

**MARKET EVALUATION OF PINFISH, *LAGODON RHOMBOIDES*, A MARINE
BAITFISH FOR THE SOUTHEASTERN UNITED STATES
FY 2010**

The annual economic impact of the Florida recreational fishery is about \$7.5 billion, the highest of any state in the United States. Despite Florida's importance as a premier fishing location, of the 257 baitfish farms identified in the 2005 USDA census of aquaculture, only 2 were located in Florida indicating potential for expansion and diversification of the aquaculture market within the state. Baitfish marketing and distribution have historically occurred on the local level. Although the cultural requirements for several marine baitfish species are known, the number of producers has not increased. This is likely due to lack of knowledge of supply and demand, wholesale and retail prices, and the perceptions of anglers and retailers about aquaculture produced marine baitfish as opposed to wild sources. The descriptive market information necessary to shape production and marketing strategies is lacking.

Using surveys of anglers and bait retailers, this project evaluated and described the market for aquaculture produced pinfish (*Lagodon rhomboides*) within Florida. The surveys indicated that local farmers producing this new product would be able to take advantage of a well-established distribution network and strengthen their agricultural competitiveness through enterprise diversification with marine baitfish. Moreover, it would help to diversify aquaculture within the southeastern U.S. and develop locally cultured live baitfish markets uninfluenced by foreign aquaculture production.

FINAL REPORT

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University of Florida - Market evaluation of pinfish, *Lagodon rhomboides*, a marine baitfish for the southeastern United States

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Problem

Florida's \$7.5 billion annual economic impact for its recreational fishery is the highest of any state in the U.S. according to the 2006 National Survey of Fishing, Hunting, and Wildlife-associated Recreation. The Florida Fish and Wildlife Conservation Commission reports that Florida's recreational saltwater fishery had an economic impact of \$5.2 billion in 2006 and was responsible for 51,500 jobs. Despite these overwhelming statistics establishing Florida as a premier fishing location, of the 257 baitfish farms recorded in the 2005 USDA census of aquaculture, only 2 were located in Florida. This disparity clearly illustrates the potential for expansion and diversification of the aquaculture market within the state of Florida and provides a strong impetus for research into marine baitfish aquaculture. The culture methods of several marine baitfish species are known but the number of producers has not increased, likely because of or influenced by the lack of knowledge of supply and demand, wholesale and retail price, and anglers and retailers perception of aquaculture produced marine baitfish.

The descriptive market information necessary to shape production and marketing strategies is lacking. Therefore, the objectives of this project were to evaluate and describe the market for aquaculture produced pinfish (*Lagodon rhomboides*) within Florida. Administration of survey instruments developed to solicit vital information from anglers and bait retailers will provide valuable information requisite to successful product market entry. Baitfish marketing and distribution has historically occurred on the local level. Local farmers producing this new crop would be able to take advantage of a well-established distribution network and strengthen their agricultural competitiveness through enterprise diversification with marine baitfish. Moreover, it would help to diversify aquaculture within the southeastern U.S. and develop locally cultured live baitfish markets uninfluenced by foreign aquaculture production.

How the Problem was Addressed

We conducted a market evaluation for aquacultured pinfish within the state of Florida.

- **Developed and implemented survey instruments designed to solicit specific market descriptive information from Florida anglers and bait retailers, necessary for successful product entry into established local markets by producers.**

Two surveys instruments were developed; one specifically designed for anglers and the other specifically designed for bait retailers. Angler survey questions addressed angler demographics, quantity and destination of fishing trips, preferred bait species and characteristics, perception of aquaculture, pinfish purchase habits, pinfish price and availability, seasonality of pinfish supply, and interest in purchasing an aquacultured pinfish. A copy of the angler survey is attached in the Appendix. Bait retailer survey questions focused on business location, baitfish species sold, shortcomings of wild baitfish, preferred baitfish characteristics, perception of aquaculture, quantities of pinfish sold, pinfish wholesale purchase prices, purchasing habits as they relate to season and pinfish size, pinfish market demand within the region, and interest in purchasing an aquacultured pinfish. A copy of the retailer survey is located in Appendix.

- **Administration of a market survey to Florida saltwater anglers through an online survey website.**

Angler surveys were administered through an online survey website (www.surveymonkey.com). Email addresses of saltwater fishing license holders (350,000+) was purchased from the Florida Fish and Wildlife Conservation Commission and transposed into a database for use. The database was reviewed and edited yielding a database comprised solely of Florida residents with a current saltwater fishing license.

An email was sent (June 9, 2011) notifying the 227,829 Licensed Florida Resident Saltwater Anglers to be expecting a survey via email. The survey invitation was emailed on June 28, 2011 (Appendix). The email included a cover letter explaining the purpose and importance of the survey, the University of Florida IRB approval number and contact information, and a link to the online survey on the Survey Monkey website. Sixty-five days later (September 1, 2011), the on-line survey was closed.

- **Administration of a market survey to Florida Atlantic coast bait retailers through various vehicles (online media, face-to-face interviews etc.).**

Following a modified Dillman total design survey method, we implemented and completed the bait retailer survey. Post cards were mailed (March 23, 2011) notifying 119 bait retailers in 13 counties along the Florida Atlantic Coast to be expecting a survey in the mail. We mailed the survey instrument (March 29, 2011) to 119 bait retailers in 13 counties. The instrument contained a cover letter explaining the purpose and importance of the survey, and the UF IRB approval number and contact information; the 22 question survey; and a self-addressed stamped envelope. Seventeen days later (April 15, 2011), a reminder letter, a duplicate 22 question survey, and a self-addressed stamped envelope were mailed to retailers that had not responded.

- **Disseminate collected data to current and potential producers through scientific and extension publications and presentations.**

Results were presented at scientific and extension meetings. Results will be published in a scientific journal and extension publications.

Public and Private Agency Cooperators

None of the work performed was by public or private agency cooperators.

Results

Results - Angler Survey

Results show 14,871 of the surveyed anglers (6.5%) completed the survey.

Answers to each question are summarized below:

1. **Age** – Overall mean 45.9 years, Male 46.2 years, Female 44.0 years, survey responses 14,871
2. **Sex** – 87.5% male, 12.5% female, survey responses 14,871
3. **County in which most of your fishing activities occur?** Summarized in Figure 1, survey responses 14,789
4. **Are you a boat owner?** 70.5% yes, 29.5% no, survey responses 14,871
5. **Do you most often fish from a BOAT CANOE/KAYAK LAND/STRUCTURE WADING?**
Boat 79.7%, Canoe/Kayak 6.5%, Land/Structure 10.3%, Wading 3.5%, survey responses 14,871
6. **On average, how many marine fishing trips do you take in a year?**
Range 0-400 trips, mean 28 trips, survey responses 14,602
7. **Of the total number of trips you take per year, for how many do you purchase live marine baitfish?** Range 0-400 trips, mean 8.6 trips, survey responses 14,494
8. **Of those trips, how many are spent NEARSHORE, OFFSHORE, TROLLING/LIVELINING, BOTTOM FISHING?**

- **Nearshore (≤1 mile from land)** 18.52 trips
- **Offshore (>1 mile from land)** 12.18 trips
- **Trolling/Livelining** 11.08 trips
- **Bottom fishing** 11.35 trips

9. Do you primarily catch or purchase your live marine baitfish?

57.8% catch, 32.1% purchase, 10.1% do not use live bait, survey responses 14,871

10. If you purchase your live marine baitfish, approximately how much do you spend per trip on live baitfish?

Range \$0-\$1000, mean \$26.82 per trip, survey responses 7,471

11. What is your favorite live marine baitfish for NEARSHORE, OFFSHORE, TROLLING/LIVELINING, BOTTOM FISHING?

- **Nearshore (≤1 mile from land)** – Summarized in Table 1, survey responses 12,280
- **Offshore (>1 mile from land)** – Summarized in Table 2
- **Trolling/Livelining** – Summarized in Table 3
- **Bottom fishing** – Summarized in Table 4

12. What is your biggest complaint with marine baitfish sold by stores/dealers?

PRICE AVAILABILITY QUALITY SIZE NONE OTHER_____

Price 30.7%

Availability 25.9%

Quality 13.1%

Size 6.0%

None 20.9%

Other 3.3%

survey responses 13,643

13. If aquaculture could produce an ideal live marine bait which characteristics would be most important?

(Rank the characteristics in order of importance from 1 – 6, with 1 being the most important and 6 being the least)

___Consistent availability ___Price ___Preferred size ___Survival ___Color ___Liveliness

	1	2	3	4	5	6	Mean Rank
Consistent Availability	30.7%	18.5%	13.4%	13.4%	12.9%	11.1%	2.93
Price	24.4%	22.4%	15.7%	13.2%	13.3%	11.0%	3.02
Preferred Size	5.3%	12.8%	24.8%	23.5%	23.5%	10.0%	3.77
Survival	16.2%	21.5%	22.3%	21.7%	12.6%	5.7%	3.10
Color	7.4%	5.3%	5.3%	9.6%	20.6%	51.8%	4.86
Liveliness	15.9%	19.6%	18.5%	18.6%	17.1%	10.3%	3.32

Survey responses 14,871

14. What is your perception of aquaculture as a means to produce bait?

**POSITIVE SOMEWHAT POSITIVE UNKNOWN SOMEWHAT NEGATIVE
NEGATIVE**

Positive 43.8%

Somewhat Positive 20.6%

Unknown 31.0%

Somewhat Negative 2.6%

Negative 2.0%

Survey responses 14,871

15. Of the fishing trips you take in a year, how many trips do you purchase live pinfish?

Range 0-524, mean 2.27 trips they purchase pinfish, survey responses 11,695, 8,127 said 0 trips

16. How many dozen live pinfish do you purchase per trip?

Range 0-36 dozen, mean 0.81 dozen, survey responses 9,873, 6,427 said 0 dozen

17. What price do you normally pay for a dozen live pinfish?

\$ _____/Small(1-2") \$ _____/Medium(2-4") \$ _____/Large(4-6") \$ _____/XL(>6")

Small – Range \$1-\$80, mean \$8.50, survey responses 1015

Medium – Range \$1-\$800, mean \$10.70, survey responses 2124

Large – Range \$1.25-\$100, mean \$12.56, survey responses 914

XL – Range \$2.50-\$125, mean \$15.06, survey responses 428

18. What sizes do you use at what times of the year? (Place an X in the boxes of all that apply)

	Winter (Dec. – Feb.)	Spring (Mar. – May)	Summer (June – Aug.)	Fall (Sept. – Nov.)
Small (1 – 2")	60.4%	45.9%	38.4%	30.3%
Medium (2 – 4")	53.7%	73.0%	61.2%	54.3%
Large (4 – 6")	32.1%	47.9%	64.8%	45.5%
XL (> 6")	26.4%	29.1%	47.8%	42.9%

Survey responses 6,078

19. How would you characterize the availability of live pinfish from local retailers in your region? ALWAYS SOMETIMES RARELY NEVER

Always 11.4%

Sometimes 55.9%

Rarely 19.6%

Never 13.1%

Survey responses 8,321

20. Would you purchase an aquaculture produced pinfish? YES MAYBE NO

Yes 49.3%

Maybe 35.5%

No 15.2%

Survey responses 11,956

21. How much would you will be willing to pay for one dozen live aquaculture produced pinfish? \$_____/Small \$_____/Medium \$_____/Large \$_____/XL

Small – Range \$0.60-\$300, mean \$6.30, survey responses 3161

Medium – Range \$0.60-\$800, mean \$8.22, survey responses 4366

Large – Range \$0.60-\$100, mean \$9.33, survey responses 3096

XL – Range \$0.60-\$125, mean \$10.74, survey responses 2297

22. County in which pinfish would be mostly used?

Summarized in Figure 2, survey responses 11,237

Results - Bait Retailer Survey

Sixty of 119 retailers sent a survey responded (50.4%) and were from 12 of 13 counties surveyed (92.3%).

The following is a summary of the survey results:

Do you sell live marine baitfish?

Yes - 50.0%

No - 41.7%

No Answer - 8.3%

If yes, how many species of live bait do you sell?

Mean - 2.4 different species

If no, why not?

33.3% are not equipped for it

16.7% bait is too hard to keep alive

11.0% only sell fresh water bait

What are the three most popular species of live baitfish you sell?

1. Shrimp 56.3%
Pinfish 28.1%
2. Finger Mullet 19.2%
Pinfish 15.4%
Pigfish 15.4%
Mud Minnows 15.4%
3. Crabs 33.3%

What is your biggest complaint with marine baitfish you purchase from your suppliers?

Availability – 56.8%

None – 35.1%

Quality – 8.1%

Price - 0

If aquaculture could produce an ideal live marine bait which characteristics would be most important?

Ranked in order:

Consistent Availability

Survival

Price

Liveliness

Preferred Size

Color

What is your perception of aquaculture as a means to produce baitfish?

Positive – 46.0%

Somewhat Positive – 13.5%

Unknown – 27.0%

Somewhat Negative – 5.4%

Negative – 8.1%

Do you sell live pinfish for bait?

Yes – 25%

No – 53.3%

No Answer – 21.7%

Please estimate how many live pinfish you sell per year.

Mean – 9123

Range – 800-26,000

What price do you normally pay wholesalers/bait fisherman for one live pinfish?

<u>Size (in.)</u>	<u>Average Paid (\$)</u>	<u>Range (\$)</u>
Small (1-2)	.50	.20 – 1.50

Medium (2-4)	.51	.20 – 1.50
Large (4-6)	.63	.20 – 1.50
XL (>6)	.80	.20 – 1.50

What sizes do you purchase and at what times of the year?

Size (in.)	Winter (Dec.-Feb.)	Spring (Mar.-May)	Summer (June-Aug.)	Fall (Sept.-Nov.)
Small (1-2)	7.0%	6.1%	7.0%	8.1%
Medium (2-4)	9.1%	10.1%	9.1%	9.1%
Large (4-6)	8.1%	8.1%	6.1%	6.1%
XL (>6)	1.0%	2.0%	2.0%	1.0%

What times of the year do you see shortages in demanded sizes for live pinfish?

Size (in.)	Winter (Dec.-Feb.)	Spring (Mar.-May)	Summer (June-Aug.)	Fall (Sept.-Nov.)
Small (1-2)	12.2%	4.9%	7.3%	7.3%
Medium (2-4)	14.6%	4.9%	4.9%	4.9%
Large (4-6)	17.0%	4.9%	4.9%	4.9%
XL (>6)	4.9%	--	--	2.4%

Overall, how would you characterize the availability of live pinfish from your supplier?

Always – 50%
 Sometimes – 27.8%
 Rarely – 11.1%
 Never – 11.1%

How would you characterize the demand for live pinfish in your region?

I could sell more if I could get them 27.8%
 The supply purchased is all I can sell 27.8%
 I cannot sell what I purchase 0%
 I am not sure 44.4%

Would you purchase an aquaculture produced pinfish?

Yes – 24.0%
 No – 28.0%
 Maybe – 48.0%

If YES or MAYBE, if an aquacultured pinfish possessed the ideal characteristics listed earlier, how much would you be willing to pay per fish?

Size (in.)	Mean (\$)	Range (\$)
Small (1-2)	.44	.20 – 1.00
Medium (2-4)	.46	.20 – 1.00
Large (4-6)	.53	.20 – 1.00
XL (>6)	.55	.20 – 1.00

Figure 1. Number of respondent anglers by county where they primarily fish.



Figure 2. Number of respondents in each county where pinfish were purchased by anglers.



Table 1. Number of responses by anglers for their favorite baitfish nearshore (≤ 1 mile from land).

Baitfish	Number of Anglers - Nearshore
Pinfish	2035
Threadfin	1629
Scaled Sardine	1415
Mullet	1391
Mud Minnow	633
Menhaden	325
Sardine	247
Goggle eye	139
Pigfish	137
Croaker	72
Round scad	68
Ballyhoo	43
Ladyfish	28
Spanish sardine	27
Blue runner	23
Eel	11
Mojarra	7
Anchovy	5
Sand perch	5
Silverside	5
Blue fish	2
Mackerel	2
Spanish mackerel	2
Bonita	1
Speedo	1
Whiting	1

Table 2. Number of responses by anglers for their favorite baitfish offshore (>1 mile from land).

Baitfish	Number of Anglers - Offshore
Pinfish	2279
Threadfin	863
Scaled sardine	656
Goggle eye	611
Ballyhoo	554
Menhaden	445
Sardine	391
Mullet	277
Mud minnow	259
Blue runner	219
Round scad	164
Pigfish	65
Spanish sardine	53
Sand perch	28
Croaker	19
Ladyfish	19
Mackerel	12
Bonita	11
Speedo	10
Eel	6
Anchovy	5
Tomtate	4
Flying fish	2
Lizard fish	1
Mojarra	1
Ribbon fish	1
Silverside	1

Table 3. Number of responses by anglers for their favorite baitfish for trolling/livelining.

Baitfish	Number of Anglers - Trolling/Livelining
Ballyhoo	1153
Threadfin	570
Pinfish	497
Goggle eye	439
Blue runner	397
Scaled sardine	365
Menhaden	346
Mullet	278
Sardine	210
Mud minnow	199
Round scad	115
Spanish sardine	33
Pigfish	19
Bonita	17
Ladyfish	17
Speedo	12
Mackerel	9
Ribbon fish	8
Eel	7
Sand perch	6
Flying fish	4
Croaker	3
Spanish mackerel	2
Bluefish	1
Mojarra	1
Needlefish	1

Table 4. Number of responses by anglers for their favorite baitfish for bottom fishing.

Baitfish	Number of Anglers - Bottom Fishing
Pinfish	2485
Scaled sardine	573
Threadfin	431
Sardine	409
Mullet	338
Mud minnow	306
Menhaden	184
Round scad	153
Pigfish	97
Goggle eye	95
Ballyhoo	93
Blue runner	56
Sand perch	39
Spanish sardine	34
Croaker	24
Ladyfish	17
Speedo	14
Anchovy	9
Bonita	7
Mackerel	5
Tomtate	4
Mojarra	3
Eel	2
Lizard fish	2
Butterfish	1
Needlefish	1

Discussion of Current and Future Benefits

Angler Survey

The range of the number of fishing trips taken per year is wide from 0-400. It is feasible that a private or charter boat takes 400 trips in a year. It is also possible that they purchase live marine baitfish every trip. 32.1% of all anglers purchased live marine baitfish and they spent about \$26.82 per trip.

Tables 1- 4 summarize the favorite marine baitfish for nearshore, offshore, trolling/liveling, and bottom fishing. Pinfish were confirmed to be the overwhelming favorite marine baitfish used nearshore, offshore, and bottom fishing while being third most popular for trolling/liveling. The trolling/liveling categories were combined in this survey and the most popular baitfish for these combined types of fishing was ballyhoo, although ballyhoo are rarely used live and are most commonly used for trolling. These data confirm the importance of pinfish to anglers in Florida and looking at the distribution of the counties anglers used pinfish in we see a statewide distribution of demand.

The most common complaint about marine baitfish being sold in bait stores was price, followed by availability. Size and quality were less important and 20.9% had no complaint about marine baitfish being sold in stores. If aquaculture produced a marine baitfish, anglers ranked consistent availability as the most important characteristic followed by price and survival. Size, color, and liveliness were less important. 43.8% of anglers were positive about aquaculture as a means to produce bait and 31% were unknown. Therefore, education and promotion of aquaculture of marine baitfish is important to make anglers aware of the potential advantages when compared to wild caught baitfish.

Pinfish were confirmed as the most popular marine baitfish in Florida and anglers responded that they use pinfish on 0-524 fishing trips per year with a mean of 2.27 trips per year. In a previous question, the upper range of the number of trips taken per year was 400, so the range of fishing trips using pinfish was greater. Again, this is likely due to charter boat captains responding to the survey. Per trip anglers said they used 0-36 dozen pinfish with a mean of just under one dozen per trip when pinfish were purchased. However, this mean was low because 6,427 responded that they did not purchase pinfish.

The prices anglers normally pay for a dozen live pinfish ranged from \$1-\$800 with an increasing price as the size of the pinfish increased. The highest price in this range seems very unlikely, although there were 128 anglers who said they spend \$30-50 per dozen, 21 who say they spend \$51-80, and 8 who spend >\$80 per dozen. So this confirms that pinfish have a high retail price in certain locations or to specific demographics. Seasonal availability according to size was seen with winter months being highest for small pinfish, spring being highest for medium pinfish, and summer was highest for large and XL pinfish. This usage pattern mirrors

the seasonal availability by size in the wild. Additionally, it is notable that all sizes of pinfish were used in all seasons. Availability in bait stores was a problem because 55.9% of the time they were sometimes available, 19.6% of the times rarely available and 13% never available. Pinfish were always available only 11.4% of the time in stores according to anglers.

Half of anglers said they would purchase aquaculture produced marine baitfish, 35.5% said maybe, and only 15% said they would not. The price anglers were willing to pay for aquaculture produced pinfish ranged from \$0.60-\$800 per dozen. Again this was a wide range and \$800 seems very high, however, again there 177 anglers who said they would spend \$30-50 per dozen, 13 who say they spend \$51-80, and 9 who spend >\$80 per dozen. The mean prices they were willing to pay for each size class of pinfish was slightly lower than what they said they currently pay for wild pinfish in stores. Pinfish were available and purchased by anglers in all coastal FL counties and some inland counties; this is not odd since pinfish are euryhaline and can tolerate low salinities of water which allows their distribution to occur in inland rivers, canals, and lakes.

Retailer Survey

Survey results indicated half of retailers questioned carried live baitfish in their location. However, 41.7% reported live marine baitfish were not currently sold and cited lack of infrastructure and bait mortality as the primary reasons for not marketing this product. These responses clearly indicate an opportunity for state extension personnel and marine bait producers to educate local bait and tackle shops regarding proper husbandry of marine baitfish and engineering of appropriate holding systems for retail purposes. Investments in training these retailers may allow for further market expansion by increasing retail locations for marine bait. Moreover, decreased holding mortality resulting from improved husbandry practices may translate into increased profits for bait retailers. A mean of 2.4 different species were offered by retailers who currently carried live bait. Respondents indicated pinfish to be the most popular of all live baitfish species sold at retail locations. Interestingly, retailers included both shrimp and crabs in their rankings of live baitfish popularity. Even though these species were outside the scope of the current survey, inclusion by retailers provides a strong impetus for further investigation into the demand for these crustacean baits. Additionally, finger mullet (19.2%) were calculated to be the second most popular species sold, with pigfish (15.4%) popularity close behind. Availability was cited by 56.8% of retailers as their main complaint with bait purchased from wholesalers. Furthermore, consistent availability was the most important characteristic identified by retailers for an aquaculture produced baitfish.

The overall popularity of pinfish in the retail market and the inherent reliability in the controlled production of a cultured product are encouraging indicators for commercial pinfish producers. The majority of respondents (59.5%) had a positive or somewhat positive association with aquaculture as a means to produce baitfish, while 27% were unsure. This data suggests the

baitfish market to be receptive to this new product offering, yet education of the undecided sector would be prudent to inform potential consumers of desirable product attributes and advantages of cultured bait versus those harvested from the wild. Only 25% of those surveyed sold live pinfish, with mean annual sales of 9,123 fish per retailer. This reduced market presence may be a direct result of pinfish availability, as 50% of retailers described their availability from suppliers as sometimes, rarely, or never. Conversely, efforts were made to elucidate angler demand as perceived by the bait retailer. Demand which outpaced supply was reported by 27.8% of respondents, while 44.4% were unsure of how to characterize consumer demand. Accurate evaluation of sales volume and consumer demand is critical to the profitability of a business. Future efforts to obtain more accurate records of regional pinfish demand would be of great use to prospective producers seeking to situate hatchery and production facilities near high volume markets.

Wholesale prices for individual pinfish increased with fish length, with mean prices ranging from \$0.50 for a small (1 – 2 inches) to \$0.80 for an extra-large (>6 inches). These values are crucial to the economics of marine baitfish culture, as production costs per fish cannot exceed these general prices if a financial profit is to be realized. Only 24% of retailers responded they would definitely purchase a cultured pinfish, while the majority of retailers (48%) were more reticent indicating they “may” purchase a cultured product. This uncertainty was further reflected in the diminished prices retailers were willing to pay for a cultured pinfish. Mean prices ranging from \$0.44 for a small to \$0.55 for an extra-large were calculated, however these responses were based on an unseen product. Further attempts to introduce and familiarize prospective consumers with this new product should be advantageous in efforts to capture new markets. Demand for pinfish in the small – large (4 -6 inches) size classes appears generally uniform throughout the year. Noticeable shortages in all four size classes were reported from December – February, corresponding with natural offshore spawning migrations in this species. The ability to augment seasonal pinfish shortages in both supply and demanded size gives the commercial baitfish producer an advantage when compared with those who rely solely on wild stocks. These seasonal shortages may allow producers to gain a larger market share and command a premium price for cultured pinfish.

These results have identified an unfilled niche in the marine baitfish market. Pinfish are a popular species with established consumer demand. Marine bait retailers appear receptive to a cultured product and directed efforts to familiarize the consumer base with cultured pinfish should help to broaden marketing opportunities.

Conclusions

- Consistent availability of bait is important to retailers and anglers. Captive culture of pinfish for retail markets should allow for more consistent market supply.
- Bait supply appears seasonal although pinfish are used year round by anglers.
- Most retailers and anglers are receptive to aquaculture as a means to supplement their baitfish supply.
- Producers may be able to target regions with decreased supply or retailers willing to pay higher prices.
- Extension efforts should target education of bait retailers and anglers about the possibility of aquaculture production of marine baitfish.

Lessons Learned

The online surveys administered to large groups of people using methods employed in this study were extremely successful at generating immediate responses and streamlining data collection. We included several open ended questions with blank boxes for question answers. The drawbacks of this type of question was that it made it very difficult to sort and analyze answers due to spelling errors and usage of slang terminology by respondents. Usage of a modified Dillman Total Design Survey Method with bait retailers resulted in a very high response rate. However, some retailers were reluctant to provide sales figures or supply us with any information. Even with the purpose of the data collection clearly explained a minority of both anglers and retailers still were distrustful of our motivations and how the survey results would be used.

Recommendations for Future Research

The baitfish retailer survey conducted in this grant only covered the east coast of Florida. It is important to conduct the same survey for the west coast and panhandle. Correlation of data linking size and seasonal supply to demand by location is needed to define locations or seasons with potential high valued markets. Future research which allows retailers and anglers hands on access to cultured pinfish would be the next step in gaining market entry. Blinded evaluations from both the retail setting and out in the field would provide great insight into the future potential of this species.

Project Beneficiaries

Current and potential aquaculture producers in the southeastern United States will benefit from these results. Bait wholesalers who acquire and distribute wild and potentially cultured baitfish will have a better idea of where to distribute to meet supply and demand. Bait retailers will benefit from a potential increase in supply as the number of marine baitfish producers increases.

An extension meeting / in-service training was held in 2011. Matthew DiMaggio gave a presentation on the results from the retailer survey (See Appendix). There were 52 attendees at this meeting / in-service training and the audience consisted of potential producers, researchers, and state or federal government employees. All attendees were surveyed before and after the meeting and 100% said they increased their knowledge of the market potential of marine baitfish in Florida.

A presentation was given by Matthew DiMaggio at the Aquaculture America 2012 conference in Las Vegas, NV (See Appendix – same powerpoint as above). This was an invited presentation in a special session on marketing of aquaculture products. Approximately 150 people attended this presentation. A published abstract was associated with this presentation (See Appendix).

A forthcoming presentation will be given on the angler survey results at the Aquaculture 2013 conference by Cortney Ohs. This is the triennial meeting of the World Aquaculture Society occurring in the US. There will be approximately 100-150 people to attend the presentation. The abstract is accepted at this time (See Appendix), the presentation is forthcoming.

Scientific and Extension Publications and Presentations (See Appendix)

DiMaggio, Matthew, Cortney Ohs. Market Survey of Florida Bait Stores. In-service training and extension conference - Focus on Aquaculture Commodities: Marine Baitfish Production and Marketing, Fort Pierce, Florida, June, 2011. (Presentation)

DiMaggio, Matthew A., Cortney L. Ohs, Audrey H. Beany, and Charles, M. Adams. 2012. Evaluation of Market Potential for Aquacultured Marine Baitfish in Florida. Aquaculture America 2012, Las Vegas, Nevada, February 2012. p. 120. (Published Abstract and Oral Presentation)

Ohs, Cortney L., Matthew A. DiMaggio, Audrey H. Beany, Charles M. Adams. 2013. Evaluation of recreational angler perception and demand for cultured marine baitfish in Florida. Aquaculture 2013, Nashville, TN, February 2013. p. 1101. (Published Abstract and Oral Presentation)

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Appendix



Fellow Florida Saltwater Fishing License Holder,

A few days from now you will receive via e-mail a request to complete a brief questionnaire for a research project being conducted by the University of Florida's Program in Fisheries and Aquatic Sciences. The survey will help to evaluate the market potential for aquaculture produced baitfish. I am contacting you in advance to let you know to expect our e-mail. Your responses will help shape research and may lead to an additional source of baitfish for retailers across the state. Thank you for your time and consideration with this important research project.

Sincerely,

Matthew A. DiMaggio, M.S.
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For more information on aquaculture research at the University of Florida please visit:
<http://irrec.ifas.ufl.edu/aquaculture>.

Angler Survey

The following information is being collected by the University of Florida's Program in Fisheries and Aquatic Sciences in an attempt to evaluate the market potential for aquaculture produced marine baitfish along the Atlantic coast of Florida. Results from this survey will help to shape research and provide an additional source of live bait, particularly during times when wild sources are unavailable. Please answer all questions as accurately as possible. Please fill in or circle the most appropriate answer where applicable. This survey should take approximately five minutes to complete.

Since this survey is being conducted through the University of Florida, it has been approved through the Institutional Review Board (IRB). In accordance with this approval, we must inform you that there are no direct benefits or risks to you for answering these questions. Participation is voluntary and you will not be compensated. Your identity will remain anonymous. You cannot be penalized for choosing not to answer certain questions. If you have any questions, please contact me directly at cohs@ufl.edu. For questions about your rights as a research participant, please contact the IRB at 1-352-392-0433. (UFIRB #2010-U-770). Thank you for taking the time to fill out this survey.

1. Age _____
2. Sex MALE FEMALE
3. County in which most of your fishing activities occur _____
4. Are you a boat owner? YES NO
5. Do you most often fish from a BOAT CANOE/KAYAK LAND/STRUCTURE WADING?
6. On average, how many marine fishing trips do you take in a year? _____
7. Of the total number of trips you take per year, for how many do you purchase live marine bait fish?

8. Of those trips, how many are spent
 - a. Nearshore (≤ 1 mile from land) _____
 - b. Offshore (> 1 mile from land) _____
 - i. Trolling/Livelining _____
 - ii. Bottom fishing _____
9. Do you primarily catch or purchase your live marine baitfish? CATCH PURCHASE
10. If you purchase your live marine baitfish, approximately how much do you spend per trip on live baitfish?
\$ _____
11. What is your favorite live marine baitfish for
 - a. Nearshore (≤ 1 mile from land) _____
 - b. Offshore (> 1 mile from land)
 - i. Trolling/Livelining _____
 - ii. Bottom fishing _____
12. What is your biggest complaint with marine baitfish sold by stores/dealers?

PRICE AVAILABILITY QUALITY SIZE NONE OTHER_____

13. If aquaculture could produce an ideal live marine bait which characteristics would be most important?

(Label the characteristics in order of importance from 1 – 6, with 1 being the most important and 6 being the least)

___Consistent availability ___Price ___Preferred size ___Survival ___Color ___Liveliness

14. What is your perception of aquaculture as a means to produce bait?

POSITIVE SOMEWHAT POSITIVE UNKNOWN SOMEWHAT NEGATIVE NEGATIVE

Pinfish

15. Of the fishing trips you take in a year, how many trips do you purchase live pinfish? _____

16. How many dozen live pinfish do you purchase per trip? _____

17. What price do you normally pay for a dozen live pinfish?

\$ _____/Small(1-2'') \$ _____/Medium(2-4'') \$ _____/Large(4-6'') \$ _____/XL(>6'')

18. What sizes do you use at what times of the year? (Place an X in the boxes of all that apply)

	Winter (Dec. – Feb.)	Spring (Mar. – May)	Summer (June – Aug.)	Fall (Sept. – Nov.)
Small (1 – 2’')				
Medium (2 – 4’)				
Large (4 – 6’)				
XL (> 6’)				

19. How would you characterize the availability of live pinfish from local retailers in your region?

ALWAYS SOMETIMES RARELY NEVER

20. Would you purchase an aquaculture produced pinfish? YES MAYBE NO

21. How much would you will be willing to pay for one dozen live aquaculture produced pinfish?

\$ _____/Small \$ _____/Medium \$ _____/Large \$ _____/XL

22. County in which pinfish would be mostly used? _____

Dear Florida bait retailer,

A few days from now you will receive in the mail a request to complete a brief questionnaire for a research project being conducted by the University of Florida's Program in Fisheries and Aquatic Sciences. The survey will help to evaluate the market potential for aquaculture produced baitfish. I am contacting you in advance to let you know to expect our mailing. Your responses will help shape research and may lead to an additional source of baitfish for retailers across the state. Thank you for your time and consideration with this important research project.

Sincerely,

Matthew A. DiMaggio, M.S.
Alumni Graduate Fellow

Cortney L. Ohs, Ph.D.
Assistant Professor

For more information on aquaculture research at the University of Florida please visit:
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March 28, 2011

Dear Florida Bait Retailer,

We are writing to ask for your help with a survey of the bait retailers. The following information is being collected by the University of Florida's Program in Fisheries and Aquatic Sciences in an attempt to evaluate the market potential for aquaculture produced marine baitfish along the Atlantic coast of Florida.

As a Florida bait retailer your input is very important to our study. Results from this survey will help to shape research and may provide an additional source of live bait, particularly during times when wild sources are unavailable. Accurate assessments of variables such as seasonal demand and species preference will help us better meet the needs of the Florida sportfishing community.

Since this survey is being conducted through the University of Florida, it has been approved through the Institutional Review Board (IRB). In accordance with this approval, we must inform you that there are no direct benefits or risks to you for answering these questions. Participation is voluntary and you will not be compensated. Your identity will remain anonymous and will not be associated with your responses in any way. You cannot be penalized for choosing not to answer certain questions. For questions about your rights as a research participant, please contact the IRB at 1-352-392-0433. (UFIRB #2010-U-770).

Completing the questionnaire will take you approximately 5 minutes. Please answer all questions as accurately as possible. Please fill in or circle the most appropriate answer where applicable. If you have any questions or concerns regarding the survey please feel free to contact Matthew DiMaggio (mdimaggi@ufl.edu) or Cortney Ohs (cohs@ufl.edu) at 772-468-3922 x134. If you prefer not to respond, please let us know by returning the questionnaire in the enclosed stamped envelope.

For more information on aquaculture research at the University of Florida, please visit: <http://irrec.ifas.ufl.edu/aquaculture> .

Thank you for your help with this important research. We look forward to your response.

Sincerely,

Matthew A. DiMaggio, M.S.
Alumni Graduate Fellow

Cortney L. Ohs, Ph.D.
Assistant Professor

Enclosure

Live Bait Retailer Survey

The following information is being collected by the University of Florida's Program in Fisheries and Aquatic Sciences in an attempt to evaluate the market potential for aquaculture produced marine baitfish along the Atlantic coast of Florida. Results from this survey will help to shape research and provide an additional source of live bait, particularly during times when wild sources are unavailable. Please answer all questions as accurately as possible. Please fill in or circle the most appropriate answer where applicable. This survey should take approximately five minutes to complete.

Since this survey is being conducted through the University of Florida, it has been approved through the Institutional Review Board (IRB). In accordance with this approval, we must inform you that there are no direct benefits or risks to you for answering these questions. Participation is voluntary and you will not be compensated. Your identity will remain anonymous. You cannot be penalized for choosing not to answer certain questions. If you have any questions, please contact me directly at cohs@ufl.edu. For questions about your rights as a research participant, please contact the IRB at 1-352-392-0433. (UFIRB #2010-U-770). Thank you for taking the time to fill out this survey.

1. County where primary business is operated _____
2. Do you sell live marine baitfish? YES NO
 - a. If NO, why not? _____
 - b. If YES, How many species of live baitfish do you sell? _____
3. What are the three most popular species of live marine baitfish you sell? ("1" being the most popular)
1. _____ 2. _____ 3. _____
4. What is your biggest complaint with marine baitfish you purchase from your suppliers?
(Circle the single most important issue below)
PRICE AVAILABILITY QUALITY NONE OTHER _____
5. If aquaculture could produce an ideal live marine bait which characteristics would be most important?
(Label the following characteristics in order of importance from 1 – 6, with 1 being the most important and 6 being the least)
___Consistent availability ___Price ___Preferred size ___Survival ___Color ___Liveliness
6. What is your perception of aquaculture as a means to produce bait? (Circle one)
POSITIVE SOMEWHAT POSITIVE UNKNOWN SOMEWHAT NEGATIVE NEGATIVE

Pinfish

7. Do you sell live pinfish for bait? YES NO
8. Please estimate how many live pinfish you sell per year? _____
9. What price do you normally *pay* wholesalers/bait fishermen for one live pinfish?
\$/Small(1-2") \$/Medium(2-4") \$/Large(4-6") \$/XL(>6")
10. What sizes do you purchase and at what times of the year? (Place an X in the boxes of all that apply)

	Winter (Dec. – Feb.)	Spring (Mar. – May)	Summer (June – Aug.)	Fall (Sept. – Nov.)
Small (1 – 2’)				
Medium (2 – 4’)				
Large (4 – 6’)				
XL (> 6’)				

11. What times of the year do you see shortages in demanded sizes for live pinfish? (Place an X in the boxes of all that apply)

	Winter (Dec. – Feb.)	Spring (Mar. – May)	Summer (June – Aug.)	Fall (Sept. – Nov.)
Small (1 – 2’)				
Medium (2 – 4’)				
Large (4 – 6’)				
XL (> 6’)				

12. Overall, how would you characterize the availability of live pinfish from your supplier?

ALWAYS SOMETIMES RARELY NEVER

13. How would you characterize the demand for live pinfish in your region?

(Circle the single most appropriate statement)

- I could sell more pinfish if I could get them
- I can’t sell what I purchase from my suppliers
- The supply I purchase is all I can sell
- I am not sure

14. Would you purchase an aquaculture produced pinfish? YES MAYBE NO

a. If YES or MAYBE, if an aquacultured pinfish possessed the ideal characteristics listed in question 5, how much would you will be willing to pay per fish?

\$_____/Small \$_____/Medium \$_____/Large \$_____/XL

EVALUATION OF MARKET POTENTIAL FOR AQUACULTURED MARINE BAITFISH IN FLORIDA

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Of the total economic impact generated by the marine recreational fishing industry in the US, the largest component is generated by Florida. Bait purchases represent a major portion of marine recreational anglers' expenditures. Despite this well established industry, development of marine baitfish aquaculture to service this significant market has been slow to evolve. Descriptive market information necessary to shape production and marketing strategies is lacking. The objective of this project was to evaluate and describe the market for live marine baitfish along the Atlantic coast of Florida, with a special focus on pinfish (*Lagodon rhomboides*) and pigfish (*Orthopristis chrysoptera*), and then to assess the potential market for a cultured product.

A survey instrument was designed and distributed to 119 bait retailers in 13 counties along the eastern coast of Florida. Surveys were developed to be concise and succinct, while still soliciting salient information vital to market evaluation. Bait retailer survey questions focused on business location, baitfish species sold, shortcomings of wild baitfish, preferred baitfish characteristics, perception of aquaculture, quantities of pinfish and pigfish sold, pinfish and pigfish wholesale purchase prices, purchasing patterns as related to season and size, perceived pinfish and pigfish market demand by region, and interest in purchasing an aquacultured baitfish.

A total of 58 surveys representing 12 counties were returned for a 48.7% response rate. Nearly half of all respondents (48.3%) carried live marine baitfish. Of those which did not (43.1%), lack of infrastructure (35.3%) and technical expertise (17.6%) were the most common reasons cited. Overall perception of aquaculture as a means to produce baitfish was predominantly positive, with 57.2% reporting a positive connotation with cultured bait. Analysis of demand data by season for both pinfish and pigfish suggested seasonal shortages for a variety of size classes. Findings suggest these shortfalls may be exploited by potential live marine baitfish growers and retailers to help gain market share and develop pricing strategies. Data resulting from this market survey will be of great value to potential growers seeking to enter the live marine baitfish market along the Atlantic coast of Florida.

Market Survey of Marine Bait Retailers

Matthew DiMaggio and Cortney Ohs

University of Florida
Indian River Research and Education Center
School of Forest Resources and Conservation
Program of Fisheries and Aquatic Sciences



Justification

- ▣ **Marine baitfish culture has potential for growth in the Southeastern US**
 - **How can we describe the market?**
 - **How can we help producers make decisions regarding**
 - ▣ **Species selection?**
 - ▣ **Price?**
 - ▣ **Seasonality?**
- ▣ **Update of work by Adams et al. 1998.**
- ▣ **Help producers get the best price for their product and assess the economic viability of the industry**

Survey Development

- ▣ **Survey instrument was developed to solicit specific information from bait retailers on Florida's east coast**
- ▣ **Survey was administered by mail using a modified Dillman method**
- ▣ **Survey packet consisted of**
 - **Cover letter**
 - **22 question survey**
 - **Self addressed stamped envelope**



Survey Response

- 119 surveys mailed to 13 counties along the Atlantic Coast
- 58 surveys completed from 12 counties
- 48.7% responded

Response by County

- Nassau – 5.2 %
- Duval – 5.2%
- St. Johns – 5.2%
- Flagler - 0
- Volusia – 15.5%
- Brevard – 12%
- Indian River – 3.4%
- St. Lucie – 6.9%
- Martin – 1.7%
- Palm Beach – 5.2%
- Broward – 13.8%
- Miami-Dade – 12.1%
- Monroe – 13.8%

Do you sell live marine baitfish?

Yes – 48.3%

No – 43.1%

No Answer – 8.6%

If NO, why not?

35.3% are not equipped for it

17.6% bait is too hard to keep alive

11.7% only sell fresh water bait

If YES, how many species of live baitfish do you sell?

2.4 different species

What are the three most popular species of live baitfish you sell?

1. Shrimp 56.7%
Pinfish 26.7%
2. Mud Minnows 16.7%
Finger Mullet 16.7%
Pinfish 16.7%
Pigfish 16.7%
3. Crabs 35.7%

What is your biggest complaint with marine baitfish you purchase from your suppliers?

Availability 54.3%

None 37.1%

Quality 8.6%

Price --

If aquaculture could produce an ideal live marine bait, which characteristics would be most important?

1. Consistent Availability
2. Survival
3. Price
4. Liveliness
5. Preferred Size
6. Color

What is your perception of aquaculture as a means to produce bait?

Positive 42.9%

Somewhat Positive 14.3%

Unknown 28.5%

Somewhat Negative 5.7%

Negative 8.6%

Do you sell live pinfish for bait?

Yes – 24.1%

No – 55.2%

No Answer – 20.7%

How many live pinfish do you sell per year?

Average – 9,123

Range – 800 to 26,000

What price do you normally pay wholesalers/bait fishermen for one live pinfish?

Size (in.)	Average Paid (\$)	Range (\$)
Small (1-2)	.53	.20 – 1.50
Medium (2-4)	.54	.20 – 1.50
Large (4-6)	.65	.20 – 1.50
XL (>6)	.80	.20 – 1.50

What size pinfish do you purchase and at what times of the year?

Size (in.)	Winter (Dec.-Feb.)	Spring (Mar.-May)	Summer (June-Aug.)	Fall (Sept.-Nov.)
Small (1-2)	7.0%	6.1%	7.0%	8.1%
Medium (2-4)	9.1%	10.1%	9.1%	9.1%
Large (4-6)	8.1%	8.1%	6.1%	6.1%
XL (>6)	1.0%	2.0%	2.0%	1.0%

What times of the year do you see shortages in demanded sizes for live pinfish?

Size (in.)	Winter (Dec.-Feb.)	Spring (Mar.-May)	Summer (June-Aug.)	Fall (Sept.-Nov.)
Small (1-2)	12.2%	4.9%	7.3%	7.3%
Medium (2-4)	14.6%	4.9%	4.9%	4.9%
Large (4-6)	17.0%	4.9%	4.9%	4.9%
XL (>6)	4.9%	--	--	2.4%

Overall, how would you characterize the availability of live pinfish from your supplier?

Always	52.9%
Sometimes	29.4%
Rarely	5.9%
Never	11.8%

How would you characterize the demand for live pinfish in your region?

I could sell more if I could get them	27.8%
The supply purchased is all I can sell	27.8%
I cannot sell what I purchase	--
I am not sure	44.4%

Would you purchase an aquaculture
produced pinfish?

Yes – 24.0%

No – 28.0%

Maybe – 48.0%

If YES or MAYBE, if an aquacultured pinfish possessed the ideal characteristics listed earlier, how much would you be willing to pay per fish?

Size (in.)	Average (\$)	Range (\$)
Small (1-2)	.44	.20 – 1.00
Medium (2-4)	.46	.20 – 1.00
Large (4-6)	.53	.20 – 1.00
XL (>6)	.55	.20 – 1.00

Summary

- ▣ **Consistent availability of bait is important to retailers**
- ▣ **Bait shortages appear seasonal**
- ▣ **Most retailers are receptive to aquaculture as a means to supplement their baitfish supply**
- ▣ **Producers may target regions with decreased supply or retailers willing to pay higher prices**
- ▣ **Production cycles should aim to supplement seasonal shortages**
- ▣ **Extension efforts should target education and system design and development to increase bait retail opportunities throughout the state**

Acknowledgement

- ▣ State funds for this project were matched with Federal funds under the Federal-State Marketing Improvement Program of the Agriculture Marketing Service, U.S. Department of Agriculture

EVALUATION OF RECREATIONAL ANGLER PERCEPTION AND DEMAND FOR CULTURED MARINE BAITFISH IN FLORIDA

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Almost all marine baitfish sold in stores are wild caught. Availability of most species is seasonal, yet demand exists year round. Aquaculture produced marine baitfish can provide anglers with a consistent supply of sought after species in desired size classes, regardless of season. There is a strong interest in the culture of live marine baitfish to be marketed to recreational anglers. However, there is a paucity of information on anglers' perception of aquaculture produced baitfish and seasonal fluctuations in demand for certain species and sizes. Thus, the objectives of this study were to develop and administer a survey instrument designed to assess the attitudes of recreational anglers with respect to a cultured baitfish product, as well as perceived trends in supply and demand, with a special focus on pinfish *Lagodon rhomboides* and pigfish, *Orthopristis chrysoptera*.

An invitation to participate in an online survey was emailed to 240,000 marine recreational fishing license holders. A total of 14,871 respondents completed some portion of the questionnaire for a 16.1% response rate; with 10,642 anglers completing the entire survey. General demographic information was gathered as well as information concerning boat ownership, county where fishing occurs, fishing frequency and type, live bait use and preferred species, purchasing habits, ideal bait characteristics, and their perspective on cultured marine baitfish. Specific questions pertaining to pinfish and pigfish were also posed to help ascertain price, availability, size, and willingness to use cultured pinfish and pigfish.

Of the respondents, 87.5% were male and 70.5% were boat owners. Inshore destinations accounted for the majority of fishing trips taken by Florida anglers. Live bait was caught by 57.8%, purchased by 32.1%, and 10.1% responded they did not use live bait in their fishing activities. The most prominent complaint anglers had with live bait purchased in retail stores was price, followed by availability. Perceptions of aquaculture produced bait were 43.8% positive, 20.6% somewhat positive, and 31% were unknown. Consistent availability and price were identified by anglers as the two most important characteristics for an aquaculture produced marine baitfish.