VIRGINIA FISHERY RESOURCE GRANT (FRG) PROGRAM
Final Report

FRG 2023-02

Project Title: **IQF Bait**

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Background / Introduction

Currently, commercial crabbers use bait block-frozen in wax-coated cardboard cartons. To use this bait they generally thaw it, which results in loss of blood and oil (primary attractants for the Chesapeake Bay Blue Crab) from the fish. This dramatically reduces the full potential of the bait. If the block of bait is not fully thawed, the crabber must pry apart the fish to bait their pots, which amounts to a significant waste of time and effort. Another issue is that the cardboard cartons used for bulk packaging of crab bait are single use only. This generates excessive and unnecessary amounts of waste, some of which leads to pollution in the Chesapeake Bay.

Purpose

The primary purpose of this project is to create a superior Individually Quick Frozen (IQF) crab bait product. This value-added product will increase the returns in the seafood industry by improving the quality and longevity of bait, improving the packaging and handling, and reducing environmental impacts by eliminating the single-use packaging.

We will use a refrigerated salt brine solution to freeze menhaden individually as opposed to block-frozen and package them in reusable/returnable containers. IQF bait will be superior because there is minimal loss of blood and oil and will not require thawing or prying apart, allowing the crabbers to use their time and energy more productively and increase their efficiency. The brine freezing process also creates a preservative effect in the bait further increasing its longevity in the pot. Our intention is to package the IQF bait product in reusable heavy-duty plastic containers with closable lids that will have a lifespan of approximately 50 or more uses, thus reducing the aforementioned cardboard waste in the Chesapeake Bay.

Methods

We experimented with three design variations and identified a particular design that successfully resulted in a quality IQF product.

Detailed below is a list of the work necessary to bring this concept to full functionality. *It's important to note the FRG funds did not support the brick and mortar construction aspects of this project.*

1. Construct / Install a stainless tank.

We constructed a stainless steel brining tank (36' L x 4' W x 30" D). Due to the corrosive nature of brine solution, these system components should be constructed from stainless steel. We designed our brine system with a proven RSW (recirculated seawater) system which utilizes titanium tubed chillers and condenser, freon refrigerant, a Carrier 5H80 compressor and a 75HP electric motor; this resulted in a quiet and efficient system that allowed us to create a brine solution with an operating temperature of -6°F.

This picture shows a hydraulic pallet tote dumper and a stainless hopper feed conveyor.

This picture shows the final design variation of our brine tank and conveyor system. This design is the prototype prior to stainless construction.

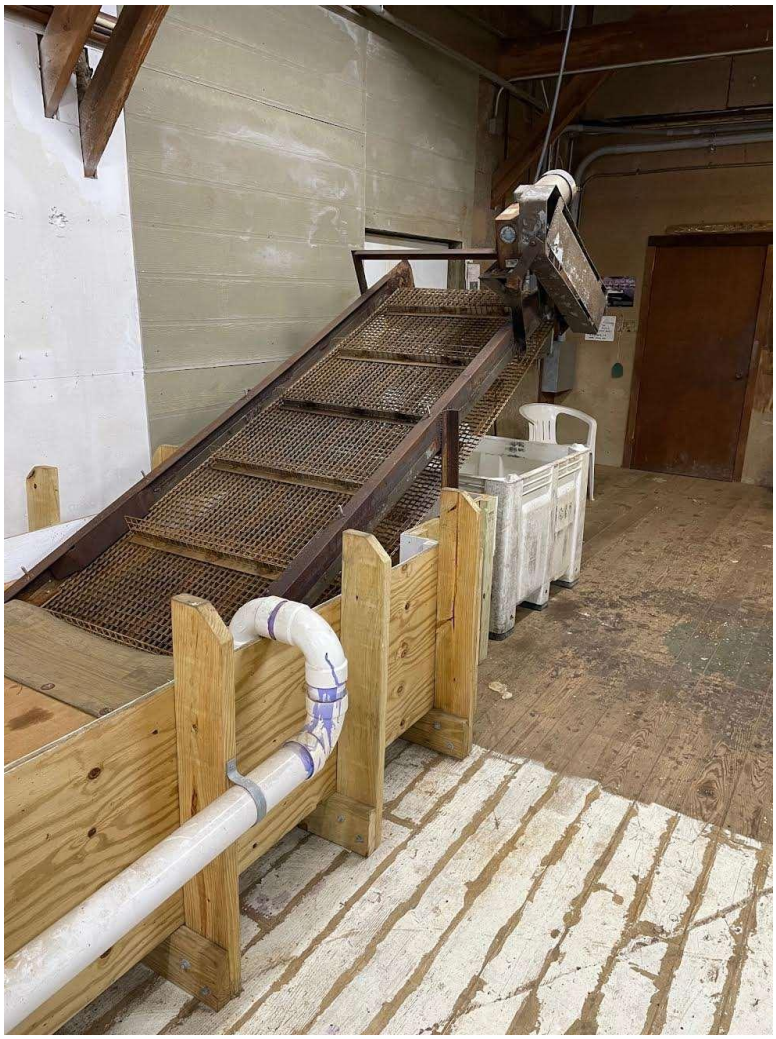
2. Develop Brine System

Our brine was created using sea water and measured amounts of sodium chloride. Researching other industries' brine solution compositions enabled us to learn that this temperature is the optimal temperature for this type of product. Operating at temperatures lower than this creates icing and flow problems. Our brine is reusable by maintaining the salinity of the solution. The primary challenge we faced was designing a process to introduce and recover fish from the brine solution. Our first attempt at creating an individually quick frozen (IQF) bait product was submerging fish within a stainless steel basket into a fiberglass tank filled with the refrigerated brine solution. We found that because the fish float freely in the brine solution, they did not freeze completely and clumped together. For our second variation we used a salt brine spray system to freeze the fish that floated and a paddle wheel to keep the fish progressing through the tank. We found that the biggest challenge to this design was recovering the fish from the tank. Through those attempts we learned that the fish must be fully submerged in the solution to freeze at the appropriate rate and that the most effective way to introduce and recover the fish from the tank is by using a continuously fed conveyor. To address those realizations, in the final variation we constructed a wooden tank with rubberized waterproofing and a mild steel framed conveyor. During our trial process with this latest variation, we collected data which led us to the conclusion that menhaden needed 20 minutes of submersion in our system to fully freeze.

This picture shows PVC piping for circulating brine solution.

3. **Construct a highly-customizable stainless steel framed conveyor system to effectively progress the fish through the brine tank and solution.**

In order to proceed to full-time utilization, the brining tank and conveyor components must be capable of withstanding the conditions presented by the brine solution. Salt brine corrodes carbon steel materials at an extremely rapid rate. Corrosion of carbon steel will lead to decline of structural integrity. In addition, it is undesirable to have iron oxide particles in the brine solution or in contact with the product. The aforementioned issue of corrosion necessitates the need for stainless steel material. The brine solution consists of sea water with added sodium chloride. The exact amount of added salt depends on the base salinity of the sea water, with the ultimate goal of reaching a critical salinity.



4. **Construct a cold storage holding freezer to store the IQF product once it finishes the brine freezing process.**

This is necessary to maintain quality of the product and facilitate timely distribution to customers and local bait suppliers. We completed this construction with the following steps:

- Site Prep: leveling of ground
- Installation/Insulation of walls: There are three existing walls, so an additional wall was installed with insulation of the walls and ceiling through use of sprayed closed cell urethane.
- Properly insulate floor: Floor was poured with fiber reinforced concrete and has properly installed ventilation to prevent buckling.
- Install Freezer door: Standardized freezer door was installed.
- Installation of Refrigeration equipment: Low horsepower compressor unit was utilized to maintain frozen IQF fish.

Freezer Image 1

Freezer Image 2

Freezer Image 3

Blast freezing unit #2

Blast freezing unit #1

5. Acquire reusable containers

We identified and purchased reusable heavy-duty containers that are nestable and stackable with a closable top. These are very user friendly and fit seamlessly into the current operations of nearly all commercial crabbers. The following image is included to provide detail on the containers we use (26.9 x 16.9 x 12.5”). *Note: We were able to purchase previously used containers at a reduced price.*

Enlarge & Video

ROUND TRIP TOTES

Damage protection ensured. Stackable on pallets.

- Cube out trucks.
- Tough plastic construction.
- Easily label for identification.
- Hinged, fold-over lid for easy stacking and nesting.

ROUND TRIP TOTES — Green, Gray, Red, Blue, Black or Yellow

MODEL NO.	OUTSIDE TOP DIM. L x W x H	INSIDE TOP DIM. L x W x H	CUBIC FT.	WT. (LBS.)	PRICE PER TOTE (MIN. 3) 3	12	24+	ADD TO CART
S-19665	11.8 x 9.8 x 7.7"	10.1 x 7.8 x 6.5"	0.3	2	$17	$16	$15	Specify Color
S-12676	15.2 x 10.9 x 9.7"	13.8 x 8.9 x 8.8"	0.6	3	18	17	16	Specify Color
S-13499	19.7 x 11.8 x 7.3"	17.7 x 10.1 x 6"	0.7	3	18	17	16	Specify Color
S-20588	21.8 x 15.2 x 9.3"	19.9 x 14.2 x 8.4"	1.4	5	19	18	17	Specify Color
S-25644	21.8 x 15.4 x 12.3"	19.8 x 13.8 x 11.3"	1.7	6	$19 each any quantity			Specify Color
S-14363	21.8 x 15.2 x 17.1"	19.8 x 13.8 x 15.8"	2.2	7	23	22	21	Specify Color
S-9745	26.9 x 16.9 x 12.5"	25.2 x 15.5 x 11"	2.3	8	28	27	26	Specify Color
S-9746	23.9 x 19.6 x 12.6"	22.5 x 18 x 11.5"	2.7	9	31	30	29	Specify Color
S-20589	27.9 x 20.6 x 15.25"	26 x 19 x 14"	4.0	13	51	49	47	Specify Color
▪ S-12677	30 x 22 x 20.5"	28.7 x 20.8 x 18.8"	6.1	17	106	103	100	Specify Color

▪ SHIPS VIA MOTOR FREIGHT


6. Provide IQF bait and survey to crabbers

The system is sufficiently operational to produce IQF bait at its full capacity. All major design hurdles have been overcome. We found with our fishing schedule a dramatic lack of time to distribute sample sets of IQF bait to crabbers. Therefore, we asked NORVA Bait, Inc. to assist us with distribution to crabbers willing to test the new product. Through this approach three separate crabbers successfully tested the IQF bait product. We requested these crabbers fill out our survey form and reply with any additional feedback. The feedback was very positive. The bait performed well and caught as many or more crabs as the block frozen bait. The reusable cartons were user friendly and required no more effort than cardboard cartons in their normal operation. Customers reported IQF bait cut down on handling time as opposed to block frozen bait. It was evident to the crabbers that the IQF process, due to its short freezing time vs. block frozen, resulted in an overall better quality bait.

Product Surveys are attached in Appendix 2.

If we could pick out a flaw in this study, it would be that our time constraints did not allow us to venture beyond our local area, limiting us to only a few surveyees. Our primary business “purse-seine fishing” does not grant us a lot of time to devote towards operating, promoting, or advertising the IQF product, as our fishing season coincides with the greatest demand for crab bait. We do believe, however, that the current infrastructure of bait distribution will facilitate full scale use. We also believe that the superior quality of IQF bait will result in increased demand, necessitating additional staffing.

7. Conclusion

We were pleased that the feedback from our surveyees was positive and they would recommend the bait to others. We achieved the goal of reducing the time spent thawing and prying apart block frozen bait. We also achieved the goal of presenting an alternative reusable packaging which cuts down on waste and potential pollution in the bay. Surveyees reported that their pots fished as well or better using our bait. Overall the freeze quality was better for the IQF because the fish were frozen more rapidly than block frozen.

Although the system and the concept are functional and prepared for full-scale operation, our company currently consists of three individuals. The vast majority of our time is dedicated to our primary business which is purse-seine fishing. This leaves us with a need to employ several individuals to institute functional day to day operation. Our intention is to continue exploring methods of distribution to areas outside our local community. This will hopefully build enough of a customer base to support the hiring of several employees, eventually leading to full-scale operation.

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APPENDIX 1: COASTAL IQF SURVEY

COASTAL IQF PRODUCTS Survey

1) How did the bait perform while in use. If satisfactory, why?

2) Was the IQF bait more effective, less effective, or about the same?

3) Was the use of the plastic carton something that works with your daily work routine? Why or why not?

4) Would you recommend this bait to others? Why or why not?

5) Based on the bait's performance would you purchase IQF bait if it cost more than bait block-frozen in wax-coated cardboard cartons?

Feedback From: _____

APPENDIX 2: SURVEY RESULTS

COASTAL IQF PRODUCTS Survey

1) How did the bait perform while in use. If satisfactory, why?

The bait was much easier to bait the pots with. It cut down on the time spent handling it. Much better than block-frozen.

2) Was the IQF bait more effective, less effective, or about the same?

More effective

3) Was the use of the plastic carton something that works with your daily work routine? Why or why not?

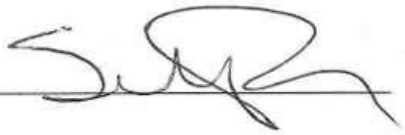
Returning the carton after use was easy to work into my routine. It was more manageable than keeping up with the trash after using block frozen bait in the cardboard boxes.

4) Would you recommend this bait to others? Why or why not?

Definitely. The IQF bait performed better and was easier to handle

5) Based on the bait's performance would you purchase IQF bait if it cost more than bait block-frozen in wax-coated cardboard cartons?

yes

Feedback From: 

COASTAL IQF PRODUCTS Survey

1) How did the bait perform while in use. If satisfactory, why?

BAIT OUT performs block FROZEN,
Quicker to HANDle & FROZEN quicker then block FROZEN
Fish Are Fresher

2) Was the IQF bait more effective, less effective, or about the same?

Most of the time, it caught more, Never less
Much FASTER to HANDle then block

3) Was the use of the plastic carton something that works with your daily work routine? Why or why not?

Yes, REUSABle CARTONS that CAN be used several times, will SAVE MUNEY & time

4) Would you recommend this bait to others? Why or why not?

Yes, For All the REASONS Above

5) Based on the bait's performance would you purchase IQF bait if it cost more than bait block-frozen in wax-coated cardboard cartons?

Yes

Feedback From: [signature]

IN

COASTAL IQF PRODUCTS Survey

1) How did the bait perform while in use. If satisfactory, why?

BAIT PERFORMED WELL. DIDN'T HAVE TO PRY APART WHICH CUT THE HANDLING TIME SOME

2) Was the IQF bait more effective, less effective, or about the same?

THE BAIT FISHED LONGER BECAUSE IT DIDN'T NEED ANY THAW TIME. SO THE BLOOD STAYED IN THE FISH.

3) Was the use of the plastic carton something that works with your daily work routine? Why or why not?

PLASTIC CARTONS WORKED FINE FOR ME. ABLE TO JUST SWAP EMTYS FOR FULLS. NO EXTRA TRIPS

4) Would you recommend this bait to others? Why or why not?

YES, I HAD GOOD RESULTS. GOOD BAIT, SAVES TIME AND EFFORT.

5) Based on the bait's performance would you purchase IQF bait if it cost more than bait block-frozen in wax-coated cardboard cartons?

YES AS LONG AS THE DIFFERENCE WASN'T TOO GREAT.

Feedback From: _____