UF IFAS Extension UNIVERSITY of FLORIDA

UF/IFAS PEER REVIEWED

FA256

https://doi.org/10.32473/edis-FA256-2023

Florida Marine Baitfish Aquaculture Series – Part 1: Marketing Opportunities and Challenges[1]

Marissa Drake, Andrew Ropicki, Matthew A. DiMaggio, Kelly Grogan, Cortney L. Ohs, Laura Tiu, Edward V. Camp, and Jordan Moor[2]

A Series on Florida Marine Baitfish Aquaculture

In 2018, Florida ranked ninth among US states in aquaculture production as measured by farmgate value with approximately $71.6 million in sales revenue (USDA NASS 2019). Florida aquaculture is extremely diverse; the state ranked first in ornamental fish production, third in crustacean production, and seventh in mollusk production by farmgate revenue in 2018 among all states (USDA NASS 2019). These aquaculture industries have benefited from Florida's warm weather and easy access to large urban areas. These factors combined with Florida's role as a marine sportfishing destination make the state an ideal location for a marine baitfish aquaculture industry. While Florida is home to several live marine baitfish aquaculture producers, it is still a small but growing industry. Despite numerous studies within the field examining the biology associated with marine baitfish aquaculture, limited information on production and marketing for the recreational fishing industry is available.

This publication is designed to supplement previous publications that examined candidate species for aquaculture, most of which focused on biological requirements. These previous publications include: FA148 – Atlantic Croaker, FA160 – Pigfish, FA168 – Pinfish, FA190 – Gulf Killifish, SGEB69 – Growing Marine Baitfish, and FA221 – Opportunities and Obstacles to Aquaculture in Florida. This publication outlines opportunities and challenges associated with marketing aquacultured live marine baitfish in Florida. In it we examine why the state of Florida is uniquely suited for the continued development of this industry, an overview of the marine recreational angling baitfish market, benefits and opportunities associated with marine baitfish marketing, and the challenges associated with selling live baitfish to marine baitfish retailers. This publication is intended to provide information to current and potential farmers, management agencies and other interested stakeholder groups.

Florida's Marine Recreational Angling Baitfish Market

Marine recreational angling is a popular pastime in Florida. In 2017, 82.2 million marine recreational fishing trips were taken in Florida. Forty-nine percent of those trips occurred on the Atlantic coast, and 51% of them took place

1. This document is FA256, one of a series of the School of Forest, Fisheries, and Geomatics Sciences Program in Fisheries and Aquatic Sciences. Original publication date March 2023. Visit the EDIS website at for the currently supported version of this publication.

2. Marissa Drake, master's graduate, School of Forest, Fisheries, and Geomatics Sciences; Andrew Ropicki, assistant professor/Extension economist, Food and Resource Economics Department and Florida Sea Grant College Program; Matthew A. DiMaggio, associate professor, UF/IFAS Tropical Aquaculture Laboratory, School of Forest, Fisheries, and Geomatics Sciences; Kelly Grogan, associate professor, Food and Resource Economics; Cortney L. Ohs, associate professor, School of Forest, Fisheries, and Geomatic Sciences; Laura Tiu, UF/IFAS Extension Florida Sea Grant agent; Edward V. Camp, assistant professor, School of Forest, Fisheries, and Geomatic Sciences; and Jordan Moor, PhD student, Food and Resource Economics Department; UF/IFAS Extension, Gainesville, Florida 32611.

on the Gulf coast. Recreational fishing is a major economic driver for Florida's coastal economy. Trip expenditures for saltwater fishing in Florida during 2017 had an estimated economic contribution of $3.2 billion in spending and supported 39,936 jobs. Saltwater fishing trips contributed $4.1 billion in output (gross sales), $1.4 billion in labor income, and $2.6 billion in value-added (state-level gross domestic product) (Lovell et al. 2020).

The popularity of marine recreational angling in Florida has created a sizable bait industry within the state. In 2017, Florida saltwater recreational anglers spent an estimated $443.5 million on all types of bait (Lovell et al. 2020). This estimate was measured at the recreational angler level and may understate bait expenditures associated with for-hire fishing trips where the cost of bait is paid by the charter or guide operator and included in the guide fee or charter price. The Lovell et al. (2020) estimate was generated using fishing trip estimates and angler trip-level spending surveys that did not distinguish between different types of bait (live, dead, frozen, artificial, species, etc.), and were not baitfish specific. These issues make it more of a challenge to identify the size of the Florida live baitfish market.

Currently, most marine baitfish sold to Florida recreational saltwater anglers are wild caught by Florida commercial harvesters, which means an estimation of the marine baitfish market can be made using Florida Fish and Wildlife Conservation Commission (FWC) commercial landings data. Table 1 presents the estimated total dockside value for 2018 through 2020 of Florida commercial landings for several species of commonly used marine baitfish. These figures are not specific to the marine recreational angling baitfish market. Some of the landings were likely sold as food fish or bait for commercial fishing operations. However, it is likely that most of these landings were sold to recreational saltwater anglers through retail operators based on limited sales of these species as food fish or bait for commercial fishing enterprises. Additionally, the table does not include sales by current marine baitfish aquaculture producers in Florida or baitfish harvested in other states but sold to Florida baitfish retailers.

Marine Baitfish Marketing Opportunities

Aquaculture of live marine baitfish for the Florida recreational fishing sector has several attractive traits for current and potential producers. The first beneficial trait is the value of the product. Ohs et al. (2021) found that Florida baitfish retailers, on average, paid $0.41 to $0.55 for wild-caught live pinfish, and $0.27 to $0.68 for wild-caught live pigfish purchased from bait fishers or baitfish wholesalers depending on the size of the fish. The same study found that the mean price retailer respondents would pay for aquacultured fish was greater than the mean price they paid for wild-caught species for all sizes of pinfish and three of four size classes of pigfish. While the price per fish is rather small, baitfish are sold at much smaller sizes than food fish, and wholesale baitfish prices compare favorably to wholesale food fish prices. Using per-fish weight and length data from a pinfish stocking density experiment combined with price data from Ohs et al. (2021), we get a wholesale price range of $7 to $18 per pound for wild-caught pinfish and $11 to $27 per pound for aquacultured pinfish (Ohs et al. 2010). We used the largest fish at the initial stocking of the project (2.64 inches and 0.025 pounds) and the average size of fish at the highest stocking density at the end of the experiment (4.29 inches and 0.074 pounds) from the stocking density research (Ohs et al. 2010), combined with the prices from Ohs et al. (2021) for medium (2-4 inch) and large (4-6 inch) pinfish. While limited Florida-specific data is available on wholesale prices for farm-raised food fish and crustaceans, a recent study found Texas-based fish farmers earned $3.00–3.65 per pound for red drum, $2.80 per pound for pacific white shrimp, and $3.25–3.50 per pound for hybrid striped bass (Treece 2017). All of these food fish prices were below marine baitfish wholesale prices per pound. This means baitfish represent a potentially lucrative production option for Florida aquaculture producers, comparatively.

Another attractive trait of marine baitfish aquaculture in Florida relates to product demand. While the number of baitfish buyers is less than the number of seafood consumers, past research has indicated that demand for live bait often exceeds supply. Adams et al. (1998) conducted the first study of the Florida market for live marine baitfish by surveying wholesale and retail bait dealers around the state and found demand often exceeds supply for most species and for preferred sizes, partly due to the seasonality of wild harvest. Limited availability of baitfish has been a recurring theme in studies of marine recreational baitfish markets in Florida and other Gulf states. Ohs, Beany, and DiMaggio (2021) surveyed Florida marine baitfish retailers and found the most common complaint with baitfish suppliers was a lack of consistent availability. When the same retailers were asked about important attributes an aquacultured baitfish product could supply, 63% of respondents indicated consistent availability was most important (Ohs, Beany, and DiMaggio 2021).

In a 2018 study, Florida marine recreational anglers who were asked what attributes, on average, would be most important for an aquacultured baitfish sold by retailers and respondents indicated that consistent supply was most important. The same study found that over 88% of anglers reported that retailers sometimes, rarely, or never had adequate bait supply, suggesting that these retailers could not meet the demand of the customers (Ohs, DiMaggio, and Beany 2018). The issue of limited baitfish supply is not restricted to Florida. In a survey of Texas retailers, 64–73% of respondents indicated they could sell more live bait if supply were available, depending on the species considered (Ropicki and Fuiman 2020). The lack of adequate supply of live marine baitfish seems to suggest there are additional opportunities for expanded production.

Quality issues with wild-caught baitfish also represent an opportunity for marine baitfish farmers. In the 2018 study of Florida marine recreational anglers, 13% of respondents reported that the quality of live marine baitfish sold by retailers was lacking, and 6% reported that the size offered did not match their angling needs (Ohs, DiMaggio, and Beany 2018). Ohs, Beany, and DiMaggio (2021) found that 9% of Florida bait retailers reported that baitfish quality was poor. Twenty-six percent of Florida bait retailers believed the most important attribute aquacultured baitfish could possess was in-store survival, and 16% listed liveliness as the most important attribute. In Ropicki and Fuiman's study of Texas bait retailers (2020), respondents reported that in-store survival was the second most important attribute of live baitfish, behind consistent availability. These results suggest that, by having control of the production and harvesting processes, marine baitfish farmers could potentially provide the market with baitfish that are livelier and survive longer in retailer and angler holding systems. This increase in product quality could lead to farmers receiving a premium price relative to wild-caught baitfish.

The seasonality of wild-caught baitfish availability presents another potential opportunity for baitfish farmers. Farmers could potentially grow fish to meet excess demand when wild-caught baitfish is available and expand the market by providing fish when wild-caught product isn't available. For some species, like pinfish, anglers want different sizes at different times of the year based on fishing location and/or species targeted (Ohs, DiMaggio, and Beany 2018). Anglers need small (1- to 2-inch) pinfish during the winter and medium (2- to 4-inch) fish during the spring (Ohs, DiMaggio, and Beany 2018). However, adult pinfish migrate offshore to spawn during the winter and larval fish come back to shore in the spring (Ohs, Grabe, and DiMaggio 2018; Oesterling, Adams, and Lazur 2004). This means in the winter season, the large fish are offshore, and the small fish (which are in demand) are not available inshore to be harvested. In the spring, when medium-sized fish are desired, there is an influx of small pinfish due to the juvenile inshore migration, which makes obtaining medium-sized pinfish in the wild more difficult. The demand for select sizes of pinfish is inconsistent with the available wild supply, and as a result, retailers often have an insufficient supply of pinfish and struggle to provide desired sizes throughout the year. Production of aquacultured baitfish has the potential to match recreational demand in terms of quantity and size preference, since baitfish producers have the ability to spawn fish outside of the normal season and thus can provide fish of different sizes throughout the year.

Previous research has found that baitfish retailers and recreational saltwater anglers are receptive to the idea of aquacultured baitfish. Ohs, DiMaggio, and Beany (2018) found that 49% of Florida recreational saltwater anglers responding to their survey would purchase an aquacultured pinfish as bait and 36% would consider it; similarly, 29% of respondents said they would purchase an aquacultured pigfish as bait and 30% would consider it. The difference in acceptance across species is likely due to differences in use between the two species. Pinfish are generally a more popular bait among Florida anglers. Florida baitfish retailers were also receptive to purchasing aquaculture baitfish. In a survey, 36% indicated they would purchase aquacultured pinfish for resale in their store and 46% would consider it. For pigfish, the numbers were 29% and 44%, respectively (Ohs, Beany, and DiMaggio 2021). This openness to aquacultured baitfish is promising for industry growth.

Marine Baitfish Marketing Challenges

Despite the opportunities associated with marine baitfish production, there are several challenges that producers would face. First, unlike food fish that can be processed prior to sale to retailers or distributors, baitfish must be delivered alive. The bait must survive transport and remain alive in the retailer's tanks until they are sold. Transport can stress fish and increase mortality rates. Producers must take available steps to limit stress on fish. Transport tanks must be stocked at appropriate densities and water quality must be maintained using techniques such as aeration, oxygenation, and/or temperature control. These techniques increase costs and represent a challenge producers must deal with.

Marketing farmed marine baitfish is in many ways more difficult than marketing farmed food fish. Food fish producers can often sell entire crops of fish in one or few occurrences through wholesalers because processed fish can be easily shipped worldwide. Production and delivery of baitfish, on the other hand, must necessarily be limited, local, and completed in small batches. While demand does currently exceed supply, because bait retailers' tank space is limited, they may simply not have room for all the fish, and live bait is highly perishable. Delivery of product to each retailer will therefore need to be done frequently in manageable quantities. Moreover, the geographic market area that a baitfish producer could supply is likely limited by the perishability of the fish. Use of live-haulers (live fish transporters) that transport large quantities of fish vast distances to increase the market area is not feasible because it would require frequent stops at multiple bait retail stands and frequent handling and disturbance of the fish which would induce stress on the fish and likely lead to high levels of mortality. These challenges could limit the potential market footprint of any single baitfish producer.

Lastly, the need to develop and maintain numerous relationships with baitfish retailers will likely be time consuming and costly but is nevertheless essential for baitfish producers. Unlike food fish producers who can sell an entire crop at once and work only occasionally with one or a few distributors and retailers, baitfish farmers would need to provide product to retailers on a consistent and as-needed basis. Producers will likely need to cultivate and sustain relationships with multiple retailers, incurring substantial marketing costs in the form of owner/employee time.

Summary

Marine batfish aquaculture is a new industry in Florida, and the marine baitfish retail sector provides several potential advantages and opportunities for current and potential growers relative to food fish marketing. At the same time, marketing live baitfish for the marine recreational angling sector involves several challenges. These advantages, opportunities, and challenges are summarized in Table 2. The advantages of the marine baitfish market include the product's high value and excess demand. Wholesale prices for live marine baitfish are higher than prices associated with commonly cultured food fish, and surveys of baitfish retailers and consumers have indicated that demand for live marine baitfish exceeds supply. Issues with availability and quality of wild-caught supply represent opportunities for baitfish aquaculture producers. Wild-caught baitfish supply is seasonal with limited availability and supplied bait sizes do not currently meet seasonal demand. Additionally, retailer surveys have indicated wild-caught baitfish in Florida sometimes have low in-store survival rates and lack liveliness. Baitfish farmers that can match demand and provide fish that survive longer in-store and are more lively than wild-caught fish have the potential to capture a price premium for their product.

Marketing live marine baitfish is relatively challenging because of the nature of the product and the retailers. Selling fish that must survive in-store and during a fishing trip creates additional costs, and marketing live fish, because of the associated handling and transport considerations, is much more complicated and expensive than marketing most commonly cultured food fish. Growers will need to invest in transport equipment, and their market footprint will likely be limited geographically to ensure product survival. Additionally, retailer tank space for live baitfish is often limited, which will require farmers to sell their baitfish in small batches to multiple stands. Developing and maintaining relationships with multiple retailers could be costly for growers.

Understanding the marketing opportunities and challenges associated with marine baitfish aquaculture is only some of the information potential baitfish producers need. Additional information needed by producers regarding production practices include species culture considerations and production system options. These issues are addressed in the next publication in the series.

References

Adams, C. M., A. M. Lazur, P. Zajicek, and D. Zimet. 1998. *An Assessment of the Market for Live Marine Baitfish in Florida*. Bureau of Seafood and Aquaculture, Florida Department of Agriculture and Consumer Services, Tallahassee, FL.

Camp, E., T. Garlock, and J. Anderson. 2020. "Opportunities and Obstacles to Aquaculture in Florida." *EDIS* 2020 (3): 6. https://doi.org/10.32473/edis-fa221-2020.

Cassiano, E. J., C. L. Ohs, and J. E. Hill. 2018. "Candidate Species for Florida Aquaculture: Pigfish, *Orthopristis chrysoptera*." *EDIS* 2018. https://edis.ifas.ufl.edu/publication/FA160.

Creswell, L. R., C. L. Ohs, and C. L. Miller. 2018. "Candidate Species for Florida Aquaculture: Atlantic Croaker, *Micropogonias undulatus*." *EDIS* 2018. https://edis.ifas.ufl.edu/publication/FA148.

Florida Fish and Wildlife Conservation Commission. *Commercial Fisheries Landings Summarieshttps://public.myfwc.com/FWRI/PFDM/ReportCreator.aspx*. Accessed on October 12, 2021.

Lovell, S. J., J. Hilger, E. Rollins, N. A. Olsen, and S. Steinback. 2020. *The Economic Contribution of Marine Angler Expenditures on Fishing Trips in the United States, 2017*. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-201, 80p. https://spo.nmfs.noaa.gov/sites/default/files/TM201.pdf.

Oesterling, M. J., C. M. Adams, and A. M. Lazur. 2004. *Marine Baitfish Culture*. Marine Resource Advisory 77: 1–77. Virginia Institute of Marine Science, College of William and Mary. https://www.vims.edu/GreyLit/VIMS/MRA77.pdf.

Ohs, C. L., S. W. Grabe, S. M. DeSantis, M. A. DiMaggio, and A. L. Rhyne. 2010. "Culture of Pinfish at Different Stocking Densities and Salinities in Recirculating Aquaculture Systems." *North American Journal of Aquaculture* 72 (2): 132–140. https://doi.org/10.1577/A09-028.1.

Ohs, C. L., R. L. Creswell, and M. A. DiMaggio. 2013. "Growing Marine Baitfish: A Guide to Florida's Common Marine Baitfish and their Potential for Aquaculture." https://nsgl.gso.uri.edu/flsgp/flsgph13002.pdf.

Ohs, C. L., M. A. DiMaggio, and A. H. Beany. 2018. "Preferences for and Perception of Cultured Marine Baitfish by Recreational Saltwater Anglers in Florida." *Aquaculture Economics & Management,* 22 (2): 264–278. https://doi.org/10.1080/13657305.2017.1298007.

Ohs, C. L., S. W. Grabe, and M. A. DiMaggio. 2018. "Candidate Species for Florida Aquaculture: Pinfish, *Lagodon rhomboides*." *EDIS* 2018.https://edis.ifas.ufl.edu/publication/FA168.

Ohs, C. L., A. H. Beany, and M. A. DiMaggio. 2021. "Survey of Florida Marine Baitfish Retailers: Assessment of Wholesale Supply and the Market Potential for Cultured Pinfish and Pigfish." *Aquaculture Economics & Management* 26 (1):57–76. https://doi.org/10.1080/13657305.2021.1893864.

Ramee, S. W., J. T. Patterson, C. L. Ohs, and M. A. DiMaggio. 2019. "Candidate Species for Florida Aquaculture: Gulf Killifish, *Fundulus grandis*." *EDIS* 2019. https://edis.ifas.ufl.edu/publication/FA190.

Ropicki, A. J., and L. A. Fuiman. 2020. "Evaluating the Potential Market for Cultured Marine Baitfish: A Survey of Texas Bait Stands." *Aquaculture Economics & Management* 24 (1): 64–78. https://doi.org/10.1080/13657305.2019.1641573.

Treece, G. D. 2017. *The Texas Aquaculture Industry – 2017*. Treece & Associates. https://www.texasaquaculture.org/PDF/2017%20PDF%20Documents/Tex.%20aquaculture%20industry%202017.pdf.

USDA (U.S. Department of Agriculture). 2019. *Census of Aquaculture (2018)*. USDA National Agricultural Statistics Services, Washington, D.C. Available: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/Aquaculture/Aqua.pdf.

Table 1. FWC Commercial Baitfish Landings by Species (Source: FWC 2021).

Species	2018	2019	2020	Average
Baitfish – uncategorized	$532,621	$605,743	$584,595	$574,320
Bigeye scad (goggle eye)	$333,746	$358,251	$276,998	$322,998
Atlantic croaker	$70,035	$104,309	$193,272	$122,539
Menhaden	$112,105	$92,041	$110,313	$104,820
Mojarra	$558,930	$574,048	$584,114	$572,364
Pinfish	$296,502	$360,366	$463,786	$373,551
Round scad (cigarfish)	$498,814	$101,752	$185,579	$262,048
Sand perch	$2,339	$5,743	$912	$2,998
Scaled sardines	$148,548	$82,502	$170,444	$133,831
Spanish sardines	$394,257	$72,986	$174,792	$214,012
Spot	$82,944	$117,666	$30,199	$76,936
Thread herring	$499,063	$1,031,276	$458,704	$663,014
Total	$3,529,904	$3,506,683	$3,233,708	$3,423,432

Table 2. Marine Baitfish Marketing—Advantages, Opportunities, and Challenges.

Advantages	Opportunities	Challenges
• High valued product relative to food fish • Excess demand relative to wild-caught supply	• Providing product when wild-caught isn't available • Providing anglers with desired sizes throughout the year • Providing a higher quality product with better in-store survival	• Product must survive transport, in-store storage, and during the fishing trip • Retailers have limited tank space necessitating frequent small-batch deliveries • Growers will likely have to develop and maintain relationships with multiple retailers