

# **A Florida Reef Manager's Guide to a Quick and Cost Effective Valuation of Reef Resources**

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## Introduction

Coral reefs are recognized around the world for their impact on local communities. Developing and developed countries may rely on reefs in different ways, but both economies still require healthy reefs to function at their fullest, as coral reefs provide billions of dollars through the services they provide (Edwards, 2013). In addition to the physical goods and protection they provide, there are both direct and indirect services gained from reefs. Direct use values come from both extractive and non-extractive uses (Bunce, 2002); extractive uses include commercial and recreational fisheries, collections for the aquarium trade, and pharmaceutical use (Brander, 2006) and non-extractive uses include tourism, recreation, research and aesthetic purposes. Indirect use values come from the functional benefits that reefs provide, mainly things like storm surge protection or biological support of a healthy oceanic environment (e.g. Moberg, 1999).

Coral reefs are being degraded due to a large range of threats, both natural and human-induced. From global warming increasing bleaching rates to beach nourishment efforts burying reefs in sediment, the problems are many and varied (Burke et al. 2011). The value of our reefs has largely been underestimated in the past. By frequently measuring the value of the reefs and associated uses and goods, decision-makers and the public alike can more accurately understand the impacts associated with degradation of reefs.

One of the largest problems in understanding the economic value of a coral reef is that uses of reefs cannot always be directly traded on the open market, but instead have to be assumed through proxy pricing (Cesar, 2003). These include the value that a person gives to a day spent in the water near a reef, while boating, diving, snorkeling, and/or fishing. These non-extractive activities are usually analyzed as use values given to the reef (Johns et al., 2001). Certain use values are not priced in the traditional manner, but instead have to be sought through

surveys or comparisons to goods that are traded on the open market. Use values are generally determined through contingent valuation surveys, which present a range of scenarios and ask people what they would be willing to pay to have that scenario come true. The use of surveys may provide a more robust data set, but contingent valuation has proven to be costly so a different, more cost-effective method can provide more frequent updates.

An economic study of South Florida's reefs may help lead towards the understanding of how important reefs are to the local economy, something that a detailed 2001 study brought to the forefront (Johns et al., 2001). The data used in that economic valuation study are now outdated, and a large-scale study is not feasible annually. While the full-scale studies cannot be replaced using this method, as the methodologies use different data and yield incomparable results, an annual economic analysis can reveal trends in spending and use in the local economy as it relates to coral reefs. A fact sheet that can be regularly updated is an important tool for reef managers. The purpose of this guide is to aid in the development of an updated understanding of the economic importance of coral reefs to south Florida. While this annual study will not yield the same level of analysis that benchmark studies provide, it can provide an overview of the trends in reef-related spending over time. The analysis explained in this guide uses existing publicly-available data sources that can be used to track trends associated with the reef-related economy.

**Purpose:** The purpose of this guide is to allow users to identify, locate and analyze easily accessible data that are collected regularly to take the pulse of the reef-related economy of South Florida.

## Methods

### Fishing

*Commercial Fishing.* Commercial fishing data is gathered annually by the Florida Fish and Wildlife Conservation Commission (FWC) and is made publicly available. This data set includes both amount of fish caught and the estimated value per pound for each County within Florida. For this analysis, data is extracted for a representative set of fish species: black grouper, hogfish, yellowtail snapper, and spiny lobster. These are some of the most highly valued and landed species, and they are all reef-dependent. Although this report looks at the regional value of the fisheries, the data is broken down by county so data sheets could include county-specific data as well.

Data Source: Florida Fish and Wildlife Conservation Commission's Commercial Fisheries Landings Summaries (<https://public.myfwc.com/FWRI/PFDM/ReportCreator.aspx>)

How to use the data:

1. Choose years.
2. Select black grouper, hogfish, yellowtail snapper and spiny lobster.
3. Under "Additional Outplant Columns" choose County, Pounds, Average Price and Estimated Value.
4. Export Report.
5. Open Excel file titled "Fisheries", copy Template and paste into new tab for current year.
6. Input data.
7. Update graph showing trends over time for both amount of fish caught and total value.

*Recreational Fishing.* Recreational fishing data is collected by the National Oceanic and Atmospheric Administration (NOAA) through their Marine Recreational Information Program (MRIP) catch survey. The same fish species – black grouper, yellowtail snapper and hogfish - were analyzed here except spiny lobster because they are not included in the database. Recreational fishermen do not sell their catches but this value represents what they would have paid for their catch on the market and therefore reflects the value extracted from the reef. One caveat to using these data is that they are based on effort surveys, which have inherent biases including undercoverage, nonresponse, and measurement error. Also, the system is based on random digital dialing (RDD) which can only contact landlines. Because few households have a landline anymore, the possible response pool is limited. The survey methods are currently being modified to collect more accurate data.

Data Source: National Oceanic and Atmospheric Administration's Marine Recreational Information Program (MRIP) catch survey (<http://www.st.nmfs.noaa.gov/recreational-fisheries/data-and-documentation/run-a-data-query>)

How to use the data:

1. Click "Experienced User".
2. Under Catch Data on the right-hand side choose Time Series.
3. Choose years, Annual, East Florida, All Modes Combined, All Ocean Combined, Total Catch, Weight of Fish (Pounds) and Table.
4. Click Other Species. Type in fish name under common name and choose the fish from the dropdown menu. Click return.
5. Click Submit Query.
6. Copy amount of fish caught to spreadsheet.
7. Calculate the price per pound by taking an average of the five Counties' price for that year.
8. Update the graphs for amount of fish caught and value.

*Fishing Licenses.* U.S. Fish and Wildlife Service tracks recreational license sales, including number of licenses sold and gross economic value for each state (this includes freshwater and saltwater licenses, but is the best available data source).

Data Source: US Fish and Wildlife Service National Fishing License Report (<http://wsfrprograms.fws.gov/Subpages/LicenseInfo/FishingLicCertHistory20042015.pdf>)

How to use the data:

1. Find most recent data and add data points to the trends table.
2. Update graphs.

### Diving

Diving data is collected annually by the Diving Equipment and Marketing Association (DEMA). Their downloadable fact sheet includes the number of new open water certifications in Florida for each of the past ten years. Each year, the fact sheet also includes an estimate of the amount of money each new open water diver spends on certification and equipment. This value is a very rough estimate. The dive business as a whole makes more than just what is spent on open water certifications, so it is an underestimate of the dive-related economy of Florida. On the other hand, the data includes all of Florida so it is an overestimate of how much South Florida makes from open water certifications.

Data Source: The Diving Equipment & Marketing Association (DEMA) fast facts sheet (<http://www.dema.org/?page=548>)

How to use the data:

1. The number of new open water certifications is listed in a table for the last 10 years.
2. The estimated total revenue per new open water certified diver is listed in a table entitled “2014 Entry-Level Diver Sales Estimates”.
3. A rough estimate of revenue for the current year is the number of new divers in Florida multiplied by the estimated revenue.
4. Update the graphs with current year data.

### Boating

Boating registration data is divided by size class, as is standard for the Florida Department of Highway Safety and Motor Vehicles. The size classes are as follows: A1 (<12’), A2 (12’-15’11”), 1 (16’-25’11”), 2 (26’-39’11”), 3 (40’-64’11”), 4 (65’-109’11), and 5 (>110’). Each size class has a different fee for registration which can be found online as well. The revenue from registered boats was calculated as the sum of the number of boats in each size class multiplied by the fee for that size class.

The percentage of boat owners in the population can then be calculated by dividing the number of boats registered in each county by that county’s population in the same year.

Data Source: Florida Highway Safety and Motor Vehicles website (updated fees here: <http://www.flhsmv.gov/feeSamples.htm#ves> under Vessel Registration Fee Chart link; number of registered boats here: <http://www.flhsmv.gov/dmv/vslfacts.html>); Florida Census Data from the Office of Economic and Demographic Research (<http://edr.state.fl.us/Content/population-demographics/data/>)

How to use the data:

1. Find current registration fees for each size class.
2. Link to table with vessel registration data for the current year.
3. For each size class, add Ples and Comm numbers together for the total number of boats in each size class.
4. Calculate revenue from registrations.
5. Update graphs.
6. Find current year’s population for each County to update information about percentage of boat owners.

## Tourism

Tourism data is available online for 3 of the 5 counties. This analysis looks at the number of visitors who participated in snorkeling and SCUBA diving activities and their contribution to the economy.

### *Monroe County*

Data Source: Tourist Development Council Market Research (<http://www.monroecounty-fl.gov/index.aspx?nid=328>).

How to use the data:

1. Click “Visitor Estimates” link under Tourist Development Council Market Research.
2. Add data from Total Visitors for current year to graph.
3. Click “Annual and Quarterly Visitor Profile Survey”.
4. Collect the following information:
  - a. Average number of nights spent in the Keys.
  - b. Percent participation in snorkeling and SCUBA diving.
  - c. Average amount spent per day.
5. Round the number of nights up to get the number of days and multiply by average amount spent to get the amount spent per person for an entire trip.
6. Add the percent snorkeling and diving and multiply that percent by the number of visitors for the year who took part in those activities. Multiply by the amount spent on each trip.

Eg. for 2013:

Total visitors: 2,895,109

Average number of nights spent in the Keys: 5.26 (round to 6 days)

Participation in snorkeling: 43.2% and SCUBA: 19%

Average amount spent per day: \$400.05

$$2,895,109 * 0.622 = 1,800,757.80$$

$$6 * \$400.05 = \$2,400.30$$

$$1,800,757.80 * \$2,400.30 = \$4,322,358,947 \text{ spent on trips involving snorkeling or diving}$$

### *Miami-Dade County*

Data Source: Greater Miami and the Beaches Visitor Industry Overview (<http://partners.miamiandbeaches.com/tools-and-resources/research-and-statistics>)

How to use the data:

1. Collect the following information:
  - a. Number of visitors that spent at least one night in Miami (under Total Overnight Visitors).
  - b. Average amount spent per day (under Overnight Visitor Spending).
  - c. Average length of stay (under Overnight Visitor Spending).
  - d. Percent of visitors who participated in water sports/activities (in table under Areas/Attractions Visited).
2. Round the number of nights up to get the number of days and multiply by average amount spent to get the amount spent per person for an entire trip.
3. Multiply the percent of people who took part in water sports by the number of visitors for the year who took part in those activities. Multiply by the amount spent on each trip.

Eg. for 2014:

Total visitors: 14,600,000

Average number of nights spent in Miami: 5.86 (round to 6 days)

Participation in water sports: 4.6%

Average amount spent per day: \$279.48

$$14,600,000 * 0.046 = 671,600$$

$$6 * \$279.48 = \$1,676.88$$

$$671,600 * \$1,676.88 = \$1,126,193 \text{ spent on trips involving snorkeling or diving}$$

### General Socioeconomic Data

General socioeconomic data comes from U.S. Census data.

Data Source: U.S. Census Population Estimates (<https://www.census.gov/popest/data/historical/>)

How to use the data:

1. Click 2010s, Vintage 2014, County Tables, Annual Population Estimates, and choose Florida.
2. Find most recent estimates for each County in the table and update graphs.

## Results

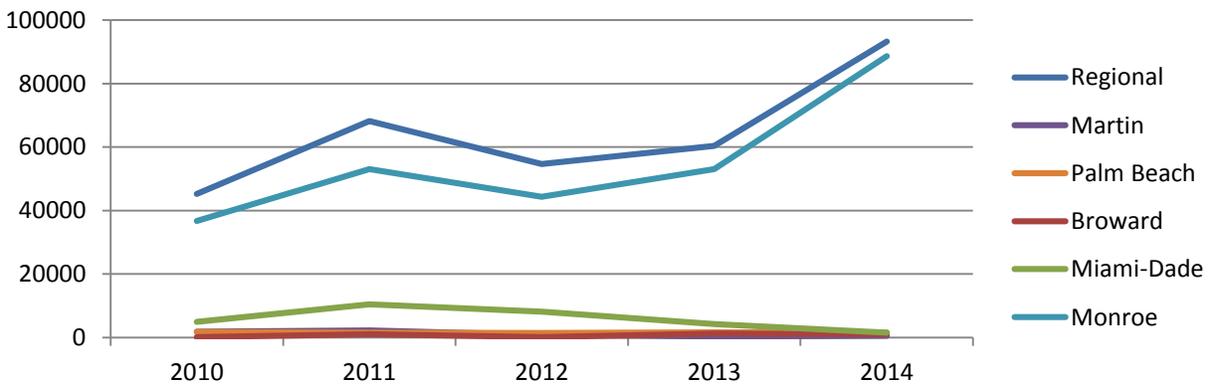
### Fishing

*Commercial Fishing.* This analysis is based on annual catch and price per pound of black grouper, hogfish, yellowtail snapper and spiny lobster. Table 1 includes data for the most recent 5 years available and Figures 1-4 show the annual harvest in both pounds and value for the South Florida region over the same timeframe.

Table 1.

		Broward		Miami-Dade		Martin		Monroe		Palm Beach		Regional totals	
		Pounds caught	Total value	Pounds caught	Total value	Pounds caught	Total value	Pounds caught	Total value	Pounds caught	Total value	Pounds caught	Total value
2010	Black grouper	89	\$313.28	4934	\$17,120.98	1805	\$7,075.60	36673	\$124,321.47	1750	\$6,580.00	45251	\$155,411.33
	Hogfish	58	\$174.58	1105	\$3,745.95	22	\$69.30	7801	\$22,232.85	1418	\$6,139.94	10404	\$32,362.62
	Yellowtail snapper	18144	\$60,419.52	161387	\$437,358.77	166	\$340.30	1501280	\$3,858,289.60	9120	\$29,366.40	1690097	\$4,385,774.59
	Spiny lobster	40883	\$244,480.34	390073	\$2,313,132.89	2107	\$10,535.00	5213953	\$32,326,508.60	26276	\$149,247.68	5673292	\$35,043,904.51
2011	Black grouper	1022	\$3,403.26	10420	\$37,512.00	2165	\$9,417.75	53009	\$190,832.40	1524	\$6,431.28	68140	\$247,596.69
	Hogfish	243	\$826.20	581	\$1,882.44	17	\$65.11	10341	\$32,780.97	239	\$893.86	11421	\$36,448.58
	Yellowtail snapper	82927	\$281,122.53	118767	\$334,922.94	133	\$339.15	1679066	\$4,751,756.78	8635	\$28,409.15	1889528	\$5,396,550.55
	Spiny lobster	31355	\$191,892.60	405944	\$2,561,506.64	3212	\$18,950.80	5291541	\$35,559,155.52	56427	\$337,997.73	5788479	\$38,669,503.29
2012	Black grouper	114	\$381.90	8107	\$29,104.13	823	\$3,456.60	44272	\$162,478.24	1364	\$5,837.92	54680	\$201,258.79
	Hogfish	79	\$346.81	545	\$2,043.75	0	\$0.00	10324	\$33,862.72	869	\$3,762.77	11817	\$40,016.05
	Yellowtail snapper	15975	\$55,912.50	141704	\$420,860.88	11	\$23.32	1924456	\$5,561,677.84	12081	\$43,733.22	2094227	\$6,082,207.76
	Spiny lobster	20388	\$117,434.88	235401	\$1,322,953.62	3478	\$18,746.42	3757337	\$22,168,288.30	47821	\$261,102.66	4064425	\$23,888,525.88
2013	Black grouper	1154	\$3,715.88	4259	\$15,417.58	309	\$1,483.20	53046	\$204,227.10	1601	\$7,140.46	60369	\$231,984.22
	Hogfish	58	\$223.88	816	\$2,472.48	377	\$1,240.33	12994	\$45,868.82	1614	\$7,117.74	15859	\$56,923.25
	Yellowtail snapper	14526	\$46,483.20	87920	\$244,417.60	2	\$4.50	1926930	\$5,472,481.20	6752	\$24,914.88	2036130	\$5,788,301.38
	Spiny lobster	16579	\$103,287.17	407217	\$2,952,323.25	1123	\$6,232.65	5585684	\$46,696,318.24	42294	\$272,373.36	6052897	\$50,030,534.67
2014	Black grouper	1001	\$4,194.19	1505	\$5,794.25	540	\$2,559.60	88668	\$359,992.08	1548	\$7,043.40	93262	\$379,583.52
	Hogfish	0	\$0.00	903	\$3,828.72	147	\$490.98	16787	\$61,440.42	2172	\$9,969.48	20009	\$75,729.60
	Yellowtail snapper	5655	\$18,152.55	34070	\$99,143.70	758	\$2,076.92	1972874	\$5,958,079.48	17603	\$65,659.19	2030960	\$6,143,111.84
	Spiny lobster	18335	\$143,196.35	481620	\$4,710,243.60	894	\$5,364.00	5025602	\$53,321,637.22	26939	\$201,503.72	5553390	\$58,381,944.89

Figure 1. Black grouper catch in pounds and value in US dollars.



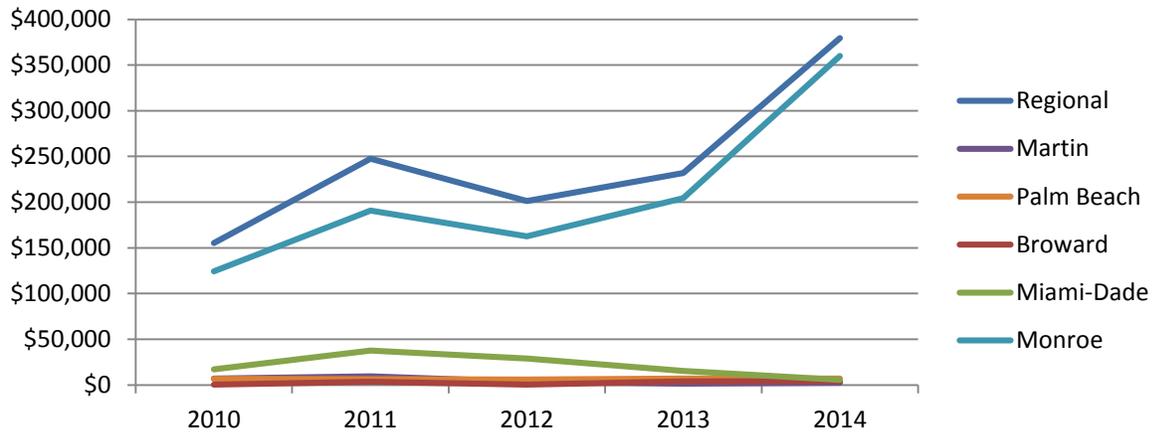


Figure 2. Hogfish catch in pounds and value in US dollars.

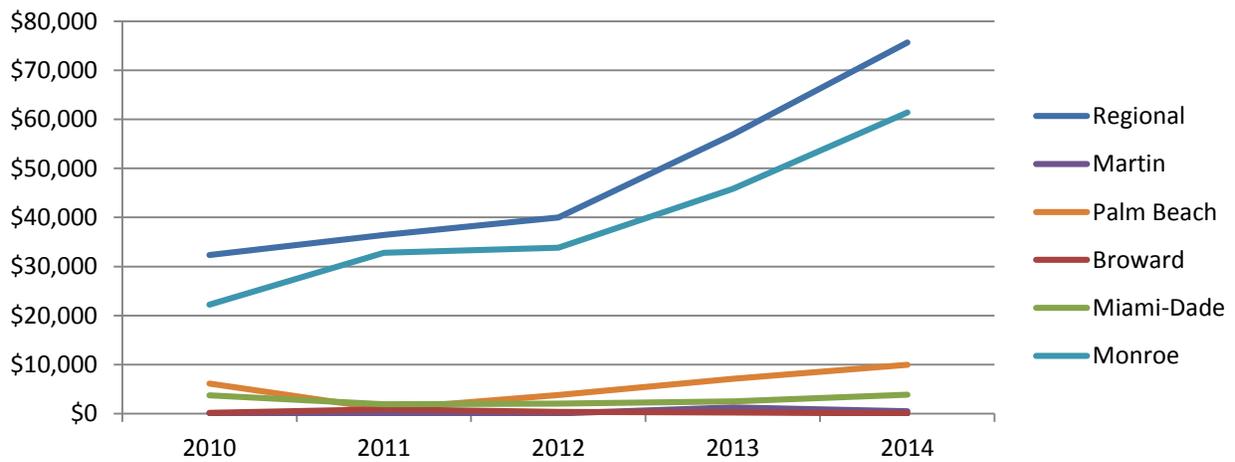
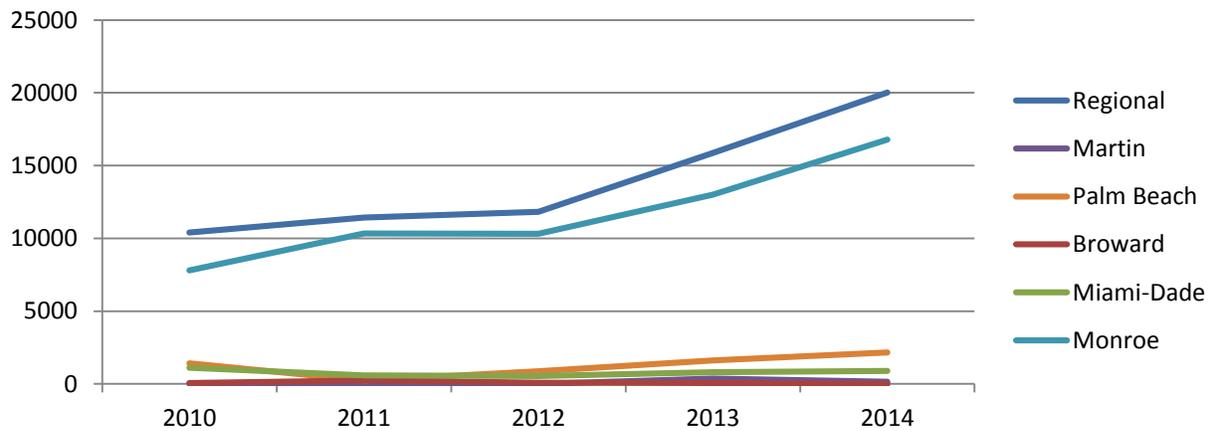


Figure 3. Yellowtail snapper catch in pounds and value in US dollars.

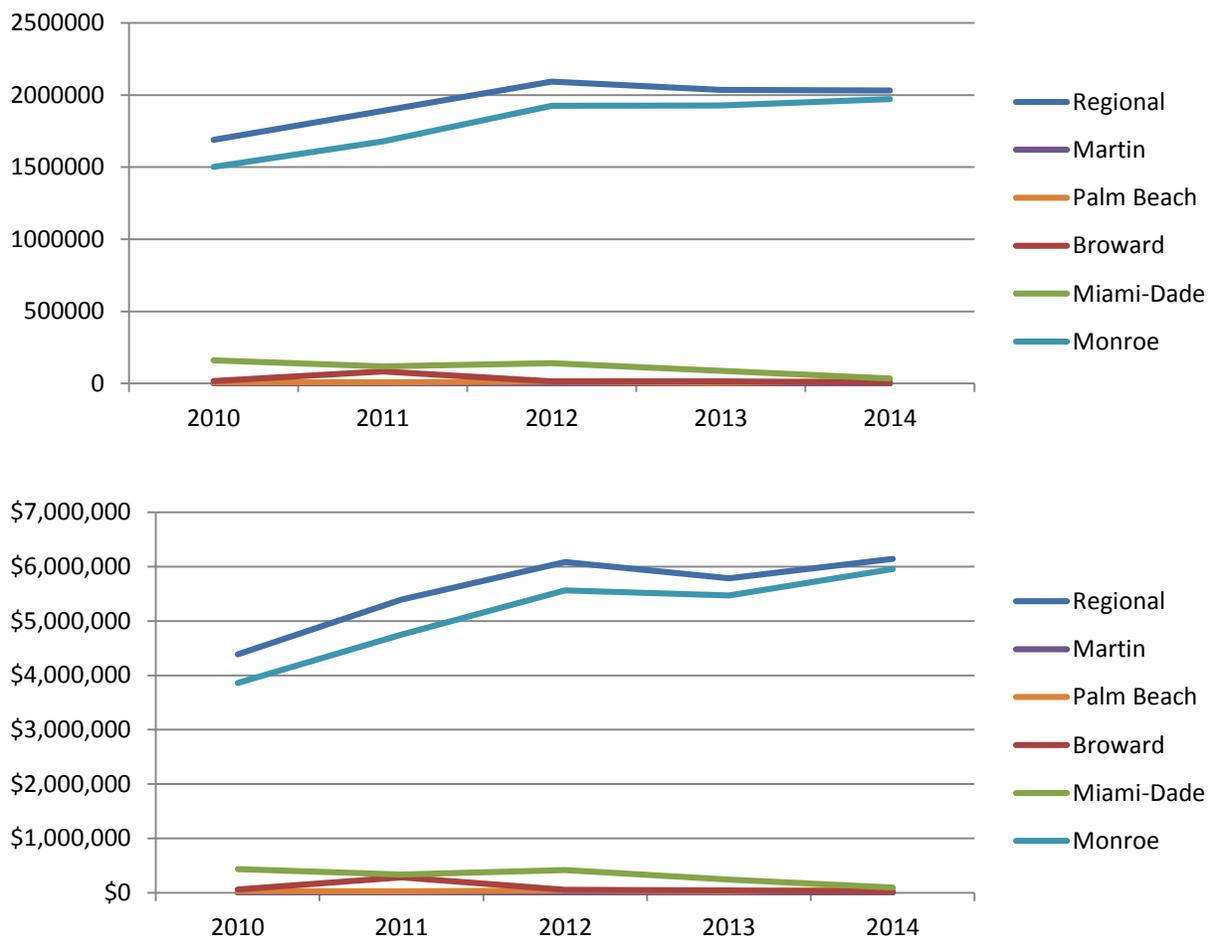
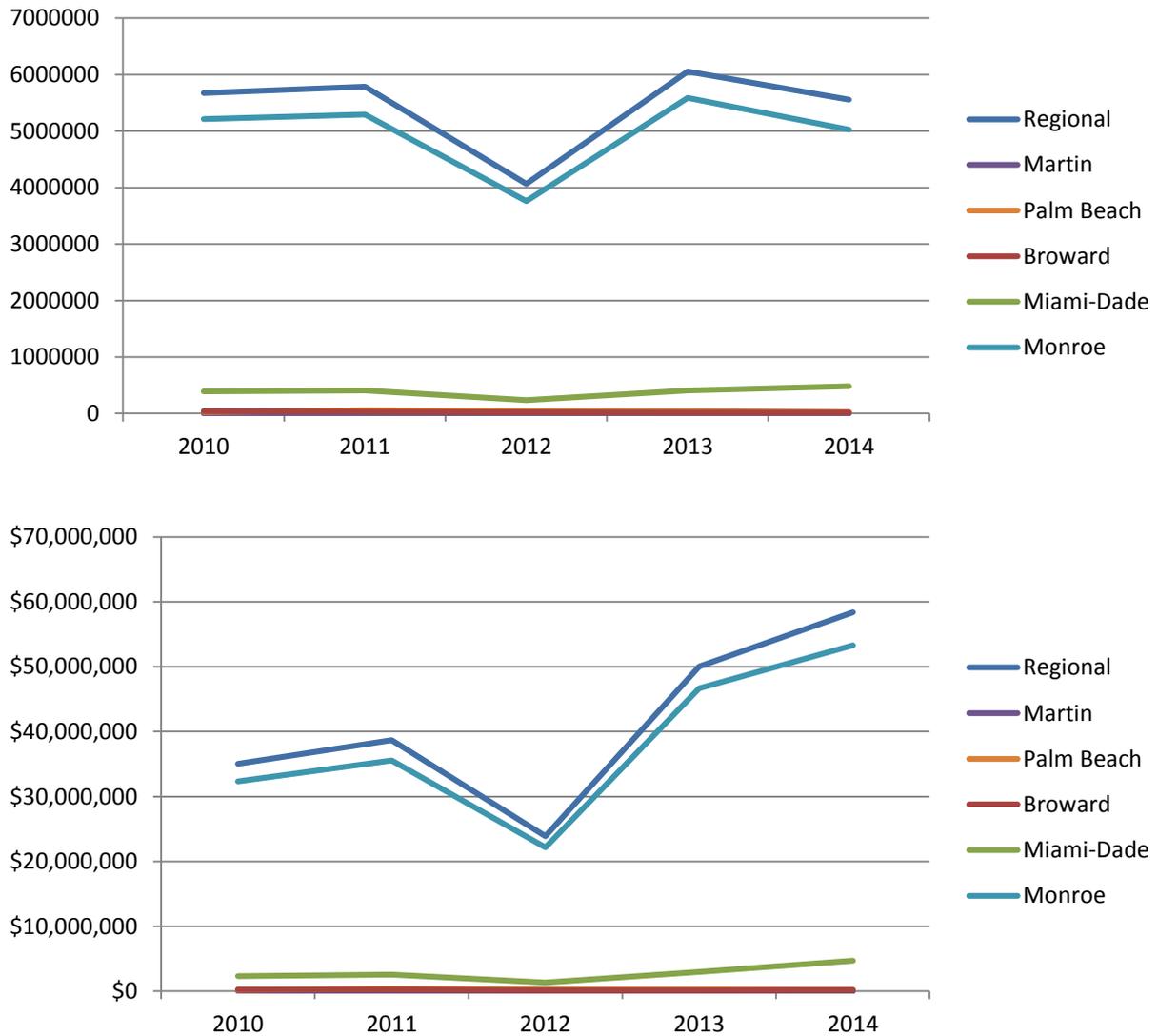


Figure 4. Spiny lobster catch in pounds and value in US dollars.

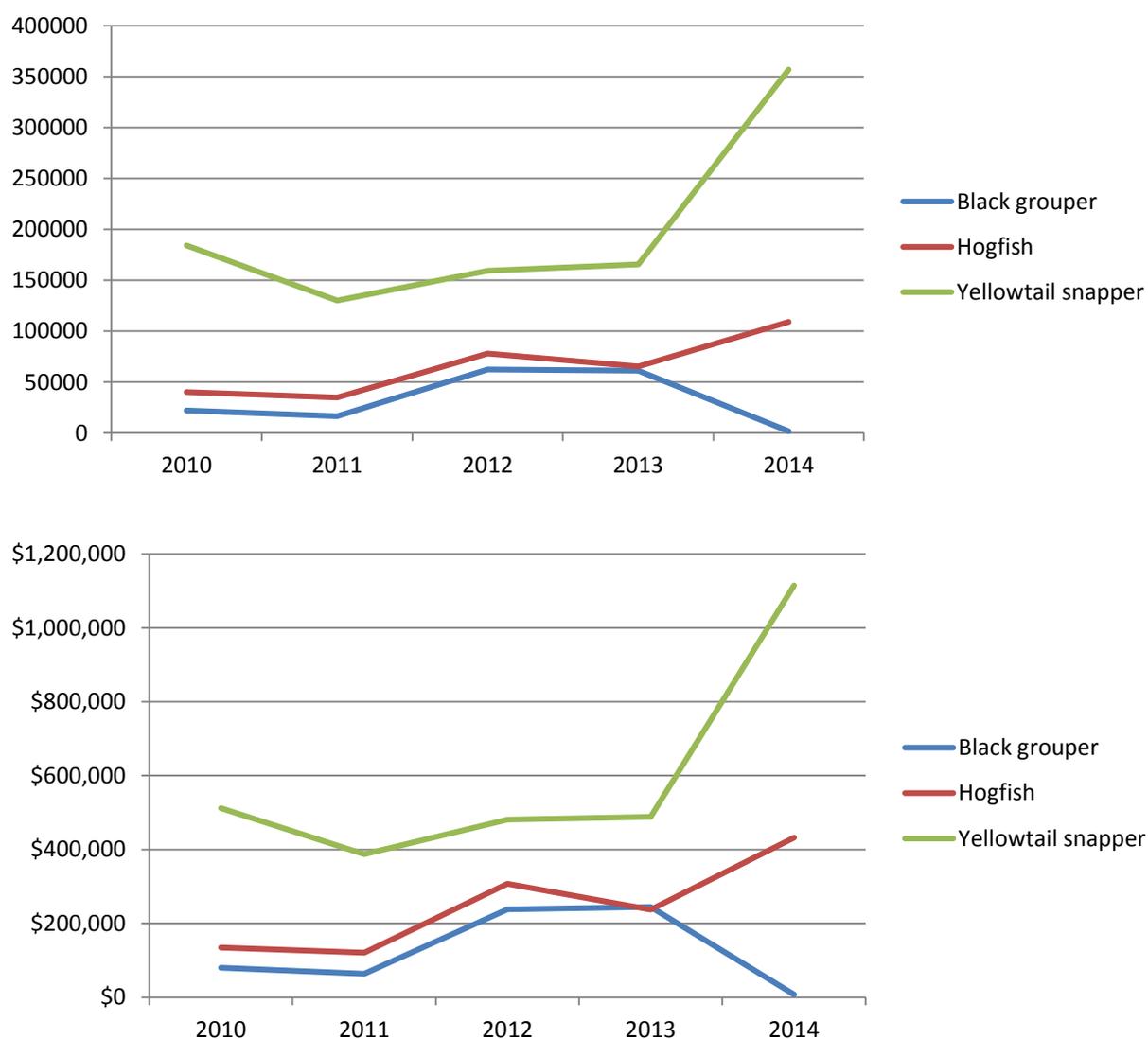


*Recreational Fishing.* This analysis is based on annual catch and price per pound of black grouper, hogfish, and yellowtail snapper. The data is not divided into individual counties so the results are tabulated as a regional total. Table 2 shows the annual recreational harvest of fish both in pounds caught and in the value of the fish if they had been bought on the market.

Table 2. Recreational catch of black grouper, hogfish and yellowtail snapper in pounds landed and the value of the catch if it had been bought and sold on the market.

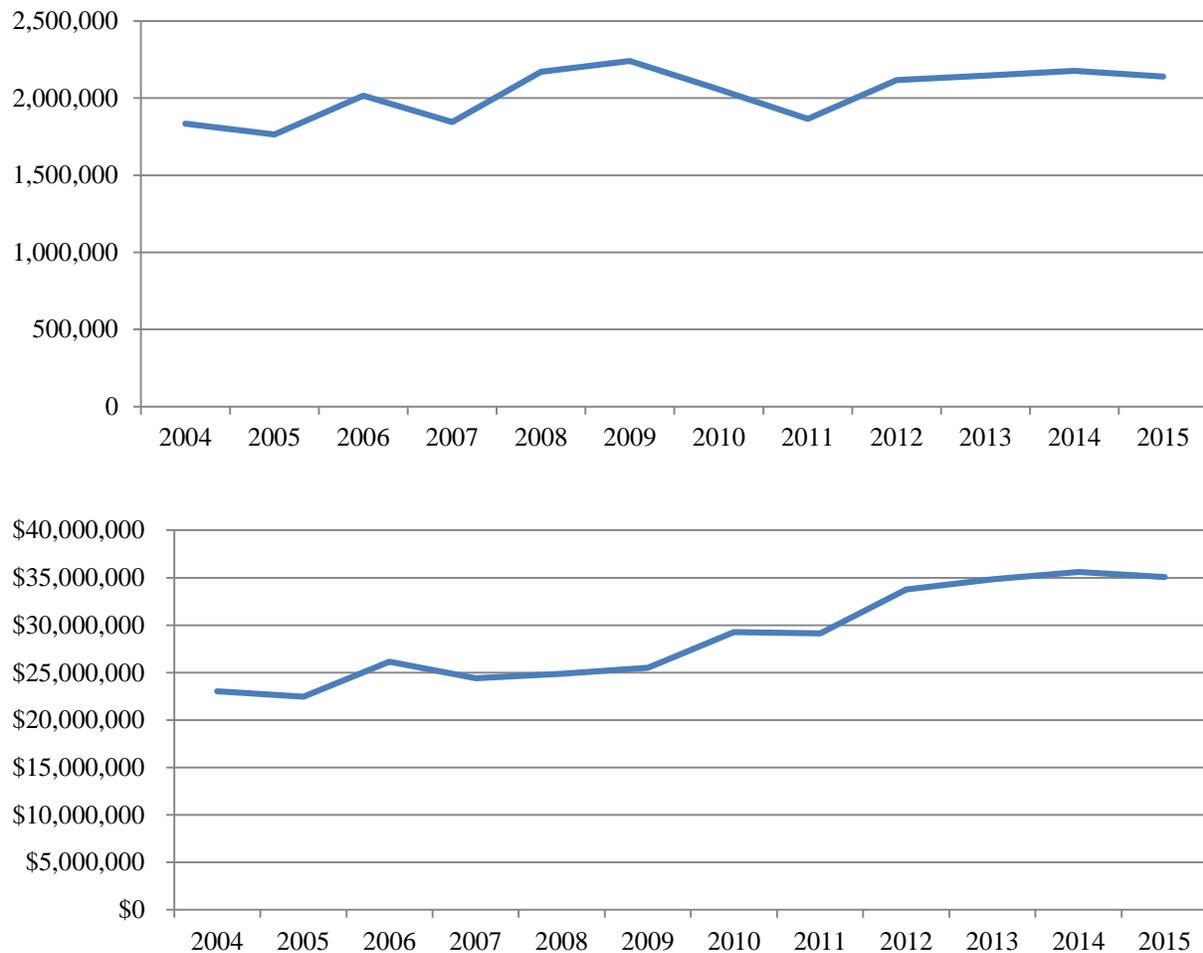
	2010		2011		2012		2013		2014	
	Pounds caught	Value								
Black grouper	22081	\$79,756.57	16603	\$63,423.46	62395	\$238,224.11	61278	\$244,499.22	1754	\$7,503.61
Hogfish	40219	\$134,572.77	34842	\$121,110.79	77971	\$307,010.81	65449	\$237,187.18	109201	\$432,162.96
Yellowtail snapper	184280	\$511,561.28	130220	\$387,534.72	159330	\$481,176.60	165437	\$488,370.02	357034	\$1,114,660.15

Figure 5. Recreational harvest in pounds and value (US dollars).



*Fishing Licenses.* Table 3 shows the number of licenses sold annually since 2004 and the revenue that was generated from those sales.

Figure 6. Number of fishing licenses sold, and the revenue generated by those sales, for the last 11 years.



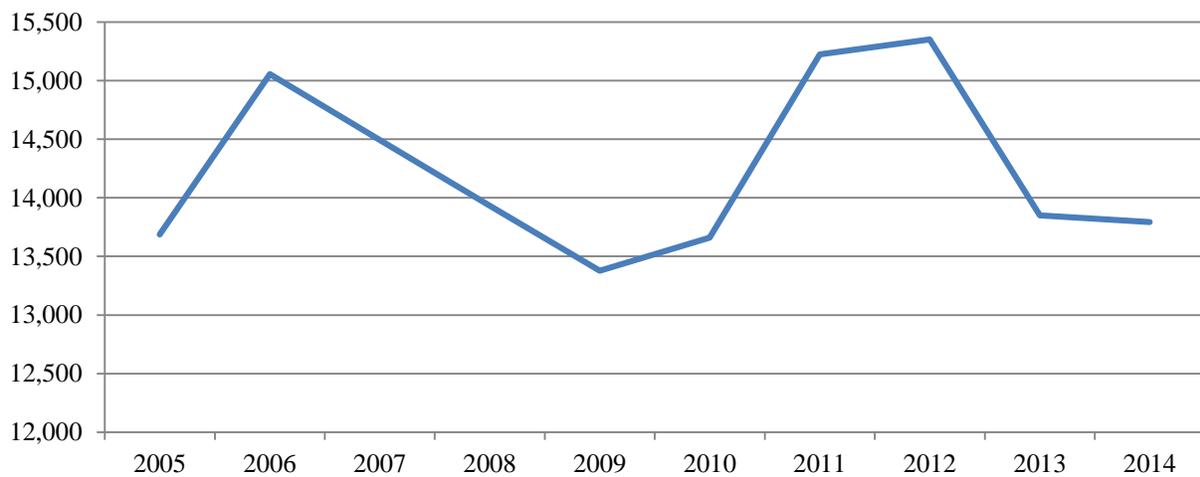
### Diving

The data available through DEMA includes an estimate of the cost of certification (including classes, equipment, etc.) but it is difficult to find past fact sheets. In the future, this data set will become more robust as those costs are reported annually and a graph can be added with the total amount spent by new divers rather than just the number of divers certified. This data is available for all of Florida so it is likely an overestimate for the South Florida region.

Table 3. The number of newly certified divers at the estimated cost of certification (where available).

Year	Number of new certifications	Estimate of cost of certification	Total amount spent
2005	13,688	Data not available	
2006	15,055	Data not available	
2007	14,493	Data not available	
2008	13,933	Data not available	
2009	13,377	Data not available	
2010	13,661	Data not available	
2011	15,226	Data not available	
2012	15,351	1503.27	23076697.77
2013	13,849	Data not available	
2014	13,793	1910.8	26355664.4

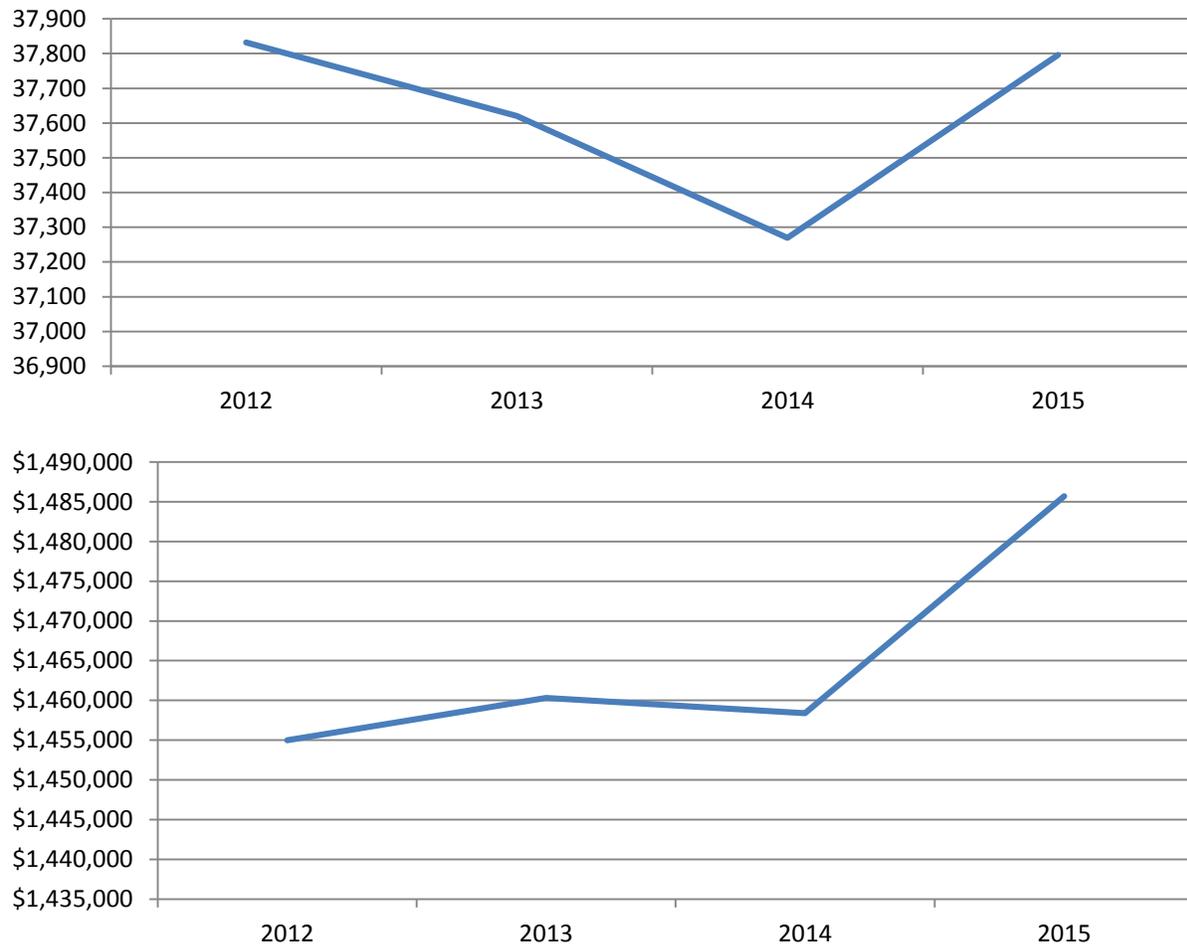
Figure 7. The number of newly certified divers in Florida over the past ten years.



## Boating

Boating is reported in both number of licenses issued each year and the value of those licenses to reflect whether changes in value are based on a change in licensing fees or a change in the number of licenses issued.

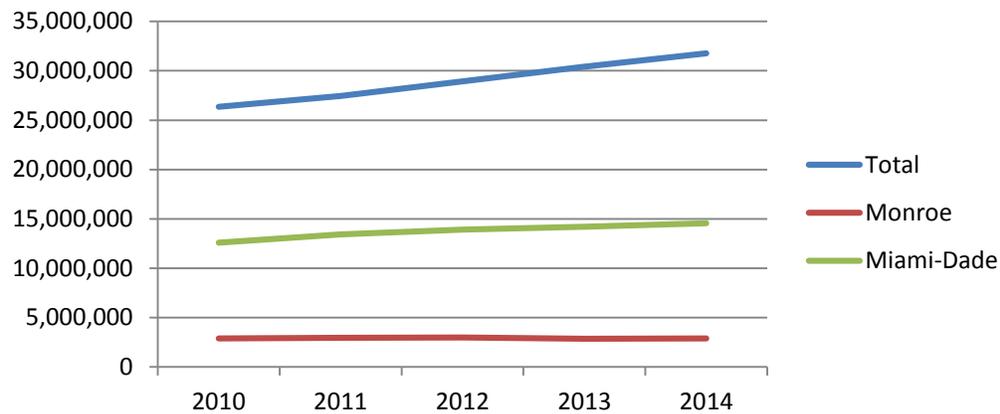
Figure 8. The number of boat licenses issued and the value of those licenses.



## Tourism

Tourism data with enough information to create economic values is only available for Monroe and Miami-Dade, and the reports are only available for the most recent year. Over time, the percentage of tourists participating in reef-related activities and the average cost of their trips should be collected so a more accurate comparison between years can be made.

Figure 9. Number of visitors to Monroe and Miami-Dade counties (not only those participating in reef-related activities).



## Socioeconomic data

Figure 10. Population growth in South Florida.

