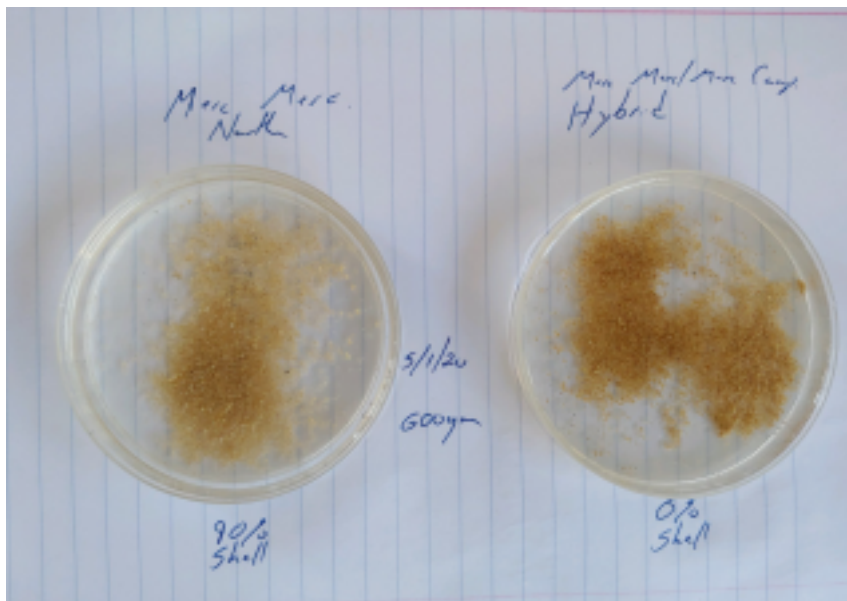
- i. PI and Hatchery: Tom McCrudden, Great Florida Shellfish Company, raiclams@bellsouth.net
- ii. Grow-out, Cedar Key: Chris Renyolds, Cedar Shoals, cedarshoalsinc@gmail.com
- iii. Grow-out, Pine Island: Tony Heeb, Cutthroat Clams, cutthroatclams@gmail.com
- iv. Grow-out, Tallahassee: Andy Arnold, North Florida Clams, northfloridaclams@yahoo.com
- v. Administration, data analysis and outreach coordination: Nicole Kirchhoff, PhD, nkirchhoff@gmail.com

E. Findings/Results

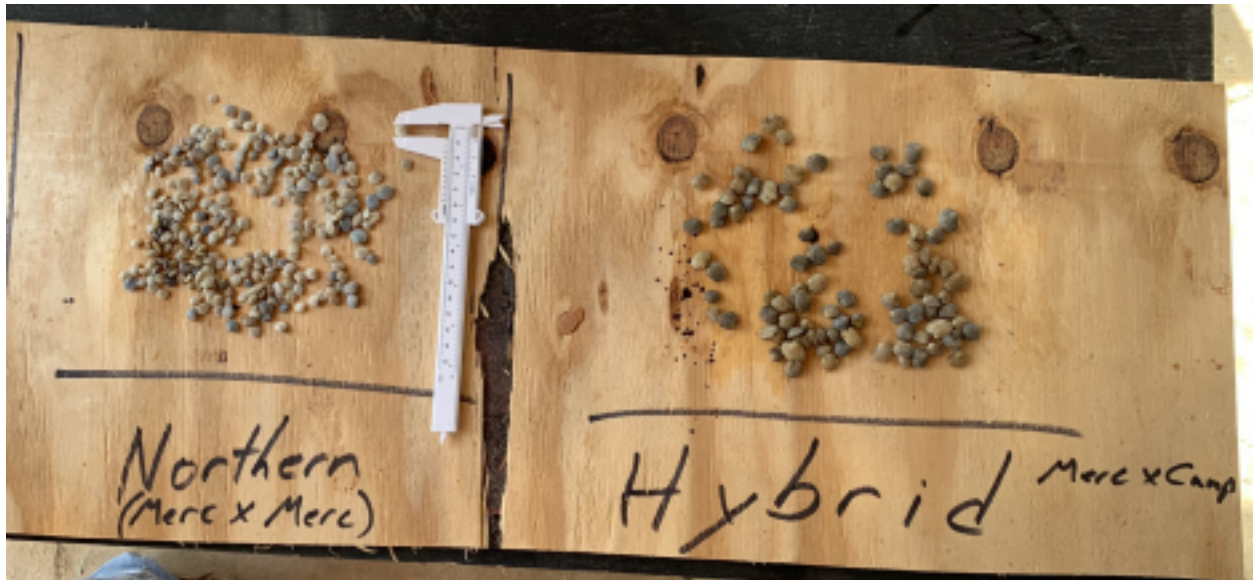
Objective 1: Survival and growth

Across all three growing locations, hybrid clams had 9-16% higher survival and grew 11-33% faster than northern clams (see Table 1). All three growers noticed substantial faster growth and higher survival rates with the hybrid clams. This difference in growth rates made it challenging for the grower to take growth and survival data for the two species. This required additional time for each grower to assess and transfer the seed at different times due to the growth rates.

While not accessed, it was noted hatchery rearing of hybrid clams also had higher survival and growth rates. This can be seen in the different planting times of the seed within the trial as it was difficult to match seed size and quantities for hybrids and northerns when northern seed had significantly lower production performance (see figure below). During the spawning and raising of the different groups, the northern group which was spawned on the same day as the hybrids, mostly died during the hatchery rearing stage of development. To offset this obstacle and keep the project on schedule, the hatchery was able to use the northern batch of clams which was produced two weeks ahead of the hybrid batch to supply to the growers. Even though the northern batch of seed was spawned 2 weeks before the hybrid batch, the hybrid clams caught up to and passed the growth prior to supplying the farmers the seed. From a hatchery perspective, it should be noted that the superior growth and survival rates of the hybrid seed allows for additional seed to be produced for industry growth and adequate seed supplies. The PI Tom McCrudden has been producing hybrid seed for over 15 years and notes the superior growth and survival is consistent with his experiences compared to the northern clams. The “lack of shelf life” stigma has hampered industry acceptance of the hybrid clams for most growers to request this seed.



See performance within the hatchery with the northern showing 90% shell (i.e. 90% mortality) and hybrids 0% shell (0% mortality) at the 600um mesh sieve size.



example of growth differences between northern and hybrid clams during an assessment data collection.





volumetric counts for growth and survival assessments

Table 1

		Northern				Hybrid			
Farmer	Description	Date	Size	#/L	Survival	Date	Size	#/L	Survival
Alligator Harbor (North Florida Shellfish)	Plant	5/17/20	4mm	10,000	100%	5/17/20	4mm	10,000	100%
	Assessment	6/4/20	6mm	4,000	90%	5/17/20	8mm	2,000	91%
	Transfer	7/14/20	8mm	2,000	88%	7/14/20	10mm	900	88%
	Assessment	9/22/20	10-12mm	800	84%	9/22/20	12-15mm	500	86%
	Assessment	11/3/20	12-15mm	550	80%	11/3/20	15-18mm	250	84%
	Assessment	12/15/20	15-18mm	300	72%	12/15/20	20-22mm	125	81%
Cedar Key (Cedar Shoals)	Plant	7/22/20	4mm	10,000	100%	8/3/20	4mm	10,000	100%
	Transfer	9/22/20	8mm	1,600	82%	10/3/20	8-10mm	1,400	91%
	Assessment	10/30/20	10-12mm	800	74%	11/3/20	12-15mm	500	89%
	Assessment	11/8/20	12-15mm	550	70%	11/18/20	15-20mm	225	86%
	Assessment	12/19/20	18mm	250	68%	12/19/20	22mm	100	84%
Pine Island (Cutthroat Clams)	Plant	5/25/20	4mm	10,000	100%	5/18/20	5mm	8,000	100%
	Transfer	8/3/20	9mm	950	74%	7/27/20	10mm	900	85%
	Assessment	9/7/20	13mm	600	74%	8/31/20	15mm	425	84%
	Assessment	10/5/20	16mm	500	71%	9/28/20	18mm	250	81%
	Assessment	10/27/20	17mm	450	71%	10/26/20	18mm	200	80%
	Assessment	11/27/20	17mm	400	67%	11/30/20	19mm	175	80%
	Assessment	12/29/20	18mm	350	67%	12/21/20	20mm	150	79%

Objective 2: Shelf-life and consumer acceptance

All three wholesalers found hybrids to have equal or better shelf life compared to northern Mercenaria clams (see Figures A, B, C and Table 2). There was found to be no consumer bias to their clam type, many consumers not educated regarding the difference in appearance between the two varieties. There is no difference in taste between the two varieties; only the ridges are more pronounced on the hybrid clams.

As anticipated, shelf life was significantly reduced for both varieties of clams during the peak months of summer, July, August, and September but the negative stigma of hybrid clams not having equal shelf life during this time was not factual.

The data was complicated by each wholesaler accessing shelf life for different time periods post harvest. We were unable to get all three growers to perform the shelf life trials at the same time as planned. They were all struggling to keep their businesses going with a dramatic reduction of sales of 70+% because of covid-19 shutdowns causing erratic and inconsistent sales. It was also complicated by the covid-19 pandemic significantly altering market chains and how seafood was retailed. Traditionally wholesalers sell products face-to-face to customers which often also include restaurants. With covid-19, face-to-face sales and restaurant retail was prohibited. This caused us to change the way the consumer bias study had to be conducted. Instead of consumer choice, consumers were instead asked their feedback regarding the clams they were sold. The feedback received showed no preference with either variety.

One unexpected development was discovered when one of the growers shipped some of both varieties to a purge facility in the state on Aug. 3rd. As expected during this time, the water temperatures were warm and the clams were required to be chilled down to 45 deg. F before shipment from the grower as per Florida Department of Agriculture and Consumer Services (FDACS) regulations. (Purging is a process used to reduce grit or sand from the shellfish and can also help to extend the shelflife by “tempering” the animals). At the purging facility, the different varieties provided different results as the hybrid has losses of about 25% while the northern variety only had about 10% losses. These poor survival results for the hybrids could possibly be improved if the clams were acclimated or tempered to the lower temperature prior to purging but would require additional research.

Figure A.

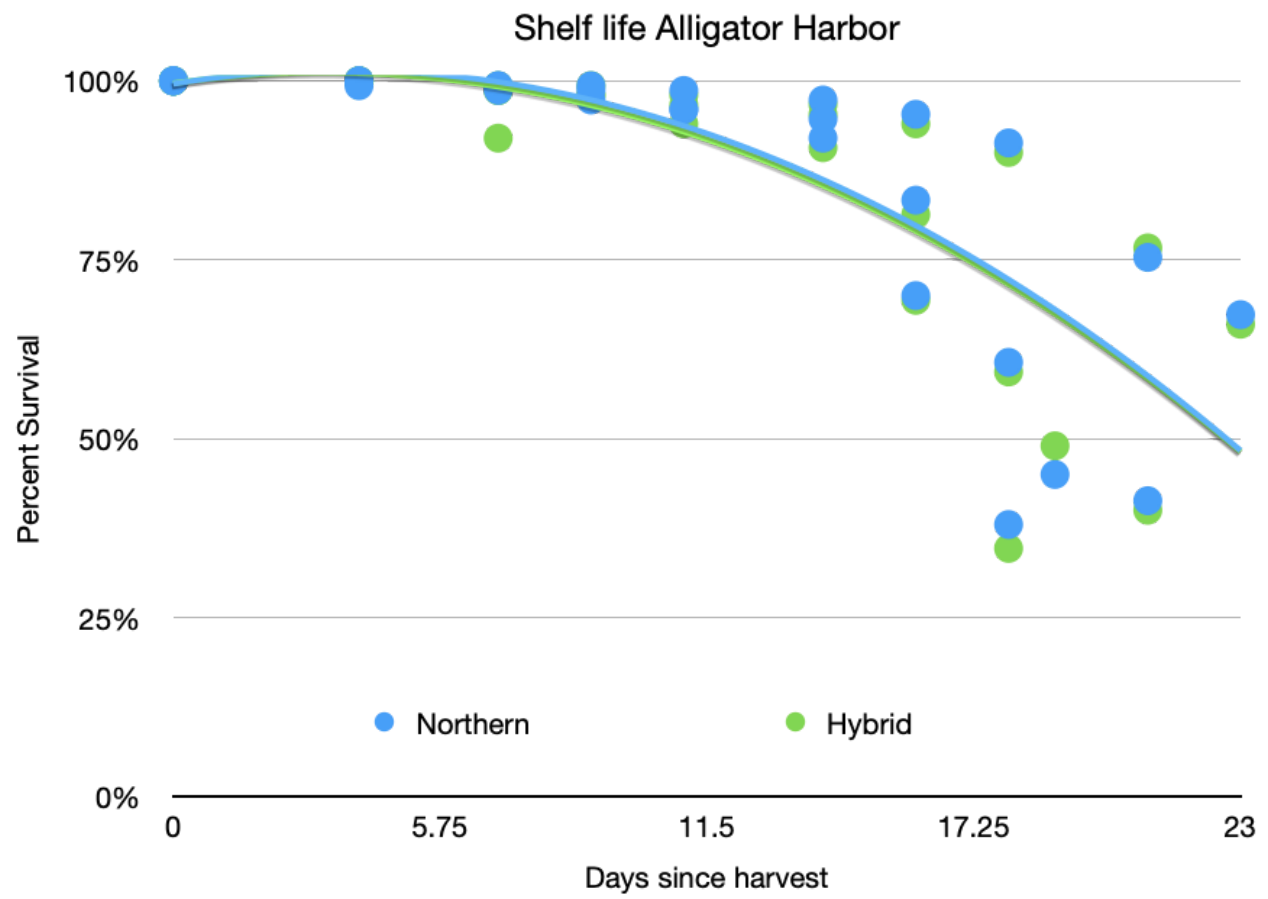


Figure B

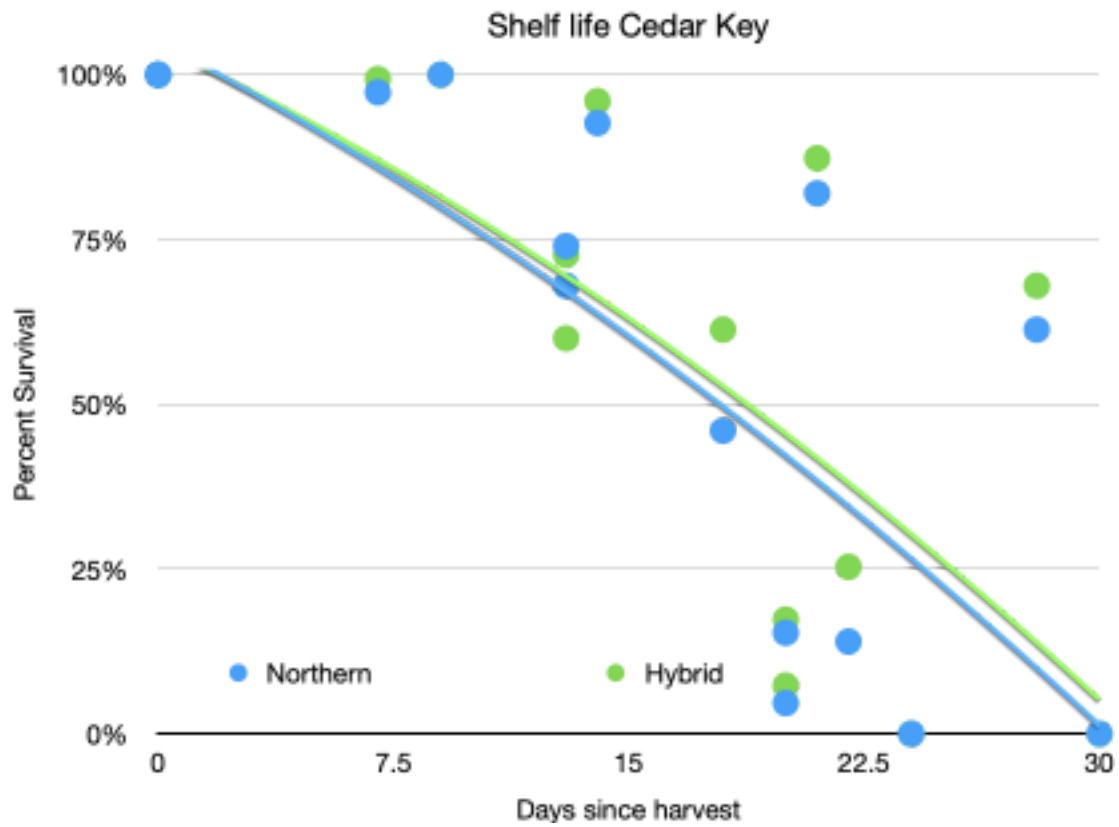
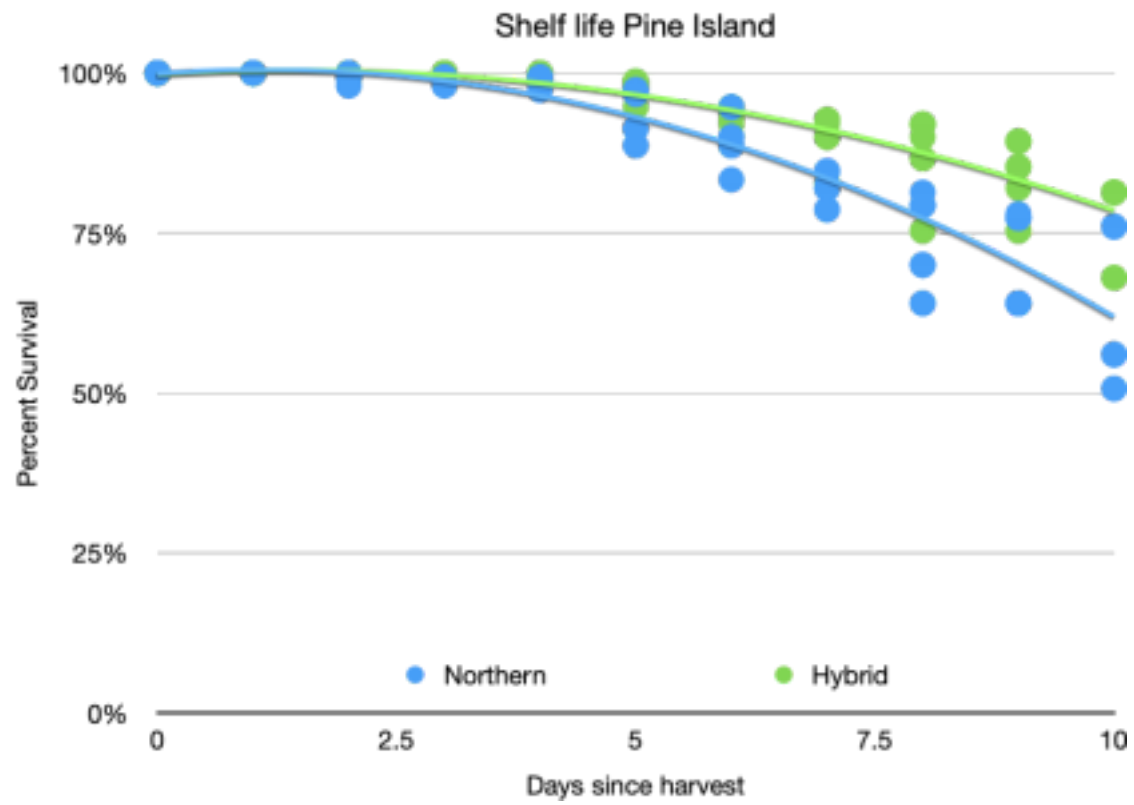


Figure C





Shelf life trial, 50 count bags of hybrid and northern clams stored side-by-side under identical conditions. And periodically unbagged and accessed for gapping and survival.

Table 2

Wholesaler	Harvest Date	Days Since Harvest	Northern	Hybrid
Alligator Harbor (North Florida Clams)	7-24-20	0	100%	100%
		4	100%	100%
		7	99%	92%
		19	45%	49%
	8-3-20	0	100%	100%
		4	99%	100%
		7	99%	99%
		9	99%	98%
		11	96%	94%
		14	92%	91%
		16	70%	69%
		18	38%	35%
	9-7-20	0	100%	100%
		4	100%	100%
		7	99%	99%
		9	97%	98%
		11	96%	97%
		14	95%	95%
		16	83%	81%
		18	61%	59%
		21	41%	40%
	10-5-20	0	100%	100%
		4	100%	100%
		7	99%	99%
		9	99%	99%
		11	99%	98%
		14	97%	97%
		16	95%	94%
		18	91%	90%
		21	75%	77%
		23	67%	66%
Pine Island (Cutthroat Clams)	7-14-20	0	100%	100%
		1	100%	100%
		2	98%	100%
		3	98%	100%
		4	97%	99%
		5	97%	95%
		6	83%	92%
		7	83%	92%

		8	81%	90%
		9	78%	82%
	9-4-20	0	100%	100%
		1	100%	100%
		2	99%	100%
		3	99%	99%
		4	99%	99%
		5	89%	99%
		6	89%	93%
		7	79%	83%
		8	64%	75%
		9	64%	75%
		10	51%	68%
	12-18-20	0	100%	100%
		1	100%	100%
		2	99%	100%
		3	99%	100%
		4	99%	99%
		5	91%	99%
		6	90%	94%
		7	85%	90%
		8	70%	87%
		9	64%	85%
		10	56%	81%
	10-3-20	0	100%	100%
		1	100%	100%
		2	100%	100%
		3	99%	100%
		4	99%	100%
		5	97%	98%
		6	95%	95%
		7	82%	93%
		8	79%	92%
		9	77%	89%
		10	76%	81%

Cedar Key (Cedar Shoals)	11-5-20	0	100%	100%
		7	97%	99%
		14	93%	96%
		21	82%	87%
		28	61%	68%
	8-7-20	0	100%	100%
		13	74%	60%

		20	5%	7%
		24	0%	0%
	8-27-20	0	100%	100%
		13	68%	73%
		20	15%	17%
		24	0%	0%
	8-31-20	0	100%	100%
		9	100%	100%
		18	46%	61%
		22	14%	25%
		30	0%	0%

F. Evaluation/Discussion

1. Describe the extent to which the project goals and objectives were attained. This description should address the following:

- i. Were the goals and objectives attained? How? If not, why? We feel all of the project goals were attained as the project proved the hybrid clams perform superior from the hatchery through the grow out phase of cultivation. The negative stigma about the shelf life was shown to not be an issue during normal handling of the product. Only one negative issue was identified and there are potential measures to mitigate these negative results if being transferred to purging operations.
- ii. Were modifications made to the goals and objectives? If so, explain. No goals or objectives were modified, however some methodology was modified due to the covid-19 pandemic as explained previously regarding consumer acceptance.
- iii. If significant problems develop which resulted in less than satisfactory or negative results, they should be discussed. No significant problems or unsatisfactory results were discovered which proved the hybrid clams should not be used by the shellfish industry to help improve growth and survival numbers for the hatcheries and growers.
- iv. The time for each grower to perform the required tasks should be addressed as this time is typically not accounted for or compensated with most grants. It took each farmer about 3hours to collect data for each survival/growth assessment, plus additional boat and crew time to locate and pull the correct bag.

Additionally, they spent additional time to pull, bag, tag then check the bags and record the data for the shelf life study. It is estimated the shelf life study took an additional 5 hours to complete and document per trial. This totals 3 hours per assessment x 10 assessments (double times because of varied growth) = 30 hours for growth/survival assessment. The time required to complete the shelf life data is 5 hours per trial x 4 trials = 20 hours. The time required to all complete tasks was approximately 50 hours x \$100.00 per hour = \$5,000. This does not account for an estimated 12 additional boat trips or other crew time utilized for this project. Each grower was compensated adequately to cover their time to provide accurate data

which is difficult to get from commercial growers as they are typically focused on maintaining operations to insure their businesses are operating efficiently. Also, many of the bags which were pulled to record growth/survival data did not properly bury back into the sand and higher than normal mortality was observed in these bags. There was also the unknown of how the hybrid clams would perform compared to the northern and whether the clams would be able to be sold. This was a risk for some of the farmers who were not sure if the trial would cause additional clean up cost for the business if the shelf life trials showed the hybrid clams were not suitable for industry standards.

We unfortunately had to exchange one of the project cooperating farmers and wholesalers as they were not adequately collecting data for the project. We were able to exchange this farmer/wholesaler and recuperate all lost time and data.

The covid-19 pandemic caused alterations to be made within the methodology. Meeting with farmers/wholesalers to discuss project methodology was made difficult due to travel and in person restrictions. Therefore some miscommunication resulted with regards to shelflife trial durations, with each farmer recording data for a different amount of time. We were still able to get usable data from the project, it just made analysis and interpretation of results more problematic.

v. We feel this project adequately tested and proved the superior growth and survival of the hybrid clams and the only additional work or research which could be performed would be to identify the proper acclimation or temper temperature to better improve the hybrid survival during transfer between the grower and purging company. This could easily be done between the two parties to deliver the product directly to the purge facility rather than process by the first party as FDACS requires the shellfish to be cooled prior to leaving the initial facility.

2. Dissemination of Project results:

i. Explain, in detail, how the projects results have been, and will be, disseminated.

Project results were disseminated within a webinar publicly announced within the aquaculture community and florida shellfish association on April 14, 2021 at 5pm. Results were also discussed during a Florida Shellfish Aquaculture Association meeting. We plan to consider submitting to a peer-reviewed journal within the next year.

G. Acknowledgments

If considering submission to a peer-reviewed journal, please include the following:

This project received funding under [subaward number] from the Gulf States Marine Fisheries Commission in cooperation with NOAA Fisheries Service. The statements, findings, conclusions, and recommendations are those of the author(s) and do not necessarily reflect the views of Gulf States Marine Fisheries Commission or NOAA Fisheries.