# An Assessment of the Market for Live, Marine Baitfish in Florida

## Project Final Report: Project DEP MR195

Submitted by

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FLORIDA SEA GRANT COLLEGE PROGRAM
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## Introduction

The harvest, distribution, and retailing of natural marine baits represents an important component of the commercial fishing industry and a vital input to marine recreational fishing activities in Florida. A wide variety of marine baits are harvested for commercial sale in Florida. Species of greatest popularity includes shrimp, ballyhoo, sardines, finger mullet, pinfish, "greenback" minnows, mud minnows and other assorted finfish. Other species of more local popularity includes sand fleas, small crab, eels, assorted mollusks, and others. In 1995, commercial landings of marine baits were reported to be 7.6 million pounds, valued at $6.0 million dockside (Florida Department of Environmental Protection, 1996(1)). The demand for some of these marine baits (e.g., sand fleas, ballyhoo) may be local in nature, while others (e.g. bait shrimp) are in demand throughout the state. Even though the majority of the commercial harvest of these baits is primarily focused in specific locations within Florida (FDEP, 1996(1)), the distribution and retailing activities associated with natural marine baits occurs throughout the state. Some of these baits are sold primarily as dead product, such as ballyhoo, sardines, frozen bait shrimp, and others. However, the highest prices are associated with those species sold live, such as pinfish, bait shrimp, "greenback" minnows, mud minnows and other small baitfish.

The demand for natural marine baits is no doubt directly linked to the demand for saltwater sportfishing activities in Florida. And the participation in saltwater sportfishing activities in Florida has been increasing (Florida Department of Environmental Protection, 1996(2)). During 1995, approximately 534,000 residents and 318,000 non-residents purchased a saltwater fishing license in Florida. This represents a 10 percent increase since 1991. An undetermined number also participated in the sport but were exempted from purchasing a license. Recent research by the Florida Sea Grant program estimates that these individuals 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 of the state (Milon and Thunberg, 1993). And when 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 (Milon and Thunberg, 1993). Thus, not only are marine baits in high demand, access to a variety of baits available is also highly valued by anglers.

Recent advances in the technology of culturing certain marine baits in Florida has increased interest in the economic potential of the culture process . Specifically, the methods for culturing marine, bait minnows (*Fundulus* spp.) have been improved in recent years, although the process has not yet been standardized and more research is needed (Lazur, 1996). However, due to the high prices currently associated with wild-caught, live, marine baitfish in Florida, marine bait minnow culture shows promise as an additional component within the diverse complement of aquatic species commercially cultured in Florida.

Although a strong market for live marine baits has existed in Florida for many years, not much is known about the specifics of the market and the distribution system for live, marine baitfish. The few studies available are either dated or site specific (Berkeley, Pybas, and Campos,

1985). As a result, little information is available for live, marine baitfish on a statewide basis. For example, the spatial characteristics of the markets for live marine baitfish species are not documented. Also, the seasonal characteristics of supply and demand for specific live, marine baitfish are not well understood. In addition, the sizes demanded for each of the various types of live, marine baitfish have never been documented. Information about the distribution system, volumes demanded per week, month, etc., quality requirements, pricing, preference for specific product attributes (cultured vs wild caught), species substitutability, and other factors are not available. Basically, little is known about the existing markets for these bait products. For example, the current level of product awareness and knowledge by prospective wholesale and retail buyers of the product is not known. The regional differences in availability and use as a recreational fishing bait is not well understood. In addition, the current pricing structure has never been described. This information is vital if prospective culturists of live, marine baitfish are to accurately assess the market potential for cultured, live, marine baitfish and effectively position their product within the existing marketing system for live, marine baits in Florida. Cultured marine baitfish must compete in the live market with wild-caught substitutes. Without information about the target market, the successful introduction of a cultured marine bait may be faced with an informational comparative disadvantage.

This study represents an attempt to describe salient characteristics of the existing market for live, marine baitfish, with a focus on marine bait minnows. The study was funded by the Florida Department of Environmental Protection Aquaculture Grant Program. Studies funded by this program address issues of current and future importance to the commercial aquaculture industry in Florida. And although the culture of marine baitfish, particularly bait minnows, does not currently exist in Florida on a commercial scale, the economic potential of such activities warranted the funding of this study. In the absence of information that would allow a better understanding of the live, marine baitfish market, any benefits gained from technological improvements in the culture process for marine baitfish may be outweighed by the effective costs associated with informational constraints to market access and entry. Thus, the information resulting from this study will be vital to any prospective marine baitfish culturist attempting to access the Florida market. The findings of this study will provide prospective culturists with the additional information required to make a wise investment decision regarding the culture of live, marine bait minnows.

Commercial viability of aquaculture hinges not only on technical feasibility, but also on economic feasibility, which must include marketing. The economic feasibility of a culture process is not achievable without access to an appropriate market such that unit production costs can be exceeded by unit price. And market access is made possible with current and comprehensive information regarding the time, space, and form characteristics of the market. The information provided by this study will therefore provide positive benefits toward the advancement of the marine bait minnow culture industry in Florida.

## Objectives of Study

The overall objective of the study is to provide a descriptive analysis of the market for live, marine baitfish in Florida, with particular emphasis on the existing and potential markets for live, marine bait minnows (*Fundulus* spp.). The descriptive information derived from the study will provide detailed market information needed by a prospective marine bait minnow culturist to properly position this new product with the existing market structure.

Specific objectives of the study include:
**(1)** Develop a survey instrument designed to solicit the detailed market-related information for live, marine baitfish as identified in the preceding discussion. The questionnaire will contain questions that will address numerous time, space, and form characteristics of the live, marine baitfish industry in Florida.
**(2)** Conduct a survey of marine bait dealers and distributors in Florida. The survey will be administered across the state in an attempt to obtain a sample that accurately reflects the regional differences inherent in the industry.
**(3)** Perform a statistical analysis of the data gathered from the dealer/distributor survey. Sample statistics and non-parametric statistics will be derived from the data generated by the survey instrument. This analysis will allow interpretation of the findings across regions of the state, species, etc.
**(4)** Provide recommendations for prospective marine bait culturists regarding strategies on how best to access the existing live, marine bait market, with particular emphasis on the market opportunities for marine bait minnows (*Fundulus* spp).

## Methodology

The general experimental design utilized in the study involved the fielding of a face-to-face survey instrument. The survey instrument was used to solicit market related information from marine bait distributors and retailers in Florida. The same survey instrument was utilized for both groups. The sample size was determined from lists of marine bait distributors and retailers as provided by FDEP and other sources. The sample was structured to reflect regional differences in the market for live, marine baitfish. The experimental design chosen is an appropriate strategy to collect the data needed to complete the study objectives. Since no single list of bait dealers for Florida exists, the survey instrument was administered in a face-to-face manner in order to generate an acceptable sample size. The statistical analysis of the data was straightforward and employed standard nonparametric statistical methods.

### Questionnaire Development -

Several survey methodologies exist by which to gather market-related information from industry representatives. These involve interviews administered via the mail and face-to-face interviews, which involve recall by the interviewee. In contrast, the "diary" format provides a more "real time" assessment (Rea and Parker, 1992; Alreck and Settle, 1985). Face-to-face and diary survey methods often provide a higher response rate, but can be much more expensive to

administer than a mail interview. For certain settings, the on-site, face-to-face interview can be very effective. This is particularly true where the typical respondent is not only the business owner but also the operator, and may have very little time during the work day to complete a written questionnaire. In these cases, a properly constructed questionnaire administered in person can be effective in soliciting the desired information. The face-to-face interview was found to be the most applicable for this study.

A questionnaire was developed for use in a face-to-face setting in retail and wholesale establishments that offer live, marine bait (see **Appendix A**). The baitfish survey instrument was designed to accommodate the environment in which the interviews were likely to occur. Since the interviews were to be conducted in a working environment (e.g., a retail bait shop or bait dealership office), the survey instrument was designed to be brief and succinct. The questionnaire was also designed to solicit the basic information needed to describe the existing and potential market for cultured, live, marine baitfish, with a particular focus on marine bait minnows. Many of the questions included within the questionnaire are of an open-ended nature that will lend the analysis to a more qualitative summary of the responses. The primary types of information solicited by the questionnaire included:

- sources of supply and market outlets
- species of baitfish sold in live form and preferred sizes of each
- seasonality of demand and volumes sold by season
- seasonality of problems associated with availability and potential sales volumes of supply constraints
- seasonality of problems associated with preferred sizes
- prices by season as paid to suppliers
- typical delivery schedules, minimum orders, and problems associated with current sources
- average retail markups or retail prices
- interest in purchasing a farm raised product and specific attributes of a farm raised product that would be desired
- willingness to pay more for a cultured product possessing the desired attributes
- current product line of live, marine baitfish and closest substitutes
- listing of live, marine baitfish that the respondent would like to sell but which are currently unavailable

Prior to administering the questionnaire, the prototype instrument was field tested to ensure the "workability" of the instrument. This was done in the same setting that the final instrument was to be utilized. Four retail live, marine bait establishments in the Cedar Key region were utilized for the pre-testing process. As a result, some minor adjustments in the question content and style were done.

**Survey Methodology and Regions Sampled -**

The survey was conducted by interviewing retail and wholesale live, marine, bait establishments in Florida during spring and summer of 1997. The survey focused on those firms who carried live, marine baits, regardless of whether the establishment sold live, marine bait minnows or not. This would allow for the survey to solicit information about why live, marine bait minnows were *not* offered.

The state was divided into eight regions. These regions are delineated in **Figure 1**. The regions were not created based on the numbers of establishments contained within each one. This is because there is no comprehensive list of retail and wholesale bait establishment in Florida. Thus, there was no way to accurately stratify the state for statistical purposes. Rather, the regions were created by the investigators based upon their collective knowledge of the recreational species targeted, habitat, population centers, and other factors. The findings of the study are reported by region.

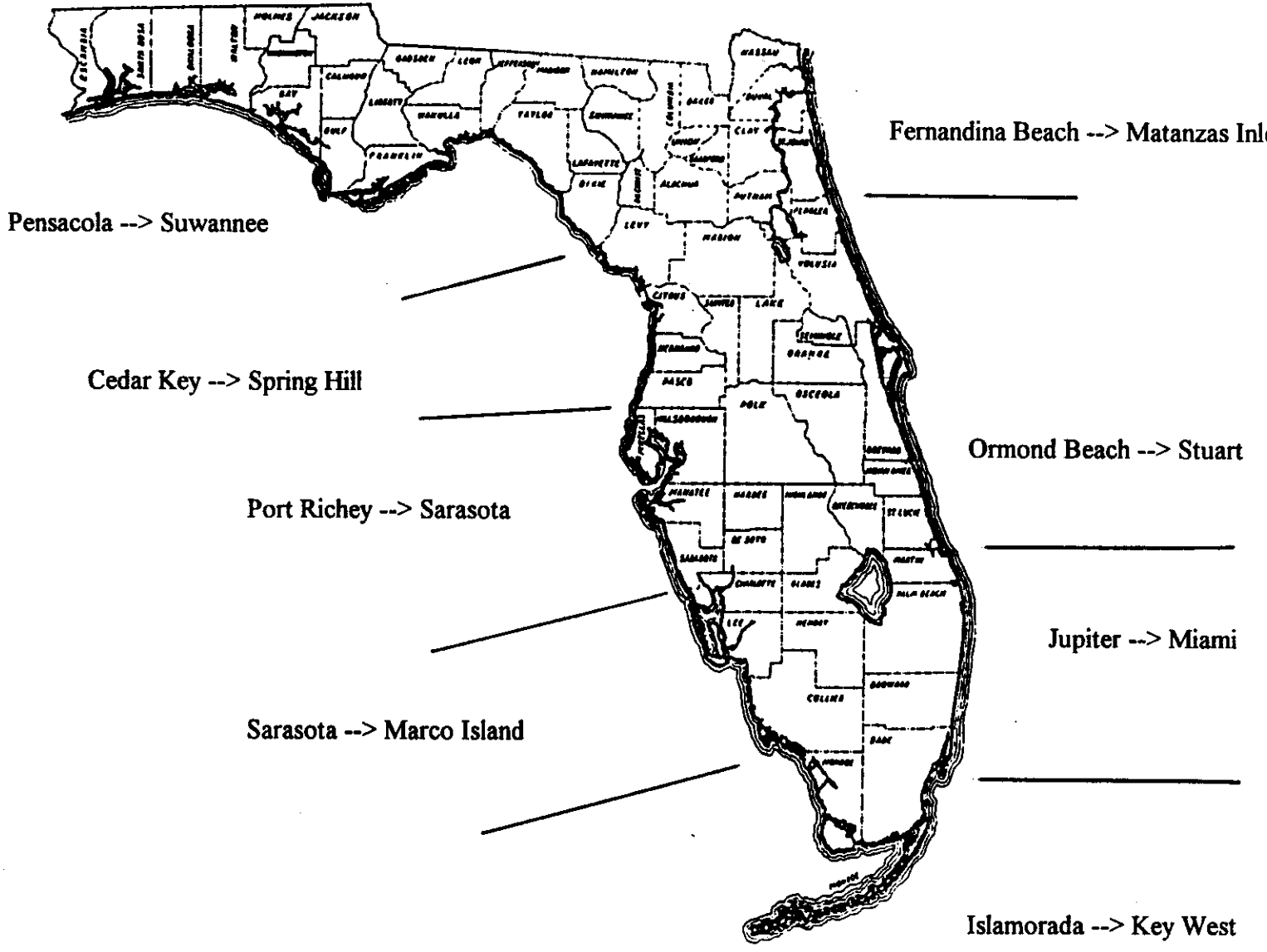
As discussed earlier, the questionnaire was administered in a face-to-face manner by a single visit to the respective establishment. Most respondents were either the owner/operator or an experienced manager knowledgeable of the local baitfish market. For other visits the interviewer encountered an employee other than a manager or the owner operator who had limited knowledge of the local baitfish market. Thus, some telephone call backs were attempted. Each respondent was provided a brief explanation as to the purpose of the study, funding source, and likely benefits of the study findings. However, some firms refused to participate.

The study was conducted in a complementary fashion with an on-going Florida Department of Agriculture and Consumer Services study previously funded by USDA-ERS. The FDACS study involved administering face-to-face interviews of live, bait shrimp distributors and dealers. The questionnaire developed for the survey was developed in conjunction with the investigative team of the proposed Florida Department of Environmental Protection study. The survey instruments for each study were comprised of very similar questions so that information can be shared, thereby providing a more complete assessment of the live, marine bait market in Florida. It was possible to make regional assignments for each investigative team such that duplication of effort in administering the statewide survey did not occur. In other words, this study surveyed certain regions of the state focusing on the live marine baitfish market (but also soliciting information on bait shrimp), while simultaneously the FDACS study surveyed the remaining regions of the state focusing on bait shrimp (but also soliciting information on live marine bait minnows). The cooperative productivity of a combined UF-IFAS / FDACS effort was maximized in this manner.

**Data Sources -**

There is no single, comprehensive, listing of retail and wholesale live, marine baitfish dealers in Florida. The population from which a sample was to be extracted was developed by consulting several sources on information. The primary source of information on wholesale dealers was obtained from FDEP Marine Fisheries Information Program. This program provided a listing of the permitted live bait wholesalers in Florida. A listing was obtained for those dealers handling live, bait shrimp. This list included 70 businesses . The first 30 of these businesses accounted for 75 percent of the total reported volume of live, bait shrimp entering into the Florida

**Figure 1.** Subregions of Study in Which Dealer Interviews Were Conducted.



market. In addition, a similar list was obtained for those firms handling live, marine baitfish, particularly pinfish, mud minnows, and/or fingerling mullet. This list contained 71 businesses, the first 25 of which accounted for 75 percent of the total reported live, bait fish entering into the Florida market. The top 19 of this same list represented 80 percent of the total reported live pinfish and mud minnows (but excluding mullet) entering into the Florida market via landings in the state.

Obtaining a list of retail dealers of live, marine baits was somewhat more difficult. Two primary sources were consulted - The Bell South Real Yellow Pages ONLINE (http://yp.bellsouth.com) and the Florida Business Directory (American Business Directories, 1997). The latter source reportedly utilizes Yellow Pages listings for compiling these published lists. These sources yielded approximately 400 retail dealers of marine baits. Most of these businesses were listed under the heading of Fishing Bait and Tackle. However, additional names were obtained while searching under other related headings. The cross referencing between the two sources (business name and address) yielded some exclusive listings, suggesting that even these two listings may not each be entirely comprehensive for Florida. An attempt was made to contact each of these retail and wholesale dealers by telephone prior to fielding the survey and was questioned about the live, marine bait products they offered. This screening process provided the interviewer some prior knowledge of each business to be contacted during the survey. In addition, interviewers consulted local telephone books upon entering a metropolitan region to check the fishing bait section for retail and wholesale dealers. Interviewers used addresses provided via the three sources, plotted addresses on locally obtained road maps and located likely firms with which to conduct the interview.

Given the lists obtained from FDEP and the two private sources, it was estimated that at least 600 retail and wholesale live, marine bait (shrimp and baitfish) dealers currently exist in Florida. However, a complete canvass of the population was deemed to be outside the scope of the project. Thus, a sample was taken from each of the eight subregions defined previously. The sample was basically an attempt by each interviewer to contact as many dealers in each region as allowed by travel and time constraints. As a result, the sample was not created on a random basis, but rather on an opportunistic basis. However, given the number of interviews conducted, the investigators feel comfortable that a large percentage of the retail and wholesale business for live, marine, bait is represented by the sample. A total of 239 interviews were conducted. The number of interviews conducted by region is given in **Table 1**. Note that the even though the state was divided into eight distinct subregions, 25 percent of the interviews were conducted in the Pensacola to Suwannee (Panhandle/Big Bend) subregion, 25 percent in the Ormond Beach to Stuart (East Central) subregion, 22 percent in the Jupiter to Key West (Southeast) subregion, 21 percent in the Port Richey to Marco Island (Southwest) subregion, and 7 percent in the Fernandina Beach to Matanzas Inlet subregion (Northeast).

To further aid in the questioning of baitfish dealers regarding specific species of baitfish, a page containing color pictures of seven of the key species was prepared (see **Appendix B**). These color pictures were useful in properly identifying each species of interest, thereby ensuring discussion between respondent and interviewer referred to the same species. Confusion about species was expected, given the colloquial names used by respondents in different subregions. For example, "white bait" is a collective term referring to several species of sardines and herrings.

| Table 1. Regional Distribution of Retail and Wholesale Live, Marine Bait Dealer Interviews | | |
|---|---|---|
| **Regions and** Subregions | **Number and Percentage of Total Interviews** | |
| **Panhandle - Big Bend** | **61** | **25 %** |
| Pensacola --> Suwannee | 40 | 17 % |
| Cedar Key --> Spring Hill | 21 | 8 % |
| **Southwest** | **51** | **21 %** |
| Port Richey --> Sarasota | 24 | 10 % |
| Sarasota --> Marco Island | 27 | 11 % |
| **Northeast** | **16** | **7 %** |
| Fernandina Beach --> Matanzas Inlet | | |
| **East Central** | **60** | **25 %** |
| Ormond Beach --> Stuart | | |
| **Southeast** | **51** | **22 %** |
| Jupiter --> Miami | 40 | 17 % |
| Islamorada --> Key West | 11 | 5 % |
| **TOTAL** | **239** | **100 %** |

## Survey Findings

The findings of the survey are presented by subregion. Specific findings are discussed for interview responses relative to five discussion categories vis-a-vis live, marine, baitfish: (1) Product Attributes, (2) Seasonality and Availability, (3) Distribution and Prices, (4) Demand, and (5) Potential for Farm-Raised Baitfish.

**Pensacola --> Suwannee -**

(1) Product Attributes: Gulf killifish (*Fundulus grandis*), also known as "bull minnows" or "mud minnows", and the "longnose" killifish (*F. similis*), also known as the "tiger minnow", were the most popular live, marine baitfish sold in north Florida on the Gulf coast. Of the two killifish species, the bull minnow dominated sales volumes. However, several retail shops and one wholesaler preferred or specialized in the tiger minnow over the bull minnow. With the exception of three shops surveyed which listed tiger minnows, most sold both fish as bull minnows. The average size fish supplied is about three inches in length. Other fish species sold were "finger" mullet (*Mugil* spp.) and "pinfish" (*Lagodon rhomboides*).

(2) Seasonality and Availability: Bull and tiger minnows are available in the spring to fall months. Many shops expressed the opinion that bull minnows were frequently in short supply and they usually will accept whatever sizes they can get from suppliers. These fish are caught by local fishermen using cast nets, small hooks, and/or minnow traps in nearshore waters. Finger mullet and pinfish were caught by several shops for their own sales. The latter species were generally available from spring to late fall and more difficult to catch in some areas during the winter months. Live eels (*Anguilla rostrata*) were available in a few shops in limited quantities for cobia bait during March to May. Many of these eels were supplied by a fish farmer located in northeast Florida. "Fiddler" crabs (*Uca rapax*) were sold by approximately 20 percent of the retail shops in the region. "Sand fleas" (*Emerita portoricensis*) were also sold by at least 50 percent of the shops in the area. These items were supplied by a few fishers in the area or by shop employees.
(3) Distribution and Prices: Bull and tiger minnows were distributed primarily by one wholesaler located within the Port St. Joe area. One retail shop occasionally caught more than they used in their own business and would supply other Pensacola area shops. Wholesale prices (i.e., the price paid to the fisher or wholesale supplier) for bull and tiger minnows ranged from $60-90 per thousand, with an average of $75 per thousand ($0.08 each) (**Table 2**). Retail prices for bull and tiger minnows ranged from $2.25-3.00 per dozen, with an average price of $2.60 per dozen. Retail prices (i.e., the price paid by the retail purchaser) for pinfish ranged from $2.00-$4.00 per dozen (depending on size). The few shops that carried finger mullet received $3.00 per dozen.

**Table 2. Wholesale and Retail Prices for Live, Marine Baitfish in the Pensacola to Suwannee Subregion**

| Species | Wholesale Prices ($/each) | | N | Retail Prices ($/dozen) | | N |
|---|---|---|---|---|---|---|
| | Range | Ave. | | Range | Ave. | |
| Pinfish | -- | -- | X | $2.00-4.00 | -- | 6 |
| Mudminnows | $0.06-0.09 | $0.08 | 18 | $2.25-3.00 | $2.60 | 19 |
| Finger Mullet | -- | -- | X | -- | $3.00 | X |

N - number of respondents ( X - three or fewer respondents).

(4) Demand: Demand for bull and tiger minnows peaks during the September to November period, which is the peak season for flounder fishing. However, both bull and tiger minnows are sold year-round. Many shops believed the demand for both exceeded supply. Pinfish is considered a good bait for grouper and snapper, but many shops mentioned that fishermen often catch their own pinfish. In some cases, pinfish is not considered to be a strong seller. Live eels were a highly valued bait for cobia during the spring, but only a few shops sold them and did not have enough supply to meet the demand for the product.
(5) Potential for Farm-Raised Baitfish: Many respondents were interested to hear that some species of marine baitfish could be farm-raised. Some shops indicated that they might be interested in buying from a grower if a steady supply could be established. Only three shops commented on desiring a larger size fish (greater than 4 inches) and were curious if a the culture

process could supply a larger fish. Thus, it appears that the demand for a cultured mud minnow or tiger minnow exists in this region of the state, particularly if supply can be assured and/or if size of harvested fish can be controlled, the latter being of lesser importance to availability.

**Cedar Key --> Spring Hill -**

(1) Product Attributes: Most retail and wholesale live, marine bait dealers in the region were familiar with live, marine baitfish, but the market is not well established. Pinfish is the predominant live, marine baitfish marketed in the region. Pinfish are well known as a bait for cobia and grouper. Pinfish have a reputation of being difficult to keep alive and are noted for fouling tank water quickly. The preferred size is dependent on the gamefish species being sought. Larger pinfish are utilized for offshore fishing (i.e. grouper, cobia), while the smaller sizes (two to three inches) are used for nearshore, flats fishing (i.e., trout, flounder).

Familiarity with mud minnows (i.e., *Fundulus* spp.) among the dealers in the region is considerably less. Only one respondent in the region carries mud minnows on a continuous basis. And this individual handles of variety of mud minnows, with individual varieties referred to as "creek chubs" or "fat-headed minnow", mud minnows, killifish, and "tiger chubs". This particular business acquires all supplies with its own harvesting effort. A preferred size is three to four inches, with local fishers preferring the largest sizes available. The "tiger chub", which is the largest variety, is well known as a good snook bait. Although, all varieties are reportedly excellent baits for redfish, flounder, trout, mangrove snapper and snook. A few respondents indicated that mud minnows were also difficult to keep alive. Some questioned about the feasibility of keeping mud minnows in the same tanks with shrimp or other baitfish to avoid the cost of additional tank systems.

Other species of live, marine baits are sold in the area. One dealer carried live "pilchards" (i.e. scaled sardine *Harengula pensacolae*), while another carried live eels and small blue crab (i.e., "dollar crabs") when available. Frozen white bait and finger mullet are also sold.

(2) Seasonality and Availability: The biggest constraint to carrying either mud minnows or pinfish was availability. There are very few wholesale producers of pinfish, and even fewer producers of mud minnows. Most respondents were not familiar with the seasonal characteristics of either supply or demand. One respondent in the northern portion of this region indicated that the prime months for the mud minnow market would be the May to August period. However, three respondents near the southern portion of the region indicated that the winter months would provide for a much stronger market, although sales would likely occur year-round. The latter was also suggested to be true for pinfish. Several respondents indicated the demand for pinfish is greatest in the winter months, but that pinfish are also much more difficult to obtain during winter.

(3) Distribution and Prices: Of the 21 dealers interviewed in the region, ten indicated that they currently sold live, marine baitfish. Pinfish are typically available throughout the region. However, the poorly developed market for mud minnows creates uncertainty in the potential sources and destinations of mud minnows. Other than the one dealer that was engaged in wholesaling and retailing mud minnows, the only other supply regions identified were the Keaton Beach and Goodland areas. However, no details on the supply volumes, seasonality, firms involved, or species were available.

Price information regarding pinfish was easier to obtain than for mud minnows. Most respondents were unwilling to provide much detailed information on prices for either species. Prices were provided in terms of several units (i.e., per each, dozen, thousand). These prices were converted to units of per each (wholesale) and one dozen (retail) for consistency (**Table 3**). Wholesale prices for pinfish ranged from $0.08 to $0.21 per each. The average price was estimated to be approximately $0.17 per each at the wholesale level. Retail prices for pinfish ranged from $3.00 to $5.00 per dozen. The average retail price as estimated to be $3.80 per dozen. Although prices for pinfish purportedly vary by size, this information was not provided by the respondents. Price information for mud minnows was much more difficult to obtain due to so few dealers currently carrying the product in the region. Wholesale prices for mud minnows were reported to be approximately $0.08 per each, with retail prices ranging from $1.20 to $2.50 per dozen and averaging $1.85 per dozen. These prices likely vary by species of minnow and size, but price data to support this suggestion were not provided. Data on volumes sold were also not provided by respondents.

**Table 3. Wholesale and Retail Prices for Live, Marine Baitfish in the Cedar Key to Spring Hill Subregion**

| Species | Wholesale Price ($ /each) | | N | Retail Price ($ / dozen) | | N |
|---|---|---|---|---|---|---|
| | Range | Ave. | | Range | Ave. | |
| Pinfish | $0.08-0.21 | $0.17 | 5 | $3.00-$5.00 | $3.80 | 5 |
| Mud minnows | -- | $0.08 | X | $1.20-$2.50 | $1.85 | X |

N - number of respondents ( X - three or fewer respondents).

(4) Demand: Of the 21 dealers interviewed, nine indicated that live, marine baitfish of any kind would serve as a suitable substitute for live shrimp, the latter being the most common form of live, marine bait used in the region. Eight of those nine respondents indicated that pinfish would be a close substitute for live shrimp, while three indicated that mud minnows would serve as a close substitute. Six respondents indicated that they would sell pinfish if they were consistently available. However, an overriding concern was that pinfish were difficult to keep alive and fouled the water very quickly. Eight respondents indicated that they would carry mud minnows if a consistent supply was available. However, five respondents suggested that the market for mud minnows is just too small to justify the expense of expanding into another live baitfish. Similar concerns regarding the technology required to hold pinfish was also expressed regarding mud minnows. Two respondents indicated that the greatest demand is for the "creek chub". The months of strongest demand was suggested to be May through August in the northern counties of the subregion, while respondents in the southern counties suggested that the winter months would be the period of highest demand for mud minnows.

(5) Potential for Farm-Raised Baitfish: Although most respondents did not explicitly express a preference for the attributes identified for a farm-raised product, the predominant concern was

consistency of supply, which is one of the key advantages of a farm-raised product relative to wild-caught product. In addition, most respondents who were interested in live pinfish or mud minnows, expressed some limited knowledge of the months in which demand would be strongest. Thus, the ability of a farm-raised product to be delivered during periods when wild-caught product may be in short supply would provide an additional advantage.

**Port Richey –> Sarasota -**

(1) Product Attributes: This regional market was characterized by a wide variety of live, marine baitfish being offered for sale. Unfortunately, a given species might be referred to be more than one colloquial name. In that sense, the color baitfish chart was invaluable for avoiding misidentifying several species. For example, scaled sardines (*Harengula pensacolae*) were referred to as "greenbacks" and "shiners", and are lumped with the threadfin herring (*Opisthonema oglinum*) as "white bait". (**Note** that the scaled sardine and threadfin herring are caught simultaneously, are not differentiated when sold, and were usually advertised and sold as "white bait"). Gulf killifish are referred to as "chubs", "creek chubs", "gator chubs", and "tiger-striped chubs" (a similar looking fish with vertical striping and a longer lower jaw). Pigfish (*Orthopristis chrysoptera*) are referred to as "grunts". Several respondents wondered why Gulf menhaden (*Brevoortia patronus*) was included on the color chart as it was unknown locally as a bait available in live form.

One respondent from Hernando County was a wholesale dealer in pinfish. He obtained his supply of pinfish from a number of individual fishers, as well as his own traps. He then sold his product to a number of retail operations in the region. Other than this individual, all retailers stated that caught their own live baitfish and/or purchased live baitfish from local commercial fishers. Three methods of harvest are used: cast nets, traps, and hook-and-line. These methods produce pinfish and "pigfish". Cast nets produce mullet, scaled sardines, threadfin herring, and Gulf killifish. The harvest method employed has an impact on the quality of bait produced. Hook-and-line yields clean, high-quality and long-lived baitfish. Traps produce baitfish of almost the same high quality (some bruising) and nets produce fish with net scars, abrasions, and bruises, which results in a shorter life expectancy in retail holding tanks (although Gulf killifish did not display net damage and were described as "unbelievably" durable).

Pinfish and pigfish are the most commonly available baitfish. Retailers attributed the almost universal availability of pinfish and pigfish to their durability as well. Finger mullet are recognized as being a good bait, but are not carried for one simple reason: a proclivity for rocketing out of tanks unexpectedly! The white baits are universally recognized as being very short lived, delicate, and for beating themselves to death against the sides of the holding tank.

The size of pinfish and pigfish plays a role in their use, but has little impact on wholesale and retail prices. Generally, pinfish and pigfish of a body length between two to three inches are sold to coastal fishers who target sea trout, cobia, snook, and redfish. Pinfish and pigfish from four to seven inches in length are sold to offshore fishers for tarpon, grouper, and shark. All live baitfish are sold by the dozen regardless of the whether they are sold into the wholesale or retail markets. Scaled sardines, threadfin herring, and Gulf killifish are sold by the dozen with no reference to size. Live fiddler crabs were sold by a few respondents. These were usually caught by the owner, local neighborhood children, or other commercial fishermen. Two retail

respondents mentioned that "tilapia" is known to be a good bait, although they were aware it would have to be acclimated to saltwater.

(2) Seasonality and Availability: Generally, pinfish, pigfish, and Gulf killifish are available throughout the year. The white baits, scaled sardines and threadfin herring, are characterized by a seasonal availability and market. When Gulf water temperatures reach 76-77 F, white bait are available. Soon after water temperatures reach 78 F and the king mackerel appear (during the March - May period, depending on seasonal temperatures), white bait are in extremely high demand as the preferred bait for king mackerel. Most retailers reported fishers will purchase some amount of baitfish to begin a trip, but count on catching more with their own cast nets.

(3) Distribution and Prices: Pinfish and pigfish are universally available. Scaled sardines and threadfin herring are universally available when in season. Gulf killifish are little known within the region from New Port Richey to southern Tampa Bay. From southern Tampa Bay through Bradenton killifish are a well recognized bait and used nearshore for recreational fishers targeting seatrout, flounder, snook and other coastal fish species. There are two different killifish of very similar appearance. These two species are sold under several different market names. The Gulf killifish (*F. grandis*) is referred to as a "creek chub" or "chub". The similar fish is of the same size and girth, but has a longer, underslung lower lip and vertical stripes on the body. It is called a "gator chub" or "tiger chub". This may possibly be *F. similis*. The two chubs are sold together indiscriminantly and are not priced differently.

Retail respondents had problems estimating the volume of the various baitfish sold. Most quoted quantities per week and a very few differentiated between daily and weekend demand. There was no reference, unlike for bait shrimp, to seasonal differences in sales volumes (**Table 4**).

**Table 4. Estimated Sales Volumes for Major Baitfish Species in the Port Richey to Sarasota Subregion**

| Species | Sales Volume per Week (Fish) | | | N |
|---|---|---|---|---|
| | Median | Average | Range | |
| Pinfish & Pigfish | 800 | 1,228 | 175- 4,900 | 9 |
| Gulf Killifish | -- | 800 | -- | X |

N - number of respondents (X - three or fewer respondents).

Wholesale and retail prices vary, but it is interesting to note that most retailers will describe a wholesale price on a per each basis, but sell on a dozen basis. One retailer explained baitfish retail prices should be twice the wholesale price. Wholesale and retail prices are given in **Table 5**. All of the retailers interviewed, except one, had a single per dozen price for baitfish. One retailer sold small pinfish and pigfish for $4.00 per dozen and large for $6.00 per dozen. At least seven retailers quoted a range of wholesale prices for pinfish and pigfish. From discussions regarding prices, apparently the range (typically $0.10-$0.25 each) does not depend on size, but rather on source (supplier) of product.

**Table 5. Wholesale and Retail Prices for Live, Marine Baitfish in the Port Richey to Sarasota Subregion**

| Species | Wholesale Price ($ / each) | | | N | Retail Price ($ / dozen) | | | N |
|---|---|---|---|---|---|---|---|---|
| | Median | Ave. | Range | | Median | Ave. | Range | |
| Pinfish & Pigfish | $0.25 | $0.33 | $0.10-0.35 | 18 | $5.00 | $5.50 | $4.00-7.50 | 9 |
| White Bait* | -- | -- | $0.10-0.25 | X | -- | -- | -- | -- |
| Gulf Killifish | $0.15 | $0.13 | $0.08-0.15 | 5 | $3.50 | $3.08 | $2.00-3.75 | X |

* Most shops catch the short-lived white bait themselves.
N - number of respondents (X - three or fewer respondents).

(4) Demand: Some retailers credited widespread availability of baitfish, retail or self-caught by the recreational fishermen, as contributing to declining bait shrimp sales.. Within this particular subregion, no respondents identified supply as a problem in terms of baitfish, although the demand for the various species as a baitfish, including Gulf killifish, was widely recognized.
(5) Potential for Farm-Raised Baitfish: Retailers were excited by the prospect of buying consistent supplies of the white bait, although they noted how difficult it is to keep these types of bait alive. Some were very interested in buying finger mullet because of its reputation as an excellent bait with a strong market. Respondents hoped domestication might calm this particular fish down (i.e. jumping out of holding tanks). Some retailers in the southern region of Tampa Bay where Gulf killifish are a common bait, were interested in a farm-raised killifish, but admitted availability is not currently a problem. There was universal agreement that the supply of pinfish and pigfish is more than adequate.

As mentioned earlier, most retailers caught their own baitfish and/or purchased from local commercial fishers. Several expressed anxiety regarding a switch to farm-raised baitfish. They did not want to put local commercial fishers out of work. They also has suspicions that this study was a preliminary attempt by state agencies to prohibit the harvest of live, marine baitfish in favor of aquaculture.

**Sarasota --> Marco Island -**
(1) Product Attributes: Much of the discussion concerning live marine bait fish described for the previous subregion also holds true for this subregion as well. The reason is related to the apparent sources of product and the methods of capture, which are both basically the same -- retailers catch their own or delivery is by a local commercial fisher who uses cast nets, traps, or hook-and-line.

The identification card was very helpful when discussing potential farm-raised marine baitfish. One mystery was solved involving the Gulf killifish. A related species is described favorably for its desirability as a live bait by retailers in the Gibsonton area and at bait shops near Sanibel Island. This killifish was variously called a "gator chub" or "tiger-striped chub" in the Gibsonton area, but has a far more marketable name near Sanibel Island...the "striped snook

minnow". The Mote Marine Laboratory kindly supplied a taxonomic identification of this species, which is known as *F. similus*, i.e., the long-nosed killifish (introduced previously in this report). The Gulf killifish is also referred to as the "bull minnow" in the Ft. Myers area. The Gulf and long-nosed killifish were recognized by shops carrying them for their durability. One shop had a resident long-nosed killifish mascot at least six inches in length.

The scaled sardine is called a "greenback" in the Ft. Myers to Naples subregion. This species is favored as a snook bait during the months of February through May, as well as during September through December. The scaled sardine and Atlantic threadfin herring were often lumped together under the commonly used term "white bait".

Pinfish and pigfish (called "grunts" throughout this subregion) are universally available. They are reportedly used most frequently as live bait for snook, grouper, and tarpon. These two species are a durable bait, but there was far less discussion by retailers as to the method of capture and quality. Periods of high demand coincide with snook season (February through May and September through December).

Finger mullet are generally recognized as a good bait, but no shops carried them as a live product. Many retailers had them in frozen form. The most frequent reason given for not carrying finger mullet was the inability to keep them in a tank system (i.e., problems with dead loss and jumping). The Gulf menhaden was not carried by any of the shops interviewed. There was little comment regarding this species, mostly limited to curiosity as to why it was pictured on the color picture sheet.

(2) Seasonality and Availability: In general, pinfish and pigfish are available from March to October, but are harder to find during the colder, winter months. White bait is only available during the warm summer months. Gulf and long-nosed killifish were reported to be available all year, but only in those areas conducive to catching them. For example, killifish frequent mud flats, open grass flats, and mangroves. They are successfully cast netted in the open grass and mud flat areas, which are not widely accessible. Cast nets easily hang-up and tear on oyster bars. Killifish harvesters must find harvestable bottoms near mangroves without oysters and relatively close to the retail shops where deliveries will be made. Because of these conditions, both species of killifish are not widely available in the region. A retailer in the Port Charlotte area indicated that killifish could be purchased from a source in the North Florida region. However, this individual did not consider killifish to be a good enough bait to warrant frequent purchases.

(3) Distribution and Prices: As noted earlier in this report, bait fish are either caught by the retailer or supplied by commercial fishers. Prices at wholesale were quoted on a per-each basis and sold at retail in units of one dozen or a per each basis. Retailers supplied a mix of retail prices (per each and dozen) which have been converted to a per dozen basis for the purposes of discussion. However, most retailers sold bait fish on a per each basis. Three respondents provided a range of retail prices for the pinfish and pigfish species, which was based on sliding scale by size - $0.50 (small), $0.75 (medium), and $1.25 (large) (**Table 6**). All the retailers purchased live bait for the same price regardless of size.

**Table 6. Wholesale and Retail Prices for Live, Marine Baitfish in the Sarasota to Marco Island Subregion**

| Species | Wholesale Price ($ / each) | | | N | Retail Price ($ / each) | | | N |
|---|---|---|---|---|---|---|---|---|
| | Median | Ave. | Range | | Median | Ave. | Range | |
| Pinfish & Pigfish | $0.25 | $0.37 | $0.16-0.50 | 21 | $6.00 | $7.80 | $3.96-15.00 | 13 |
| White Bait* | $0.25 | $0.26 | $0.08-0.75 | 7 | -- | -- | $2.04-6.00 | X |
| Killifish | $0.13 | $0.14 | $0.10-0.17 | X | -- | -- | $3.00-6.00 | X |

N - number of respondents ( X - three or fewer respondents).

Estimates of the volumes (numbers of fish) sold is unfortunately crude at best. None of the retail respondents interviewed made references to personal records when reacting to questions and all respondents quoted estimates extemporaneously as a mix of per day or per week sales. Since most retail respondents provided estimates on a per day basis, the estimates provided by other respondents were converted to daily units (**Table** 7).

**Table 7. Estimated Sales Volumes for Major Baitfish Species in the Sarasota to Marco Island Subregion.**

| Species | Sales Volume per Day (Fish) | | | N |
|---|---|---|---|---|
| | Median | Average | Range | |
| Pinfish & Pigfish* | 65 | 90 | 10-250 | 15 |
| White Bait | -- | -- | 200-1,000 | X |
| Gulf Killifish | -- | -- | 85-200 | X |
| Mullet | -- | -- | 150-200 | X |

* Three retail respondents gave weekend sales that are not included in estimates provided in this table: 100-120, 100-200, and 400-500.
N - number of respondents (X - three or fewer respondents).

Some respondents commented on the potential demand for live, marine, baitfish that could be generated by party boat operations. A shrimp wholesaler was enthusiastic for farm-raised pinfish. This individual indicated that 3,000 could be sold every Friday to local party boat operators. An additional 200-800 pinfish could likely be sold every day on the regular delivery route from January to May. This individual stated that the potential business might justify dedicating a truck for three to four days per week just to handle pinfish. Similarly, a retail respondent indicated that 1,500 pinfish could be sold every day to party boat operators. Another respondent with an established business of providing pinfish to party boat operations was interviewed, but made no comments about the existing market.

(5) Potential for Farm-Raised Baitfish: The party boat market for pinfish is attractive and should be addressed in more detail. Respondent's enthusiasm for this market may have resulted from the perceived need for large quantities of pinfish delivered to a few locations on specific days. If feasible, culturing pinfish would provide several advantages over wild-caught supplies. Travel time and handling would be reduced and timely orders could be placed to facilitate production planning and harvest.

Gulf and long-nosed killifish are a potential bait for this subregion because of stronger retail familiarity and limitations on harvest effort. As the strong local interest in killifish was revealed through additional interviews, a point-of-sale card was proposed as a potential means to promote sales of killifish as a recreational bait. The model card would describe the species of game fish that could be targeted with killifish as a bait, and best fishing methods by which to use killifish. Retail respondents supported the development of such a card. Many respondents who were at first uninterested in killifish as a bait, indicated a willingness to try killifish if marketing support, such as point-of-sale assistance, were provided.

Response to finger mullet and white bait was much like that reported in the Port Richey to Sarasota subregion. Retail respondents expressed interest in finger mullet because of its excellent reputation as a live bait. They could not provide much demand or price information because of a general lack of experience with this bait. Respondents were, however, excited by the idea of additional supplies of white bait, but were skeptical that a farm-raised white bait could survive any better than a wild-caught product. The technical feasibility of culturing white bait is an entirely different issue.

One retail respondent indicated an interest in farm-raised tilapia as a bait for brackish water areas. This individual understood that tilapia may need to be acclimated to a higher salinity before it could be placed in a marine bait tank.

**Islamorada --> Key West -**

(1) Product Attributes: The predominant live, marine baitfish offered in this subregion is pinfish, although several respondents also carried live finger mullet and pilchards. Small blue crab, "dollar crab", are also a common marine bait offered by retail dealers in the area. No respondents indicated carrying mud minnows either currently or in the past. The range of sizes for pinfish in the local market is from two to three inches to five to six inches. The smaller pinfish are utilized for targeting snook, while the larger sizes are used for tarpon fishing. There are apparently few problems obtaining the desired sizes. "Silver" (*Mugil curema*) and finger mullet are also sold in the region, with sizes ranging up to a eight to 12 inches in length. In addition, pilchards are sold live, with the preferred size being four to five inches. An equal number of respondents obtained their live marine baitfish supplies from local fishermen versus wholesale bait dealers. A few indicated that they were able to produce for themselves all the pinfish needed. Expressed difficulties in keeping either pinfish or mullet alive was a common theme for respondents.

(2) Seasonality and Availability: Problems with availability depend on the species of interest. Virtually all respondents who carried pinfish expressed few problems with either obtaining the necessary supply volumes or the desired sizes. Basically, pinfish are easy to obtain all year. Finger and silver mullet are available during the runs that occur during late fall and winter. However, mullet are extremely scarce during the summer months. Similarly, pilchards are

difficult to find all year.
(3) Distribution and Prices: Significant price differences existed between pinfish and other live, marine baitfish (**Table 8**). This may be due to the fact that pinfish are utilized for targeting smaller, nearshore species, while mullet and pilchards are utilized for targeting larger species of gamefish. The trip expenditures of fishermen targeting the latter group (i.e. larger boats and heavier gear/tackle) may be higher, thus bidding up the prices for mullet and pilchard baits. The data collected by this study, however, cannot support or refute this hypothesis. However, the prices per each for pinfish are substantially lower than the prices indicated by respondents for both mullet and pilchards. Wholesale prices for pinfish were consistently reported to be $0.50 each. Retail prices ranged from $0.90 to $1.25 per each, with the majority of respondents indicating that the current retail price is $1.00 each. Wholesale prices for finger and silver mullet ranged from $8.00 per dozen (approximately $0.69 each) to $1.00 each, while retail prices ranged from $2.00 to $3.00 per each. Wholesale prices for pilchards were reported to be $1.00 each, with retail prices averaging about $2.25 each. **Note** that the retail prices reported in **Table 7** have been converted to units of one dozen.

**Table 8. Wholesale and Retail Prices for Live, Marine Baitfish in the Islamorada to Key West Subregion**

| Species | Wholesale Price ($ / each) | | N | Retail Price ($ / dozen)[1] | | N |
|---|---|---|---|---|---|---|
| | Range | Ave. | | Range | Ave. | |
| Pinfish | -- | $0.50 | 7 | $10.80-15.00 | $12.00 | 9 |
| Silver Mullet | -- | $0.69 | X | $24.00-36.00 | $30.00 | X |
| Finger Mullet | -- | $1.00 | X | $24.00-36.00 | $27.00 | X |
| Pilchards | -- | $1.00 | X | $24.00-36.00 | $27.00 | X |

N - number of respondents ( X - three or fewer respondents).
[1] Prices are typically quoted on a per each basis in this market, but have been converted to units of one dozen for reporting consistency. The reader can convert back to per each unit prices to reveal the actual price ranges quoted by respondents.

Weekly sales volumes for pinfish greatly exceeded that reported for either mullet or pilchards (**Table 9**). Sales volumes for pinfish ranged from 500 to 700 fish per week. Estimated weekly sales volumes for silver mullet and pilchards were 200 to 300 and 100 to 200, respectively. Respondents indicated that sales volumes will vary considerably depending on the season and species being targeted by local recreational fishermen.
(4) Demand: The demand for live pinfish is very strong in the Keys region. However, the demand peaks during two distinct periods of the year. For example, the winter (January to March) snook season creates a period of high demand. And during this time a smaller pinfish (i.e., two to four inches) is in demand. During the spring and summer (May - August) tarpon season, a larger pinfish (i.e., five inches and larger) is demanded by fishers. These larger pinfish are also used to target permit. Two respondents indicated that sales of 1,000 to 2,000 pinfish a week would be

**Table 9. Estimated Sales Volumes for Major Baitfish Species in the Islamorada to Key West Subregion.**

| Species | Sales Volume per Week (Fish) | | N |
|---|---|---|---|
| | Average | Range | |
| Pinfish | 535 | 500-700 | 7 |
| Silver Mullet | 275 | 200-300 | X |
| Finger Mullet | -- | -- | -- |
| Pilchards | 150 | 100-200 | X |

N - number of respondents (X - three or fewer respondents).

possible during the tarpon season if supplies were available. The demand for finger mullet also peaks during these two periods of the year. Pilchards are in demand primarily during the summer months. For both finger mullet and pilchards, demand easily exceeds supply during the summer months. Other species were mentioned as marketable if consistent live supplies were available. These included "silversides" (*Menidia* spp and *Membras* spp), "goggle-eyes" or bigeye scad (*Selar crumenophthalmus*), and ballyhoo (*Hemiramphus brasiliensis*). Some respondents not currently carrying live baitfish indicated an interest in pilchards, finger mullet, and pinfish, thereby reaffirming the demand for these well known species.

(5) Potential for Farm-Raised Baitfish: All but one of the respondents indicated an interest in obtaining supplies of farm-raised baitfish. Of the potential favorable attributes of a farm-raised product, nine respondents indicated that consistent availability would be most important. Seven respondents indicated that preferred sizes would be most important. Three respondents indicated that survival in holding systems (two respondent) and price (one respondent) were most important. Price was suggested to be least important to seven respondents, while five indicated that survival in holding systems was least important. Only three respondents indicated preferred sizes (two respondents) and consistent availability (one respondent) were least important. Six respondents indicated a willingness to pay more for a farm-raised product possessing the preferred attributes mentioned above, while four indicated an unwillingness to pay more. Of those that indicated a willingness to pay more for a farm-raised product, the percentage increase in price they would be willing to pay ranged from five to 40 percent, with an average of twenty percent.

**Jupiter --> Miami -**

(1) Product Attributes: The predominant live, marine baitfish sold by retail dealers in this subregion are pilchards and goggle-eyes. Other baitfish being sold include pinfish, finger mullet, croaker (*Micropogon undulatus*), and ballyhoo. A number of the dealers interviewed also carried small blue crab(i.e., dollar crab). No respondents carried mud minnows, although one respondent expressed an interest in trying them if available. The preferred size for pilchards is four to five inches, with some being sold as large as eight inches. Goggle-eyes are sold at a larger size, with the most common sizes ranging from four inches up to 12 inches. The larger sizes being used for

billfish in offshore waters. Finger mullet are typically sold in the five to six-inch size range. Pinfish are sold into two distinct markets, with a smaller fish (two to three inches) demanded by the inshore market and a larger fish (five to six inches) demanded by the offshore market.

Although pinfish are typically supplied by a wholesale dealer, pilchards and goggle-eyes are usually caught by the dealer themselves. Most respondents who carried pilchards and goggle-eyes indicated that these fish were extremely difficult to keep alive. The cost associated with deadloss would make purchasing from other suppliers not cost effective. Several respondents indicated an interest in learning how to reduce mortality of these bait species.

(2) Seasonality and Availability: Supplies of pinfish are sufficiently available year round. Pilchards are also consistently available, with the exception of the summer months when supplies are reportedly sometimes difficult to obtain. But given that most pilchards and goggle-eyes are obtained by the bait dealers themselves, the supply problems may be related to time available to fish for them, since few fishers sell them and fewer dealers exist. Finger mullet are typically available during the fall months, which coincides with snook season. Several respondents indicated that finger mullet are particularly difficult to obtain on a year-round basis.

(3) Distribution and Prices: Of the four varieties of live, marine baitfish commonly available in the area, goggle-eyes receive a higher price (**Table 10**). The per dozen retail price for goggle-eyes ranged from $36 to $40 per dozen, with one dealer reporting prices of up to $100 per dozen during tournaments. The average price per dozen for goggle-eyes was $38. The retail price for pilchards ranged from $4 to $20 per dozen, with the average price being almost $12 per dozen. The wholesale price (paid to fishers) for pilchards ranged from $0.08 to $0.50 each, with an average per each price of $0.33. All respondents who provided price information on goggle-eyes obtain their own supplies, thus wholesale prices did not apply. The average wholesale price for pinfish was $0.50 per each, with retail prices ranging from $12 to $15 and an average price of $13. Only limited price data was available for finger mullet. The average retail price per dozen was estimated to be $12. Wholesale pricing for pilchards and pinfish, as well as retail prices for pinfish and finger mullet, is commonly quoted on a per each basis. Retail prices for pilchards and goggle-eyes, however, are typically provided on a per dozen basis.

**Table 10. Wholesale and Retail Prices for Live, Marine Baitfish in the Jupiter to Miami Subregion**

| Species | Wholesale Price ($/ each) | | N | Retail Price ($ / dozen) | | N |
|---|---|---|---|---|---|---|
| | Range | Ave. | | Range | Ave. | |
| Pilchards | $0.08-0.50 | $0.33 | 4 | $4-20 | $11.50 | 6 |
| Goggle-eyes | -- | -- | - | $36-40 | $38[1] | X |
| Finger Mullet | -- | -- | - | -- | $12 | X |
| Pinfish | -- | $0.50 | X | $12-15 | $13 | X |

N - number of respondents ( X - three or fewer respondents).

[1] One respondent indicated a price of $100 per dozen for tournament participants. This value was not included in the computations for average and range.

Average reported sales volumes for pilchards, goggle-eyes, and pinfish were very similar within the area (**Table 11**). For example, average sales of pilchards was estimated to be 53 dozen per week, with sales ranging from 20 to 88 dozen per week depending on the weather. Most respondents indicated that sales of pilchards were fairly consistent year-round. Average reported sales of goggle-eyes was 54 dozen per week, with a range of 44 to 70 per week. Goggle-eye sales were much more seasonal and linked to tournaments and the billfish season. Pinfish sales were estimated to average 50 per week. No sales volume data were provided by the respondents for finger mullet.

**Table 11. Estimated Sales Volumes for Major Baitfish Species in the Jupiter to Miami Subregion.**

| Species | Sales Volume per Week (dozen fish) | | N |
|---|---|---|---|
| | Average | Range | |
| Pilchards | 53[1] | 20-88 | 6 |
| Goggle-eyes | 54 | 44-70 | X |
| Finger Mullet | -- | -- | -- |
| Pinfish | 50 | -- | X |

N - number of respondents (X - three or fewer respondents).
[1] One respondent indicated sales of 1,000 dozen per week during brief periods. This value was not included in the computations for average and range.

(4) Demand: The demand for live pilchards and goggle-eyes is very strong in the region. The demand for goggle-eyes is more seasonal, while pilchards are in demand throughout the year. The same is true for pinfish, with an increase in demand during the summer months. Although pilchards, goggle-eyes, pinfish, and finger mullet are generally available within the regional market, a number of respondents either did not carry one or more of these species, or did not carry any kind of live, marine, baitfish. Of these respondents, thirteen indicated an interest in carrying pinfish; ten each expressed an interest in finger mullet; six each would like to carry pilchards and goggle-eyes; two each would like to carry croakers and greenies; and one respondent each indicated an interest in carrying ballyhoo, menhaden, and mud minnows. However, 21 of 40 respondents indicated that the reason they did not carry any live, marine baitfish, or maintained a very limited supply, was the problems associated with keeping them alive and the resulting costs from dead loss. The potential market for mud minnows appeared to be fairly weak. This is likely a combination of a general lack of familiarity with the species and mud minnows not being a preferred bait for the offshore species typically targeted in the subregion.
(5) Potential for Farm-Raised Baitfish: The market for a farm-raised live, marine baitfish in the area does not appear to be too strong. One of the primary reasons is the fact that the most important baitfish species are readily available from wild capture. However, some limited interest in farm-raised baitfish was expressed by a few respondents. Four respondents indicated they

would be interested in farm-raised, live, marine baitfish, while five indicated they would not be interested. In terms of the product attributes that would be looked for in a farm-raised product, five respondents indicated consistency of availability was most important, while three and one respondents indicated that reduced holding tank loss and preferred sizes, respectively, would be most important. In contrast, four and five respondents indicated that a consistent availability and price, respectively, would be least important. Interestingly, two respondents indicated that reduced losses in holding tanks would be least important. Four respondents indicated a willingness to pay more for a farm-raised product, while two indicated they would not pay more. For those respondents indicating they would pay more, the percentage increase ranged from 50 percent to 100 percent. These respondents indicated that the market for pilchards, in particular, is very strong and higher wholesale prices for a farm-raised bait could easily be passed on to the final buyer.

**Ormond Beach --> Stuart -**

(1) Product Attributes: The primary live, marine baitfish sold by retail dealers in this subregion are pinfish, pigfish, finger mullet, and croakers. A total of 60 dealers were interviewed. Of that total, the number carrying a given species as a live bait is given as follows: pinfish (26 respondents), pigfish (17 respondents), finger mullet (26 respondents), and croakers (7 respondents). Five respondents indicated they carried mud minnows, while two other respondents carried spots (*Leisotomus xanthurus*). In addition, two respondents indicated that they carried "herring" and "mojarra" (Gerreidae spp.), although no specific information was provided on size, sales volumes, or prices. Most dealers carried a combination of species (23 respondents), while some carried only a single species (11 respondents). Those carrying a single species either carried finger mullet or pinfish. Generally, those firms carrying a mix of species obtained their product from commercial fishers and from their own vessel. Firms carrying only a single species, typically obtained their product from either a wholesale dealer (pinfish in particular) or a commercial fisher.

Size ranges of the live, marine baitfish sold in this subregion varies considerably for each species. In most cases, the size demanded by the buyer is dependent on the gamefish species being targeted or the time of the year. The size of pinfish sold by 26 respondents carrying this species ranged from two to four inches (15 respondents), four to six inches (four respondents), and six to eight inches (five respondents). The average size sold within the subregion was 3.75 inches. The smaller pinfish are used for trout, while the larger ones are used for snook. The same size categories also applied to pigfish. The size of pigfish sold by the 17 respondents carrying this species ranged from two to four inches (11 respondents), four to six inches (four respondents) and six to eight inches (two respondents). The average size pigfish sold in the subregion is four inches. And as with pinfish, the smaller pigfish are used for trout fishing, while the larger pigfish are used for targeting snook. The sizes of finger mullet sold within the region are somewhat larger than for pinfish or pigfish. The size of finger mullet sold by the 26 respondents carrying them ranged from three to four inches (six respondents), four to six inches (15 respondents), and six to eight inches (six respondents). The average size sold in this subregion is approximately five inches. The larger finger mullet are used for targeting snook and tarpon, while the smaller ones are utilized for trout fishing. Croakers are also sold, but at a larger size than any of the other baitfish species. For example, the croaker sold as bait ranged in size

from four to six inches (five respondents) and seven to eight inches (two respondents, with an average size of approximately six inches. The mud minnows sold ranged in size from two to five inches (two respondents), with an average size of about four inches. The single respondent selling spots reported a six-inch average size.

For most species, an equal number of respondents indicated they obtained their product from either commercial fishers or their own vessels. As indicated above, those carrying only a single species generally obtained their product from either a wholesale dealer or a commercial fishermen. Apparently, wholesale dealers do not play an important role in the live, marine baitfish market in this subregion. As with other regions of the state, many respondents expressed frustration in keeping baitfish alive. This is particularly true for dealers located off the water, who are dependent obtaining water supplies from shrimp distributors. These dealers indicated that the inability to obtain good quality water rendered the holding of live baitfish almost impossible.

(2) Seasonality and Availability: The supply availability of each baitfish species varied considerably. Some respondents indicated no problems in obtaining the necessary supplies on year-round basis, while most expressed difficulties is obtaining the necessary supplies during key seasons of the year. It is not clear if problems with availability are more directly linked with natural abundance of a given species across seasons, or with a poorly established market and distribution system. Periods of poor weather was noted as a prevalent, limiting factor in obtaining wild-caught baitfish.

While most respondents suggested that pinfish are available only on a sporadic basis, some indicated greater problems in availability occurring during certain seasons. These patterns of availability did not appear to be highly correlated with the specific location within the subregion. In both the northern and southern locations of the subregion, most dealers indicated that pinfish were particularly hard to obtain during the cooler months of winter and early spring. However, some suggested that supply problems also occur during the summer and fall, both in terms of volume and preferred sizes.

The market for pigfish is apparently better developed during the warmer months. As a result, the supply problems expressed by respondents was primarily limited to the spring and summer. Some respondents indicated that they were uncertain a market even existed during the cooler months. Although availability of pigfish was problematic year-round, most suggested an inability to obtain the necessary volumes during the spring and summer. The market for pigfish appears to be less developed in the northern locations of this subregion.

As with pinfish and pigfish, respondents that problems with availability existed during most seasons. However, most respondents indicated that finger mullet were particularly hard to find during the fall and winter months. And as with pinfish and pigfish, the seasonal pattern in availability did not appear to be related to the northern or southern locations in this subregion, but rather similar throughout.

The availability of mud minnows was found to be problematic year round. Similarly, the availability of croakers was problematic year-round, with two respondents indicating that croakers were hard to find during the spring months. No information was provided on the availability of spots.

(3) Distribution and Prices: Prices for the key live, marine baitfish species varied considerably, although the reported wholesale prices for all species and the retail prices for croaker and mud

minnows result from a small number of observations (**Table 12**). Unfortunately, no sales volume data were collected for the wholesale and retail dealers in this subregion.

Wholesale prices for pinfish ranged from $0.30 to $0.66 per each, with an average wholesale price per each of $0.45. Wholesale prices were usually provided on a per each basis. Only two respondents reported acquiring their pinfish from dealers. Eleven respondents each reported obtaining their product from commercial fishers and/or their own vessel. Retail prices for pinfish ranged from $5 to $12 per dozen, with an average price of $7.90. One marina quoted tournament prices for pinfish of $6.45 for three fish. This quote was not included in the computations for price range and average. Some retail quotes were provided on a "small" and "large" basis. Typically, such quotes provided a $2 to $3 difference between prices for the two size categories. Retail prices were typically provided on a per dozen basis, except the southern part of this subregion, where retail prices were usually quoted on a per each basis.

Wholesale prices for pigfish ranged from $0.15 to $0.50 per each. The average per each wholesale price was approximately $0.26. As with pinfish, wholesale prices for pigfish are typically quoted on a per each basis. All respondents acquired their pigfish supplies from commercial fishers and/or their own vessels. Retail prices for pigfish ranged from $4 to $12 per dozen, with an average retail price of about $6. And as with pinfish, some prices were quoted on a small and large basis, with a $2 to $3 difference between the two. All pigfish prices were quoted on a per dozen basis.

Wholesale prices for finger mullet ranged from $0.15 to $0.33 per each. The average wholesale price was $0.24 each. In contrast to pinfish and pigfish, finger mullet prices are typically quoted on a per dozen basis at the wholesale level. Retail dealers of finger mullet acquired their supplies from commercial fishers and/or their own vessel. Retail prices of finger mullet ranged from $3 to $12 per dozen, with an average retail price per dozen of $5. Retail prices provided by dealers in the southern areas of this subregion were higher than that found for the overall region (i.e., $7 average for respondents in the Sebastian to Stuart area).

Few observations were collected for croakers, mud minnows, and spot. The average wholesale prices per each for each species were very similar (i.e., $0.19 for croakers and $0.22 for mud minnows), while the retail price for croakers ($8.90 per dozen) was twice that reported for mud minnows ($4.40). The market for these two species is likely very different. Croakers are utilized for larger nearshore species, such as tarpon and large snook, whereas mud minnows are used for smaller nearshore species such as spotted seatrout, flounder, and snook. Croaker appears to be more familiar than mud minnows among users of live, marine baitfish in this subregion. The market for croaker, however, appears to not be well established. This latter point is suggested by the retail price range for croaker, which extended from $2 to $15 per dozen, depending on size. Although very few respondents indicated they carried spot as a live bait, the reported wholesale and retail prices exceeded those provided for all other species.

(4) Demand: The respondents indicated a strong market for pinfish, pigfish, and finger mullet. However, this market may be seasonal. Lesser markets were found to exist for croakers, mud minnows, and spots. The demand for live pinfish exists year-round in the subregion. But the market is reportedly much stronger during the cooler months of late fall, winter, and early spring, which coincides with snook season. The periods of February through May and September through December were specifically mentioned by almost half the respondents as the peak demand

**Table 12. Wholesale and Retail Prices for Live, Marine Baitfish in the Ormond Beach to Stuart Subregion**

| Species | Wholesale Price ($ / each) | | N | Retail Price ($ / dozen) | | N |
|---|---|---|---|---|---|---|
| | Range | Ave. | | Range | Ave. | |
| Pinfish | $0.30-0.66 | $0.45 | 9 | $5-12 | $7.90[1] | 21 |
| Pigfish | $0.15-0.50 | $0.26 | 6 | $4-12 | $6.10 | 17 |
| Finger Mullet | $0.15-0.32 | $0.24 | 5 | $3-12 | $5.00[1] | 25 |
| Croakers | -- | $0.19 | X | $2-15 | $8.90 | 7 |
| Mud minnows | -- | $0.22 | X | $3-7 | $4.40 | 5 |
| Spot | -- | $0.66 | X | -- | $11.00 | X |

N - number of respondents ( X - three or fewer respondents).
[1] Observations for pinfish (2) and finger mullet (1) were omitted due to prices being much larger relative to the range of the remaining observations. These prices represented small markets at specific marinas where prices were quoted for tournaments and were not representative of the regional market described by the data provided above.

for pinfish, although again as many respondents specifically indicated that snook season is the period of greatest demand. Several respondents, however, indicated that a market for pinfish exists year-round, with fishers using pinfish to target seatrout and grouper. Other more specific markets reportedly exist in the local charter industry and seasonal tournaments.

In contrast, the demand for pigfish apparently peaks during the late spring, summer and early fall months. Though snook season during the cooler months was mentioned as a period of demand, the seatrout season during the summer months was suggested as being the most important market. However, no clear pattern of preference was determined from responses which delineated months of peak demand, except that the demand for pigfish is apparently consistent during the warmer months and constrained primarily by supply availability during the cooler months. One respondent indicated that it was unclear whether a meaningful market exists in the cooler months.

Finger mullet appear to be in demand year-round. However, as was the case with pigfish, availability during the winter months constrains the growth of this market. The respondents consistently indicated that finger mullet were particularly hard to find during the winter months. And in addition, the preferred sizes were also difficult to obtain during most of the year. Flounder, seatrout, and snook are the primary species that recreational fishers target when using live, finger mullet as bait.

A few other species were mentioned as suitable for use in this subregion as a live bait. These included herring, "mojarra", "ribbonfish" (*Trichiurus lepturus*), eels, "yellowtail", greenies, and goggle-eyes. Ribbonfish are often utilized as a bait for king mackerel, while greenies and goggle-eyes are used in the offshore tournaments for billfish. Responses were unclear regarding the target species for which mojarra and yellowtails would be used. Other than the few respondents that indicated they are currently selling mud minnows, twelve additional respondents

indicated they would carry mud minnows if consistent supplies were available. The majority of these respondents were in the northern area of this subregion. Mud minnows are a preferred bait for trout and snook, as they are in other subregions of the state.
(5) Potential for Farm-Raised Baitfish: A market for farm-raised live, marine baitfish in this subregion appears to have some potential. Twenty-three respondents indicated an interest in purchasing farm-raised product to augment current supplies. Nine other respondents indicated they would have no interest, primarily because it is too easy to catch their own or they have a good relationship with an existing supplier. Of those who expressed an interest in farm-raised baitfish, the preferences for product attributes is clear. Seventeen respondents indicated that a consistent supply is the most important attribute of a farm-raised baitfish, while fifteen indicated price as being most important. Ten respondents indicated increased survival in holding tanks as most important. Interestingly, only six respondents indicated that being able to obtain preferred size as being the most important. Of those, several mentioned size preference to be particularly important in the finger mullet market. In general, supply consistency and competitive pricing is apparently much more important that size selection. Twenty-three respondents indicated they would pay more for farm-raised marine baitfish, while fifteen respondents indicated they would not pay more. Of those who indicated a willingness to pay more, the average percentage increase over current prices respondents would be willing to pay is approximately ten percent. The most common price increase respondents indicated they would be willing to pay is five to ten percent.

**Fernandina Beach --> Matanzas Inlet -**
(1) Product Attributes: Killifish, known in this area as mud minnows, were the predominant live baitfish. With the exception of one shop, all bait shops in the region carried them as a live product. Finger mullet were also available in several of the shops. Both were considered strong sellers. The supply was derived from several local wholesalers who caught their product in the Fernandina Beach area. A few shops caught their own mud minnows. Finger mullet were reported to be in continual short supply. Whatever size was available from producers was quickly sold. Mullet availability was limited primarily because of their delicate nature, which results in most purveyors having considerable difficulty catching and holding finger mullet alive for any appreciable length of time. The average size of mud minnows was 2.5 to 3.0 inches in total length. Several shops also sold tiger minnows. All of the respondents liked handling mud minnows and reported minimal loss because of the fish's inherent hardiness. Live bait fish were held in the same type of tank system as utilized for bait shrimp.
(2) Seasonality and Availability: Finger mullet were available from late spring to the fall months. Mud minnows were available in nearshore waters from warmer months until late fall. The limited supply in winter coincided with slower demand for the product as a bait. Peak demand was found to be during peak flounder fishing months, which occurs from late spring through the summer. As mentioned above, finger mullet availability was sometimes impacted by the fact that some suppliers found them difficult to keep alive in the holding systems currently available. Two other live baits were sold in this region. Fiddler crabs were supplied by primarily one wholesaler from the Gulf coast. Retail prices for these crabs averaged $7.00 per quart (approximately 55 count) or $4.50 per pint. Small, live blue crabs (*Callinectes sapidus*) less than 3 inches (i.e., "dollar crabs") were also sold by a limited number of shops, who primarily caught their own product.

Retail prices for these bait crabs averaged $1.00 each.
(3) Distribution and Prices: Mud minnows were supplied by several wholesalers who were also fishers. Wholesale prices for mud minnows ranged from $55-60 per thousand. The average price for the area was $56.50 per thousand ($0.06 each). Retail prices ranged from $1.70-2.50 per dozen for mud minnows and $2.50-3.25 per dozen for finger mullet. Average retail price for mud minnows $2.05 per dozen. Average retail price for finger mullet was $2.95 per dozen. Sales volumes for bait shops willing to share numbers for mud minnow sales ranged from 1,000 to 4,000 per week during the summer and fall months.
(4) Demand: Demand for both mud minnows and finger mullet appeared strong, with a few shops reporting that they often could not obtain enough supply to meet demand. One shop owner believed that he could sell 5,000 to 10,000 per week during the summer and fall months if consistent supply was available.
(5) Potential for Farm-Raised Baitfish: Three shops indicated that the potential for farm-raised mud minnows would be good and there would be no difficulty in selling such fish. Others were generally unfamiliar with aquaculture or unaware of the possibility of culturing baitfish.

## Summary and Recommendations

A survey of wholesale and retail dealers of live, marine, baitfish was conducted in eight subregions of coastal Florida. A sample of wholesale and retail dealers of live, marine, baitfish was generated from dealers lists provided by FDEP and derived from private sources. A total of 239 wholesale and retail dealers were interviewed utilizing a face-to-face questionnaire during spring and summer of 1997. The questionnaire solicited information regarding several demand and supply characteristics of the live, marine baitfish species sold by the responding dealers.

In general, the demand for live, marine baitfish is strong in all subregions of the state. Live, marine baitfish represent an important component of the live bait complement utilized by marine recreational fishers in Florida. Some species, such as pinfish and finger mullet, are a familiar bait and utilized by recreational fishers throughout the state (**Table 13**). The markets for other species, such as goggle-eye and croaker, are defined by a more delineated, local demand. The baitfish species and preferred sizes demanded are directly linked with the recreational species targeted in the region. The demand for most species often exceeds supply, not only in terms of volume, but also in terms of preferred sizes. Supply shortages occur due in large part to a dependence on wild-harvest methods, which are characterized by inherent limits associated with seasonal weather conditions, migratory patterns and abundance of fish stocks, time constraints of harvesters, etc. With the possible exception of pinfish, the availability of most species (i.e., finger mullet, pigfish, *Fundulus*) is seasonally limited. However, the regional differences in the nearshore and offshore recreational fishery provides for differences in live, marine baitfish species preferences. Pinfish is utilized for a variety of species and is universally available. Thus, pinfish is in demand by recreational fishers statewide. Finger mullet is also a popular bait species statewide, but is difficult to obtain during the winter months in most subregions of the state. Familiarity with *Fundulus*, or mud minnows, is limited to the northern regions of the state, in particular along the Gulf coast. However, supplies of mud minnows is even more restricted, thus resulting in less familiarity among (1) recreational fishers, in terms of target species and (2) wholesale dealers, in

**Table 13. Summary of Survey Findings for Species Sold and Price by Subregion.**

| Subregion | Key Live Baitfish Species Sold | Wholesale Price Per Each (average or range) | Retail Price Per Dozen (average or range) |
|---|---|---|---|
| **Gulf Coast -** | | | |
| Pensacola-->Suwannee | Pinfish | n/a | $3.00 |
| | Finger Mullet | n/a | $2.00-4.00 |
| | Fundulus | $0.08 | $2.60 |
| Cedar Key-->Spring Hill | Pinfish | $0.17 | $3.80 |
| | Fundulus | $0.08 | $1.85 |
| Port Richey-->Sarasota | Pinfish / Pigfish | $0.33 | $5.50 |
| | White Bait | $0.10-0.25 | n/a |
| | Fundulus | $0.13 | $3.08 |
| Sarasota--> Marco Island | Pinfish / Pigfish | $0.37 | $7.80 |
| | White Bait | $0.26 | $2.04-6.00 |
| | Fundulus | $0.14 | $3.00-$6.00 |
| **Atlantic Coast -** | | | |
| Fernandina Bch-->Matanzas Inlet | Finger Mullet | n/a | $2.95 |
| | Fundulus | $0.06 | $2.05 |
| Ormond Beach-->Stuart | Pinfish | $0.45 | $7.90 |
| | Pigfish | $0.26 | $6.10 |
| | Finger Mullet | $0.24 | $5.00 |
| | Croakers | $0.19 | $8.90 |
| | Fundulus | $0.22 | $4.40 |
| | Spot | $0.66 | $11.00 |
| Jupiter--> Miami | Pinfish | $0.50 | $13.00 |
| | Pilchards | $0.33 | $11.50 |
| | Goggle-eyes | n/a | $38.00 |
| | Finger Mullet | n/a | $12.00 |
| Islamorada-->Key West | Pinfish | $0.50 | $12.00 |
| | Pilchards | $1.00 | $27.00 |
| | Silver Mullet | $0.80 | $30.00 |
| | Finger Mullet | $1.00 | $27.00 |

terms of handling characteristics and product sources. Other species have an even more local demand, such as croaker and goggle-eye, which are considered a good bait for larger, offshore species. Various species of "white bait" and pigfish are also popular baits, but are often supplied only by the dealers themselves.

These supply limitations create an market opportunity for a farm-raised baitfish. Supplies of cultured bait may be less seasonal in nature, given that the baitfish would be grown in a controlled environment. Preferred sizes could be produced on demand and delivered in contracted quantities. Hardiness may also be bred into a cultured baitfish, thereby reducing deadloss. Refining culture techniques may yield more efficient holding tanks, further reducing mortality in wholesale and retail holding systems. Such qualities associated with a cultured product were found to be in demand by survey respondents. The majority of respondents who expressed an interest in a farm-raised product suggested that supply consistency would be the most important attribute of a farm-raised baitfish. Mortality and availability of preferred sizes were next in importance, with pricing being the least important. Some respondents indicated little interest in a farm-raised product, primarily because they had an established relationship with an existing dealer or could supply their needs with their own vessel. This was often the case with dealers handling pinfish and pigfish, or those dealers catering to the needs of offshore fishermen. However, for those dealers supplying the needs of recreational fishers targeting nearshore species, there is considerable interest in farm-raised baitfish, such as mud minnows and finger mullet. Although species preference and availability varies across subregions of the state, deadloss is a pervasive concern among wholesale and retail dealers. Some dealers will not purchase a given species because of expected mortality in existing holding tank systems, rather than because of availability problems or lack of demand by local recreational fishers.

Several **recommendations** for market development and additional research are suggested by this study. The following recommendations apply not only to *Fundulus*, but also to some of the other more important species of live, marine baitfish demanded by recreational fishers in Florida. These recommendations include:

(1) Additional research needs to be done with *Fundulus* spp. to determine the most efficient culture techniques (i.e., free spawn versus egg transfer), shipping methods, holding tank design, etc.

(2) Conduct economic analysis on mud minnow aquaculture in Florida, utilizing data derived from production studies and market survey information.

(3) Conduct follow-up demonstration project(s) linked to established wholesale dealers to test *Fundulus* spp. market acceptance on the basis of price, quality, species, and season in the most promising regions of the state.

(4) Develop recreational angler educational materials in the form of point-of-sale materials to promote the use of farm-raised live, marine, baitfish through identification of bait fish species, fishing methods, and target recreational species.

(5) Live bait retailer tank designs and operational instructions are needed to improve water quality, reduce deadloss, and improve live bait quality for all species, including *Fundulus*. Develop prototype recirculating holding system and conduct series of educational workshops on handling techniques.

(6) Conduct a survey of recreational fishers in each region of the state to determine live, marine baitfish use patterns and preferences, and determine level of awareness of *Fundulus* as a live bait. Determine if recreational demand patterns corroborate findings regarding dealers.

(7) Conduct growout research whereby second and third generation mullet are cultured to test whether they will adapt to holding tank environments and prove to be a durable, transportable, and acceptable farm-raised live baitfish.

(8) Given the pervasive problems with deadloss associated with live, marine baitfish, an extremely hardy bait fish could be a critical market attribute to establishing a farm-raised, marine baitfish industry. Interagency consideration and acceptance of certain hardy species, such as tilapia, would broaden the product line for potential industry participants.

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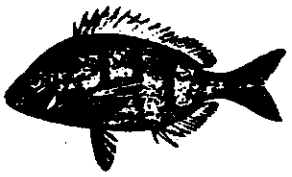
# Appendix A



# Live Marine Bait Fish Retailers and Dealers

1. **What *percentage* of the live bait fish you handle are...**

Sources

- purchased from a wholesale dealer _____%
- purchased directly from fishermen _____%
- produced by your own vessel _____%

NOTE: REMEMBER TO FIND OUT WHO THEIR WHOLESALE SUPPLIER IS.

Outlets

- sold retail _____%
- sold wholesale _____%

Your region of wholesale distribution is:

_____

2. **What species of live bait fish do you sell and what percentage of the total does each represent? Is there a *preferred size* for each?**

| | Retail | Whsl | Notes on preferred size |
|---|---|---|---|
| Pinfish | (____%) | (____%) | _____ |
| Minnows | (____%) | (____%) | _____ |
| Finger mullet | (____%) | (____%) | _____ |
| Others | (____%) | (____%) | _____ |
| | (____%) | (____%) | _____ |
| | (____%) | (____%) | _____ |
| | 100% | 100% | |

**Does the *preferred size* change by season, differ based on how the bait will be used, etc? How so? Note differences for various species?**

3. **Which months exhibit the strongest demand for live bait fish? On average, what *volume* of live bait fish are sold during these months (average by day, week, month) (note differences of the various species)?**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

Notes:

**In which months do you have the greatest problem with availability? In other words, how much *more* (percentage) could you sell if not limited by supply (note differences of the various species)?**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

Notes:

4. **Do you have a *problem getting the desired sizes* during certain seasons? If so, for what *sizes* does the availability problem exist and during what months (note differences for various species)?**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

Notes:

5. **What are the typical prices *you pay* for live bait fish purchased from a wholesaler or fisherman? Does this vary by season (note differences of the various species)? (Indicate units of measure).**

* WHOLESALE AND RETAIL PRICES

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

**Do *you pay* a premium for *preferred* sizes? (If so, what sizes and what prices?)**
Notes:

6. **If you purchase from others, on average how *often* do you take delivery?**
**_____ times per _____**

**Do you currently experience any specific product or service problems with your live orders? What are they?**

7. **What is your *minimum order* for live marine bait fish? Does it change by season or month (note differences of the various species)?**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

Notes:

8. **What is the *average* retail markup for live marine bait fish? Does this vary by season by species sold, etc.?**

9. **Would you be interested in purchasing *farm-raised* live marine bait fish? Yes ____ No _____**

**If so, what specific qualities/attributes would be most important to you as a buyer?**

| | *-----Level of Importance -------* | | |
|---|---|---|---|
| | Most | Least | None |
| -consistent availability | ___ | ___ | ___ |
| - preferred sizes | ___ | ___ | ___ |
| - survival | ___ | ___ | ___ |
| - price | ___ | ___ | ___ |
| - other _____ | ___ | ___ | ___ |

**Would you pay *more* for these qualities in cultured product? Yes____ No ____**
**If yes, on average (disregarding volume, season, species) how much? _____%**

10. **What live marine baits would serve as the *closest substitute* for live marine bait fish? Do they compete seasonally?**

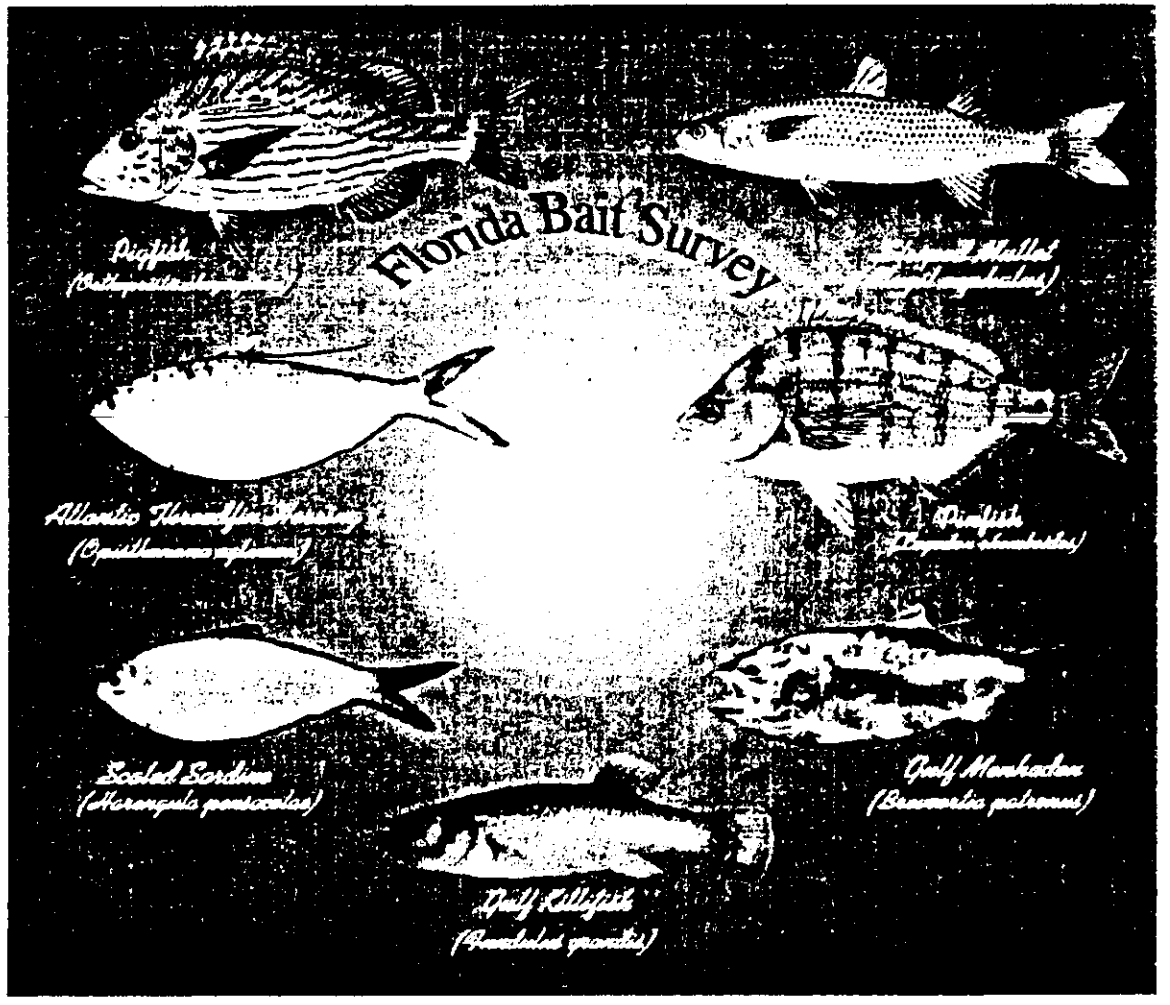
**What species are used?**

11. **What other types of live marine baits do you currently sell?**

12. **Are there any live marine baits you would like to sell that are currently unavailable in sufficient quantities?**

**General comments:**

# Appendix B


Florida Bait Survey
Scaled Sardine
(Harengula pensacolae)
Gulf Menhaden
(Brevoortia patronus)
Gulf Killifish