

An Economic Profile of Florida's Marine Life Industry



By

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I. Introduction

I. A. Background

The marine life industry in Florida – as defined by the Florida Administrative Code (F.A.C.) – pertains to the non-lethal harvest of saltwater fish, invertebrates, and plants for commercial purposes (F.A.C. Rule 46-42). Products are landed live and sold to wholesalers, retailers, or direct to individual aquarium owners (foreign and domestic). Some products, such as sand dollars, are dried and destined for the shell/curio market. The vast majority of products, however, are destined for the hobby aquaria industry. According to the Pet Industry Joint Advisory Council (PIJAC), tropical fish-keeping is the second most popular hobby (after photography) in the United States. Aside from fish, the successful establishment of an “artificial reef” requires colonization by invertebrates (Loiselle and Baensch).

Live “tropical” aquatic products include both marine and freshwater species. In Florida, the marine component of the larger industry – for live ornamental aquatic products – is derived almost exclusively from the capture of wild specimens (exceptions include the culture of clown fish and live rock).¹ Conversely, the freshwater species (primarily fish) are cultured or “farmed.” According to the PIJAC, Florida produces and supplies 95 percent of the tropical fish sold in North America. In addition, tropical fish and plants are the number one air freight commodity for the state of Florida; each week an estimated 15,000 to 20,000 boxes leave Tampa International Airport alone (PIJAC). The PIJAC estimates the annual value of tropical species collected and farmed in Florida at approximately \$60 million. For comparison, the worldwide wholesale market for marine (i.e., saltwater) ornamental products – wild and farmed – is estimated at more than \$100 million (Aquaculture Development Program; National Sea Grant Office).

I. B. The Marine Life Industry in Florida

I. B. 1. Regulations and Requirements for Participation

The collection of live tropical, ornamental, marine species – including fish, invertebrates, and plants – is regulated by Chapter 46-42 of the Florida Administrative Code (F.A.C.). This “Marine Life Rule” was implemented in 1991 and has since been amended three times (in 1992, 1993 and 1995). The major components of the current rule are summarized below.

Recreational harvesters – for example, individuals wishing to stock their own aquarium – are subject to daily “bag” limits on the collection of marine life species. For fish and invertebrates, the maximum daily catch equals 20 individuals (including no more than five angelfish) and no

¹ The Harbor Branch Oceanographic Institute has successfully reared six species of clownfish in captivity. The “culturing” of live rock is allowed by individuals who lease submerged lands from the State of Florida (F.A.C. 46-42.008).

more than one gallon of plants (F.A.C. 46-42.005).² Commercial harvesters have higher daily limits for butterflyfish, angelfish, and giant Caribbean anemones (F.A.C. 46-42.006). In order to exceed the daily recreational bag limits, however, commercial collectors must have a current Saltwater Products License (SPL).

According to Florida Statute 370.06(2), every person, firm, or corporation that sells, offers for sale, barter, or exchanges for merchandise any saltwater products harvested and landed in Florida must have a valid SPL. The annual fee for an SPL ranges from \$50 to \$600 depending on residency and whether the license is issued to an individual or a vessel. In order to harvest marine life specimens in particular (e.g., tropical fish and invertebrate species including mollusks, plants, live rock and live sand), a \$75 “marine life fishery” endorsement is also required. In addition to the SPL and marine life endorsement, a restricted species endorsement is needed to sell the majority of species (F.A.C. 46-42(2-4)).³ This endorsement is issued to individuals or firms that can certify a minimum income threshold from the sale of saltwater products in at least one of the last three years. The typical threshold is 25 percent or \$5,000 (whichever is less) from employment, entrepreneurship, pensions, retirement benefits, and social security benefits.

Aside from bag limits and permitting requirements, certain species are subject to a minimum and/or maximum size restriction (F.A.C. 46-42.004). For example, the butterflyfishes and several species of angelfish – including the Grey, French, Blue, Queen, and Rock Beauty – are currently subject to both a minimum and maximum length (i.e., individuals outside the range cannot be landed). Maximum lengths are also specified for the gobies, jawfish, and Spanish hogfish, while Spotfin hogfish are subject to a minimum length requirement for landing. The size restrictions pertain only to those species captured in Florida’s state or adjacent federal waters; they do not pertain to interstate or international commerce (e.g., individuals collected elsewhere and imported into Florida).

Not all species may be collected. The list of prohibited species includes Longspine urchins, Bahama starfish, hard and stony corals, sea fans, and fire corals (F.A.C. 46-42.009). In addition, live rock may only be harvested from submerged lands leased by the state of Florida if the individual has a FDEP or federal permit for live rock culture (F.A.C. 46-42.008). Hence, in order to collect live rock in Florida, an individual needs (1) an SPL with marine life and restricted species endorsements, (2) a submerged lands lease, and (3) a FDEP or federal permit.

Rule 46-42 of the F.A.C. also includes restrictions on allowable gears, including nets (hand held, barrier, and drop), trawls, slurp guns, and quinaldine (F.A.C. 46-42.007). Barrier nets cannot exceed 60 feet in length, have a depth greater than 8 feet, and a mesh larger than $\frac{3}{4}$ inch. Drop nets are also restricted to a mesh size of $\frac{3}{4}$ inch and cannot exceed 12 feet. Trawls, which can only be used to collect dwarf seahorses, must be towed by a vessel no longer than 15 feet (and at less than idle speed) with an opening no larger than 12 inches by 48 inches. Quinaldine – a chemical used to briefly anesthetize fish and facilitate their capture – may be used only if the

² In addition, Rule 46-44 of the F.A.C. contains an allowable species list for sharks and prohibits the take of more than one per person, or two per vessel, per day.

³ The list of “restricted” fish, invertebrates, and plants – which comprise the majority of all species landed – is reproduced in Appendix B.

individual has a special \$25 activity license issued by FDEP (FDEP Rule 62R-4.004). The chemical must be diluted with seawater at no more than 2% concentration.

Finally, all collected marine life must be harvested live and the vessel must contain a continuously circulating live well, aeration, or oxygenation system (F.A.C. 46-42.0035). Species may be collected from all state waters, excluding the Biscayne National Park (unless permission is obtained from the park superintendent), and adjacent federal waters. Harvest limits apply to species collected from all areas.

During the 1998 Session of the Florida Legislature, a moratorium on the issue of new marine life endorsements was passed effective 1 July 1998 to 1 July 2002 (Senate Bill 1506). The bill also mandated that the Marine Fisheries Commission (MFC) prepare a report of options for the establishment of a limited-entry program for the marine life fishery by 1 July 2000. The MFC consulted interested commercial fishing organizations and held three public hearings to solicit input for policy development. The resulting report to the Florida Legislature included a number of options (all with mixed support and opposition) for establishing a limited entry program for Florida's marine life industry (Division of Marine Fisheries, 2000). There was general support for continuation of the moratorium, however there were those that want it coupled with "a specific goal in terms of licenses rather than an indefinite continuation." Those supporting continuation of the moratorium also proposed a number of conditions, all of which had mixed support and opposition. The conditions included (1) continuation of the moratorium until those who are not reporting landings stop paying for the license, (2) using attrition to reduce numbers of licenses, and (3) basing the ability to renew the endorsement on reported landings. There was also discussion of qualifying landings by using marine life landings only, or by using total reported landings. There was general support for raising the income threshold of fishing income from \$5,000 to \$10,000 (in any one of three previous years) in order to renew the license. A limited entry license based on reported landings had some support, but there was no clear consensus as to when to initiate a cut-off date for implementation. Tiered licenses, based upon type of equipment used for harvest was also explored. For example, one license would be required for SCUBA or chemical use, another for roller frame trawl use, and another for trap/bycatch use. Other discussions focused transfer ability of licenses, and also on the idea that a license could only be used by one or a limited number of people (Division of Marine Fisheries, 2000).^a Detailed codes were not available for 1997-1998 data. The Marine Fisheries Commission is also considering establishing (1) bag limits for tricolor hermit crabs and turbo snails, (2) changing the bag limit for pink-tipped anemones, (3) changing the size and bag limits of Cuban and Spanish hogfish, (4) allowing the harvest of small coastal sharks, and (5) adding some grunt species to the marine life species list (Marine Fisheries Commission Staff Paper, September 1998).

I. B. 2. Market Channels

Following landing, commercial products are typically sold to a local wholesaler for distribution in Florida or export (interstate or international). Harvesters may also act as wholesalers and brokers of imported products. This primary distribution chain is depicted in Figure 1:

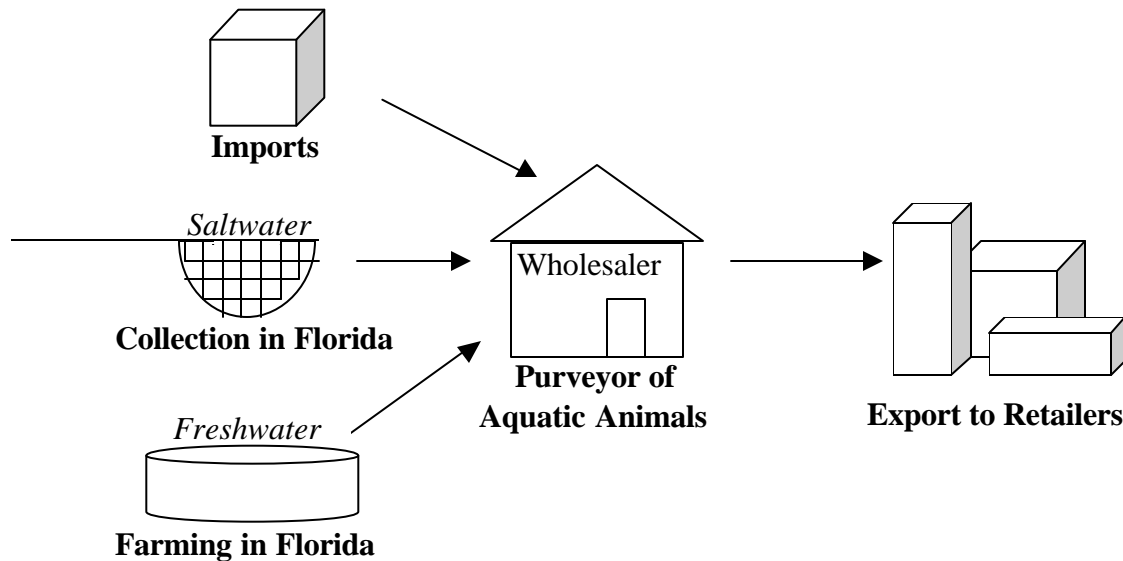


Figure 1. Typical Distribution System for Tropical Ornamental Marine Species

According to Januzzi (1991), 83 percent of collected specimens are destined for U.S. markets (48 percent remain in Florida, 35 percent are exported to other states). Of the specimens that remain in Florida, 65 percent are sold to wholesalers in South Florida.

I. B. 3. Need for Research

The tropical fish-keeping hobby is the second most popular in the United States (PIJAC). More importantly, interest in home aquariums continues to grow. Industry growth has been especially prevalent for the establishment of “artificial reefs” due to recent technological advances and breakthroughs in the care of such species. Marine aquarists rely on live specimens – fish and invertebrates such as plants, rock, sand, and crustaceans – collected from the wild. In the United States, such collection is restricted to South Florida and Hawaii.

The recent awareness of the plight of coral reefs – such as the designation of 1997 as the “International Year of the Reef” – has begun to highlight the marine life collection industry. According to the World Resources Institute (WRI), almost all reefs of the Florida Keys are at a moderate threat from human activities, including the over fishing 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. In the Caribbean, decades of over fishing has led, in many places, to very low levels of grazing fish species. Because of this, herbivorous sea urchins (a non-burrowing species) have played an increasingly important role in keeping down algae growth.”

As discussed in section I.B.3 above, collection practices in Florida have been regulated since the early 1990s with passage of Florida Statute 46-42. However, until 1998, participation – and hence fishing effort – has been effectively unrestricted. Senate Bill 1506 placed a four-year moratorium (beginning July 1, 1998) on the issue of new “marine life endorsements,” without which marine life collected in Florida cannot be sold (Florida Statute 370.06(2)(d)2). The current moratorium (and potential future limited entry system) could produce a wide variety of economically beneficial effects by eliminating myopically driven practices that lead to a disregard for other fishers, recreational divers, reef health, fish mortality rates, and lower revenues (as smaller fish are collected and sold for a lower price). Given the diversity of species collected, such a generic program could neglect the protection of certain species.

The State of Florida instituted a comprehensive data collection program – the Marine Fisheries Information System – in 1990. The data resulting from this system are commonly called “Trip Ticket” data, because the program requires that all landings of saltwater fish, saltwater products, and shellfish destined for sale, barter, or trade be reported to the FDEP on a trip-by-trip basis (Rule 62R-5). The data pertaining to the tropical marine ornamental products has, however, yet to be analyzed. Past and current trends regarding the exploitation of individual species are necessary to accurately assess whether existing regulations are sufficient. Specifically, a thorough analysis of the data – Florida landings and trade statistics – would aid the Florida Marine Fisheries Commission in analyzing regulatory options. In addition, the descriptions and opinions of industry members, primarily Florida collectors and dealers, are crucial to the accurate understanding and ultimate success of future regulations.

Lastly, the culture of marine ornamental species is, at present, a nonviable supplement or alternative to the capture industry since – for many species – (1) information on reproduction in captivity is unknown, (2) reproduction in captivity is prohibitively expensive, and/or (3) restricted by environmental regulations regarding release into the wild due to possible harm to native species.

I. B. 4. Objectives and Outline of Analysis

Study objectives include:

1. To characterize the supply and demand of Florida’s ornamental marine life products by examining historical landings and trade statistics.
2. To identify trends in the volume and value of approximately 320 species landed in Florida, and the number of harvesters, in order to assess the future economic potential of the industry.
3. To ascertain if proposed management strategies, such as the generic (i.e., species independent) limited entry system, could improve efficiency by reducing overcrowding and/or overharvesting in the industry.
4. To determine the views of U.S. wholesalers regarding the state of the industry and role that Florida supply has, can, and could be expected to play in the future.

Using data from the Florida Marine Fisheries Information System (described in the next section), the quantity and value of landed species are examined. In addition, the number of trips, collection/capture locations, and numbers of industry participants (i.e., collectors and dealers/wholesalers) from 1990 through 1998 are analyzed. Statistics on the local industry are then compared to trends in total U.S. import and exports – by species and country of origin – of Live Ornamental Fish (National Trade Data and Economic Bulletin Board, SIC0273). In addition, these statistics are augmented with data from the U.S. Department of Agriculture (Animal and Plant Health Inspection Service data) and the U.S. Fish and Wildlife Service (e.g., declaration form #3177). Although some data series aggregate information on saltwater, freshwater, and aquacultured product, historical trends and regional differences are important given the (at least slight degree of) substitutability or complementarity between sources and species.

Trip Ticket data were also utilized to develop a survey instrument for (1) Florida dealers (i.e., all first buyers of harvested product in Florida), of which there were 66 in fiscal year 1998, and (2) the 125 largest wholesalers in the United States (from the Pet Supplies Marketing Directory). Since these dealers handle both Florida and foreign-sourced product, they are the primary source of information regarding the relationship between species, identifying substitutes and complements, and the future of the industry in Florida. Questions focused on Florida product but also addressed larger marketing issues. The responses are compared to a 1996 member survey conducted by the American Marinelife Dealers Association and to the most recent annual survey of independent pet retailers conducted by *Pet Dealer* (a trade magazine).

II. Marine Life Landings in Florida from 1990 to 1998

II. A. Data Description

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 products since 1990. 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 each transaction typically occurs immediately following the trip, these forms are referred to as “trip tickets”.. Landings that are not sold, bartered, or exchanged are excluded from the data set maintained by the FDEP.

Since there are size limits for some species (46-42.004), the FDEP trip tickets also allow the collector to report the size of individuals (e.g., small, medium, large). The size information is, however, not applicable for all species and is frequently unreported. Due to the main objectives of this analysis and limitations due to the magnitude of results (given the number of species, years, quarters, and areas), this information is not incorporated into this analysis. It is important to note, however, that the size of wild-caught fish will vary depending on variety, season (e.g., due to water temperature and availability of food), 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.

Prior to 1990, landings data were collected from individual holding quinaldine permits (Hess and Stevely). Given that the corresponding data excludes invertebrate data, prices, and the harvest of fish without chemical use, these data are not analyzed in this report.

II. B. Number of Marine Life Industry Participants

The number of participants in the marine life industry from 1990 to 1998 is summarized in Table 1. 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. Currently, there are approximately 65 licensed dealers in the State of Florida. These dealers are legally allowed to purchase marine life species from licensed collectors and are required to submit information regarding the transaction to FMRI. This required reporting information consists of the collector's license number, species landed (quantity and unit price), area where collection occurred, and the transaction date. Individuals can be licensed as both a collector and dealer.

To collect marine life in excess of the daily bag limit of 20 specimens and one gallon of marine plants, an individual or business needs a saltwater products license (SPL) with both a restricted species endorsement and marine life endorsement (F.A.C. 46-42.006). The marine life endorsement (MLE) is the only authority that applies exclusively to the marine life industry. The total number of MLE's increased from 1990 to 1997. In 1997, approximately 800 endorsements had been issued whereas fewer than 200 were issued in 1990. The number of active marine life endorsements (i.e., endorsements with reported landings), however, has remained fewer than 230. In 1998, only 128 MLE's were active. The total number of MLE's issued declined recently due to a moratorium that will remain in effect at least until 2003. However, there continues to remain a significant amount of latent effort in the fishery. It is believed that these are commercial enterprises, individual fisherman and businesses, that are retaining permits to hedge against further restrictions in other fisheries.

Table 1. Number of Commercial Participants in the Florida Marine Life Industry

License Year	Active	Restricted	Saltwater		Marine Life	
	Wholesale Dealers	Species Endorsements	Products License Total	License Active	Endorsements 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

Note: "Active" refers to license numbers that reported landings during the year.

II. C. Products

According to data collected by the Florida Department of Environmental Protection (FDEP), approximately 320 marine ornamental species have been landed in Florida for commercial purposes from 1990 to 1998. The total includes over 180 different species of fish (57 percent) and 137 invertebrate species (43 percent), including live rock, live sand, and various plant species.

Slightly over 70 percent of fish species and approximately half of the invertebrate species are classified as “restricted” (Figure 2). The harvest of restricted species is subject to additional regulations, which are discussed in sub-section 1.B.1 below.

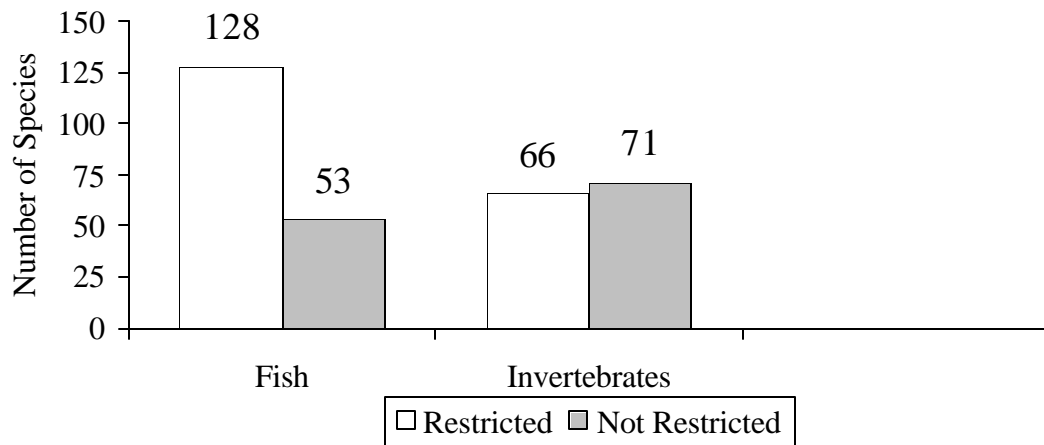


Figure 2. Number of Species Landed in Florida by Type and Restricted Status, 1990-98.

Aside from the type of organism and restricted status, each individual is identified by its common name, genus, species, and/or family. 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. Exceptions include the blennies, sharks, and rays. Of the over 180 fish species landed, there are a total of just 67 common names representing 51 families (e.g., bass, groupers, hamlets, and perch are all members of the serranidae family). The common fish names are listed in Table 2 with the corresponding list of invertebrates.

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 145 species are reduced to just 34 distinct groups. In addition, it will be useful in the analysis to further distinguish the invertebrate species as, for example, sessile or mobile. Sessile invertebrates are completely immobile and include such species as plants, live rock, and live sand. Slow moving invertebrates – such as anemones, corals, sponges, and marine worms – are frequently included in this category. The mobile invertebrates can also be categorized by whether they are segmented. For example, unsegmented mobile invertebrates would include the molluscs (i.e., marine snails, nudibranches, bivalves, and octopi). Segmented mobile invertebrates (arthropoda, class crustacea) include shrimps, prawns, lobsters, and crabs. Lastly, the echinodermatas or “spiny skinned ones”, are

characterized by radial symmetry and include sand dollars, sea urchins, starfish, brittlestars, and sea cucumbers.

Table 2. List of Ornamental Marine Species Collected in Florida, 1990-98

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

Notes: Common names reflect biological family, number in parentheses corresponds to the number of different genus and species combinations related to the family. Names are listed in alphabetical order.

II. D. Location of Capture

The Marine Fisheries Information System – the data collection program maintained by the FDEP – has divided the fishing areas in Florida into 17 distinct sections. Each of the 17 primary areas is further subdivided into distinct subregions. In addition, separate fishing area codes have been defined for Georgia, Barbados, the Virgin Islands, and Puerto Rico. These codes are presented in Appendix A, Figure A-1.

Only eight of the 17 primary areas were reported as sources of marine life collected for commercial purposes from 1990 through 1996. However, nine additional areas reported landings in 1997 and 1998. Because most of the landings were relatively small, the nine areas are included in the “all others” category. The identified collecting regions ranged from the Crystal River - Tarpon Springs area on Florida’s West Coast down to the Miami area on Florida’s southern East Coast. Overall, the Marathon area (748.0, 748.1, and 748.9) accounted for the highest value of landings (31.1 percent or \$7.2 million) and most number of trips (39.4 percent or nearly 181,000) (Table 3, Figure 3). The areas reported represented approximately 75 percent of the total number of trips taken and 76.8 percent value of marine life landed. The source region was not reported for 15.8 percent of trips that accounted for 15.2 percent of landed value (Table 3). Also, the total value which of landings over all areas does not agree with the total value of landings reported in section II.E. because some observations were excluded because of confidentiality considerations.

Table 3. Summary of Total Trips and Value of Landings by Area, 1990-98.

Area		90-96	90-96	97-98	97-98	90-98	90-98	90-98	90-98	90-98
Name	Code ^a	No. of Trips	Landings (thous.\$)	No. of Trips	Landings (thous.\$)	Total Trips	Total Trips	Percent of Total Trips	Total Landings (thous.\$)	Percent of Total Landings
Crystal River-Tarpon Springs										
Offshore Waters	6.0	18,851	302							
St. Joseph Sound	6.1	6	7							
Other Inland Waters	6.2	9	13							
Federal Waters	6.9	9,511	2,301							
Total	6.0	28,377	2,623	3,115	213	31,492	2,836	6.86%	2,836	12.32%
Tampa										
Offshore Waters	5.0	503	155							
Tampa Bay	5.1	98	98							
Sarasota Bay	5.3	51	10							
Federal Waters	5.9	6,783	1,371							
Total	5.0	7,435	1,634	305	124	7,740	1,758	1.69%	1,758	7.64%
Fort Myers										
Offshore Waters	4.0	44	192							
Charlotte Harbor	4.1	9	61							
Pine Island Soud and San Carlos Bay	4.3	16	183							
Federal Waters	4.9	76	64							
Total	4.0	145	500	67	54	212	554	0.05%	554	2.41%
Everglades										
Offshore Waters	3.0	10	1							
Whitewater Bay	3.1	1	5							
All Other Inland Waters	3.2	4	6							
Federal Waters	3.9	50	33							
Total	3.0	65	45	27	5	92	50	0.02%	50	0.22%
Tortugas										
All Waters	2.0	52	5							
Federal Waters	2.9	1	4							
Total	2.0	53	9	1,225	51	1,278	60	0.28%	60	0.26%
Key West										
North of US 1	1.0	21,029	667							
South of US 1 (FL Bay)	1.1	8,483	835							

Federal Waters	1.9	7,966	813							
Total	1.0	37,478	2,315	8,647	656	46,125	2,971	10.04%	2,971	12.91%
Marathon										
South of US 1	748.0	75,810	2,663							
North of US 1 (FL Bay)	748.1	8,756	241							
Federal Waters	748.9	80,566	3,587							
Total	748.0	165,132	6,491	15,807	668	180,939	7,159	39.40%	7,159	31.10%
Miami										
Offshore Waters	744.0	45,915	1,054							
Florida Bay	744.1	3,101	97							
Biscayne Bay, Card Sound and Barnes Sound	744.2	1,414	84							
Federal Waters	744.9	21,940	915							
Total	744.0	72,370	2,150	2,816	137	75,186	2,287	16.37%	2,287	9.93%
All Others										
Total				43,504	1,851	43,504	1,851	9.47%	1,851	8.04%
Unknown										
Total		71,851	3,464	817	30	72,668	3,494	15.82%	3,494	15.18%
Grand Total		382,906	19,231	76,330	3,789	459,236	23,020	100.00%	23,020	100.00%

^a Detailed codes were not available for 1997-1998 data.

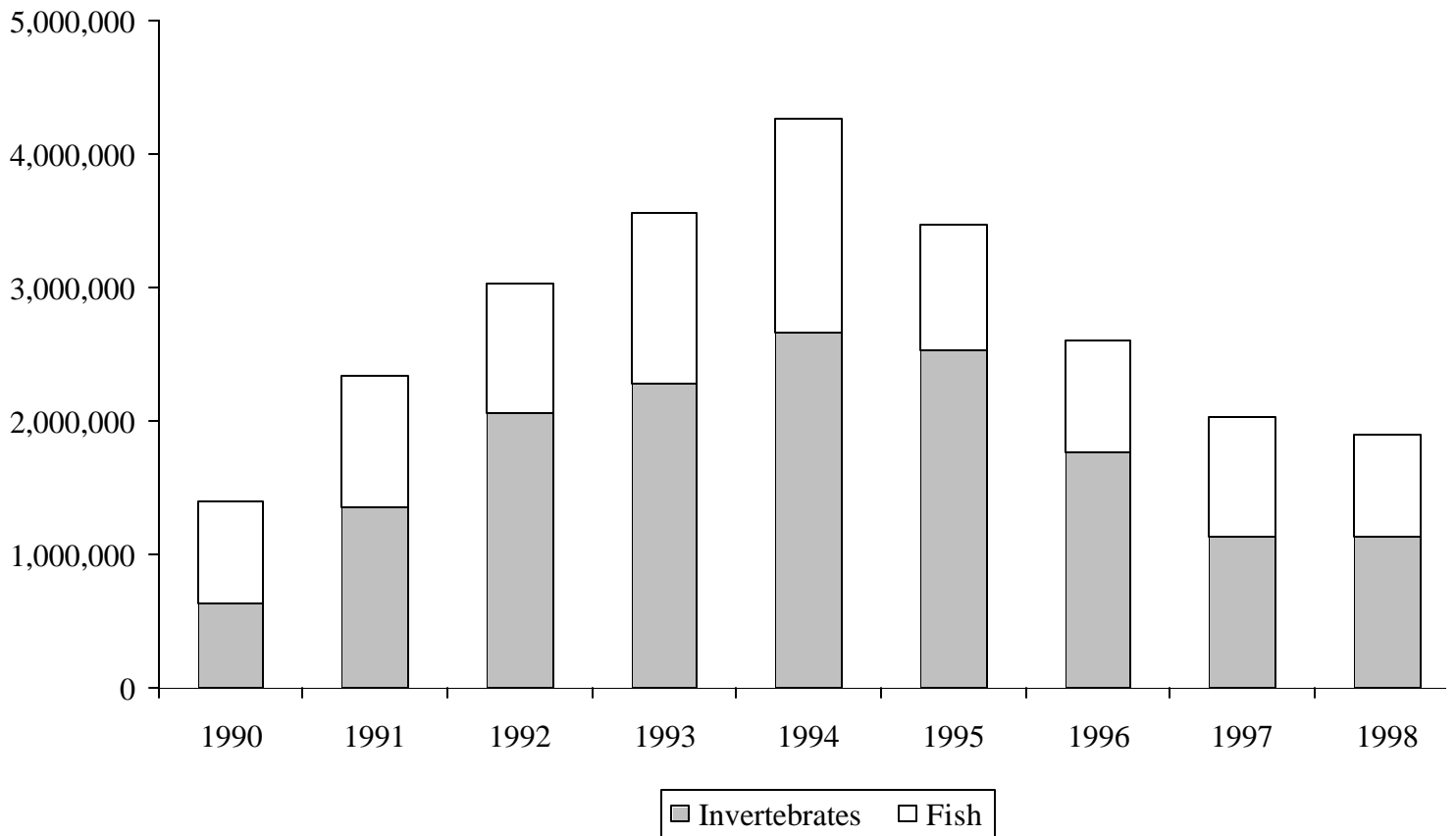


Figure 4. Annual dockside value of commercial marine life landings in Florida, 1990-98

II. E. General Trends in Marine Life Landings and Values

At this point it bears repeating that the “marine life” fishery in Florida is defined in the regulations and legislation to include only saltwater species that are collected live and intended for the aquarium industry (*i.e.*, commercial purposes). The total dockside value of marine life landings in Florida increased from \$1.4 million in 1990 to approximately \$4.3 million in 1992 (Figure 4, Table 4). The total value of this fishery then decreased to about \$3.5 million in 1995 and can be accounted for by decrease in the landings of live rock and sand, which fell from approximately 1.2 million pounds (536,758 kg.) in 1995 to 166,000 pounds (75,709 kg.) in 1998. The reason for the dramatic decrease was the prohibition of all commercial harvest of live rock and sand, in both Atlantic 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 and federal agencies. By 1998, there were seven commercial liverock culture leases off the coast of Florida, but total production was relatively low. (Florida Marine Research Institute, 1999).

Table 4. Landings and Value of Fish and Invertebrates Collected in Florida, 1990-1998.

Year	Fish			Invertebrates		All	
	Landings	Value	Percent of Total Value	Landings	Value	Percent of Total Value	Total Value
1990	245401	\$766,868	55%	1173861	\$635,950	45%	\$1,401,818
1991	291311	\$986,885	42%	1504535	\$1,357,720	58%	\$2,344,605
1992	393497	\$971,115	32%	2156511	\$2,061,135	68%	\$3,032,250
1993	355017	\$1,283,871	36%	2978591	\$2,282,590	64%	\$3,566,461
1994	425781	\$1,612,597	38%	3011263	\$2,660,887	62%	\$4,273,484
1995	259387	\$944,172	27%	3388298	\$2,528,508	73%	\$3,472,680
1996	205832	\$832,603	32%	3466233	\$1,773,081	68%	\$2,605,684
1997	278105	\$903,923	44%	3147607	\$1,134,274	56%	\$2,038,197
1998	201212	\$759,363	40%	3340825	\$1,136,385	60%	\$1,895,748
Totals	2656643	\$9,060,397	37%	24167724	\$15,570,530	63%	\$24,630,927

Trends in the Volume and Value of Finfish Landings

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 approximately 200,000 in 1998. Dockside value followed the same general pattern, increasing from \$766,000 in 1990 to \$1.6 million in 1994, then declining to \$759,000 in 1998 (Figure 4, Table 4). Note that in 1992, landings increased 35 percent 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 approximately 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 only \$0.17 in 1992, a decline of nearly 84%.

During the 1990-98 period, over 180 individual species of finfish were harvested. For simplicity, these species were grouped into 66 categories using their common name as defined by the Florida Marine Research Institute. The Institute uses a three digit code for each species and associated with this code are: (1) a 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*, *Lactophrys 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 66 aggregate finfish groups are listed in Appendix Table D-1. 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 dockside value (Table 5). Predominant species within each of the top groups are listed in Appendix Table D-2. 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 approximately 22% of the total dockside value of live marine finfish collected from 1990 to 1998 (Table 5).

With the exception of seahorses and surgeonfish, all species groups exhibited a decline in landings volumes from 1990 to 1998 (Tables 6 and 7). The largest species group decline was reported to be the butterflyfish (48%), while seahorses were the species group with the largest increase (184%). Trends in landings for each of the top 10 species groups are shown in Appendix E, Figure 1-10.

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 8). 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 (Figure 4), 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. Price trends for each of the top 10 species groups are found in Appendix E, Figures 1 through 10.

Table 5. Economic Importance of Top Fish Species Collected in Florida

	Total Value 1990-98	% Fish Value	Cumulative Percent
1. Angelfish	\$4,891,917	54.0%	54.0%
2. Hogfish	676,696	7.5	61.5
3. Damselfish	316,368	3.5	65.0
4. Jawfish	293,857	3.2	68.2
5. Wrasse	289,019	3.2	71.4
6. Butterflyfish	273,876	3.0	74.4
7. Seahorses	238,631	2.6	77.0
8. Parrotfish	233,147	2.6	79.6
9. Surgeons	201,162	2.2	81.8
10. Drum	174,865	1.9	83.7

Table 6. Average annual landings and prices by most valuable fish species group, 1990 – 1998.

Species Group	Average Annual Landings (Number)	Change in Landings 1990-1998 (Percent)	Average Annual Price 1990-1998 (Dollars)	Change in Price 1990-1998 (Percent)	Average Annual Value (Dollars)
Angelfish	71,793	-31.6	7.60	44.5	543,546
Hogfish	9,911	-13.1	7.55	13.6	75,189
Damselfish	26,408	-34.0	1.33	-10.5	35,152
Jawfish	12,901	-6.8	2.42	17.4	32,651
Wrasse	19,735	-42.4	1.64	13.5	32,113
Butterflyfish	11,029	-48.3	2.86	26.4	30,431
Seahorse	48,426	+184.4	0.77	-29.2	26,515
Parrotfish	5,308	-39.5	4.87	97.9	25,905
Surgeonfish	7,317	+18.3	3.09	3.9	22,351
Drum	9,230	-43.0	2.11	15.3	19,429

Source: Florida Marine Research Institute, Florida Department of Environmental Protection. St. Petersburg, Florida.

Table 7. Annual Commercial Landings of the Ten Fish Species (grouped by common name) that comprise the Highest Average Landed Value 1990-98 in Florida

Species Group	1990-98 Average		Number Landed								
	Value	Landings	1990	1991	1992	1993	1994	1995	1996	1997	1998
1. Angelfish	\$543,546	71,793	71,459	82,589	86,711	79,782	82,668	73,666	60,602	59,817	48,839
2. Hogfish	\$75,189	9,911	8,535	8,794	9,888	10,112	13,494	12,451	10,633	7,869	7,419
3. Damsel fish	\$35,152	26,408	32,150	31,702	38,337	21,558	29,387	27,504	14,102	21,703	21,225
4. Jawfish	\$32,651	12,901	6,325	4,995	16,624	22,151	28,267	13,596	9,285	8,976	5,894
5. Wrasse	\$32,113	19,735	23,440	25,032	27,227	20,686	21,713	16,920	12,453	16,633	13,512
6. Butterflyfish	\$30,431	11,029	12,667	15,266	15,479	13,213	12,949	9,420	6,941	6,772	6,551
7. Seahorse	\$26,515	48,426	5,969	13,982	83,715	71,815	110,948	23,341	19,037	90,049	16,977
8. Parrotfish	\$25,905	5,308	4,953	5,760	8,374	6,212	8,728	3,876	2,866	4,004	2,998
9. Surgeonfish	\$22,351	7,317	6,511	6,881	8,930	9,342	8,378	6,791	5,359	5,961	7,702
10. Drum	\$19,429	9,230	11,891	9,816	9,505	10,569	11,526	9,086	7,233	6,661	6,781

Source: Florida Marine Research Institute, Florida Department of Environmental Protection, St. Petersburg, Florida

Table 8. Annual Dockside Prices of the Ten Fish Species (grouped by common name) that comprise the Highest Average Landed Value 1990-98 in Florida

Species Group	1990-98 Average		Dockside Unit Price								
	Value	Landings	1990	1991	1992	1993	1994	1995	1996	1997	1998
1. Angelfish	\$543,546	71,793	\$5.62	\$7.00	\$6.61	\$9.13	\$8.85	\$6.92	\$7.61	\$8.54	\$8.12
2. Hogfish	\$75,189	9,911	7.43	6.56	4.01	8.84	9.23	7.28	7.89	8.23	8.44
3. Damselfish	\$35,152	26,408	1.33	1.20	1.08	1.53	2.01	1.30	1.22	1.12	1.19
4. Jawfish	\$32,651	12,901	2.01	2.19	2.17	2.38	3.07	2.44	2.60	2.58	2.36
5. Wrasse	\$32,113	19,735	1.48	1.65	1.20	1.44	2.40	1.60	1.70	1.65	1.68
6. Butterflyfish	\$30,431	11,029	2.65	2.74	2.10	2.78	4.14	2.20	2.59	3.17	2.35
7. Seahorse	\$26,515	48,426	1.13	1.10	0.17	0.12	0.88	1.07	1.34	0.35	0.80
8. Parrotfish	\$25,905	5,308	2.90	4.29	3.33	6.72	6.40	4.04	5.21	5.18	5.74
9. Surgeonfish	\$22,351	7,317	3.34	2.44	1.85	3.34	4.05	2.51	3.41	3.41	3.47
10. Drum	\$19,429	9,230	1.83	1.81	1.48	2.02	3.46	1.77	2.24	2.24	2.11

Source: Florida Marine Research Institute, Florida Department of Environmental Protection, St. Petersburg, Florida

Trends in the Volume and Value of Invertebrate Landings

The approximately 150 individual species of invertebrates collected by the marine life industry in Florida from 1990 to 1998 were grouped, into 32 major species groups (Appendix Table D-3) using the same procedure as with the finfish. 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) marine plants, and (3) live rock and live sand.

The patterns in invertebrate landings volumes and value during the 1990-98 period varied somewhat across the three major groups (Figures 5 and 6). Landings of invertebrate animals exhibited a steady increase from approximately 850,000 individual animals in 1990 to 3.3 million animals in 1998, an increase of 290% (Table 9). However, the total dockside value of the animals increased from approximately \$376,000 in 1990 to a peak of \$1.2 million in 1994, then declined steadily to \$896,000 in 1998 as species less valuable on a per unit basis (such as snails, starfish, and sand dollars) garnered an increasing share of the total volume. Landings of plants increased from approximately 31,000 individuals in 1990 to a peak of 37,000 in 1995. Plant landings then declined dramatically (approximately 62%) to 14,000 in 1998 (Table 9).

Figure 5. Annual landings of invertebrates collected in Florida by type, 1990-98.

	Type					
	Invertebrate Animals		Marine Plants		Live Rock and Live Sand	
Year	Landings (Number ^a)	Value (Dollars ^a)	Landings (Number ^a)	Value (Dollars ^a)	Landings (Pounds ^a)	Value (Dollars ^a)
1990	849	377	31	8	245	252
1991	893	467	30	38	578	853
1992	1,352	581	28	48	777	1,433
1993	1,989	1,036	35	33	954	1,213
1994	1,888	1,209	31	29	1,079	1,422
1995	2,171	1,053	37	43	1,175	1,432
1996	2,637	899	20,	31	809	843
1997	3,148	911	21	41	185	183
1998	3,340	897	14	22	167	218

^a All numbers, dollars and pounds are in thousands.

Source: Florida Marine Institute, Florida Department of Environmental Protection, St. Petersburg, Florida.

Table 9. Annual Landings and Values of Invertebrates Collected in Florida by Type, 1990-1998.

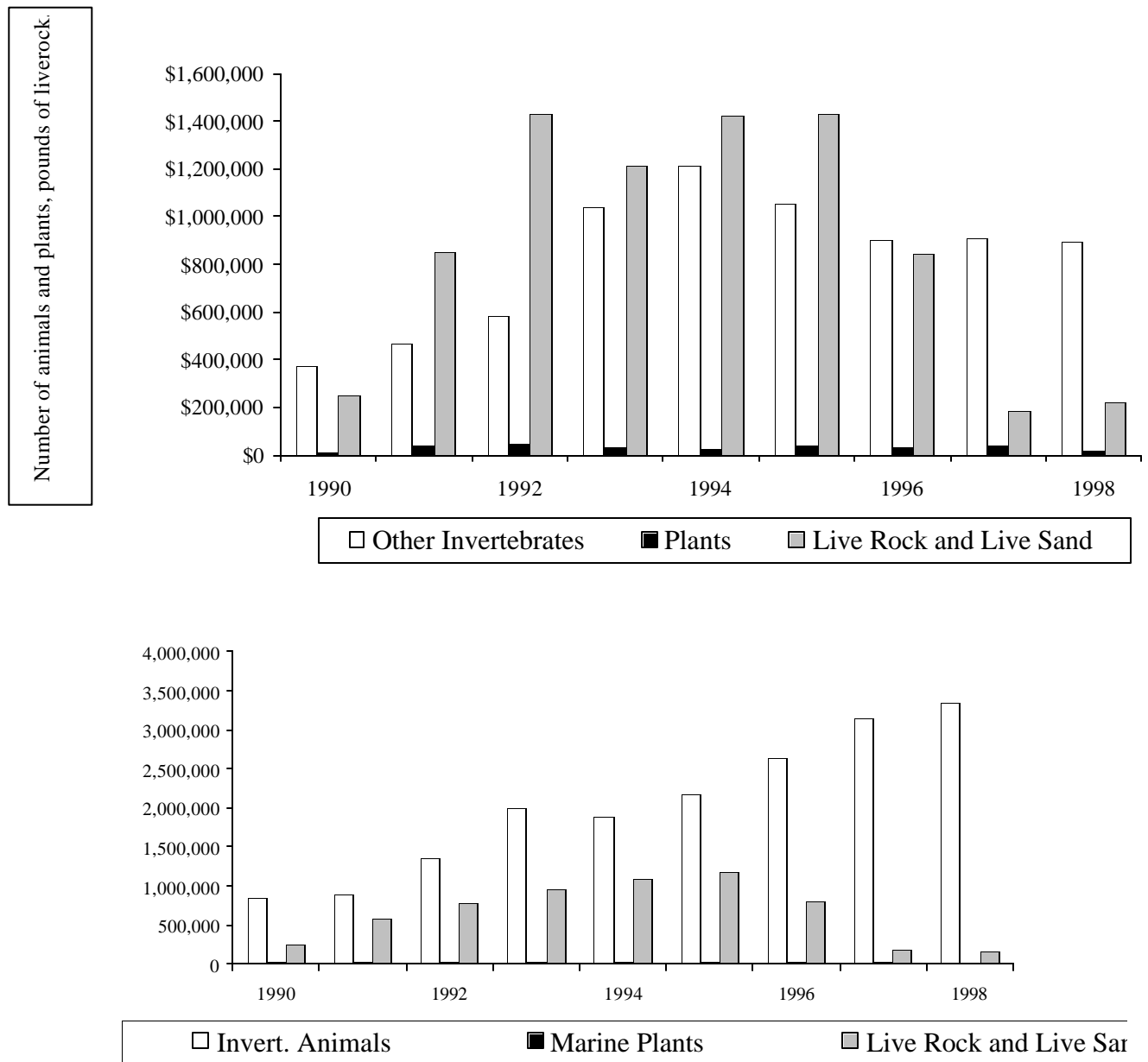


Figure 6. Annual dockside value of invertebrates collected in Florida by type, 1990-98.

The dockside value of marine plants reached peaks in 1992 and 1995, then declined with landings volumes to \$22,000 in 1998. As discussed previously, 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 approximately 245,000 pounds (110,250 kg) in 1990 to 1.2 million pounds (530,000 kg) in 1995, a 390% increase. Following the moratorium on landings in federal waters, landings decreased to 166,600 pounds (75,709 kg) in 1998. The

dockside value of live rock and sand reached equivalent peaks of about \$1.4 million in 1992 and 1995, then decreased dramatically to \$218,000 in 1998 as reported landings were comprised predominantly of live rock cultured on permitted lease sites (Table 9).

Ten species groups accounted for 89% of the total dockside value attributable to invertebrate animals, plants, and live rock and sand during the 1990-98 period (Table 10). The most important single species group was live rock, which accounted for almost 50% of the dockside 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 dockside value (Table 10). The primary species within each of the top 10 invertebrates species groups are listed in Appendix Table D-4.

Table 10. Economic Importance of Top Invertebrate Species Collected in Florida, 1990-1098.

	Total Value 1990-98	Percent of Invertebrate Value	Cumulative Percent
1. Live Rock	\$7,357,422	48.8%	48.8%
2. Snails	1,262,345	8.1	56.8
3. Anemones	1,128,348	7.2	64.1
4. Crabs	913,848	5.9	70.0
5. Starfish	729,706	4.7	74.7
6. Gorgonians	685,047	4.4	79.1
7. Sand Dollars	542,991	3.5	82.6
8. Urchins	385,953	2.5	85.1
9. Sponges	349,564	2.2	87.3
10. Live Sand	307,662	2.0	89.3

Table 11. Average annual landings and prices by most valuable invertebrate species group, 1990 – 1998.

Species Group	Average Annual Landings	Change in Landings 1990-1998	Average Annual Price 1990-1998	Change in Price 1990-1998	Average Annual Value
	(Number) ^a	(Percent)	(Dollars)	(Percent)	(Dollars)
Live Rock	623,279 ^a	-63.5	1.38	91.1	837,491
Snail	373,587	791.0	0.40	-44.7	140,261
Anemone	275,812	-26.0	0.57	29.7	125,372
Crab	236,674	754.8	0.57	-62.5	101,539
Starfish	205,012	1,824.0	0.39	-88.8	81,078
Gorgonian	28,736	128.8	2.29	21.7	76,116
Sand Dollar	438,850	202.9	0.14	-33.3	60,332
Urchin	36,823	28.8	1.14	234.0	42,884
Sponge	17,534	0.9	2.40	80.5	41,063
Live Sand	42,876	N.A.	N.A.	N.A.	34,185

^a Number landed for all species except live rock and live sand, which are measured in pounds.

Source: Florida Marine Research Institute, Florida Department of Environmental Protection. St. Petersburg, Florida.

Table 12. Annual Commercial Landings of the Ten Invertebrate Species (grouped by common name) that comprise the Highest Average Landed Value 1990-98 in Florida

Species Group	1990-98 Average		Landings ^a								
	Value	Landings	1990	1991	1992	1993	1994	1995	1996	1997	1998
1. Live Rock	\$837,491	623,279 lbs	249,093	581,376	776,810	954,197	1,087,065	1,094,723	671,226	104,044	90,975
2. Snail	\$140,261	373,587	90,369	182,180	257,752	293,688	288,406	480,706	470,357	493,614	805,210
3. Anemone	\$125,372	275,812	272,476	302,701	334,043	293,590	307,891	335,795	233,649	200,533	201,629
4. Crab	\$101,539	236,674	92,250	90,845	119,591	152,375	117,889	181,074	252,882	334,559	788,598
5. Starfish	\$ 81,078	205,012	26,575	28,220	129,574	333,911	314,071	222,102	543,782	975,368	511,297
6. Gorgonian	\$ 76,116	28,736	17,803	24,350	23,898	29,960	32,106	35,976	37,057	44,867	40,743
7. Sand Dollar	\$ 60,332	438,850	254,832	88,191	193,574	560,480	578,574	619,716	776,582	781,567	771,817
8. Urchin	\$ 42,884	36,823	31,745	35,495	33,008	41,156	39,052	41,268	36,039	33,232	40,900
9. Sponge	\$ 41,063	17,534	17,017	18,858	17,886	18,626	18,236	17,659	14,459	15,464	17,166
10. Live Sand	\$ 34,185	42,876 lb	N/A	N/A	N/A	N/A	4,802	86,175	138,194	81,129	75,584

^a Number landed for all species except live rock and live sand, which are measured in pounds.

Source: Florida Marine Research Institute, Florida Department of Environmental Protection, St. Petersburg, Florida.

Table 13. Annual Dockside Price of the Ten Invertebrate Species (grouped by common name) that comprise the Highest Average Landed Value 1990-98 in Florida

Species Group	1990-98 Average		Dockside Unit Price ^a								
	Value	Landings	1990	1991	1992	1993	1994	1995	1996	1997	1998
1. Live Rock	\$837,491	623,279 lbs	\$1.01	\$1.47	\$1.84	\$1.27	\$1.30	\$1.20	\$1.12	\$1.30	\$1.93
2. Snail	\$140,261	373,587	0.38	0.22	0.37	0.61	0.55	0.68	0.28	0.26	0.21
3. Anemone	\$125,372	275,812	0.37	1.47	0.42	0.48	0.53	0.43	0.44	0.47	0.48
4. Crab	\$101,539	236,674	0.48	0.43	0.40	1.46	0.86	0.55	0.42	0.34	0.18
5. Starfish	\$ 81,078	205,012	0.80	0.78	0.12	0.30	0.95	0.23	0.17	0.08	0.09
6. Gorgonian	\$ 76,116	28,736	1.98	1.58	0.94	2.23	3.80	2.42	2.80	2.47	2.41
7. Sand Dollar	\$ 60,332	438,850	0.12	0.27	0.15	0.17	0.12	0.10	0.11	0.11	0.08
8. Urchin	\$ 42,884	36,823	0.50	0.56	0.34	0.55	1.12	1.77	1.86	1.94	1.67
9. Sponge	\$ 41,063	17,534	1.59	1.76	1.49	1.93	3.22	2.77	3.05	2.96	2.87
10. Live Sand	\$ 34,185	42,876 lb	N/A	N/A	N/A	1.00	0.78	1.39	0.68	0.59	0.56

^a Number landed for all species except live rock and live sand, which are measured in pounds.

Source: Florida Marine Research Institute, Florida Department of Environmental Protection, St. Petersburg, Florida.

With the exception of live rock and anemones, all of the top ten invertebrate species groups experienced 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 11). Year-to-year changes in landings of the top 10 species groups are shown in Table 12 and Appendix D, Figures 11-20. As with finfish species, dockside prices also varied across invertebrate species groups. As shown in Table 11, the highest average unit prices during the 1990-1998 period were associated with sponges (\$2.40), gorgonians (\$2.29), live rock (\$1.14 per pound), and urchins (\$1.14). Annual dockside prices of the top ten species groups are shown in Table 13 and in Appendix E, Figures 11-20.

DISCUSSION

The marine life collection industry in Florida has grown during the past decade as the number of licensed collectors (*i.e.*, fishers with MLEs) increased from 159 to 743 and either the volume or value of the primary species increased. The growth is particularly evident in the collection of invertebrate animals. The harvest of live rock and 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. The moratorium extends to 2002. 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., acceptable harvesting methods). The implementation of these regulations reflects concern regarding the sustainability of the marine life resources. The information presented in this section represents the only analysis of harvest data collected by Florida Marine Research Institute since the initiation of data collection efforts in 1990. The reported trends in landings provide 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. Landings data should next be examined in terms of expended effort (*i.e.*, trips) to better determine if the State's management goals are being achieved. Without such insight, the assurance of the sustainable use of these marine life resources in the face of growing demand by domestic and international markets cannot be ensured.

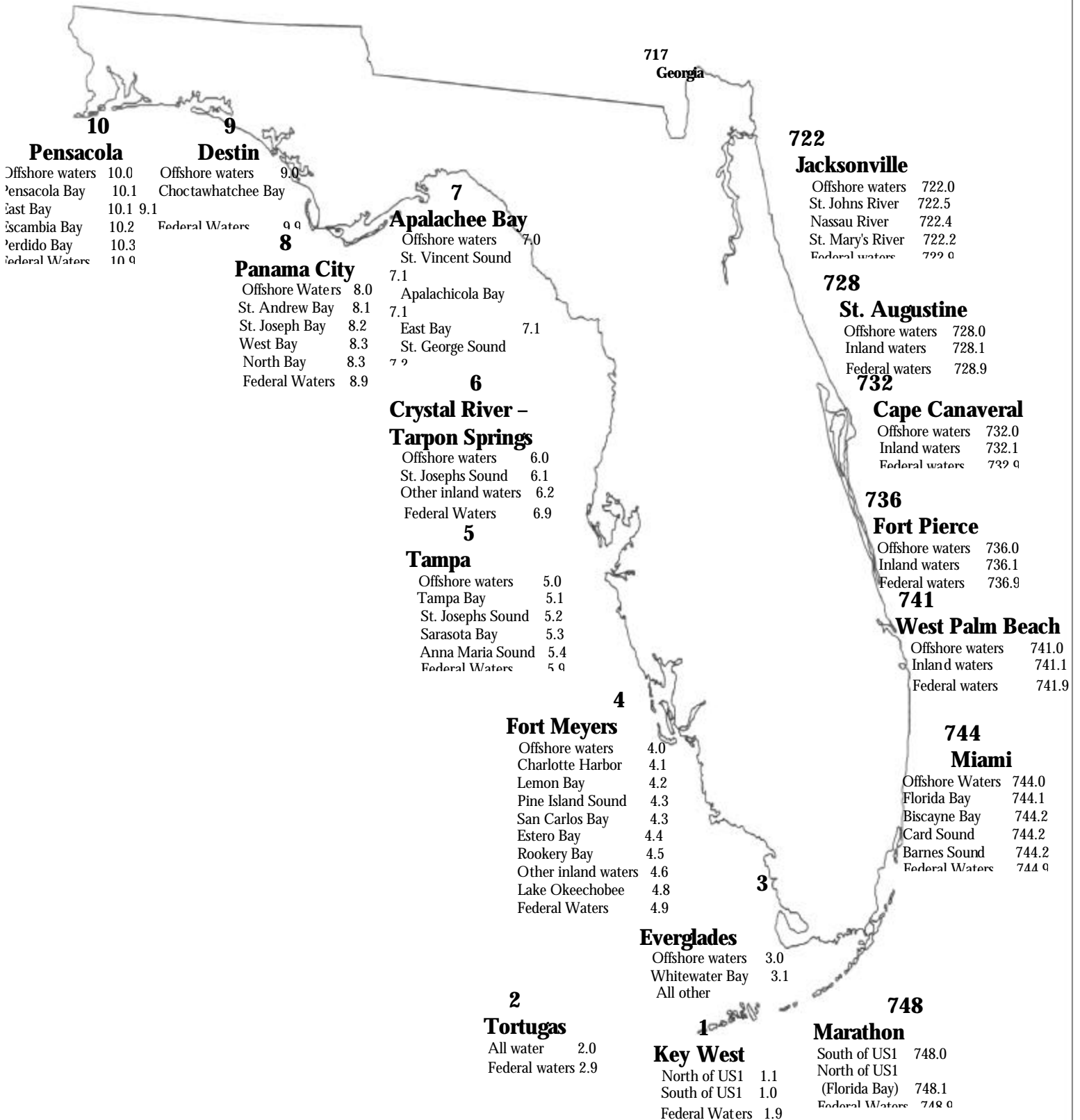
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Appendix A

Marine Fisheries Trip Ticket Fishing Area Codes

Appendix A. Figure 1. Marine Fisheries Trip Ticket Fishing Area



Source: Department of Environmental Protection, Marine Research

Appendix B

Restricted Species Identified in Chapter 46-42 of the F.A.C.

Appendix B. Restricted Species Identified in Chapter 46-42 of the F.A.C.

Chapter 46-42(2) Fish Species:

- (a) Moray eels – Family Muraenidae
- (b) Snake eels – Genera *Myichthys* and *Myrophis* of the Family Ophichthidae
- (c) Toadfish – Family Batrachoididae
- (d) Frogfish – Family Antennariidae
- (e) Batfish – Family Ogcocephalidae
- (f) Clingfish – Family Gobiesocidae
- (g) Trumpetfish – Family Aulostomidae
- (h) Cornetfish – Family Fistulariidae
- (i) Pipefish/seahorses – Family Syngnathidae
- (j) Hamlet/seabass – Family Serranidae, except genera *Epinephaus*, *Mycteroperca*, and *Centropristis*
- (k) Basslets – Family Grammistidae
- (l) Cardinalfish – Family Apogonidae
- (m) High-hat, Jackknife-fish, Spotted drum, Cubbyu – genus *Equetus* of the Family Sciaenidae
- (n) Reef Croakers – *Odontocion dentex*
- (o) Sweepers – Family Pempheridae
- (p) Butterflyfish – Family Chaetodontidae
- (q) Angelfish – Family Pomacanthidae
- (r) Damselfish – Family Pomacentridae
- (s) Hawkfish – Family Cirrhitidae
- (t) Wrasse/hogfish/razorfish – Family Labridae, except *Lachnolaimus maximus*
- (u) Parrotfish – Family Scaridae
- (v) Jawfish – Family Opistognathidae
- (w) Blennies – Families Clinidae and Blenniidae
- (x) Sleepers – Family Eleotrididae
- (y) Gobies – Family Gobiidae
- (z) Tangs and surgeonfish – Family Acanthuridae
- (aa) Filefish/triggerfish – Family Balistes, except *Balistidae capriscus*
- (bb) Trunkfish/cowfish – Family Ostraciidae
- (cc) Pufferfish/burrfish/ballonfish – *Diodon holocanthus*, *Canthigaster rostrata*, *Chilomycterus schoepfi*.

Chapter 46-42(3) Invertebrate Species:

- (a) Sponges – Class Demospongia, except Order Dictyoceratida
- (b) Upside-down jellyfish – Genus *Cassiopeia*
- (c) Siphonophores/hydroids – Class Hydrozoa, except Order Milleporina
- (d) Soft corals – Subclass Octocorallia, except *Gorgonia flabellum* and *ventalina*
- (e) Sea anemones – Orders Actinaria Zoanthidea, Corallimorpharia, and Ceriantharia
- (f) Featherduster worms/calcareous tubeworms – Families Sabellidae and Serpulidae
- (g) Star-shells – *Astraea americana* or *Astraea phoebia*
- (h) Nudibranchs/sea slugs – Subclass Opisthobranchia
- (i) Fileclams – Genus *Lima*

- (j) Octopods – Order Octopoda, except *Octopus vulgaris*
- (k) Shrimp – Genera *Periclimenes*, *Lysmata*, *Stenopus*, and *Alpheus*
- (l) Crabs – *Stenorhynchus seticornis*, *Stenocionops furcata*, *Clibanarius vittatus*, *Phimochirus opercalatus*, *Porcellana sayana*, *Percnon gibbesi*, *Metoporphaphis calcarata*
- (m) Starfish – Class Asteroidea, except *Oreaster reticulatus*
- (n) Brittlestars – Class Ophiuroidea
- (o) Sea urchins – Class Echinoidea, except *Diadema antillarum* and Order Clypeasteroida
- (p) Sea cucumbers – Class Holothuroidea
- (q) Sea lillies – Class Crinoidea

Chapter 46-42(4) Plant Species:

- (a) *Caulerpa* – Family Caulerpaceae
- (b) *Halimeda*/mermaid's fan/mermaid' shaving brush – Family Halimedaceae
- (c) Coralline red algae – Family Corallinaceae

Appendix C

Summary of Florida's Collection Regulations

Appendix C. Summary of Florida’s Collection Regulations (Rule 46-24 titled “Marine Life”)

46-42.01 Purpose and Intent; Designation of Restricted Species; Definition of “Marine Life Species”.—

(1)

- (a) The purpose and intent of this chapter are to protect and conserve Florida’s tropical marine life resources, assure the continuing health and abundance of these species, and assure that harvesters in this fishery use nonlethal methods of harvest.
- (b) Landing of live rock propagated through aquaculture is allowed pursuant to provisions of this chapter.

(2) The following fish species, as they occur in waters of the state and in federal Exclusive Economic Zone (EEZ) waters adjacent to state waters, are hereby designated as restricted species pursuant to Section 370.01(20), Florida Statutes:

- (a) Moray eels – Family Muraenidae
- (b) Snake eels – Genera *Myichthys* and *Myrophis* of the Family Ophichthidae
- (c) Toadfish – Family Batrachoididae
- (d) Frogfish – Family Antennariidae
- (e) Batfish – Family Ogcocephalidae
- (f) Clingfish – Family Gobiesocidae
- (g) Trumpetfish – Family Aulostomidae
- (h) Cornetfish – Family Fistulariidae
- (i) Pipefish/seahorses – Family Syngnathidae
- (j) Hamlet/seabass – Family Serranidae, except genera *Epinephaus*, *Mycteroperca*, and *Centropristis*
- (k) Basslets – Family Grammistidae
- (l) Cardinalfish – Family Apogonidae
- (m) High-hat, Jackknife-fish, Spotted drum, Cubbyu – genus *Equetus* of the Family Sciaenidae
- (n) Reef Croakers – *Odontocion dentex*
- (o) Sweepers – Family Pempheridae
- (p) Butterflyfish – Family Chaetodontidae
- (q) Angelfish – Family Pomacanthidae
- (r) Damselfish – Family Pomacentridae
- (s) Hawkfish – Family Cirrhitidae
- (t) Wrasse/hogfish/razorfish – Family Labridae, except *Lachnolaimus maximus*
- (u) Parrotfish – Family Scaridae
- (v) Jawfish – Family Opistognathidae
- (w) Blennies – Families Clinidae and Blenniidae
- (x) Sleepers – Family Eleotrididae
- (y) Gobies – Family Gobiidae
- (z) Tangs and surgeonfish – Family Acanthuridae
- (aa) Filefish/triggerfish – Family Balistes, except *Balistidae capriscus*
- (bb) Trunkfish/cowfish – Family Ostraciidae

(cc)Pufferfish/burrfish/ballonfish – *Diodon holocanthus*, *Canthigaster rostrata*,
Chilomycterus schoepfi.

(3) The following invertebrate species, as they occur in waters of the state and in federal Exclusive Economic Zone (EEZ) waters adjacent to state waters, are hereby designated as restricted species pursuant to Section 370.01(20), Florida Statutes:

- (a) Sponges – Class Demospongia, except Order Dictyoceratida
- (b) Upside-down jellyfish – Genus *Cassiopeia*
- (c) Siphonophores/hydrroids – Class Hydrozoa, except Order Milleporina
- (d) Soft corals – Subclass Octocorallia, except *Gorgonia flabellum* and *ventalina*
- (e) Sea anemones – Orders Actinaria Zoanthidea, Corallimorpharia, and Ceriantharia
- (f) Featherduster worms/calcareous tubeworms – Families Sabellidae and Serpulidae
- (g) Star-shells – *Astraea americana* or *Astraea phoebia*
- (h) Nudibranchs/sea slugs – Subclass Opisthobranchia
- (i) Fileclams – Genus *Lima*
- (j) Octopods – Order Octopoda, except *Octopus vulgaris*
- (k) Shrimp – Genera *Periclimenes*, *Lysmata*, *Stenopus*, and *Alpheus*
- (l) Crabs – *Stenorhynchus seticornis*, *stenocionops furcata*, *Clibanarius vittatus*,
Phimochirus opercalatus, *Porcellana sayana*, *Percnon gibbesi*, *Metoporphaphis calcarata*
- (m) Starfish – Class Asteroidea, except *Oreaster reticulatus*
- (n) Brittlestars – Class Ophiuroidea
- (o) Sea urchins – Class Echinoidea, except *Diadema antillarum* and Order Clypeasteroidea
- (p) Sea cucumbers – Class Holothuroidea
- (q) Sea lillies – Class Crinoidea

(4) The following species of plants, as they occur in waters of the state and in federal Exclusive Economic Zone (EEZ) waters adjacent to state waters, are hereby designated as restricted species pursuant to Section 370.01(20), Florida Statutes:

- (a) *Caulerpa* – Family Caulerpaceae
- (b) *Halimeda*/mermaid’s fan/mermaid’ shaving brush – Family Halimedaceae
- (c) Coralline red algae – Family Corallinaceae

(5) For the purposes of Section 370.06(2)(d), Florida Statutes, the term “marine life species: is defined to mean those species designated as restricted species in subsections (2), (3), and (4) of this chapter.

46-24.002 Definitions.

46-24.003. Prohibition of Harvest: Longspine Urchin, Bahama Starfish.

46-24.0035 Live Landing and Live Well Requirements.

46-24.0036 Harvest in Biscayne National Park Prohibited

46-24.004 Size Limits.--

- (1) Angelfish
- (2) Butterflyfishes
- (3) Gobies
- (4) Jawfishes
- (5) Spotfin and Spanish hogfish

46-24.005 Bag Limit.--

(1) Except as provided in Rule 46-24.006 or subsections (3) or (4) of this rule, no person shall harvest, possess while in or on the waters of the state, or land more than 20 individuals per day of tropical ornamental marine life species, in any combination.

(2) Except as provided in Rule 46-24.006, no person shall harvest, possess while in or on the waters of the state, or land more than 1 gallon per day of tropical ornamental plants, in any combination of species.

(3) Except as provided in Rule 46-24.006, no person shall harvest, possess while in or on the waters of the state, or land more than 5 angelfishes (Family Pomacanthidae) per day. Each angelfish shall be included in the 20 individual bag limit specified in subsection (1).

(4) Unless the season is closed, no person shall harvest, possess while in or on the waters of the state, or land more than 6 colonies per day of octocorals. Each octocoral shall be included in the 20 individual bag limit specified in subsection (1).

46-24.006 Commercial Season, Harvest Limits.--

(1) Except as provided in Rule 46-24.008(7), no person shall harvest, possess while in or on the waters of the state, or land quantities of tropical ornamental marine life species or tropical ornamental marine plants in excess of the bag limits established in Rule 46-24.005 unless such person possesses a valid saltwater products license with both a marine life fishery endorsement and a restricted species endorsement issued by the Department of Environmental Protection.

(2)

- (a) Angelfish – 75 per person or 150 per vessel, per day, whichever is less
- (b) Butterflyfishes – 75 per vessel per day
- (c) Octocoral season is same as season in federal waters. Harvesters may also harvest attached substrate within 1 inch of the perimeter
- (d) Giant Caribbean or “pink-tipped” anemones – 400 per vessel per day

46-24.007 Gear Specifications and Prohibited Gear.-

(1) The following types of gear shall be the only types allowed for the harvest of any tropical fish, whether from state waters or from federal EEZ waters adjacent to state waters:

- (a) Hand held net
- (b) Barrier net, with a total length not exceeding 60 feet, a depth not exceeding 8 feet, and a mesh size not exceeding $\frac{3}{4}$ inch

- (c) Drop net, with a maximum dimension not exceeding 12 feet and a mesh size not exceeding $\frac{3}{4}$ inch
- (d) Slurp gun
- (e) Quinaldine, if:
 - 1. the person possesses a special activity license,
 - 2. the chemical is diluted to no more than 2% with seawater (prior to dilution in seawater, quinaldine shall only be mixed with isopropyl alcohol or ethanol.
- (f) A roller frame trawl operated by a person possessing a valid live bait shrimping license (i.e., marine life are incidental bycatch)
- (g) A trawl ($\leq 12'' \times 58''$ and 5lbs) no longer than 15 feet in length and no greater than idle speed to collect live dwarf seahorses (*Hippocampus zosterae*)

(2) Bags or containers may be used to store collected specimens. A single blunt rod, used in connection with an allowable gear type, may also be used.

(3) Species may be harvested as bycatch provided bag limits are not exceeded.

46-42.008 Live Rock: Harvest in State Waters Prohibited; Aquacultured Live Rock Harvest and Landing Allowed.-

46-42.009 Prohibition on the Taking, Destruction, or Sale of Marine Corals and Sea Fans; Exception; Repeal of Section 370.114, Florida Statutes

Appendix D

Tables

Table D-1. Fish species groups collected by the commercial marine life industry in Florida, 1990-98^a

Angelfish (6)	Catfish	Goatfish (2)	Mojarra	Scorpionfish (2)	Stargazer (2)
Balloonfish	Chub	Goby (3)	Moray (5)	Seahorse (3)	Stingray (2)
Barracuda	Clingfish	Grouper (5)	Parrotfish (9)	Searobin	Surgeonfish (4)
Bass (8)	Coronetfish (3)	Grunt (5)	Perch	Soapfish	Sweeper
Batfish	Cowfish (3)	Hamlet (6)	Pilotfish	Soldierfish	Tilefish
Bigeye	Cusk-Eel	Hawkfish	Pipefish	Spadefish	Toadfish
Blenny (8)	Damselfish (14)	Hogfish (3)	Porgy	Squirrelfish (3)	Triggerfish (3)
Brotula	Drum (4)	Jack (2)	Puffer (3)	Shark (3)	Tripletail
Burrfish	Filefish (6)	Jawfish (4)	Ray (4)	Sheephead	Trumpetfish
Butterflyfish (6)	Flounder	Lizardfish	Razorfish	Skate	Trunkfish (2)
Cardinalfish (3)	Frogfish (2)	Minnow	Remora (2)	Snapper (3)	Wrasse (8)

^a Species groups listed in alphabetical order. Parentheses contain the number of individual species that comprise each group.

Table D-2. Primary Fish Species within the Top Fish Species Groups in terms of Average Value,1990-1998.

Species Group	Species	Scientific Name	% Value by Group
1. Angelfish	Blue	Holacanthus Bermudensis	26%
2. Hogfish	Spotfin (=cuban)	Bodianus Pulchellus	70
3. Damsel fish	Blue Chromis (=reef)	Chromis Cyaneus	37
4. Jawfish	Yellowhead	Opistognathus Aurifrons	91
5. Wrasse	Bluehead	Thalassoma Bifasciatum	54
6. Butterflyfish	Spotfin	Chaetodon Ocellatus	99
7. Seahorse	Dwarf	Hippocampus Zosteræ	76
8. Parrotfish	Striped (=painted)	Scarus Croicensis	57
9. Surgeonfish	Blue (young are yellow)	Acanthurus Coeruleus	82
10. Drum	High-hat	Equetus Acuminatus	57

Notes: Ranking based on average value of landings 1990-98. Top individual species (by economic value) based on 1990-96 landings data.

Table D-3. Invertebrate species groups collected by the commercial marine life industry in Florida, 1990-98^a

Anemone (6)	Gorgonian (3)	Oyster	Sea Hare
Bryozoa	Jellyfish (2)	Penshell	Shrimp (8)
Chiton	Isopod	Plant (4)	Snail (26)
Clam (4)	Live Rock (6)	Polychaete (5)	Sponge (4)
Conch (7)	Live Sand	Sand Dollar (4)	Starfish (8)
Cowrie (2)	Lobster (3)	Scallop (2)	Tunicates
Crab (15)	Nudibranch (3)	Sea Biscuit (3)	Urchin (5)
Fileclam (2)	Octopus (4)	Sea Cucumber (2)	Whelk (2)

^a Species groups listed in alphabetical order. Parentheses contain the number of individual species that comprise each group.

Table D-4. Primary Invertebrate Species within the Top Invertebrate Species Groups in terms of Average Value, 1990-1998.

Species Group	Species	Scientific Name	% Value by Group
1. Live Rock	Algae	NA	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 (=common)	Echinaster Sentus	65
6. Gorgonian	Red	Swiftia Exserta, Others	38
7. Sand Dollar	Other (not 5-, 6-, notched)	Encope, Leofia, Mellita spp.	90
8. Urchin	Variable or Green (=pincushion)	Lythechinus Variegatus	56
9. Sponge	Red Tree	? (Class Demospongia)	51
10. Live Sand	NA	NA	NA

Notes: Ranking based on average value of landings 1990-98. Top individual species (by economic value) based on 1990-96 landings data.

Appendix E

Figures

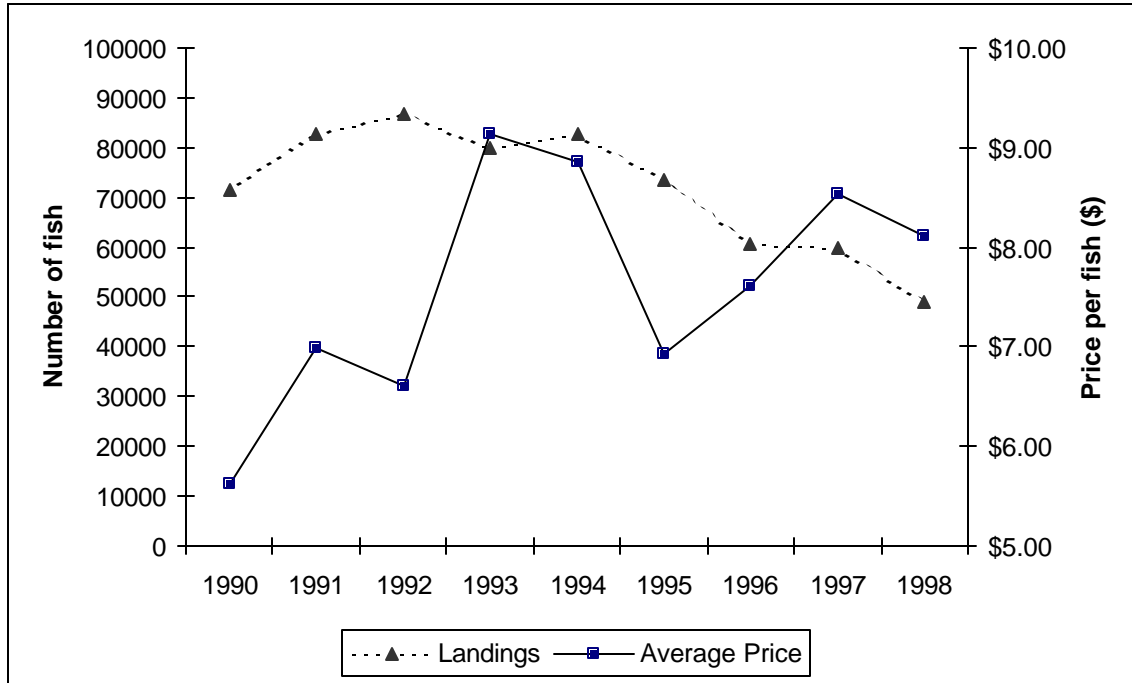


Figure 1. Landings and Average Dockside Price of Angelfish, Florida, 1990-1998.

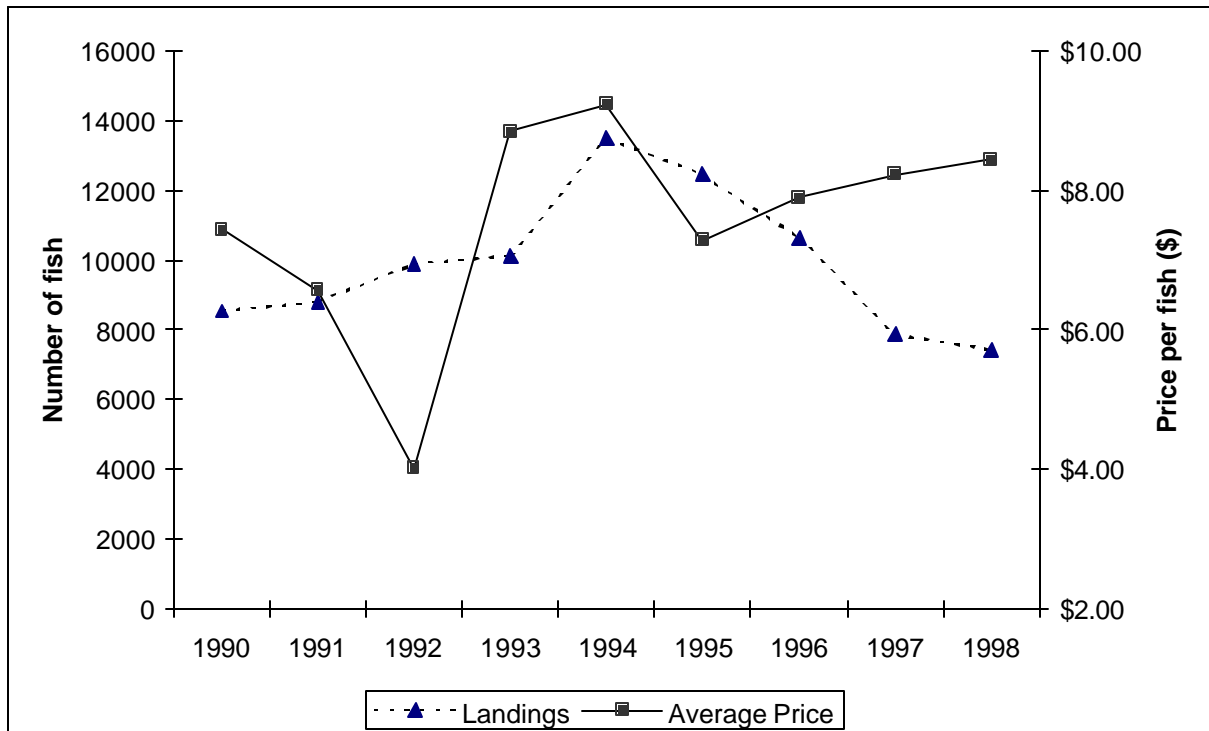


Figure 2. Landings and Average Dockside Price of Hogfish, Florida, 1990-1998.

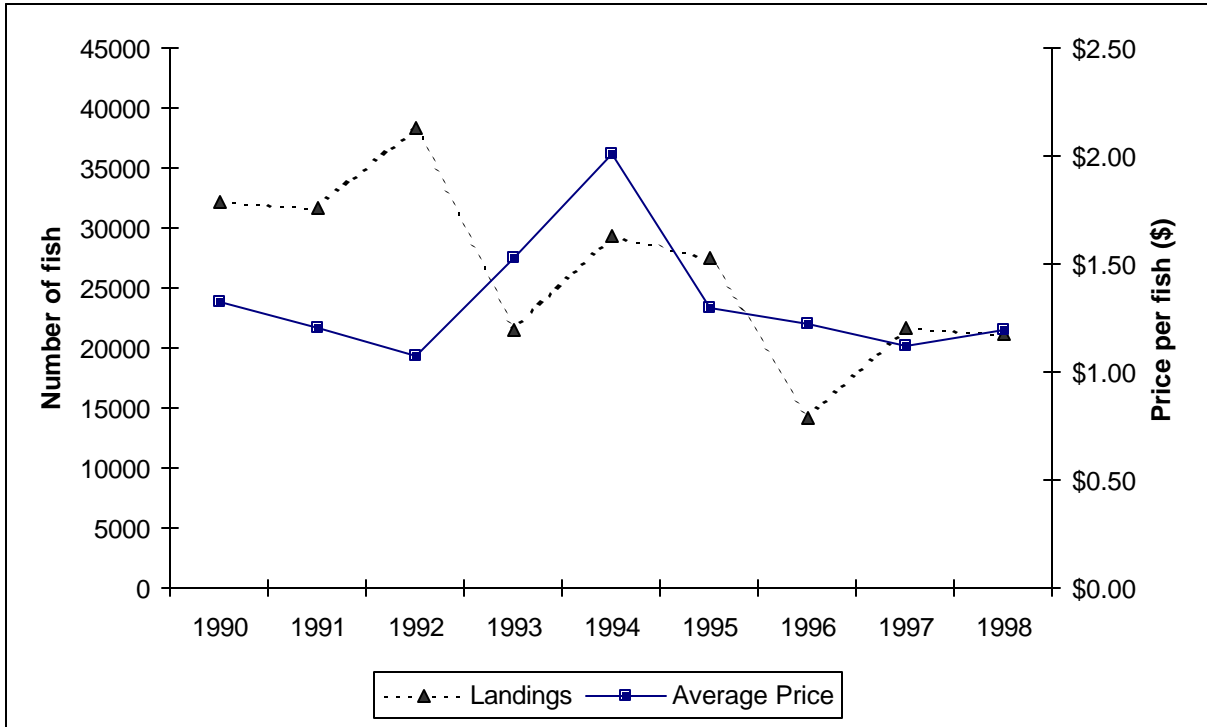


Figure 3. Landings and Average Dockside Price of Damselfish, Florida, 1990-1998.

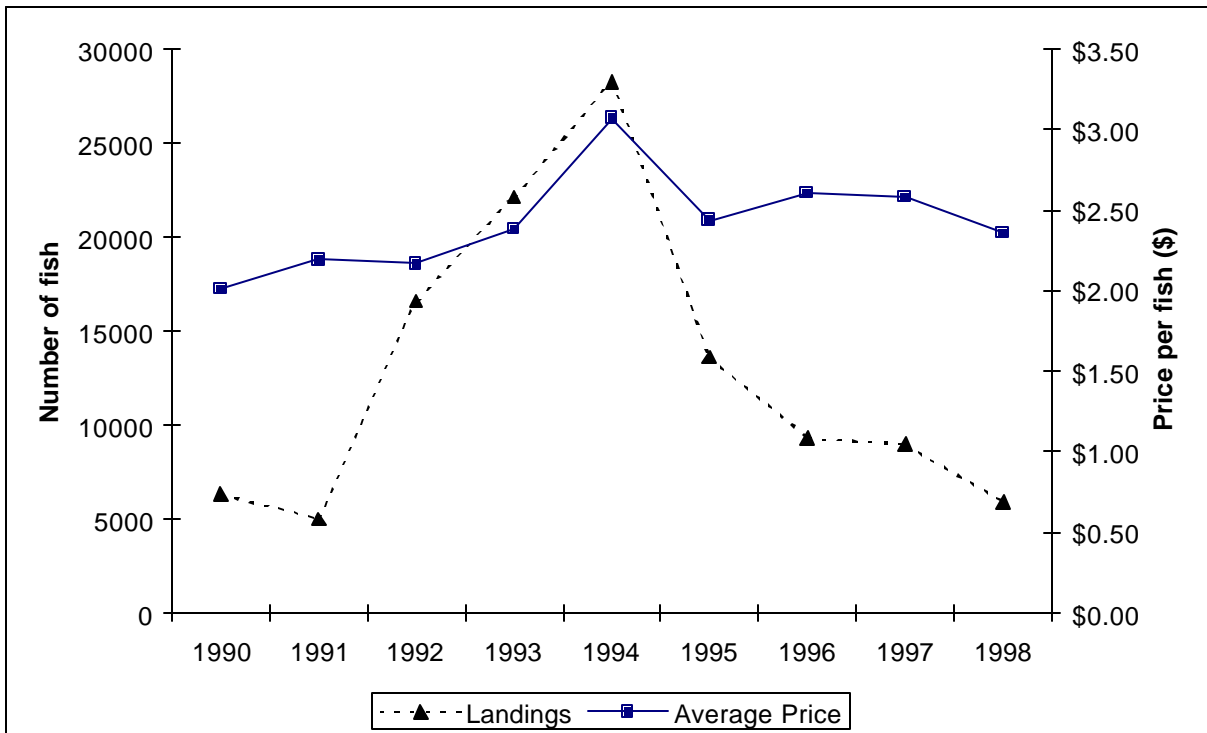


Figure 4. Landings and Average Dockside Price of Jawfish, Florida, 1990-1998

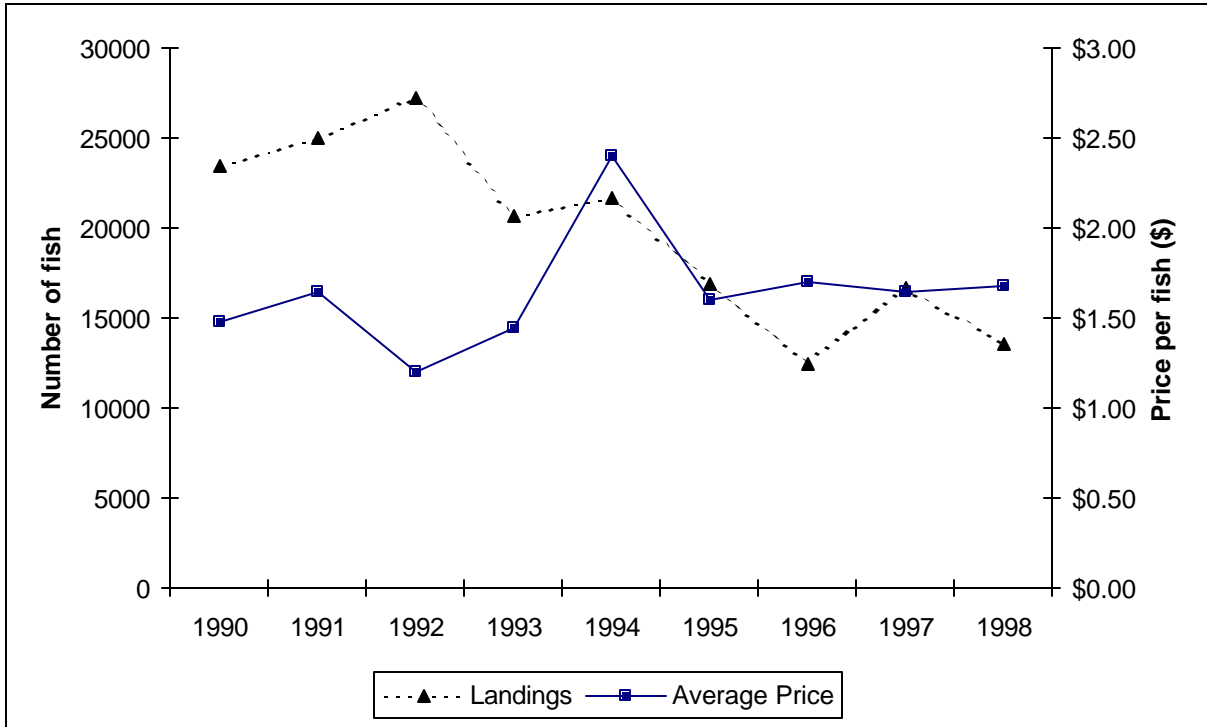


Figure 5. Landings and Average Dockside Price of Wrasse, Florida, 1990-1998

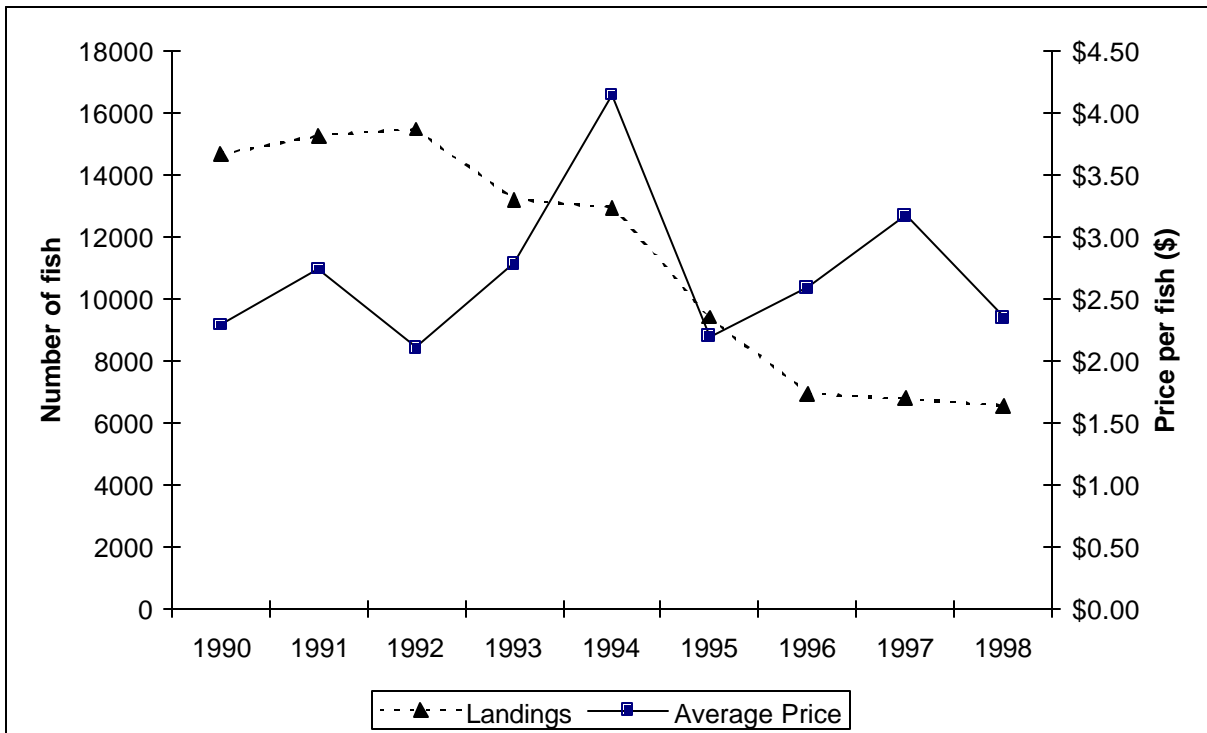


Figure 6. Landings and Average Dockside Price of Butterfly, Florida, 1990-1998

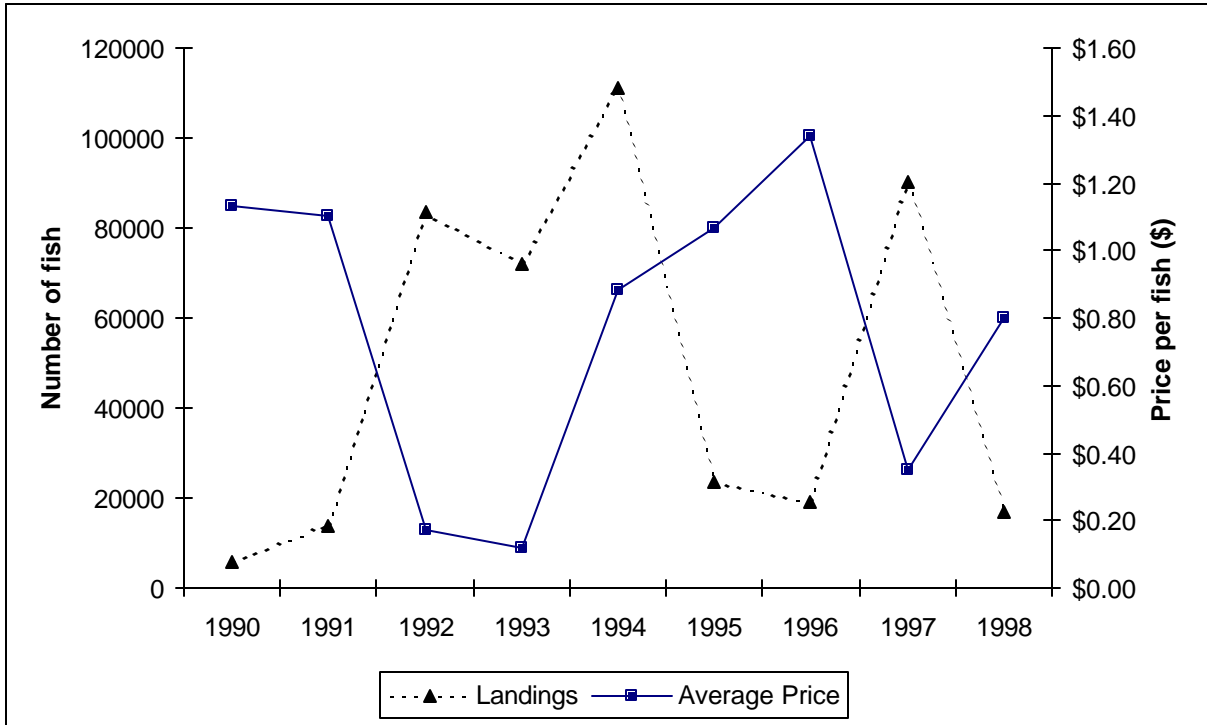


Figure 7. Landings and Average Dockside Price of Seahorse, Florida, 1990-1998

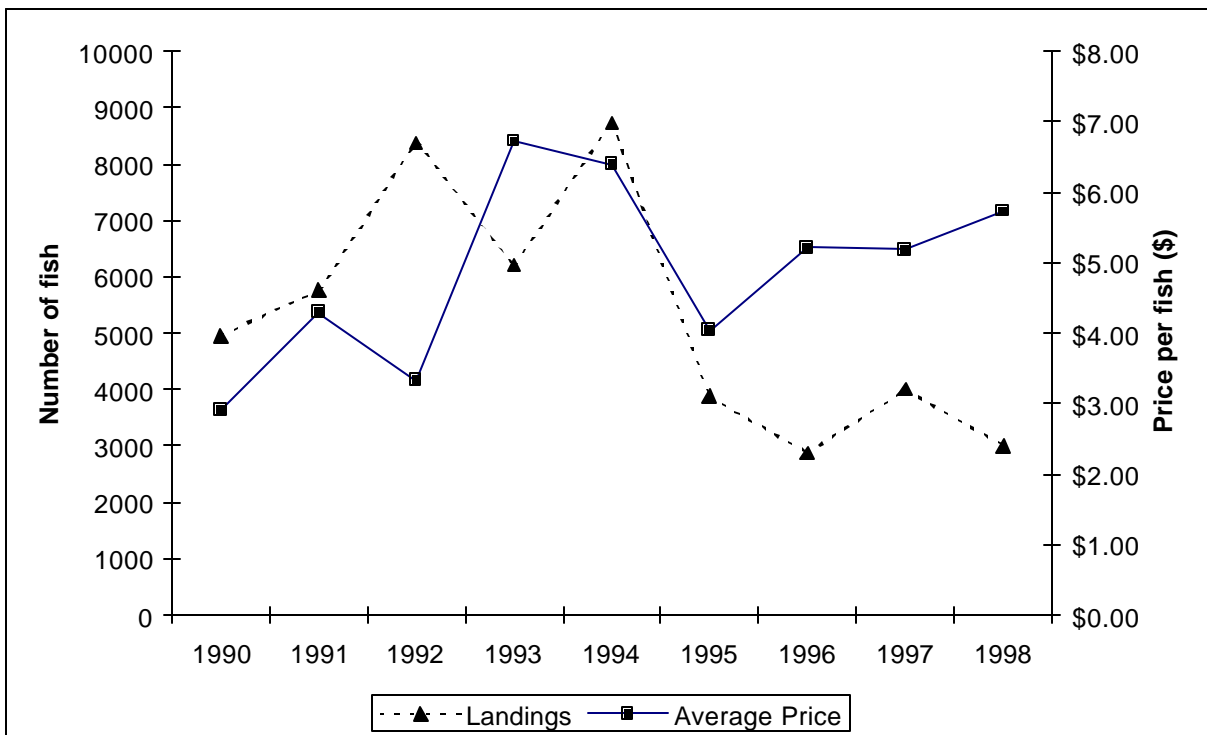


Figure 8. Landings and Average Dockside Price of Parrotfish, Florida, 1990-1998

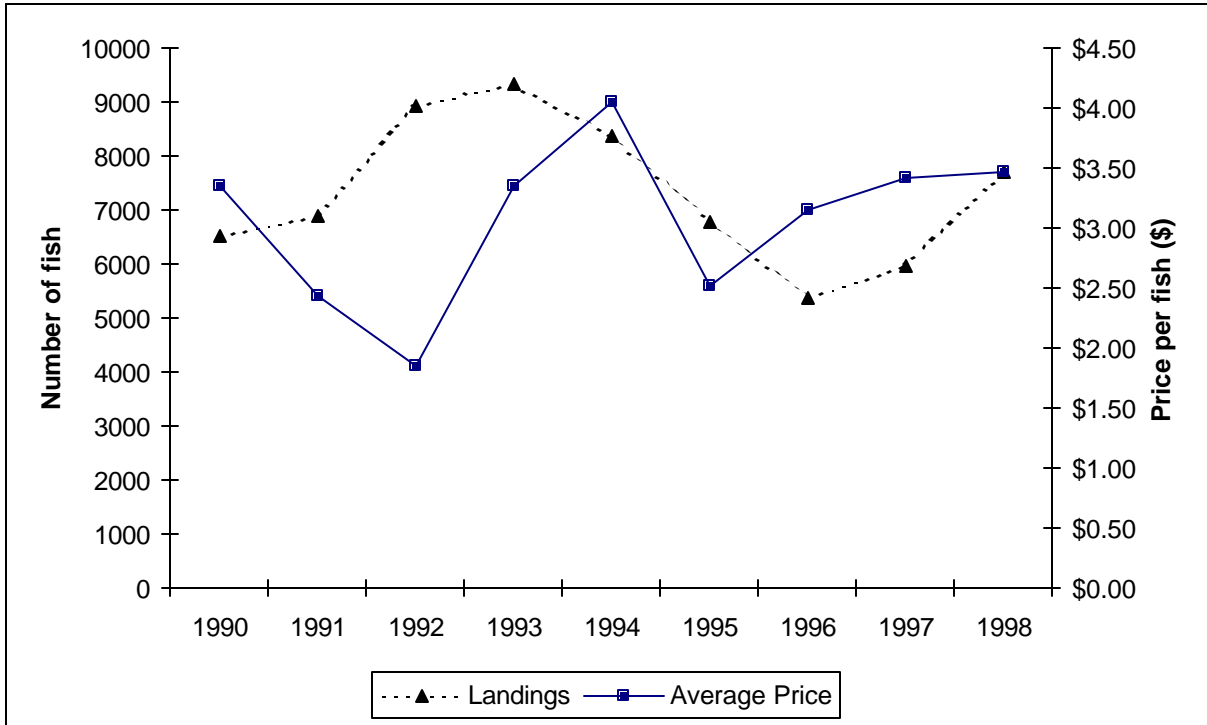


Figure 9. Landings and Average Dockside Price of Surgeonfish, Florida, 1990-1998

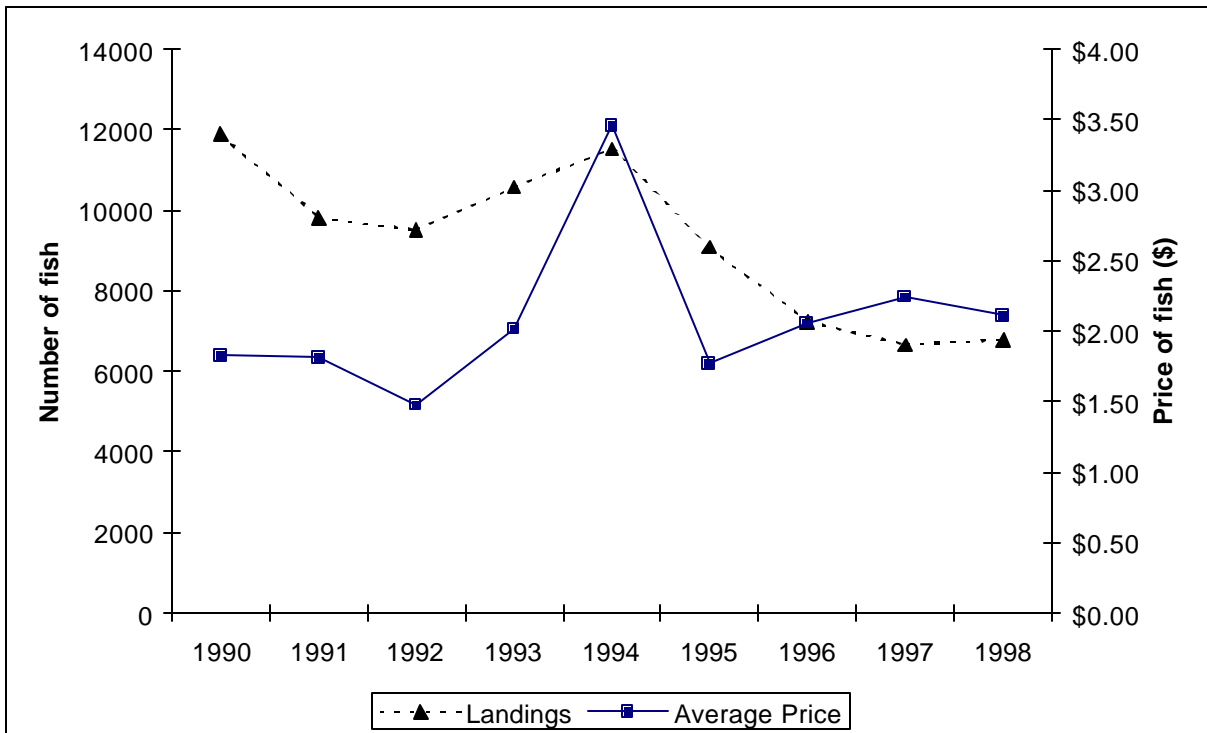


Figure 10. Landings and Average Dockside Price of Drum, Florida, 1990-1998

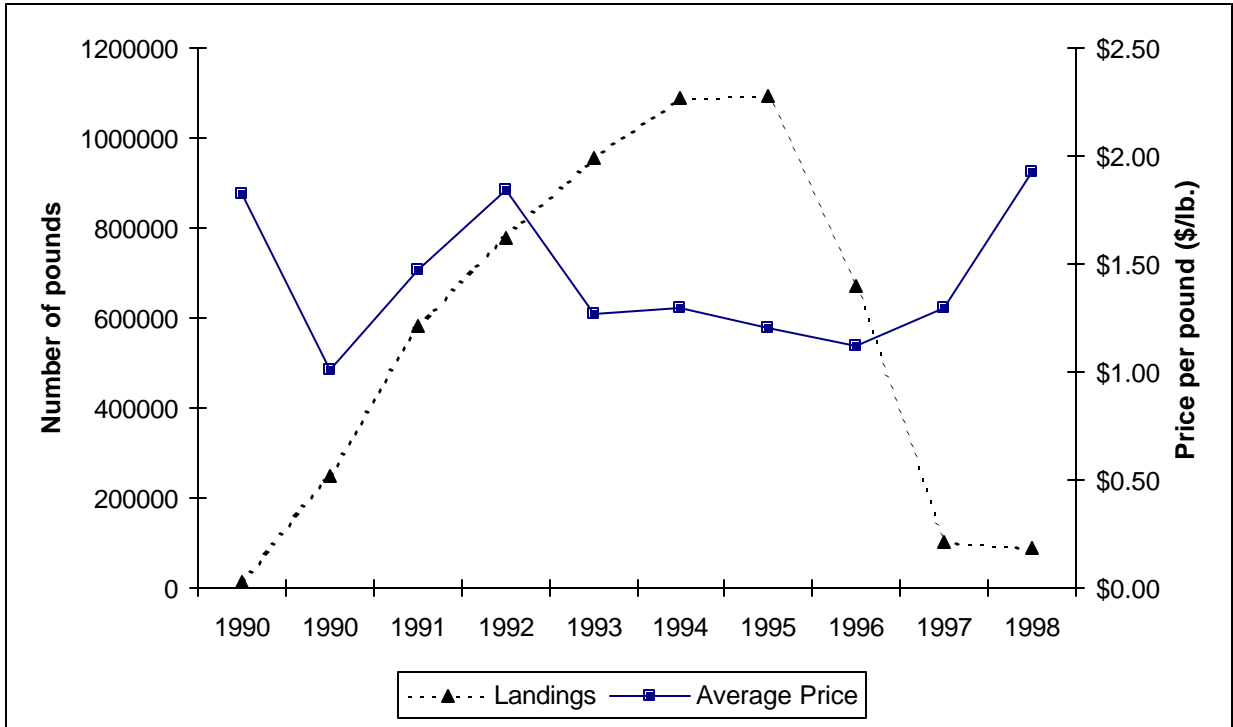


Figure 11. Landings and Average Dockside Price of Live Rock, Florida, 1990-1998

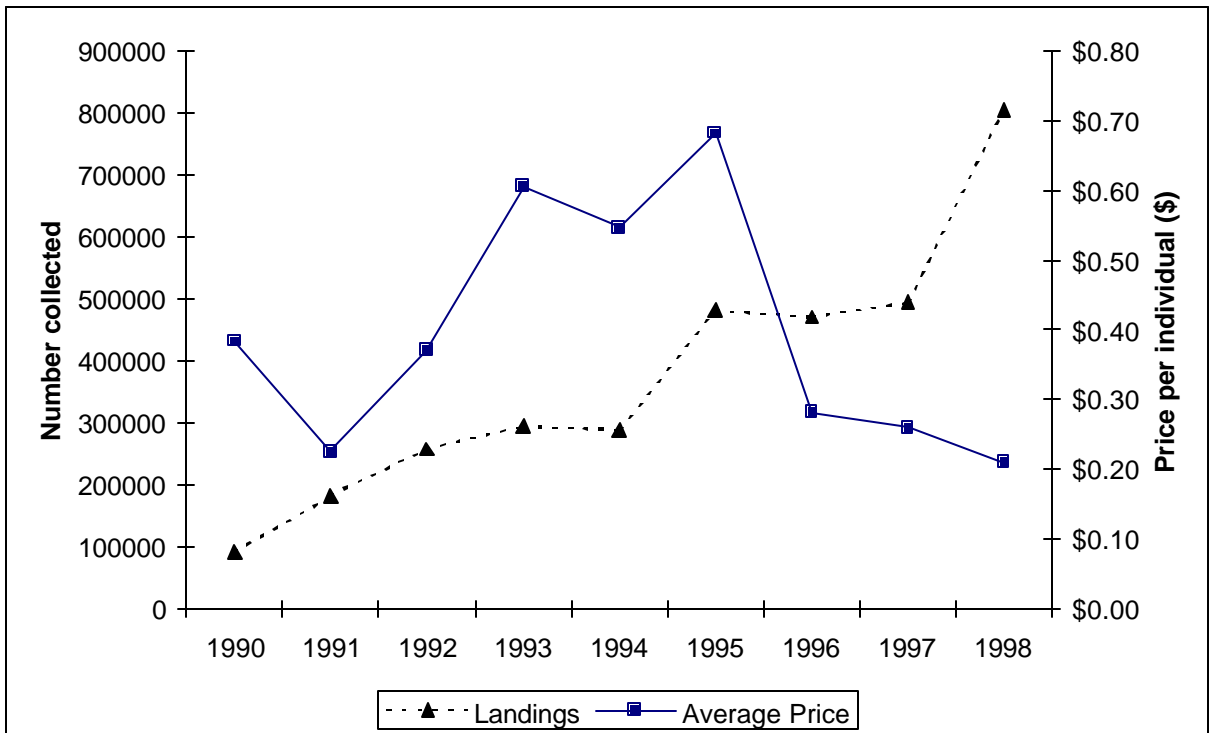


Figure 12. Landings and Average Dockside Price of Snail, Florida, 1990-1998

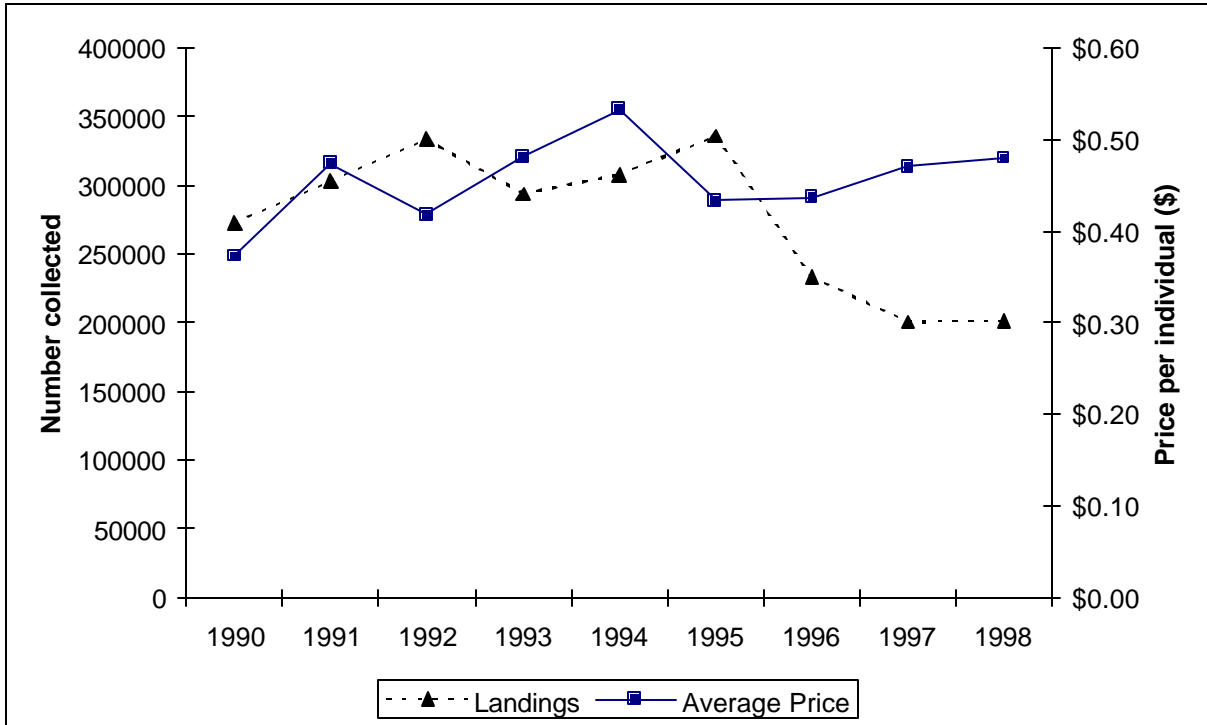


Figure 13. Landings and Average Dockside Price of Anemone, Florida, 1990-1998

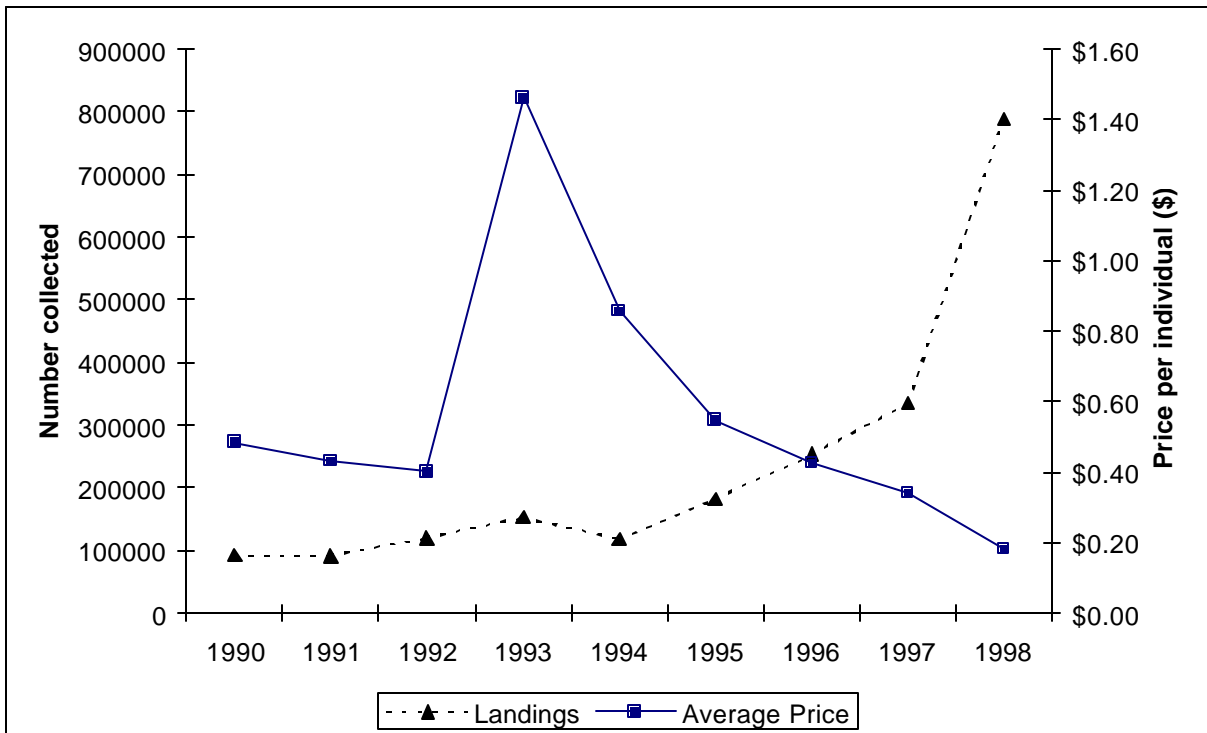


Figure 14. Landings and Average Dockside Price of Crab, Florida, 1990-1998

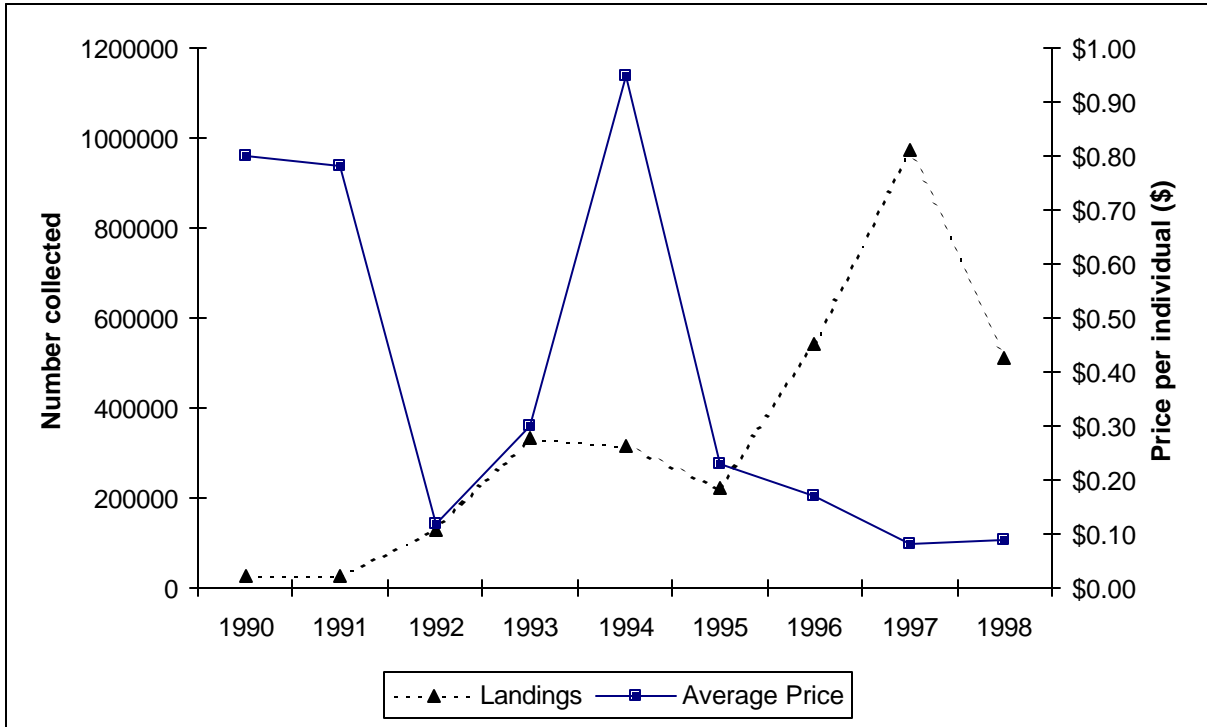


Figure 15. Landings and Average Dockside Price of Starfish, Florida, 1990-1998

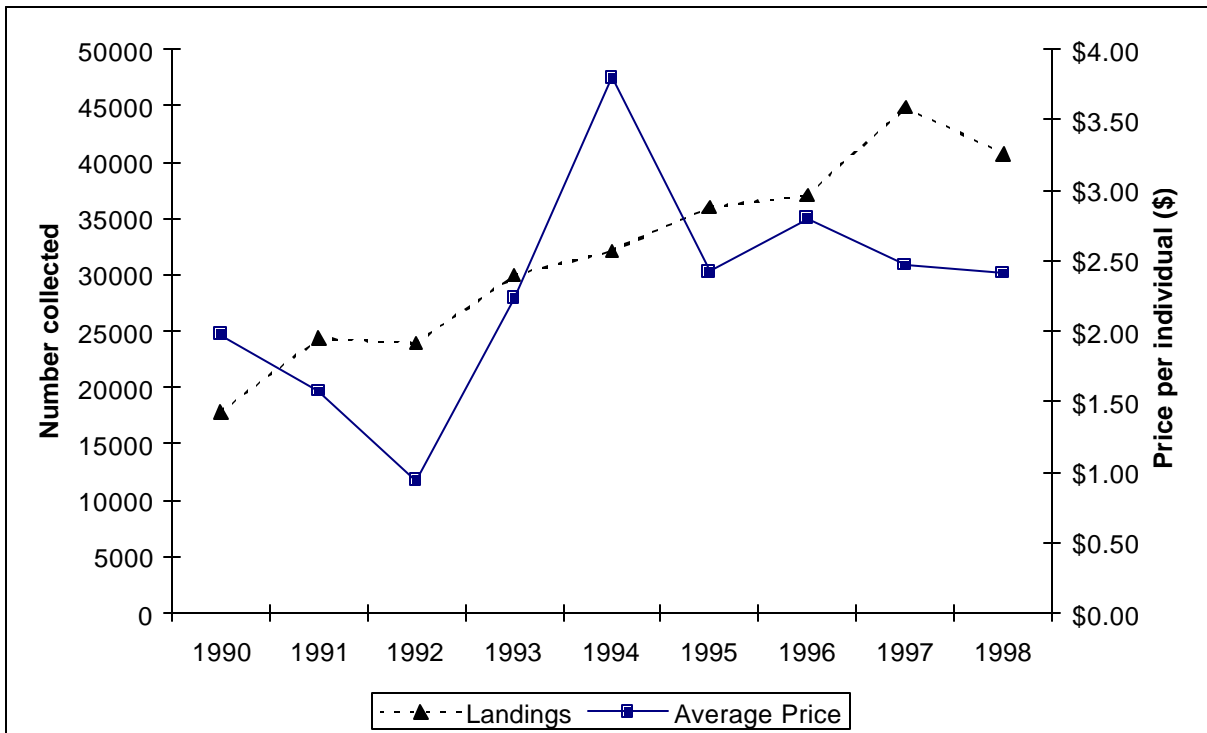


Figure 16. Landings and Average Dockside Price of Gorgonian, Florida, 1990-1998

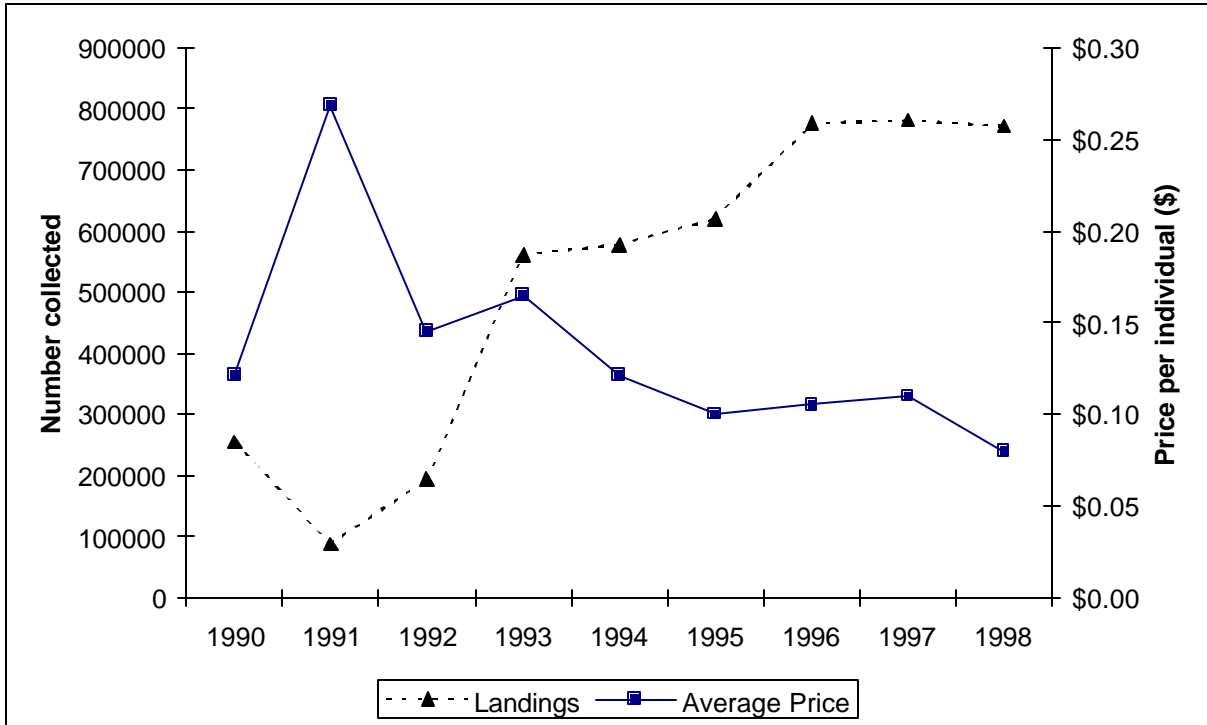


Figure 17. Landings and Average Dockside Price of Sand Dollar, Florida, 1990-1998

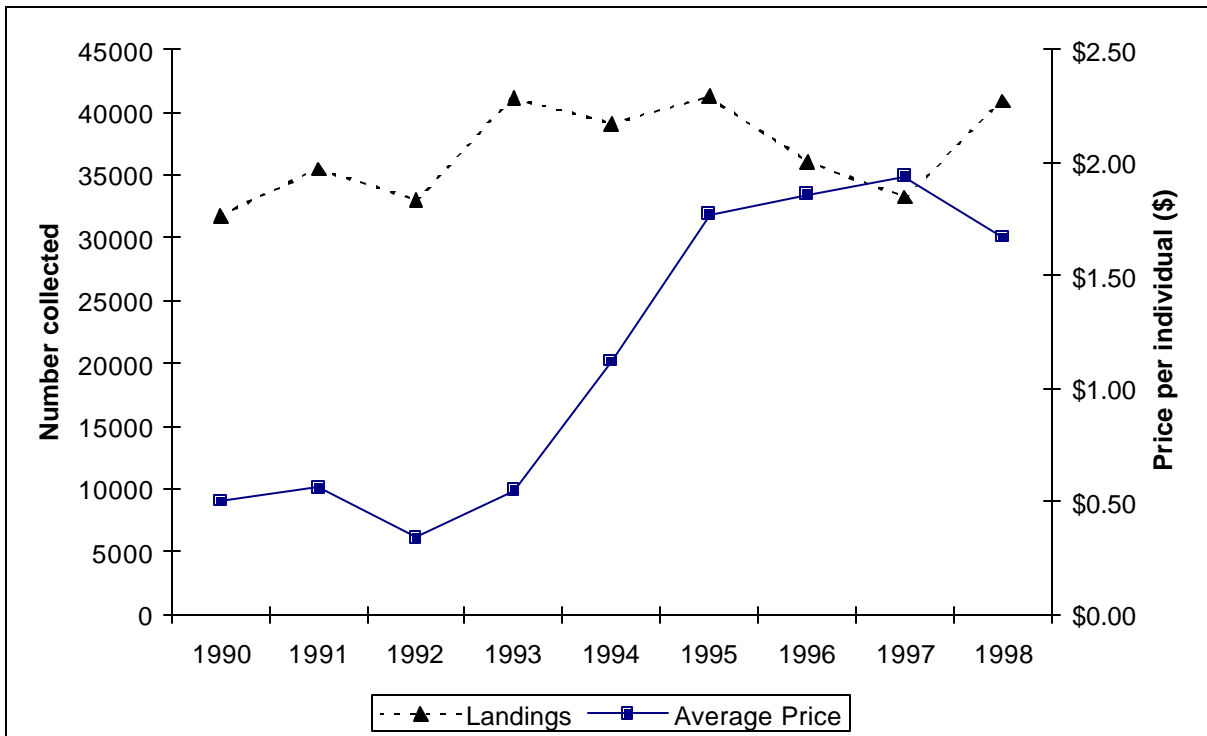


Figure 18. Landings and Average Dockside Price of Urchin, Florida, 1990-1998

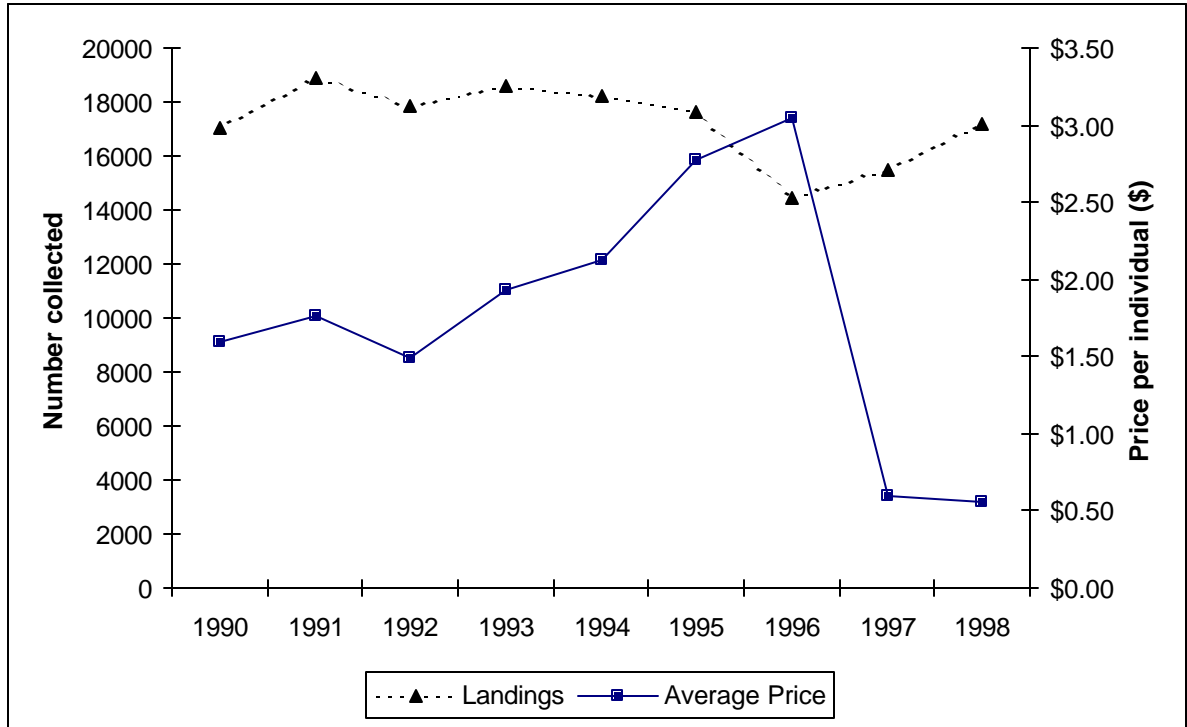


Figure 19. Landings and Average Dockside Price of Sponge, Florida, 1990-1998

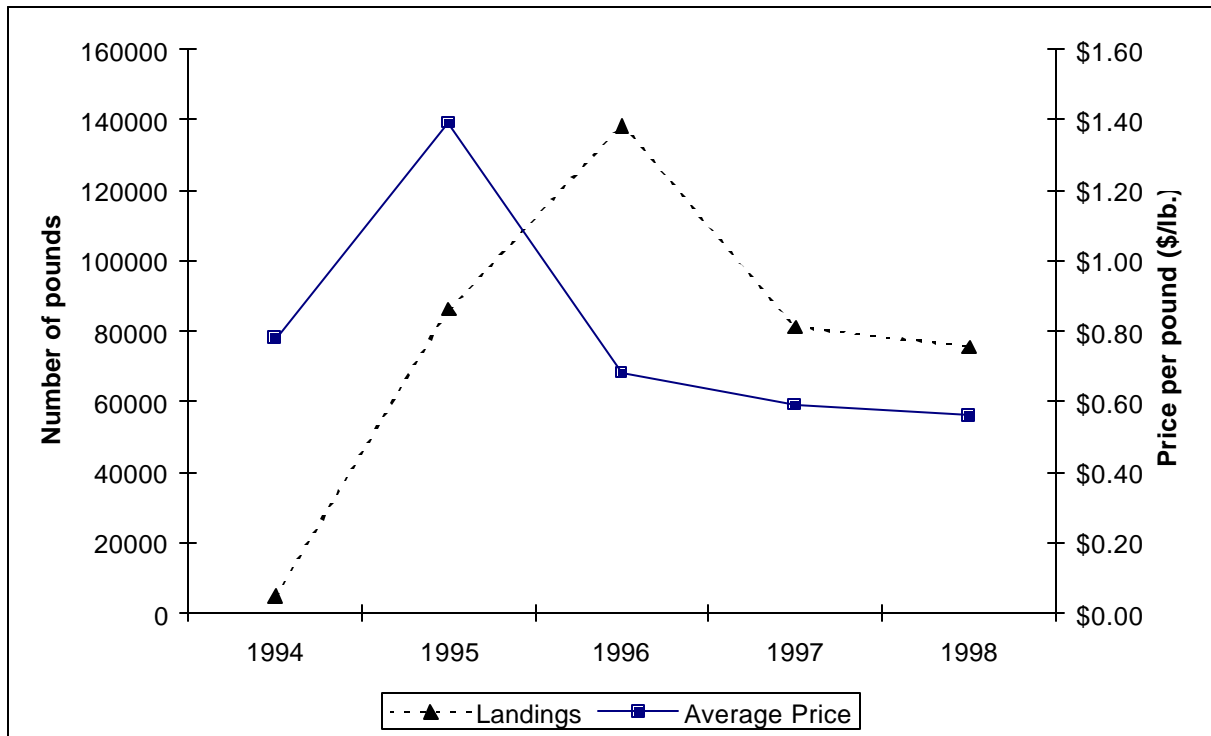


Figure 20. Landings and Average Dockside Price of Live Sand, Florida, 1990-1998.