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Economic Considerations for the Prospective Mudminnow Culturist in Florida¹

Chuck Adams and Andy Lazur²

Introduction

The harvest, distribution, and retailing of natural marine baits represent an important component of the commercial fishing industry and a vital input to saltwater sportsfishing activities in Florida. A wide variety of marine bait species are harvested for commercial sale in Florida. Species of greatest popularity include shrimp, ballyhoo, sardine, finger mullet, pinfish, "greenback" minnows, "mudminnows" (*Fundulus spp.*), and other assorted finfish. Other species of more local demand include sand fleas, "dollar" crabs, eel, and assorted mollusks. In 1999, commercial landings of marine baits were reported to be 9.2 million pounds, valued at \$8.6 million dockside [Florida Fish and Wildlife Conservation Commission (1), 2000]. Although the demand for some of these species (i.e., sand flea, dollar crabs) may be local, the demand for others (i.e., bait shrimp) is statewide. Even though the majority of the commercial harvest of these baits is primarily focused in specific locations within Florida, the distribution and retailing activities associated with natural marine baits occur throughout the state. Some bait species are sold primarily as a dead product (e.g., ballyhoo, sardines, and frozen bait

shrimp). However, the highest retail prices are associated with those species sold live (e.g., pinfish, bait shrimp, "greenback" minnows, mudminnows, and other small baitfish).

Recent advances in the technology of culturing certain marine baits in Florida have increased interest in the financial feasibility of the culture process. Specifically, the method for culturing mudminnows has been improved in recent years, although the process has not yet been standardized and more research is needed (Lazur, 1996; Lazur and Zimet, 1996; McGee and Lazur, 1994; Strawn, et. al., 1986; and Tatum, et. al., 1982). However, due to the high prices associated with wild-caught live marine baitfish in Florida, mudminnows show promise as an additional candidate species within the diverse array of aquatic species commercially cultured in Florida for food; stock enhancement; bio-research; and ornamental, recreational, and other purposes (Florida Agricultural Statistics Service, 2000).

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2. Chuck Adams, professor, Department of Food and Resource Economics, and marine economics specialist, Florida Sea Grant Program, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL.; and Andy Lazur, aquaculture specialist, Horn Point Laboratory, Maryland Sea Grant Program, University of Maryland, Cambridge, MD.

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Objective

The objective of this publication is to provide the prospective culturist with an initial overview of the market for mudminnows and the costs and earnings associated with a small-scale commercial mudminnow culture operation of two sizes. The reader should bear in mind that although the market for mudminnows appears to be strong in certain regions of Florida, a more complete understanding of the culture technology and market for live mudminnows is needed to allow a fully objective investment decision. Therefore, the market assessments and financial analyses presented in this publication should be considered to be preliminary. However, the prospective culturist should find this analysis useful in assessing mudminnows as a potential candidate species.

The Market for Mudminnows

The demand for natural marine baits is directly linked to, or derived from, the demand for saltwater sportsfishing activities in Florida. The participation in saltwater sportsfishing activities in Florida has been increasing [Florida Fish and Wildlife Conservation Commission (2), 2000]. During the 1999-00 fiscal year, 602,000 residents and 404,000 nonresidents purchased a saltwater fishing license in Florida. This represents a 28% increase in the number of licenses sold as compared to the 1990-91 fiscal year. An undetermined number also participated in the sport, but were exempted from purchasing a license (e.g., military personnel; fishing from shore, bridge, or pier; etc.). Recent survey research by the Florida Sea Grant Program estimates that individuals engaged in saltwater sportsfishing in Florida spend about \$160 million annually on all forms of natural and artificial baits, with the largest share of these expenditures occurring in the Tampa Bay and Indian River Lagoon regions (Milon and Thunberg, 1993). When survey respondents were asked to indicate a preference for alternative saltwater fishing regulatory methods, "further restrictions on the types of permissible baits" received the highest level of opposition among all choices. Thus, not only are marine baits in high demand, access to a variety of baits is also highly valued by anglers.

A market assessment study jointly conducted by the University of Florida (UF) and the Florida Department of Agriculture and Consumer Services (FDACS) provides insight into the market for certain marine baitfish species, including mudminnows (Adams, Lazur, Zajicek, and Zimet, 1998). The key market-related findings of the study specifically as it concerns mudminnows are as follows:

- Demand for mudminnows as bait exceeds supply virtually throughout Florida.
- All current supplies are wild-caught.
- The preferred size for mudminnows is 2.5-3.5 inches in total length, but larger sizes are preferred in certain regions and during certain seasons.
- Mudminnows are known as a very durable bait that are easy to keep alive using the existing live-bait, holding system technology.
- The demand, and thus price, for mudminnows can be very seasonal (e.g., directly linked with seasons for trout, snook and flounder) and vary by region.

The UF/FDACS study described the prices (where available) for live mudminnows by region in Florida during 1997 (Table 1). For example, the per-each wholesale price for mudminnows was \$0.08 (or \$80 per 1,000 fish, the standard terminology used in the industry) in the Pensacola-Suwannee region, whereas the per-dozen retail price in the same region was \$2.60. Wholesale prices ranged from \$0.06 to \$0.22 (\$60-\$220 per 1,000 fish). Retail prices ranged from \$1.85 to \$6.00. The highest wholesale prices were seen in the Ormond Beach-Stuart region, whereas the highest retail prices were found in the Sarasota-Marco Island region.

Selected Financial Characteristics of the Culture Operations

The proposed mudminnow culture system consists of a series of outdoor ponds. The fish are allowed to spawn on mats in brood ponds and then the eggs are transferred to growout ponds for culture to market size. The technology required to operate such

a system is described in the literature (Lazur, 1996; Strawn, et. al., 1986; Tatum, et. al., 1982). Thus, the culture methodology will not be described further here, and the reader is encouraged to consult the literature for the specifics of the culture technology.

Capital Investment Costs

The initial investment costs associated with facilities of two different sizes are given in Table 2 (five-acre facility) and Table 4 (10-acre facility). The cost of land has not been included in the analysis, as the prospective culturist is assumed to have the property on which the facility will be located. The five-acre facility consists of four 1-acre growout ponds and two 0.5-acre brood ponds, for a total of five water surface acres. The 10-acre facility consists of four 0.5-acre (water surface) brood ponds and four 2-acre (water surface) growout ponds, for a total of 10 water surface acres.

Total initial capital investment for the 10-acre pond system is \$87,220 (Table 4). Pond construction costs are estimated to be \$65,855, or 75% of the total initial cost. The pond construction costs include the cost of earth moving for pond and levee construction, as well as the well, pond drainage and plumbing system, and levee stabilization. The total cost for equipment is \$21,365, which includes a pole shed, holding/grading tank for sorting the fish by size, aerators, feed storage shed, and other items. The total initial capital cost per acre for the 10-acre facility is \$8,722. Note that the capital cost per acre for the 5-acre facility is \$10,495 (Table 2). Thus, economies of scale exist in the initial investment.

Annual Operating Expenses

Operating expenses include variable and fixed costs. The major variable expenses associated with mudminnow production include feed, electricity to run the aerators and pumps, chemicals, and labor. For the 5-acre facility, total annual variable costs are estimated to be \$14,845 (Table 3), whereas annual variable costs for the 10-acre system are estimated to be \$22,259 (Table 5). Fixed costs, or overhead, are estimated to be \$7,555 and \$11,715 for the 5-acre and 10-acres facilities, respectively. The major overhead expenses are depreciation and interest on the capital investment loan.

Annual Returns

Production for the system is assumed to be 87,500 marketable mudminnows per acre of growout acreage. The mudminnows are assumed to be sold into the wholesale market at \$70 per thousand. Thus, annual gross revenue for the 5-acre and 10-acre systems are \$24,500 and \$49,000, respectively (Tables 3 and 5). Net returns for each system is \$2,100 and \$15,026 for the 5-acre and 10-acre facilities, respectively. The return per acre for the 10-acre system is \$1,503, whereas the same estimate for the 5-acre system is \$420. Again, considerable economies of scale exist that allow per-acre cost reductions to occur as facility size is increased via greater pond size and number of ponds. Note that the breakeven price (alternatively, the total cost) per 1000 fish decreases from \$64 for the 5-acre facility to about \$49 for the 10-acre facility.

Conclusion

The culturing of live, marine bait fish may be a viable commercial aquaculture activity in Florida. Mudminnows, in particular, may hold promise as a candidate species. Recent research has shown a strong market for mudminnows by recreational saltwater anglers. In virtually all regions of the state where mudminnows are used as bait, the supply is unable to keep up with the demand (the supply now available is obtained entirely from wild catch). And, although the market price varies considerably around the state, the breakeven price from the existing technology is well below the current wholesale prices for mudminnows. Thus, for both a 5-acre and 10-acre culture facility, the projected annual net returns are positive. Although this analysis suggests that commercial culture of mudminnows may be profitable, a more comprehensive assessment of the market is needed. Also, additional research is needed to identify the most efficient culture techniques (free spawn versus egg transfer), shipping methods to reduce fish mortality, and holding tank designs that would improve water quality. Only after these issues have been addressed will potential investors in mudminnow culture be able to make a truly wise investment.

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Table 1. Wholesale and retail prices for mudminnows by region of Florida, 1997.

Subregion	Wholesale Price (per each)	Retail Price (per dozen)
<i>Gulf Coast</i>		
Pensacola-Suwannee	\$0.08	\$2.60
Cedar Key-Spring Hill	\$0.08	\$1.85
Port Richey-Sarasota	\$0.13	\$3.08
Sarasota-Marco Island	\$0.14	\$3.00-\$6.00
<i>Atlantic Coast</i>		
Fernandina Beach-Matanzas Inlet	\$0.06	\$2.05
Ormond Beach-Stuart	\$0.22	\$4.40
Jupiter-Miami	N/A	N/A
Islamorada-Key West	N/A	N/A

Table 2. Initial investment costs for a 5-acre mudminnow production facility.*

Item	Cost/Unit	Quantity	Total Cost
<i>Pond Construction</i>			
Earth moving	\$1	21,000 cubic yards	\$21,000
Well (6-inch)		1	\$7,000
Water supply lines			\$1,600
Electrical supply lines			\$2,000
Ditches and detention ponds		1	\$3,000
Drainage systems	\$300	6	\$1,800
Gravel	\$12	55 cubic yards	\$660
Levee stabilization cost			\$300
Pond construction total			\$37,000
<i>Equipment</i>			
Pole shed		1	\$700
Holding/grading tank	\$700	2	\$1,400
Tank facility supplies			\$1,200
Electric paddlewheel aerator (1 hp)	\$850	4	\$3,400
Electric pump sprayer aerator (3/4 hp)	\$700	2	\$1,400
Seine		1	\$1,200
Feed storage shed		1	\$800
Fish hauling tank		1	\$1,200
Oxygen meter		1	\$800
Water quality test kit		1	\$250
Egg mats	\$5	250	\$1,250
Dip nets	\$25	3	\$75
Waders	\$70	2	\$140
Bird control supplies			\$500
Broodstock	\$0.08	10,000	\$800
Equipment total			\$15,115
<i>Total Initial Investment</i>			\$52,475
<i>Total Cost Per Water Surface Acre</i>			\$10,495
* Facility consists of four 1-acre growout ponds and two 0.5-acre brood ponds.			

Table 3. Annual budget for a 5-acre mudminnow production facility.*

Item	Price or Cost/Unit	Quantity	Total Revenue/Cost
<i>Gross Receipts</i>	\$70/K	350,000	\$24,500
<i>Variable Costs</i>			
Feed	7 tons	\$300	\$2,100
Fertilizer	1 ton	\$250	\$250
Electricity	20,000 kwh	\$0.07	\$1,750
Fuel	250 gallons	\$1.50	\$375
Repair/maintenance			\$750
Chemicals			\$2,500
Miscellaneous supplies			\$400
Family labor	600 hours	\$6 per hour	\$3,600
Hired labor	400 hours	\$6 per hour	\$2,400
Interest on operating loan			\$720
Total variable costs			\$14,845
<i>Fixed Costs</i>			
Interest on capital loan			\$2,031
Depreciation			\$4,524
Taxes, insurance, etc.			\$1,000
Total fixed costs			\$7,555
<i>Total Costs</i>			\$22,400
<i>Net Returns to Owner</i>			\$2,100
<i>Breakeven Price Per 1,000 fish</i>			\$64
<i>Net Returns Per Water Surface Acre</i>			\$420
* Facility consists of four 1-acre growout ponds and two 0.5-acre brood ponds.			

Table 4. Initial investment costs for a 10-acre mudminnow production facility.*

Item	Cost/Unit	Quantity	Total Cost
<i>Pond Construction</i>			
Earth moving	\$1	38,835 cubic yards	\$38,835
Well (6-inch)		1	\$7,000
Water supply lines			\$6,000
Electrical supply lines			\$3,500
Ditches and detention pond		1	\$6,000
Drainage systems	\$400	8	\$3,200
Gravel	\$12	85 cubic yards	\$1,020
Grass establishment			\$300
Pond construction total			\$65,855
<i>Equipment</i>			
Pole shed		1	\$2,400
Holding/grading tank	\$733	3	\$2,200
Tank facility supplies			\$1,200
Electric paddlewheel aerator (1 hp)	\$850	4	\$3,400
Electric pump sprayer aerator (3/4 hp)	\$700	4	\$2,800
Seine		1	\$1,200
Feed storage shed		1	\$1,100
Fish hauling tank		1	\$1,200
Oxygen meter		1	\$800
Water quality test kit		1	\$250
Egg mats	\$5	500	\$2,500
Dip nets	\$25	3	\$75
Waders	\$70	2	\$140
Bird control supplies			\$500
Broodstock	\$0.08	20,000	\$1,600
Equipment total			\$21,365
<i>Total Initial Investment</i>			\$87,220
<i>Total Cost Per Water Surface Acre</i>			\$8,722
* Facility consists of four 2-acre growout ponds and four 0.5-acre brood ponds.			

Table 5. Annual budget for a 10-acre mudminnow production facility.*

Item	Price or Cost/Unit	Quantity	Total Revenue/Cost
<i>Gross Receipts</i>	\$70/K	700,000	\$49,000
<i>Variable Costs</i>			
Feed	\$300	14 tons	\$4,200
Fertilizer	\$250	1.6 tons	\$400
Electricity	\$0.08	40,000 kwh	\$2,800
Fuel	\$1.50	450 gallons	\$675
Repair/maintenance			\$1,000
Chemicals			\$3,500
Miscellaneous supplies			\$600
Family labor	\$6 per hour	900 hours	\$5,400
Hired labor	\$6 per hour	400 hours	\$2,400
Interest on operating loan			\$1,284
Total variable costs			\$22,259
<i>Fixed Costs</i>			
Interest on capital loan			\$3,473
Depreciation			\$7,152
Taxes, insurance, etc.			\$1,090
Total fixed costs			\$11,715
<i>Total Costs</i>			\$33,974
<i>Net Returns to Owner</i>			\$15,026
<i>Breakeven Price Per 1,000 Fish</i>			\$48.53
<i>Net Returns Per Water Surface Acre</i>			\$1,503
* Facility consists of four 2-acre growout ponds and four 0.5-acre brood ponds.			