The Marine Life Fishery in Florida, 1990–98

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Introduction

Tropical fish-keeping is the second most popular hobby after photography in the United States (PIJAC, 1999). More importantly, interest in home aquaria continues to grow. Industry growth has been especially prevalent for the establishment of "artificial reef" aquariums, which require colonization by invertebrates (Loiselle and Baensch, 1995), due to recent technological advances and breakthroughs in the care of such species. Marine aquariums in particular rely primarily on live specimens (fish and invertebrates such as plants, live rock[1], live sand[2], and crustaceans) collected from the wild. This is because only about a dozen marine ornamental fish species are cultured commercially (Larkin and Degner, 2001). In the United States, the collection of marine ornamental species is restricted primarily to south Florida and Hawaii.

The marine life industry in Florida, as defined by the Florida Administrative Code (FAC), pertains to the nonlethal harvest of saltwater fish, invertebrates, and plants for commercial purposes (FAC Online[3]), primarily as ornamentals for the aquarium market. Products are landed live and sold to wholesalers, retailers, or direct to individual aquarium owners. Some products, such as sand dollars (family Mellitidae), are dried and destined for the shell/curio market. The vast majority of products, however, are destined for the hobby aquaria industry (PIJAC, 1999). Florida accounts for 95% of U.S. production (collection and culture) of tropical fish (saltwater and freshwater) (Watson and Shireman, 1996).

The State of Florida instituted a comprehensive data collection program, the Marine Fisheries Information System, in 1985 (FAC Online[4]). The data resulting from this system are commonly called "trip ticket" data, because the program requires that all landings of saltwater products intended for sale, barter, or trade be reported on a trip-level basis. The collection of trip ticket data for marine life began in 1990. Assessment of individual species and fishing effort are necessary to determine whether existing regulations are likely to be effective at maintaining the sustainability of the resources. To date, however, the data for marine ornamental species have not been studied.

Specifically, a thorough analysis of the marine ornamental species landings and effort data would aid in the development and analysis of regulatory options. For example, the current moratorium in Florida on entrants into the marine ornamental species fishery until 2005, could produce a variety of economically beneficial effects by eliminating myopic fishing behavior. Short-run harvest decisions can produce a disregard for other fishermen, recreational divers, reef health, mortality rates, optimal harvest sizes, seasonal demand, etc. that can lower revenues. However, a moratorium cannot control fishing effort or participation rates (e.g. number of active fishermen). And, given the diversity of species collected, such a generic program could neglect the protection of species of specific concern. Moreover, the designation of 1997 as the "International Year of the Reef" brought international attention to the marine life collection industry. According to the World Resources Institute (WRI, 1998),

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ABSTRACT—The marine life fishery in Florida is defined as the harvest of live marine specimens (fish and invertebrate species including plants, and also live rock, and live sand) for commercial use, primarily as ornamentals for the aquarium market. This paper summarizes the regulatory measures that have been implemented and the data collected on 318 species between 1990 and 1998. Regional analysis shows the primary collecting areas, and seasonal analysis shows when the majority of landings occur. Statistics on the number of participants provide insight into the size of the industry.

[1] Live rock means rock with living marine organisms attached to it. (FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.002(7). Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.)

[2] Live sand is no longer included in the regulations so there is no formal (legal) definition. In general, it refers to sand that has been exposed to seawater for a period of time such that it can more effectively support live organisms.

[3] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[4] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68E-5. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

nearly all reefs of the Florida Keys are at a moderate threat from human activities, including the overfishing of target species. In addition,

> "At a minimum, over fishing results in shifts in fish size, abundance, and species composition within reef communities. Evidence suggests that removal of key herbivore and predator species may ultimately affect large-scale ecosystem changes. For example, removal of triggerfish has been linked with explosions in burrowing urchin populations, their prey, who subsequently accelerate reef erosion through feeding activities." (WRI, 1998:1).

To fill an informational gap that is needed for effective regulatory analysis, this paper summarizes the data collected by the State of Florida on 1) the harvest of live marine specimens for commercial use and 2) the participation by licensed and permitted fishermen. Following an overview of the regulatory environment, a description of the landings distinguishes between fish and invertebrates and, in particular, identifies statistics for live rock and live sand (which are reported in pounds rather than numbers).

In general, numbers of invertebrates landed greatly exceeds the number of fish landed. This is because, for example, hundreds of small snails can be harvested with a single scoop of a bucket. This harvesting method contrasts with the capture of fish species, which often requires diving gear and the use of slurp guns or nets to harvest an individual specimen. Another reason for distinguishing between fish and invertebrates is that fish prices per unit are, in general, higher.

Within the fish and invertebrate groups, data are summarized by common names. This decision was made in order to reduce the scope of the analysis since over 320 different species were landed during the study period. Furthermore, landings volume and value, average prices, and trip-level catch rates and revenue are only presented for the ten most valuable fish and invertebrate species groups, which are aggregated by common name.

Regulatory Overview

The harvest of live marine ornamental species for commercial purposes is regulated in Florida by Chapter 68B-42 (formerly 46-42) of the Florida Administrative Code (FAC Online[3]). This chapter specifies the licensing requirements; identifies the "restricted species," which require an additional license to harvest; and establishes allowable gear use (including the use of nets, traps, chemicals, etc.) and harvest restrictions (including prohibitions on collecting certain species, quotas, closed seasons, closed areas, and allowable fish sizes). The major components of the current regulations are summarized below.

Recreational harvesters—for example, individuals wishing to stock their own aquarium—are subject to daily "bag" limits or quotas. For fish and invertebrates, the daily quota is 20 specimens (including no more than 5 angelfish and 6 colonies of octocorals) and no more than 1 gallon of plants (FAC Online[5]). Commercial harvesters have higher daily quotas for a number of fish and invertebrates, namely: butterflyfish, angelfish, porkfish, Spanish and Cuban hogfishes, starsnails, blue-legged hermit crabs, and giant Caribbean anemones (FAC Online[6]). To exceed the daily recreational bag limits, however, commercial collectors must have a current saltwater products license (SPL). To commercially harvest marine life specimens in particular, a marine life endorsement (MLE) is also required. During the 1998 session of the Florida Legislature, a moratorium on the issuance of new MLE's was passed, effective 1 July 1998 and was recently extended until 1 July 2005. In addition to the SPL and MLE, a restricted species endorsement is needed to sell the majority of fish, invertebrate, and plant species (FAC Online[7]). These licenses and endorsements are issued by the Florida Fish and Wildlife Conservation Commission (FFWCC), which is the agency charged with managing the state's fisheries according to regulations passed by the Florida Legislature.

Aside from daily bag limits and annual permitting requirements, certain fish species are subject to size restrictions (FAC Online[8]). For example, butterflyfishes and several species of angelfish—including gray, French, blue, queen, and rock beauty—are currently subject to minimum and maximum length restrictions. Maximum lengths are also specified for gobies, jawfish, and Spanish hogfish, while spotfin hogfish are subject to a minimum length requirement.

Not all species may be harvested. The list of prohibited species includes longspine sea urchins, Bahama starfish, sea fans (*Gorgonia flabellum* or *G. ventalina*), all hard and stony corals, and all fire corals (FAC Online[9]). The prohibition on the harvest of sea fans and corals does not, however, apply to such organisms that are attached to legally harvested live rock.

Although the harvest of native live rock from state waters is now prohibited, live rock can be cultured provided that the rock is "of a readily distinguishable geologic character from rock native to

[5] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.005. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[6] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.006. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[7] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Fish Chapt. 68B-42(2), Invertebrates Chapt. 68B-42(3), and Plants Chapt. 68B-42(4). Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[8] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.004. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[9] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.003, 68B-42.009. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

the area or be securely marked or tagged" (FAC Online[10]). In addition, live rock may only be harvested from submerged lands leased from the State of Florida if the individual has an Aquaculture Certificate issued by the Florida Department of Agriculture and Consumer Services and a Federal Live Rock Aquaculture Permit issued by NOAA's National Marine Fisheries Service.

Allowable gear restrictions regulate the use of nets (hand held, barrier, and drop), trawls, and slurp guns (FAC Online[11]). Barrier nets cannot exceed 60 feet in length, have a depth greater than 8 feet, and a mesh larger than ¾ inch. Drop nets are also restricted to a mesh size of ¾ inch and maximum dimension of 12 feet. Trawls, which can only be used to collect dwarf seahorses, must be a towed by a vessel no longer than 15 feet (and at no greater than idle speed) with an opening no larger than 12 inches by 48 inches. Quinaldine (2-methylquinoline, CAS No. 91-63-4), a chemical used to briefly anesthetize fish and facilitate their capture, may be used only if the individual has a special activity license issued by the FFWCC (Rule 62R-4.004).

Finally, all collected marine life must be harvested live and the vessel must contain a continuously circulating live well, aeration, or oxygenation system (FAC Online[12]). Species may be collected from all state waters, excluding the U.S. Department of Interior's Biscayne National Park (unless permission is obtained from the park superintendent), and adjacent Federal waters (FAC Online[13]). Harvest limits apply to species collected from all areas.

Data and Methods

The Florida Department of Environmental Protection (FDEP), formerly known as the Department of Natural Resources, has been collecting data on the harvest of live marine ornamental products since 1990. The Marine Fisheries Information System is the data collection program maintained by the FDEP. These data are maintained and analyzed by the Florida Marine Research Institute (FMRI). Prior to 1990, landings data were collected only from individuals holding quinaldine permits. Given that the pre 1990 data exclude invertebrates, prices, and the harvest of fish without chemical use, these data are not analyzed in this report. All data described in this report were obtained from FMRI.[14]

The FDEP requires licensed wholesale dealers (i.e. buyers) to report dealer and harvester (collector) license numbers, the location of harvest, the species and quantity purchased, and the value of each transaction by species (Chapter 62R-5). Since these transactions typically occur immediately following the trip, these forms are referred to as "trip tickets." In the case of live marine ornamentals, the majority of collectors are also dealers that inventory product for a period of time before selling (Larkin and Degner, 2001). Thus, the trip ticket information most aptly reflects the total revenue received by harvesters for specimens that survive to the first point of sale. In addition, landings that are not sold, bartered, or exchanged (i.e. harvested for commercial use) are excluded from the data set.

The trip tickets also allow the collector to report the size of individual specimens collected (e.g. small, medium, large) since there are size limits for some species. The size information is, however, not mandatory and is frequently unreported. Due to the scope of the data considered in this description (i.e. given the number of species, years, seasons, and areas), species size information is not incorporated into this analysis. It is important to note, however, that the size of wild-caught ornamental fish will vary depending on species, season, location, and sex of the fish. These factors can also affect specific characteristics of the fish, such as color. For many species, size and color differences translate into price differences.

The landings of the majority of marine ornamental species are measured in terms of the number of specimens collected live by the harvester. Landings of some species of invertebrates are, however, measured in pounds (e.g. live rock and live sand) and gallons (e.g. snails and plants). To facilitate comparisons between fish and invertebrates and among invertebrates, data is most frequently summarized by landed value (i.e. harvester revenue calculated from the quantities and prices reported on the trip tickets) vs. volume.

Results

Industry Participants

The number of licensed marine life dealers increased significantly in the mid 1990's, but by 1998 this number had declined to the level observed in the early 1990's (Table 1). In 1998, there were 66 licensed dealers in the State of Florida. Individuals can be licensed as both a collector and dealer, and many hold both licenses (Larkin and Degner, 2001). Information on all other permits, licenses, and endorsements are also summarized in Table 1 for the 1990–91 to 1998–99 seasons.

The MLE is the only license/permit that applies exclusively to the marine life industry. The total number of MLE's increased from 1990 to 1997. In 1997, about 800 endorsements had been issued, whereas fewer than 200 were issued in 1990. The number of active marine life endorsements (i.e. endorsements with

[10] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.008(3)(a). Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[11] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.007. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[12] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.0035. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[13] FAC Online. 2001. Florida Dep. State, Div. Elections, Tallahassee, Fla. Official publication, Florida Administrative Code annotated, available from LexisNexis, 701 East Water Street, Charlottesville, VA 22902, Chapt. 68B-42.0036. Available online at http://fac.dos.state.fl.us/faconline/chapter68.pdf.

[14] FMRI. 2000. Marine fisheries trip ticket program data. Unpublished data obtained from the Florida Marine Fisheries Institute, Florida Fish and Wildlife Conserv. Comm., 100 Eighth Avenue S.E., St. Petersburg, Fl 33701-5095.

Yellowhead jawfish,
Opistognathus aurifrons.
Photo by Dr. Luiz A. Rocha,
Smithsonian Tropical Research Unit.

Blue angelfish,
Holacanthus bermudensis.
Photo by Dr. Luiz A. Rocha,
Smithsonian Tropical Research Unit.

Blue chromis,
Chromis cyanea.
Photo by Dr. Luiz A. Rocha,
Smithsonian Tropical Research Unit.

Bluehead wrasse,
Thalassoma bifasciatum.
Photo by Dr. Luiz A. Rocha,
Smithsonian Tropical Research Unit.

Spotfin hogfish,
Bodianus pulchellus.
Photo by Dr. Luiz A. Rocha,
SmithsonianTropical Research Unit.

Table 1.—Number of commercial participants in the Florida marine life industry (FMRI, text footnote 14).

License year	Active[1] wholesale dealers	Restricted species endorsements	Saltwater products license		Marine life endorsements	
			Total	Active	Total	Active
1990–91	69	127	349	297	159	107
1991–92	91	265	436	289	311	164
1992–93	109	362	521	329	389	197
1993–94	114	431	572	317	477	222
1994–95	112	523	655	318	566	229
1995–96	103	589	698	273	630	205
1996–97	98	626	706	213	668	175
1997–98	105	726	844	241	801	198
1998–99	66	703	767	152	743	128

[1] The term active refers to license numbers that reported landings during the year.

reported landings), however, has remained fewer than 230. Only 128 MLE's were active in 1998. The total number of MLE's issued declined recently due to a moratorium established 1 July 1998 that will remain in effect at least until 1 July 2005. However, there continues to remain a significant amount of latent effort in the fishery (33% in 1990 and 83% in 1998).

Table 2.—Common names of marine ornamental species collected in Florida, 1990–98 (FMRI, text footnote 14).

Fish		Invertebrates
Angelfish (6)	Moray (5)	Anemone (6)
Balloonfish	Parrotfish (9)	Bryozoa
Barracuda	Perch	Chiton
Bass (8)	Pilotfish	Clam (4)
Batfish	Pipefish	Conch (7)
Bigeye	Porgy	Cowrie (2)
Blenny (8)	Puffer (3)	Crab (15)
Brotula	Ray (4)	Fileclam (2)
Burrfish	Razorfish	Gorgonian (3)
Butterflyfish (6)	Remora (2)	Jellyfish (2)
Cardinalfish (3)	Scorpionfish (2)	Isopod
Catfish	Seahorse (3)	Live rock (6)
Chub	Searobin	Live sand
Clingfish	Shark (3)	Lobster (3)
Coronetfish (3)	Sheephead	Nudibranch (3)
Cowfish (3)	Skate	Octopus (4)
Cusk-eel	Snapper (3)	Oyster
Damselfish (14)	Soapfish	Penshell
Drum (4)	Soldierfish	Plant (4)
Filefish (6)	Spadefish	Polychaete (5)
Flounder	Squirrelfish (3)	Sand dollar (4)
Frogfish (2)	Stargazer (2)	Scallop (2)
Goatfish (2)	Stingray (2)	Sea biscuit (3)
Goby (3)	Surgeonfish	Sea cucumber (2)
Grouper (5)	Sweeper	Sea hare
Grunt (5)	Tang (3)	Sea urchin (5)
Hamlet (6)	Tilefish	Shrimp (8)
Hawkfish	Toadfish	Snail (26)
Hogfish (3)	Triggerfish (3)	Sponge (4)
Jack (2)	Tripletail	Starfish (8)
Jawfish (4)	Trumpetfish	Tunicates
Lizardfish	Trunkfish (2)	Whelk (2)
Minnow	Wrasse (8)	
Mojarra		

Note: Names reflect the biological family and the numbers in parentheses correspond to the number of different genus and species combinations related to the family. Names are listed in alphabetical order.

Product Types

A total of 318 marine ornamental species were landed in Florida for commercial purposes from 1990 to 1998. The total includes 181 species of fish (57%) and 137 invertebrate species (43%), which includes live rock, live sand, and various plant species. Slightly over 70% of fish species (121) and about half of the invertebrate species (71) are classified as "restricted" (i.e. requiring an additional license to harvest).

Aside from the type of organism and restricted status, each specimen is identified by its common name, genus, species, and/or family by FMRI. For the fishes, species that share a common name typically are from the same family. For example, there are nine species of parrotfish that are all members of the Scaridae family. Of the 181 fish species landed, there are a total of 67 common names representing 51 families (e.g. bass, groupers, hamlets, and perch are all members of the Serranidae family). The common fish and invertebrate names for live marine specimens harvested for commercial use in Florida are listed in Table 2.

For the invertebrate species, common names do not match specific families as closely as the fish species. For example, the 26 "snails" represent 21 different families and the 15 "crabs" represent 10 families. When grouped by common name, however, the 137 species are reduced to 32 common-name groups. In this analysis, live rock and live sand are frequently distinguished from the remaining invertebrates, which are not further divided.

Table 3 lists the 10 species groups of fish and invertebrates that accounted for the highest average annual landed values, which were calculated from reported landings and prices received by harvesters (i.e. harvester revenues), and the primary species within each group in terms of landed value. The jawfish and butterflyfish groups are

Table 3.—Top 10[1] marine fish and invertebrate species in terms of average value, 1990–98 (FMRI, text footnote 14).

Common name	Species	Scientific name	Percent value by name
Fish			
1. Angelfish	Blue	*Holacanthus bermudensis*	26%
2. Hogfish	Spotfin (Cuban)	*Bodianus pulchellus*	70
3. Damselfish	Blue chromis (reef)	*Chromis cyanea*	37
4. Jawfish	Yellowhead	*Opistognathus aurifrons*	91
5. Wrasse	Bluehead	*Thalassoma bifasciatum*	54
6. Butterflyfish	Spotfin	*Chaetodon ocellatus*	99
7. Seahorse	Dwarf	*Hippocampus zosterae*	76
8. Parrotfish	Striped (painted)	*Scarus croicensis*	57
9. Surgeonfish	Blue	*Acanthurus coeruleus*	82
10. Drum	High-hat	*Equetus acuminatus*	57
Invertebrates			
1. Live rock	Algae	N/A[2]	36
2. Snail	Turbonella	Family Turbinellidae	45
3. Anemone	Giant Caribbean	*Condylactus gigantea*	63
4. Crab	Horseshoe	*Limulus polyphemus*	33
5. Starfish	Red spiny sea star	*Echinaster sentus*	65
6. Gorgonian	Red	*Swiftia exserta*	38
7. Sand dollar	Other	*Encope, Leofia, Mellita* spp.	90
8. Sea urchin	Variable or green	*Lythechinus variegatus*	56
9. Sponge	Red tree	Class Demospongia	51
10. Live sand	N/A	N/A	NA

[1] Rankings are based on average value of landings to harvesters, 1990-98. Top individual species (by economic value) based on 1990-96 landings data.

[2] N/A indicates not applicable.

comprised primarily (91–99%, respectively) of a single species, namely, the yellowhead, *Opistognathus aurifrons*, and spotfin, *Chaetodon ocellatus*, respectively. Among the invertebrates, no single species comprises more than 65% of the total value of any of the top 10 groups.

Regional Data

The State of Florida has defined 17 primary marine fishing areas for the purpose of data collection. Finer geographic resolution is available within each of the primary areas as Federal waters are distinguished and state waters are divided into smaller subareas. Trip tickets with area information represented about 75% of the total number of trips reported and 77% of the total value (as received by the harvester) of marine life landed. The source region was not reported for 16% of trips that accounted for 15% of landed value.

Only 8 of the 17 primary areas were reported as significant sources of marine life collected for commercial purposes. The identified collecting regions ranged from the Crystal River to Tarpon Springs areas on Florida's west coast down to the Miami area on Florida's southern east coast. Overall, the Marathon area accounted for the highest value of landings (31% or $7.2 million) and the highest number of trips (39% or nearly 181,000).

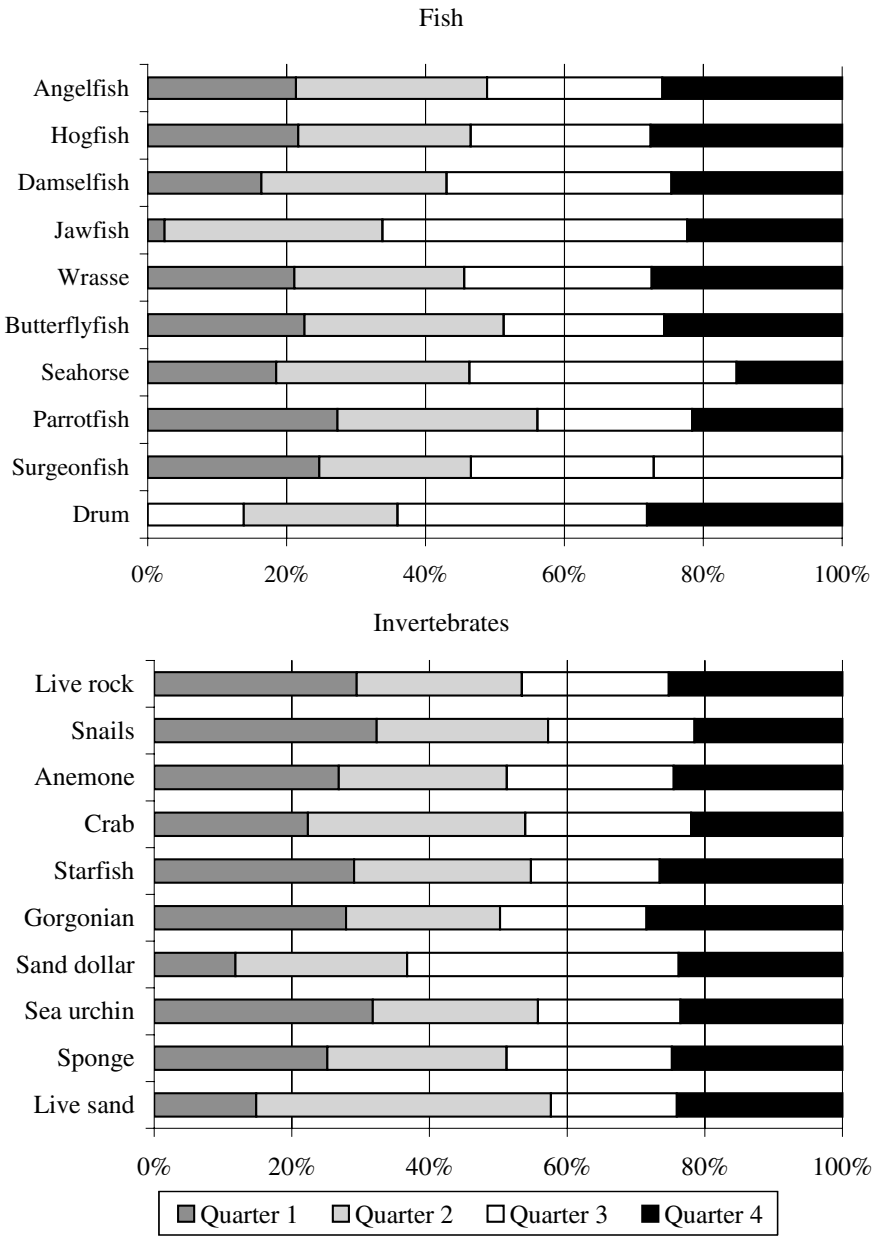

Figure 1.–Quarterly revenues for the top 10 marine fish and invertebrate species groups, 1990-98 (FMRI, text footnote 14).

Seasonal Data

To examine seasonal differences, the total landed value of fish and invertebrates was calculated for each quarter (January–March, April–June, July–September, October–December). In general, fish landings have been somewhat equally distributed during the season in terms of value to the harvester. When fish revenues were highest, in 1994, the second quarter accounted for a relatively larger share. On average, the value of fish landings were highest during the second quarter and lowest during the fourth quarter; average fish landings were valued at $274,387 and $208,958 (accounting for 28% and 22% of average annual landings) for the second and fourth quarters, respectively.

When the revenues are examined for the top 10 revenue-generating groups of fish species, some seasonal patterns are evident. Figure 1 (top panel) shows the quarterly revenue shares for each of the top fish species. For the top 2 fish species, revenues are roughly equally distributed throughout the year. Jawfish and drum are primarily caught in the third quarter and each contribute relatively little in the first quarter. Conversely, the value of parrotfish and surgeonfish landings have been highest in the first quarter. Seahorses are the only species group for which the share of annual landings value falls below 20% in the fourth quarter.

The quarterly total value of invertebrates ranged from $404,072 (accounting for 24%) to $456,746 (accounting for 26%) for the first and third quarters, respectively (Figure 1, bottom panel). There was no noticeable change in landings distribution over time and, thus, this information was not included.

When comparing the fish revenue distribution with the invertebrates, the first quarter accounted for a larger share of annual revenues for the invertebrate species. Sand dollars and live sand were the exception, where revenues of these species were highest in the second and third quarters, as with the majority of fish species. Over 40% of live sand revenues were reported from April through June. The share of revenues (landed values) in the fourth quarter was above 20% for all invertebrate species and all fish species except seahorses. With the exception of sand dollars, it appears that invertebrate revenues are lowest in the summer months (July through August).

Table 4.—Annual commercial landings and value of marine fish and invertebrates collected in Florida by type, 1990–98 (FMRI, text footnote 14).

			Invertebrates					
	Fish		Animals		Plants		Live rock and live sand	
Year	No. (1,000)	Value ($1,000)	No. (1,000)	Value ($1,000)	Gal. (1,000)	Value ($1,000)	Lb. (1,000)	Value ($1,000)
1990	245	767	849	377	31	8	249	252
1991	291	987	893	467	30	38	581	853
1992	393	971	1,352	581	28	48	777	1,433
1993	355	1,284	1,989	1,036	35	33	954	1,213
1994	426	1,613	1,888	1,209	31	29	1,092	1,422
1995	259	944	2,171	1,053	37	43	1,180	1,432
1996	206	833	2,637	899	20	31	809	843
1997	278	904	3,148	911	21	41	185	183
1998	201	759	3,340	897	14	22	167	218

Data by Product Type

Annual landings for fish averaged 295,060 individuals over the 1990–98 period. Landings for invertebrates as a group cannot be summed due to differences in measurement units across species. For example, live rock is measured in pounds and anemones are measured by number. In terms of annual value, fish and invertebrates averaged $1,006,822 and $1,730,059, respectively. Thus, invertebrates are worth more to the industry since they collectively averaged 63% of total industry value over the study period. The average invertebrate share was, however, affected by the surge in the collection of wild live rock that peaked in 1995 when invertebrate species accounted for 73% of total industry value. The invertebrate share was lowest in 1990 at 45%, prior to the establishment of the live rock and live sand collection activities.

The total value (harvester revenues) of Florida marine life landings increased from $1.4 million in 1990 to about $4.3 million in 1994. The total value of this fishery then decreased to about $1.9 million by 1998. The decline is explained by a reduction in live rock and live sand landings, which fell from about 1.2 million pounds in 1995 to 167,000 pounds in 1998 (Table 4). The reason for the dramatic decrease was the prohibition of all commercial harvest of live rock and sand, in both Atlantic Ocean and Gulf of Mexico waters adjacent to Florida. The only exception is the harvest of live rock from permitted commercial culture sites approved by the appropriate state or Federal agencies. By 1998, there were seven commercial live rock culture leases off the coast of Florida, but total production has remained low (FMRI[14]).

Fish Species Data

Landings and value of marine ornamental finfish increased to peak levels in 1994, then decreased through 1998. Reported landings increased from 245,000 individual fish in 1990 to 426,000 in 1994, then declined to about 200,000 in 1998 (Table 4). Total value followed the same general pattern, increasing from $767,000 in 1990 to $1.6 million in 1994, then declining to $759,000 in 1998. In 1992, landings increased 35% while the total value of landings declined slightly. The increased landings were due specifically to a five-fold increase in the collection of seahorses (from about 14,000 harvested in 1991 to 83,700 harvested in 1992), primarily *Hippocampus zosterae* (i.e. dwarf seahorses). In addition, the increased landings of seahorses lowered market prices; the average price paid by dealers for seahorses fell from $1.10 in 1991 to $0.17 in 1992, a decline of nearly 84%.

During the 1990–98 period, 181 individual species of finfish were harvested. For simplicity, these species were grouped into 67 categories using their common name as defined by FMRI; a three-digit code for each species is associated with a (1) common name, 2) genus and species, and 3) family. The common name is most closely associated with the family. For example, the data set contains three genus and species of "cowfish" including *Lactophrys polygonia, L. quadricornis,* and family Ostraciidae, which are listed (in common name field), respectively, as honeycomb cowfish, scrawled cowfish, and other cowfish. Although each species has its own unique code, each is a member of the Ostraciidae family, and data from all three are aggregated and included under the common name "cowfish." Note that not all codes are associated with a unique genus and species and, thus, fall into an "other" category. Consequently, the number of individual species should be considered as conservative.

The 67 aggregate finfish groups are listed in Table 2. If a group consists of multiple species, parentheses are used to indicate the number of individual species that are included in the common name groupings. Of these groups, ten accounted for nearly 84% of the total value. The most important species group was angelfish, which represented 54% of the total value. Hogfish accounted for 7.5% of the total while the other eight groups accounted for about 22% of the total value of live marine finfish collected from 1990 to 1998. Since each species group contains multiple species, it may be helpful to know how important any single species may be, especially when regulations can be enacted at the species level.

Table 5.—Annual commercial landings of the top 10 marine fish species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Number of specimens landed annually									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Angelfish	71,459	82,589	86,711	79,782	82,668	73,666	60,602	59,817	48,839	71,793
2. Hogfish	8,535	8,794	9,888	10,112	13,494	12,451	10,633	7,869	7,419	9,911
3. Damselfish	32,150	31,702	38,337	21,558	29,387	27,504	14,102	21,703	21,225	26,408
4. Jawfish	6,325	4,995	16,624	22,151	28,267	13,596	9,285	8,976	5,894	12,901
5. Wrasse	23,440	25,032	27,227	20,686	21,713	16,920	12,453	16,633	13,512	19,735
6. Butterflyfish	12,667	15,266	15,479	13,213	12,949	9,420	6,941	6,772	6,551	11,029
7. Seahorse	5,969	13,982	83,715	71,815	110,948	23,341	19,037	90,049	16,977	48,426
8. Parrotfish	4,953	5,760	8,374	6,212	8,728	3,876	2,866	4,004	2,998	5,308
9. Surgeonfish	6,511	6,881	8,930	9,342	8,378	6,791	5,359	5,961	7,702	7,317
10. Drum	11,891	9,816	9,505	10,569	11,526	9,086	7,233	6,661	6,781	9,230

Table 6.—Annual average unit price of the top 10 marine fish species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Average unit price ($ each)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Angelfish	$5.62	$7.00	$6.61	$9.13	$8.85	$6.92	$7.61	$8.54	$8.12	$7.60
2. Hogfish	7.43	6.56	4.01	8.84	9.23	7.28	7.89	8.23	8.44	7.55
3. Damselfish	1.33	1.20	1.08	1.53	2.01	1.30	1.22	1.12	1.19	1.33
4. Jawfish	2.01	2.19	2.17	2.38	3.07	2.44	2.60	2.58	2.36	2.42
5. Wrasse	1.48	1.65	1.20	1.44	2.40	1.60	1.70	1.65	1.68	1.64
6. Butterflyfish	2.65	2.74	2.10	2.78	4.14	2.20	2.59	3.17	2.35	2.86
7. Seahorse	1.13	1.10	0.17	0.12	0.88	1.07	1.34	0.35	0.80	0.77
8. Parrotfish	2.90	4.29	3.33	6.72	6.40	4.04	5.21	5.18	5.74	4.87
9. Surgeonfish	3.34	2.44	1.85	3.34	4.05	2.51	3.41	3.41	3.47	3.06
10. Drum	1.83	1.81	1.48	2.02	3.46	1.77	2.24	2.24	2.11	2.17

With the exception of seahorses and surgeonfish, all top fish species groups exhibited a decline in landings volumes from 1990 to 1998 (Table 5). The largest species group decline was reported to be the butterflyfish (–48%), while seahorses were the species group with the largest increase (184%).

Average per unit prices varied considerably across species. For example, in 1998 the average unit price for angelfish and hogfish both exceeded $8 per fish, while the unit price for damselfish, jawfish, wrasse, butterflyfish, and drum were less than $3 (Table 6). The average price for seahorses was less than $1. With the exception of angelfish, the species exhibiting the highest landings volume (i.e. damselfish, wrasse, and seahorses) also showed the lowest average unit price. The average unit price for angelfish varied considerably during the 1990–98 period, increasing from $5.62 in 1990 to $9.13 in 1993, before declining to $6.92 in 1995. The unit average price for angelfish then increased to $8.12 in 1998.

Invertebrate Species Data

The 137 individual species of invertebrates collected by the marine life industry in Florida from 1990 to 1998 were analyzed by their 32 respective common names (Table 2). Due to the diversity of the invertebrate species, these groups are further aggregated into the following three categories: 1) invertebrate animals (including crustaceans, mollusks, starfish, anemones, sea cucumbers, sponges, nudibranches, bryozoa, etc.), 2) plants (including those of the Caulerpaceae, Halimedaceae, and Corallinaceae families), and 3) live rock and live sand.

The patterns in invertebrate landings volumes and value during the 1990 to 1998 period varied somewhat across the three major groups. Landings of invertebrate animals exhibited an increase from about 850,000 individual animals in 1990 to over 3.3 million in 1998, an increase of 290% (Table 4). However, the total value of the animals increased from about $376,000 in 1990 to a peak of $1.2 million in 1994, then declined steadily to $896,000 in 1998 as less valuable species on a per unit basis (such as snails, starfish, and sand dollars) garnered an increasing share of total landings by volume.

Landings of marine plants increased from about 31,000 gallons in 1990 to a peak of 37,000 gallons in 1995. Plant landings then declined dramatically (about 62%) to 14,000 in 1998 (Table 4). The value of marine plants reached peaks in 1992 and 1995, then declined with landings volumes to $22,000 in 1998.

The landings of live rock and live sand mirror the enactment of legislation intended to eliminate the harvest of naturally occurring live rock. Live rock landings increased from 249,093 pounds in 1990 to about 1.1 million pounds in 1995, a 340% increase (Table 7). Following the moratorium on landings in Federal waters, landings decreased to 90,975 pounds in 1998. The value of live rock and sand reached equivalent peaks of about $1.4 million in 1992 and 1995, then decreased dramatically to a total of

Table 7.—Annual commercial landings of the top 10 marine invertebrate species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Landings (no. or lb.)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Live rock[1]	249,093	581,376	776,810	954,197	1,087,065	1,094,723	671,226	104,044	90,975	623,279
2. Snail[2]	90,369	182,180	257,752	293,688	288,406	480,706	470,357	493,614	805,210	373,587
3. Anemone[2]	272,476	302,701	334,043	293,590	307,891	335,795	233,649	200,533	201,629	275,812
4. Crab[2]	92,250	90,845	119,591	152,375	117,889	181,074	252,882	334,559	788,598	236,674
5. Starfish[2]	26,575	28,220	129,574	333,911	314,071	222,102	543,782	975,368	511,297	205,012
6. Gorgonian[2]	17,803	24,350	23,898	29,960	32,106	35,976	37,057	44,867	40,743	28,736
7. Sand dollar[2]	254,832	88,191	193,574	560,480	578,574	619,716	776,582	781,567	771,817	438,850
8. Sea urchin[2]	31,745	35,495	33,008	41,156	39,052	41,268	36,039	33,232	40,900	36,823
9. Sponge[2]	17,017	18,858	17,886	18,626	18,236	17,659	14,459	15,464	17,166	17,534
10. Live sand[1]	N/A[3]	N/A	N/A	N/A	4,802	86,175	138,194	81,129	75,584	42,876

[1] Pounds landed (lb.).
[2] Number landed (no.).
[3] Not applicable (N/A).

Table 8.—Annual unit price of the top 10 marine invertebrate species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Average unit price ($)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Live rock[1]	$1.01	$1.47	$1.84	$1.27	$1.30	$1.20	$1.12	$1.30	$1.93	$1.38
2. Snail[2]	0.38	0.22	0.37	0.61	0.55	0.68	0.28	0.26	0.21	0.40
3. Anemone[2]	0.37	1.47	0.42	0.48	0.53	0.43	0.44	0.47	0.48	0.57
4. Crab[2]	0.48	0.43	0.40	1.46	0.86	0.55	0.42	0.34	0.18	0.57
5. Starfish[2]	0.80	0.78	0.12	0.30	0.95	0.23	0.17	0.08	0.09	0.39
6. Gorgonian[2]	1.98	1.58	0.94	2.23	3.80	2.42	2.80	2.47	2.41	2.29
7. Sand dollar[2]	0.12	0.27	0.15	0.17	0.12	0.10	0.11	0.11	0.08	0.14
8. Sea urchin[2]	0.50	0.56	0.34	0.55	1.12	1.77	1.86	1.94	1.67	1.14
9. Sponge[2]	1.59	1.76	1.49	1.93	3.22	2.77	3.05	2.96	2.87	2.40
10. Live sand[1]	N/A[3]	N/A	N/A	1.00	0.78	1.39	0.68	0.59	0.56	0.83

[1] Dollars per pound landed ($/lb.).
[2] Dollars per specimen landed ($ each).
[3] Not applicable (N/A).

$218,000 in 1998 (Table 4) as reported landings consisted only of live rock cultured on permitted lease sites.

Ten invertebrate species groups accounted for over 89% of the total value attributable to invertebrate animals, plants, and live rock and sand during the 1990–98 period. The most important single species group was live rock, which accounted for almost 50% of the value accumulated during the 1990–98 period, despite the drastic declines following the 1995 moratorium. Snails, anemones, and crabs combined accounted for 20% of the value, with the other six species contributing the remaining 30% of the total value.

With the exception of live rock and anemones, all of the top 10 invertebrate species groups experienced net increases in landings volumes during the 1990–98 period, with some being dramatic. For example, starfish, snails, and crabs, exhibited increases in landings of 1,824%, 791%, and 755%, respectively, from 1990 to 1998 (Table 7). As with finfish species, prices also varied across invertebrate species groups (Table 8). The highest average unit prices during the 1990 to 1998 period were associated with sponges ($2.40), gorgonians ($2.29), live rock ($1.38 per pound), and sea urchins ($1.14).

Trip-level Data

Data were provided on an individual species basis, thus, trip information (i.e. number of trips) was averaged by species, then averaged by species group. Hence, the aggregate number of trips cannot be determined; this information would need to be evaluated at the collector level. Due to confidentiality, however, this information is not sufficiently complete for purposes of analysis. This is because several full-time collectors essentially specialize in the harvest of certain species. These individuals land other species but have developed either special skills needed to collect certain species (especially fish) or have found areas where such species are located (Larkin and Degner, 2001). In addition, some collectors even cultivate certain resources, leaving juveniles to harvest at a later date when they are larger and can command a higher price.

From 1990 to 1998, landings of fish per trip for a given species averaged 9.3 but were reported to be as much as 7,800 while landings of invertebrates per trip for a given species averaged 158 but were reported to be as much as 92,500 (FMRI[14]). This extreme variation reflects

Table 9.—Annual landings per trip of the top 10 marine fish species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text foonote 14).

	Average landings per trip (no.)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Angelfish	9.2	8.2	9.4	9.3	8.1	9.7	9.6	7.5	6.9	8.7
2. Hogfish	5.1	3.9	4.4	4.4	6.3	6.8	6.7	5.2	6.4	5.5
3. Damselfish	14.3	9.6	9.8	6.7	9.7	12.7	10.7	10.0	12.7	10.7
4. Jawfish	10.7	8.6	18.1	17.4	21.4	16.1	14.4	29.8	27.4	18.2
5. Wrasse	8.8	7.3	6.8	5.6	7.6	7.5	6.8	9.6	10.1	7.8
6. Butterflyfish	3.5	3.5	4.1	3.8	3.3	3.8	3.6	3.8	4.0	3.7
7. Seahorse	26.0	54.7	148.0	139.7	447.4	381.9	193.1	15.3	50.9	161.9
8. Parrotfish	3.5	3.4	3.7	3.1	4.0	3.8	2.8	4.8	4.0	3.7
9. Surgeonfish	3.6	3.5	3.7	3.8	3.3	4.2	4.1	5.8	6.9	4.3
10. Drum	10.3	7.8	6.3	6.3	7.6	7.4	7.5	9.4	8.8	7.9

Table 10.—Annual landings per trip of the top 10 marine invertebrate species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Average landings per trip (no. or lb.)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Live rock[1]	181.3	237.4	232.1	274.5	280.3	364.0	417.3	404.1	571.4	329.1
2. Snail[2]	96.8	109.0	150.9	154.8	162.9	365.7	391.3	382.4	416.7	247.8
3. Anemone[2]	167.8	133.4	131.5	109.0	148.0	182.0	134.9	177.8	182.5	151.9
4. Crab[2]	33.4	25.5	28.3	72.6	29.7	49.9	129.0	106.9	225.8	77.9
5. Starfish[2]	N/A[3]	N/A	N/A	N/A	N/A	N/A	N/A	21.0	19.5	20.1
6. Gorgonian[2]	24.4	17.8	17.5	21.2	23.8	24.3	20.6	53.6	40.3	27.0
7. Sand dollar[2]	14,459.5	2,320.8	2,901.5	3,517.5	5,524.8	6,272.7	6,359.4	7,414.0	14,352.0	7,013.6
8. Sea urchin[2]	25.1	31.1	25.3	29.3	29.2	30.1	25.0	37.3	41.0	30.4
9. Sponge[2]	12.0	13.5	10.3	13.2	13.5	12.8	11.5	12.7	16.9	12.9
10. Live sand[1]	N/A	N/A	N/A	N/A	358.0	501.2	1,896.5	1,223.6	N/A	994.8

[1] Pounds landed (lb.).
[2] Number landed (no.).
[3] Not applicable (N/A).

Table 11.—Annual revenue per trip of the top 10 marine fish species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Average revenue per trip ($)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Angelfish	49.29	55.42	60.25	78.09	67.03	64.44	75.52	66.13	58.93	63.90
2. Hogfish	35.37	25.36	17.80	37.92	57.60	48.80	52.36	42.28	55.28	41.42
3. Damselfish	21.22	12.18	11.17	10.08	19.94	16.65	13.09	11.65	15.89	14.65
4. Jawfish	21.97	17.73	39.09	41.71	68.23	40.28	37.49	77.57	65.18	45.47
5. Wrasse	15.70	12.62	8.01	8.57	20.19	11.46	13.01	16.90	16.25	13.63
6. Butterflyfish	9.08	15.01	22.19	12.88	17.73	8.96	12.64	9.96	8.89	13.04
7. Seahorse	21.37	47.31	20.92	21.02	596.51	366.56	205.44	26.96	55.56	151.29
8. Parrotfish	14.97	13.69	15.38	26.53	28.99	17.20	20.85	24.97	21.07	20.41
9. Surgeonfish	10.15	9.38	9.56	14.47	12.56	11.18	13.01	19.72	33.23	14.81
10. Drum	31.94	22.33	15.71	18.39	36.00	15.64	19.94	21.40	14.90	21.81

the ability of collectors to harvest thousands of small "critters" in a very short period of time. Because the data do not allow for the evaluation of all species landed on each trip, these trip-level data may be conservative estimates of the activity of collectors that harvest multiple species during a given trip.

Aside from the aggregate averages, it is helpful to examine the data for the individual species. To that end, information on annual average landings and value (i.e. total harvest revenue) are calculated at the trip level for each of the top 10 fish and invertebrate species groups (Tables 9–12).

With the exception of seahorses, landings for fish species within the top 10 groups averaged between 4 and 18 fish per trip (seahorse landings averaged 162 per trip) (Table 9). Jawfish is perhaps the only species group whose landings per trip have increased over time; the average catch rate per trip increased from nearly 11 fish per trip in 1990 to over 27 per trip in 1998. In general, landings of each species varied annually.

Landings per trip (i.e. catch rate) for the top invertebrate species are summarized in Table 10. In general, catch rates for invertebrates greatly exceed those for fish. Only 4 of the top 10 invertebrate species were characterized

Table 12.—Annual revenue per trip of the top 10 marine invertebrate species by common name that account for the highest average landed value, 1990–98, in Florida (FMRI, text footnote 14).

	Average revenue per trip ($)									
Common name	1990	1991	1992	1993	1994	1995	1996	1997	1998	Average
1. Live rock	185.85	327.09	400.78	340.76	408.55	417.32	460.52	728.67	1,001.15	474.52
2. Snail	54.93	28.69	55.48	87.37	102.61	511.41	112.48	111.85	102.07	129.65
3. Anemone	74.89	79.78	66.04	68.92	91.25	85.05	70.08	92.49	93.90	80.27
4. Crab	16.55	11.42	14.54	158.54	26.46	28.90	45.59	49.40	47.10	44.28
5. Starfish	N/A[1]	N/A	N/A	N/A	N/A	N/A	N/A	17.87	16.24	17.06
6. Gorgonian	52.68	24.75	16.64	47.96	99.22	53.31	67.11	134.55	96.26	65.83
7. Sand dollar	1,753.09	623.22	448.83	871.36	675.04	687.00	637.74	748.00	1,046.00	832.25
8. Sea urchin	13.74	20.54	12.13	17.51	32.37	39.23	25.59	40.89	37.57	26.62
9. Sponge	19.76	22.57	16.68	28.68	25.19	30.48	25.75	31.77	47.54	27.60
10. Live sand	N/A	N/A	N/A	N/A	395.58	822.11	971.33	448.38	N/A	659.35

[1] Not applicable (N/A).

by landings of equal to or less than 30 specimens per trip. Landings of sand dollars averaged 7,014 per trip, which is significantly higher than that for the next highest group, snails, with 248 per trip. Note that live rock and live sand are both measured in pounds and thus cannot be compared to other invertebrate species. However, trends in average catch rates are comparable. Most of the top invertebrates experienced increases in catch rates between 1990 and 1998. In particular, landings of live rock, snails, anemones, and crabs all increased.

The average annual revenue received per trip by fish species group is shown in Table 11. Recall that since collectors can harvest multiple species during a given trip, these revenues may not equal the total trip revenue. Average revenues for the top fish species ranged from about $13 to $151 for butterflyfish and seahorses, respectively. With the exception of seahorses, the next highest revenue generator per trip was angelfish, which accounted for about $64 per trip. When comparing the average landings in the first few years vs. the last, it appears that revenues per trip for hogfish, jawfish, and surgeonfish have increased while those for damselfish, butterflyfish, and drum have declined slightly.

The average revenue per trip for invertebrates exceeded that for fish (Table 12). Among the top 10 invertebrate species, trip revenues averaged from about $17 for starfish to over $800 for sand dollars. It may be that effort directed at invertebrates is more specialized and thus fewer different species are landed per trip. During the 1990–98 period, revenues per trip increased for nearly all species, especially live rock. However, note that live rock landings are no longer unrestricted since all production must come from permitted culture lease sites.

Summary and Conclusions

The marine life collection industry in Florida has grown during the past decade as the number of licensed collectors (i.e. fishermen with MLE's) increased from 159 to 743. As a result, the volume and/or value of landings of the top 10 fish and invertebrate species groups increased. The growth is particularly evident in the collection of invertebrate animals (i.e. excluding plants, live rock, and live sand). The harvest of live rock and live sand also increased dramatically during the 1990–95 period, but declined due to a moratorium on the collection of naturally occurring rock and sand in state and Federal waters.

Although the number of harvesting participants increased dramatically during the 1990–98 period, the implementation of a temporary moratorium on marine life endorsements has limited further entry into the industry until 2005. Regulations have also been imposed on certain species (e.g. size limits, bag limits, and trip limits), but most regulations apply to the industry as a whole (e.g. allowable harvest methods). The implementation of these regulations reflects concern regarding the sustainability of marine life resources in Florida.

The information presented in this paper includes data collected by FMRI since the initiation of the marine life trip ticket program in 1990. The reported regional, seasonal, and trip-level analysis (along with trends in landings, prices, and/or total values) provides some insight into the harvest pressure being exerted on wild stocks of ornamental finfish and invertebrate animals. Although no stock assessments exist for any of the individual species targeted by the marine life collection industry, such information (particularly for the predominant species) could be useful to resource managers as they develop effective management measures for this growing industry.

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