

Florida Keys National Marine Sanctuary: Socioeconomic Supporting Documentation for the Restoration Blueprint, 2019



U.S. Department of Commerce
Wilbur Ross, Secretary

National Oceanic and Atmospheric Administration
Neil A. Jacobs, Ph.D.
Assistant Secretary of Commerce for Environmental
Observation and Prediction

National Ocean Service
Nicole LeBoeuf, Assistant Administrator (Acting)

Office of National Marine Sanctuaries
John Armor, Director

Report authors:

Vernon (Bob) Leeworthy¹, Danielle Schwarzmann², and
Ryan Shea²

¹ NOAA ONMS

² National Marine Sanctuary Foundation

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Sunlight shines on a coral reef in Florida Keys National Marine Sanctuary. Photo: Matt McIntosh/NOAA





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Contact

Danielle Schwarzmann, Ph.D.
Economist
National Marine Sanctuary Foundation
1305 East West Highway
SSMC4, 11th Floor
Silver Spring, MD 20910
Phone: 240-533-0705
Danielle.Schwarzmann@noaa.gov

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Glossary of acronyms

BEA – U.S. Department of Commerce Bureau of Economic Analysis
CERCLA – Comprehensive Environmental Response, Compensation and Liability Act
DEIS – draft environmental impact statement
DHR – Florida Department of State Division of Historical Resources
EPA – U.S. Environmental Protection Agency
ESA – Endangered Species Act
FAC – Florida Administrative Code
FKNMS – Florida Keys National Marine Sanctuary
FKNMSPA – Florida Keys National Marine Sanctuary and Protection Act
FWRI – Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute
GIS – geographic information system
GMFMC – Gulf of Mexico Fishery Management Council
IMPLAN – impact analysis for planning
MBTA – Migratory Bird Treaty Act
MMPA – Marine Mammal Protection Act
NAICS – North American Industry Classification System
NOAA – National Oceanic and Atmospheric Administration
NOAA Fisheries – NOAA’s National Marine Fisheries Service
NROGO – Non-Residential Rate of Growth Ordinance
ONMS – NOAA’s Office of National Marine Sanctuaries
RSMAS – University of Miami’s Rosenstiel School for Marine and Atmospheric Science
ROGO – Rate of Growth Ordinance
SPA – sanctuary preservation area
SPL – saltwater product license
TDC – Monroe County Tourist Development Council
USFWS – U.S. Fish and Wildlife Service



Abstract

Originally produced in 2017, this document provides updated background analysis for the draft environmental impact statement, the regulatory impact review, and initial and final regulatory flexibility act socioeconomic impact analysis of the revised regulations for Florida Keys National Marine Sanctuary. General and spatially-specific regulations that apply to Florida Keys National Marine Sanctuary are analyzed. For the spatially-specific regulations, there is the “no action” plus three additional alternatives (alternatives 2, 3, and 4) with increasing levels of protection as the number increases. Benefits and costs of a regulatory alternative are analyzed using the concept of opportunity costs. The costs of the “no action” alternative are what is given up versus other alternatives proposed. The costs for the “no action” alternative are the lost benefits, or opportunity costs, of not adopting the more protective alternatives, whereas the benefits are the avoidance of the costs of adopting the proposed regulatory alternatives. For each regulation and each alternative for each regulation, potential benefits, costs, and net benefits (benefits minus costs) are estimated. The highest net benefit alternative is identified in the case of multiple alternatives. Two periods, short- and long-term, are also analyzed for benefits, costs, and net benefits, and the estimates are projections about future, potential impacts. In analyzing spatially-specific regulations, the concept of “maximum potential loss” is used as the analytical starting point. This conservative measurement assumes that all activity within a spatial alternative that is displaced is lost to society. The second step of the analysis evaluates the likelihood that the “maximum potential loss” will occur. After presenting these analyses for each of the regulatory alternatives, the preferred alternatives are discussed.

Key words

Florida Keys National Marine Sanctuary, regulatory impact analysis, economic impact

Executive summary

This report details an updated background analysis for the draft environmental impact statement (DEIS), the regulatory impact review, and initial and final Regulatory Flexibility Act socioeconomic impact analysis of the revised regulations for Florida Keys National Marine Sanctuary (FKNMS). The primary area where socioeconomic impacts take place from use of sanctuary resources is Monroe County/Florida Keys, Florida. Monroe County includes the Florida Keys and Everglades National Park. All Monroe County residents and businesses, except for a few park staff and the park concessions, exist in the Florida Keys. So, for purposes of this report, Monroe County and the Florida Keys are synonymous.

The spatial alternatives have been revised in light of both dropped or changed sanctuary-wide regulations as well as recent hurricanes. General regulations that apply to the entire FKNMS and spatially-specific regulations are analyzed. For the spatially-specific regulations, there is the “no action” plus three additional alternatives (alternatives 2, 3, and 4) with increasing levels of protection as the number increases. The costs of the “no action” alternative are what is given up versus other alternatives proposed. The costs for the “no action” alternative are the lost benefits (opportunity costs) of not adopting the more protective alternatives, whereas the benefits are the avoidance of the costs of adopting the proposed regulatory alternatives. For each regulation and each alternative for each regulation, potential benefits, costs, and net benefits are estimated. Benefits are quantified where possible or assessed qualitatively. The highest net benefit alternative is identified in the case of multiple alternatives.

Sanctuary-wide regulations

- NOAA is proposing to update the coral and live rock prohibition to require FKNMS authorization for permitted live rock aquaculture activities. Alternative 3 is preferred.
- NOAA is proposing an update to the exception for discharge of water generated by routine vessel operations to prohibit graywater discharge from cruise ships while inside boundaries of FKNMS. Alternatives 2 and 3 are preferred.
- NOAA is proposing a modification for a shoreline slow speed zone. Alternative 3 is preferred.
- For historical resources, NOAA has determined that the permitting process needs revision to improve results from this activity.
- NOAA is proposing a new regulation to clarify prohibitions specific to the practice of fish feedings and its threat to the sanctuary. Alternatives 2 and 3 are preferred.
- NOAA is proposing regulations to address the threat of vessel groundings, deserted vessels, and abandoned gear, as well as to provide authority to address their associated impacts. Alternatives 2 and 3 are preferred.

Within-zone regulations

- NOAA is proposing a new regulation that would provide authority to address damages from large vessel use of mooring buoy systems. Alternatives 2 and 3 are preferred.
- To address concerns regarding potential threats to sanctuary resources, human safety, and conflict of use, NOAA is proposing an update to existing sanctuary preservation area regulations. Alternatives 2, 3 are preferred.
- NOAA is proposing minor modifications to the regulations for Tortugas North Ecological Reserve access permits. Updated regulations will still require access permits. Alternatives 2 and 3 are preferred.
- NOAA is proposing a baitfish permit phase-out alternative. Alternative 3 is the preferred alternative.
- U.S. Fish and Wildlife Service (USFWS) is proposing an update to aircraft overflight regulations to include altitude regulations. Alternative 3 is preferred.

Spatial regulations

Alternative 3 proposes to maintain many of the marine zones in the no action alternative and adds the same total number of marine zones as Alternative 2, but with a different mix of zone types and larger area. Alternative 3 provides additional, targeted site-specific protection where resource damage is evident and is NOAA's preferred alternative. Alternative 3 would have more net benefits than alternatives 1 and 2, but fewer net benefits than Alternative 4. That said, there are other benefits of the spatial regulation alternatives not included in the net benefit estimates that include: passive economic use value, science, and education values. These potential values not included in the assessed net benefits are discussed in detail qualitatively and briefly simulated.

Finally, Alternative 3 is preferred for the proposed sanctuary boundary expansion. It is expected that there will be significant net benefits in the short-term and long-term for all the sanctuary boundary alternatives.

Chapter 1: Introduction

This serves as a background document for the draft environmental impact statement (DEIS), the regulatory impact review, and initial and final Regulatory Flexibility Act socioeconomic impact analysis of the revised regulations for Florida Keys National Marine Sanctuary (FKNMS). More details are found here than in the summaries in the aforementioned referenced documents.

This document was originally produced in 2017. However, some of the general sanctuary-wide regulations were dropped or changed, and the spatial alternatives were revisited after Hurricane Irma (2017) altered many habitats. Therefore, this document includes revisions to the general sanctuary-wide and spatial alternatives, including the boundary expansions.

There are two general types of regulations analyzed here: (1) general regulations applying across all of FKNMS and (2) spatially-specific regulations. Chapter 3 will address the general regulations and Chapter 4 will address the spatially-specific regulations.

Regulatory alternatives. In most regulatory analyses, there are various alternatives. At a minimum, there is always the “no action” alternative and the proposed alternative. For most of the general regulations, there is only the “no action” versus the proposed alternative. For the spatially-specific regulations, there is the “no action” plus three additional alternatives (alternatives 2, 3, and 4). As the alternative number increases, so does the level of protection.

Economics uses the concept of “opportunity costs,” or the cost of the next best foregone alternative. In application here, benefits and costs of a regulatory alternative are analyzed using this concept. The costs of the “no action” alternative are what is given up versus other alternatives proposed. Therefore, costs for the “no action” alternative are the lost benefits (opportunity costs) of not adopting the more protective alternatives. Benefits of the “no action” alternative are the avoidance of the costs of adopting the proposed regulatory alternatives.

For each regulation and each alternative for each regulation, the “potential” benefits, costs, and net benefits (benefits minus costs) are assessed. Benefits are quantified where possible, but generally, a qualitative assessment is provided identifying the type of users that will receive benefits versus the type of users that will suffer the costs. When multiple alternatives are analyzed, the one generating the highest net benefits is identified.

Two periods are analyzed for benefits, costs, and net benefits. The short-term period is five years or less, while the long-term period is greater than five years. Benefits, costs, and net benefits are always projections about future, *potential* impacts. In analyzing spatially-specific regulations, the concept of “maximum potential loss” is used as a starting point of the analysis. This measurement assumes that all activity within a spatial alternative that is displaced is lost, i.e.,

that there is no possibility for making up the lost activity by relocating the activity to other places (“no substitution,” in economics jargon). A second step of the analysis evaluates the likelihood that the “maximum potential loss” will occur. Humans are resilient and often innovative in adjusting to change. Past monitoring of what actually happened post-implementation of spatial regulations that displaced users has found that the “maximum potential losses” did not occur. In fact, very little to zero negative impacts were detected (California Department of Fish and Wildlife 2008; Jeffrey et al. 2012). However, without future monitoring, the uncertainty of the potential impacts cannot be assessed, so benefits and costs presented here come with a certain amount of associated uncertainty.

Chapter 2: Description of the affected socioeconomic environment

In describing the socioeconomics of the affected environment, the ONMS Socioeconomic Research and Monitoring Program uses study area profiles. Study area profiles provide the basis of analyses to establish the dependencies of local communities/economies on sanctuary resource uses and for assessing how people can adapt to or mitigate policy/management changes that are estimated to affect their levels of use. Profiles include a county or collection of counties where the majority of economic impacts (e.g., output, income, and employment) and social impacts take place that are associated with use of sanctuary resources. A standard sanctuary study area profile includes information on population, population density, demographics (e.g., sex, race/ethnicity, and age), poverty rate, unemployment rate, income by place of work/industry, employment by industry, income by place of residence, and per capita income. All of these measurements are available from existing sources that can be easily updated. These data are then supplemented by studies done on the socioeconomics of the different uses and users.

Defining the geographic scope, i.e., collection of counties that define a study area for a sanctuary, is an evolving process. An initial assessment is done based on past studies of sanctuary resource use and where the economic and social (socioeconomic) impacts were known to take place. In the case of FKNMS, much research has been done since 1995-96 on the various uses of sanctuary resources.

The primary area where socioeconomic impacts take place from use of sanctuary resources is Monroe County/Florida Keys, Florida. Monroe County includes the Florida Keys and Everglades National Park (Figure 2.1). All Monroe County residents and businesses, except for a few park staff and the park concessions, exist in the Florida Keys. Therefore, for purposes of this profile, Monroe County and the Florida Keys are synonymous.

Studies investigating recreation-tourism in the Florida Keys (English et al. 1996; Leeworthy and Ehler 2010) showed that significant economic impacts take place in the three-county area of Broward, Miami-Dade, and Monroe County by visitors to the Florida Keys. Additionally, a study on commercial fisheries showed that catch from FKNMS is landed in other counties on the west coast of Florida, primarily in Collier and Lee counties (Leeworthy and Wiley 2000). However, the primary socioeconomic impacts of sanctuary resource use occur in Monroe County/Florida Keys, so in this report the scope of attention is limited to this study area. Most of the measures presented here are limited to the period 1990 to 2010, but in some cases, estimates for 2015 are provided.

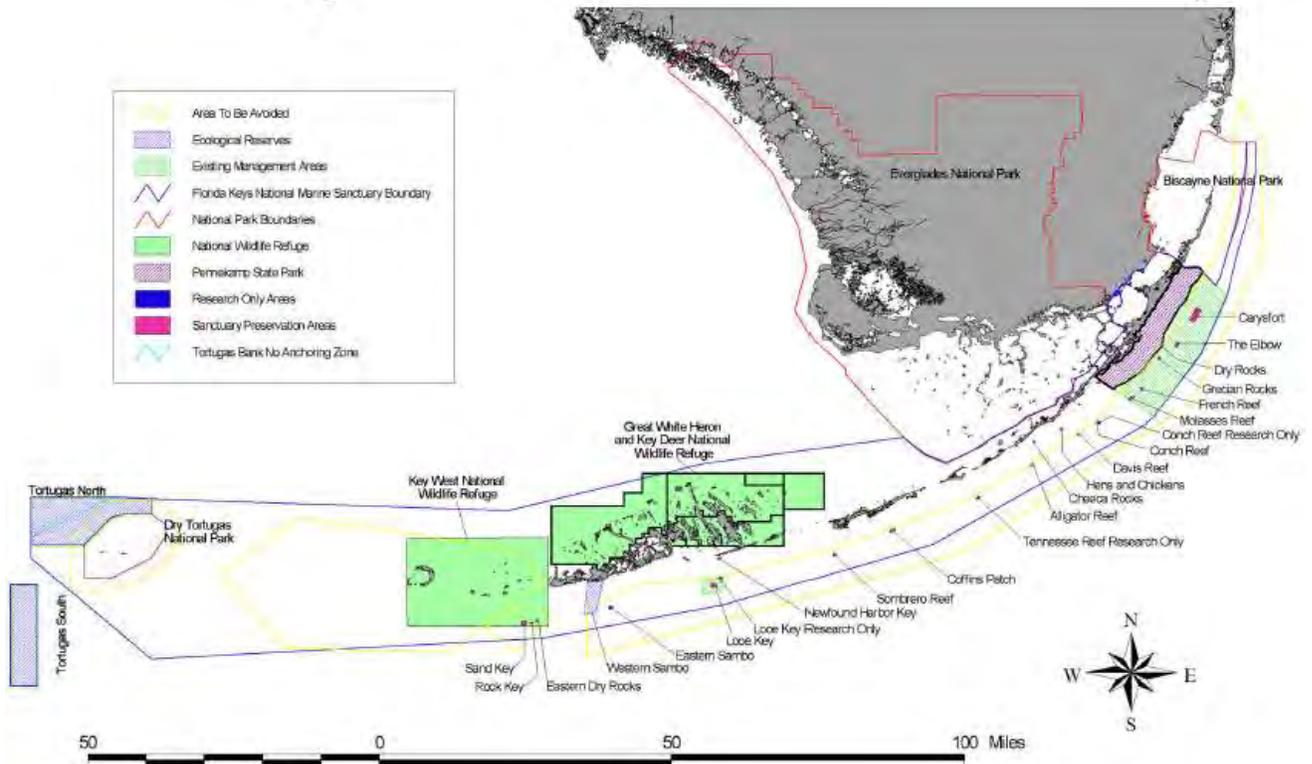


Figure 0.1. Map of Monroe County/Florida Keys and Florida Keys National Marine Sanctuary. Image: NOAA

Population and key measurements of economic status in the study area

Population is a major driver of any study area. When assessing the conditions of sanctuary resources in ONMS condition reports, population is a key driver behind the pressures placed on sanctuary resources. Many in the population are also beneficiaries of the ecosystem services generated from sanctuary resources. Here information is presented on the total population, population density, population growth, and projected population growth of the study area (Monroe County/Florida Keys). Tourism is a dominant feature of the study area so the “functional population,” or the amount of people in Monroe County/Florida Keys on a given day, is addressed. For some key measures of the economic status of the study area, per capita income, poverty rates, and unemployment rates are presented as key indicators in this section. Monroe County/Florida Keys is compared to the United States (U.S.) and Florida for status and trends in selected measures (Table 2.1).

Table 0.1. Selected socioeconomic measures for description of the study area

Area	2010 population	Population change 2000-2010	2010 population density ¹	2010 per capita income (\$)	2010 persons below poverty (%)	2010 unemployment rate (%)
Monroe County	73,090	-8.17	74.33	35,074	10.6	7.1
Florida	18,801,310	17.64	350.61	26,733	14.7	11.3
U.S.	308,745,538	9.71	87	39,791	13.25	9.6

¹ Number of people per square mile.

Sources: U.S. Department of Commerce, U.S. Census Bureau; Bureau of Economic Analysis, Regional Economic Information Systems

Population. The 20th century brought major changes to the Florida in terms of transportation and residential and commercial infrastructure. In the early 1900s, travel between many of these islands was only possible by boat. However, this changed in the 1890s when Henry Flagler, president of the Florida East Coast Railway, brought the Overseas Railroad down Florida's east coast to Miami. The railroad was later extended to Key West in 1912 (Parks 1968). On Labor Day, 1935, a hurricane struck the upper Florida Keys and permanently destroyed the railroad. The railroad's right-of-way was then sold and rebuilt into the Overseas Highway, which opened in 1938. This replacement road, which includes more than 40 bridges connecting the islands, eliminated the ferry rides and narrow wooden bridges of the first highway, making the Keys more accessible from the Florida mainland (Marzyck 1991).

Between 1938 and the early 1980s, vehicles traveled down the Keys on a narrow two-lane roadway that was built on top of the old railroad bridges. The narrow Overseas Highway restricted or deterred the movement of wide vehicles to some extent. Large recreational vehicles, camper trailers, and wide boats seldom ventured south of the Upper Keys.

Several events occurred in the early 1980s that permanently changed the infrastructure and subsequently the economy of the Keys. First was the construction of wider bridges from Key Largo to Key West. Additionally, the roadway was widened to allow passage of supply trucks and the safe transit of recreational vehicles, camper trailers, and wide boats. Along with the bridges came a larger water pipeline that supplied the Keys with fresh water from the well fields in Florida City and a new electrical line to supply dependable power throughout the islands.

Another benchmark of change came when the Monroe County Tourist Development Council was created in 1982, which is currently funded through a "bed tax." A portion of this bed tax was and remains dedicated to advertising to attract more visitors to the Keys. From 2002 to 2009, the total revenue from the bed tax fluctuated between \$14 million and \$15.5 million. The peak was 2005 at \$15.5 million but declined to \$14.1 million in 2009.

Monroe County, Florida, had a population of 73,090 in 2010, approximately 0.4% of the state (Table 2.1). The functional population of Monroe County/Florida Keys has been estimated for 1995-96 (Leeworthy and Wiley 1996) and 2007-08 (Leeworthy et al. 2010). For 1995-96, the functional population was estimated to be between 105,000 and 112,000 during the average day in the summer season (June through November) and 131,000 to 137,000 during the winter season (December through May). For 2007-08, the functional population was estimated to be 102,000 to 103,000 for the summer season and 116,000 to 117,000 for the winter season. Part of the decline was due to a decrease in the resident population and the 2007-08 recession that resulted in declines in tourism. Visitor numbers have been increasing the past several years, and in 2015 visitor estimates now exceed those of 1995-96. In its comprehensive plan for 2030, Monroe County forecasted the “functional population.” For 2010, Monroe County had a “functional population” of 155,288 and was forecasted to increase to 157,400 by 2015 and 162,355 by 2030.

Population growth. Development of the islands outside of Key West began slowly in the 1940s and boomed from the 1950s to 1990s, allowing for a significant growth in population (Table 2.2). The population of Monroe County rose from 17,114 in 1900 to 78,024 by 1990. The population increased more slowly between 1990 and 2000 and was 79,589 by 2000. However, the population has been steadily declining in Monroe County since 2000 and as of April 1, 2010, the population is estimated at 73,090 (U.S. Census Bureau 2010).

Table 0.2. Population growth and projected growth

Measurement/time period	U.S.	Florida	Monroe County
<i>Population growth (%)</i>			
1970 to 1980	11.6	43.6	20.2
1980 to 1990	9.8	32.7	23.5
1990 to 2000	13.1	23.5	2.0
2000 to 2010	9.5	17.6	-8.2
2010 to 2015	4.1	7.80	6.00
<i>Population projections (%)¹</i>			
2010 to 2020	11.6	43.6	20.2
2020 to 2030	9.8	32.8	23.5
2030 to 2040	13.1	23.5	2.0

Sources: U.S. Department of Commerce, U.S. Census Bureau; Woods and Poole (2011)

From 1970 to 1990, Monroe County/Florida Keys population growth exceeded that of the U.S. but was slower than Florida (Table 2.2). Post 1990, Monroe County/Florida Keys’ population growth has been significantly slower than either the U.S. or Florida. The major factor has been the Rate of Growth Ordinance (ROGO) restricting new housing development. The major constraint on growth was hurricane evacuation. Monroe County/Florida Keys population actually declined from 2000 to 2010. Much of this decline is explained by affordable housing for service workers in the tourism industry.

The Census of Intercounty Commuters, which shows the number of people who live and work in the county versus the number who live outside the county and commute to work, and the U.S. Department of Commerce Bureau of Economic Analysis' personal income estimates show that low wage service workers have moved out of Monroe County/Florida Keys to Miami-Dade County and are commuting to work in Monroe County/Florida Keys (Census Bureau 2013; Bureau of Economic Analysis 2013; U.S. Department of Commerce). This finding explains why total employment has been increasing while population has been declining.

Population density. Population density, the number of people per square mile, is an indicator of the extent of the pressures that the study area's population might have on sanctuary resources. Population density of Monroe County, at 74.3 people, is moderately lower than the U.S., and substantially lower than Florida (Table 2.1).

Per capita income. Per capita income is an indicator for the health and economic status of a community. In 2010, per capita income in Monroe County/Florida Keys was \$56,415. In 2010, the per capita income in Monroe County/Florida Keys was higher than the U.S. and Florida (Table 2.3). Real per capita income (adjusted for inflation) grew faster in Monroe County/Florida Keys, from 1990 to 2005 than in the U.S. or Florida. From 2005 to 2010, it declined less than in Florida, but more than the U.S., which showed slight growth (Table 2.3).

Unemployment rates. Another indicator of economic health in a study area is the unemployment rate. In 2010, the unemployment rate was 7.1% in Monroe County/Florida Keys (Table 2.1). In 2010, Monroe County's unemployment was lower than both the U.S. and Florida. Historically, unemployment rates were also lower in Monroe County than in the U.S. and Florida in 1990, 2000, 2005, and 2010 (Table 2.3). These trends have continued for both years 2011 and 2012.

Table 0.3. Unemployment rates and per capita personal income

Measurement/year	U.S.	Florida	Monroe County
<i>Unemployment rate (%)</i>			
1990	5.6	6.3	2.7
2000	4.0	3.8	2.9
2005	5.1	3.8	2.7
2010	9.6	10.9	7.8
2011	8.9	9.8	7.0
2012	8.1	8.4	5.7
2013	7.4	7.1	4.9
2014	6.2	6.2	4.1
2015	5.3	5.3	3.5
<i>Per capita income</i>			
1990	\$19,354	\$19,437	\$22,448
2000	\$30,319	\$29,079	\$38,038
2005	\$35,452	\$36,274	\$51,021
2010	\$39,791	\$38,493	\$56,415
2011	\$42,453	\$39,896	\$58,941
2012	\$44,267	\$40,983	\$70,639
2013	\$44,262	\$40,771	\$67,081
2014	\$46,414	\$42,868	\$71,976
2015	\$48,112	\$44,424	\$74,409
<i>Per Capita Income (2016\$)</i>			
1990	\$35,611	\$35,764	\$41,304
2000	\$42,143	\$40,420	\$52,873
2005	\$43,606	\$44,617	\$62,756
2010	\$43,770	\$42,342	\$62,057
2011	\$45,425	\$42,689	\$63,067
2012	\$46,480	\$43,032	\$74,171
2013	\$45,590	\$41,994	\$69,093
2014	\$46,878	\$43,297	\$72,696
2015	\$48,593	\$44,868	\$75,153

Sources: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System; U.S. Department of Labor, Bureau of Statistics, Consumer Price Index

Demographic profiles

For demographic profiles, gender, race/ethnicity, and age were chosen as the most important population characteristics. Race and ethnicity are treated separately in the Census of the U.S. Racial categories include “White,” “Black or African American,” “Asian,” “Alaskan Native or Native American,” “Native Hawaiian or Other Pacific Islander,” and “Multiple Races.” Hispanic represents ethnicity, and in the Census, is recorded separately from race, with any race being

eligible for being Hispanic. In the Census, Hispanic is Hispanic, Latino, or of Spanish Origin. Race and ethnicity were combined in one graph; therefore, percentages will not add up to 100%.

Gender: Gender distribution has changed over time in Monroe County/Florida Keys from 1990 to 2010. In 1990 and 2010, there was a greater proportion of males than females in Monroe County compared to U.S. and Florida. However, in 2000, Florida had a greater proportion of males than females than both Monroe County/Florida Keys and the U.S. (Figure 2.2).

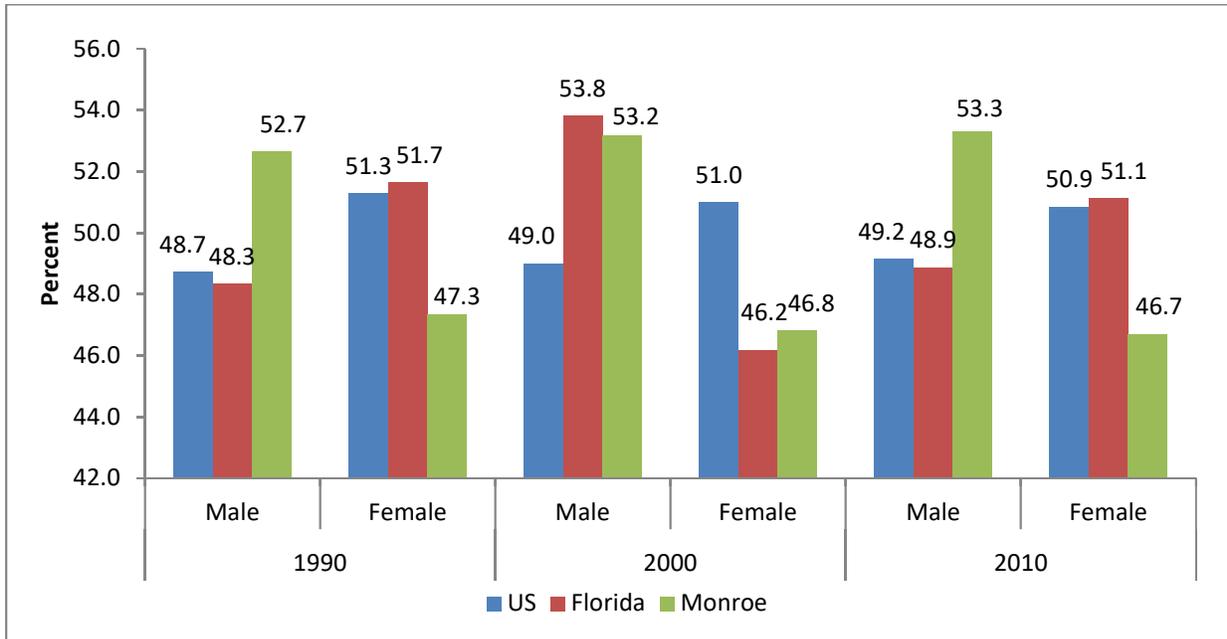


Figure 0.2. Gender distribution in Monroe County versus the U.S. and Florida, 1990, 2000, 2010

Race/ethnicity. In 2010, the White population of Monroe County was higher than that of the U.S. and Florida. The Hispanic population was higher than the U.S., although lower than Florida. All other populations were lower than the U.S. and Florida (Figure 2.3). The White population in Monroe County/Florida Keys has slowly declined from 1990 to 2010, while the Hispanic population has increased. The Black and Other populations have declined in 2000, but rose back in 2010. The American Indian and Asian categories have not changed substantially from 1990 to 2010 (Figure 2.4).

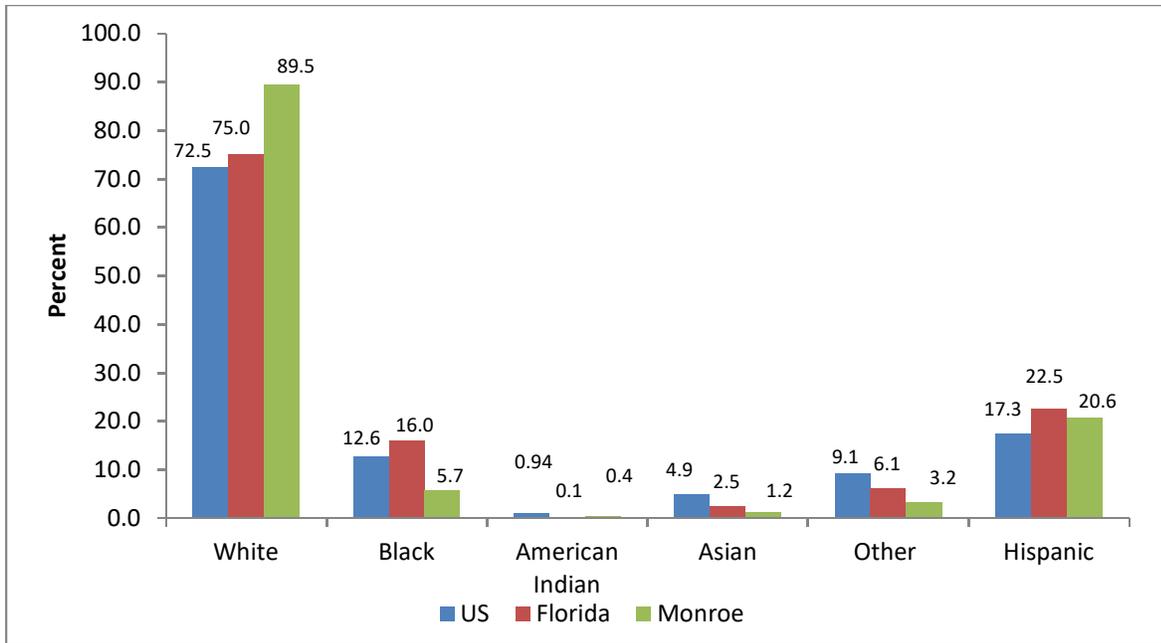


Figure 0.3. Race/ethnicity in Monroe County versus the U.S. and Florida, 2010

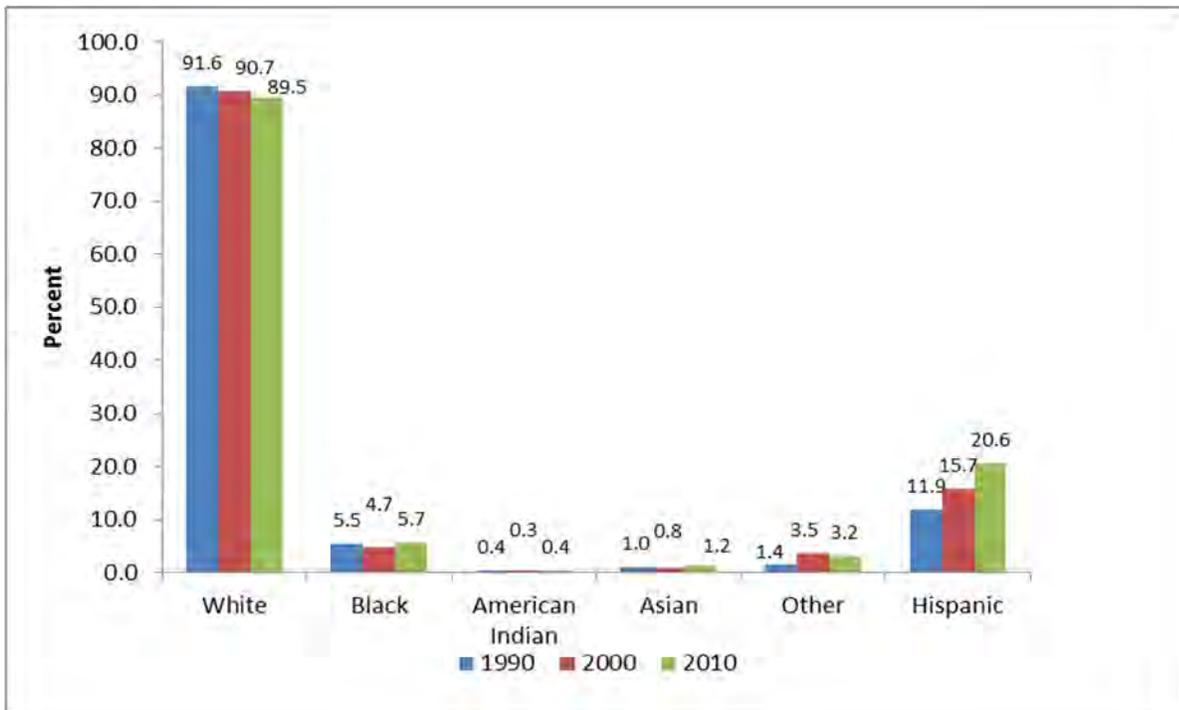


Figure 0.4. Race/ethnicity in Monroe County, 1990, 2000, and 2010

Age. In, 2010, the age distribution of Monroe County/Florida Keys was different from the U.S. and Florida. Compared to the U.S. it was skewed to the right, with a higher proportion of people aged 45 or older, and a lower proportion of children and young adults (Figure 2.5). The age distribution changed over time. In general, the proportion of population ages 0 to 44 and population ages 55 to 64 has decreased, and the populations aged 45 to 54 and 65 and older have increased since 1990 (Figure 2.6). The key age group for workers in the tourism service industry (ages 20 to 44) shows significant declines from 1990 to 2010, which is correlated with affordable housing and the changes in number of commuters to Monroe County/Florida Keys.

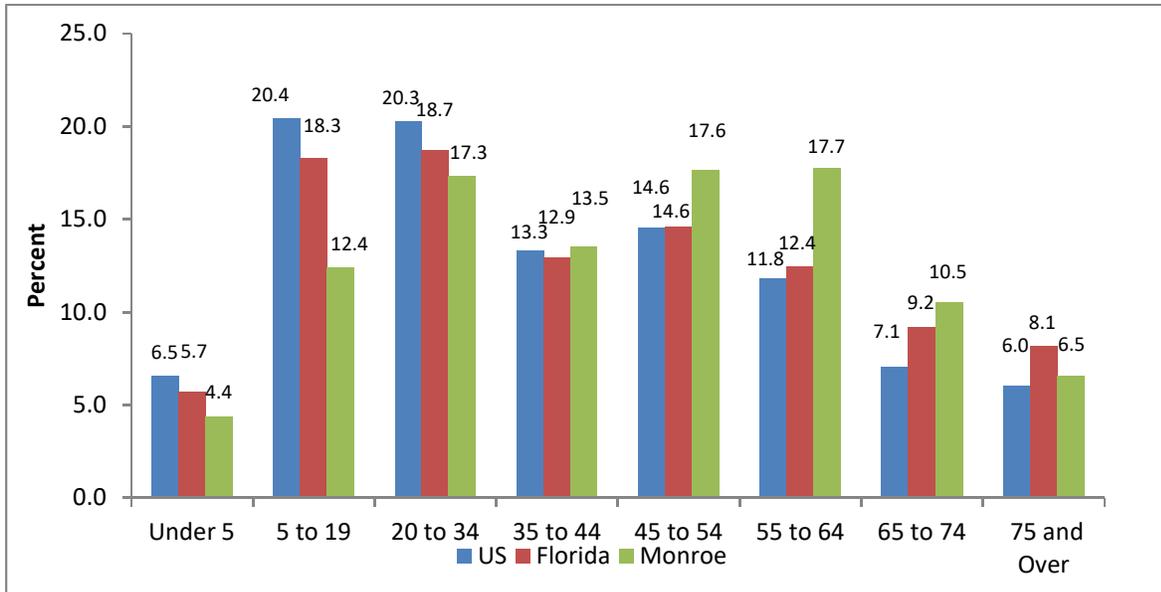


Figure 0.5. Age distributions in Monroe County versus the U.S. and Florida, 2010

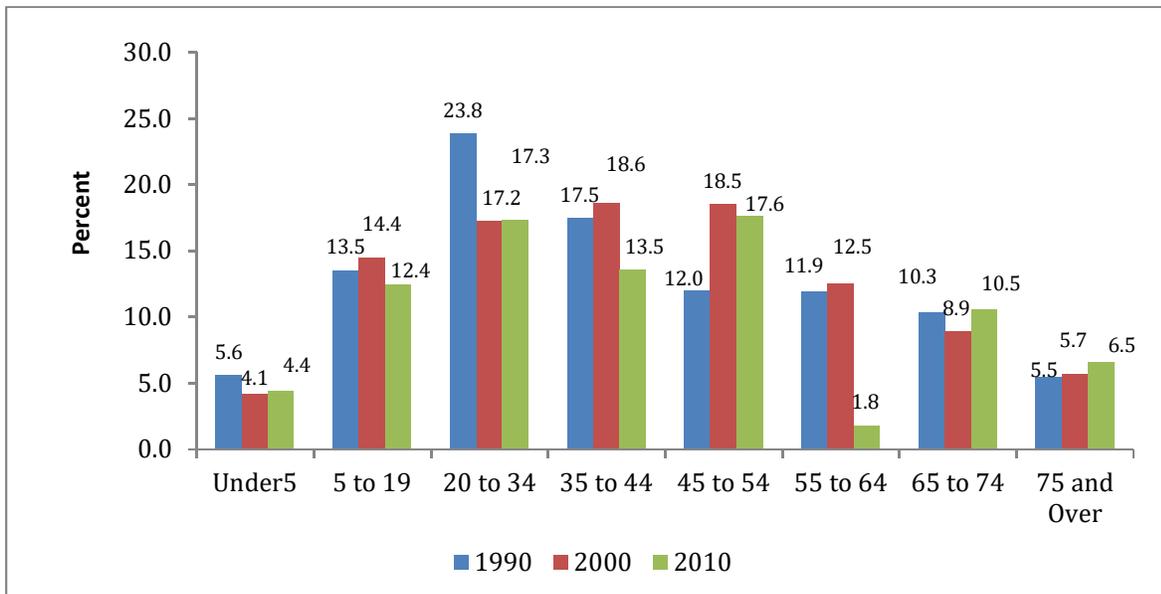


Figure 0.6. Age Distribution in Monroe County 1990, 2000, and 2010

Economic profile

In the previous section, a couple of key indicators of the health of the economy using per capita income, poverty rates, and unemployment rates were presented. Here, the total personal income generated within Monroe County (income by place of work) and what is received by residents of Monroe County (income by place of residence) are analyzed. The U.S. Department of Commerce's Bureau of Economic Analysis maintains the national income accounts to both ends. People that live in a given area often receive income not derived by work in the area where they live. Many people commute to places of work outside the county where they live. People receive interest, dividends, and capital gains from investments. Retirees receive pensions and social security payments. The unemployed receive unemployment compensation. Income by place of work as a percent of income by place of residence is usually a good indicator of whether an area has a significant retirement community or serves as a bedroom community for adjacent counties. Sources of income not tied to the status of work in the local economy can provide more resilience to the economy, making it less subject to vicissitudes of local work.

Regional economic theory and economic models of local economies classify industries into basic or export industries and local industries. Basic industries or export industries are the drivers of a local economy and bring new dollars into the community. Local industries are a response to these basic or export industries in meeting local demands for goods and services—they are what are included in the ripple or multiplier impacts from changes in the basic or export industries.

Basic or export industries

In Monroe County/Florida Keys, there are six basic or export industries: (1) tourism, (2) retirement, (3) bedroom community, (4) commercial fishing, (5) the military, and (6) manufacturing. Tourism and retirement are the leading industries. Tourism and retirement both bring new dollars into the community that is unassociated with work in Monroe County/Florida Keys. Tourists bring new dollars into the community and spend it on a wide variety of goods and services, generating local income and employment. Retirees receive pensions, social security, and returns on investments and spend this money locally, generating income and employment. The U.S. Navy has a significant presence in Key West, which brings new dollars into the local economy that generates local income and employment. Most commercial fishing catch is exported outside Monroe County/Florida Keys, so demand originates outside the county and again brings new dollars into the community, generating local income and employment. Monroe County/Florida Keys also serves as a bedroom community for people who work in counties to the north. They bring those dollars earned from work outside the county and spend it locally on goods and services, thus generating both local income and employment. Manufacturing is small in Monroe County/Florida Keys but is focused on artistic goods and services such as jewelry, art, literature, and other gifts and souvenirs. Most of these goods and services are sold to those who reside outside Monroe County/Florida Keys and are thus a source of new dollars flowing into the area, supporting local income and jobs.

Recreation-tourism

Recreation-tourism is the most important economic sector in the Monroe County/Florida Keys economy. Both the demand and supply side of this important industry is discussed. The demand side includes estimates for both visitors and residents of Monroe County/Florida Keys. When estimating economic impact/contribution of the resident component of spending and its impact on output, income, and employment on the Monroe County economy, care is taken to avoid double counting by only using the “export” portion of use and spending (spending from income not derived from work in Monroe County). The double-counting would occur since part of resident spending is based on income received from work in Monroe County that is the result of the multiplier process of other export or basic industries, the predominant one being visitor recreation-tourism.

Recreation-tourism demand. A good indicator for the tourism sector is the number of visitors. The estimation of total visitor visitation on an annual basis is a new effort by the Monroe County Tourist Development Council (TDC) and is based on the study conducted in partnership between NOAA and the TDC in 1995-96 (Leeworthy and Wiley 1996) and 2007-08 (Leeworthy, Loomis, and Paterson 2010). The TDC started producing annual estimates of visitation in 2008-09 for person-trips and continued this through 2013-2014 (Bennet 2014). The TDC changed methodologies in 2013 for domestic visitors (U.S. residents) by using an internet panel of a random sample of U.S. households (Schutz 2016). Person-stays (same as person-trips) and person-days are estimated for all visitors (includes people on business and no leisure/recreation activity), leisure visitors (i.e., those doing leisure/recreation activities), and overnight leisure visitors. In 2015, the TDC also started estimating international visitation (TDC 2017). Only person-trips are estimated for international visitors. The average length of visit by domestic visitors is used to approximate person-days of international visitors.

In 1995-96, it was estimated that there were 3.06 million person-trips/visits made to the Florida Keys for all visitors and 2.54 million, or 83%, were recreating visitors. In 2007-08, there were 3.27 million person-trips/visits made to the Florida Keys with 3.01 million, or 92%, by recreating visitors (Table 2.4). Part of the change in the percent of visitors participating in recreation was due to a more expansive definition of recreation. After adjusting for the change in definition of recreating visitors, 89% were recreating visitors in 2007-08.

Table 0.4. Monroe County/Florida Keys visitation 1995-96 versus 2007-08

	1995-96 (millions)	2007-08 (millions)	Percent change
<i>Person-trips/visits</i>			
All visitors	3.06	3.27	6.86
Recreating visitors	2.54	3.01	18.5
Non-recreating visitors	0.52	0.26	-50
<i>Person-days</i>			

All visitors	16.27	13.94	-14.32
Recreating visitors	13.3	12.82	-3.61
Non-recreating visitors	2.97	1.12	-62.29

Source: Leeworthy (2010)

As noted in the population section of this report, person-days of visitation is the more relevant measure of intensity of visitation. While the number of person-trips increased by about 6.9% for all visitors and 18.5% for recreating visitors from 1995-96 to 2007-08, person-days decreased 14.3% for all visitors and 3.6% for recreating visitors. Much of the decrease in person-days can be explained by the increasing percentage of visitation measured in person-trips shifting to the cruise ship passengers. The share of cruise ship passengers increased from 12.7% in 1995-96 to 23.5% in 2007-08, but because all cruise ship passengers are one-day trips, the share of person-days was only 2.4% in 1995-96 and 5.5% in 2007-08. Updated estimates for visitation for all visitors from 2008-09 through 2013-2014 (Bennett 2015) show cruise ship passengers reached a high of 31% of all visitors in 2008-09 and ranged from 26.8% to 31.1% for all visitors from 2008-09 to 2013-2014 (Figure 2.7). Person-trips for all visitors has declined from 2007-08 to 2008-09 from 3.27 million to about 2.77 million. This was due to the recession hitting the Florida Keys one year after the official national recognition of the recession. Visitation has been steadily increasing since 2008-09, increasing from 2.77 million in 2008-09 to 2.98 million in 2011-2012 (Bennett 2015). The TDC does not estimate person-days of visitation but cruise ship passengers have declined both in absolute numbers and the percent of all visitors since 2008-09 from a high of 859 thousand (31% of all visitors) to 797 thousand (27.4% of all visitors) in 2013-14 (Bennett 2015; see Appendix E, Table E.1).

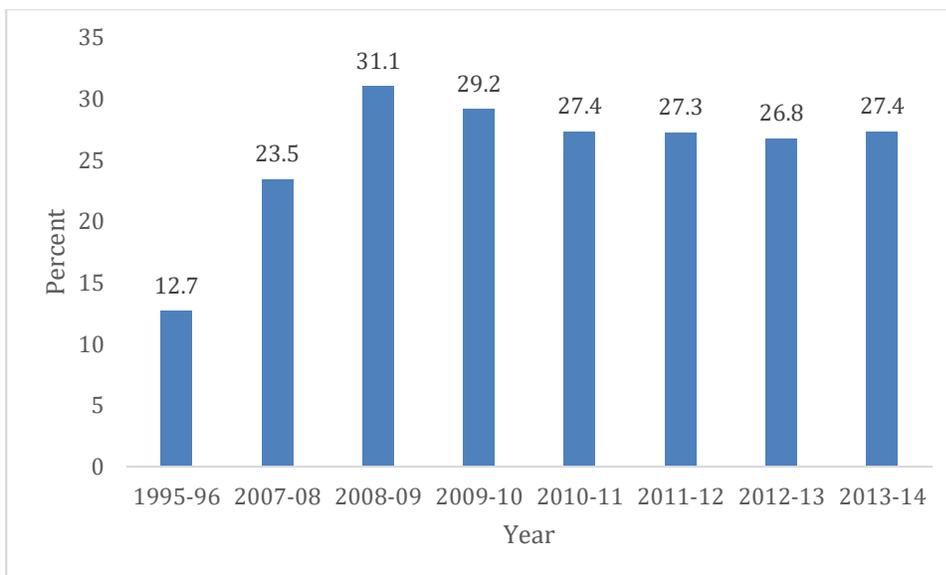


Figure 0.7. Cruise ship passengers as a percent of all visitors to the Florida Keys 1995-96 to 2013-14

As mentioned above, person-days is the best measure of the intensity of visitation. The new methodologies for estimating domestic visitation in 2013 to 2015 included estimates of person-days. In 2013, domestic leisure/recreation visitors spent 15.98 million person-days in the Florida Keys. This increased to 16.22 million in 2014 and to 16.52 million in 2015. Therefore, by 2013, domestic visitors alone had surpassed the 1995-96 estimates for recreating visitors (see Appendix E, Table E.2).

International visitation was estimated for 2015 by the TDC at 1.16 million person-trips. An estimate of person-days for international visitors was developed by using the average length of stay by domestic visitors (3.49 days per person-trip). This yielded an estimate of 4.05 million person-days of international visitation. When adding this to the estimate of domestic visitor person-days, it yields 20.57 million person-days of recreating visitors for 2015 (see Appendix E, Table E.2). This is an increase from 1995-96 to 2015 of 54.7%.

In 1995-96 and 2007-08, the economic contribution of recreating visitors (tourists) was estimated for Monroe County/Florida Keys (English et al. 1996 Leeworthy and Ehler 2010). In 1995-96, it was estimated that visitors spent \$1.63 billion (measured in 2008 \$). These expenditures generated \$1.82 billion in total output and \$693 thousand in income, in turn supporting 21.8 thousand full-time and part-time jobs. In 2007-08, spending increased 22.1% to \$1.99 billion, which generated \$2.23 billion in output and \$970 million in income; this in turn supported 32 thousand full-time and part-time jobs. The share of the Monroe County economy accounted for by recreating visitors remained relatively constant, around 60.5% of output in 1995-96 and just shy of 60% in 2007-08. For income, recreating visitors accounted for 45% of Monroe County's income in 1995-96 and 43.8% in 2007-08. Meanwhile, regarding employment, recreating visitors accounted for 46.5% of all full-time and part-time jobs in 1995-96 and 55.3% of all full-time and part-time jobs in 2007-08 (Table 2.5).

Table 0.5. Total impact of recreating visitor spending on the Monroe County economy: 1995-96 and 2007-08

Measurement	1995-96	2007-08	% change	% of Monroe County economy	
				1995-96	2007-08
Total spending (billions 2008\$)	\$1.63	\$1.99	22.1		
Total output ¹ (billions 2008\$)	\$1.82	\$2.23	22.5	60.5	59.9
Total income ¹ (millions 2008\$)	\$693	\$970	40.0	45.0	43.8
Total employment ¹ (thousands of full and part-time jobs)	21.8	32	46.8	46.5	55.3

¹ Includes multiplier or ripple effects of spending.

Source: Leeworthy (2010)

Residents of Monroe County also engage in recreation activities and spend money while doing such activities in Monroe County. Again, the most comprehensive studies were done in 1995-96 (Leeworthy and Wiley 1997) and 2008 (Leeworthy and Morris 2010). In 1995-96, residents

enjoyed over 4 million person-days of recreation in Monroe County/Florida Keys, and this declined to a little over 2.7 million person-days in 2008 (Table 2.6). Part of the decline can be explained by the recession and part by the decline in the population of Monroe County.

The export sector for residents was estimated at 1.28 million person-days in 1995-96 and 1.12 million in 2008. This was associated with \$129.2 million of export spending in 1995-96 and \$113.96 million in 2008. The export spending generated \$144.71 million in output in 1995-96 and \$127.64 million in 2008. Export income generated was \$42.29 million in 1995-96, but unlike other measurements, export income increased to \$47.69 million in 2008. In 1995-96, 2,414 full and part-time export jobs were supported. This fell to 1,622 in 2008. In terms of the percent of the Monroe County economy dependent on resident spending on recreation activity, the economy became less dependent on resident spending for output, income, and employment (Table 2.6).

Table 0.6. Total impact of recreating resident spending on the Monroe County economy: 1995-96 and 2008

Measurement	1995-96	2007-08	% Change	% of Monroe County economy	
				1995-96	2007-08
Total person-days (millions)	4.093	2.734	-33.2	-	-
Export person-days (millions)	1.283	1.124	-12.4	-	-
Total spending (millions 2008\$)	\$553.92	\$258.12	-53.4	-	-
Export spending (millions 2008\$)	\$129.22	\$113.96	-11.8	-	-
Export output ¹ (millions 2008\$)	\$144.71	\$127.64	-11.8	4.79	3.42
Export income ¹ (millions 2008\$)	\$42.29	\$47.69	12.8	2.75	2.15
Export employment ¹ (number of full and part-time jobs)	2,414	1,622	-32.8	5.14	2.80

¹ Includes multiplier or ripple effects of spending.

Sources: Leeworthy and Wiley (1997); Leeworthy and Morris (2010)

Recreation activities. In total, visitors and residents enjoyed 25.55 million person-days of recreation in Monroe County/Florida Keys in 2008. The top four activities were beach use, scuba diving & snorkeling, wildlife viewing, and fishing. Visitors accounted for over 91% of the beach use, 83.3% of the scuba diving & snorkeling, 81.7% of the wildlife viewing, and 63.4% of the fishing. Visitors accounted for over 93% of the charter boat fishing, while residents accounted for over 44% of the flats/backcountry fishing (Table 2.7).

Table 0.7. Visitor and resident recreation use by activity 2008 (thousands of person-days)

Type of activity	Visitors	Residents	Total	Percent visitor	Percent of total
Beach use	3,162.9	305.1	3,468.0	91.20	29.03
Recreational fishing	1,312.1	756.5	2,068.6	63.43	17.31
Charter boat fishing	222.0	16.2	238.2	93.20	1.99
Flats/backcountry fishing	149.9	189.1	339.0	44.22	2.84
Scuba diving & snorkeling	2,306.2	463.5	2,769.7	83.27	23.18
Recreational boating	700.4	245.9	946.3	74.01	7.92
Personal water craft	264.6	53.6	318.2	83.16	2.66
Windsurfing, sailboarding	17.8	3.9	21.7	82.03	0.18
Wildlife viewing	2,185.5	488.3	2,673.8	81.74	22.38
From a boat	661.0	203.8	864.8	76.43	7.24
From land	1,524.5	284.5	1,809.0	84.27	15.14
Total¹	9,684.9	2,263.2	11,948.1	81.06	100.00

¹ Total includes double counting across activities since people can do more than one activity per day. A person-day is any part of a day or a whole day.

Sources: Leeworthy, Loomis, and Paterson (2010); Leeworthy and Morris (2010)

Visitation at state and national parks. Monroe County/Florida Keys has 11 state parks and two national parks (Table 2.8). Everglades National Park is located in Monroe County outside and northwest of the Florida Keys. However, many people access FKNMS from boat ramps located in the Flamingo area of Everglades National Park. Most of the activity in FKNMS from access via Everglades National Park is for flats/backcountry fishing.

One state park, Florida Keys Overseas Heritage Trail, opened in 2011. It is an extensive trail of historical significance and has the highest visitation. In 2015, it accounted for 38.5% of all state park visitation in the Florida Keys. State park visitation has been highly variable over the six-year period 2010-2015, ranging from a low of 2.1 million for all state parks in 2010 to a high of almost 4.6 million in 2013 (Table 2.8).

Table 0.8. Visitation at Monroe County state and national parks 2010 to 2015

Park	2010	2011	2012	2013	2014	2015
Key Largo Hammock Botanical	13,928	15,288	16,026	17,067	19,620	38,871
John Pennekamp Coral Reef	717,649	782,056	809,471	885,171	977,580	668,790
Florida Keys Overseas Heritage Trail	0	583,436	2,057,973	1,771,547	1,333,535	1,465,192
Windley Key Fossil Reef Geological	15,517	15,410	16,631	12,582	10,682	9,970
Lignum Vitae Key Botanical	28,664	34,671	38,591	88,946	25,732	111,518

Indian Key Historic	31,540	37,748	52,261	68,787	68,102	70,190
San Pedro Underwater Archaeological	4,017	2,326	4,563	11,165	18,540	11,034
Long Key	141,300	122,943	106,099	199,809	207,928	114,834
Curry Hammock	108,900	117,413	165,876	204,102	194,851	135,814
Bahia Honda	615,267	698,475	700,336	801,383	784,203	636,334
Fort Zachary Taylor Historic	426,903	516,633	513,589	523,527	545,061	538,855
Total state parks	2,103,685	2,926,399	4,481,416	4,584,086	4,185,834	3,801,402
Everglades National Park	915,538	934,351	1,141,906	1,047,116	1,110,901	1,077,427
Dry Tortugas National Park	53,890	75,171	60,550	58,401	64,865	70,862
Total national parks	969,428	1,009,522	1,202,456	1,105,517	1,175,766	1,148,289
Total all state and national parks	3,073,113	3,935,921	5,683,872	5,689,603	5,361,600	4,949,691

Sources: Florida Department of Environmental Protection; Bureau of Operational Services and National Park Service: <https://irma.nps.gov/Stats>

The six-year average visitation for all state parks was 3.68 million, while for the two national parks it was 1.1 million (Table 2.9). Across all state and national parks, the six-year average for visitation was 4.78 million. State parks accounted for almost 77% of all state and national park visitation using the six-year average.

Table 0.9. Visitation at Monroe County state and national parks: Six-year averages

Park	Six-year average	% of state parks	% of national parks	% of all parks
Key Largo Hammock Botanical	20,133	0.55		0.42
John Pennekamp Coral Reef	806,786	21.92		16.87
Florida Keys Overseas Heritage Trail	1,201,947	32.66		25.13
Windley Key Fossil Reef Geological	13,465	0.37		0.28
Lignum Vitae key Botanical	54,687	1.49		1.14
Indian Key Historic	54,771	1.49		1.15
San Pedro Underwater Archaeological	8,608	0.23		0.18
Long Key	148,819	4.04		3.11
Curry Hammock	154,493	4.20		3.23
Bahia Honda	706,000	19.18		14.76
Fort Zachary Taylor Historic	510,761	13.88		10.68
Total state parks	3,680,470	100.00		76.96
Everglades National Park	1,037,873		94.20	21.70
Dry Tortugas National Park	63,957		5.80	1.34
Total national parks	1,101,830		100.00	23.04
Total all state and national parks	4,782,300			100.00

John Pennekamp Coral Reef State Park, created in 1960, is the most visited state park (not counting the Florida Keys Overseas Heritage Trail) in the Florida Keys. For the six-year period, the park accounted for 22% of Florida's state park visitation and 17% of state and national park visitation. Bahia Honda State Park was ranked second in state park visitation over the six-year period, accounting for 19% of all state park visitation and almost 15% of all state and national park visitation.

Additionally, Dry Tortugas National Park is very remote: around 70 miles from Key West and accessible only by boat or seaplane. Dry Tortugas National Park has restricted access to the park in its most recent management plan, making it even more difficult to visit. Very few people access the park via private household boats, so almost all access is provided to Fort Jefferson via a large, air-conditioned catamaran ferry or by seaplane. Once at Fort Jefferson, there are no operations that can disperse people throughout the park by boat. All operators that take people to Dry Tortugas National Park are required to have a permit. Dry Tortugas National Park accounted for 6% of all national park visitation and a little over 1% of the total state and national park visitation in Monroe County using the six-year averages.

Everglades National Park is a very popular national park, drawing over 1 million visitors a year (six-year average was 1.1 million). As mentioned previously, only a portion of Everglades National Park visitation enters FKNMS via boat ramps at the Flamingo area in Everglades National Park. Using the six-year averages, Everglades National Park accounted for 94% of the national park visitation and almost 22% of the total state and national park visitation in Monroe County.

Recreation-tourism-supply. Demand for recreation-tourism can be constrained directly by the supply of facilities that provide access, or indirectly, such as by the hurricane evacuation requirement and the capacity of the roads to facilitate evacuation. To some extent, number of housing units that can be permitted each year by the Monroe County ROGO is constrained by the hurricane evacuation requirement and road capacity. With this housing constraint, the number of visitors is constrained as well.

The Florida Department of Environmental Protection Division of State Parks has long maintained an inventory on the supply of areas and facilities to accommodate recreation (Table 2.10). It began with the requirement to develop state comprehensive outdoor recreation plans, where supply and demand for outdoor recreation were assessed to justify obtaining funds from the federal Land and Water Conservation Fund to aid in purchasing land and building facilities. To some extent, these facilities and areas constrain the amount of recreation and tourism that Monroe County can accommodate and yield a satisfactory recreation experience. If recreators, especially visitors or tourists, are not satisfied with their experience, they may substitute to other destinations. Therefore, supply of facilities and areas plays an important part in determining the level of sustainable tourism. Local and state planners often use industry standards for use of a

facility or area that can accommodate and yield a satisfactory experience. By combining supply and demand information, planners make decisions about how much to invest in additional facilities and areas.

Table 0.10. Public recreation facilities providing public access in Monroe County

Type of facility	#	Type of facility	#
<i>Overnight facilities (#)</i>		<i>Marinas (#)</i>	
R/V trailer sites	3,385	Saltwater (#)	124
Tent sites	363	Slips/moorings	4,188
Cabins	241	Freshwater (#)	2
Primitive camping areas (acres)	14.6	Slips/moorings	48
Primitive tent campsites	1	<i>Fishing facilities (piers)</i>	
<i>Picnic tables (#)</i>		Saltwater (#)	
Tables	2,831	Length (linear feet)	2,664
Shelters	180	Freshwater (#)	1
<i>Cultural resources</i>		Length (linear feet)	
Museum/interpretive buildings	20	<i>Boardwalks/catwalks (#)</i>	
Historical/archeological sites/structures	70	Saltwater (#)	36
Common structures	4	Length (linear feet)	17,920
<i>Trails (miles and tenths)</i>		Freshwater (#)	
Trailheads	9	Length (linear feet)	50
<i>Single use</i>		<i>Jetties</i>	
Hiking	12.7	Saltwater (linear feet)	3,574
Canoe/kayak	70.5	<i>Golf courses (#)</i>	
Bicycle paved	1.5	9-hole reg. Course	0
Jogging/exercise	1.3	18-hole reg. Course	5
Nature study/interpretive	9.7	Par 3/executive course	5
<i>Multiple use</i>		Total golf holes	
Hiking	84.1	<i>Outdoor courts (#)</i>	
Bicycle unpaved	10.4	Tennis	121
Bicycle paved	72.3	Basketball	48
Jogging/exercise	72.9	<i>Playing fields (#)</i>	
Nature study/interpretive	1.4	Baseball/softball	21
<i>Beach areas (#)</i>		Football/soccer	
Saltwater (#)	63	Multi-purpose	11
Length (linear feet)	94,065	<i>Other facilities</i>	
Width (linear feet)	2,180	Equipped play area	37
<i>Boat ramps (#)</i>		Parking areas	
Boat ramps	92	Parking spaces	1,796
Total lanes	103	Recreation centers	37
		Swimming pools	62

Source: Florida Department of Environmental Protection, Division of Recreation and Parks (2016)

Retirement

Retirees receive income from several sources. Social Security and disability payments, Medicare, and veterans’ benefits are major sources. From 2000 to 2015, they accounted for between 6.6% and 8.2% of all personal income received by Monroe County residents (Figure 2.8). Dividends, interest, and rent are another source of funds through which retirees receive income; although retirees do not receive all of this income, they likely receive a significant portion. This source of Monroe County residents’ income accounted for 42.2% of income in 2001 and 49.3% in 2015 (Figure 2.9).

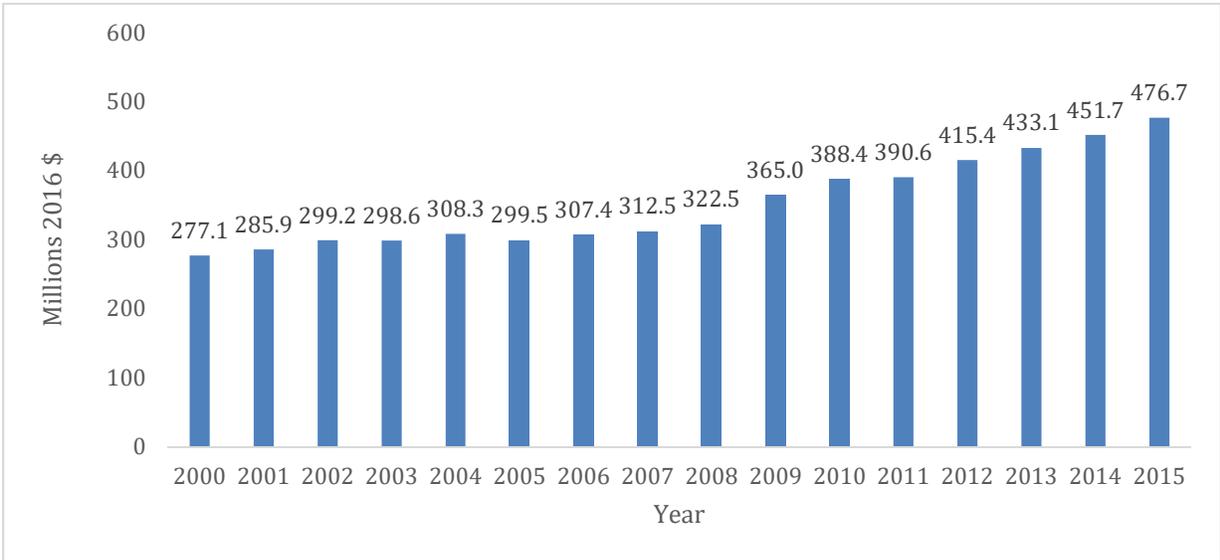


Figure 0.8. Retirees’ income from Social Security, Medicare, and veterans benefits 2000-2015 (2016\$)

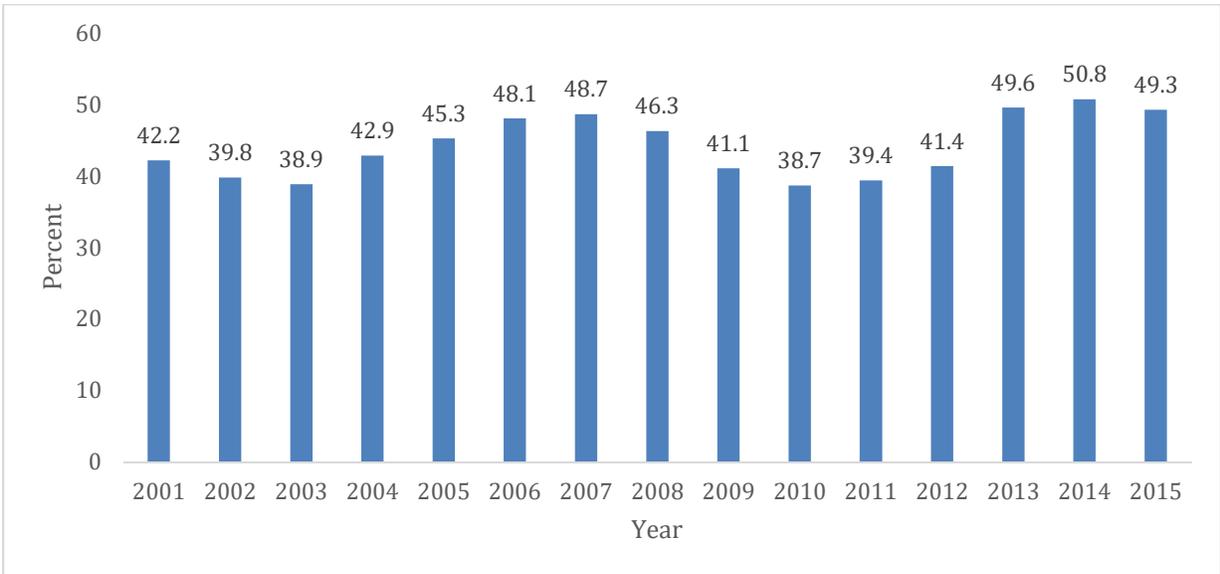


Figure 0.9. Dividends, interest, and rent as a percent of total income received by Monroe County residents 2001-2015 (2016\$)

Military

The U.S. Navy has a significant presence in Monroe County/Florida Keys. Military income paid to military personnel ranged from \$107.6 million in 2000 to \$146.6 million in 2010 (Figure 2.10). As a percent of Monroe County's total income, the military directly accounted for 2.17% in 2015 with a high of 3.35% in 2011. Other spending by the military also has economic impacts, but data for those were not available.

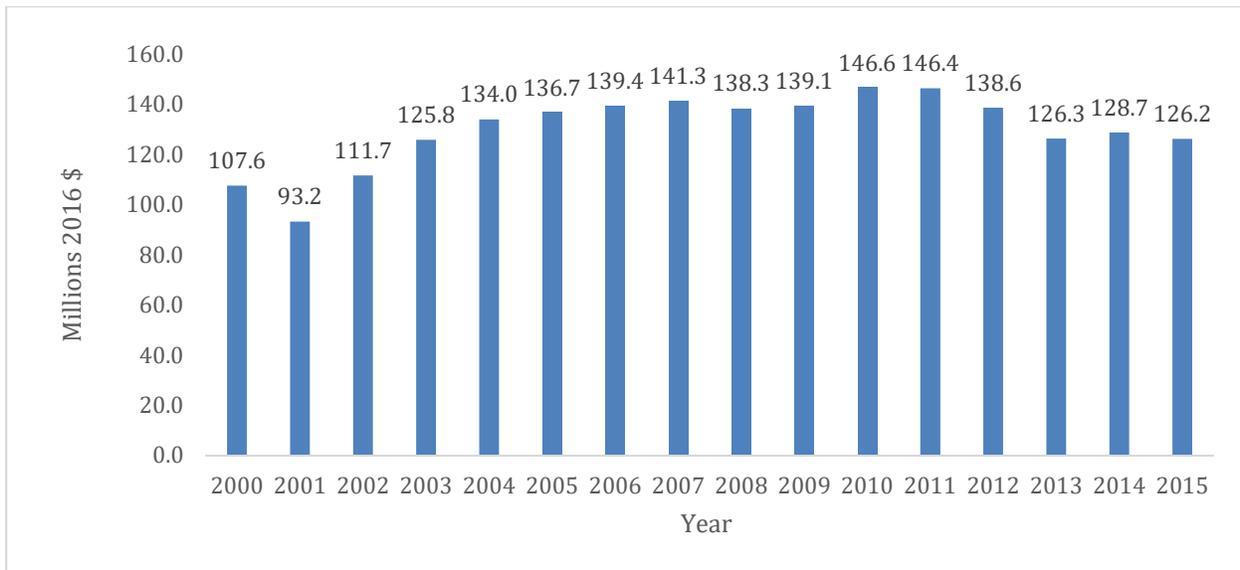


Figure 0.10. Military Income Monroe County 2000 to 2015 (2016 \$)

Bedroom community

Monroe County/Florida Keys serves as a bedroom community for counties to the north according to the Census of Intercounty Commuters (U.S. Department of Commerce, U.S. Census Bureau). The Bureau of Economic Analysis uses this information to calculate the flows of income between counties when producing estimates of income-by-place-of-residence versus income-by-place-of-work. This is captured in what is called the “resident adjustment” in the income accounts for each county. Although there are more workers living outside the county but working *inside* than those living inside the county but working *outside*, the net flow of income into the county is positive for most years. In 2001, the resident adjustment, or net flow of income, into the county was at its highest with about \$29.6 million (2016\$) and reached a low of -\$300 thousand in 2010 (Figure 2.11). From 2001 to 2015, the net flow of income into Monroe County as a percent of Monroe County's total income ranged from 0.70% in 2001 to -0.01% in 2010. In 2015, it was about 0.01% of Monroe County's total income.

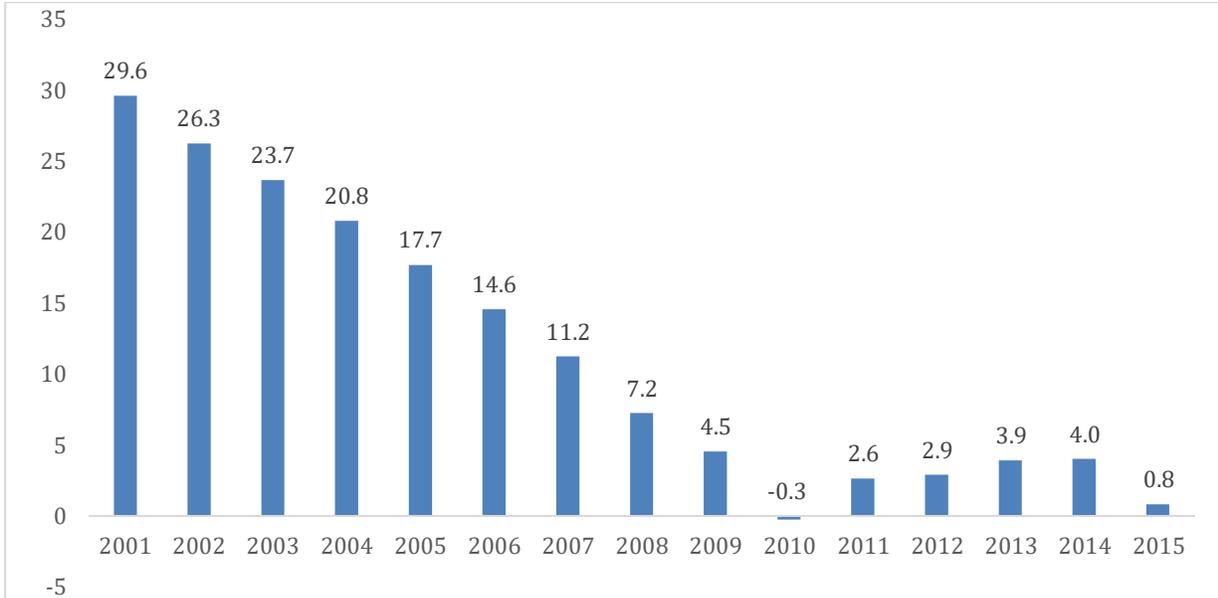


Figure 0.11. Bedroom community net flow of income into Monroe County 2000 to 2015 (millions 2016\$)

Manufacturing

Monroe County/Florida Keys has a small manufacturing sector focused on art, literature, jewelry, gifts, and souvenirs. Most of this activity is located in Key West. From 2000 to 2015, direct income from the manufacturing sector (2016\$) ranged from \$11.8 million in 2011 to \$30.3 million in 2015 (Figure 2.12). As a percent of Monroe County’s total income, it ranged from 0.27% in 2011 to a high of 0.52% in 2015.

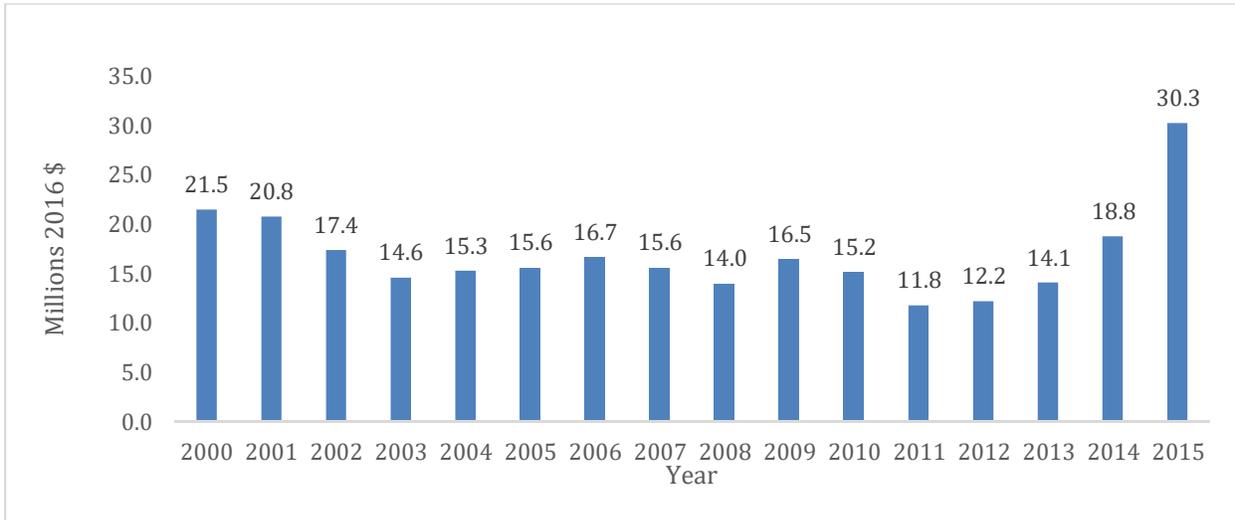


Figure 0.12. Manufacturing income in Monroe County 2000 to 2015 (millions 2016\$)

Commercial fishing

Like recreation-tourism, commercial fishing is a direct use of natural resources in FKNMS. The national income accounts do not cover the commercial fisheries well since commercial fishing

operations tend to have small numbers of employees with a higher proportion of fishermen being proprietors. The national income accounts are based on state employment security reporting called ES-202 reports. Most commercial fishermen and crew are not covered by ES-202 reporting requirements; therefore, they are under-counted in our national income accounts.

The state of Florida’s Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute (FWRI) keeps information on Florida’s commercial fisheries. Data for the commercial fisheries and marine life collection for the period 1997 to 2013 were obtained. FWRI maintains data from “landings tickets” that contain information on where fish are caught and landed. The economic and social impacts originate from the landing location. FWRI has “statistical areas” for recording where the fish is caught. The statistical areas are generally very large areas, so they do not support spatial analyses at fine scales. The FWRI statistical areas that best overlay the boundaries of FKNMS were selected to estimate the amount of commercial catch and marine life collection that come from FKNMS.

Table 2.11 lists the statistical area numbers and descriptions, and Figure 2.13 shows FKNMS boundaries overlaid with the boundaries of each FWRI statistical area. Appendix A contains maps for nine commercial fishing species/species groups and two maps for marine life collection (fish and invertebrates) by statistical area for the 2009-2013 average catch (measured in pounds of catch).

Table 0.11. FWRI statistical areas and FKNMS boundaries for commercial fisheries

Area Number	Area Name
1.0	Key West, south of US 1, State Waters
1.1	Key West, North of US 1, State Waters
1.8	Key West, North of US 1, Federal Waters
1.9	Key West, South of US 1, Federal Waters
2.0	Tortugas, Gulf of Mexico State Waters
2.2	Tortugas, South Atlantic State Waters
2.8	Tortugas, Federal Waters - Gulf Council
2.9	Tortugas, Federal Waters - South Atlantic Council
744.6	Card Sound
748.0	Marathon, South of US 1, State Waters
748.1	Marathon, North of US 1 State Waters (Florida Bay)
748.9	Marathon, Federal Waters

Source: Florida Fish and Wildlife Research Institute (FWRI)

FWRI reports where the catch from each statistical area is landed by county. Not all the catch from the statistical areas that define FKNMS is landed in Monroe County/Florida Keys. In 2013, the proportion of catch from FKNMS landed in Monroe County ranged from a low of 10.5% for food shrimp to a high of 99.87% for stone crab claws.

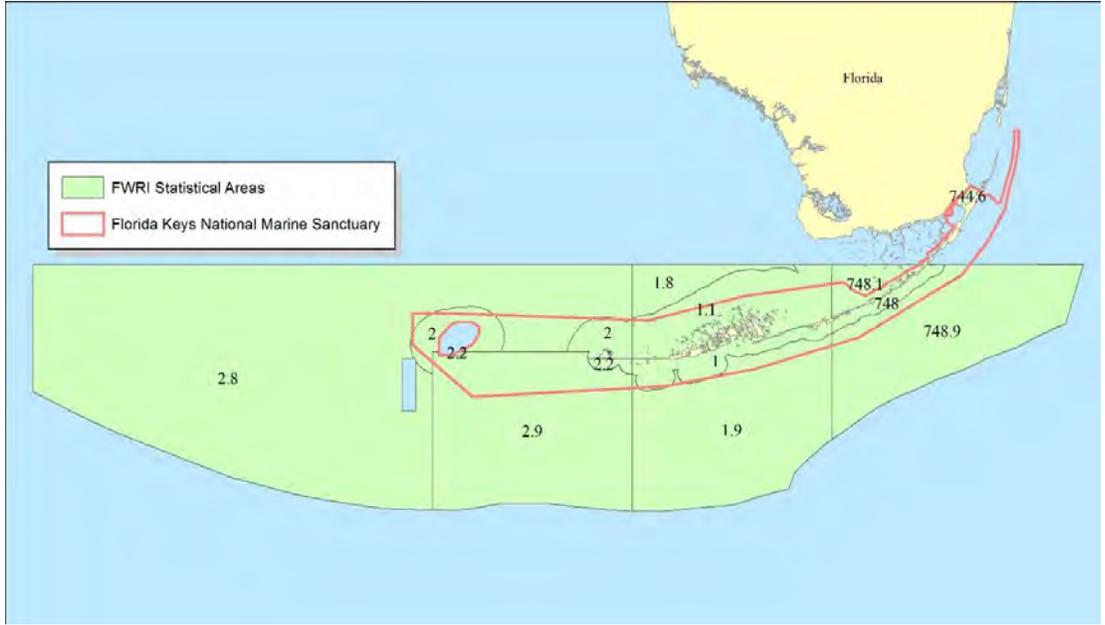


Figure 0.13. FWRI statistical areas and FKNMS boundaries

Trends in revenue from catch. From 2000 to 2012, total revenues received by fishermen for their catch declined throughout the state of Florida as well as catch from FKNMS and the catch from FKNMS landed in Monroe County (Figure 2.14). Revenues from catch in FKNMS and landings of that catch in Monroe County have declined more than in the state as a whole (-26.2 for the state of Florida, -30.4% for FKNMS, and -31.3% for Monroe County). However, for the 2009 to 2012 time period, revenues from catch increased within all three areas, with catch increasing 44.7% for FKNMS and 59.5% for Monroe County.

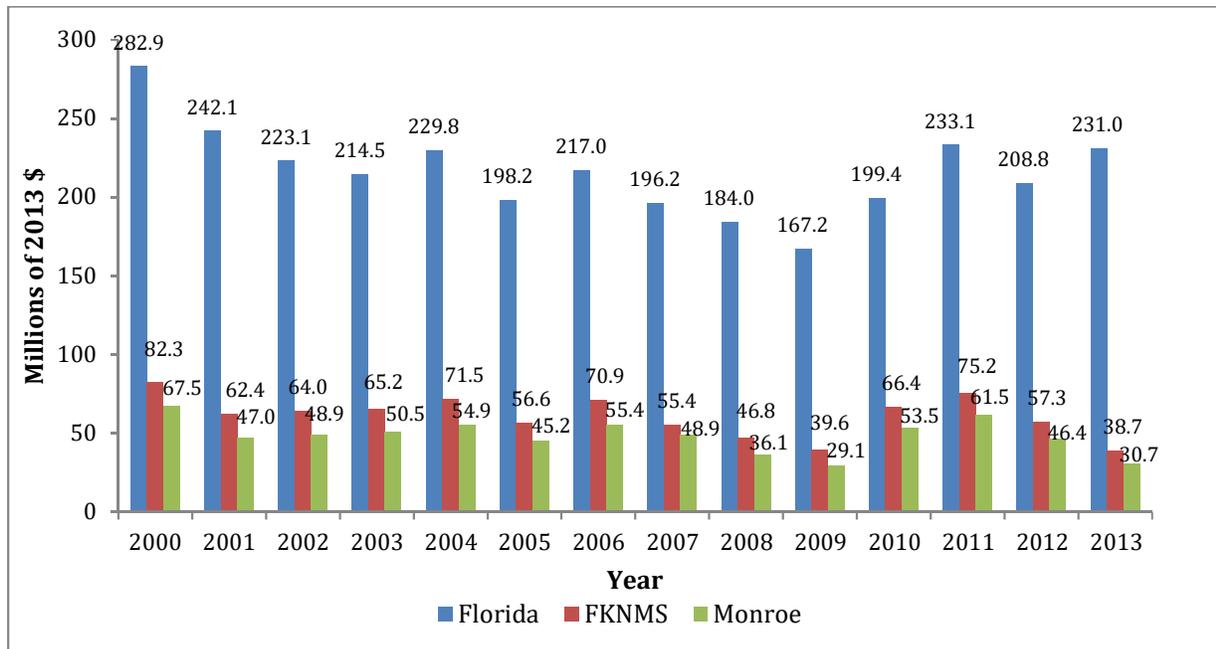


Figure 0.14. Commercial fishing harvest revenues in Florida, FKNMS, and Monroe County, 2000 to 2013

Revenues from marine life collection in FKNMS have been much more volatile than for the entire state of Florida (see figures 2.16 and 2.15, respectively). Plants, live rock, and live sand are no longer harvested from the statistical areas that make up FKNMS. The current levels of marine life collection in FKNMS are not significant, ranging from a high of \$28,100 in 2007 to a low of \$400 in 2012.

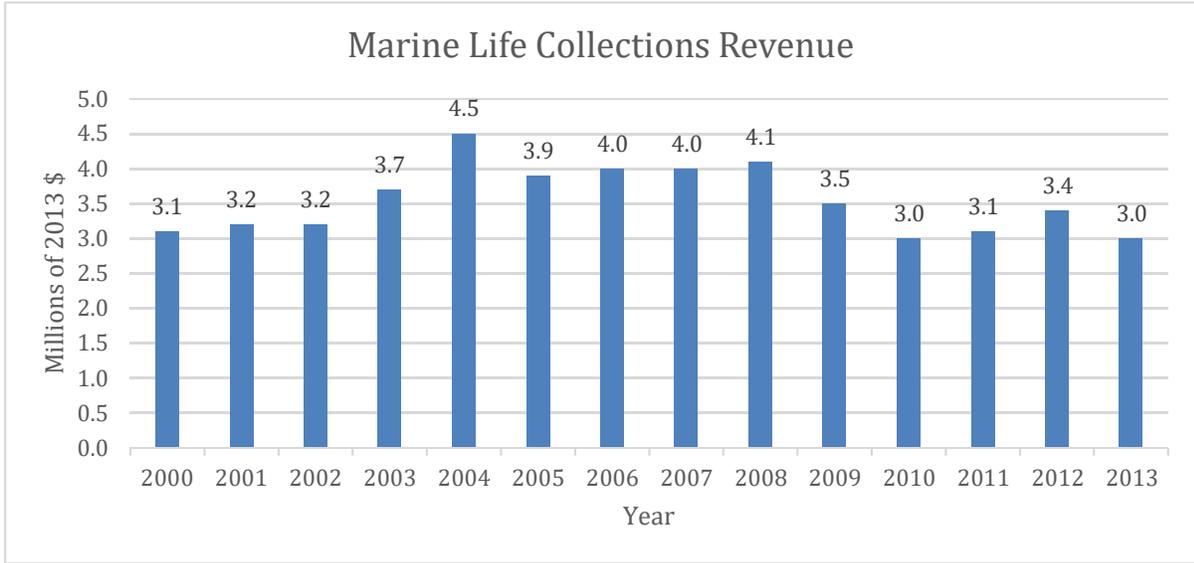


Figure 0.15. Marine life collection revenues for the state of Florida 2000 to 2013

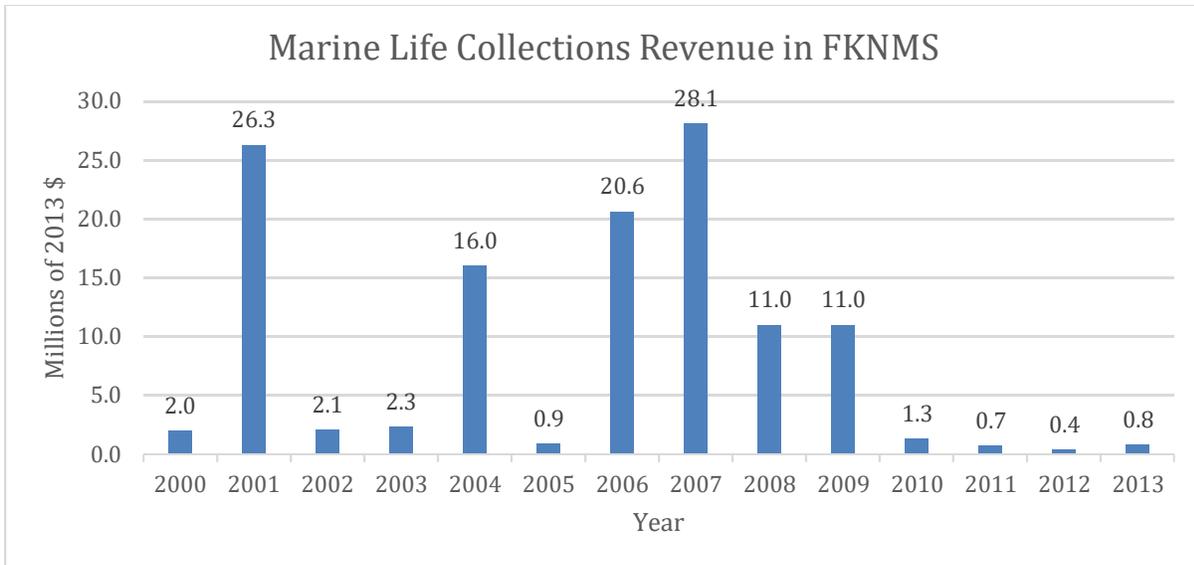


Figure 0.16. Marine life collection revenues from FKNMS landed in Monroe County, 2000 to 2013

Baselines for assessing impacts of regulations. In assessing the potential impacts of regulations, one needs estimates of baseline conditions for which estimates of impacts are derived. This requires an assessment of trends and stock assessments because estimates of future potential impacts should be judged based on what is sustainable in the future. If the trend for a

species/species group is in the downward direction, and if one uses the last year as the baseline for judging potential future impacts, one could overestimate the impacts of the regulation since a decline in catch would be expected even without a regulation that might restrict catch. In most cases, the NOAA Fisheries Southeast Region Office recommends using a five-year average as the baseline for assessing potential impacts of regulations (Stephen Holiman personal communication 2014). If a fishery is overfished, or is receiving special management attention because of concern over the negative trends in catch, the recommendation is to use the Fishery Council’s annual catch limits as the relevant baseline. Table 2.12 reports the 2009-13 average catch measured in pounds and revenue received by the fishermen by species/species groups for the commercial fisheries. Table 2.13 reports the 2009-13 averages for fish and invertebrates in marine life collection. In any future analyses of the impacts of regulations that potentially affect the fisheries, the 2009-13 baselines would be used unless the annual catch limits are significantly different.

Table 0.12. Commercial fishing landings from FKNMS: 2009-2013 average, by species/species groups

Species/species group	Pounds	% of pounds	Revenue (2018\$) ¹	% of revenue	% landed in Monroe County
All finfish	4,488,641	30.70	10,837,780	18.43	86.4
Reef fish	2,600,184	17.78	7,937,547	13.50	88.17
Grouper/snapper	2,205,794	15.09	7,409,983	12.60	87.59
Other reef fish	394,389	2.70	527,564	0.90	96.86
Sharks	242,234	1.66	306,649	0.52	96.78
Mackerel	1,003,521	6.86	1,303,777	2.22	98.03
King mackerel	888,266	6.07	1,205,985	2.05	98.06
Tuna, mahi mahi, wahoo, and swordfish	262,423	1.79	1,086,748	1.85	68.48
Other finfish	380,279	2.60	203,058	0.35	90.97
All invertebrates	10,133,518	69.30	47,975,576	81.57	77.13
All lobster	3,695,255	25.27	24,036,978	40.87	99.45
Spiny lobster	3,694,690	25.27	24,032,709	40.86	99.49
Food shrimp	5,156,489	35.26	12,137,283	20.64	10.51
Bait shrimp	19,607	0.13	1,782	0.00	100
All crab	1,070,527	7.32	11,500,285	19.55	99.67
Stone crab	1,013,608	6.93	11,358,012	19.31	99.87
Sponges	191,263	1.31	298,559	0.51	70.62
Other invertebrates	377	0.00	689	0.00	69.64
Total all species/species groups	14,622,160	100.00	58,813,356	100.00	79.78

¹ Dollars converted to February 2014 dollars using the Consumer Price Index for All Urban Consumers, U.S. City Average, All Items.

Sources: Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute; U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index

Table 0.13. Marine life collection in FKNMS: 2009-2013 average, by species group

Species group	Pounds	Percent of pounds	Revenue (2014\$) ¹	Percent of revenue
Fish	589	3.23	2,921	43.36
Invertebrates	17,672	96.77	3,815	56.64
Plants	0	0.00	0	0.00
Live rock	0	0.00	0	0.00
All marine life	18,261	100.00	6,736	100.00

¹ Dollars converted to February 2014 dollars using the Consumer Price Index for All Urban Consumers, U.S. City Average, All Items.

Sources: Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute; U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index

Selling fish in the state of Florida requires a “saltwater product license.” In 2013, there were 12,492 holders of saltwater product licenses for fishing in Florida. This includes fishing operations that are located outside the state of Florida that fish in Florida waters. In Monroe County, there were 1,312 saltwater product licenses in 2013 or 10.5% of all saltwater product licenses. From 2000 to 2013, saltwater product licenses in Florida declined from 14,163 to 12,492 or 11.8%, while those in Monroe County declined from 2,463 to 1,312 or 46.7% (Figure 2.17). Murray & Associates (2006) found that from 1995 to 2005, the commercial fisheries in the Florida Keys were consolidating due to new fishery management actions with fewer part-time fishermen and each fisherman fishing more gear per fisherman. They described this trend as the “professionalization” of the fisheries. The social impacts of this professionalization and the factors leading to it are discussed in Shivilani (2014).

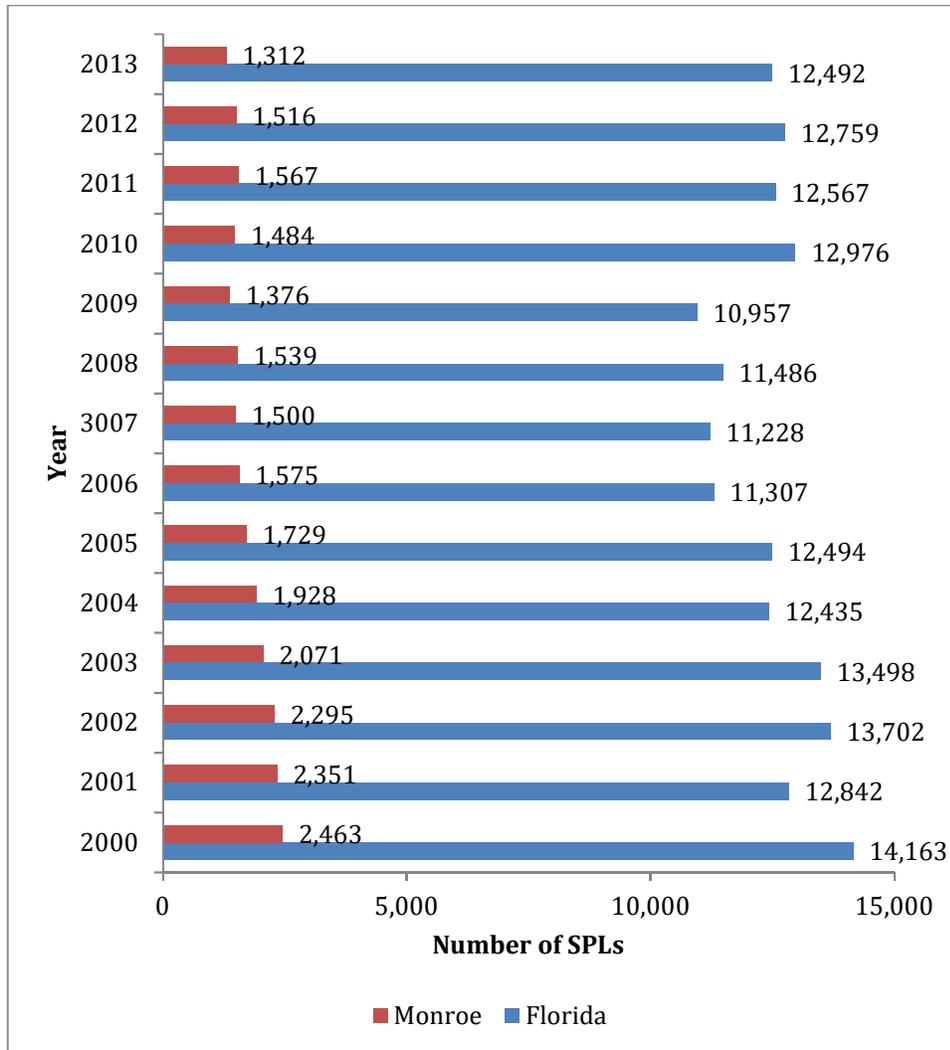


Figure 0.17. Saltwater product licenses (SPL) in Florida and Monroe County 2000 to 2013

The 2009-13 average of the total landings from FKNMS was about \$55.5 million, of which about \$44.3 million (~80%) was landed in Monroe County. Other significant counties of landing include Lee and Hillsborough counties, primarily with food shrimp landings (60.54% in Lee County). The commercial fishing catch in FKNMS is dominated by invertebrates, which for the 2009-13 average accounted for 81.57% of the revenue received by fishermen; meanwhile finfish accounted for 18.43%. For invertebrates, spiny lobster accounted for 40.86% of all revenues received by fishermen, divided between food shrimp at 20.64% and stone crabs at 19.31%. For finfish, reef fish accounted for 13.5% of all revenues received by fishermen. The grouper/snapper species group of reef fish accounted for 12.6% of all revenues. King mackerel accounted for 2.05%, while the species group of tuna, mahi mahi, wahoo, and swordfish accounted for 1.85% of all revenues (Table 2.12).

Economic impacts of the FKNMS catch on the Monroe County economy. The last study of the economic impact of the commercial fisheries on Monroe County was done in 1995 (CEMR

1995). However, details of the market channel distributions of catch and the market mark-ups at each market channel (e.g., harvest revenue to that directly exported, wholesale, processing, retail, and restaurant) was not provided. The most updated information on market channel distributions and mark-ups was from a 1986 study (Rockland 1988) and Adams (1992). These distributions and mark-ups were used in Leeworthy (2000) for the analyses of the potential impact of the proposed Tortugas Ecological Reserve. They are used here as the closest approximation to what the economic impact of the commercial fisheries catch from FKNMS on the Monroe County economy (Table 2.14).

Table 0.14. Market distribution of catch and price mark-ups

	All finfish	All invertebrates
<i>Percent of catch landed in Monroe County</i>		
Wholesale distribution (%)		
a. Exported	80	90
b. Keys retail	6	3
c. Keys restaurant	14	7
<i>Price markups (%)</i>		
a. Wholesale	27	37
b. Keys retail	84.5	30
c. Keys restaurant	257.1	257.1

Sources: Adams (1992) and Rockland (1988) for percent distributions by market channel and mark-ups

Table 0.15. Economic impact for FKNMS commercial fisheries in Monroe County

	All finfish	All invertebrates	Total
Percent of catch landed in Monroe County	86.4	77.1	78.8
Distribution of revenue by market (2018\$)			
a. Exported	7,491,075	33,290,260	40,781,336
b. Keys retail	561,831	1,109,676	1,671,506
c. Keys restaurant	1,310,938	2,589,242	3,900,180
Primary output (2018\$)			
a. Wholesale	9,513,666	45,607,657	55,121,323
b. Keys retail	1,036,577	1,442,578	2,479,155
c. Keys restaurant	4,681,360	9,246,185	13,927,545
Total primary output	15,231,603	56,296,419	71,528,022
Total output	18,277,924	67,555,703	85,833,628
Total income	11,332,312	41,884,536	53,216,849
Total jobs	269	995	1,265

Sources: Adams (1992) and Rockland (1988) for percent distributions by market channel and market-channel mark-ups, Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute and U.S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index

Historically, the Monroe County/Florida Keys commercial fishery has been a primarily export industry with most of the catch sold outside the county (exported) (Shivlani 2014). Using the

2009-13 average harvest revenues received by fishermen, it is estimated that the economic impact on Monroe County from catch made in FKNMS in 2018 dollars is more than \$85.8 million in total output, about \$53.2 million in income, and 1,265 full- and part-time jobs (Table 2.15). These totals include the ripple or multiplier impacts in Monroe County.

Labor force, employment, and income

The labor force and total employment and their respective growth rates are good indicators of a healthy (or stagnant) economy as well as the opportunities for employment. These are important elements in assessing whether people can adapt to changes in resource management/policy decisions that may displace them from resource use.

Proprietors' income, proprietors' employment, and the proportion of the study area's income and employment accounted for by proprietors are analyzed. This is usually a good indicator of small businesses which are often connected to resource use in the sanctuary (e.g., commercial fishing operations and recreation-tourist related businesses).

Personal income and employment by industry sector is also explored. This is important for economic impact analyses of resource management/policy decisions. When researchers are able to map the spending (that relates to resource use in the sanctuary) in the local economy to economic sectors, input-output models such as IMPLAN (impact analysis for planning) can then be used. The IMPLAN model allows us to estimate the multiplier impacts on the local economy and assess the proportion of the local economy affected.

There are some problems with obtaining complete information by economic sector for any county since there are rules that do not allow the government to publish data on a sector in a county if there are fewer than 10 firms in the county. The data are reported as "D" meaning "non-disclosure." For the 2015 Monroe County totals, there were no sectors reported as non-disclosure. This is not the case for many prior years.

Labor Force. In 2015, there were 46,046 people in the Monroe County labor force, which is approximately 0.5% of the entire Florida labor force. From 1990 to 2010, it grew slower than the Florida labor force (Table 2.16 and Figure 2.18).

Table 0.16. Labor force and labor force growth for Monroe County versus Florida, 1990-2015

Year	Florida	Monroe
<i>Labor force</i>		
1990	6,465,579	40,978
2000	7,869,690	45,192
2005	8,635,032	45,137
2010	9,176,601	46,303

2011	9,274,860	47,008
2012	9,368,500	47,008
2013	9,437,681	44,330
2014	9,560,334	45,154
2015	9,627,843	46,046
<i>Labor force growth (%)</i>		
1990-2000	21.7	10.3
2000-2010	9.7	-0.1
2010-2015	4.9	-0.6

Source: U.S. Department of Labor, Bureau of Labor Statistics

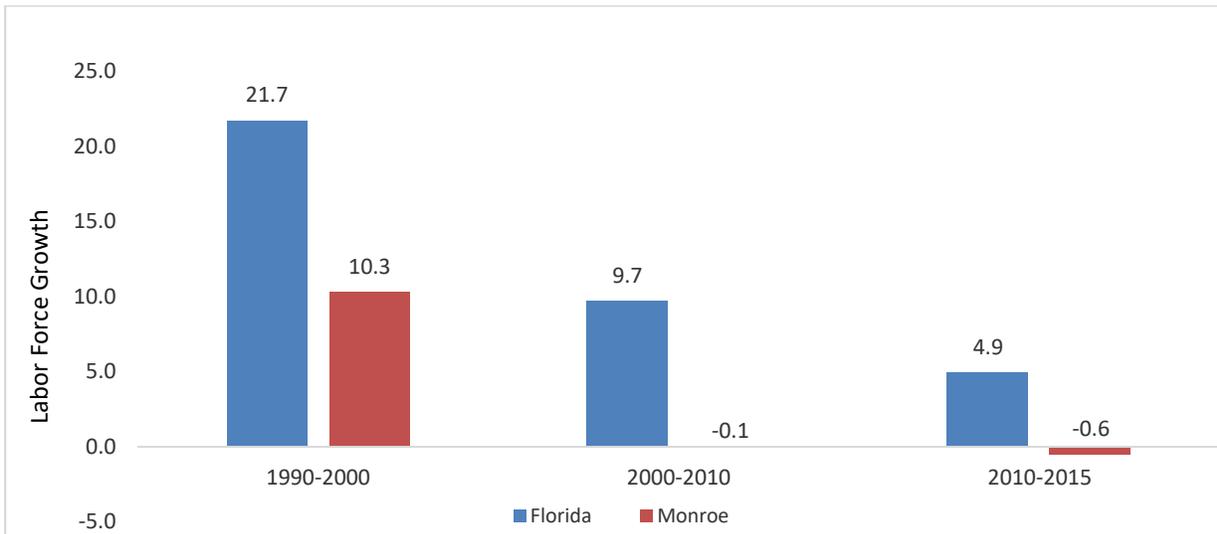


Figure 0.18. Labor force growth, Monroe County versus Florida, 1990-2000 to 2010-2015

Personal income. The U.S. Department of Commerce Bureau of Economic Analysis (BEA) maintains two concepts of personal income in their Regional Economic Information System. Income is reported by “place-of-work” and by “place-of-residence.” Income by place-of-work is the income generated by work in the geographic area of study, and is reported by economic sector (e.g., farm, manufacturing, retail, wholesale, etc.). Income by place-of-residence is reported by where the income is received, and is the total amount of income received by those who live in the Monroe County. It includes income from investments, pensions, social security payments, and other transfer payments. In addition, it includes income earned in work outside Monroe County. This would include the income a county resident earns working in a county outside Monroe County. The amount of income earned by people who live outside the Monroe County is subtracted as they take their incomes home to areas outside the Monroe County. This information comes from the Census of Inter-county Commuters. BEA uses the information to generate what is called the “residence adjustment,” which can be either positive or negative depending on whether people living in and working outside the study area are earning more or

less than people living outside and working inside the study area. Economists often refer to this as the “bedroom community effect.”

In using the input-output model IMPLAN or other economic impact model to estimate the economic impacts of activity in a study area, an important first step is defining the study area of impact. Since IMPLAN assumes that all those who work in the study area live in the study area, and thus spend most of their income there, defining the study area such that the bedroom community effect is small makes estimates more accurate. Income by place-of-work as a percent of total income by place-of-residence serves as an indicator of two key study area economic traits: whether it is an economy with a significant bedroom community and/or whether there is a large retirement community. When the percent of income by place-of-work is low relative to income by place-of-residence (below 100%, Table 2.17), economists then look to the resident adjustment and the amount of transfer payments in pensions and social security payments to further describe the nature of the local economy.

In 2015, the income by place of work as a percent of income by place-of-residence was 44.9% in Monroe County, lower than that of Florida (Table 2.17). Income by place-of-residence was higher in Monroe County than in Florida in 1990 but has been lower than Florida since 2000. From 1990 to 2000, the percentage increased in Monroe and Florida. Since 2000, the percent of income by place-of-work has decreased in Monroe and Florida (Table 2.17 and Figure 2.19).

Table 0.17. Personal income by place of residence and place of work in Monroe County versus Florida, 1990 to 2015

Year/area	Income by place of residence (millions 2016\$)	Income by place of work (millions 2016\$)	Work as a percent of residence
1990			
Monroe	3,231	1742.48	53.9
Florida	466,116	226,500	48.6
2000			
Monroe	4,202	2,345	55.8
Florida	648,635	433,882	66.9
2005			
Monroe	4,758	2,458	51.7
Florida	778,827	520,698	66.9
2010			
Monroe	4,543	2,397	52.8
Florida	794,605	489,437	61.6
2015			
Monroe	5,823	2,614	44.9
Florida	909,642	463,647	51.0

Source: U.S. Department of Commerce, Bureau Economic Analysis, Regional Economic Information System

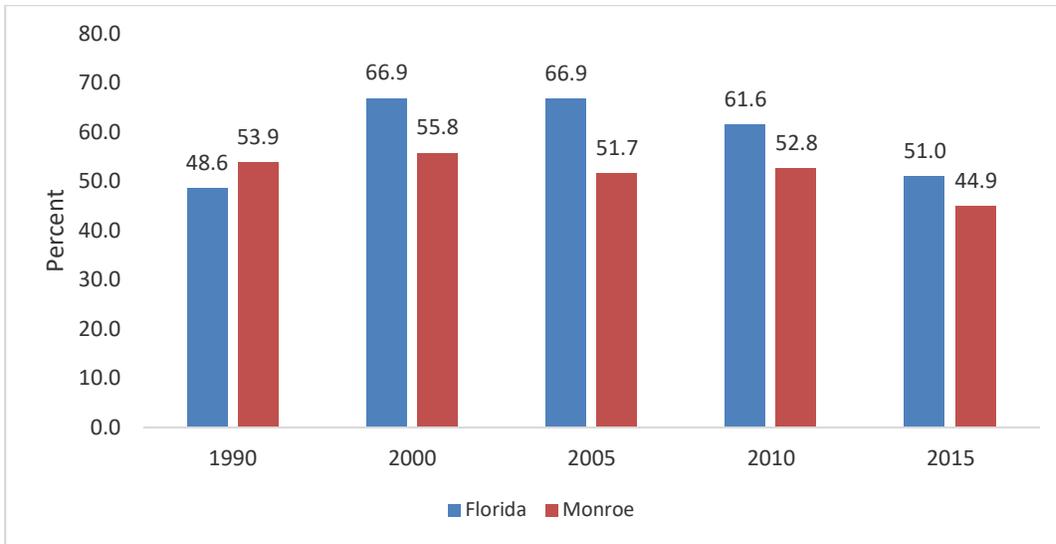


Figure 0.19. Income by place of work as a percent of residence, Monroe and Florida, 1990 to 2015

Employment. In 2015, 62,780 people were employed in Monroe County, approximately 0.56% of all employment in Florida (Table 2.18). Total employment in Monroe County grew more slowly from 1990 to 2010. However, both experienced an increase in total employment growth from the period 2010 to 2015 as both the state and county recovered from the financial crisis (Figure 2.20).

Table 0.18. Total employment in Monroe County and Florida: 1990, 2000, 2010, and 2015

Area	1990	2000	2010	2015
Monroe	43,697	53,096	54,926	62,780
Florida	6,740,289	8,841,607	9,880,909	11,287,608

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System

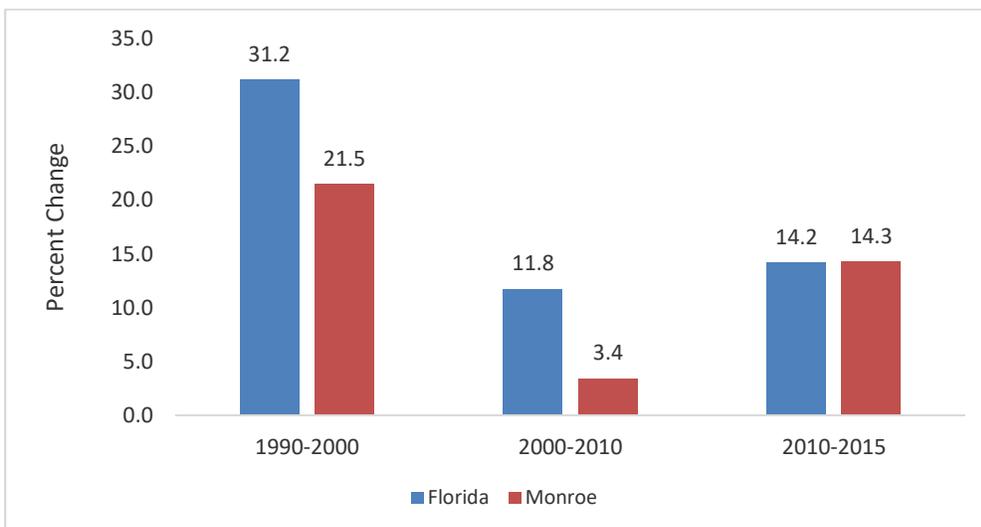


Figure 0.20. Growth in total employment, Florida versus Monroe County, 1990 to 2015

Proprietor's income and employment. When analyzing the potential impacts of sanctuary management strategies and regulations, it is a requirement under the Regulatory Flexibility Act to analyze the potential impacts on small entities, which are primarily small businesses. In general, almost all businesses related to either the commercial fishing industry or the recreation-tourist industries are small businesses. Good indicators of the extent of small businesses in the study area are the extent of proprietor's income and employment.

In 2015, there were 18,673 proprietors employed in Monroe County, making up 29.7% of total employment in Monroe County. The proprietors made a little over \$306 million in that year, or 11.7% of all income earned by place-of-work in Monroe County (Table 2.19). Monroe County had lower percent of its income from proprietors than Florida, but a higher percent of employment, from 1990 to 2015 (Figures 2.21 and 2.22).

Table 0.19 Proprietor's income and employment, Monroe County versus Florida, 1990 to 2015

Year/area	Proprietor's income (thousands 2016\$)	%	Proprietor's employment	%
1990				
Monroe	232,639	9.0	8,410	19.2
Florida	22,213,411	16.2	1,000,093	14.8
2000				
Monroe	444,997	15.4	12,333	23.2
Florida	47,993,411	23.0	1,351,948	15.3
2010				
Monroe	259,163	8.3	16,570	30.2
Florida	43,122,933	18.7	2,315,090	23.4
2015				
Monroe	306,492	11.7	18,673	29.7
Florida	52,914,371	9.6	2,817,006	25.0

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System

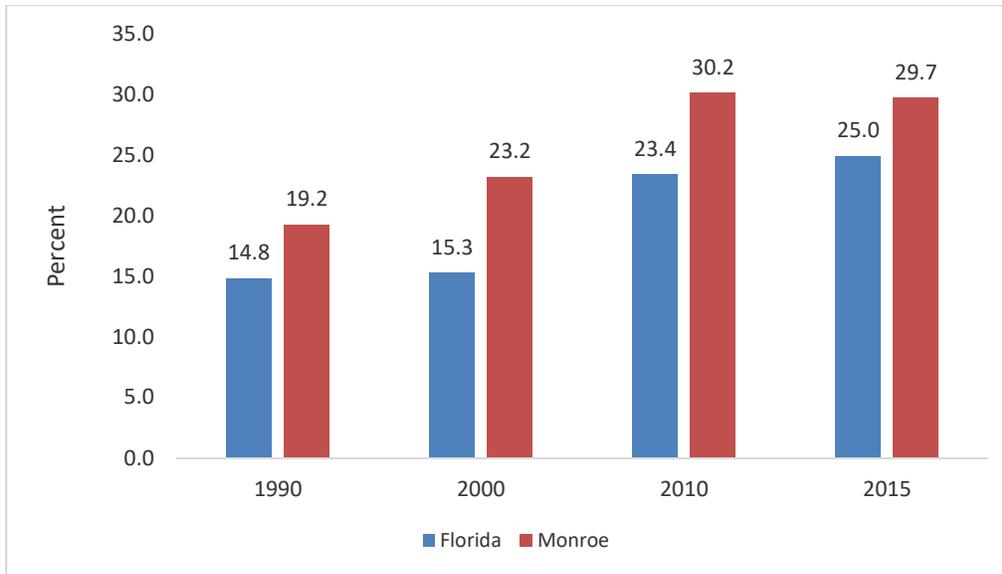


Figure 0.21. Proprietor's employment as a percentage of total employment

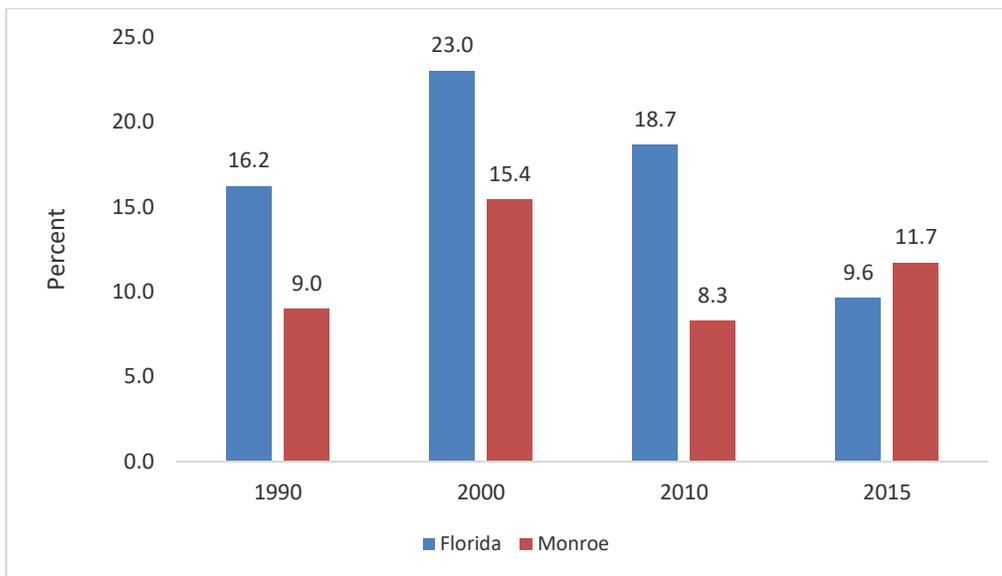


Figure 0.22. Proprietor's income as a percentage of personal income

Personal income and employment by industry sector. In its Regional Economic Information System, the BEA reports income and employment for different geographic areas by industry or economic sector using the North American Industry Classification System (NAICS) industry classification codes. The NAICS codes identify different sectors of the economy using codes up to four digits. The higher the number is within a sector, the more specific the industry. For example, “retail trade” is the 44-45 series. Therefore, at the 44-45 level, all retail trade is included. Code 441 is “motor vehicle and parts dealers” and code 442 is “furniture and home furnishing stores.”

For Monroe County, results are report at the highest level, i.e., for each series only the “00” level of detail. Even here, some of the information is classified as “ND” for non-disclosure meaning the numbers cannot be reported because there are fewer than 10 firms in that industry or economic sector in the county. Thus, if Monroe County has fewer than 10 firms in a sector, Monroe County will be coded “ND” for non-disclosure.

Personal income by industry. In 2015, Monroe County had a noticeably higher proportion of personal income from “accommodation and food services” and “government and government enterprises” sectors than in Florida, with lower proportion from the “health care and social assistance,” “professional, scientific, and technical services,” “finance and insurance,” “wholesale trade,” and “manufacturing” sectors (Figure 2.23).

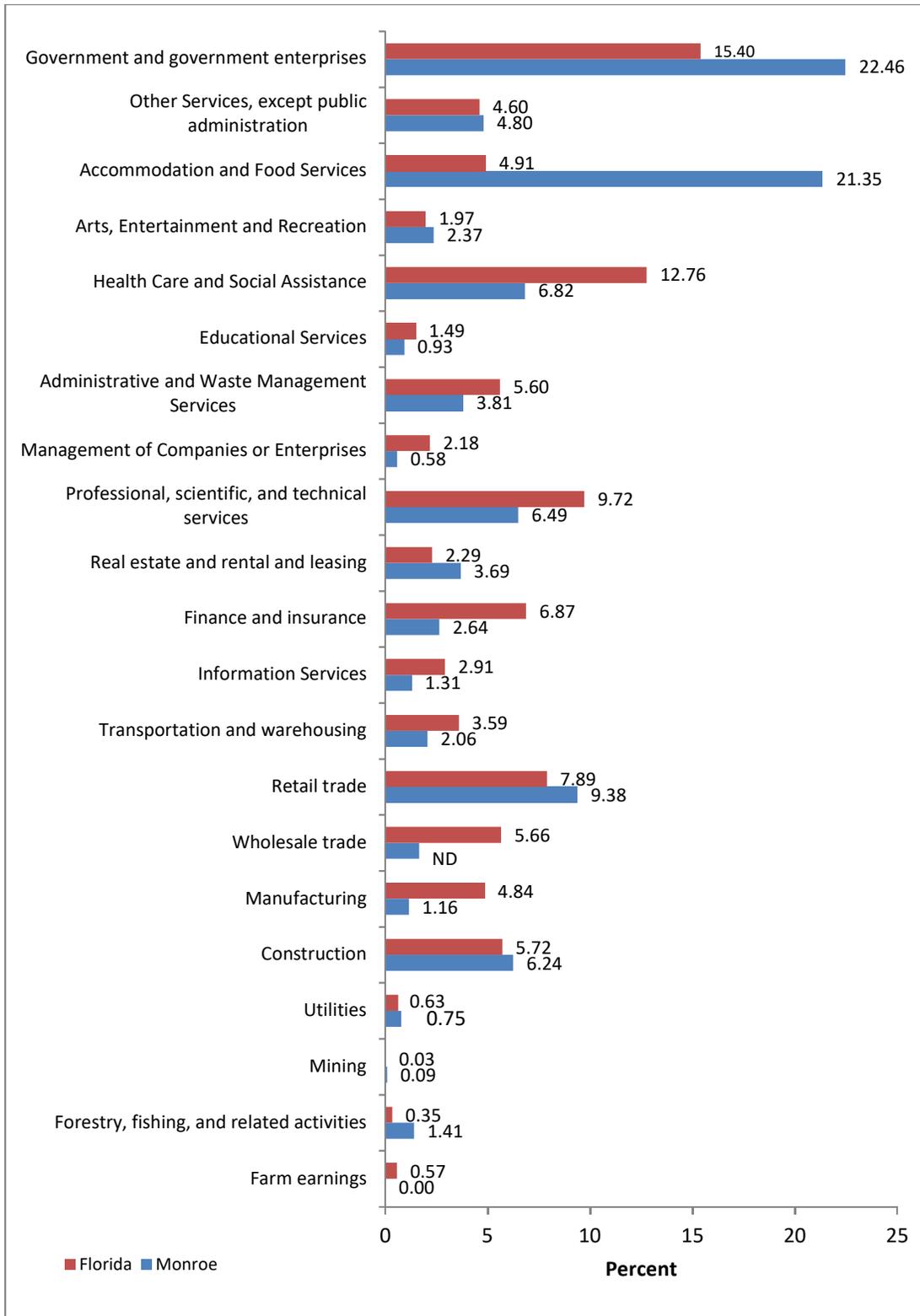


Figure 0.23. Personal income by industry for Florida and Monroe County, 2015

Employment by industry. In 2015 Monroe County had a higher proportion of its employment created by “accommodation and food services,” “real estate, and rental and leasing,” and “forestry, fishing, and related activities” (fishing in Monroe County) sectors compared to Florida, with a lower proportion from the “health care and social assistance,” “administrative and waste management services,” “finance and insurance,” and “manufacturing” sectors (Figure 2.24).

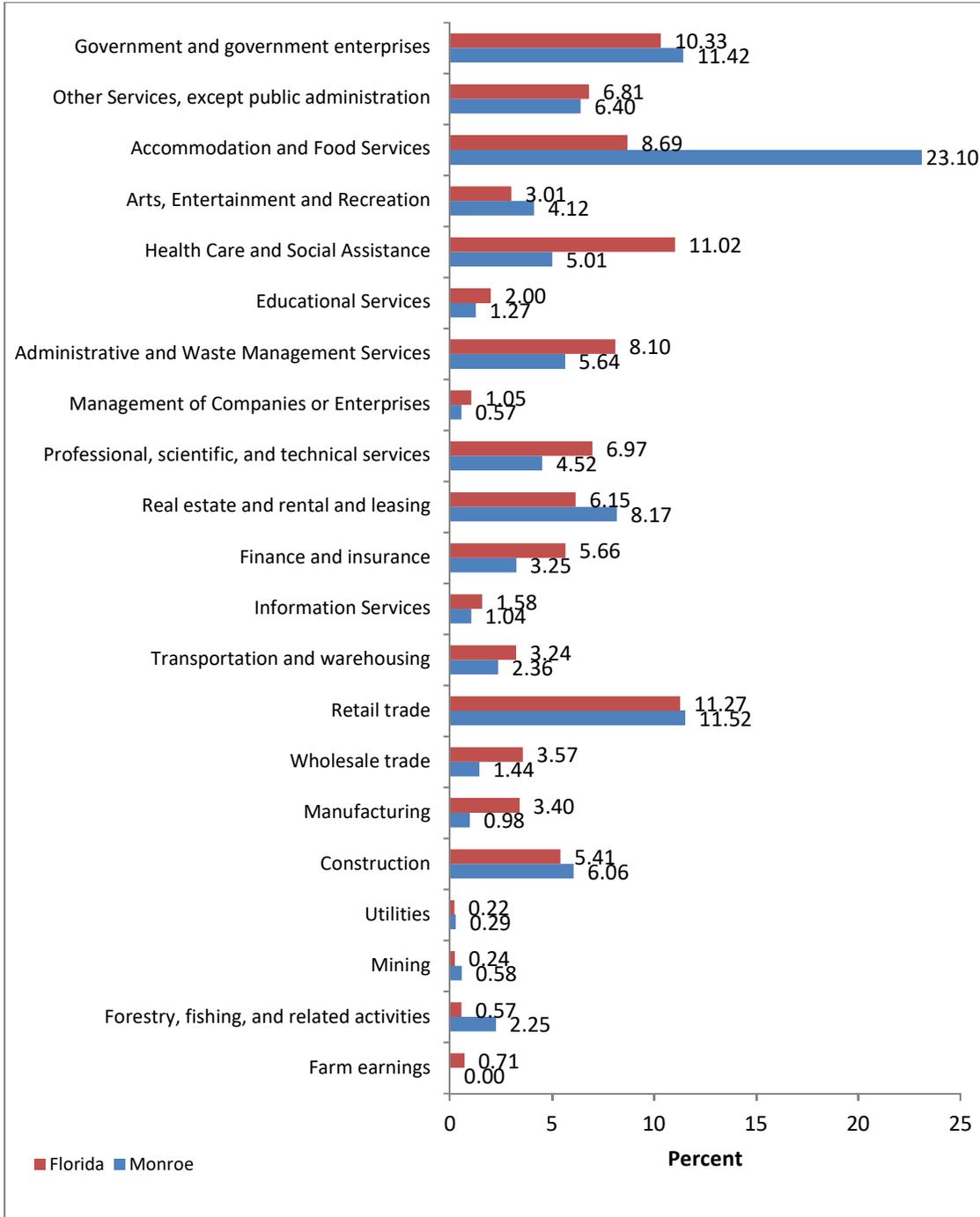


Figure 0.24. Employment by industry for Florida and Monroe County, 2015

Land use and development

Current and future uses of land and development are based on the Monroe County 2030 Comprehensive Plan’s technical document (Monroe County Growth Management 2011).

“The County includes the Mainland area and over 1,700 islands which lie along the Florida Straits, dividing the Atlantic Ocean to the east from the Gulf of Mexico to the west, and defining one edge of the Florida Bay. The mainland Planning Area (PA) encompasses two national landmarks: The Everglades National Park and the Big Cypress National Preserve and accounts for approximately 85 percent of 562,149 acres of the overall County land mass. Since 99.8% of the Mainland PA consists of federal lands designated as Conservation use; the existing conditions of this element will focus primarily on lands within the unincorporated Lower, Middle, and Upper PAs.”

Monroe County 2030 Technical Document, Land Use

“In addition to the planning direction established in Section 2.1, the Plan is framed by several important components including, its geographic location; the Florida Keys Carrying Capacity Study (FKCCS); efficient hurricane evacuation; federal laws relating to the Coastal Barrier Resource System (CBRS) and the Endangered Species Act; and the goals established within Livable Communities Keys Plans. In addition, Big Pine Key and No name Key are guided by the Habitat Conservation Plan (HCP).”

Monroe County 2030 Technical Document, Land Use

Monroe County residential development is also controlled by the ROGO, which limits the amount of residential development based upon the ability to safely evacuate the Keys within 24 hours. Under the ROGO, the state only allocates 197 housing units per year to the county for building permit issuance.

Monroe County also adopted the Non-Residential Rate of Growth Ordinance (NROGO) in 2001 to “...ensure a reasonable balance between the amount of future non-residential (primarily commercial) development and the needs of a slower growing residential population...” [Monroe County 2030 Technical Document, Land Use]. The NROGO attempts to maintain a ratio of approximately 239 square feet of nonresidential floor area for each new residential permit issued through ROGO.

Monroe County also adopted a “tier system” in 2006 as a companion to the ROGO. The tier system directs growth to the least environmentally sensitive areas:

- I* = Tier I – Natural areas
- II* = Tier II – Big Pine Key and No Name Key in the Lower Keys only
- III* = Tier III – Infill areas
- III-A* = Special protection area
- U* = Undesignated Tier - Properties that originally had a tier designation but became undesignated by a court order
- 0* = Property does not have a tier designation. Most of these occur in the Upper Keys and some are right-of-way parcels. These are being reviewed and will be designated at some later date.

Existing land uses. Existing land use includes:

“... the land mass of the unincorporated Keys portion of the County is approximately 73,138 acres. Sixty five percent of land area is found in the Lower Keys PA, three percent in the Middle Keys PA, and 32 percent in the Upper Keys PA. Since the Lower Keys PA is the largest in land mass, it is not surprising that it has the highest ratio of existing land use designations, when compared to the other PAs. The exception applies to Commercial and Public Buildings and Grounds where percent ratios are larger in the Upper Keys PA. More than 75 percent of land in the unincorporated Keys is set aside for conservation purposes. Of the developed land uses, Residential is the largest land use category, representing approximately 6.8 percent of the land uses in the County, followed by Military at 5.5 percent, Utilities and Rights-of-Way at 4.4 percent, Vacant at 3.2 percent, Recreation at 1.8 percent and Commercial at 1.2 percent.”

Monroe County 2030 Technical Document, Land Use

Table 2.20 shows the existing land uses in unincorporated Monroe County; Table 2.21 shows the existing land uses for incorporated Monroe County.

Table 0.20. Existing land use by planning area (acres): Unincorporated Monroe County

Existing land use	Lower Keys	Middle Keys	Upper Keys	Total	Percent of total
Commercial	337.0	67.7	495.3	900.0	1.2%
Conservation	36,201.6	1,458.7	17,859.2	55,519.5	75.9%
Educational	49.2	0.0	30.8	80.0	0.1%
Industrial	414.8	0.2	40.6	455.6	0.6%
Institutional	99.6	0.4	60.8	160.8	0.2%
Military	4,025.7	0.0	0.0	4,025.7	5.5%
Other public utilities and right-of-way	1,665.6	141.8	1,429.3	3,236.6	4.4%
Public buildings and grounds	17.1	33.0	61.2	111.3	0.2%
Recreational	640.8	132.1	548.3	1,321.2	1.8%
Residential	2,599.9	201.9	2,186.4	4,988.2	6.8%
Vacant or undeveloped	1,376.2	108.3	854.4	2,338.9	3.2%
Total	47,427.6	2,144.1	23,566.2	73,137.9	100.0%
Percent total by planning region	64.9%	2.9%	32.2%	100.0%	-

Sources: Monroe County Growth Management 2010, “MC_ELU_510”; Monroe County Property Appraiser 2010, “Public Parcel.” NOTE: Slight difference in totals due to rounding. Monroe Comprehensive Plan 2030, Technical Document (Table 2.5).

Table 0.21. Existing land use in incorporated Monroe County (acres)

Existing Land Use	Key Colony Beach	City of Layton	City of Key West	City of Marathon	Village of Islamorada	Total
Commercial	6.6 (3)	4 (16)	301 (6.8)	707 (14.4)	368 (9.7)	1,387
Conservation	8.8 (4)	0 (0)	0 (0)	246 (5)*	1,139 (30)	1,394
Educational	0 (0)	0 (0)	-	-	-	0
Industrial	0 (0)	0 (0)	-	64 (1.3)	133 (3.5)	197
Institutional	2.2 (1)	.15 (.5)	882 (19.9)*	0 (0)	76 (2)*	960
Military	0 (0)	0 (0)	1,622.7 (36.6)	0 (0)	0 (0)	1,622.7
Other Public Utilities and Right of Way	0 (0)	0 (0)	431 (9.7)	-	-	431
Public Buildings and Grounds	32.8 (15)	.15 (.5)	-	-	361 (9.5)	394
Recreational	2.2 (1)	0 (0)	-	-	-	2.2
Residential	144.5 (66)	18.7 (75)	652.8 (14.7)	2,550 (51.9)	1,188 (31.3)	4,554
Vacant or Undeveloped	21.9 (10)	2 (8)	548 (12)	1,346 (27.4)	531 (14)	2,449
Total	219 (100)	25 (100)	4,437.7 (100)	4,912 (100)	3,796	13,390

Percent by land use in parenthesis.

*Total of all categories not specified.

Source: Monroe County Comprehensive Plan 2030, Technical Document (2011).

Functional population projections. Population projections for the “functional population” are also a driver for estimating future land uses. The functional population includes the number of people that are permanent residents plus the amount of seasonal residents in the Florida Keys on a given day. This number varies by season because of the seasonality of visitation patterns. In addition, seasonal visitors are a classification used by the Monroe County Planning Department that ties population with demand for housing as well as for evacuation. Seasonal residents include visitors to Monroe County (including day visitors) and residents that are renting. The “functional” population projections are constrained by all the above noted constraints on growth and development.

The functional population for all of Monroe County (unincorporated and incorporated areas) is important for planning roads, water supply and sewage treatment, and other infrastructure needs. One of the most important uses is for hurricane evacuation, which is a key element constraining growth in Monroe County. Most of the land that can be developed in Monroe County exists in the unincorporated areas, so the population projections are important in assessing the potential for growth in the development of those lands.

From 2015 to 2030, the functional population for all of Monroe County is projected to increase 3.1%, adding an average of 330 people per year (Table 2.22). In the unincorporated areas of the county, the functional population is projected to grow 3.05%, adding on average 146 people per year (Table 2.23).

Table 2.22. Functional population forecast for Monroe County, 2010 to 2030

Year	Permanent¹	Seasonal	Functional
2010	76,887	78,401	155,288
2011	78,080	77,974	156,054
2012	77,960	78,431	156,391
2013	77,840	78,887	156,727
2014	77,720	79,343	157,063
2015	77,600	79,800	157,400
2016	77,460	80,270	157,730
2017	77,320	80,740	158,060
2018	77,180	81,211	158,391
2019	77,040	81,211	158,251
2020	76,900	81,681	158,581
2021	76,760	82,151	158,911
2022	76,620	82,622	159,242
2023	76,480	83,092	159,572
2024	76,340	83,562	159,902
2025	76,200	84,503	160,703
2026	76,060	84,973	161,033
2027	75,920	85,444	161,364
2028	75,780	85,914	161,694
2029	75,640	86,384	162,024
2030	75,500	86,855	162,355

¹ Permanent population is not the same as the resident population of Monroe County. Seasonal population includes residents that rent as well as seasonal visitors.

Source: Monroe County Comprehensive Plan 2030, Technical Document (2011), Table 7

Table 0.22. Functional population forecast for unincorporated Monroe County, 2010 – 2030

Year	Permanent ¹	Seasonal	Functional
2010	35,368	35,440	70,808
2011	35,917	35,249	71,166
2012	35,862	35,453	71,315
2013	35,806	35,658	71,464
2014	35,751	35,862	71,613
2015	35,696	36,067	71,763
2016	35,632	36,277	71,909
2017	35,567	36,488	72,055
2018	35,503	36,698	72,201
2019	35,438	36,909	72,347
2020	35,374	37,120	72,494
2021	35,310	37,330	72,640
2022	35,245	37,541	72,786
2023	35,181	37,752	72,933
2024	36,116	37,962	74,078
2025	35,052	38,173	73,225
2026	34,988	38,384	73,372
2027	34,923	38,594	73,517
2028	34,859	38,805	73,664
2029	34,794	39,016	73,810
2030	34,730	39,226	73,956

¹ Permanent population is not the same as the resident population of Monroe County. Seasonal population includes residents that rent as well as seasonal visitors.

Source: Monroe County Comprehensive Plan 2030, Technical Document (2011), Table 9

Future land uses. In analyzing future land uses, Monroe County uses the ROGO and NROGO allocations, population projections for the functional population, densities measured as dwelling units that are allowed per land use type, and the tier designations that give different points under the ROGO for different types of land use with emphasis on protecting natural areas and special protection areas.

The future land uses for unincorporated Monroe County (Table 2.24) are somewhat different from what was presented in the existing land uses (Table 2.20). Differences exist in land use classifications and some estimates of total amount of acreage by planning areas (e.g., Lower Keys, Middle Keys, and Upper Keys). The differences have to do with the mapping exercise and placing the map data by land use type in a geographic information system (GIS) for analysis. For the Lower Keys, the total acreage increases 11.7 acres, thus raising the total acreage to 47,438.7 for the Lower Keys and to 73,149.6 for all three planning areas. The greatest differences were due to land classification for “conservation.” In the future land use analysis, this category was

divided up across “conservation,” “resident conservation,” and “undesigned.” Residential land use was divided into low, medium, and high-density land for different number of dwelling units that would be allowed in each density category.

Table 0.23. Future land use distribution, Monroe County unincorporated areas

Future land use	Lower Keys	Middle Keys	Upper Keys	Total	Percent of total
Agricultural	18.8	0.0	1.9	20.7	0.0%
Airport district	22.6	0.0	19.7	42.2	0.1%
Conservation	19,591.5	489.1	11,553.9	31,634.6	43.2%
Education	28.5	0.0	32.2	60.6	0.1%
Industrial	415.8	0.0	0.0	415.8	0.6%
Institutional	87.6	0.0	43.5	131.0	0.2%
Military	4,381.2	0.0	0.0	4,381.2	6.0%
Mixed use/commercial	885.4	138.6	1,009.1	2,033.2	2.8%
Mixed use/commercial fishing	113.2	25.3	12.6	151.1	0.2%
Public buildings/grounds	20.2	0.0	26.8	47.1	0.1%
Public facilities	55.7	27.2	57.4	140.3	0.2%
Recreation	526.8	848.3	638.5	2,013.5	2.8%
Residential conservation	12,133.9	266.3	6,189.9	18,590.1	25.4%
Residential low density	2,846.5	23.9	941.0	3,811.4	5.2%
Residential medium density	2,922.1	231.3	2,137.3	5,290.7	7.2%
Residential high density	422.3	41.8	903.0	1,367.0	1.9%
Undesignated	2,966.7	52.4	0.1	3,019.2	4.1%
Total	47,438.7	2,144.1	23,566.8	73,149.6	100.0%
Percentage of total	64.9%	2.9%	32.2%	100.0%	

Source: Monroe County Comprehensive Plan 2030, Technical Document (2011), Table 2.36

Land uses analysis. Monroe County conducted several scenarios of development growth on the unincorporated lands. The analysis uses the concept of theoretical development potential, which is defined as the maximum allocated density and intensity based on Policy 101.4.21 for growth management and the land use designation in the absence of other controlling factors, such as tier designation. Different scenarios are based on different specifications of tiers. Under each scenario the total maximum allowed density (dwelling units), current annual ROGO allocation, and years of growth are provided (Table 2.24).

Under theoretical maximum density for all 73,149 acres in the unincorporated Monroe County, there would be 111,365 dwelling units. With the ROGO at 197 annual units, the span of growth would be 565 years. Applying the NROGO 239 square feet per ROGO unit, the unincorporated area includes 363,634,872.5 square feet, which will allow 7,723 years of growth.

The second part of the analysis is focused on vacant lands and the different specifications of tiers. There are 2,339 acres of vacant land in unincorporated Monroe County. Using the theoretical maximum density and the ROGO of 197 units annually, 52 years of growth can be accommodated. Four scenarios were estimated using the conservative spectrum of one dwelling unit per lot and different specifications of the tiers. For total vacant lots with density of one dwelling unit per lot without specification of tiers, 4,075 dwelling units would be allowed. With the ROGO of 197 annual units, this scenario would accommodate 21 years of growth.

The next set of scenarios included different specifications of tiers, which include classifications of types of lands where development is discouraged by allocating points under the ROGO. The first scenario includes all tiers. It leads to 3,927 dwelling units and with the ROGO at 197 annual units, 21 years of growth. Other scenarios dropped different tiers. Using the functional population projections, it was determined that there was a need of 1,680 dwelling units in Monroe County by 2030, and the scenarios above the conclusion was that there appears to be sufficient land available to accommodate residential and non-residential development to 2030.

Sewer connections. In 1999, the state of Florida passed legislation mandating the entire island chain of the Florida Keys install advanced wastewater treatment systems. The legislation was passed to address the nearshore deteriorating water quality around the Keys. The installation of the advanced wastewater treatment systems eliminates the use of tens of thousands of septic tanks, illegal cesspits, and ineffective small treatment (Figure 2.25).

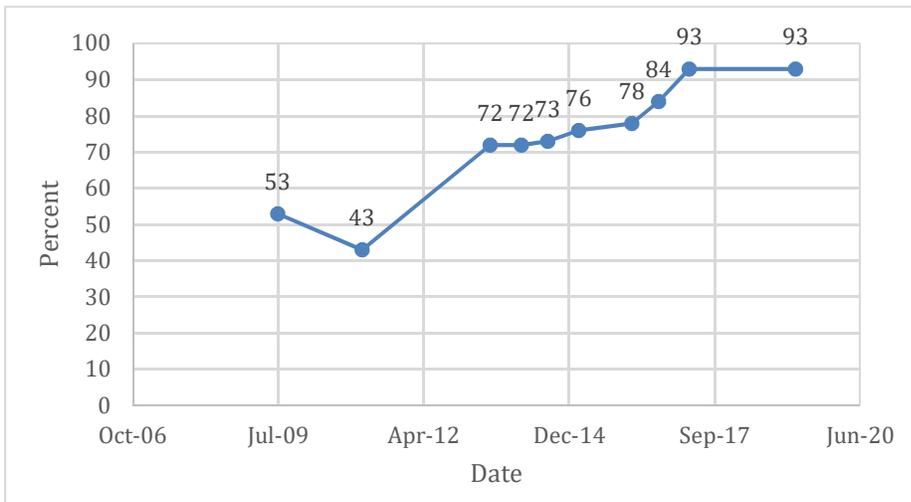


Figure 0.25. Total equivalent dwelling unit connection percentage to sewer in the Florida Keys
 Source: Correspondence with NOAA, IEA, and Florida Keys Aqueduct Authority/Monroe County (2019)

Chapter 3: General regulations

There are two types of general regulations in Florida Keys National Marine Sanctuary: sanctuary-wide and within-in zones.

SANCTUARY-WIDE REGULATIONS

Coral and live rock prohibition update

Alternative 1: No action (status quo). Prohibit coral, live rock aquaculture activities, and require a special use permit from FKNMS for live rock aquaculture

FKNMS current regulations currently prohibit removal of, injury to, or possession of coral or live rock (15 CFR 922.163 (a) (2)). There is an exception to this prohibition for activities permitted under 50 CFR part 622, which are federally permitted live rock aquaculture activities. The Florida Department of Agriculture and Consumer Services also issues permits for live rock aquaculture activities in state waters, though an exception for state-permitted live rock aquaculture is not included in the current regulatory language.

Alternative 2

NOAA is proposing that no change be made the existing live rock prohibition.

Alternative 3 (preferred).

NOAA is proposing that no change be made the existing live rock prohibition. However, recognizing that greater oversight by FKNMS of these activities is needed, NOAA proposes to:

Develop a memorandum of agreement/understanding with the state of Florida and National Marine Fisheries Service for management and permitting of live rock aquaculture activities in the sanctuary.

While this is a programmatic management plan activity, it is included here to provide the reader the full list of proposed alternatives related to live rock aquaculture. For more details of this management plan activity, see Section 3.5 in the Florida Keys National Marine Sanctuary draft environmental impact statement.

Alternative 4 (most environmentally-protective alternative)

NOAA is proposing to update the live rock prohibition to require FKNMS authorization for permitted live rock aquaculture activities:

Require sanctuary authorization for existing and any future live rock aquaculture activities.

With this proposed update, NOAA would require a sanctuary authorization to the existing and any future live rock aquaculture permit holders (as of 2015: state leases [14] and federal permits [14]). Sanctuary authorizations issued to the existing and potential future permit holders could include additional conditions designed to protect sanctuary resources to the greatest extent possible while still allowing compatible aquaculture activities to occur.

Current and future live rock aquaculture operators within the sanctuary would be required to obtain an authorization from ONMS per 15 CFR 922.49 to comply with FKNMS regulations. The proposed regulation update will provide consistency with other types of activities that are prohibited but may be allowed under permit or letter of authorization, including research and restoration actions involving corals, and placement of equipment on the seafloor for aquaculture purposes (e.g., coral nursery structures). In addition, the proposed update will provide FKNMS with greater ability to address activities that might otherwise be contrary to FKNMS goals and objectives, complicate enforcement, and/or lead to illegal poaching of corals. Current federal and state permits apply only limited terms and conditions to live rock aquaculture activities; FKNMS is able to craft specific conditions designed to protect resources to the greatest extent possible while allowing compatible aquaculture activities to occur.

Analysis – Coral and live rock prohibition update

Since the mid-1990s, there have been 18 federally permitted sites within the boundaries of FKNMS. These sites ranged from 0.12 to 1 acre. In addition, from 2009 to 2015, the state licensed between six to eight aquaculture operations in FKNMS. Not all permits are active (i.e., they are neither depositing nor harvesting) every year. From 2009 to 2015, there were between seven and 14 sites that were active (Figure 3.1).

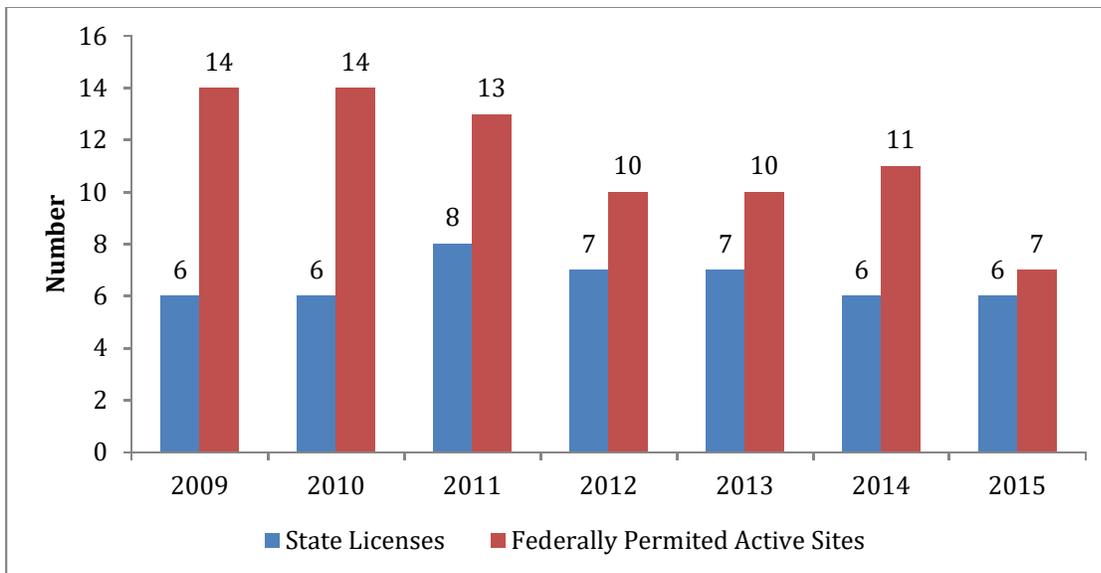


Figure 0.1. Live rock aquaculture state licenses and federally permitted active sites in FKNMS, 2009-2015

Sources: Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute; NOAA Fisheries Southeast Region Office, Regional Aquaculture Coordinator

From 2009 to 2015, the annual average number of pounds harvested of live rock from aquaculture was 25,611, with a value to the harvester of \$36,233. In all but two of these years, 100% of the harvest was landed in Monroe County (Table 3.1).

Table 0.1. Live rock aquaculture harvest from FKNMS, 2009-2015

Year	Pounds	Value (2018\$)	Percent landed in Monroe County ¹
2009	33,853	\$58,792	100.0
2010	25,276	\$23,398	100.0
2011	18,895	\$19,827	100.0
2012	30,917	\$46,357	96.3
2013	36,195	\$53,317	99.2
2014	18,510	\$27,027	100.0
2015	15,629	\$24,912	100.0
2009-2015 average	25,611	\$36,233	99.16

Sources: Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, Trip Ticket Information

¹ In 2012, 400 lbs. valued at \$1,646 was landed in Miami-Dade County. In 2013, 22lbs. worth \$45 was landed in Miami-Dade County and 600 lbs. valued at \$365 was landed in St. Lucie County.

Benefits: The benefits are largely administrative except that enforcement and the avoidance of illegal poaching are a benefit in both the short and long-term to the industry. Alternative 4 has the greatest potential benefits.

Costs: There will be the cost of filling out paperwork for a permit, but these costs should be minimal. Alternative 3 will have the lowest costs.

Net benefits: There should be small net benefits in both the short-term and long-term for all alternatives, but greatest net benefits for Alternative 3 since the five-year phase out of Alternative 4 will have less immediate benefits. Alternative 4 will have the least net benefits and could have significant losses to the several businesses that depend on their live rock aquaculture permits for a significant portion of their businesses.

Discharge regulation exception update

Alternative 1: No action

Existing FKNMS regulations currently prohibit discharging or depositing materials or other matter within the boundary of the sanctuary (15 CFR 922.163(a)(4)). Exceptions include discharging or depositing: (1) fish, fish parts, and bait during traditional fishing operations; (2) vessel cooling water or engine exhaust; and (3) water generated by routine vessel operations (e.g., deck wash and graywater), excluding oily wastes from bilge pumping. In certain protected zones, including ecological reserves, sanctuary preservation areas, and research-only areas, only

discharges from engine exhaust and cooling water are allowed. In 2010, NOAA amended FKNMS regulations to eliminate the exemption for discharges of biodegradable effluent incidental to vessel use and generated by marine sanitation devices approved under the Clean Water Act.

Alternatives 2, 3, and 4

NOAA is proposing an update to the existing exception for discharge of water generated by routine vessel operations to prohibit graywater discharge from cruise ships while inside boundaries of FKNMS.

Prohibit certain discharges from cruise ships.

This proposed update will increase protection of water quality and sanctuary resources from pollutants present in cruise ship gray water. The discharge prohibitions are necessary to protect sanctuary resources and qualities from the effects of pollutants associated with discharges. This proposed update would be effective throughout the entire sanctuary, in both state and federal waters.

In conjunction with this proposed prohibition, a new definition for “cruise ship” would be added to the regulations to clarify the specific applicability of this prohibition.

Cruise ship means a vessel with 250 or more passenger berths for hire.

This proposed modification also applies in alternatives 3 and 4. Alternative 3, which includes this proposed modification, is NOAA’s preferred alternative.

Analysis – Discharge regulation exception update

Benefits: Water quality is fundamental to all water-based recreation-tourism uses in FKNMS, as well as commercial fishing and protection of the quality of the food supplied by this industry. In 2007-8, the recreation-tourism industry included \$2.1 billion in visitor and resident spending, which generated \$2.36 billion in output, \$1.02 billion in income, and 33,622 full- and part-time jobs in Monroe County. Recreation-tourism accounted for 63.3% of the total Monroe County’s economy output (Leeworthy 2010a; Leeworthy 2010b). For the 2009-13 time-frame, the annual average value of landings in 2018 dollars was \$58.8 million, which generated \$85.8 million in output, \$53.2 million in income, and 1,265 full- and part-time jobs (Leeworthy et al. 2019). Thus, protecting the water quality of FKNMS has enormous potential short-term and long-term benefits.

Costs: The costs to the cruise ship industry are minimal to non-existent since they can discharge their graywater once outside sanctuary boundaries.

Net benefits: The potential net benefits are high both in the short-term and long-term.

Shoreline slow speed zone

Alternative 1: No action

Existing sanctuary-wide regulations include regulations specific to operation of vessels that prohibit operating a vessel at a speed greater than 4 knots or in a manner which creates a wake within 100 yards of residential shorelines (§922.163 (a)(50(iii)(D))). This regulation does not apply within officially marked channels.

Alternatives 2 and 3

Alternatives 2 and 3 maintain the existing regulation as described above in Alternative 1. Alternative 3, which includes this proposed modification, is NOAA's preferred alternative.

Alternative 4

To address impacts to shallow water habitats and dependent wildlife including primarily nesting, roosting, and foraging bird species, NOAA proposes to update the sanctuary-wide idle speed/no wake within 100 yards of residential shorelines regulation to be modified to require "slow speed" and apply to all shorelines within the sanctuary.

The proposed updated sanctuary-wide regulation would:

Extend this prohibition to apply to all shorelines within the sanctuary and modify the restriction to slow speed.

In conjunction with this proposed prohibition, a new definition for "slow speed" would be added to the regulations to clarify the specific applicability of this prohibition.

Slow speed means that a vessel must be fully off plane and completely settled into the water. The vessel must then proceed at a speed which is reasonable and prudent under the prevailing circumstances to avoid the creation of an excessive wake or other hazardous condition, which endangers or is likely to endanger other vessels or other persons using the waterway. Due to the different speeds at which vessels of different sizes and configurations may travel while in compliance with this definition, there is no specific numerical speed assigned to slow speed. A vessel that is:

- (a) Operating on plane is not proceeding at this speed;*
- (b) In the process of coming off plane and settling into the water or coming up onto plane is not proceeding at this speed;*
- (c) Operating at a speed that creates an excessive wake or other hazardous condition which unreasonably or unnecessarily endangers other vessels or other persons using the waterway, or is likely to do so, is not proceeding at this speed;*

(d) Completely off plane and which has fully settled into the water and is proceeding at a reasonable and prudent speed with little or no wake is proceeding at this speed.

This definition is informed by and consistent with state of Florida definitions 68C-22.002.

Analysis – Shoreline slow speed reduction

Benefits: The slow speeds close to shore provide boating safety, shoreline erosion protection, avoidance of property damage from reduced wake, lower disturbance to wildlife, and sometimes avoidance of strikes to manatees. Alternatives 2 and 3 do not have increased benefits over alternative 1, since there are no changes. Alternative 4 has increased benefits since the regulation is extended to all shorelines, especially wildlife areas.

Costs: There are no added costs for alternatives 2 and 3, since no changes in current regulations are proposed. Added costs of slowing down are minimal for Alternative 4.

Net Benefits: There are no added net benefits for alternatives 2 and 3 since no changes are proposed. There would be potentially large net benefits for Alternative 4 with the extension to all shorelines, especially in wildlife areas.

Emergency regulations

Alternative 1: No action

Current regulations allow for a temporary regulation in effect for up to 60 days with a one 60-day extension.

Alternative 2, 3, and 4

A temporary regulation to be in effect for up to six months (180 days), with one six month (additional 186 day) extension.

Analysis – Emergency regulations

Benefits: Emergency regulations allow the sanctuary to respond to emergencies and unforeseen impacts to sanctuary resources to prevent or minimize the destruction of, loss of, or injury to a sanctuary resource or the quality of the resources. In the short-term, some activities might be displaced. However, it is expected that there would be short-term benefits in public safety and long-term gains in protection of sanctuary resources to ensure the future flow of benefits.

Costs: Temporary displacement of activities, but in the short-term substitution or re-location of activities will most likely be available and short-term losses minimal. In the long-term, there will be no costs since these are temporary regulations.

Net benefits: Due to both short-term safety and long-term protection of sanctuary resources from loss or injury, net benefits are expected.

Historical resources

Alternative 1: No action

The current permit categories for activities involving historical resources include survey/inventory of historical resources, research/recovery of historical resources, and deaccession/transfer of historical resources. Since implementation of the initial 1997 FKNMS management plan, 61 unique historical resource projects have been granted a survey/inventory or research/recovery of historical resources permit. No deaccession/transfer permits have been applied for or issued. Existing historical resources permit requirements are outlined at §922.166(b), (c), and (d).

Alternatives 2, 3, and 4

Based on 15 years of historical resource management, issuance of dozens of historical resource permits, and evaluation of the efforts of the permittees towards meeting NOAA's stewardship goals, NOAA has determined that the historical resources permitting process needs revision to improve results from this activity and more closely align NOAA permitting regulations with those of the Florida Department of State Division of Historical Resources (DHR). In consideration of the sensitive non-renewable character of historical resources and the shared stewardship responsibilities invested in NOAA and DHR, NOAA is proposing modifications to the historical resources permit categories as follows:

Eliminate the survey/inventory, research/recovery, and deaccession/transfer of historical resources permit categories and replace them with a single archaeological research permit category that is consistent with the standards and procedures implemented by Chapter 1A-32, Florida Administrative Code, for Archaeological Research on State Lands in Florida.

The current FKNMS historical resources permitting system has hampered the protection of these resources and created difficulties for the joint evaluation of permit actions with the DHR. With 60% of the sanctuary lying within state waters, the current FKNMS permit system has effectively reduced the level of resource protection afforded to historical resources in state waters and hampered effective and consistent management of historical resources across the sanctuary. NOAA therefore seeks to reconcile its standards for archaeological research permits by adopting those utilized by DHR, which have been implemented successfully throughout the state since 1975. NOAA believes aligning its permit processes with that of the DHR will improve the quality of historical research projects undertaken in the sanctuary and reporting of same, further aiding NOAA with its conservation mandates and advancing interpretation of sanctuary historical resources to the public.

In conjunction with this proposed prohibition, a new definition for "archaeological research" would be added to the regulations to clarify the specific applicability of this prohibition.

Archaeological research *means scientific study of the physical remains of human activity and its surrounding environmental context utilizing research questions to inform society's understanding of the past.*

This definition is informed by and consistent with Florida's 1A-32 archaeological research permit standards and with the Secretary of the Department of Interior's Standards for Archeological Documentation.

In conjunction with this proposed change, the *Office of National Marine Sanctuaries Instructions for Submitting Applications for National Marine Sanctuary Permits and Authorizations, Appendix G Florida Keys National Marine Sanctuary Archeological Research Permits* will be updated.

In conjunction with this proposed change and DEIS, the *Programmatic Agreement for the Purpose of Historical Resource Management in Florida Keys National Marine Sanctuary* will be updated. The parties to this agreement include NOAA's Florida Keys National Marine Sanctuary and the State of Florida Historical Preservation Office. A draft of the updated programmatic agreement outlines the process NOAA and the state of Florida will coordinate to manage historic resources within the sanctuary including requirements, standards, and procedures for the archaeological research permit.

This proposed modification also applies in alternatives 3 and 4. Alternative 3, which includes this proposed modification, is NOAA's preferred alternative.

Analysis – Historical resources

Benefits: Although an economic valuation study has not been conducted in the Florida Keys on maritime heritage and cultural resources, a study done on the Graveyard of the Atlantic (Mires 2014), which includes Monitor National Marine Sanctuary, found that visitors' willingness to pay for maritime heritage increased with:

- expansion of the number of shipwrecks protected;
- the level of investments in museum exhibits;
- educational workshops on maritime heritage and training in maritime archaeology; and
- maritime heritage trails, including virtual trails using video and mobile phone technology.

The expanded protections offered by improving the research permit process would be expected to yield more of each of the benefits estimated by Mires (2014) for the historical resources in FKNMS. The level of potential benefits are the same for alternatives, 2, 3 and 4.

Costs: The costs should decline with the streamlined and more efficient permit process proposed.

Net benefits: There would be expected high net benefits in both the short-term and long-term for all three alternatives.

Fish feeding regulation

Alternative 1: No action

Existing FKNMS discharge regulations for discharges within the sanctuary boundary do not explicitly or adequately address activities associated with feeding fish, sharks, or other marine life species from vessels or by divers. Existing FKNMS discharge regulations do, however, include an exception of fish, fish parts, chumming materials, or bait used incidental to and only while conducting a traditional fishing activity. (Existing sanctuary-wide discharge regulations and associated exceptions are detailed at §922.163(a)(4)). Existing Florida State Rule 68B-5.005 prohibits divers from engaging in the practice of fish feeding and anyone from operating any vessel for hire for the purpose of carrying passengers to any site in the salt waters of the state to engage in fish feeding or to allow such passengers to observe fish feeding. This regulation does not currently extend into the federal waters of the sanctuary.

Alternatives 2, 3, and 4

Fish feeding is a common practice in the Florida Keys and is conducted at various locations including from shore, from boats, and by divers and snorkelers. Fish feeding is generally conducted in order to attract fish. This practice has resulted in human safety issues and has been shown to alter fish behavior. NOAA is proposing a new regulation to explicitly address fish feeding and its threat to sanctuary resources. This new proposed regulation will clarify prohibitions specific to the practice of fish feeding.

To address the potential impact that the feeding of fish, shark, or other marine species poses for human safety, the environment, and changes in fish behavior, NOAA is proposing the following regulation:

Prohibit the feeding of fish, sharks, or other marine species from any vessel and/or while diving.

The proposed regulation does not affect the existing discharge exemption, which allows discharge of fish, fish parts, chumming materials, or bait used incidental to and only while conducting a traditional fishing activity in the sanctuary.

In conjunction with this proposed requirement, a new definition of “feeding” would be added to the regulations to clarify the specific applicability of this regulation.

Feeding means the offering, giving, or attempting to give any food or other substance to fish, sharks, or other marine species except for the purpose of harvesting such marine species as otherwise allowed by state and federal law.

In conjunction with this proposed requirement, a new definition of “diver” would be added to the regulations to clarify they specific applicability of this regulation. This definition is consistent with Florida State Rule 68B-5.005.

Diver means any person who is wholly or partially submerged in the water and is equipped with a facemask, facemask and snorkel, or underwater breathing apparatus.

For this proposed regulation, the sanctuary’s existing definition for “vessel” will apply.

Vessel means a watercraft of any description, including, but not limited to, motorized and non-motorized watercraft, personal watercraft, airboats, and floatplanes while maneuvering on the water, capable of being used as a means of transportation in/on the waters of the sanctuary.

This proposed modification also applies in alternatives 3 and 4. Alternative 3, which includes this proposed modification, is NOAA’s preferred alternative.

Analysis – Fish feeding regulation

Benefits: Very few diving operations in the Florida Keys conduct this type of activity. Therefore, the benefits are likely to be very small in the short-term and potentially larger in the longer-term, if other dive operations were to start conducting fish feeding to attract business. The dive business is highly competitive and dive operations are always looking for a marketing edge.

Costs: The costs are low in the short-term, and as mentioned above, few operations are known to engage in this practice. However, for the few that do, it could have substantial impacts on their individual businesses. The dive business is a highly competitive and low margin of profit business. The few that are impacted might struggle to stay in business if the market niche that they have carved out for themselves is eliminated. Over the long-term, these costs might be expected to increase as the tourist market grows.

Net benefits: The net benefits are likely to be low in the short-term but potentially larger in the long-term. The costs however are likely to be absorbed by only a few firms that might be significantly impacted.

Vessel groundings, deserted vessels, and abandoned gear regulation

Alternative 1: No action

Currently, removal of grounded, abandoned, or deserted vessels, and the harmful matter aboard such vessels (e.g., motor oil, fishing gear that could cause entanglement) is not specifically required unless a discharge has occurred, there is alteration to the seabed, or there is destruction, loss, or injury to a sanctuary resource. Existing FKNMS regulations also do not include a requirement to provide notice of a grounded vessel.

Alternatives 2, 3, and 4

To address concerns regarding the potential threats to the marine environment from deserted or abandoned vessels, NOAA is proposing regulations to address this threat and provide additional

authority to address derelict vessel debris and associated impacts. The proposed regulation would prohibit the following:

Prohibit deserting a vessel aground, at anchor, or adrift in the sanctuary

This proposed new regulation is consistent with other sanctuary sites and state of Florida rules (Statute 823.11) that prohibit abandoning vessels. When implementing this proposed regulation, NOAA will use the criteria outlined in Florida Statute 327.4107. If an unattended vessel in sanctuary waters meets the state’s vessel at risk criteria, this proposed regulation could be applied.

In conjunction with this proposed prohibition, new definitions for “derelict vessel,” “deserting,” and “abandoning” would be added to the regulations to clarify the specific applicability of this prohibition.

As per Florida Statutes 823.11:

Derelict vessel means a vessel (as defined in s. 327.02) that is left, stored, or abandoned: (1) in a wrecked, junked, or substantially dismantled condition upon any waters of the sanctuary; (2) at a port within the sanctuary boundary without the consent of the agency having jurisdiction thereof; or (3) docked, grounded, or beached upon the property of another without the consent of the owner of the property.

As per ONMS system-wide definitions:

Deserting means leaving a vessel aground, adrift, wrecked, junked, or in substantially dismantled condition without notification to the Director of the vessel going aground or becoming adrift, wrecked, junked, or substantially dismantled within 24 hours of its discovery and developing and presenting to the Director a preliminary salvage plan within 72 hours of such notification, after expressing or otherwise manifesting intention not to undertake or to cease salvage efforts, or when the owner/operator cannot after reasonable efforts by the Director be reached within 24 hours of the vessel’s condition being reported to authorities; or leaving a vessel at anchor when its condition creates potential for a grounding, discharge, or deposit and the owner/operator fails to secure the vessel in a timely manner.

Abandoning means all tangible personal property that does not have an identifiable owner and that has been disposed on public property in a wrecked, inoperative, or partially dismantled condition or has no apparent intrinsic value to the rightful owner; leaving without intent to remove any structure, material, or other matter on or in the seabed or submerged lands of a sanctuary.

In conjunction with this proposed prohibition, a new definition of “deserting” would be added to the regulations to clarify the specific applicability of this prohibition.

Deserting means leaving a vessel aground or adrift without notification to the Director of the vessel going aground or becoming adrift within 12 hours of its discovery and developing and presenting to the Director a preliminary salvage plan within 24 hours of such notification, after expressing or otherwise manifesting intention not to undertake or to cease salvage efforts, or when the owner/operator cannot after reasonable efforts by the Director be reached within 12 hours of the vessel's condition being reported to authorities; or leaving a vessel at anchor when its condition creates potential for a grounding, discharge, or deposit and the owner/operator fails to secure the vessel in a timely manner.

Once a vessel is grounded, there is a high risk of discharge of harmful matter in the marine environment. Currently, removal of harmful substances (e.g., motor oil, gear that could cause entanglement) is not specifically required unless a discharge has occurred. Therefore, NOAA is proposing an additional regulation that would establish the following prohibition:

Prohibit leaving harmful matter aboard a grounded, deserted, or abandoned vessel in the sanctuary.

In conjunction with this proposed requirement, a new definition of “harmful matter” would be added to the regulations to clarify the specific applicability of this requirement.

Harmful matter means any substance or combination of substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may pose a present or potential threat to FKNMS resources or qualities.

These substances include fishing nets, fishing line, hooks, fuel, oil, and those contaminants (regardless of quantity) listed pursuant to 42 USC 101(14) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) at 40 CFR 302.4.

To enhance agency response time to vessel grounding incidents and potential threats to the marine environment, NOAA is proposing a regulation requiring the notification of vessel groundings:

Require notification of grounding incident by vessel operator/owner within 24 hours of incident and removal of vessel within 72 hours of incident.

Adding this proposed new regulation would provide additional authority to address derelict vessel debris and associated impacts. This proposed regulation is consistent with Florida Statute 403.93345 Coral Reef Protection.

These new prohibitions and requirements would help reduce or avoid harm to FKNMS resources from derelict vessels because of direct impact of the settling or colliding of a vessel on habitats and potential leakage of hazardous or harmful matter from a vessel. NOAA would have the authority to enforce removal of deserted vessels to prevent potential groundings, collisions, or hazardous fuel leaks that could harm FKNMS resources. Under existing regulations, vessel owners can be held liable for groundings and associated fuel spills that violate seabed disturbance or discharge regulations. The main purpose of the proposed regulations is to make enforcement easier and to require vessel owners to take care of deserted vessels before they become grounded and cause damage.

Analysis – Vessel groundings, deserted vessels, and abandoning gear regulation

Benefits: The potential for harm to sanctuary resources from derelict and/or abandoned vessels is very high. There have been multiple groundings in the Florida Keys, which led to the creation of FKNMS. Damage assessments and restorations due to vessel groundings have been in the multiple millions of dollars. These additional regulations will further minimize future damage to resources and protect a multi-billion-dollar economy dependent on the sanctuary’s resources. There will be potential for both substantial short and long-term benefits from these protections.

Costs: The cumulative costs to industry or individuals is minimal compared to their liability if the derelict or abandoned vessel damages sanctuary resources and damage assessment cases are brought to recover damages from responsible parties and to pay for restoration of the damaged resources.

Net benefits: The potential for high net benefits exist in both the short and long-term from this set of regulations.

WITHIN-ZONE REGULATIONS

Large vessel mooring buoy regulation

Alternative 1 (no action)

Mooring buoys serve as an important management tool in FKNMS, allowing boaters to visit and use sanctuary resources without damaging coral reef and other important ecosystems. Current marker- and mooring buoy-associated restrictions include a prohibition on damaging or removing markers, including mooring buoys. However, mooring buoy use by large vessels has been shown to damage the mooring buoy anchoring hardware and in some cases the substrate in which the hardware is secured.

Alternative 2, 3, and 4

NOAA is proposing a new regulation that would provide authority to address damages from large vessel use of mooring buoy systems.

Prohibit large vessels over 65' length overall from using small mooring buoys. Require vessels under 65' length overall to use small designated FKNMS mooring buoys.

This proposed regulation would also apply to vessels rafting up to one another on a single mooring buoy if their combined length is equal to or greater than 65' length overall. In conjunction with this prohibition, NOAA would designate specific "large vessel only" mooring buoys in areas frequented by large vessels, which will facilitate compliance with this proposed new regulation and ensure mooring buoy availability for smaller vessels. NOAA will work with various user groups to ensure that an adequate number of large vessel mooring buoys are available and sited at appropriate locations.

Analysis – Large vessel mooring buoy regulation

Benefits: The benefits include the avoidance of mooring buoy repair costs and the damage to hardbottom and surrounding habitat caused by large vessels pulling mooring buoys loose. Large vessel owners would also benefit by avoidance of fines for damaging the natural environment.

Costs: The costs include the additional costs of supplying enough mooring buoys to accommodate existing and future uses by large vessels or rafting of vessels that would be the equivalent of a large vessel.

Net benefits: It is expected there will be both short-term and long-term net benefits for this regulatory alternative.

Prohibition of catch and release fishing by trolling in four sanctuary preservation areas

Alternative 1: No action

Existing FKNMS regulations detailed at §922.167(d)(1)(iii) include an exception for catch and release fishing by trolling in four sanctuary preservation areas: Conch Reef, Alligator Reef, Sombrero Reef, and Sand Key.

Alternatives 2, 3, and 4

To address concerns regarding potential threats to sanctuary resources, human safety, and conflict of use, NOAA is proposing the following update to existing sanctuary preservation area regulations:

Prohibit catch and release fishing by trolling in the Conch Reef, Alligator Reef, Sombrero Reef, and Sand Key sanctuary preservation areas.

Updating this regulation will also meet the need as outlined in Chapter 2 to simplify and, where possible, make consistent the specific marine zone regulations and access restrictions within each zone type. With this proposed update, regulations and access restrictions would be consistent

across all sanctuary preservation areas. This prohibition on catch and release fishing by trolling would be applied in any new proposed sanctuary preservation area.

This proposed modification also applies in alternatives 3 and 4. Alternative 3, which includes this proposed modification, is NOAA's preferred alternative.

Analysis – Prohibition of catch and release fishing by trolling in four sanctuary preservation areas

Benefits: The main benefit of sanctuary preservation areas has been the reduction in conflicts between fishing and other consumptive activities with non-consumptive activities such as snorkeling and scuba diving (Shivlani et al. 2008). This regulatory alternative has both short-term and long-term benefits to non-consumptive user groups.

Costs: The fishers who are trolling would potentially suffer both short-term and long-term costs from displacement. However, there are abundant places available to relocate this activity and therefore the likelihood of either short-term or long-term costs is very low.

Net benefits: It is expected that there will be both short-term and long-term net benefits for this regulatory alternative.

Baitfish permit phase-out alternative

Alternative 1: No action

The issuance of permits for limited bait fishing in sanctuary preservation areas has been implemented by FKNMS since the initial 1997 management plan. Since that time, permits have been issued as follows: cast net permits are issued for and valid in all sanctuary preservation areas and are issued by calendar year; hair-hook permits are valid in only Davis, Conch, and Alligator sanctuary preservation areas and are issued for October 15 through April 15, and fishing is allowed only from 5:00 a.m. until 10:00 a.m.

Alternatives 2, 3, and 4

NOAA is proposing the following update to existing regulations:

Eliminate the practice of issuing permits to allow capture of baitfish from within sanctuary preservation areas by any gear type (a three-year phase-out).

The practice of issuing baitfish permits will be phased out over a three-year period. During this time, only individuals who have historically held baitfish permits will be issued any further permits. Baitfish permit data from 2015 will be used to determine those eligible for permits in the three-year phase out period.

Historical permit issuance compliance

Over the years (1997-2014), there have been 2,711 baitfish permits issued. The vast majority – about 96% each year – of permits are issued to cast net fishermen. From the total number of permits issued, the sanctuary has received the required reporting on about two-thirds of them, representing 409 individuals out of the total of 745 permittees. The level of reporting non-compliance has generally been decreasing, but it has varied considerably from a maximum of 58% in 1997/98 and 56% in 2003 to a low of 17% in both 2012 and 2013 (figures 3.2 and 3.3).

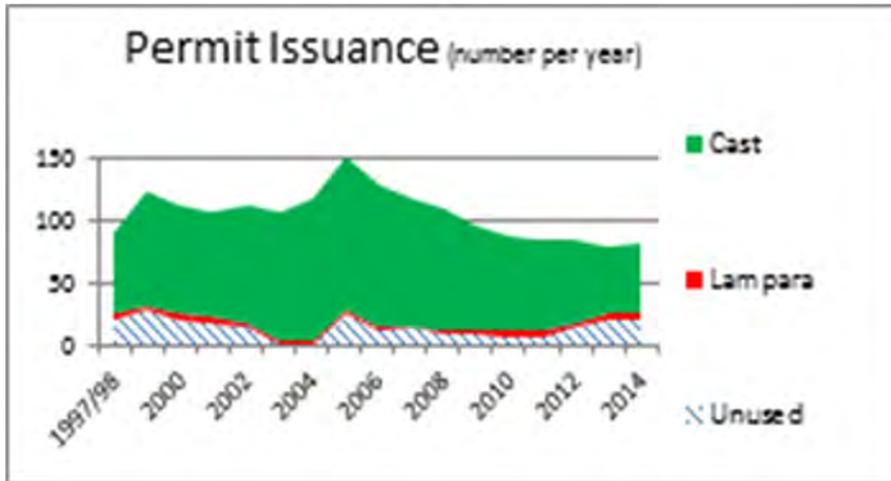


Figure 0.2. Number of bait fishing permit issued by gear type, 1997/98-2014

Source: FKNMS Baitfish Permit Database

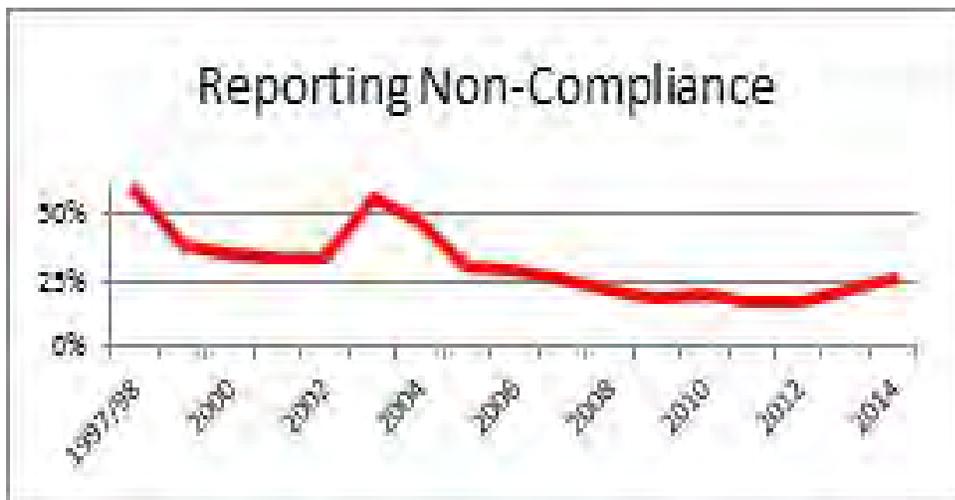


Figure 0.3. Rate of non-compliance with bait fishing permits, 1997-2014

Source: FKNMS Baitfish Permit Database

Among the 409 individuals in reporting compliance, there is an average of 4.4 permits issued per person with a maximum of 17 (every year). About a fourth of these individuals reported never having used their permits (including one individual who received 15 permits from 1997 to 2014), while 44% used their permit every time. Single permits were issued and used by 70 individuals

(17%), while single permits were issued and unused by 65 individuals (16%). Conversely, people who received a higher number of permits generally, but not always, used them every time: of the individuals receiving 10 or more permits (65 or 16% of the total number of individuals), 80% used their permit more than half of the time and only 2 never used their permits at all (Figure 3.4).

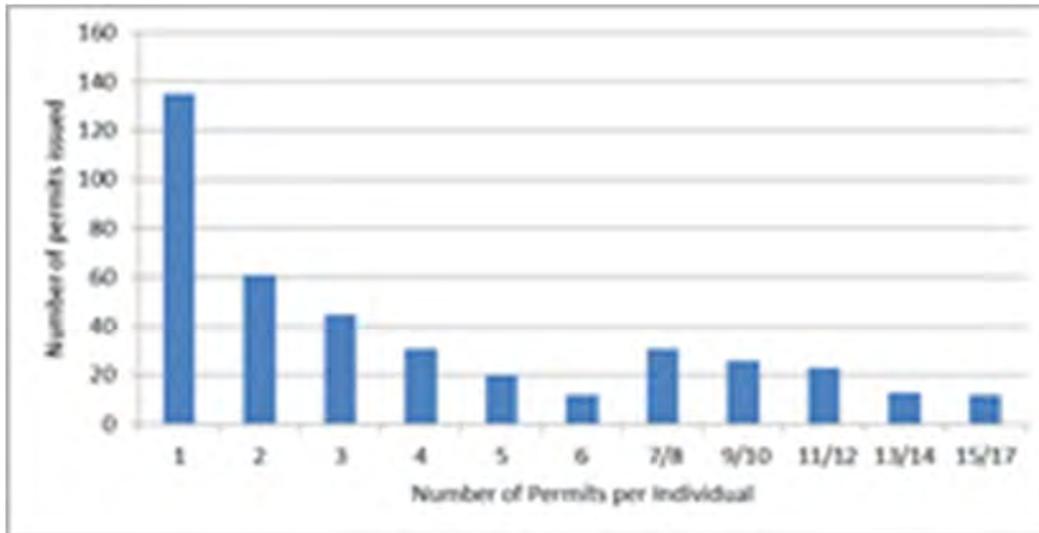


Figure 0.4. Average annual number of bait fishing permits per individual, 1997-2014

Source: FKNMS Baitfish Permit Database

The total number of reports includes about 544 reports of permits being unused (30% of issued permits reporting). Of these, 40% do not list which type of gear they had intended to use. For many of the others, the type of fisherman can be inferred, and in nearly all of these cases, they were issued to cast net fishermen. There are only three reported instances (from one family) of lampara permits that were unused in any given year.

From those in compliance with reporting requirements, there have been 1,187 reports of catch from 291 cast net fishermen and 56 reports from 17 lampara fishermen (plus reports from one non-commercial fisherman who uses both types). [These numbers should be taken as relative, since there are inconsistencies, such as reports of catch by people not holding permits in a given year; these anomalies, though, amount to about 2/10ths of 1% of the total number of reports.] All of the following reported statistics are based on the number of permittees who were in compliance for reporting requirements, not the total number of permits issued.

Socioeconomic impact analysis

For purposes of socioeconomic impact analysis, a five-year average of 2010 to 2014 for bait fishing is used. For recreation-tourism benefits, a lower bound set of estimates is generated using estimates of recreation-tourist uses from the 2007-08 study (Leeworthy et al. 2010; Leeworthy and Morris 2010); the economic models of the Monroe County economy (Leeworthy 2010;

Leeworthy and Morris 2010); the non-market economic values per person-day from Johns et al. (2003); and the lower bound assumption for baseline use that only 1% of the scuba diving and snorkeling is potentially impacted with a quality change of 5% and unit elasticity for use and value (i.e., for a 5% change in quality there is a 5% change in use and corresponding change in economic contribution to the local economy and the non-market economic values of the use).

Bait fishing. From 2010 to 2014, the five-year annual average number of permits issues was 104 for cast nets, 3.4 for lampara nets, and 17.8 for hair hook for a total of 125.5. Cast net permits made up 83% of the total permits, 2.7% were for lampara nets, and 14.19% for hair hooks. About 25% (31.4) permits were not used (Table 3.2).

Table 0.2. Number of baitfish permits for sanctuary preservation areas, 2010-2014

Year	Cast net	% Cast net	Lampara net	% Lampara net	Hair hook	% Hair hook	Total	Number not used	% not used
2010	109	81.34	4	2.99	21	15.67	134	28	20.90
2011	99	81.15	4	3.28	19	15.57	122	21	17.21
2012	102	85.71	3	2.52	14	11.76	119	35	29.41
2013	101	82.79	3	2.46	18	14.75	122	37	30.33
2014	110	84.62	3	2.31	17	13.08	130	36	27.69
5-year average	104.2	83.09	3.4	2.71	17.8	14.19	125.4	31.4	25.04

Source: FKNMS Baitfish Permit Database

Catch was reported for cast net and lampara nets sometimes in number of fish and sometimes in pounds of fish. Number of fish was divided by 11 to get pounds of fish and pounds of fish were multiplied by 11 to get number of fish to derive total catch both in terms of number of fish and pounds of fish. The five-year annual averages were 13,401 fish for cast nets and 553,048 for lampara nets for a total of 566,449 fish. This translates into an estimated number of pounds of fish of 1,218 for cast nets, and 50,277 for lampara nets, totaling 51,495 pounds (Table 3.3). Although cast net permit holders made up 83% of the permit holders, they only caught 2.3% of the catch. Lampara net permit holders made up only 2.71% of the permit holders but caught 97.7% of the catch.

Table 0.3. Baitfish and ballyhoo from sanctuary preservation areas by permit, 2010-2014

Year	Number of fish, cast net	Number of fish, lampara	Total number of fish	Pounds, cast net	Pounds, lampara	Total pounds
2010	16,489	524,205	540,694	1,499	47,655	49,154
2011	18,665	87,358	106,023	1,697	7,942	9,638
2012	11,413	559,995	571,408	1,038	50,909	51,946
2013	12,777	568,480	581,257	1,162	51,680	52,842
2014	7,659	1,025,202	1,032,861	696	93,200	93,896
5-year average	13,401	553,048	566,449	1,218	50,277	51,495

Source: FKNMS Baitfish Permit Database

Dependency on the sanctuary preservation areas for baitfish was estimated in terms of days of effort and catch inside the sanctuary preservation areas versus outside the sanctuary preservation areas. Cast net permit holders had a five-year annual average of 255.2 days in the sanctuary preservation areas and 253.8 days outside the sanctuary preservation areas, with 50% of their total bait fishing days in the sanctuary preservation areas. For catch, cast net permit holders caught 49.44% of their catch in the sanctuary preservation areas (Table 3.4). Lampara net permit holders were much more dependent for their catch and effort in the sanctuary preservation areas. Lampara net permit holders spent 88.4% of their effort and caught almost 100% of their catch from the sanctuary preservation areas (Table 3.5).

Table 0.4. Sanctuary preservation area (SPA) cast net baitfish permit holders' dependency on SPAs: Catch and effort, 2010-2014

Year	Days in SPAs	Days out of SPAs	Total days bait fishing	% of days in SPAs	Catch in SPAs	Catch out of SPAs	Total catch bait fishing	% of catch in SPAs
2010	303	274	577	52.51	16,469	15,653	32,122	51.27
2011	308	324	632	48.73	18,665	21,848	40,513	46.07
2012	250	233	483	51.76	11,413	11,309	22,722	50.23
2013	190	214	404	47.03	12,777	11,302	24,079	53.06
2014	225	224	449	50.11	7,659	8,397	16,056	47.70
5-year average	255.2	253.8	509	50.14	13,396.6	13,701.8	27,098	49.44

Source: FKNMS Baitfish Permit Database

Table 0.5. Sanctuary preservation area (SPA) lampara net baitfish permit holders' dependency on SPAs catch and effort, 2010-2014

Year	Days in SPAs	Days out of SPAs	Total days bait fishing	% of days in SPAs	Catch in SPAs	Catch out of SPAs	Total catch bait fishing	% of catch in SPAs
2010	23	2	25	92.00	524,205	66	524,271	99.99
2011	22	5	27	81.48	87,358	7	87,365	99.99
2012	22	3	25	88.00	559,955	44	559,999	99.99
2013	15	0	15	100.00	568,480	0	568,480	100.00
2014	17	3	20	85.00	1,025,202	2006	1,027,208	99.80
5-year average	19.8	2.6	22.4	88.39	553,040	424.6	553,465	99.92

Source: FKNMS Baitfish Permit Database

To put sanctuary preservation area permit holder catch into perspective, the total commercial fishing catch for baitfish and ballyhoo was compiled for catch from FKNMS and catch landed in Monroe County. For catch from FKNMS, the five-year annual average was 299,263 pounds worth \$239,518 to the fishermen (Table 3.6). The lampara net sanctuary preservation area baitfish permit holders' catch in the sanctuary preservation areas accounted for 16.8% of this catch. The amount of baitfish and ballyhoo landed in Monroe County is much greater than that caught in FKNMS. This is due the large recreational fishing sector in the Florida Keys. The five-year average of baitfish and ballyhoo landed in Monroe County was 876,489 pounds worth \$637,513 to the fishermen (Table 3.7).

Table 0.6. Baitfish and ballyhoo commercial catch in FKNMS, 2010-2014 (2018\$)

Year	Baitfish pounds	Ballyhoo pounds	Total pounds	Baitfish value (2018\$)	Ballyhoo value (2018\$)	Total value (2018\$)
2010	5,673	409,812	415,485	\$9,824	\$296,428	\$306,252
2011	18,462	390,181	408,643	\$10,075	\$279,751	\$289,827
2012	9,138	199,751	208,889	\$9,006	\$165,056	\$174,062
2013	4,604	282,985	287,589	\$6,944	\$258,092	\$265,036
2014	9,778	165,931	175,709	\$15,127	\$147,288	\$162,414
5-year average	9,531	289,732	299,263	\$10,195	\$229,323	\$239,518

Source: Florida Fish and Wildlife Research Institute
<https://public.myfwc.com/FWRI/PFDM/ReportCreator.aspx>.

Table 0.7. Baitfish and ballyhoo commercial landings in Monroe County, 2010-2014 (2018\$)

Year	Bait fish pounds	Ballyhoo pounds	Total pounds	Baitfish value (2018\$)	Ballyhoo value (2018\$)	Total value (2018\$)
2010	19,905	868,148	888,053	\$15,464	\$666,537	\$682,001
2011	59,614	920,338	979,952	\$22,140	\$636,154	\$658,294
2012	23,738	785,095	808,833	\$16,384	\$471,757	\$488,141
2013	16,469	909,469	925,938	\$13,234	\$699,607	\$712,841
2014	22,418	757,250	779,668	\$23,458	\$622,828	\$646,286
5-year average	28,429	848,060	876,489	\$18,136	\$619,376	\$637,513

Source: Florida Fish and Wildlife Research Institute
<https://public.myfwc.com/FWRI/PFDM/ReportCreator.aspx>.

Assuming that those who have permits for catching baitfish in sanctuary preservation areas that are displaced by the prohibition must purchase bait to replace lost catch, it is estimated that the average annual loss at “maximum potential loss” (i.e., they cannot replace the lost catch by catching bait outside the sanctuary preservation areas) is between \$16,746 (13,396.6 fish divided by 12 * \$15, 12-pack frozen ballyhoo) with an average loss per permit holder of \$161 per year and \$26,793 (13,396.6 fish * \$2 per fish) with an average loss per permit holder of \$257.62 for cast net permit holders. The cost to lampara net permit holders will be \$42,356 (50,276 pounds of fish * \$0.84, the average price per pound of ballyhoo) with an average loss of \$12,458 per permit holder (Florida Fish and Wildlife Research Institute).

Benefits to recreation-tourism and reduction in administrative costs

Consistent regulations in the sanctuary preservation areas, i.e., no-take areas, could potentially lower enforcement costs. Consistent regulations could also help to resolve any potential user conflicts with non-consumptive recreation users, thereby enhancing the value of the non-consumptive recreation experience. There is also the benefit of eliminating the bait fishing permit system with a reduction in administrative costs of the regulation.

Using lower bound estimates of potential benefits, 17.96 thousand person-days of scuba diving and snorkeling activity by both residents and visitors to FKNMS would be annually impacted. This would result in an increase in spending of about \$2.82 million with an associated impact on the Monroe County economy (including multiplier impacts) of \$3.16 million in output and about \$1.4 million in income and about 41 full and part-time jobs (Table 3.8). In addition, this change in use would also result in increases in non-market economic value (consumers’ surplus) of about \$28.5 million per year (Table 3.9).

Further, an estimated \$2,400 to \$2,800 (2018\$) would be saved annually in administrative costs by eliminating the bait fishing permits by FKNMS.

Table 0.8. Benefits to scuba divers and snorkelers from bait fishing prohibition in sanctuary preservation areas: Annual economic contribution to Monroe County (thousands 2018\$)

Measurement	Residents	Visitors	Total
Person-days ¹	3.96	14.00	17.96
Change ²			
Spending ³	\$466.85	\$2,357.86	\$2,824.72
Output ³	\$522.87	\$2,640.80	\$3,163.67
Income ³	\$195.35	\$1,167.20	\$1,362.56
Employment (full- and part-time jobs) ³	6	35	41

¹ Assumption is 1% of use estimated in 2007-08 for scuba diving and snorkeling in FKNMS is impacted by prohibition of bait fishing in the sanctuary preservation areas.

² Scenario for change is for a 5% change in quality assuming a value elasticity of 1.0 or for a 5% change in quality of a 5% change in use.

³ Economic model for Monroe County recreation-tourist uses from Leeworthy (2010); Leeworthy and Morris (2010) updated using wages-to-employment ratios by industry from the 2014 County Business Patterns. All dollar values converted to 2018 dollars using the Consumer Price Index.

Table 0.9. Benefits to scuba divers and snorkelers of bait fishing prohibition in sanctuary preservation areas: Annual non-market economic value (2018\$)

Type of user/activity	Person-days of use (thousands) ¹	Economic Value Per Person-Day ²	Total value of use in (thousands of 2018\$)	Change in value of use for 5% in quality (thousands of 2018\$) ³
<i>Residents</i>				
Scuba diving	1.039	\$18.05	\$18.75	0.938
Snorkelers	2.933	\$12.16	\$35.67	1.784
Total	3.962		\$54.43	2.721
<i>Visitors</i>				
Scuba diving	3.97	\$30.14	\$119.65	\$5.98
Snorkelers	10.03	\$39.49	\$396.08	\$19.80
Total	14.00		\$515.72	\$25.79
<i>All</i>				
Scuba diving	5.00		\$138.40	\$6.92
Snorkelers	12.96		\$431.75	\$21.59
Total	17.96		\$570.15	\$28.51

¹ Assumption is 1% of use estimated in 2007-08 for scuba diving and snorkeling in FKNMS is impacted by prohibition of bait fishing in the sanctuary preservation areas.

² From Johns et al. (2003) for natural reef use inflated to 2018 dollars using the consumer's price index.

³ Scenario is for a 5% change in quality assuming a value elasticity of 1.0 or for a 5% change in quality a 5% change in value.

Costs. Fishermen catching their own bait might have either to buy their bait or catch their bait outside the sanctuary preservation areas. If they have to pay for bait, the cost could be between

\$16,746 and \$26,793 for all cast net permit holders per year or between \$161 and \$258 per permit holder annually. If they are able to pass on the costs to customers, then there are no lost profits, but the losses transfer to customers in the form of non-market economic value (consumers' surplus). If they are able to catch their bait outside the sanctuary preservation areas (they currently catch about 50% of their baitfish outside the sanctuary preservation areas), there would be no losses. The change in quantity in catch is not great enough to impact prices, so there is no change in consumers' surplus to those purchasing baitfish. There are only potential of lost profits to the charter/guide operations or to customers of the operations in the form of consumers' surplus depending on to what extent operators pass on the costs of baitfish to their customers.

Net benefits. Given the value of non-consumptive recreation uses, primarily scuba diving and snorkeling, the enhanced value of the recreation experience is expected to more than offset the potential costs to baitfish permit holders and there would be net benefits from this regulatory alternative. The increases in income to residents of Monroe County would more than offset the potential losses even assuming maximum potential loss for bait fishing and a lower bound estimate on benefits to recreation-tourism. In addition, the potential increases in net economic value (consumers' surplus) to scuba divers and snorkelers are expected to generate net benefits of eliminating bait fishing in the sanctuary preservation areas.

Tortugas North Ecological Reserve access permits

Alternative 1: No action

Existing FKNMS regulations detailed at §922.167(1)(viii) require permits to access the Tortugas Ecological Reserve North for any activity other than for passage without interruption through the reserve, for law enforcement purposes, or for purposes of monitoring. The current permit process as detailed at §922.167 requires request of a Tortugas North Ecological Reserve access permit at least 72 hours, but no longer than one month, before the desired effective date of the permit. In addition, current regulations require notification of no less than 30 minutes and no more than six hours upon entering or leaving the reserve and include a two-week maximum permit duration.

Alternatives 2, 3, and 4

Tortugas North Ecological Reserve remains an important sanctuary marine zone for continued protection, management, and controlled access through issuance of access permits. Over a four-year period (2012-2015), FKNMS has issued a total of 143 Tortugas Ecological Reserve North access permits, with an average of 36 per year. The average time spent in the reserve is seven days and activities conducted while in the reserve generally include diving and snorkeling with one or two research missions per year.

Based on 15 years of management and issuance of access permits, NOAA is proposing minor modifications to the regulations for Tortugas North Ecological Reserve access permits. While still requiring access permits, updated regulations will:

Remove the current requirement for requesting access permits to Tortugas Ecological Reserve North no longer than one month before the date of the permit.

Remove the requirement to notify FKNMS before entering and upon leaving Tortugas Ecological Reserve North.

FKNMS recognizes the advance planning needed for commercial operators. Based on the level and type of activity in the Tortugas North Ecological Reserve, these permit request time restriction requirements are not deemed necessary. Access permits will still be required for access to the Tortugas North Ecological Reserve as they serve a valuable purpose in tracking activity and informing enforcement personnel of the vessels approved for operation within the reserve.

This proposed modification also applies in alternatives 3 and 4. Alternative 3, which includes this proposed modification, is NOAA's preferred alternative.

Analysis - Tortugas North Ecological Reserve access permits

Benefits. The benefits are relatively minor. The proposed change would make the permit process less burdensome, which might lead to expanded economic opportunities for diving operations or private households that want to bring their boats to Tortugas North for diving. The benefits are the same for alternatives 2, 3 and 4.

Costs: There is a minor reduction in costs in dropping the timing limitations for requesting permits. The impact is the same for alternatives 2, 3, and 4.

Net benefits: With benefits increasing slightly and costs declining slightly, there are small net benefits for alternatives 2, 3, and 4.

Chapter 4: Spatial regulations

Description of alternatives

For the spatial regulations, there are four alternatives: the “no action alternative” (Alternative 1) and three alternatives offering more protection. As the alternative numbers increase, the amount of protection increases. All boundary expansions, except that of the areas to be avoided and Pulley Ridge, are included in the analysis in this chapter. The Tortugas region boundary expansions are included in this chapter. Chapter 5 addresses boundary expansion of the areas to be avoided and Pulley Ridge under alternatives 2, 3, and 4. For definitions of the different types of marine zones, see Appendix F.

Alternative 1: No action

No changes to existing regulations.

Alternative 2

Alternative 2 provides additional targeted protections to areas with demonstrated natural resource impacts (e.g., vessel prop scarring) and with sensitive habitats and wildlife, while also placing greater emphasis on allowing sustainable public use than alternatives 3 and 4. Alternative 2 is specifically designed to minimize conflicting and heavy concentrations of use while still allowing a relatively high level of overall use. This alternative maintains many of the marine zones in the no action alternative and adds 35 marine zones to provide additional, targeted site-specific protection where resource damage is evident. In these new zones, Alternative 2 implements the least restrictive regulations to meet the resource protection goals set by the Sanctuary Advisory Council and the Florida Keys National Marine Sanctuary and Protection Act (FKNMSPA).

This alternative incorporates most of the spatial and regulatory recommendations from the advisory council and its working groups (shallow water wildlife and habitat protection and ecosystem protection working groups). In addition, as the shallow water wildlife and habitat protection working group recommended several regulatory options for each zone, ONMS staff incorporated these across alternatives 2, 3, and 4. The shallow water wildlife and habitat protection working group recommendations included in alternative 2 are those allowing a greater level of public access and use. Alternatives 3 and 4 include the more restrictive options that the working group recommended.

Specifically, Alternative 2 adds 35 zones, 31 wildlife management areas, two sanctuary preservation areas, and two conservation areas compared to the no action alternative (Table 4.1). Conservation area is a new proposed zone type that would include both the existing ecological reserves and special use areas as one zone type.

For marine zoning, this alternative expands the total number of different zones from 57 areas in Alternative 1 (no action) to 92. There are 59 wildlife management areas, 25 sanctuary preservation areas, and eight conservation areas. Although there is a significant increase in the total number of areas (zones), the amount of added protection in terms of habitat is only an additional 9.29% (Table 4.1). This percentage of additional habitat protection is important because it is used to scale the potential benefits to non-consumptive recreation for areas (zones) that displace consumptive users (e.g., special use research only areas and ecological reserves). Special use research only areas displace all users and are labelled as “restoration and research only.” Therefore, there are no benefits for these areas to non-consumptive users, but may have “potential” benefits for those who have nonuse of passive economic use value (to be defined and estimated below) and scientific value.

Alternative 3 (preferred)

The regulations in Alternative 3 place a greater emphasis on resource protection over allowing a high level of use. Alternative 3 proposes to maintain many of the marine zones in the no action alternative and adds the same total number of marine zones as Alternative 2, but with a different mix of zone types and larger area. Alternative 3 provides additional, targeted site-specific protection where resource damage is evident. Again, as in Alternative 2, this alternative incorporates most of the spatial and regulatory recommendations from the advisory council and its working groups.

Specifically, Alternative 3 adds 35 zones, 32 wildlife management areas (one more than Alternative 2), and three sanctuary preservation areas (one more than Alternative 2). In total, this alternative expands the total number of different zones from 57 areas in Alternative 1 (no action) to 92. There are 60 wildlife management areas, 26 sanctuary preservation areas, and six conservation areas. Although there is a significant increase in the total number of areas (zones), the amount of added protection in terms of habitat is only an additional 10.45% (Table 4.1). This percentage of additional habitat protection in zones is important because it is used to scale the potential benefits to non-consumptive recreation for areas (zones) that displace consumptive users (e.g., special use research only areas and ecological reserves), which is significant. Special use research only areas displace all users and are labelled as “restoration and research only.” Therefore, there are no benefits for these areas to non-consumptive users, but may have potential benefits for those who have nonuse of passive economic use value (to be defined and estimated below) and scientific value.

Alternative 4

Alternative 4 is primarily designed to protect large contiguous habitats. This alternative strives to meet a balance between protections of targeted site-specific locations where resource damage is evident while also providing protection of the largest area of contiguous habitats compared to the other alternatives proposed. To do this, some marine zones are combined and larger zones are included in each of the five geographic regions (Upper Keys, Middle Keys, Lower Keys,

Marquesas, and Tortugas). This approach aims to meet Goal 2 of the advisory council regulatory and zoning alternatives development work-plan: *Protect large, contiguous, diverse, and interconnected habitats that provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life and protect and preserve all habitats and species.* The marine-zone-specific regulations and access restrictions would be more restrictive in Alternative 4 than in any of the other proposed alternatives. Like alternatives 2 and 3, this alternative incorporates most of the spatial and regulatory recommendations from the advisory council and its working groups (shallow water wildlife and habitat protection and ecosystem protection working groups). However, this alternative includes the greatest conservation protection measures and most restrictive access recommendations over all the other three alternatives. Some of the zones in this alternative were discussed by the advisory council working groups but not included as part of their final recommendations to the advisory council, in particular, the Long Key/Tennessee Reef Ecological Reserve, the Tortugas Spawning Corridor, and shoreline to deep reef zone at Carysfort Reef. ONMS used the information discussed through the working group process and additional input from other NOAA offices, other agencies, and the research community to develop components of this alternative.

Specifically, Alternative 4 adds 33 wildlife management areas (one more than Alternative 3), subtracts one sanctuary preservation area (one less than Alternative 1 and four less than Alternative 3), and seven conservation areas (five more than is included in Alternatives 2 and seven more than in Alternative 3) compared to the no action alternative. In total, this alternative expands the total number of different zones from 57 areas in Alternative 1 (no action) to 96. There are 61 wildlife management areas, 22 sanctuary preservation areas, and 13 conservation areas. Sanctuary preservation areas were combined to form larger connected areas. The amount of added protection in terms of habitat increase greatly to 44.24% (Table 4.1). This percentage of additional habitat protection is important because it is used to scale the potential benefits to non-consumptive recreation for areas (zones) that displace consumptive users (e.g., special use research only areas and ecological reserves), which is significant. Special use research only areas displace all users and are designated as “restoration or research only.” Therefore, there are no benefits for these areas to non-consumptive users, but may have potential benefits for those who have nonuse of passive economic use value (to be defined and estimated below) or scientific value.

Table 0.1. Number and size of marine zones by type of zone and regulatory alternative

Alternatives	Sanctuary boundary (sq. mile)	Total zoned (sq. miles) ¹	Additional percent zoned	Number wildlife management areas	Number sanctuary preservation areas ²	Number ecological reserve/special use research only areas/conservation area ^{3,4,5}	Number total ⁶
1-No action	3,925	1,033	0.00	29	19	6	56
2	4,669	1,129	9.29	59	25	8	94
3-Preferred	4,669	1,141	10.45	60	26	8	96
4	4,927	1,433	44.24	60	22	13	97

¹ Includes area included in national wildlife refuges.

² no take areas.

³ Ecological reserves are no take areas.

⁴ Special use areas are set aside for restoration or research only.

⁵ Ecological reserves and special use research only areas are changed to conservation areas in alternatives 2, 3, and 4.

⁶ Includes management areas (existing management areas in Alternative 1); does not include national wildlife refuges.

Method of analysis

A two-step analysis was conducted. In step one, the amount of displaced activity tends to be quantitative and based on GIS analysis. It is assumed that all activity currently located in an area that is prohibited is lost, i.e., there is no ability to make up the activity by relocating to other areas (substitution). Therefore, the results on costs of an alternative in step one are labelled “maximum potential loss.”

Step two is qualitative and considers factors that evaluate the likelihood that the maximum potential loss might actually occur. In past evaluations of no-take, marine reserves, and research only areas (California Department of Fish and Wildlife, 2008; Jeffrey et al. 2012), little to no losses actually occurred based on post-implementation monitoring. However, at this stage of analysis, it cannot be assumed that there will not be losses, i.e., there is some uncertainty in projected future outcomes that can only be answered with future monitoring.

Analyses include the benefits, costs, and net benefits for the short-term (five years or less) and the long-term (more than five years).

Spatial data for commercial and recreational fisheries

For both commercial and recreational fisheries, the best available spatial resolution for data was for large national statistical areas used by the FWRI for commercial fisheries and by NOAA Fisheries (National Marine Fisheries Service) for recreational fishing effort. FWRI keeps commercial fishery landings’ pounds and value or revenue received by the fishermen (sometimes

referred to as ex vessel value) by species and gear type by where both are caught and landed. Where the fish are landed is where the primary socioeconomic impacts take place. There are 12 statistical areas that best overlay the boundaries of FKNMS (Table 2.6 and Figure 2.13) and that best define commercial catch and recreational fishing effort in FKNMS.

The data at the large statistical areas is not at fine enough spatial resolution to analyze and spatial alternatives proposed. FKNMS, unlike the design and evaluation of alternatives for the Tortugas Ecological Reserve (Leeworthy and Wiley 2000), did not invest in gathering finer resolution spatial data for either the commercial or recreational fisheries. Therefore, a method used in California many years ago to assess the impacts of oil and gas platforms on the fisheries was used here to derive finer resolution spatial data to support analyses.

The method uses habitat-species relationships developed by biologists for many species. Ault and Smith at University of Miami's Rosenstiel School for Marine and Atmospheric Science (RSMAS) provided habitat-species relationships for the nine reef fish species (Ault and Smith 2016). The nine species accounted for most of the reef fish caught in FKNMS (93.97% of all snapper-grouper and 87.72% of all reef fish). NOAA's National Centers for Coastal Ocean Science (NCCOS) has 36 habitats in their GIS system for FKNMS. (See Appendix B for the reef fish species and Appendix C for habitat distributions). NCCOS took the commercial catch (pounds and value) by species and statistical area and distributed these control totals by habitats. The control total was those presented for the 2009-13 averages in Chapter 2. For spiny lobster, the habitat species relationship was provided by FWRI (Cox and Hunt 2005).

Two of the most important commercial fisheries – shrimp and stone crab – are not reef-associated and therefore could not be analyzed the same way as the commercial finfish species. Instead, commercial catch records (pounds landed and revenues) were distributed evenly across each associated trip ticket area for the Keys region using ArcGIS. From this distribution, a shrimp and stone crab per meter² factor was created. This factor was then multiplied by the area of each zone added or removed to calculate potential catch loss or gained, respectively. Therefore, there is greater uncertainty of the estimates of “maximum potential loss” for the commercial shrimp and stone crab fisheries.

For the recreational fisheries, NOAA Fisheries Marine Recreational Fishing Statistics Program data was used by RSMAS researchers (Smith 2016) to derive estimates of recreational fishing effort by the nine reef fish species by gear type (e.g., hook-and-line and spear) and mode of access (e.g., charter/guide boat, private/rental boat, and shore modes). Control totals of person-trips (which are calculated the same as person-days, i.e., one person fishing any part of a day or a whole day) are used for the five-year average 2010-14. Again, these control totals were distributed spatially using the habitat-species relationships. Spiny lobster recreational fishing effort was provided by FWRI (Matthews 2016), which surveys the recreational spiny lobster fishery. FWRI produces separate estimates for the two-day sport season and the regular season.

Again, the 2010-14 average for both seasons was used, distributing them spatially using the habitat-species relationships provided by FWRI (Cox and Hunt 2005).

Appendix B has the control totals used by large statistical area for the commercial and recreational fisheries and Appendix C contains the habitat-species relationships.

An important aspect of evaluating potential future impacts is the choice of baseline estimations for different uses from which future impacts are estimated. The baseline amount of use should be sustainable, otherwise gains or losses cannot be easily attributable to the proposed regulatory changes. This is especially true for the fisheries. For the fisheries, a five-year average as representing a sustainable baseline was used.

Analysis of alternatives

For the commercial and recreational fisheries, alternatives 2 and 3 have the same potential impacts since they have identical changes in habitats with added protections.

Commercial fisheries

Step one costs. For analyzing maximum potential loss, the economic impact model in Chapter 2 is used. Outputs by spatial alternative from GIS were inputted into the model. For the “no action alternative” (Alternative 1), there is of course no loss at step one of the analysis to the commercial fisheries. The costs for the Alternative 1 are the potential lost benefits of the other alternatives.

In terms of revenue to fishermen potentially impacted, the potential lost revenue for alternatives 2 and 3 was estimated at \$513,000 or 1% of all commercial fishing revenue from FKNMS (Table 4.2). In table 4.2 and 4.3, the percentage landed in Monroe County for each group of commercial catch is based upon data from FWRI. The total percent is the weighted average of catch landed in Monroe County. In addition, Alternative 4 potential lost revenue was estimated at \$814,000 or 1.38% of all commercial fishing revenue in FKNMS (Table 4.3).

For alternatives 2 and 3, the impacts for shrimp are small but negative, meaning there is actually an increase in shrimp catch relative to the no action alternative. The reason for this is the alternatives open up areas that were previously closed to shrimp fishing and this more than offset the added areas closed to shrimping. The economic impacts on the Monroe County economy of these potential losses were estimated and are summarized in Tables 4.4 and 4.5. Details of pounds and value by species that were used in the economic model are in Appendix E.

Alternatives 2 and 3 had the smallest impact with \$1.05 million in output, \$650,000 in income, and 15.4 jobs (Table 4.4). Alternative 4 had the greatest potential impact with \$1.46 million in output, \$908 thousand in income, and 21.6 jobs (Table 4.5).

The potential impacts are dominated by the impacts estimated for invertebrates since, as shown in Chapter 2, invertebrates (primarily spiny lobster, shrimp, and stone crabs) dominate the value

of the commercial fisheries in FKNMS. Most of the reef fish (88.2%), spiny lobster (99.5%), and stone crab (99.9%) are landed in Monroe County; however, only 10.5% of shrimp are landed in Monroe County. Most of the economic impacts of shrimp landings occur in Lee, Collier, and Hillsborough counties.

Table 0.2. Revenue impact for FKNMS commercial fisheries in Monroe County: Alternatives 2 and 3, 2018\$

Species	Impacted revenue	Percent landed in Monroe County	Revenue impacted in Monroe County
Reef fish	\$199,912	88.2	\$176,263
Spiny lobster	\$282,300	99.5	\$280,860
Stone crab	\$50,353	99.9	\$50,288
Shrimp	\$52,651	10.5	\$5,534
Total	\$585,216	87.7	\$512,944

Table 0.3. Revenue impact for FKNMS commercial fisheries in Monroe County: Alternative 4, 2018\$

Species	Impacted revenue	Percent landed in Monroe County	Revenue impacted in Monroe County
Reef fish	\$213,001	88.2	\$187,803
Spiny lobster	\$379,978	99.5	\$378,040
Stone crab	\$168,291	99.9	\$168,072
Shrimp	\$52,719	10.5	\$5,541
Total	\$813,989	90.8	\$739,456

Table 0.4. Economic impact for FKNMS commercial fisheries in Monroe County: Alternatives 2 and 3, 2018\$

	All finfish	All invertebrates	Total
Percent of catch landed in Monroe County	88.2	95.5	94.5
Distribution of revenue by market (\$)			
A. Exported	\$141,010	\$346,773	\$487,783
B. Keys retail	\$10,576	\$11,559	\$22,135
C. Keys restaurant	\$24,677	\$26,971	\$51,648
Primary output (\$)			
A. Wholesale	\$179,083	\$475,079	\$654,162
B. Keys retail	\$19,512	\$15,027	\$34,539
C. Keys restaurant	\$88,121	\$96,314	\$184,435
Total primary output	\$286,716	\$586,420	\$873,136
Total output	\$344,059	\$703,704	\$1,047,764
Total income	\$213,317	\$436,297	\$649,613
Total jobs	5.1	10.4	15.4

Table 0.5. Economic impact for FKNMS commercial fisheries in Monroe County: Alternative 4, 2018\$

	All finfish	All invertebrates	Total
Percent of catch landed in Monroe County	88.2	95.5	94.5
Distribution of revenue by market (\$)			
A. Exported	\$150,243	\$540,889	\$691,132
B. Keys retail	\$11,268	\$18,030	\$29,298
C. Keys restaurant	\$26,292	\$42,069	\$68,362
Primary output (\$)			
A. Wholesale	\$190,808	\$741,018	\$931,826
B. Keys retail	\$20,790	\$23,439	\$44,228
C. Keys restaurant	\$93,890	\$150,229	\$244,119
Total primary output	\$305,488	\$914,686	\$1,220,174
Total output	\$366,586	\$1,097,623	\$1,464,208
Total income	\$227,283	\$680,526	\$907,809
Total jobs	5.4	16.2	21.6

Step two costs. The maximum potential losses estimated here are not likely to occur based on several factors. One, the fisheries in FKNMS and elsewhere in Florida have been consolidating into fewer fishermen that fish with more gear (Shivlani 2014). Management has been evolving to include catch share programs, which also must first deal with allocations between recreational and commercial fishermen for the same annual catch limits. Further, the commercial fisheries in FKNMS (Monroe County) have been declining not because of any decline in stocks but instead other economic forces. The shrimp industry has been heavily impacted by imports of shrimp produced by aquaculture driving prices down (see Leeworthy Chapter 6 in Jeffrey et al. 2012). A major factor has been the gentrification of the Florida Keys/Monroe County, making the cost of boat berthing high and the value of land higher than is economically justified for fish houses for commercial fishermen to sell their catch (Shivlani 2014). In addition, experience with the Tortugas Ecological Reserve found little to no impact of the no take marine reserve as fishermen were able to relocate to other fishing grounds and make up the lost catch from the closed areas (Leeworthy Chapter 6 in Jeffrey et al. 2012).

Recreational fisheries

For the recreational fisheries, the economic impact model used in Leeworthy and Ehler (2010) was modified to address charter boat fishing and private/rental boat fishing by adjusting expenditure categories (Appendix D). The estimates of use potentially impacted from the GIS analysis were fed into the models for each type of use (e.g., charter boat and private/rental boat for all nine reef fish species and for spiny lobster). The same was done for recreational spiny lobster fishing. Estimates of person-days affected and spending and the associated impacts on total output, income, and employment, including multiplier impacts, represent maximum potential impact.

In addition, there is a potential for losses in non-market economic values (consumers' surplus) for recreational anglers. An estimate of non-market economic value per person-day of \$20.61 (converted from 2000 to 2018 dollars) was used from Johns et al. (2003), which is a weighted average of resident and visitor values. This was multiplied by the potential person-days of fishing impacted by each alternative.

Step one costs – Maximum potential costs, charter boat anglers. Alternative 1 has no costs to charter boat anglers since there are no additional area closures. The costs for Alternative 1 are the potential lost benefits of the other alternatives.

For alternatives 2 and 3, 21,325 person-days are potentially displaced, with an estimated loss in spending of \$4.8 million. This spending is then associated with a potential loss of about \$4.3 million in output, \$2.6 million in income, and 69.17 full- and part-time jobs. Potential losses in non-market economic value were estimated at \$460,000.

Alternative 4 has the highest potential impact, with 22,595 person-days displaced with an associated loss in spending of about \$5 million. This potential spending loss is then associated with a potential loss of almost \$5.7 million in output, about \$2.8 million in income, and 73 full- and part-time jobs. Potential losses for non-market economic value were estimated to be about \$487,200 (Table 4.6).

Table 0.6. Potential economic impact of spatial regulatory alternatives: Charter boat fishing: Maximum potential loss

Measure ^{1,2}	Alternative 2	Alternative 3	Alternative 4
Person-days	21,325	21,325	22,595
Expenditures (2018\$)	\$4,773,095	\$4,773,095	\$5,057,310
Output (2018\$)	\$5,345,867	\$5,345,867	\$5,664,187
Income (2018\$)	\$2,606,075	\$2,606,075	\$2,761,254
Employment (number of jobs)	69.17	69.17	73.3
Non-market economic value (2018\$)	\$459,839	\$459,839	\$487,220

¹ Output, income, and employment include multiplier impacts.

² Maximum potential loss.

Step one costs – Maximum potential costs, private/rental boat anglers. Alternative 1 has no costs to private/rental boat anglers since there are no additional area closures. The costs of Alternative 1 are the potential benefits lost for the other alternatives.

For alternatives 2 and 3, 49,774 person-days are potentially displaced with an estimated loss in spending of about \$7.1 million. This spending is then associated with a potential loss of about \$8 million in output, about \$3.6 million in income, and 101.3 full- and part-time job. Potential losses in non-market economic value were estimated to be \$1.1 million.

Alternative 4 has the highest potential impact with 52,763 person-days potentially displaced, with an associated loss in spending of about \$7.5 million. This potential spending loss is then

associated with a potential loss of about \$8.4 million in output, about \$3.8 million in income, and 107 full- and part-time jobs. Potential losses in non-market economic value were estimated to be over \$1.1 million (Table 4.7).

Table 0.7. Potential economic impact of spatial regulatory alternatives: Private/rental boat fishing

Measure ^{1,2}	Alternative 2	Alternative 3	Alternative 4
Person-days	49,774	49,774	52,763
Expenditures (2018\$)	\$7,116,319	\$7,116,319	\$7,543,636
Output (2018\$)	\$7,970,278	\$7,970,278	\$8,448,872
Income (2018\$)	\$3,590,629	\$3,590,629	\$3,806,238
Employment (number of jobs)	101.30	101.30	107.4
Non-market economic value (2018\$)	\$1,073,290	\$1,073,290	\$1,137,738

¹ Output, income, and employment include multiplier impacts.

² Maximum potential loss.

Step one costs – Spiny lobster recreational fishing. Alternative 1 has no costs to spiny lobster fishing since there are no additional area closures. The costs of the no action alternative are the potential lost benefits of the other alternatives.

For alternatives 2 and 3, 7,708 person-days are potentially displaced with an estimated loss in spending of about \$1.1 million. This spending is then associated with a potential loss of about \$1.3 million in output, about \$580,000 in income, and 16.26 full- and part-time jobs. Potential loss in non-market economic values was estimated to be \$166,000.

Alternative 4's impact was the greatest. An estimated 9,983 person-days are potentially displaced, with a potential loss in spending of \$1.5 million. This potential loss in spending is associated with a potential loss of about \$1.7 million in output, about \$751,000 in income, and 20.1 full- and part-time jobs. Potential loss in non-market economic value was estimated to be \$215,270 (Table 4.8).

Table 0.8. Potential economic impact of spatial regulatory alternatives: Spiny lobster¹, maximum potential loss

Measure ^{2,3}	Alternative 2	Alternative 3	Alternative 4
Person-days	7,708	7,708	9,983
Expenditures (2018\$)	\$1,142,706	\$1,142,706	\$1,479,925
Output (2018\$)	\$1,279,831	\$1,279,831	\$1,657,516
Income (2018\$)	\$579,946	\$579,946	\$751,093
Employment (number of jobs)	16.26	16.26	20.1
Non-market economic value (2018\$)	\$166,215	\$166,215	\$215,266

¹ Includes two-day and regular seasons.

² Output, income, and employment include multiplier impacts.

³ Maximum potential loss.

Step one costs – All recreational fishing. Alternative 1 has no costs to recreational fishing since there are no additional area closures. The cost of the no action alternative is the loss of the potential benefits of the other alternatives.

For Alternatives 2 and 3, it is estimated that 78,808 person-days are potentially displaced, with a loss in spending of almost \$13 million. This spending is then associated with a potential loss of about \$14.6 million in output, about \$6.8 million in income, and 186.72 full- and part-time jobs. Potential loss in non-market economic values was estimated to be \$1.7 million.

Alternative 4 had the greatest impact. An estimated 85,341 person-days are potentially displaced with a potential loss in spending of \$14.1 million. This potential loss in spending is associated with a potential loss of about \$15.8 million in output, \$7.3 million in income, and 202 full- and part-time jobs. Potential loss in non-market economic value was estimated to be about \$1.84 million (Table 4.9).

Table 0.9. Potential economic impact of spatial regulatory alternatives: All recreational fishing, maximum potential loss

Measure ^{1,2}	Alternative 2	Alternative 3	Alternative 4
Person-days	78,808	78,808	85,341
Expenditures (2018\$)	\$13,032,120	\$13,032,120	\$14,080,871
Output (2018\$)	\$14,595,975	\$14,595,975	\$15,770,576
Income (2018\$)	\$6,776,650	\$6,776,650	\$7,318,585
Employment (number of jobs)	186.72	186.72	202.0
Non-market economic value (2018\$)	\$1,699,343	\$1,699,343	\$1,840,224

¹ Output, income, and employment include multiplier impacts.

² Maximum potential loss.

Non-consumptive recreation

The added protections provided by the spatial alternatives are expected to increase the quality of the areas for non-consumptive types of recreation (e.g., scuba diving, snorkeling, and viewing wildlife). Use, spending, and its associated impact on the Monroe County economy (e.g., output, income, and employment) would all be expected to increase. The numbers used for use are from the 2007-08 study on recreation-tourism (Leeworthy et al. 2010; Leeworthy and Morris 2010). For the uses by activity, the uses were only for activity done via access by boat. For calculating economic contribution to the Monroe County economy, only 13.63% of use is used since only this proportion of use and spending is from the export sector, which is based on income not earned from work in Monroe County and eliminates double counting from the multiplier process of visitor spending. The uses for calculating the non-market economic values (consumers' surplus) do not need to be adjusted since there is no double counting for these measures.

A key assumption in estimating benefits from non-consumptive recreation is that the proportion of activity and value increases is in direct proportion to the amount of area protected in special zones. As the amount of protected area increases so does the amount of activity supported. Using

this assumption, 9.29% more area is protected under Alternative 2, 10.45% under Alternative 3, and 13.63% under Alternative 4.

Alternative 2 had the lowest potential benefit with a gain of almost 221,560 person-days of non-consumptive recreation activity. This increase in activity has an annual non-market economic value estimated at over \$14.3 million (Table 4.10). Alternative 3 has a slightly higher “potential” benefit with an increase of 249,000 person-days of non-consumptive recreation activity, with an associated annual value estimated at over \$16.1 million (Table 4.11). Alternative 4 had a higher potential increase in benefit with an estimated increase of over 324,000 person-days of non-consumptive recreation valued at \$21.1 million (Table 4.12).

Table 0.10. Potential benefits to non-consumptive recreation users, annual non-market economic values (2018\$): Alternative 2

Type of user/activity	Person-days of use (thousands) ¹	Value per person-day (2018\$) ²	Annual value (thousands 2018\$)
<i>Residents</i>			
Snorkelers from boat	12.03	12.16	146.35
Scuba divers from boat	9.65	18.05	174.21
Wildlife Viewing from boat	8.36	86.65	724.45
Total	30.05		1,045.00
<i>Visitors</i>			
Snorkelers from boat	93.23	39.49	3,681.40
Scuba divers from boat	36.88	30.14	1,111.51
Wildlife viewing from boat	61.41	138.65	8,514.13
Total	191.51		13,307.03
<i>All users</i>			
Snorkelers from boat	105.26		3,827.74
Scuba divers from boat	46.53		1,285.72
Wildlife viewing from boat	69.77		9,238.58
Total	221.56		14,352.04

¹ Person-days of activity from a 2007-08 boat study of recreation-tourism in the Florida Keys/Key West (Leeworthy et al. 2010; Leeworthy and Morris 2010) times 9.29% impacted by spatial alternative.

² Non-market values per person-day for snorkelers and scuba divers from Johns et al. (2003) and for wildlife viewing from Leeworthy and Bowker (1997) converted to 2018 dollars using the Consumer Price Index.

Table 0.11. Potential benefits to non-consumptive recreation users, annual non-market economic values (2018\$): Alternative 3

Type of user/activity	Person-days of use (thousands) ¹	Value per person-day (2018\$) ²	Annual value (thousands 2018\$)
<i>Residents</i>			
Snorkelers from boat	13.53	12.16	164.62
Scuba divers from boat	10.86	18.05	195.96
Wildlife viewing from boat	9.40	86.65	814.90
Total	33.80		1,175.49
<i>Visitors</i>			
Snorkelers from boat	104.87	39.49	4,141.07
Scuba divers from boat	41.49	30.14	1,250.30
Wildlife viewing from boat	69.07	138.65	9,577.25
Total	215.43		14,968.62
<i>All users</i>			
Snorkelers from boat	118.40		4,305.69
Scuba divers from boat	52.34		1,446.26
Wildlife viewing from boat	78.48		10,392.16
Total	249.22		16,144.11

¹ Person-days of activity from a boat 2007-08 study of recreation-tourism in the Florida Keys/Key West (Leeworthy et al. 2010; Leeworthy and Morris 2010) times 10.45% impacted by spatial alternative.

² Non-market values per person-day for snorkelers and scuba divers from Johns et al. (2003) and for wildlife viewing from Leeworthy and Bowker (1997) converted to 2016 dollars using the Consumer Price Index.

Table 0.12. Potential benefits to non-consumptive recreation users, annual non-market economic values (2018\$): Alternative 4

Type of user/activity	person-days of use (thousands) ¹	Value per person-day (2018\$) ²	Annual value (thousands 2018\$)
Residents			
Snorkelers from boat	17.65	12.16	214.66
Scuba divers from boat	14.16	18.05	255.53
Wildlife viewing from boat	12.26	86.65	1,062.60
Total	44.07		1,532.78
Visitors			
Snorkelers from boat	136.74	39.49	5,399.78
Scuba divers from boat	54.10	30.14	1,630.33
Wildlife viewing from boat	90.07	138.65	12,488.31
Total	280.91		19,518.41
All users			
Snorkelers from boat	154.39		5,614.43
Scuba divers from boat	68.25		1,885.86
Wildlife viewing from boat	102.33		13,550.91
Total	324.98		21,051.19

¹ Person-days of activity from a boat 2007-08 study of recreation-tourism in the Florida Keys/Key West (Leeworthy et al. 2010; Leeworthy and Morris 2010) times 44.24% impacted by spatial alternative.

² Non-market values per person-day for snorkelers and scuba divers from Johns et al. (2003) and for wildlife viewing from Leeworthy and Bowker (1997) converted to 2018 dollars using the Consumer Price Index.

Summary of economic impact

Benefits. Closing areas has shown to increase the quality of marine life, thus benefiting those engaged in non-consumptive forms of recreation via scuba diving, snorkeling, and wildlife viewing. Increasing areas for protection may also result in increases in passive economic use value. This value alone has swamped other economic values in other places (Tortugas Ecological Reserve: Leeworthy and Wiley 2000; Hawaii’s coral reef ecosystems: Bishop et al. 2011; Flower Garden Banks boundary expansion, Stefanski and Shimshack 2016). In addition, there may be long-term benefits of scientific value.

Costs. In the short-term, there may be some losses due to closed areas. In the longer-term, if these areas have replenishment effects increasing total stock sizes, as has been found in the Tortugas area, the commercial fisheries may actually receive benefits instead of costs. However, this may not occur in the commercial fisheries if more stocks are allocated to the valuable recreational fishery or gentrification reduces the size of the commercial fishery.

Net benefits. The “no action alternative” (Alternative 1) has the lowest net benefits. The costs of this alternative are the forgone benefits of the more protective actions of alternatives 2, 3, and 4. It is expected that net benefits from the other alternatives would be in the order of their numbers, i.e., alternatives 2 and 3 would have higher net benefits than Alternative 1, but fewer net benefits than Alternatives 4. Similarly, Alternative 3 would have more net benefits than Alternatives 1 and 2, but fewer net benefits than Alternative 4, with Alternative 4 having the greatest net benefits.

The maximum potential costs for the fisheries (commercial and recreational) are not likely to occur and therefore the negative net benefits for Alternative 1 (Table 4.13), in terms of impacts on the Monroe County Economy, will not likely occur (Table 4.14). In the long-term, if there are positive impacts to fishing stocks outside the protected areas (replenishment effect), then there will likely be net benefits to the fisheries and overall positive impacts to the Monroe County economy.

For non-market economic value, even in the step one analysis, there are net benefits for alternatives 2, 3, and 4 (Table 4.13) and this conclusion is strengthened in the step two analysis (Table 4.14). Alternative 1 would have negative net benefits, since the net benefits from the more protective alternatives would generate net benefits. Non-market economic values are the appropriate values to include in formal benefit-cost analyses and are the values used in damage assessment cases to sue responsible parties for damages to natural resources.

Table 0.13. Step one analysis, net benefits in short-term using maximum potential costs for fisheries and lower bound estimates for non-consumptive recreation by spatial alternative (2018\$)

User group/measurement	Alternative 2	Alternative 3	Alternative 4
<i>Commercial fishing¹</i>			
Output	\$1,047,763.58	\$1,047,763.58	\$1,464,208.37
Income	\$649,613.42	\$649,613.42	\$907,809.19
Employment	15.44	15.44	21.57
Non-market economic value	\$0.00	\$0.00	\$0.00
<i>Recreational fishing¹</i>			
Output	\$14,595,975.17	\$14,595,975.17	\$15,770,575.68
Income	\$6,776,649.83	\$6,776,649.83	\$7,318,584.64
Employment	186.72	186.72	202.00
Non-market economic value	\$1,699,343.47	\$1,699,343.47	\$1,840,223.73
<i>Total displaced uses¹</i>			
Output	\$15,643,738.74	\$15,643,738.74	\$17,234,784.05
Income	\$7,426,263.25	\$7,426,263.25	\$8,226,393.83
Employment	202.16	202.16	223.57
Non-market economic value	\$1,699,343.47	\$1,699,343.47	\$1,840,223.73
<i>Non-consumptive recreational use^{2,3}</i>			
Output	\$34,025,481.34	\$38,202,526.55	\$49,811,400.61
Income	\$14,914,158.39	\$16,744,128.89	\$21,832,618.05
Employment	420.48	472.20	615.71
Non-market economic value	\$14,173,342.15	\$15,310,248.25	\$21,051,194.96
<i>Net gain (+) or loss (-)</i>			
Output	\$18,381,742.60	\$22,558,787.81	\$32,576,616.56
Income	\$7,487,895.14	\$9,317,865.64	\$13,606,224.22
Employment	218.32	270.04	392.13
Non-market economic value	\$12,473,998.68	\$13,610,904.78	\$19,210,971.22

¹ Maximum potential loss are not likely to occur (see text above).² Lower bound estimates of potential benefits to non-consumptive users (see text).³ For more detail on all the uses see Appendix D, Table D22.

Table 0.14. Step two analysis, net benefits in short-term accounting for other factors (2018\$)

User group/measurement	Alternative 2	Alternative 3	Alternative 4
<i>Commercial fishing¹</i>			
Output	\$0.00	\$0.00	\$0.00
Income	\$0.00	\$0.00	\$0.00
Employment	0.00	0.00	0.00
Non-market economic value	\$0.00	\$0.00	\$0.00
<i>Recreational fishing¹</i>			
Output	\$0.00	\$0.00	\$0.00
Income	\$0.00	\$0.00	\$0.00
Employment	0.00	0.00	0.00
Non-market economic value	\$1,699,343.47	\$1,699,343.47	\$1,840,223.73
<i>Total displaced uses¹</i>			
Output	\$0.00	\$0.00	\$0.00
Income	\$0.00	\$0.00	\$0.00
Employment	0.00	0.00	0.00
Non-market economic value	\$1,699,343.47	\$1,699,343.47	\$1,840,223.73
<i>Non-consumptive recreational use^{2,3}</i>			
Output	\$34,025,481.34	\$38,202,526.55	\$49,811,400.61
Income	\$14,914,158.39	\$16,744,128.89	\$21,832,618.05
Employment	420.48	472.20	615.71
Non-market economic value	\$14,173,342.15	\$15,310,248.25	\$21,051,194.96
<i>Net gain (+) or loss (-)</i>			
Output	\$18,381,742.60	\$22,558,787.81	\$32,576,616.56
Income	\$7,487,895.14	\$9,317,865.64	\$13,606,224.22
Employment	218.32	270.04	392.13
Non-market economic value	\$12,473,998.68	\$13,610,904.78	\$19,210,971.22

¹ Maximum potential loss are not likely to occur (see text above).

² Lower bound estimates of potential benefits to non-consumptive users (see text).

³ Assumes 10% loss due to having to substitute to less preferred sites.

Other potential benefits

Other benefits of the spatial regulation alternatives not included in the estimates of net benefits in tables 4.13 and 4.14 include passive economic use value, science, and education values. For passive economic use values, conservative lower bound estimates of the potential benefits of the added protections are used. Economic values for science and education are harder to come by and will only be discussed qualitatively.

Passive economic use. Nonuse, or passive use, economic values encompass what economists refer to as option value, existence value, and other nonuse values. All nonuse economic values

are based on the fact that people are willing to pay some dollar amount for a good or service they currently do not use or consume directly today (but might or might not in the future). In the case of an ecological reserve, they are not current visitors (users), but they derive some benefit from the knowledge that the reserve exists in a certain state and are willing to pay some dollar amount to ensure that actions are taken to keep the reserve in that state.

Option value is a bit different from other nonuse economic values in that option value is a willingness to pay for the possibility of some future use. Weisbrod (1964) first introduced the concept of option value. As argued by Weisbrod, an individual uncertain as to whether or not they will visit some unique site at some future point in time would be willing to pay a sum in excess of their consumer's surplus to assure that the site would be available in the future should they wish to visit it. Option value then is characterized by uncertainty of both future supply and future demand. Some, such as Freeman (1993), have questioned whether option value is a legitimate economic value. However, the U.S. Environmental Protection Agency (EPA) still lists option value as a legitimate value to be included in intrinsic benefits when conducting benefit-cost analysis of proposed regulations mandated under the terms of Executive Order 12291.

Other nonuse values have traditionally been labeled according to motive, e.g., existence value or bequeath value. The key distinctions between option value and other nonuse values is that the other nonuse values do not relate to any future use and uncertainty is not a factor. Existence value is an individual's willingness to pay a dollar amount to simply know that a resource will be protected in a given state. Bequeath value is an individual's willingness to pay a dollar amount to ensure the resource will be protected in a given state so their heirs may have the opportunity to enjoy them. The motives themselves are unimportant as to the value's legitimacy, since, in economics, people's motives for their willingness to pay for any good or service is not questioned. Motives with respect to nonuse values are used simply to differentiate them from use values. Randall and Stoll (1983) have argued that when estimating nonuse economic values, nonuse economic values cannot be separated from use values for users of the resource. Methods available for estimating nonuse economic values are only capable of revealing "total value" which cannot be broken down into separate components of use and nonuse. Pure nonuse economic values can only be estimated for nonusers.

The terminology of "passive use" economic values has become more accepted when referring to nonuse economic values. This change in terminology grew out of the debate over whether nonuse economic values could actually be measured. People must have some knowledge of the resource they are being asked to place a dollar value, whether it is through a newspaper, magazine, television show, etc. People must first learn about the resource—and its current state—and then must decide what they would be willing to pay to ensure that the resource will be protected in that state. It is of key importance that the individuals are making this decision under their budget constraints. That is, willingness to pay is constrained by a person's income and

wealth and the person is forced to make a budget allocation between spending for protection of the resource or on something else.

To date there are no studies on FKNMS addressing passive economic use value; however, Spurgeon (1992) has offered two sets of identifiable factors which will dictate the magnitude of nonuse or passive use economic values. First, nonuse economic values will be positively related to the quality, condition, and uniqueness of the ecosystem on a national or global scale. Second, the size of population, standard of education, and environmental perception of people in the country owning or having jurisdiction over the ecosystem will be positively related to nonuse or passive use economic values. Thus, nonuse or passive use economic values are determined by both supply and demand conditions. The existence of many similar (“substitute”) sites would reduce the value. Although Spurgeon limits his scope to the people in the country owning or having jurisdiction over the ecosystem, people from all over the world may have nonuse or passive use economic values for ecosystem protection in other countries. Debt for nature protection swaps being conducted by The Nature Conservancy in South America are just one example. Legitimacy of including the values of people from other countries is more a judicial concern than an economic one. In some judicial proceedings, people from other countries might not have legal standing over issues of resource protection and their economic values may be eliminated from inclusion in the proceedings.

To date there have been no studies on estimating passive economic use value for FKNMS. In the socioeconomic impact analysis of alternatives for the Tortugas Ecological Reserve (a no-take area), Leeworthy and Wiley (2000) did a policy analysis using a range of studies on passive economic use value from around the world. This analysis used a range of values on willingness to pay per household per year and simulated what the potential values for the Tortugas Ecological Reserve would be using lower bound estimates of willingness to pay per household per year and assuming only 1% of U.S. households would be willing to pay for the Tortugas Ecological Reserve protections. The conclusion was that even using the most conservative estimates of what passive economic use value for the Tortugas protections might be, those benefits would far exceed the costs even if maximum potential loss were to happen.

More recently two studies have been done that include coral reef ecosystems. Bishop et al. (2010) estimated the “total economic value” of the coral reef ecosystems around the Main Hawaiian Islands. Total economic value includes direct use and passive economic use values. However, a national sample of U.S. households was conducted so those who have used Hawaii’s coral reefs or had planned to visit Hawai‘i and use the coral reefs sometime in the future was only 29.6% of the sample, so most of the total economic value was for passive economic use value. In this study, people were asked their annual willingness to pay per household for increasing protection of Hawaii’s coral reef ecosystems from 1% to 25% in no-take status and for restoring five acres per year that had been damaged by ship groundings. About five acres per

year had been damaged by ship groundings where the responsible party could not be identified. The restoration would allow for recovery in 10 years versus 50 years for natural recovery. For the broader protection increasing from 1% to 25% of the reefs in no-take status, people were willing to pay \$224.81 per household per year, while they were willing to pay an additional \$62.82 per household per year for restoring the five acres damaged due to ship grounding for a total willingness to pay per household per year of \$287.62. When multiplied by 116,716,292 U.S. households in 2010, the total annual willingness to pay was estimated to be \$26.24 billion for the no-take protections and \$7.33 billion for the restoration of five acres per year for a total annual willingness to pay of \$33.57 billion.

A more recent study was done for expanding the boundaries of Flower Garden Banks National Marine Sanctuary. Stefanski and Shimshack (2016) did a study on expanding Flower Garden Banks National Marine Sanctuary from its current three banks to an additional nine banks in the northwest Gulf of Mexico. A national sample of 1,526 U.S. households was done in 2011-12. It was estimated that households would be willing to pay on average \$35 to \$107 per household per year for extending the current protections in Flower Garden Banks National Marine Sanctuary to the additional nine banks. Using the 2010 number of U.S. households, the total annual willingness to pay would be \$4.08 billion to \$12.49 billion. The cost of protections was estimated at \$15 million over a five-year period. Thus, considering the benefits of the protection, the net gain to the nation would be a great deal.

Using the annual lower bound willingness-to-pay for boundary expansion of Flower Garden Banks National Marine Sanctuary of \$4.08 billion and some conservative assumptions about the percent of that value that might apply to the expansion of protected areas in FKNMS, the potential benefits of the spatial alternatives is estimated for passive economic use values. The lower bound percentages are 1%, 5% and 10% of the \$4.08 billion as applied to the most protective alternative (Alternative 4). These values are then scaled to the relative percent of added protection of each alternative (Alternative 2, 9.29%; Alternative 3, 10.45%; Alternative 4, 44.24%). Under scenario one (1%), the passive economic use values are significantly greater than for the activities that are displaced in either step one or step two analyses (Tables 4.13 and 4.14). In scenarios two (5%) and three (10%), the potential benefits from passive economic use values are greater than all other uses in all alternatives. Therefore, even under uncertainty of information, benefit-cost analysis would conclude there are net benefits to even more protective alternatives.

Table 0.15. Simulation of potential benefits of spatial alternatives: Passive economic use values

Alternative	Percent of estimated value ^{1,2}		
	1%	5%	10%
Alternative 2 (millions 2018\$)	\$3.97	\$19.83	\$39.66
Alternative 3 (millions 2018\$)	\$4.46	\$22.30	\$44.61
Alternative 4 (millions 2018\$)	\$18.89	\$94.44	\$188.89

¹ Percent of lower bound estimate of \$4.08 billion per year for Flower Garden Banks National Marine Sanctuary boundary expansion (Stefanski and Shimshack 2016).

² Estimates scaled by alternative using the relative percent of added protected area. Alternative 2, 9.29%; Alternative 3, 10.45%; Alternative 4, 44.24%.

Research/science and education. Marine protected areas and especially marine reserves or no-take areas provide a multitude of benefits. Sobel (1996) provides a long list of these benefits. Scientific and education values were categorized by Sobel into those things a reserve provides that increase knowledge and understanding of marine systems. Sobel provides the following lists of benefits:

Scientific

- Provides long-term monitoring sites
- Provides focus for study
- Provides continuity of knowledge in undisturbed site
- Provides opportunity to restore or maintain natural behaviors
- Reduces risks to long-term experiments
- Provides controlled natural areas for assessing anthropogenic impacts, including fishing and other impacts.

Educational

- Provides sites for enhanced primary and adult education
- Provides sites for high-level graduate education
- Number of research permits
- Education efforts (number of students).

Chapter 5: Boundary expansions

Alternative 1: No action

For the sanctuary boundary no action alternative, the sanctuary encompasses 10,167 km².

Alternative 2

Alternative 2 includes expansion of the sanctuary boundary by 1,932 km² (1,205 km² of area to be avoided and 727 km² of the Tortugas region area). The boundary is expanded in two locations to align with the regulatory area to be avoided boundary: (a) the area north of the existing boundary and west of Biscayne National Park and (b) south of the existing boundary. Alternative 2 includes the area within the Tortugas region between the existing sanctuary boundary and the Tortugas Ecological Reserve South. In Alternative 2, the sanctuary boundary encompasses a total area of 12,099 km² (Table 5.1).

Alternative 2 includes expansion of the sanctuary boundary to encompass 1,205 km² of the area to be avoided that is currently outside the existing sanctuary boundary. The area to be avoided was established through Florida Keys National Marine Sanctuary and Protection Act in 1990 (55 FR 19418-19419), codified in regulation in 1997 (62 FR 32161), and slightly modified in 2001 (66 FR 34533) as four areas to be avoided where tank vessels and vessels larger than 50 meters are prohibited from entering. Since sanctuary designation, the sanctuary has been implementing this regulation. The area to be avoided boundary expansion proposes aligning the geographic boundary of the sanctuary with the existing area to be avoided boundaries. Existing sanctuary-wide regulations and proposed updated or new sanctuary-wide regulations apply in this expanded area.

The expansion in the Tortugas Region aligns with the existing particularly sensitive sea area, encompasses the Tortugas Ecological Reserve South and extends to the west of Tortugas Ecological Reserve South. This expansion provides additional protections for important ecological resources and the ecological connectivity in the region, particularly between Tortugas Ecological Reserve North and South and Tortugas Bank. In addition, expanding the sanctuary boundary to align with the particularly sensitive sea area will align the sanctuary boundary with an area established by the International Maritime Organization in 2002 to protect areas for special ecological, socioeconomic, or scientific reasons and that are vulnerable to damage by international maritime activities. Existing sanctuary-wide regulations and proposed updated or new sanctuary-wide regulations will apply in this expanded area.

Alternative 3

Alternative 3 includes the same proposed boundary expansion as described in Alternative 2. Alternative 3 is NOAA's preferred alternative. In Alternative 3, the sanctuary boundary encompasses a total area of 12,099 km² (Table 5.1).

Alternative 4

Alternative 4 includes the boundary expansion as proposed and described in alternatives 2 and 3 and proposes to include a distinct unit at Pulley Ridge. Alternative 4 proposes expansion of the sanctuary boundary by 2,598 km² (1,205 km² km of area to be avoided area, 727 km² of the Tortugas region area, and 666 km² at Pulley Ridge). In Alternative 4, the sanctuary boundary encompasses a total area of 12,765 km² (Table 5.1).

The proposed expansion at Pulley Ridge provides additional protection for an area of nationally significant mesophotic coral reef habitat with demonstrated connectivity to the Florida Keys. The expansion proposed overlaps with the existing Gulf of Mexico Fishery Management Council (GMFMC) habitat area of particular concern. In the proposed Pulley Ridge boundary expansion, existing sanctuary-wide regulations and proposed updated or new sanctuary-wide regulations will apply. In addition, a no-anchoring regulation for all vessels is proposed in the Pulley Ridge expansion area.

As noted, this expanded area is a GMFMC habitat area of particular concern with associated regulations. Sanctuary expansion does not in any way alter that designation or existing regulations. GMFMC expanded the habitat area of particular concern in Pulley Ridge South, adding Pulley Ridge South Portion A (GMFMC, 2018). Pulley Ridge South prohibited use of bottom tending gears including bottom longlines, bottom trawls, buoy gear (except highly migratory species buoys that do not touch the bottom), and pots and traps. In addition, anchoring is prohibited. In Pulley Ridge South Portion A, all the same prohibitions apply except bottom longlines. The exception was granted to minimize impacts on the commercial fishing operations.

Analysis of alternatives

The impacts of the minor corrections in the Tortugas region were included in the analysis of zones. Addressed here are the area to be avoided and Pulley Ridge.

Benefits: For the areas to be avoided, there are no added benefits for Alternative 1. Alternatives 2 and 3 are the same, with Alternative 3 being the preferred alternative with 1,205 km² added protection. The areas to be avoided protect the coral reefs habitats from damages caused by groundings of large vessels transiting the region. Past groundings have resulted in millions of dollars in damages and restoration costs and the areas to be avoided are designed to avoid these potential damages and costs to both the industry that is responsible for the damages and the

losses to those who value the coral reef resources. A significant portion of the Monroe County economy is dependent on the coral reef resources.

Alternative 4, the environmental alternative, includes the same area to be avoided expansions as alternatives 2 and 3 but also includes the expansion to include Pulley Ridge. Currently, there is no documentation of any recreational use of Pulley Ridge. Therefore, the benefits of coral reef protections for recreational use are expected to be minimal in the short-term. Over the long-term, recreational “for hire” fishing and diving operations could develop a business using these resources and thus generate future benefits. Some private households may also venture out there, generating additional benefits. Probably the greatest benefit would be from what economists call nonuse of passive economic use value (see extensive definition and discussion of this type of value under the zoning alternatives). As shown in the zoning section using results for the boundary expansion of Flower Gardens Bank National Marine Sanctuary, the potential benefits can be high. In addition, the added protections might also offer increased benefits to scientific value, especially in the long-term.

Costs: There are costs of implementing the area to be avoided for the technologies for monitoring vessel traffic and alerting rescue crews to keep vessels from grounding on the coral reefs and for the rescue crews. For Pulley Ridge, the expansion will have little impact since GMFMC regulations already apply for the commercial fisheries. Other sanctuary-wide regulations (e.g., discharging wastes; vessel grounding, deserted vessels and abandoning gear; and large vessel mooring buoy) would apply to commercial fishing operations. However, these costs are likely to be minimal and can be avoided. The marine transportation industry could possibly suffer additional costs due to the no anchoring regulation. However, this is expected to be minimal as there are other safe alternatives for anchoring.

Net benefits: As in the past implementation of the areas to be avoided, it is expected that there will be significant net benefits in the short-term and long-term for all alternatives. For Alternative 4, the Pulley Ridge expansion offers the potential for high net benefits in the short-term and long-term with the potential for higher net benefits in the long-term if recreation becomes a significant activity.

Table 0.1. Boundary expansions in FKNMS by alternative (km²)

Alternative	Total area	Expansion area	Area to be avoided expansion	Tortugas expansion	Pulley Ridge¹
1 - No action (status quo)	10,167	0	0	0	0
2	12,099	1,932	1,205	727	0
3 - Preferred	12,099	1,932	1,205	727	0
4 - Environmental	12,765	2,598	1,205	727	666

¹ Pulley Ridge comprises two habitat areas of particular concern. Both areas protect corals and Portion A was added by Final Amendment 9 to the Fishery Management Plan for the Corals and Coral Reefs of the Gulf of Mexico, U.S. Waters, Gulf of Mexico Fishery Management Council (2018).

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Appendix A: Maps of commercial fishing by statistical area

Figure	Description
1	Grouper/snapper average catch 2009-2013 (pounds)
2	Other reef fish average catch 2009-2013 (pounds)
3	King mackerel average catch 2009-2013 (pounds)
4	Pelagic species average catch 2009-2013 (pounds)
5	Sharks average catch 2009-2013 (pounds)
6	Spiny lobster average catch 2009-2013 (pounds)
7	Stone crab claws average catch 2009-2013 (pounds)
8	Food shrimp average catch 2009-2013 (pounds)
9	Sponges average catch 2009-2013 (pounds)

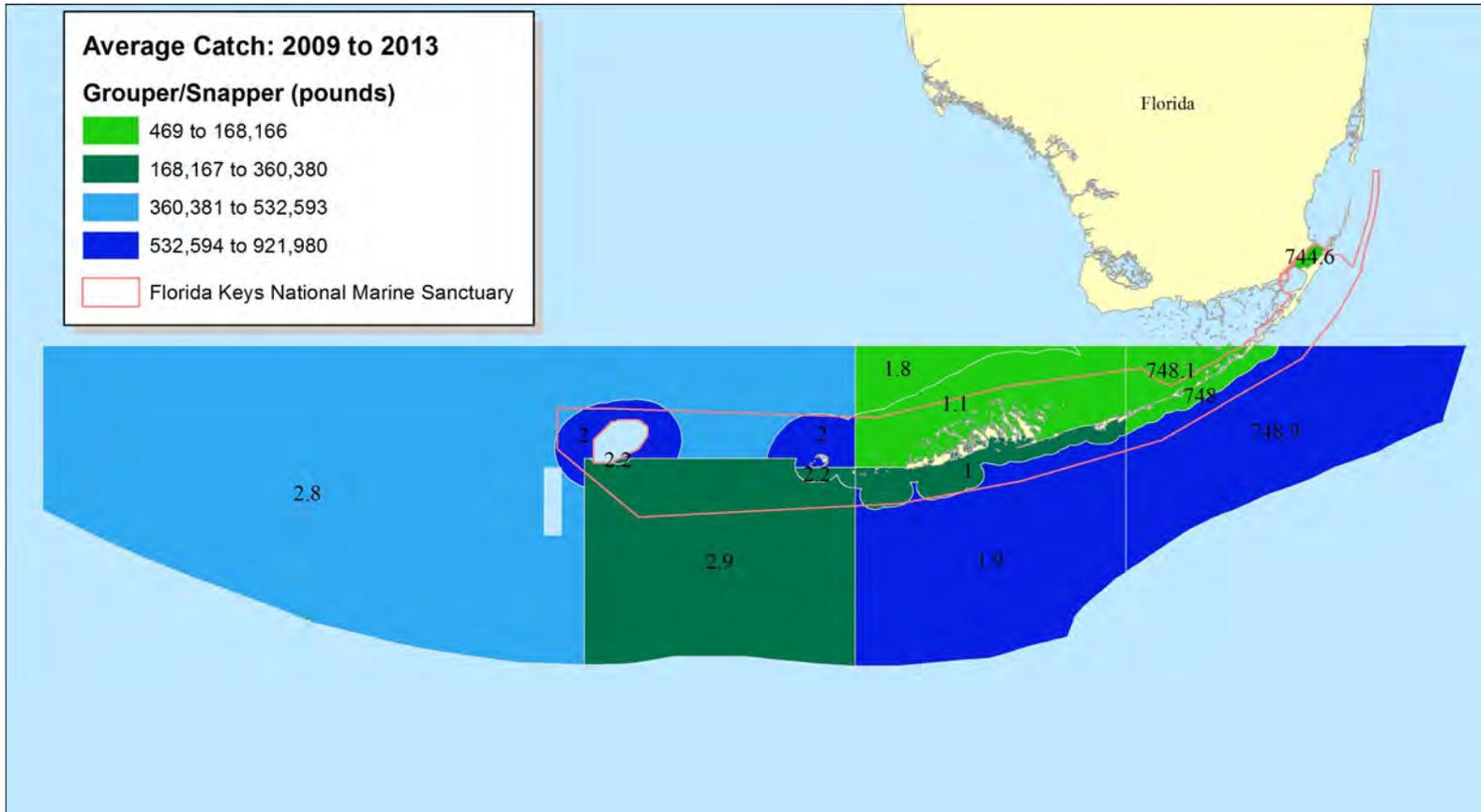


Figure A.1. Grouper/snapper average catch 2009-2013 (pounds)

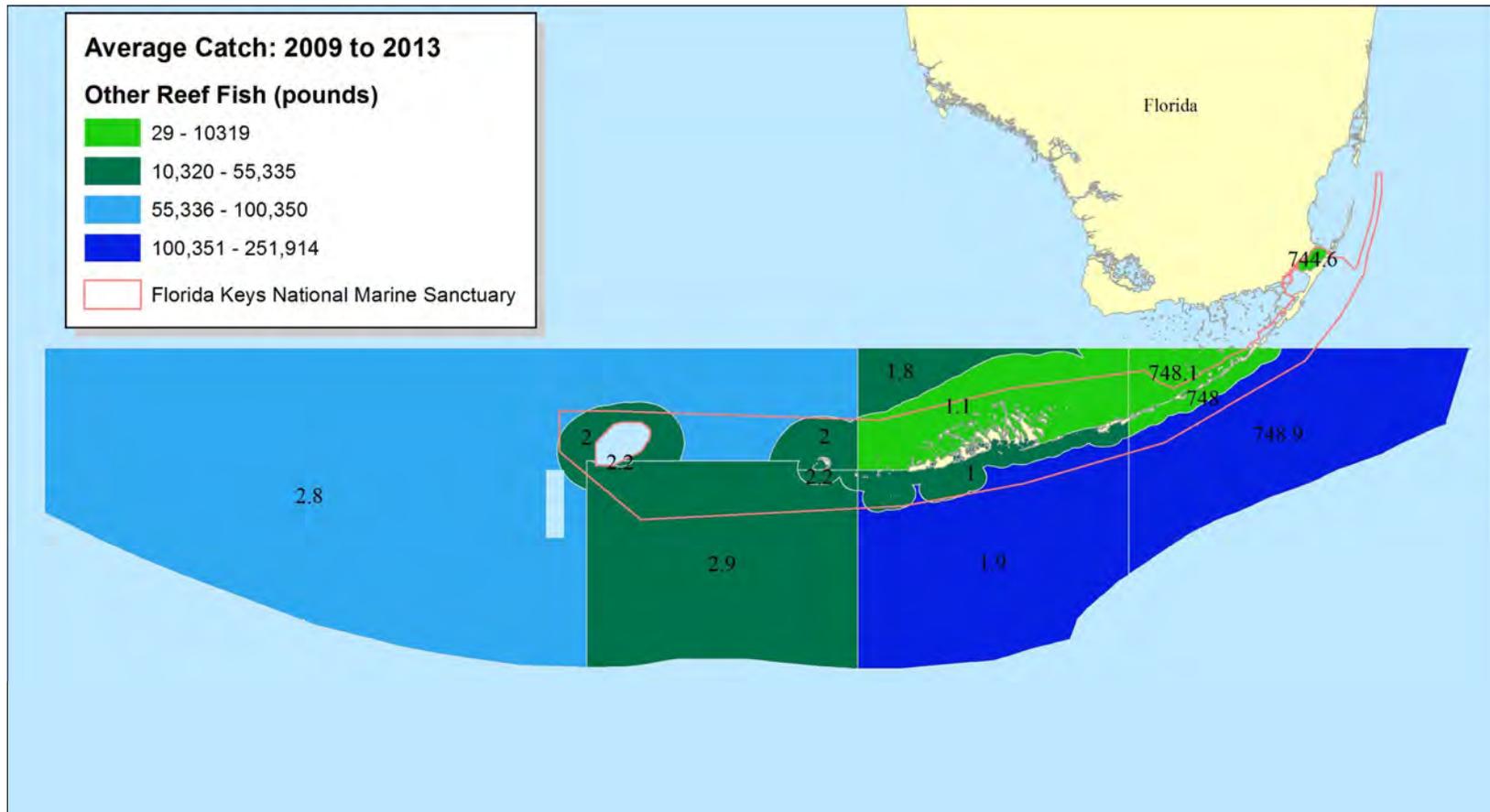


Figure A.2. Other reef fish average catch 2009-2013 (pounds)

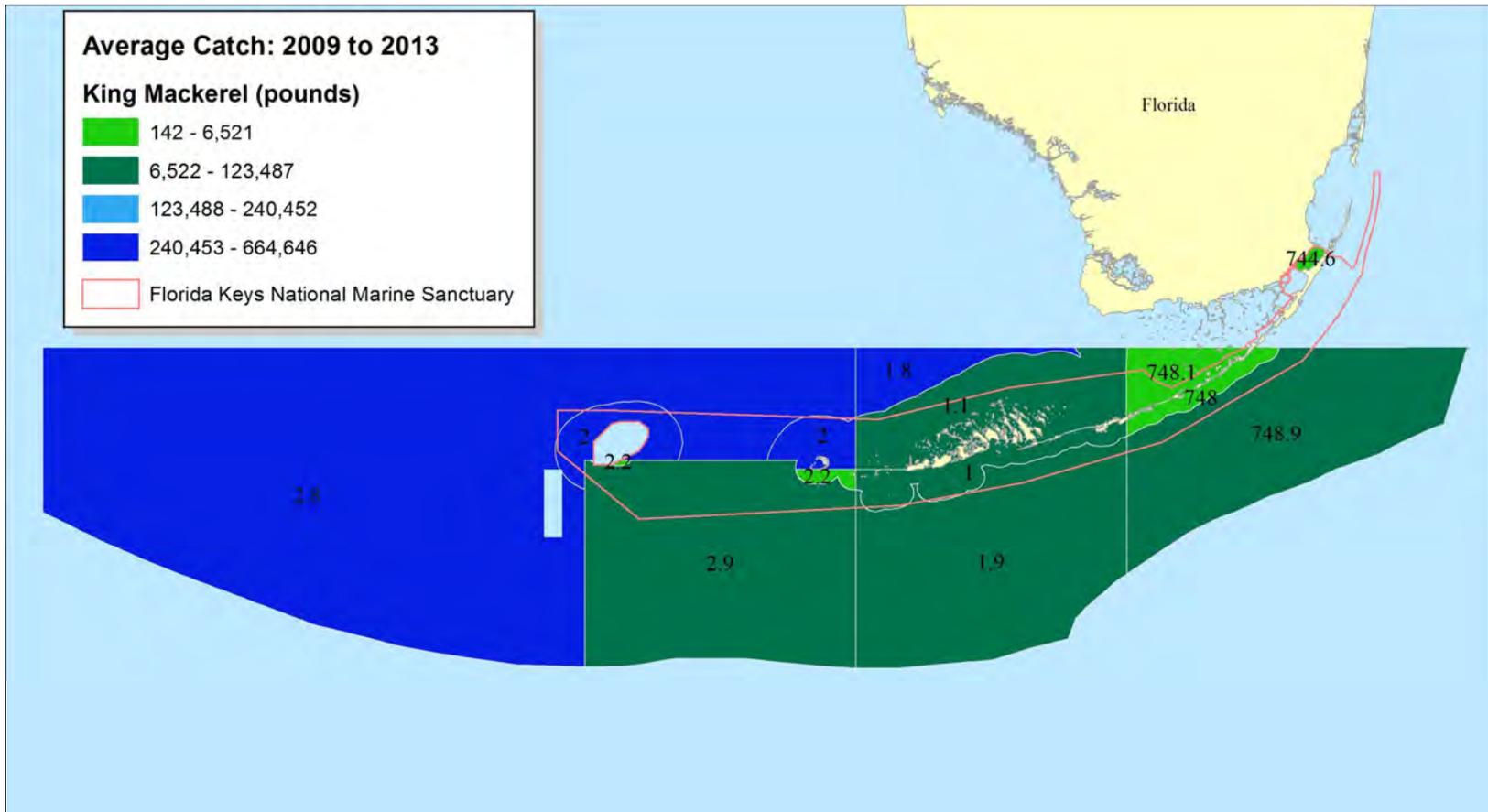


Figure A.3. King mackerel average catch 2009-2013 (pounds)

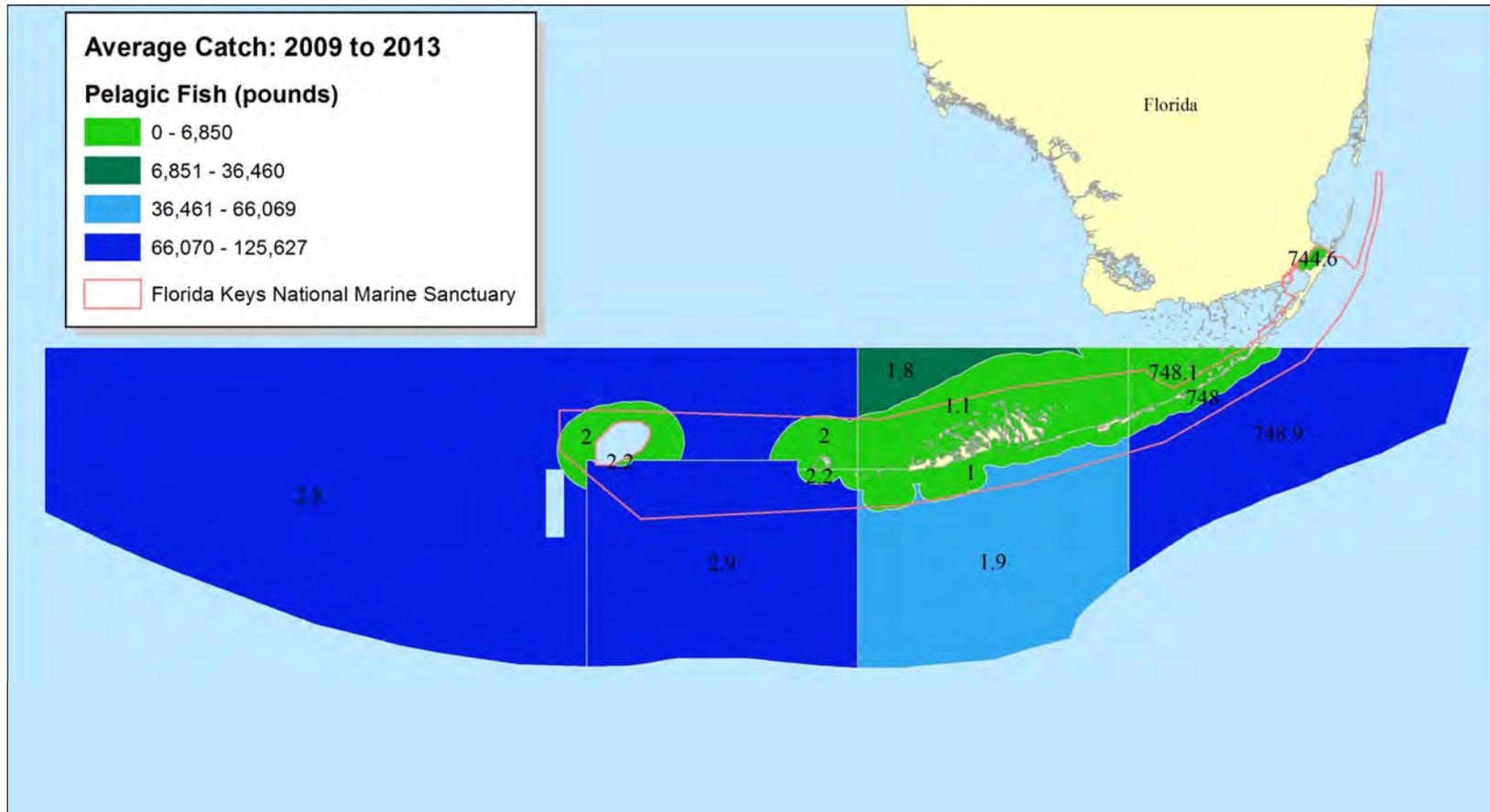


Figure A.4. Pelagic species average catch 2009-2013 (pounds)

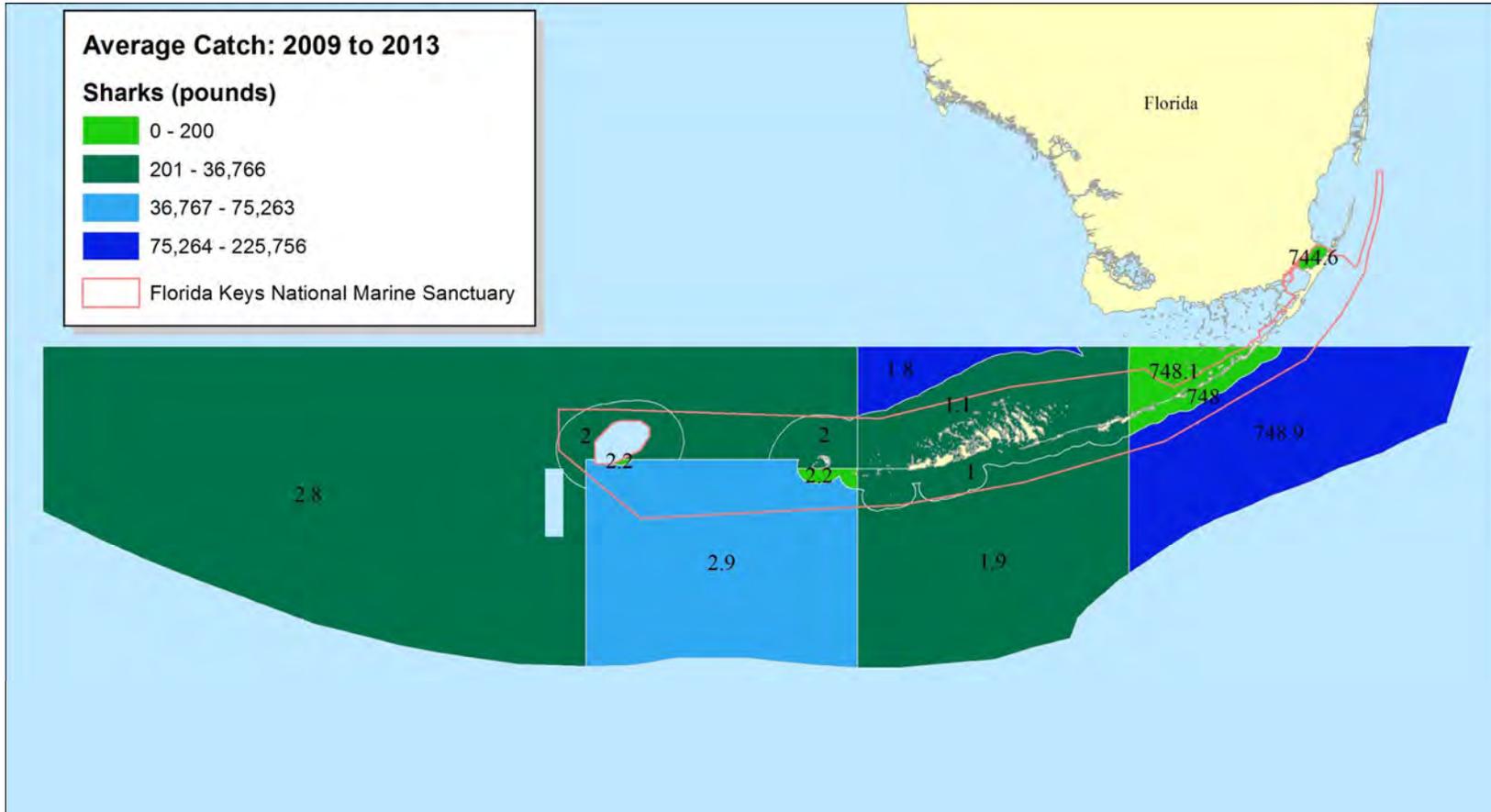


Figure A.5. Sharks average catch 2009-2013 (pounds)

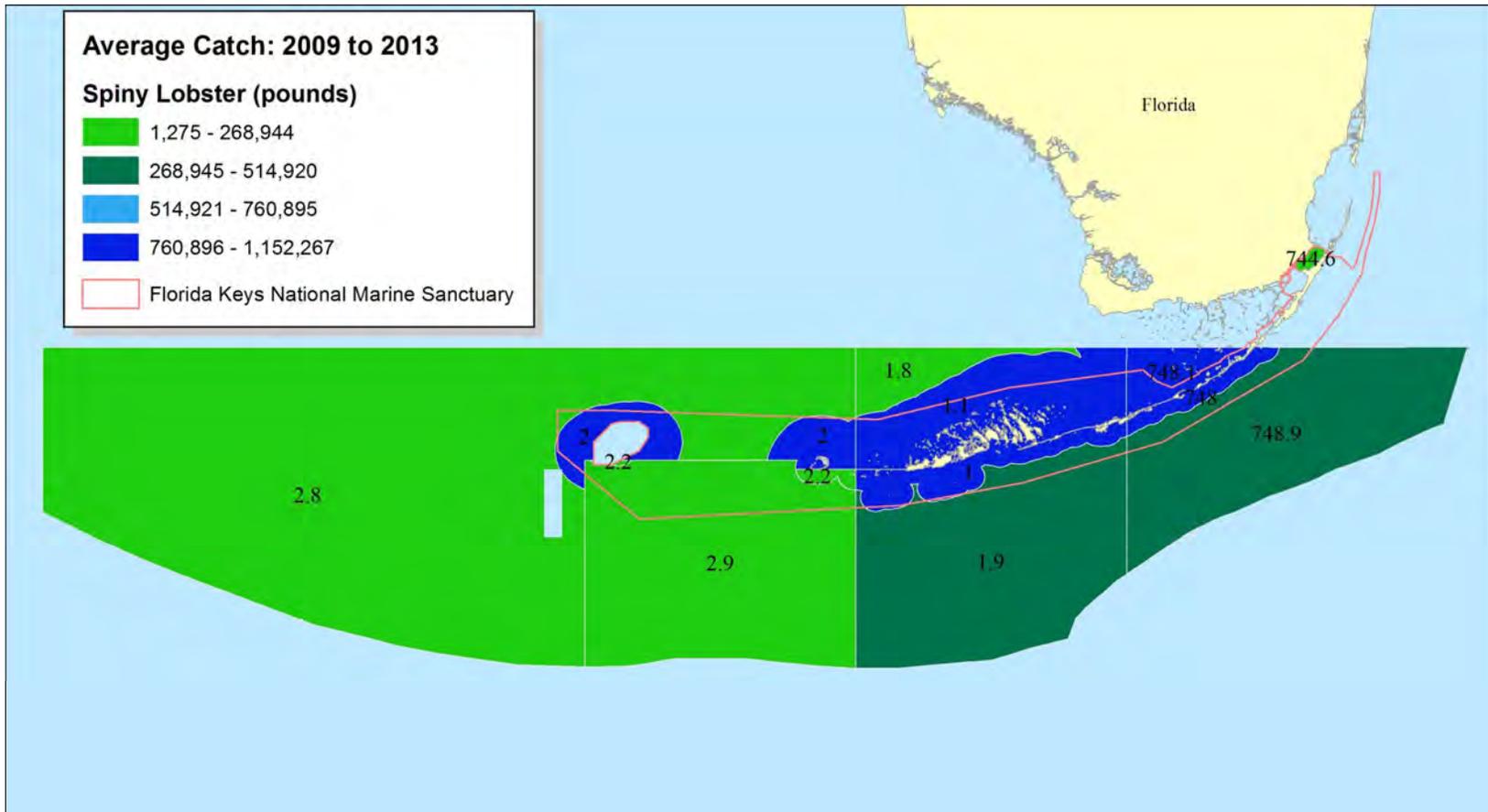


Figure A.6. Spiny lobster average catch 2009-2013 (pounds)

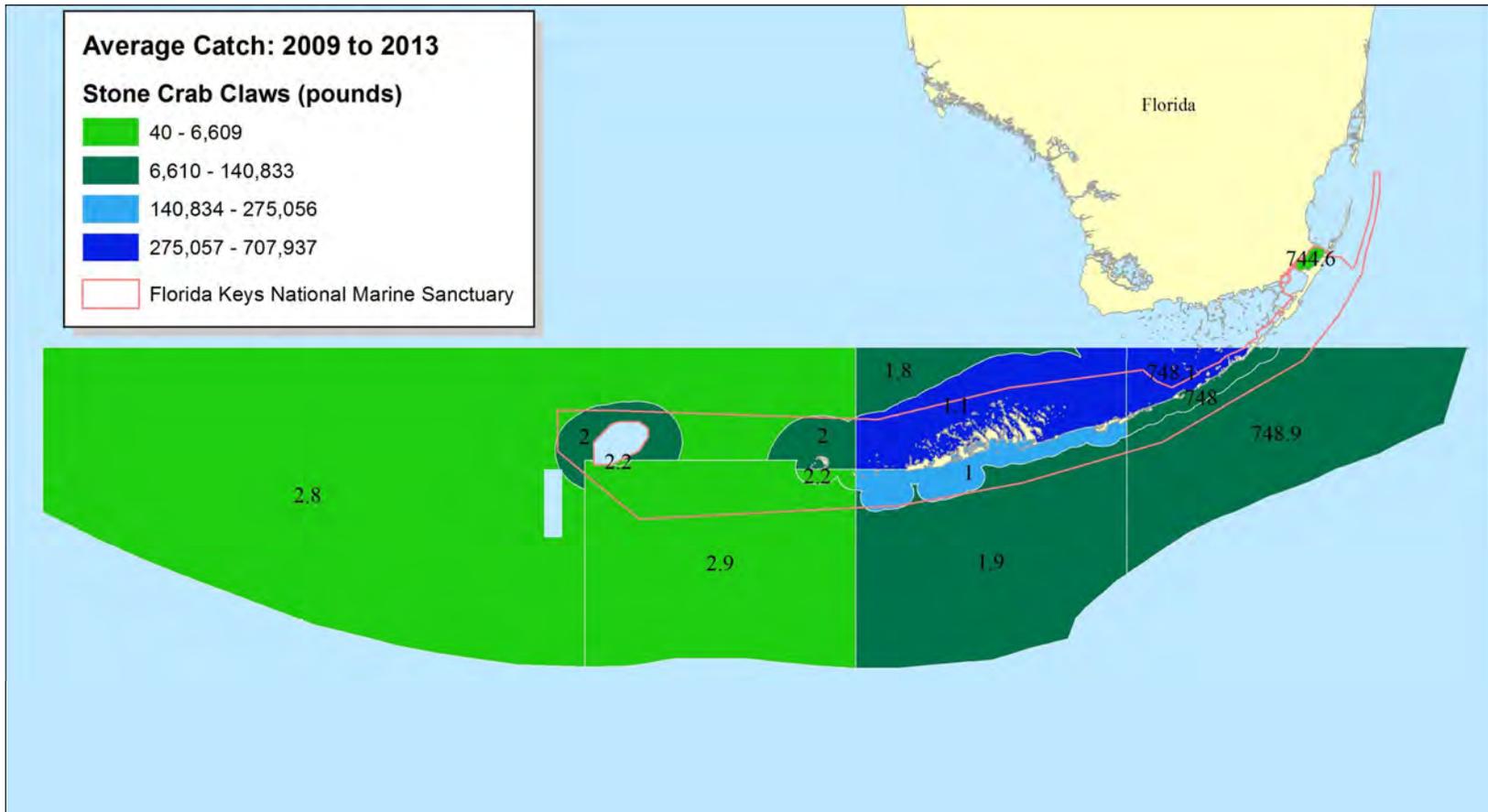


Figure A.7. Stone crab claws average catch 2009-2013 (pounds)

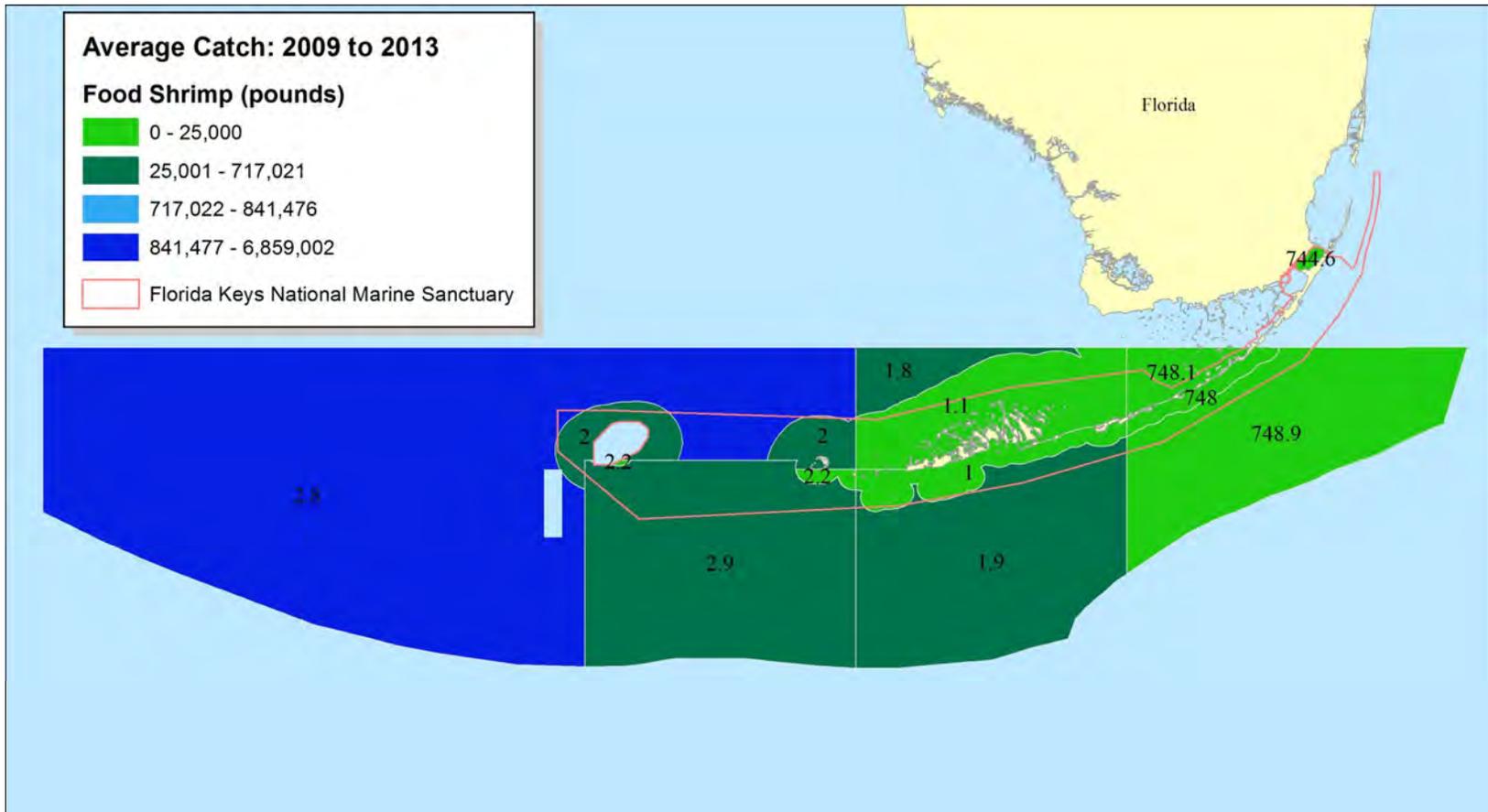


Figure A.8. Food shrimp average catch 2009-2013 (pounds)

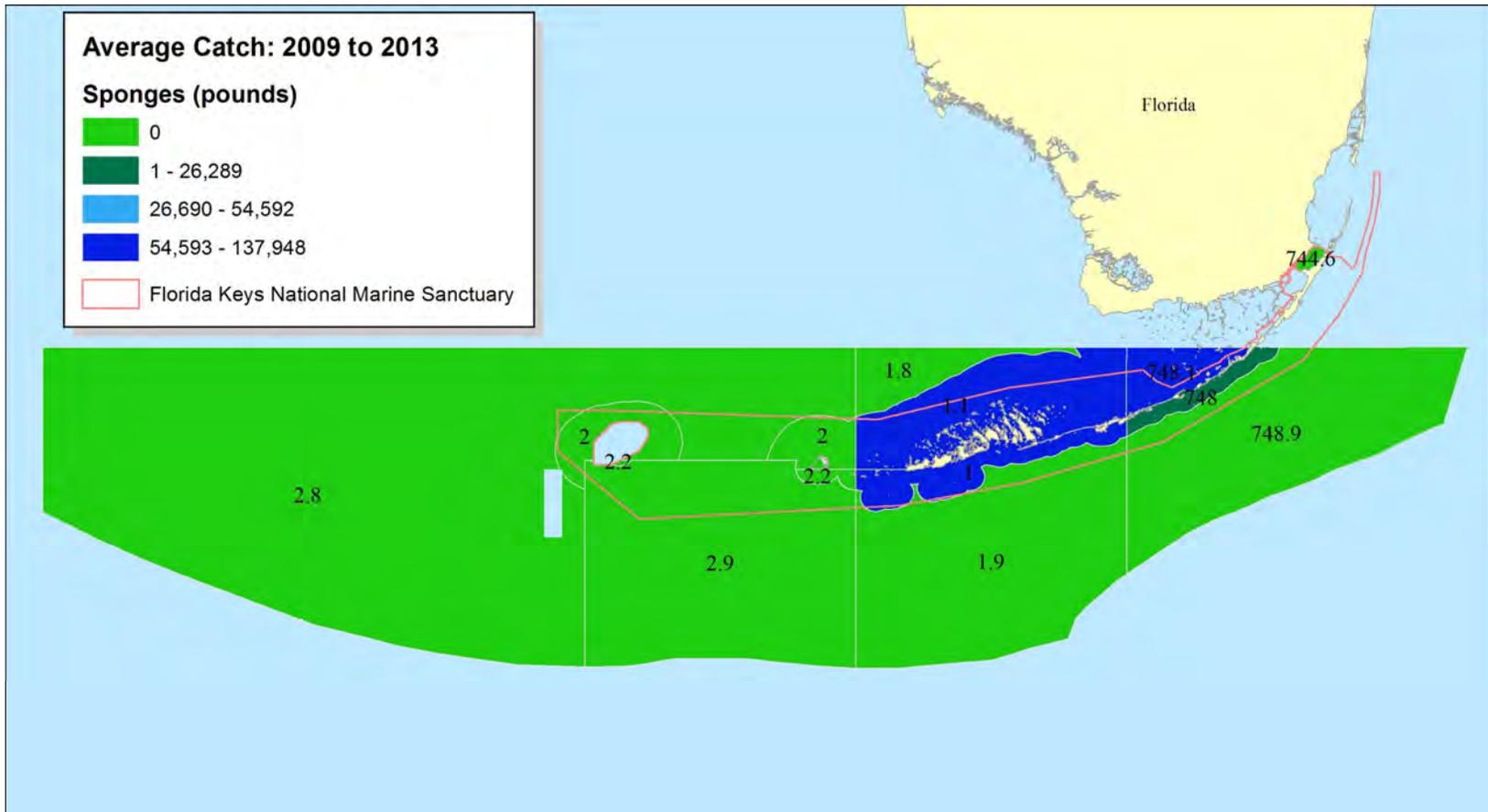


Figure A.9. Sponges average catch 2009-2013 (pounds)

**Appendix B: Commercial fish catch in FKNMS from
1997-2013 and 2009-2013 average:
Pounds and revenue (2014\$) & commercial fish catch
by statistical area for nine species/species groups with
habitat species relationships**

Table B.1. All commercial finfish catch in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	5,455,341	\$14,313,619
1998	5,368,497	\$12,360,579
1999	5,177,762	\$11,538,256
2000	4,739,432	\$9,546,492
2001	4,874,843	\$9,906,501
2002	4,770,250	\$9,901,250
2003	5,102,492	\$10,294,205
2004	5,217,348	\$12,325,458
2005	5,771,456	\$11,856,104
2006	5,587,591	\$11,328,916
2007	3,678,933	\$8,365,634
2008	3,812,854	\$8,243,921
2009	5,152,825	\$9,768,026
2010	4,299,089	\$8,816,363
2011	4,930,175	\$11,540,655
2012	4,499,790	\$11,582,924
2013	3,561,328	\$9,379,670
2009-2013 average	4,488,641	10,217,527

Table B.2. All commercial reef fish catch in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	2,717,851	\$7,923,962
1998	2,652,479	\$7,731,061
1999	2,692,631	\$7,664,815
2000	2,386,023	\$6,899,308
2001	2,399,438	\$6,668,036
2002	2,414,623	\$6,594,691
2003	2,347,641	\$6,288,208
2004	2,899,955	\$7,838,216
2005	2,704,981	\$7,174,821
2006	2,539,274	\$7,618,359
2007	1,942,167	\$5,981,103
2008	2,120,563	\$5,939,980
2009	2,614,082	\$6,995,821
2010	2,441,085	\$6,699,664
2011	2,700,936	\$8,196,608
2012	2,978,807	\$8,850,832
2013	2,266,009	\$6,673,460
2009-2013 average	2,600,184	7,483,277

Table B.3. All commercial grouper-snapper catch in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	2,372,801	\$7,458,489
1998	2,360,573	\$7,336,524
1999	2,383,792	\$7,242,572
2000	2,187,706	\$6,628,605
2001	2,111,911	\$6,257,598
2002	2,128,244	\$6,228,723
2003	2,071,518	\$5,950,914
2004	2,472,190	\$7,341,585
2005	2,093,626	\$6,438,445
2006	2,149,611	\$7,106,646
2007	1,671,091	\$5,636,386
2008	1,777,267	\$5,490,094
2009	2,283,685	\$6,613,634
2010	1,965,087	\$6,152,659
2011	2,321,619	\$7,698,455
2012	2,498,425	\$8,209,714
2013	1,960,156	\$6,255,066
2009-2013 average	2,205,794	6,985,906

Table B.4. All commercial other reef fish catch in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	345,050	\$465,474
1998	291,906	\$394,537
1999	308,839	\$422,243
2000	198,317	\$270,704
2001	287,527	\$410,438
2002	286,379	\$365,967
2003	276,123	\$337,294
2004	427,765	\$496,630
2005	611,355	\$736,376
2006	389,663	\$511,713
2007	271,076	\$344,718
2008	343,296	\$449,886
2009	330,397	\$382,187
2010	475,998	\$547,005
2011	379,317	\$498,153
2012	480,382	\$641,117
2013	305,853	\$418,394
2009-2013 average	394,389	497,371

Table B.5. All commercial catch of sharks in FKNMS 1997-2003 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	277,369	\$540,809
1998	398,662	\$635,543
1999	247,986	\$393,018
2000	337,604	\$415,237
2001	551,025	\$823,468
2002	507,176	\$896,828
2003	567,854	\$1,110,874
2004	465,759	\$888,108
2005	522,712	\$883,418
2006	742,783	\$1,108,372
2007	190,935	\$268,219
2008	194,344	\$333,537
2009	474,731	\$591,253
2010	210,888	\$255,436
2011	293,649	\$331,625
2012	128,934	\$138,640
2013	102,967	\$128,542
2009-2013 average	242,234	289,099

Table B.6. All commercial mackerel catch in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	844,761	\$1,040,912
1998	1,076,719	\$1,410,812
1999	1,299,790	\$1,422,934
2000	875,003	\$1,054,480
2001	1,187,830	\$1,361,880
2002	950,678	\$1,244,690
2003	1,280,315	\$1,329,907
2004	883,604	\$1,053,752
2005	1,807,640	\$1,885,882
2006	1,559,233	\$1,499,845
2007	842,887	\$1,013,568
2008	869,799	\$1,047,662
2009	1,471,122	\$1,453,044
2010	1,002,020	\$1,122,444
2011	1,077,911	\$1,428,374
2012	841,291	\$1,138,299
2013	625,261	\$1,003,645
2009-2013 average	1,003,521	1,229,161

Table B.7. All commercial king mackerel catch in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	659,664	\$898,953
1998	1,012,069	\$1,353,249
1999	1,048,747	\$1,277,186
2000	650,745	\$914,722
2001	906,822	\$1,212,015
2002	910,966	\$1,205,781
2003	1,056,443	\$1,218,921
2004	856,951	\$1,028,830
2005	1,262,984	\$1,550,128
2006	977,489	\$1,228,650
2007	810,884	\$987,161
2008	790,690	\$966,029
2009	1,237,895	\$1,318,666
2010	870,758	\$1,004,087
2011	955,383	\$1,307,845
2012	767,876	\$1,068,439
2013	609,417	\$985,793
2009-2013 average	888,266	1,136,966

Table B.8. All commercial catch of tuna, mahi mahi, wahoo, and swordfish in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	1,069,250	\$4,387,273
1998	594,838	\$2,268,955
1999	565,877	\$1,778,291
2000	408,339	\$863,811
2001	322,238	\$826,348
2002	331,424	\$914,991
2003	408,769	\$1,274,334
2004	612,524	\$2,311,179
2005	434,648	\$1,736,639
2006	257,892	\$897,146
2007	237,685	\$863,474
2008	222,919	\$708,383
2009	189,458	\$507,532
2010	158,242	\$544,759
2011	368,448	\$1,355,376
2012	285,789	\$1,293,861
2013	310,180	\$1,421,238
2009-2013 average	262,423	1,024,553

Table B.9. All commercial catch of other finfish in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	546,110	\$420,662
1998	645,799	\$314,209
1999	371,478	\$279,198
2000	732,463	\$313,656
2001	414,312	\$226,768
2002	566,349	\$250,051
2003	497,913	\$290,882
2004	355,506	\$234,204
2005	301,475	\$175,344
2006	488,409	\$205,194
2007	465,259	\$239,269
2008	405,229	\$214,359
2009	403,432	\$220,376
2010	486,854	\$194,059
2011	489,231	\$228,672
2012	264,969	\$161,294
2013	256,911	\$152,785
2009-2013 average	380,279	191,437

Table B.10. All commercial catch of invertebrates in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	14,341,346	\$78,877,654
1998	17,367,495	\$87,402,372
1999	13,629,033	\$85,907,960
2000	11,341,525	\$72,732,180
2001	10,571,716	\$52,465,696
2002	11,870,478	\$54,080,483
2003	12,590,829	\$54,903,478
2004	13,244,678	\$59,162,018
2005	9,906,437	\$44,738,386
2006	11,285,701	\$59,617,998
2007	7,627,793	\$47,062,128
2008	9,791,590	\$38,522,593
2009	9,673,458	\$29,814,788
2010	13,387,366	\$57,554,992
2011	12,690,994	\$63,693,754
2012	9,532,595	\$45,733,351
2013	5,383,179	\$29,352,646
2009-2013 average	10,133,518	45,229,906

Table B.11. All commercial catch of lobsters in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	5,530,180	\$33,318,791
1998	4,516,127	\$24,850,690
1999	5,841,876	\$35,872,395
2000	4,598,348	\$31,118,561
2001	2,565,602	\$17,140,047
2002	3,587,799	\$21,867,898
2003	3,524,184	\$19,901,716
2004	4,040,824	\$22,802,226
2005	2,712,280	\$16,193,873
2006	4,005,213	\$26,626,615
2007	3,099,650	\$25,335,984
2008	2,735,435	\$19,352,203
2009	3,688,724	\$12,416,848
2010	4,877,968	\$32,578,948
2011	4,912,514	\$34,419,000
2012	3,357,221	\$20,044,719
2013	1,639,849	\$13,847,124
2009-2013 average	3,695,255	\$22,661,328

Table B.12. All commercial catch of spiny lobsters in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	5,514,964	\$33,127,931
1998	4,506,223	\$24,738,835
1999	5,840,105	\$35,854,794
2000	4,595,374	\$31,078,490
2001	2,563,511	\$17,113,520
2002	3,585,952	\$21,844,566
2003	3,523,236	\$19,895,910
2004	4,040,121	\$22,795,580
2005	2,709,052	\$16,137,154
2006	4,002,994	\$26,591,674
2007	3,099,476	\$25,333,620
2008	2,735,208	\$19,351,444
2009	3,688,482	\$12,415,702
2010	4,877,358	\$32,576,183
2011	4,911,698	\$34,415,235
2012	3,356,580	\$20,038,656
2013	1,639,332	\$13,840,740
2009-2013 average	3,694,690	22,657,303

Table B.13. All commercial catch of food shrimp in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	6,126,841	\$37,452,395
1998	10,288,776	\$42,005,278
1999	5,096,566	\$24,386,347
2000	4,455,659	\$21,214,081
2001	5,961,400	\$23,454,789
2002	6,386,664	\$18,354,600
2003	7,251,740	\$18,129,253
2004	7,378,779	\$18,770,608
2005	5,663,585	\$14,566,219
2006	5,660,768	\$16,900,408
2007	2,751,466	\$6,896,178
2008	5,929,277	\$13,100,513
2009	4,989,717	\$11,102,954
2010	7,366,703	\$14,593,483
2011	5,945,345	\$13,344,381
2012	4,540,323	\$10,861,251
2013	2,940,356	\$7,311,229
2009-2013 average	5,156,489	11,442,660

Table B.14. All commercial catch of bait shrimp in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	22,699	\$1,400
1998	21,710	\$1,254
1999	19,542	\$1,188
2000	27,428	\$1,596
2001	13,708	\$727
2002	7,766	\$405
2003	10,857	\$715
2004	8,909	\$5,676
2005	13,460	\$836
2006	15,579	\$997
2007	25,497	\$30,195
2008	14,686	\$24,165
2009	23,619	\$2,759
2010	19,223	\$1,325
2011	22,940	\$1,771
2012	8,802	\$893
2013	23,450	\$1,654
2009-2013 average	19,607	1,680

Table B.15. All commercial catch of crabs in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	2,354,866	\$7,530,267
1998	2,139,014	\$19,844,827
1999	2,224,613	\$24,789,698
2000	1,869,105	\$19,775,405
2001	1,583,488	\$11,109,013
2002	1,427,300	\$13,059,160
2003	1,378,143	\$16,194,843
2004	1,422,659	\$16,796,266
2005	1,139,050	\$13,306,970
2006	1,262,257	\$15,533,264
2007	1,309,278	\$14,096,399
2008	719,912	\$5,394,258
2009	758,717	\$5,962,852
2010	905,122	\$10,052,210
2011	1,629,625	\$15,678,377
2012	1,444,586	\$14,555,535
2013	614,587	\$7,961,609
2009-2013 average	1,070,527	10,842,117

Table B.16. All commercial catch of stone crab claws in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	1,954,104	\$7,036,001
1998	1,944,920	\$19,613,790
1999	1,908,696	\$24,362,183
2000	1,599,322	\$19,375,976
2001	1,299,605	\$10,680,403
2002	1,303,480	\$12,896,091
2003	1,366,733	\$16,178,024
2004	1,406,044	\$16,769,294
2005	1,122,092	\$13,272,214
2006	1,239,575	\$15,500,622
2007	1,296,745	\$14,080,261
2008	700,215	\$5,357,150
2009	741,320	\$5,939,305
2010	893,244	\$10,038,745
2011	1,509,024	\$15,395,219
2012	1,372,713	\$14,358,179
2013	551,739	\$7,808,482
2009-2013 average	1,013,608	10,707,986

Table B.17. All commercial catch of sponges in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	305,394	\$573,561
1998	399,602	\$697,404
1999	438,470	\$716,296
2000	389,572	\$621,851
2001	446,666	\$760,368
2002	460,707	\$798,272
2003	420,286	\$672,734
2004	392,837	\$786,549
2005	377,774	\$670,153
2006	341,671	\$556,652
2007	441,860	\$703,324
2008	392,007	\$651,188
2009	212,562	\$328,413
2010	218,204	\$328,863
2011	180,091	\$249,848
2012	181,303	\$270,525
2013	164,156	\$229,712
2009-2013 average	191,263	281,472

Table B.18. All commercial catch of other invertebrates in FKNMS 1997-2013 and 2009-2013 average (2014\$)

Year	Pounds	Revenue (2014\$)
1997	1,366	\$1,241
1998	2,266	\$2,919
1999	7,966	\$142,036
2000	1,413	\$686
2001	852	\$752
2002	242	\$148
2003	5,619	\$4,217
2004	670	\$694
2005	234	\$270
2006	213	\$62
2007	42	\$48
2008	273	\$266
2009	119	\$962
2010	146	\$163
2011	479	\$376
2012	360	\$428
2013	781	\$1,318
2009-2013 average	377	650

Table B.19. Commercial catch of black grouper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	3,588	16,000
1.1	Key West, North of US 1	363	1,734
1.8	Key West, N. OF US 1, Federal (2001)	808	3,688
1.9	Key West, S. OF US 1, Federal (2001)	14,150	63,819
2	Tortugas, All waters	4,461	19,224
2.2	Tortugas, South Atlantic state waters	1,435	6,292
2.8	Tortugas, Federal waters-Gulf Council	8,827	38,304
2.9	Tortugas, Federal-S. Atl. Council (2001)	1,587	7,265
744.6	Card Sound	0	0
748	Marathon, South OF US 1	548	2,433
748.1	Marathon, North OF US 1 (Florida Bay)	72	292
748.9	Marathon, Federal waters	14,782	64,406
All	FKNMS	50,621	223,457

Table B.20. Commercial catch of gag grouper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	73	320
1.1	Key West, North of US 1	45	212
1.8	Key West, N. of US 1, Federal (2001)	276	1,262
1.9	Key West, S. OF US 1, Federal (2001)	247	1,106
2	Tortugas, All waters	102	499
2.2	Tortugas, South Atlantic state waters	22	94
2.8	Tortugas, Federal waters-Gulf Council	4,858	22,425
2.9	Tortugas, Federal-S. Atl. Council (2001)	1,240	5,568
744.6	Card Sound	0	0
748	Marathon, South of US 1	50	195
748.1	Marathon, North of US 1 (Florida Bay)	0	0
748.9	Marathon, Federal waters	398	1,390
All	FKNMS	7,312	33,069

Table B.21. Commercial catch of red grouper by area in FKNMS 2009-2013 (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	1,983	7,685
1.1	Key West, North of US 1	988	4,087
1.8	Key West, N. of US 1, Federal (2001)	3,284	12,027
1.9	Key West, S. of US 1, Federal (2001)	4,511	16,985
2	Tortugas, All waters	3,181	10,988
2.2	Tortugas, South Atlantic state waters	1,685	5,581
2.8	Tortugas, Federal waters-Gulf Council	85,953	290,566
2.9	Tortugas, Federal-S. Atl. Council (2001)	10,882	36,884
744.6	Card Sound	0	0
748	Marathon, South of US 1	175	644
748.1	Marathon, North of US 1 (Florida Bay)	272	904
748.9	Marathon, Federal waters	2,253	7,914
ALL	FKNMS	115,167	394,264

Table B.22. Commercial catch of gray snapper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	12,100	27,722
1.1	Key West, North of US 1	1,749	4,779
1.8	Key West, N. of US 1, Federal (2001)	2,582	6,329
1.9	Key West, S. of US 1, Federal (2001)	28,162	61,715
2	Tortugas, All waters	15,753	37,212
2.2	Tortugas, South Atlantic state waters	7,913	15,350
2.8	Tortugas, Federal waters-Gulf Council	4,093	10,122
2.9	Tortugas, Federal-S. Atl. Council (2001)	3,648	9,191
744.6	Card Sound	0	0
748	Marathon, South of US 1	7,898	21,680
748.1	Marathon, North of US 1 (Florida Bay)	673	2,372
748.9	Marathon, Federal waters	27,777	69,985
All	FKNMS	112,347	266,456

Table B.23. Commercial catch of mutton snapper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	3,998	10,529
1.1	Key West, North of US 1	637	1,756
1.8	Key West, N. of US 1, Federal (2001)	1,126	3,032
1.9	Key West, S. of US 1, Federal (2001)	15,592	44,569
2	Tortugas, All waters	7,638	20,687
2.2	Tortugas, South Atlantic state waters	2,304	5,519
2.8	Tortugas, Federal waters-Gulf Council	31,085	78,710
2.9	Tortugas, Federal-S. Atl. Council (2001)	2,570	7,260
744.6	Card Sound	0	0
748	Marathon, South of US 1	884	2,567
748.1	Marathon, North of US 1 (Florida Bay)	147	501
748.9	Marathon, Federal waters	13,531	44,504
All	FKNMS	79,512	219,633

Table B.24. Commercial catch of lane snapper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	854	2,069
1.1	Key West, North of US 1	81	177
1.8	Key West, N. of US 1, Federal (2001)	218	557
1.9	Key West, S. of US 1, Federal (2001)	619	1,560
2	Tortugas, All waters	112	277
2.2	Tortugas, South Atlantic state waters	2	4
2.8	Tortugas, Federal waters-Gulf Council	312	778
2.9	Tortugas, Federal-S. Atl. Council (2001)	27	64
744.6	Card Sound	0	0
748	Marathon, South of US 1	74	199
748.1	Marathon, North of US 1 (Florida Bay)	73	180
748.9	Marathon, Federal waters	244	602
All	FKNMS	2,617	6,465

Table B.25. Commercial catch of yellowtail snapper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	107,603	327,352
1.1	Key West, North of US 1	4,006	14,348
1.8	Key West, N. of US 1, Federal (2001)	30,418	97,215
1.9	Key West, S. of US 1, Federal (2001)	376,808	1,178,333
2	Tortugas, All waters	519,315	1,607,444
2.2	Tortugas, South Atlantic state waters	117,775	361,340
2.8	Tortugas, Federal waters-Gulf Council	116,208	369,720
2.9	Tortugas, Federal-S. Atl. Council (2001)	72,822	229,915
744.6	Card Sound	352	1,188
748	Marathon, South of US 1	22,091	65,376
748.1	Marathon, North of US 1 (Florida Bay)	307	1,224
748.9	Marathon, Federal waters	346,589	1,107,782
All	FKNMS	1,714,295	5,361,237

Table B.26. Commercial catch of hogfish snapper by area in FKNMS 2009-2013 average (2014\$)

Area	Area name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	2,276	8,437
1.1	Key West, North of US 1	607	2,285
1.8	Key West, N. of US 1, Federal (2001)	183	702
1.9	Key West, S. of US 1, Federal (2001)	2,174	8,542
2	Tortugas, All waters	737	2,454
2.2	Tortugas, South Atlantic state waters	259	743
2.8	Tortugas, Federal waters-Gulf Council	361	1,231
2.9	Tortugas, Federal-S. Atl. Council (2001)	117	335
744.6	Card Sound	0	0
748	Marathon, South of US 1	468	1,610
748.1	Marathon, North of US 1 (Florida Bay)	55	195
748.9	Marathon, Federal waters	1,735	6,410
All	FKNMS	8,972	32,945

Table B.27. Commercial catch of white grunts by area in FKNMS 2009-2013 average (2014\$)

Area	Area Name	Pounds	Revenue (2014\$)
1	Key West, South of US 1	7,199	7,627
1.1	Key West, North of US 1	1,202	1,271
1.8	Key West, N. of US 1, Federal (2001)	658	692
1.9	Key West, S. of US 1, Federal (2001)	4,756	4,970
2	Tortugas, All waters	2,612	2,657
2.2	Tortugas, South Atlantic state waters	186	96
2.8	Tortugas, Federal waters-Gulf Council	1,788	1,712
2.9	Tortugas, Federal-S. Atl. Council (2001)	475	508
744.6	Card Sound	40	64
748	Marathon, South of US 1	2,934	4,108
748.1	Marathon, North of US 1 (Florida Bay)	137	166
748.9	Marathon, Federal waters	2,734	3,022
All	FKNMS	24,721	26,894

Table B.28. Commercial catch of spiny lobsters by area in FKNMS 2009-2013 average (2014\$)

Area	Area Name	Pounds	Revenue (2014\$)
1.0	Key West, South of US 1	498,074	2,965,597
1.1	Key West, North of US 1	691,360	4,091,308
1.8	Key West, N. of US 1, Federal (2001)	58,374	343,761
1.9	Key West, S. of US 1, Federal (2001)	225,442	1,320,526
2.0	Tortugas, All waters	639,854	3,594,781
2.2	Tortugas, South Atlantic state waters	42,451	274,200
2.8	Tortugas, Federal waters-Gulf Council	133,549	742,060
2.9	Tortugas, Federal-S. Atl. Council (2001)	119,672	572,907
744.6	Card Sound	765	4,150
748.0	Marathon, South of US 1	496,738	3,467,328
748.1	Marathon, North of US 1 (Florida Bay)	589,530	3,978,870
748.9	Marathon, Federal waters	215,862	1,411,496
All	FKNMS Total	3,711,670	22,766,983

Table B.29. Recreational fishing effort in FKNMS by type of boat access: 2010-2014 average (person-days)

Mode	Species	Gear	n_years	Mean annual recreational effort (person-days)
Charter vessels	Black grouper	Hook-line	5	100140
Private vessels	Black grouper	Hook-line	5	177343
Charter vessels	Gag	Hook-line	5	89123
Private vessels	Gag	Hook-line	5	133454
Charter vessels	Red grouper	Hook-line	5	86463
Private vessels	Red grouper	Hook-line	5	227526
Charter vessels	Gray snapper	Hook-line	5	89222
Private vessels	Gray snapper	Hook-line	5	238997
Charter vessels	Lane snapper	Hook-line	5	78648
Private vessels	Lane snapper	Hook-line	5	185422
Charter vessels	Mutton snapper	Hook-line	5	109035
Private vessels	Mutton snapper	Hook-line	5	192889
Charter vessels	Yellowtail snapper	Hook-line	5	97567
Private vessels	Yellowtail snapper	Hook-line	5	234055
Charter vessels	White grunt	Hook-line	5	80769
Private vessels	White grunt	Hook-line	5	223163
Charter vessels	Hogfish	Hook-line	5	76054
Private vessels	Hogfish	Hook-line	5	219964
Private vessels	Hogfish	Spear	5	37737

¹. Person-days and person-trips are equivalent measures in the Marine Recreational Fishing Statistics Program of the National Fisheries Service (NMFS).

Source: NOAA NMFS, Marine Recreational Fishing Statistics Program. Estimates produced by University of Miami, RSMAS, Smith and Ault (2016).

Table B.30. Florida Keys recreational fishing effort (person-days 2010-2014 average): Nine reef fish species effort scaled to total effort in FKNMS

	RSMAS provided	proportion	Scaled to total	Scaling factor
Charter species				
Black grouper	100,140	0.12408599	17,604	0.175796
Gag grouper	89,123	0.110434549	15,667	0.175796
Red grouper	86,463	0.107138476	15,200	0.175796
Gray snapper	89,222	0.110557222	15,685	0.175796
Lane snapper	78,648	0.097454713	13,826	0.175796
Mutton snapper	109,035	0.135108008	19,168	0.175796
Yellowtail snapper	97,567	0.120897721	17,152	0.175796
White grunt	80,769	0.100082897	14,199	0.175796
Hogfish	76,054	0.094240422	13,370	0.175796
Total	807,021	1	141,871	0.175796
Private/rental species				
Black grouper	177,343	0.094807944	38,939	0.219569
Gag grouper	133,454	0.071344792	29,302	0.219569
Red grouper	227,526	0.121635882	49,958	0.219569
Gray snapper	238,997	0.127768303	52,476	0.219569
Lane snapper	185,422	0.099126995	40,713	0.219569
Mutton snapper	192,889	0.103118869	42,352	0.219569
Yellowtail snapper	234,055	0.1251263	51,391	0.219569
White grunt	223,163	0.119303413	49,000	0.219569
Hogfish: hook-and-line	219,964	0.117593221	48,297	0.219569
Hogfish: spear	37,737	0.02017428	8,286	0.219569
Total	1,870,550	1	410,714	0.219569

Source: NOAA NMFS, Marine Recreational Fishing Statistics Program. Estimates produced by University of Miami, RSMAS, Smith and Ault (2016).

Appendix C: Habitat species relationships and recreational effort distribution computations

Table C.1. Habitat classification in the geographic information system for FKNMS and southeast Florida

Classification variable	Description	FKNMS	Southeast Florida
ARTF_NA	Artificial reef	X	
CONT_HR	Contiguous reef, high relief	X	
CONT_LR	Contiguous reef, low relief	X	
CONT_MR	Contiguous reef, moderate relief	X	
CPDP_HR	Colonized pavement, deep, high relief		X
CPDP_LR	Colonized pavement, deep, low relief		X
CPSH_HR	Colonized pavement, shallow, high relief		X
CPSH_LR	Colonized pavement, shallow, low relief		X
DPRC_HR	Deep ridge complex, high relief		X
DPRC_LR	Deep ridge complex, low relief		X
ISOL_HR	Isolated reef structures, high relief	X	
ISOL_LR	Isolated reef structures, low relief	X	
ISOL_MR	Isolated reef structures, moderate relief	X	
LIRI_HR	Linear reef, inner reef line, high relief		X
LIRI_LR	Linear reef, inner reef line, low relief		X
LIRM_HR	Linear reef, middle reef line, high relief		X
LIRM_LR	Linear reef, middle reef line, low relief		X
LIRO_HR	Linear reef, outer reef line, high relief		X
LIRO_LR	Linear reef, outer reef line, low relief		X
OTHR_NA	Other non-reef habitat		X
PTDP_HR	Patch reefs, deep, high relief		X
PTDP_LR	Patch reefs, deep, low relief		X
PTSH_HR	Patch reefs, shallow, high relief		X
PTSH_LR	Patch reefs, shallow, low relief		X
RGDP_HR	Reef ridge, deep, high relief		X
RGDP_LR	Reef ridge, deep, low relief		X
RGSH_HR	Reef ridge, shallow, high relief		X
RGSH_LR	Reef ridge, shallow, low relief		X
RUBB_LR	Reef rubble, low relief	X	
SAND_NA	Sand	X	X
SGRS_NA	Seagrass	X	

Table C.1. (Continued)

Classification variable	Description	FKNMS	Southeast Florida
SPGR_HR	Spur-groove reef, high relief	X	X
SPGR_LR	Spur-groove reef, low relief	X	X
UCHB_LR	Unconsolidated hard bottom, low relief	X	
UNCR_UN	Unclassified reef	X	
UNDF_UN	Undefined, unknown	X	

Source: NOAA, National Ocean Service, National Centers for Coastal Ocean Science (NCCOS), Geographic Information System for FKNMS Southeast Florida

Table C.2. Distributions by habitats for nine reef fish species in FKNMS¹

Species of reef fish	Habitat	n	Dbar	n * Dbar	Proportion in habitat class
Red grouper	CONT_HR	579	22.686	13135.19	0.306886917
Red grouper	CONT_LR	408	20.812	8491.296	0.198388212
Red grouper	CONT_MR	525	26.716	14025.9	0.327697118
Red grouper	ISOL_LR	194	14.405	2794.57	0.065291535
Red grouper	ISOL_MR	169	25.766	4354.454	0.101736218
White grunt	CONT_HR	579	338.441	195957.3	0.414256561
White grunt	CONT_LR	408	131.526	53662.61	0.113443505
White grunt	CONT_MR	525	293.356	154011.9	0.325583315
White grunt	ISOL_LR	194	133.383	25876.3	0.054702865
White grunt	ISOL_MR	169	257.548	43525.61	0.092013754
Hogfish	CONT_HR	579	33.339	19303.28	0.311519034
Hogfish	CONT_LR	408	29.291	11950.73	0.192862511
Hogfish	CONT_MR	525	31.847	16719.68	0.269824441
Hogfish	ISOL_LR	194	34.124	6620.056	0.106835385
Hogfish	ISOL_MR	169	43.617	7371.273	0.118958629
Mutton snapper	CONT_HR	579	18.643	10794.3	0.33050565
Mutton snapper	CONT_LR	408	14.807	6041.256	0.184974458
Mutton snapper	CONT_MR	525	16.506	8665.65	0.265329579
Mutton snapper	ISOL_LR	194	19.999	3879.806	0.118794008
Mutton snapper	ISOL_MR	169	19.402	3278.938	0.100396305
Gray (mangrove) snapper	CONT_HR	579	375.367	217337.5	0.606669794
Gray (mangrove) snapper	CONT_LR	408	12.078	4927.824	0.01375539
Gray (mangrove) snapper	CONT_MR	525	185.532	97404.3	0.271891636
Gray (mangrove) snapper	ISOL_LR	194	55.521	10771.07	0.030066074
Gray (mangrove) snapper	ISOL_MR	169	164.533	27806.08	0.077617105
Lane snapper	CONT_HR	579	19.047	11028.21	0.486764718
Lane snapper	CONT_LR	408	0.068	27.744	0.001224568
Lane snapper	CONT_MR	525	18.648	9790.2	0.432121137
Lane snapper	ISOL_LR	194	0	0	0
Lane snapper	ISOL_MR	169	10.71	1809.99	0.079889577
Black grouper	CONT_HR	579	20.593	11923.35	0.529526964
Black grouper	CONT_LR	408	3.002	1224.816	0.054395221
Black grouper	CONT_MR	525	14.019	7359.975	0.326863356
Black grouper	ISOL_LR	194	2.377	461.138	0.020479569
Black grouper	ISOL_MR	169	9.158	1547.702	0.06873489

Table C.2. (Continued)

Species of reef fish	Habitat	n	Dbar	n * Dbar	Proportion in habitat class
Gag grouper	CONT_HR	579	0.333	192.807	0.241562835
Gag grouper	CONT_LR	408	0.273	111.384	0.139550093
Gag grouper	CONT_MR	525	0.741	389.025	0.487399222
Gag grouper	ISOL_LR	194	0	0	0
Gag grouper	ISOL_MR	169	0.621	104.949	0.13148785
Yellowtail snapper	CONT_HR	579	997.337	577458.1	0.599618131
Yellowtail snapper	CONT_LR	408	151.69	61889.52	0.064264536
Yellowtail snapper	CONT_MR	525	421.303	221184.1	0.229672034
Yellowtail snapper	ISOL_LR	194	174.884	33927.5	0.035229467
Yellowtail snapper	ISOL_MR	169	405.822	68583.92	0.071215832

¹. Mean density (number per 100x100m grid cell) by habitat type for principal exploited in Dry Tortugas National Park, a lightly fished region.

Source: Ault and Smith (2016)

Table C.3. Habitat-species relationships and distributions by habitat for spiny lobsters in FKNMS

Habitat type	Habitat variable ¹	Proportion
Forereef	CONT_HR	0.342835907
Offshore patch	ISOL_HR	0.126979932
Inshore patch	ISOL_LR	0.162953175
Backreef	RUBB_LR	0.367230985

¹ See Table C1 for description of habitat variable.

Source: Cox and Hunt (2005)

C.4. Computation procedure for spatial fishing effort based on species habitat use patterns

Symbol	Description
N_h	Number of map grid cells (100 x 100 m) in habitat h (determined from GIS mapgrid)
\bar{D}_h	Mean target fish species density per grid cell in habitat h
Y_h	Fish abundance (numbers) in habitat h
$p(Y_h)$	Proportion of fish abundance in habitat h
E	Total recreational fishing effort (person-trips) directed at a given target species
E_h	Fishing effort in habitat h
$E_{grid,h}$	Fishing effort in a grid cell in habitat h

Compute total animals for a habitat type:

$$Y_h = \bar{D}_h \cdot N_h$$

Compute proportion of abundance by habitat type:

$$p(Y_h) = \frac{Y_h}{\sum_h Y_h}$$

Compute fishing effort by habitat type:

$$E_h = E \cdot p(Y_h)$$

Compute fishing effort per 100 x 100 m grid cell by habitat type:

$$E_{grid,h} = \frac{E_h}{N_h}$$

Appendix D: Economic impact models for recreational activities by spatial alternatives

Table D.1a. Derivation of direct wages and salaries income and employment for Monroe County charter boat fishing: Alternatives 2 and 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$953,703		\$236,747		7.95
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$52,313	0.1964	\$10,274	17,715	0.58
Camping site (RV/tent/camper)	\$0.07	\$1,420	0.1964	\$279	17,715	0.02
<i>Privately owned</i>		\$0				
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$780,668	0.2652	\$207,033	30,973	6.68
Rental home, cottage, cabin, condo	\$5.13	\$109,360	0.1581	\$17,290	30,526	0.57
Camping site (RV/tent/camper)	\$0.47	\$9,942	0.1882	\$1,871	18,807	0.10
Food and beverages	\$51.80	\$1,104,724		\$276,685		12.56
Food & drinks consumed at restaurants & bars	\$40.54	\$864,463	0.2913	\$251,818	21,596	11.66
Beverages purchased at a store for carry-out	\$2.84	\$60,598	0.1035	\$6,272	27,682	0.23
Food purchased at a store for carry-out	\$8.42	\$179,663	0.1035	\$18,595	27,682	0.67
Transportation	\$11.85	\$252,806		\$33,602		1.37
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$61,781	0.1804	\$11,145	26,680	0.42
Gas & oil - auto or RV	\$5.35	\$114,094	0.0395	\$4,507	22,835	0.20
Repair & services - auto or RV	\$0.60	\$12,782	0.2353	\$3,008	40,146	0.07
Parking fees & tolls	\$1.08	\$22,961	0.2367	\$5,435	15,197	0.36
Taxi fare	\$0.44	\$9,468	0.2891	\$2,737	26,660	0.10
Bus fare						
a) Package tour	\$0.44	\$9,468	0.2067	\$1,957	29,456	0.07
b) Any other bus fare	\$0.18	\$3,787	0.2067	\$783	29,456	0.03
Airline fare		\$0				
a) Package tours	\$0.04	\$947	0.2067	\$196	33,375	0.01
b) Any other airline fares	\$0.63	\$13,492	0.2067	\$2,789	33,375	0.08
Ferry fare	\$0.19	\$4,024	0.2598	\$1,045	28,044	0.04
Boating	\$0.00	\$0		\$0		0.00
Boat, jet ski, and wave runner rental	\$0.00	\$0	0.2191	\$0	23,993	0.00
Boat fuel and oil	\$0.00	\$0	0.0395	\$0	22,835	0.00
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.00	\$0	0.2224	\$0	28,029	0.00
Boat slip or marina fees (this trip only)	\$0.00	\$0	0.2224	\$0	28,029	0.00
Sailing charters or sunset cruises	\$0.00	\$0	0.2749	\$0	30,379	0.00

Table D.1a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$87.78	\$1,871,900		\$514,585		16.94
Cut bait	\$0.70	\$14,913	0.2749	\$4,100	30,379	0.13
Live bait	\$0.30	\$6,391	0.2749	\$1,757	30,379	0.06
Daily or special fishing permits/licenses	\$0.21	\$4,497	0.2749	\$1,236	30,379	0.04
Fishing lines, fly lines, fish nets, traps	\$2.55	\$54,443	0.2749	\$14,966	30,379	0.49
Charter/party boat/guide fees	\$84.02	\$1,791,655	0.2749	\$492,526	30,379	16.21
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0.00		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$371,634		\$58,214		2.87
Film purchases	\$0.31	\$6,628	0.1034	\$685	22,745	0.03
Film development	\$0.01	\$237	0.1034	\$24	22,745	0.00
Footwear	\$0.83	\$17,753	0.1307	\$2,320	19,247	0.12
Clothing	\$8.88	\$189,368	0.1307	\$24,750	19,247	1.29
Souvenirs and gifts (not including clothing)	\$6.29	\$134,214	0.2087	\$28,011	21,054	1.33
Other general merchandise	\$1.10	\$23,434	0.1034	\$2,423	22,745	0.11
Services	\$0	\$7,338		\$2,587		0.06
Barber, laundry, and other personal services	\$0.08	\$1,657	0.2392	\$396	27,355	0.01
Telephone, fax, other business services	\$0.01	\$237	0.2996	\$71	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$5,444	0.3893	\$2,119	48,108	0.04
Total Trip	\$213.93	\$4,562,104		\$1,122,420		41.75

Table D.1b. Derivation of total output and income for Monroe County charter boat fishing: Alternatives 2 and 3

Person-days (from Table D.1a)	21,325
x	
Expenditures per person-day	\$213.93
=	
Total expenditures (Table D.1a)	\$4,562,104
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$3,193,473
x	
Output multiplier	1.6
=	
Total output	\$5,109,557
Reported gross sales 2015 in 2016\$	4,711,094,075
Percent of gross sales	0.1085
Wages & salaries income (direct) (from Table D.1a)	\$1,122,420
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$1,556,797
x	
Income multiplier	1.6
=	
Total income	\$2,490,875
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0953

Table D.1c. Derivation of total employment in Monroe County charter boat fishing: Alternatives 2 and 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.1a)	41.75
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	54.27380715
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (Table D.1a)	\$1,122,420
=	
Proprietor's income (direct)	\$182,730.03
divided by	
Proprietor's income-to-employment ratio	15,950
=	
Proprietor's direct employment	11.45642835
x	
Employment multiplier	1.3
=	
Total proprietor's employment	14.89335685
Total direct employment	53.20551077
Total employment	69.167164
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0016

Table D.2a. Derivation of direct wages and salaries income and employment for Monroe County charter boat fishing: Alternative 4

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$55,428	0.1964	\$10,886	17,715	0.61
Camping site (RV/tent/camper)	\$0.07	\$1,505	0.1964	\$296	17,715	0.02
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$827,153	0.2652	\$219,361	30,973	7.08
Rental home, cottage, cabin, condo	\$5.13	\$115,872	0.1581	\$18,319	30,526	0.60
Camping site (RV/tent/camper)	\$0.47	\$10,534	0.1882	\$1,982	18,807	0.11
Food and beverages	\$51.80	\$1,170,505		\$293,160		13.31
Food & drinks consumed at restaurants & bars	\$40.54	\$915,938	0.2913	\$266,813	21,596	12.35
Beverages purchased at a store for carry-out	\$2.84	\$64,206	0.1035	\$6,645	27,682	0.24
Food purchased at a store for carry-out	\$8.42	\$190,361	0.1035	\$19,702	27,682	0.71
Transportation	\$11.85	\$267,859		\$35,603		1.45
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$65,460	0.1804	\$11,809	26,680	0.44
Gas & oil - auto or RV	\$5.35	\$120,888	0.0395	\$4,775	22,835	0.21
Repair & services - auto or RV	\$0.60	\$13,543	0.2353	\$3,187	40,146	0.08
Parking fees & tolls	\$1.08	\$24,328	0.2367	\$5,758	15,197	0.38
Taxi fare	\$0.44	\$10,032	0.2891	\$2,900	26,660	0.11
Bus fare						
a) Package tour	\$0.44	\$10,032	0.2067	\$2,074	29,456	0.07
b) Any other bus fare	\$0.18	\$4,013	0.2067	\$829	29,456	0.03
Airline fare						
a) Package tours	\$0.04	\$1,003	0.2067	\$207	33,375	0.01
b) Any other airline fares	\$0.63	\$14,296	0.2067	\$2,955	33,375	0.09
Ferry fare	\$0.19	\$4,264	0.2598	\$1,108	28,044	0.04
Boating	\$0.00	\$0		\$0		0.00
Boat, jet ski, and wave runner rental	\$0.00	\$0	0.2191	\$0	23,993	0.00
Boat fuel and oil	\$0.00	\$0	0.0395	\$0	22,835	0.00
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.00	\$0	0.2224	\$0	28,029	0.00
Boat slip or marina fees (this trip only)	\$0.00	\$0	0.2224	\$0	28,029	0.00
Sailing charters or sunset cruises	\$0.00	\$0	0.2749	\$0	30,379	0.00

Table D.2a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$87.78	\$1,983,362		\$545,226		17.95
Cut bait	\$0.70	\$15,801	0.2749	\$4,344	30,379	0.14
Live bait	\$0.30	\$6,772	0.2749	\$1,862	30,379	0.06
Daily or special fishing permits/licenses	\$0.21	\$4,765	0.2749	\$1,310	30,379	0.04
Fishing lines, fly lines, fish nets, traps	\$2.55	\$57,685	0.2749	\$15,858	30,379	0.52
Charter/party boat/guide fees	\$84.02	\$1,898,339	0.2749	\$521,853	30,379	17.18
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0.00		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$393,763		\$61,681		3.05
Film purchases	\$0.31	\$7,023	0.1034	\$726	22,745	0.03
Film development	\$0.01	\$251	0.1034	\$26	22,745	0.00
Footwear	\$0.83	\$18,810	0.1307	\$2,459	19,247	0.13
Clothing	\$8.88	\$200,644	0.1307	\$26,224	19,247	1.36
Souvenirs and gifts (not including clothing)	\$6.29	\$142,206	0.2087	\$29,678	21,054	1.41
Other general merchandise	\$1.10	\$24,830	0.1034	\$2,567	22,745	0.11
Services	\$0	\$7,775		\$2,741		0.06
Barber, laundry, and other personal services	\$0.08	\$1,756	0.2392	\$420	27,355	0.02
Telephone, fax, other business services	\$0.01	\$251	0.2996	\$75	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$5,769	0.3893	\$2,246	48,108	0.05
Total trip	\$213.93	\$4,833,755		\$1,189,255		44.24

**Table D.2b. Derivation of total output and income for Monroe County charter boat fishing:
Alternative 4**

Person-days (from Table D.2a)	22,595
x	
Expenditures per person-day	\$213.93
=	
Total expenditures (Table D.2a)	\$4,833,755
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$3,383,629
x	
Output multiplier	1.6
=	
Total output	\$5,413,806
Reported gross sales 2015 in 2016\$	4,711,094,075
Percent of gross sales	0.1149
Wages & salaries income (direct) (from Table D.2a)	\$1,189,255
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$1,649,497
x	
Income multiplier	1.6
=	
Total income	\$2,639,195
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.1010

Table D.2c. Derivation of total employment in Monroe County charter boat fishing: Alternative 4

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.2a)	44.24
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	57.512
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (Table D.2a)	\$1,189,255
=	
Proprietor's income (direct)	\$193,610.71
divided by	
Proprietor's income-to-employment ratio	15,950
=	
Proprietor's direct employment	12.13860276
x	
Employment multiplier	1.3
=	
Total proprietor's employment	15.78018359
Total direct employment	56.37860276
Total employment	73.29218359
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0016

Table D.3a. Derivation of direct wages and salaries income and employment for Monroe County private/rental boat fishing: Alternatives 2 and 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$2,225,996		\$552,581		18.55
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$122,101	0.1964	\$23,981	17,715	1.35
Camping site (RV/tent/camper)	\$0.07	\$3,315	0.1964	\$651	17,715	0.04
<i>Privately owned</i>		\$0				
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$1,822,124	0.2652	\$483,227	30,973	15.60
Rental home, cottage, cabin, condo	\$5.13	\$255,252	0.1581	\$40,355	30,526	1.32
Camping site (RV/tent/camper)	\$0.47	\$23,205	0.1882	\$4,367	18,807	0.23
Food and beverages	\$51.80	\$2,578,487		\$645,799		29.31
Food & drinks consumed at restaurants & bars	\$40.54	\$2,017,706	0.2913	\$587,758	21,596	27.22
Beverages purchased at a store for carry-out	\$2.84	\$141,438	0.1035	\$14,639	27,682	0.53
Food purchased at a store for carry-out	\$8.42	\$419,343	0.1035	\$43,402	27,682	1.57
Transportation	\$11.85	\$590,063		\$78,429		3.20
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$144,201	0.1804	\$26,014	26,680	0.98
Gas & oil - auto or RV	\$5.35	\$266,302	0.0395	\$10,519	22,835	0.46
Repair & services - auto or RV	\$0.60	\$29,835	0.2353	\$7,020	40,146	0.17
Parking fees & tolls	\$1.08	\$53,592	0.2367	\$12,685	15,197	0.83
Taxi fare	\$0.44	\$22,100	0.2891	\$6,389	26,660	0.24
Bus fare						
a) Package tour	\$0.44	\$22,100	0.2067	\$4,568	29,456	0.16
b) Any other bus fare	\$0.18	\$8,840	0.2067	\$1,827	29,456	0.06
Airline fare		\$0				
a) Package tours	\$0.04	\$2,210	0.2067	\$457	33,375	0.01
b) Any other airline fares	\$0.63	\$31,492	0.2067	\$6,509	33,375	0.20
Ferry fare	\$0.19	\$9,392	0.2598	\$2,440	28,044	0.09
Boating	\$6.74	\$335,364		\$76,253		2.53
Boat, jet ski, and wave runner rental	\$1.70	\$84,532	0.2191	\$18,521	23,993	0.77
Boat fuel and oil	\$0.72	\$35,912	0.0395	\$1,419	22,835	0.06
Boat repairs	\$3.53	\$175,693	0.2603	\$45,733	33,878	1.35
Boat launch fees	\$0.03	\$1,657	0.2224	\$369	28,029	0.01
Boat slip or marina fees (this trip only)	\$0.04	\$2,210	0.2224	\$491	28,029	0.02
Sailing charters or sunset cruises	\$0.71	\$35,360	0.2749	\$9,720	30,379	0.32

Table D.3a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$3.76	\$187,295		\$51,487		1.69
Cut bait	\$0.70	\$34,807	0.2749	\$9,568	30,379	0.31
Live bait	\$0.30	\$14,917	0.2749	\$4,101	30,379	0.13
Daily or special fishing permits/licenses	\$0.21	\$10,497	0.2749	\$2,886	30,379	0.09
Fishing lines, fly lines, fish nets, traps	\$2.55	\$127,074	0.2749	\$34,933	30,379	1.15
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0.00		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$867,415		\$135,875		6.71
Film purchases	\$0.31	\$15,470	0.1034	\$1,600	22,745	0.07
Film development	\$0.01	\$552	0.1034	\$57	22,745	0.00
Footwear	\$0.83	\$41,437	0.1307	\$5,416	19,247	0.28
Clothing	\$8.88	\$441,995	0.1307	\$57,769	19,247	3.00
Souvenirs and gifts (not including clothing)	\$6.29	\$313,264	0.2087	\$65,378	21,054	3.11
Other general merchandise	\$1.10	\$54,697	0.1034	\$5,656	22,745	0.25
Services	\$0	\$17,127		\$6,038		0.14
Barber, laundry, and other personal services	\$0.08	\$3,867	0.2392	\$925	27,355	0.03
Telephone, fax, other business services	\$0.01	\$552	0.2996	\$166	29,901	0.01
Physician, dentist, and other medical services	\$0.26	\$12,707	0.3893	\$4,947	48,108	0.10
Total trip	\$136.65	\$6,801,748		\$1,546,462		62.14

Table D.3b. Derivation of total output and income for Monroe County private/rental boat fishing: Alternatives 2 and 3

Person-days (from Table D.3a)	49,774
x	
Expenditures per person-day	\$136.65
=	
Total expenditures (Table D.3a)	\$6,801,748
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$4,761,223
x	
Output multiplier	1.6
=	
Total output	\$7,617,957
Reported gross sales 2015 in 2016\$	4,711,094,075
Percent of gross sales	0.1617
Wages & salaries income (direct) (from Table D.4a)	\$1,546,462
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$2,144,942
x	
Income multiplier	1.6
=	
Total income	\$3,431,907
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.1313

Table D.3c. Derivation of total employment in Monroe County private/rental boat fishing: Alternatives 2 and 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.3a)	62.14
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	80.77934124
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (Table D.3a)	\$1,546,462
=	
Proprietor's income (direct)	\$251,763.94
divided by	
Proprietor's income-to-employment ratio	15,950
=	
Proprietor's direct employment	15.78457298
x	
Employment multiplier	1.3
=	
Total proprietor's employment	20.51994488
Total direct employment	77.92252778
Total employment	101.2992861
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0016

Table D.4a. Derivation of direct wages and salaries income and employment for Monroe County private/rental boat fishing: Alternative 4

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$2,359,662		\$585,762		19.66
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$129,433	0.1964	\$25,421	17,715	1.43
Camping site (RV/tent/camper)	\$0.07	\$3,514	0.1964	\$690	17,715	0.04
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$1,931,537	0.2652	\$512,244	30,973	16.54
Rental home, cottage, cabin, condo	\$5.13	\$270,579	0.1581	\$42,779	30,526	1.40
Camping site (RV/tent/camper)	\$0.47	\$24,598	0.1882	\$4,629	18,807	0.25
Food and beverages	\$51.80	\$2,733,319		\$684,577		31.07
Food & drinks consumed at restaurants & bars	\$40.54	\$2,138,864	0.2913	\$623,051	21,596	28.85
Beverages purchased at a store for carry-out	\$2.84	\$149,931	0.1035	\$15,518	27,682	0.56
Food purchased at a store for carry-out	\$8.42	\$444,523	0.1035	\$46,008	27,682	1.66
Transportation	\$11.85	\$625,495		\$83,138		3.39
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$152,860	0.1804	\$27,576	26,680	1.03
Gas & oil - auto or RV	\$5.35	\$282,293	0.0395	\$11,151	22,835	0.49
Repair & services - auto or RV	\$0.60	\$31,626	0.2353	\$7,442	40,146	0.19
Parking fees & tolls	\$1.08	\$56,810	0.2367	\$13,447	15,197	0.88
Taxi fare	\$0.44	\$23,427	0.2891	\$6,773	26,660	0.25
Bus fare						
a) Package tour	\$0.44	\$23,427	0.2067	\$4,842	29,456	0.16
b) Any other bus fare	\$0.18	\$9,371	0.2067	\$1,937	29,456	0.07
Airline fare						
a) Package tours	\$0.04	\$2,343	0.2067	\$484	33,375	0.01
b) Any other airline fares	\$0.63	\$33,383	0.2067	\$6,900	33,375	0.21
Ferry fare	\$0.19	\$9,956	0.2598	\$2,587	28,044	0.09
Boating	\$6.74	\$355,501		\$80,831		2.69
Boat, jet ski, and wave runner rental	\$1.70	\$89,607	0.2191	\$19,633	23,993	0.82
Boat fuel and oil	\$0.72	\$38,069	0.0395	\$1,504	22,835	0.07
Boat repairs	\$3.53	\$186,243	0.2603	\$48,479	33,878	1.43
Boat launch fees	\$0.03	\$1,757	0.2224	\$391	28,029	0.01
Boat slip or marina fees (this trip only)	\$0.04	\$2,343	0.2224	\$521	28,029	0.02
Sailing charters or sunset cruises	\$0.71	\$37,483	0.2749	\$10,304	30,379	0.34

Table D.4a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$3.76	\$198,542		\$54,579		1.80
Cut bait	\$0.70	\$36,897	0.2749	\$10,143	30,379	0.33
Live bait	\$0.30	\$15,813	0.2749	\$4,347	30,379	0.14
Daily or special fishing permits/licenses	\$0.21	\$11,128	0.2749	\$3,059	30,379	0.10
Fishing lines, fly lines, fish nets, traps	\$2.55	\$134,704	0.2749	\$37,030	30,379	1.22
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0.00		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$919,501		\$144,034		7.11
Film purchases	\$0.31	\$16,399	0.1034	\$1,696	22,745	0.07
Film development	\$0.01	\$586	0.1034	\$61	22,745	0.00
Footwear	\$0.83	\$43,925	0.1307	\$5,741	19,247	0.30
Clothing	\$8.88	\$468,535	0.1307	\$61,238	19,247	3.18
Souvenirs and gifts (not including clothing)	\$6.29	\$332,074	0.2087	\$69,304	21,054	3.29
Other general merchandise	\$1.10	\$57,981	0.1034	\$5,995	22,745	0.26
Services	\$0	\$18,156		\$6,400		0.15
Barber, laundry, and other personal services	\$0.08	\$4,100	0.2392	\$981	27,355	0.04
Telephone, fax, other business services	\$0.01	\$586	0.2996	\$175	29,901	0.01
Physician, dentist, and other medical services	\$0.26	\$13,470	0.3893	\$5,244	48,108	0.11
Total trip	\$136.65	\$7,210,175		\$1,639,323		65.87

Table D.4b. Derivation of total output and income for Monroe County Private/Rental Boat Fishing: Alternative 4

Person-days (from Table D.4a)	52,763
x	
Expenditures per person-day	\$136.65
=	
Total expenditures (Table D.4a)	\$7,210,175
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$5,047,123
x	
Output multiplier	1.6
=	
Total output	\$8,075,396
Reported gross sales 2015 in 2016\$	4,711,094,075
Percent of gross sales	0.1714
Wages & salaries income (direct) (from Table D.4a)	\$1,639,323
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$2,273,741
x	
Income multiplier	1.6
=	
Total income	\$3,637,986
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.1392

**Table D.4c. Derivation of total employment in Monroe County private/rental boat fishing:
Alternative 4**

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.4a)	65.87
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	85.631
Proprietor's employment	
Proprietors' income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (Table D.4a)	\$1,639,323
=	
Proprietor's income (direct)	\$266,881.78
divided by	
Proprietor's income-to-employment ratio	15,950
=	
Proprietor's direct employment	16.73240028
x	
Employment multiplier	1.3
=	
Total proprietor's employment	21.75212036
Total direct employment	82.60240028
Total employment	107.3831204
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0016

Table D.5a. Derivation of direct wages and salaries income and employment for Monroe County recreational lobster fishing: Alternatives 2 and 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$344,728		\$85,575		2.87
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$18,909	0.1964	\$3,714	17,715	0.21
Camping site (RV/tent/camper)	\$0.07	\$513	0.1964	\$101	17,715	0.01
<i>Privately owned</i>		\$0				
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$282,182	0.2652	\$74,835	30,973	2.42
Rental home, cottage, cabin, condo	\$5.13	\$39,529	0.1581	\$6,250	30,526	0.20
Camping site (RV/tent/camper)	\$0.47	\$3,594	0.1882	\$676	18,807	0.04
Food and beverages	\$51.80	\$399,316		\$100,011		4.54
Food & drinks consumed at restaurants & bars	\$40.54	\$312,471	0.2913	\$91,023	21,596	4.21
Beverages purchased at a store for carry-out	\$2.84	\$21,904	0.1035	\$2,267	27,682	0.08
Food purchased at a store for carry-out	\$8.42	\$64,941	0.1035	\$6,721	27,682	0.24
Transportation	\$12.60	\$97,112		\$13,331		0.53
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$22,332	0.1804	\$4,029	26,680	0.15
Gas & oil - auto or RV	\$5.35	\$41,241	0.0395	\$1,629	22,835	0.07
Repair & services - auto or RV	\$0.60	\$4,620	0.2353	\$1,087	40,146	0.03
Parking fees & tolls	\$1.08	\$8,299	0.2367	\$1,964	15,197	0.13
Taxi fare	\$0.44	\$3,422	0.2891	\$989	26,660	0.04
Bus fare						
a) Package tour	\$0.04	\$342	0.2067	\$71	29,456	0.00
b) Any other bus fare	\$0.18	\$1,369	0.2067	\$283	29,456	0.01
Airline fare		\$0				
a) Package tours	\$1.19	\$9,155	0.2067	\$1,892	33,375	0.06
b) Any other airline fares	\$0.63	\$4,877	0.2067	\$1,008	33,375	0.03
Ferry fare	\$0.19	\$1,455	0.2598	\$378	28,044	0.01
Boating	\$6.74	\$51,936		\$11,809		0.39
Boat, jet ski, and wave runner rental	\$1.70	\$13,091	0.2191	\$2,868	23,993	0.12
Boat fuel and oil	\$0.72	\$5,562	0.0395	\$220	22,835	0.01
Boat repairs	\$3.53	\$27,209	0.2603	\$7,082	33,878	0.21
Boat launch fees	\$0.03	\$257	0.2224	\$57	28,029	0.00
Boat slip or marina fees (this trip only)	\$0.04	\$342	0.2224	\$76	28,029	0.00
Sailing charters or sunset cruises	\$0.71	\$5,476	0.2749	\$1,505	30,379	0.05

Table D.5a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$8.06	\$62,118		\$17,076		0.56
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.21	\$1,626	0.2749	\$447	30,379	0.01
Fishing lines, fly lines, fish nets, traps	\$2.55	\$19,679	0.2749	\$5,410	30,379	0.18
Charter/party boat/guide fees	\$5.29	\$40,813	0.2749	\$11,219	30,379	0.37
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0.00		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$134,332		\$21,042		1.04
Film purchases	\$0.31	\$2,396	0.1034	\$248	22,745	0.01
Film development	\$0.01	\$86	0.1034	\$9	22,745	0.00
Footwear	\$0.83	\$6,417	0.1307	\$839	19,247	0.04
Clothing	\$8.88	\$68,449	0.1307	\$8,946	19,247	0.46
Souvenirs and gifts (not including clothing)	\$6.29	\$48,513	0.2087	\$10,125	21,054	0.48
Other general merchandise	\$1.10	\$8,471	0.1034	\$876	22,745	0.04
Services	\$0.34	\$2,652		\$935		0.02
Barber, laundry, and other personal services	\$0.08	\$599	0.2392	\$143	27,355	0.01
Telephone, fax, other business services	\$0.01	\$86	0.2996	\$26	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$1,968	0.3893	\$766	48,108	0.02
Total trip	\$141.69	\$1,092,194		\$249,779		9.96

Table D.5b. Derivation of total output and income for Monroe County recreational lobster fishing: Alternatives 2 and 3

Person-days (from GIS analysis)	7,708
x	
Expenditures per person-trip	\$141.69
=	
Total expenditures (Table D.5a)	\$1,092,194
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$764,535
x	
Output multiplier	1.6
=	
Total output	\$1,223,257
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.0260
Wages & salaries income (direct) (from Table D.7a)	\$249,779
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$346,444
x	
Income multiplier	1.6
=	
Total income	\$554,310
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0212

Table D.5c. Derivation of total employment in Monroe County for recreational lobster fishing: Alternatives 2 and 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.5a)	0.05
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	12.94
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.5a)	\$249,779
=	
Proprietor's income (direct)	\$40,664
divided by	
Proprietor's income-to-employment ratio	15,950
=	
Proprietor's direct employment	2.55
x	
Employment multiplier	1.3
=	
Total proprietor's employment	3.31
Total direct employment	12.51
Total employment	16.26
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0259

Table D.6a. Derivation of direct wages and salaries income and employment for Monroe County recreational lobster fishing: Alternative 4

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$446,459		\$110,829		3.72
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$24,489	0.1964	\$4,810	17,715	0.27
Camping site (RV/tent/camper)	\$0.07	\$665	0.1964	\$131	17,715	0.01
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$365,456	0.2652	\$96,919	30,973	3.13
Rental home, cottage, cabin, condo	\$5.13	\$51,195	0.1581	\$8,094	30,526	0.27
Camping site (RV/tent/camper)	\$0.47	\$4,654	0.1882	\$876	18,807	0.05
Food and beverages	\$51.80	\$517,156		\$129,525		5.88
Food & drinks consumed at restaurants & bars	\$40.54	\$404,683	0.2913	\$117,884	21,596	5.46
Beverages purchased at a store for carry-out	\$2.84	\$28,368	0.1035	\$2,936	27,682	0.11
Food purchased at a store for carry-out	\$8.42	\$84,106	0.1035	\$8,705	27,682	0.31
Transportation	\$12.60	\$125,771		\$17,265		0.68
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$28,922	0.1804	\$5,217	26,680	0.20
Gas & oil - auto or RV	\$5.35	\$53,411	0.0395	\$2,110	22,835	0.09
Repair & services - auto or RV	\$0.60	\$5,984	0.2353	\$1,408	40,146	0.04
Parking fees & tolls	\$1.08	\$10,749	0.2367	\$2,544	15,197	0.17
Taxi fare	\$0.44	\$4,432	0.2891	\$1,281	26,660	0.05
Bus fare						
a) Package tour	\$0.04	\$443	0.2067	\$92	29,456	0.00
b) Any other bus fare	\$0.18	\$1,773	0.2067	\$366	29,456	0.01
Airline fare						
a) Package tours	\$1.19	\$11,857	0.2067	\$2,451	33,375	0.07
b) Any other airline fares	\$0.63	\$6,316	0.2067	\$1,306	33,375	0.04
Ferry fare	\$0.19	\$1,884	0.2598	\$489	28,044	0.02
Boating	\$6.74	\$67,262		\$15,294		0.51
Boat, jet ski, and wave runner rental	\$1.70	\$16,954	0.2191	\$3,715	23,993	0.15
Boat fuel and oil	\$0.72	\$7,203	0.0395	\$285	22,835	0.01
Boat repairs	\$3.53	\$35,238	0.2603	\$9,172	33,878	0.27
Boat launch fees	\$0.03	\$332	0.2224	\$74	28,029	0.00
Boat slip or marina fees (this trip only)	\$0.04	\$443	0.2224	\$99	28,029	0.00
Sailing charters or sunset cruises	\$0.71	\$7,092	0.2749	\$1,950	30,379	0.06

Table D.6a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$8.06	\$80,449		\$22,115		0.73
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.21	\$2,105	0.2749	\$579	30,379	0.02
Fishing lines, fly lines, fish nets, traps	\$2.55	\$25,487	0.2749	\$7,006	30,379	0.23
Charter/party boat/guide fees	\$5.29	\$52,857	0.2749	\$14,530	30,379	0.48
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$173,974		\$27,252		1.35
Film purchases	\$0.31	\$3,103	0.1034	\$321	22,745	0.01
Film development	\$0.01	\$111	0.1034	\$11	22,745	0.00
Footwear	\$0.83	\$8,311	0.1307	\$1,086	19,247	0.06
Clothing	\$8.88	\$88,649	0.1307	\$11,586	19,247	0.60
Souvenirs and gifts (not including clothing)	\$6.29	\$62,830	0.2087	\$13,113	21,054	0.62
Other general merchandise	\$1.10	\$10,970	0.1034	\$1,134	22,745	0.05
Services	\$0.34	\$3,435		\$1,211		0.03
Barber, laundry, and other personal services	\$0.08	\$776	0.2392	\$186	27,355	0.01
Telephone, fax, other business services	\$0.01	\$111	0.2996	\$33	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$2,549	0.3893	\$992	48,108	0.02
Total trip	\$141.69	\$1,414,506		\$323,491		12.89

Table D.6b. Derivation of total output and income for Monroe County recreational lobster fishing: Alternative 4

Person-days (from GIS analysis)	9,983
x	
Expenditures per person-trip	\$141.69
=	
Total expenditures (Table D.6a)	\$1,414,506
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$990,154
x	
Output multiplier	1.6
=	
Total output	\$1,584,247
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.03
Wages & salaries income (direct) (from Table D.6a)	\$323,491
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$448,682
x	
Income multiplier	1.6
=	
Total income	\$717,891
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0275

Table D.6c. Derivation of total employment in Monroe County for recreational lobster fishing: Alternative 4

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.6a)	12.89
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	16.76
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.6a)	\$323,491
=	
Proprietor's income (direct)	\$52,664
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	3.24
x	
Employment multiplier	1.3
=	
Total proprietor's employment	4.21
Total direct employment	16.13
Total employment	20.96
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0334

Table D.7a. Derivation of direct wages and salaries income and employment for Monroe County resident recreational diving: Alternative 2

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$5.06	\$109,285		\$28,415		0.95
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$0.20	\$4,314	0.1964	\$847	17,715	0.05
Camping site (RV/tent/camper)	\$0.03	\$719	0.1964	\$141	17,715	0.01
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$4.70	\$101,376	0.2652	\$26,885	30,973	0.87
Rental home, cottage, cabin, condo	\$0.00	\$0	0.1581	\$0	30,526	0.00
Camping site (RV/tent/camper)	\$0.13	\$2,876	0.1882	\$541	18,807	0.03
Food and beverages	\$32.21	\$695,494		\$158,264		7.08
Food & drinks consumed at restaurants & bars	\$21.28	\$459,428	0.2913	\$133,831	21,596	6.20
Beverages purchased at a store for carry-out	\$5.46	\$117,913	0.1035	\$12,204	27,682	0.44
Food purchased at a store for carry-out	\$5.47	\$118,152	0.1035	\$12,229	27,682	0.44
Transportation	\$4.65	\$100,418		\$7,711		0.41
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$0.04	\$959	0.1804	\$173	26,680	0.01
Gas & oil - auto or RV	\$3.79	\$81,724	0.0395	\$3,228	22,835	0.14
Repair & services - auto or RV	\$0.03	\$719	0.2353	\$169	40,146	0.00
Parking fees & tolls	\$0.69	\$14,859	0.2367	\$3,517	15,197	0.23
Taxi fare	\$0.10	\$2,157	0.2891	\$624	26,660	0.02
Bus fare						
a) Package tour	\$0.00	\$0	0.2067	\$0	29,456	0.00
b) Any other bus fare	\$0.00	\$0	0.2067	\$0	29,456	0.00
Airline fare						
a) Package tours	\$0.00	\$0	0.2067	\$0	33,375	0.00
b) Any other airline fares	\$0.00	\$0	0.2067	\$0	33,375	0.00
Ferry fare	\$0.00	\$0	0.2598	\$0	28,044	0.00
Boating	\$23.19	\$500,650		\$22,847		0.97
Boat, jet ski, and wave runner rental	\$0.07	\$1,438	0.2191	\$315	23,993	0.01
Boat fuel and oil	\$22.47	\$485,072	0.0395	\$19,160	22,835	0.84
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.12	\$2,636	0.2224	\$586	28,029	0.02
Boat slip or marina fees (this trip only)	\$0.33	\$7,190	0.2224	\$1,599	28,029	0.06
Sailing charters or sunset cruises	\$0.20	\$4,314	0.2749	\$1,186	30,379	0.04

Table D.7a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$5.44	\$179,986		\$45,600		1.63
Rental fee for equipment	\$0.32	\$69,503	0.2191	\$15,228	23,993	0.63
Charter/party boat/guide service	\$5.12	\$110,483	0.2749	\$30,372	30,379	1.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$376,266		\$58,940		2.91
Film purchases	\$0.31	\$6,710	0.1034	\$694	22,745	0.03
Film development	\$0.01	\$240	0.1034	\$25	22,745	0.00
Footwear	\$0.83	\$17,975	0.1307	\$2,349	19,247	0.12
Clothing	\$8.88	\$191,728	0.1307	\$25,059	19,247	1.30
Souvenirs and gifts (not including clothing)	\$6.29	\$135,887	0.2087	\$28,360	21,054	1.35
Other general merchandise	\$1.10	\$23,726	0.1034	\$2,453	22,745	0.11
Services	\$0.34	\$7,429		\$2,619		0.06
Barber, laundry, and other personal services	\$0.08	\$1,678	0.2392	\$401	27,355	0.01
Telephone, fax, other business services	\$0.01	\$240	0.2996	\$72	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$5,512	0.3893	\$2,146	48,108	0.04
Total trip	\$88.32	\$1,969,528		\$324,395		14.01

Table D.7b. Derivation of total output and Income for Monroe County resident recreational diving: Alternative 2

Person-days (from GIS analysis)	21,591
x	
Expenditures per person-trip	\$88.33
=	
Total expenditures (Table D.7a)	\$1,969,528
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$1,378,670
x	
Output multiplier	1.6
=	
Total output	\$2,205,871
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.05
Wages & salaries income (direct) (from Table D.7a)	\$324,395
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$449,936
x	
Income multiplier	1.6
=	
Total income	\$719,897
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0275

**Table D.7c. Derivation of total employment in Monroe County for resident recreational diving:
Alternative 2**

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.7a)	14.01
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	18.21
Proprietor's employment	
Proprietors' income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.7a)	\$324,395
=	
Proprietor's income (direct)	\$52,812
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	3.25
x	
Employment multiplier	1.3
=	
Total proprietor's employment	4.22
Total direct employment	17.26
Total employment	22.43
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0357

Table D.8a. Derivation of direct wages and salaries income and employment for Monroe County resident recreational diving: Alternative 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$5.06	\$123,468		\$32,102		1.08
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$0.20	\$4,874	0.1964	\$957	17,715	0.05
Camping site (RV/tent/camper)	\$0.03	\$812	0.1964	\$160	17,715	0.01
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$4.70	\$114,532	0.2652	\$30,374	30,973	0.98
Rental home, cottage, cabin, condo	\$0.00	\$0	0.1581	\$0	30,526	0.00
Camping site (RV/tent/camper)	\$0.13	\$3,249	0.1882	\$611	18,807	0.03
Food and beverages	\$32.21	\$785,752		\$178,803		8.00
Food & drinks consumed at restaurants & bars	\$21.28	\$519,051	0.2913	\$151,200	21,596	7.00
Beverages purchased at a store for carry-out	\$5.46	\$133,215	0.1035	\$13,788	27,682	0.50
Food purchased at a store for carry-out	\$5.47	\$133,486	0.1035	\$13,816	27,682	0.50
Transportation	\$4.65	\$113,449		\$8,712		0.46
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$0.04	\$1,083	0.1804	\$195	26,680	0.01
Gas & oil - auto or RV	\$3.79	\$92,330	0.0395	\$3,647	22,835	0.16
Repair & services - auto or RV	\$0.03	\$812	0.2353	\$191	40,146	0.00
Parking fees & tolls	\$0.69	\$16,787	0.2367	\$3,974	15,197	0.26
Taxi fare	\$0.10	\$2,437	0.2891	\$704	26,660	0.03
Bus fare						
a) Package tour	\$0.00	\$0	0.2067	\$0	29,456	0.00
b) Any other bus fare	\$0.00	\$0	0.2067	\$0	29,456	0.00
Airline fare		\$0				
a) Package tours	\$0.00	\$0	0.2067	\$0	33,375	0.00
b) Any other airline fares	\$0.00	\$0	0.2067	\$0	33,375	0.00
Ferry fare	\$0.00	\$0	0.2598	\$0	28,044	0.00
Boating	\$23.19	\$565,622		\$25,812		1.09
Boat, jet ski, and wave runner rental	\$0.07	\$1,625	0.2191	\$356	23,993	0.01
Boat fuel and oil	\$22.47	\$548,023	0.0395	\$21,647	22,835	0.95
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.12	\$2,978	0.2224	\$662	28,029	0.02
Boat slip or marina fees (this trip only)	\$0.33	\$8,123	0.2224	\$1,807	28,029	0.06
Sailing charters or sunset cruises	\$0.20	\$4,874	0.2749	\$1,340	30,379	0.04

Table D.8a. (Continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$5.44	\$132,674		\$36,034		1.20
Rental fee for equipment	\$0.32	\$7,852	0.2191	\$1,720	23,993	0.07
Charter/party boat/guide service	\$5.12	\$124,821	0.2749	\$34,313	30,379	1.13
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$425,097		\$66,589		3.29
Film purchases	\$0.31	\$7,581	0.1034	\$784	22,745	0.03
Film development	\$0.01	\$271	0.1034	\$28	22,745	0.00
Footwear	\$0.83	\$20,307	0.1307	\$2,654	19,247	0.14
Clothing	\$8.88	\$216,610	0.1307	\$28,311	19,247	1.47
Souvenirs and gifts (not including clothing)	\$6.29	\$153,522	0.2087	\$32,040	21,054	1.52
Other general merchandise	\$1.10	\$26,805	0.1034	\$2,772	22,745	0.12
Services	\$0.34	\$8,394		\$2,959		0.07
Barber, laundry, and other personal services	\$0.08	\$1,895	0.2392	\$453	27,355	0.02
Telephone, fax, other business services	\$0.01	\$271	0.2996	\$81	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$6,228	0.3893	\$2,424	48,108	0.05
Total trip	\$88.32	\$2,154,456		\$351,010		15.19

Table D.8b. Derivation of total output and income for Monroe County resident recreational diving: Alternative 3

Person-days (from GIS analysis)	24,393
x	
Expenditures per person-trip	\$88.32
=	
Total expenditures (Table D.8a)	\$2,154,456
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$1,508,119
x	
Output multiplier	1.6
=	
Total output	\$2,412,991
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.05
Wages & salaries income (direct) (from Table D.8a)	\$351,010
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$486,851
x	
Income multiplier	1.6
=	
Total income	\$778,961
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0298

Table D.8c. Derivation of total employment in Monroe County for resident recreational diving: Alternative 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.8a)	15.19
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	19.75
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.8a)	\$351,010
=	
Proprietor's income (direct)	\$57,144
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	3.51
x	
Employment multiplier	1.3
=	
Total proprietor's employment	4.57
Total direct employment	18.70
Total employment	24.31
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0387

Table D.9a. Derivation of direct wages and salaries income and employment for Monroe County resident recreational diving: Alternative 4

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$5.06	\$160,991		\$41,859		1.40
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$0.20	\$6,355	0.1964	\$1,248.10	17,715	0.07
Camping site (RV/tent/camper)	\$0.03	\$1,059	0.1964	\$208	17,715	0.01
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$4.70	\$149,340	0.2652	\$39,605	30,973	1.28
Rental home, cottage, cabin, condo	\$0.00	\$0	0.1581	\$0	30,526	0.00
Camping site (RV/tent/camper)	\$0.13	\$4,237	0.1882	\$797	18,807	0.04
Food and beverages	\$32.21	\$1,024,553		\$233,144		10.43
Food & drinks consumed at restaurants & bars	\$21.28	\$676,798	0.2913	\$197,151	21,596	9.13
Beverages purchased at a store for carry-out	\$5.46	\$173,701	0.1035	\$17,978	27,682	0.65
Food purchased at a store for carry-out	\$5.47	\$174,054	0.1035	\$18,015	27,682	0.65
Transportation	\$4.65	\$147,928		\$11,359		0.60
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$0.04	\$1,412	0.1804	\$255	26,680	0.01
Gas & oil - auto or RV	\$3.79	\$120,390	0.0395	\$4,755	22,835	0.21
Repair & services - auto or RV	\$0.03	\$1,059	0.2353	\$249	40,146	0.01
Parking fees & tolls	\$0.69	\$21,889	0.2367	\$5,181	15,197	0.34
Taxi fare	\$0.10	\$3,177	0.2891	\$919	26,660	0.03
Bus fare						
a) Package tour	\$0.00	\$0	0.2067	\$0	29,456	0.00
b) Any other bus fare	\$0.00	\$0	0.2067	\$0	29,456	0.00
Airline fare						
a) Package tours	\$0.00	\$0	0.2067	\$0	33,375	0.00
b) Any other airline fares	\$0.00	\$0	0.2067	\$0	33,375	0.00
Ferry fare	\$0.00	\$0	0.2598	\$0	28,044	0.00
Boating	\$23.19	\$737,523		\$33,656		1.43
Boat, jet ski, and wave runner rental	\$0.07	\$2,118	0.2191	\$464	23,993	0.02
Boat fuel and oil	\$22.47	\$714,575	0.0395	\$28,226	22,835	1.24
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.12	\$3,884	0.2224	\$864	28,029	0.03
Boat slip or marina fees (this trip only)	\$0.33	\$10,592	0.2224	\$2,356	28,029	0.08
Sailing charters or sunset cruises	\$0.20	\$6,355	0.2749	\$1,747	30,379	0.06

Table D.9a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$5.44	\$172,995		\$46,985		1.57
Rental fee for equipment	\$0.32	\$10,238	0.2191	\$2,243	23,993	0.09
Charter/party boat/guide service	\$5.12	\$162,756	0.2749	\$44,742	30,379	1.47
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$554,290		\$86,826		4.29
Film purchases	\$0.31	\$9,885	0.1034	\$1,022	22,745	0.04
Film development	\$0.01	\$353	0.1034	\$37	22,745	0.00
Footwear	\$0.83	\$26,479	0.1307	\$3,461	19,247	0.18
Clothing	\$8.88	\$282,441	0.1307	\$36,915	19,247	1.92
Souvenirs and gifts (not including clothing)	\$6.29	\$200,180	0.2087	\$41,778	21,054	1.98
Other general merchandise	\$1.10	\$34,952	0.1034	\$3,614	22,745	0.16
Services	\$0.34	\$10,945		\$3,858		0.09
Barber, laundry, and other personal services	\$0.08	\$2,471	0.2392	\$591	27,355	0.02
Telephone, fax, other business services	\$0.01	\$353	0.2996	\$106	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$8,120	0.3893	\$3,161	48,108	0.07
Total trip	\$88.32	\$2,809,224		\$457,687		19.80

Table D.9b. Derivation of total output and income for Monroe County resident recreational diving: Alternative 4

Person-days (from GIS analysis)	31,806
x	
Expenditures per person-trip	\$88.32
=	
Total expenditures (Table D.9a)	\$2,809,139
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$1,966,396.98
x	
Output multiplier	1.6
=	
Total output	\$3,146,235
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.07
Wages & salaries income (direct) (from Table D.9a)	\$457,687
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$634,811.50
x	
Income multiplier	1.6
=	
Total income	\$1,015,698
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0389

**Table D.9c. Derivation of total employment in Monroe County for resident recreational diving:
Alternative 4**

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.15a)	19.80
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	25.75
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.15a)	\$457,687
=	
Proprietor's income (direct)	\$74,511
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	4.58
x	
Employment multiplier	1.3
=	
Total proprietor's employment	5.95
Total direct employment	24.38
Total employment	31.70
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0505

Table D.10a. Derivation of direct wages and salaries income and employment for Monroe County visitor recreational scuba diving and snorkeling: Alternative 2

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$5,819,035		\$1,444,517		48.48
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$319,188	0.1964	\$62,688	17,715	3.54
Camping site (RV/tent/camper)	\$0.07	\$8,666	0.1964	\$1,702	17,715	0.10
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$4,763,261	0.2652	\$1,263,217	30,973	40.78
Rental home, cottage, cabin, condo	\$5.13	\$667,261	0.1581	\$105,494	30,526	3.46
Camping site (RV/tent/camper)	\$0.47	\$60,660	0.1882	\$11,416	18,807	0.61
Food and beverages	\$51.80	\$6,740,490		\$1,688,199		76.63
Food & drinks consumed at restaurants & bars	\$40.54	\$5,274,538	0.2913	\$1,536,473	21,596	71.15
Beverages purchased at a store for carry-out	\$2.84	\$369,738	0.1035	\$38,268	27,682	1.38
Food purchased at a store for carry-out	\$8.42	\$1,096,214	0.1035	\$113,458	27,682	4.10
Transportation	\$12.60	\$1,639,266		\$225,024		8.92
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$376,959	0.1804	\$68,003	26,680	2.55
Gas & oil - auto or RV	\$5.35	\$696,147	0.0395	\$27,498	22,835	1.20
Repair & services - auto or RV	\$0.60	\$77,992	0.2353	\$18,351	40,146	0.46
Parking fees & tolls	\$1.08	\$140,096	0.2367	\$33,161	15,197	2.18
Taxi fare	\$0.44	\$57,772	0.2891	\$16,702	26,660	0.63
Bus fare						
a) Package tour	\$0.04	\$5,777	0.2067	\$1,194	29,456	0.04
b) Any other bus fare	\$0.18	\$23,109	0.2067	\$4,777	29,456	0.16
Airline fare						
a) Package tours	\$1.19	\$154,539	0.2067	\$31,943	33,375	0.96
b) Any other airline fares	\$0.63	\$82,324	0.2067	\$17,016	33,375	0.51
Ferry fare	\$0.19	\$24,553	0.2598	\$6,379	28,044	0.23
Boating	\$6.74	\$876,683		\$199,334		6.63
Boat, jet ski, and wave runner rental	\$1.70	\$220,976	0.2191	\$48,416	23,993	2.02
Boat fuel and oil	\$0.72	\$93,879	0.0395	\$3,708	22,835	0.16
Boat repairs	\$3.53	\$459,283	0.2603	\$119,551	33,878	3.53
Boat launch fees	\$0.03	\$4,333	0.2224	\$964	28,029	0.03
Boat slip or marina fees (this trip only)	\$0.04	\$5,777	0.2224	\$1,285	28,029	0.05
Sailing charters or sunset cruises	\$0.71	\$92,434	0.2749	\$25,410	30,379	0.84

Table D.10a. (continued)

Appendix D: Economic impact models for recreational activities by spatial alternatives

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$3.01	\$391,402		\$102,197		3.55
Rental fee for equipment	\$0.74	\$96,767	0.2191	\$21,202	23,993	0.88
Charter/party boat/guide service	\$2.26	\$294,635	0.2749	\$80,995	30,379	2.67
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$2,267,532		\$355,195		17.54
Film purchases	\$0.31	\$40,440	0.1034	\$4,182	22,745	0.18
Film development	\$0.01	\$1,444	0.1034	\$149	22,745	0.01
Footwear	\$0.83	\$108,322	0.1307	\$14,158	19,247	0.74
Clothing	\$8.88	\$1,155,430	0.1307	\$151,015	19,247	7.85
Souvenirs and gifts (not including clothing)	\$6.29	\$818,911	0.2087	\$170,907	21,054	8.12
Other general merchandise	\$1.10	\$142,984	0.1034	\$14,785	22,745	0.65
Services	\$0.34	\$44,773		\$15,783		0.37
Barber, laundry, and other personal services	\$0.08	\$10,110	0.2392	\$2,418	27,355	0.09
Telephone, fax, other business services	\$0.01	\$1,444	0.2996	\$433	29,901	0.01
Physician, dentist, and other medical services	\$0.26	\$33,219	0.3893	\$12,932	48,108	0.27
Total trip	\$136.64	\$17,779,180		\$4,030,249		162.11

Table D.10b. Derivation of total output and income for Monroe County visitor recreational scuba diving and snorkeling: Alternative 2

Person-days (from GIS analysis)	130,116
x	
Expenditures per person-trip	\$136.64
=	
Total expenditures (Table D.10a)	\$17,779,180
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$12,445,426
x	
Output multiplier	1.6
=	
Total output	\$19,912,682
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.42
Wages & salaries income (direct) (from Table D.10a)	\$4,030,249
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$5,589,955
x	
Income multiplier	1.6
=	
Total income	\$8,943,929
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.3422

Table D10c. Derivation of total employment in Monroe County for visitor recreational scuba diving and snorkeling: Alternative 2

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.10a)	162.11
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	210.74
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.10a)	\$4,030,249
=	
Proprietor's income (direct)	\$656,125
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	40.33
x	
Employment multiplier	1.3
=	
Total proprietor's employment	52.43
Total direct employment	202.44
Total employment	263.17
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.4192

Table D.11a. Derivation of direct wages and salaries income and employment for Monroe County visitor recreational scuba diving and snorkeling: Alternative 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$6,545,631		\$1,624,888		54.54
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$359,043	0.1964	\$70,516	17,715	3.98
Camping site (RV/tent/camper)	\$0.07	\$9,748	0.1964	\$1,914	17,715	0.11
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$5,358,027	0.2652	\$1,420,949	30,973	45.88
Rental home, cottage, cabin, condo	\$5.13	\$750,579	0.1581	\$118,666	30,526	3.89
Camping site (RV/tent/camper)	\$0.47	\$68,234	0.1882	\$12,842	18,807	0.68
Food and beverages	\$51.80	\$7,582,145		\$1,898,997		86.20
Food & drinks consumed at restaurants & bars	\$40.54	\$5,933,146	0.2913	\$1,728,325	21,596	80.03
Beverages purchased at a store for carry-out	\$2.84	\$415,905	0.1035	\$43,046	27,682	1.56
Food purchased at a store for carry-out	\$8.42	\$1,233,094	0.1035	\$127,625	27,682	4.61
Transportation	\$12.60	\$1,843,954		\$253,122		10.03
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$424,028	0.1804	\$76,495	26,680	2.87
Gas & oil - auto or RV	\$5.35	\$783,071	0.0395	\$30,931	22,835	1.35
Repair & services - auto or RV	\$0.60	\$87,730	0.2353	\$20,643	40,146	0.51
Parking fees & tolls	\$1.08	\$157,589	0.2367	\$37,301	15,197	2.45
Taxi fare	\$0.44	\$64,985	0.2891	\$18,787	26,660	0.70
Bus fare						
a) Package tour	\$0.04	\$6,499	0.2067	\$1,343	29,456	0.05
b) Any other bus fare	\$0.18	\$25,994	0.2067	\$5,373	29,456	0.18
Airline fare						
a) Package tours	\$1.19	\$173,835	0.2067	\$35,932	33,375	1.08
b) Any other airline fares	\$0.63	\$92,604	0.2067	\$19,141	33,375	0.57
Ferry fare	\$0.19	\$27,619	0.2598	\$7,175	28,044	0.26
Boating	\$6.74	\$986,150		\$224,224		7.45
Boat, jet ski, and wave runner rental	\$1.70	\$248,568	0.2191	\$54,461	23,993	2.27
Boat fuel and oil	\$0.72	\$105,601	0.0395	\$4,171	22,835	0.18
Boat repairs	\$3.53	\$516,632	0.2603	\$134,479	33,878	3.97
Boat launch fees	\$0.03	\$4,874	0.2224	\$1,084	28,029	0.04
Boat slip or marina fees (this trip only)	\$0.04	\$6,499	0.2224	\$1,445	28,029	0.05
Sailing charters or sunset cruises	\$0.71	\$103,976	0.2749	\$28,583	30,379	0.94

Table D.11a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$3.01	\$440,275		\$114,958		3.99
Rental fee for equipment	\$0.74	\$108,850	0.2191	\$23,849	23,993	0.99
Charter/party boat/guide service	\$2.26	\$331,424	0.2749	\$91,109	30,379	3.00
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$2,550,668		\$399,546		19.73
Film purchases	\$0.31	\$45,490	0.1034	\$4,704	22,745	0.21
Film development	\$0.01	\$1,625	0.1034	\$168	22,745	0.01
Footwear	\$0.83	\$121,847	0.1307	\$15,925	19,247	0.83
Clothing	\$8.88	\$1,299,703	0.1307	\$169,871	19,247	8.83
Souvenirs and gifts (not including clothing)	\$6.29	\$921,165	0.2087	\$192,247	21,054	9.13
Other general merchandise	\$1.10	\$160,838	0.1034	\$16,631	22,745	0.73
Services	\$0.34	\$50,364		\$17,754		0.42
Barber, laundry, and other personal services	\$0.08	\$11,372	0.2392	\$2,720	27,355	0.10
Telephone, fax, other business services	\$0.01	\$1,625	0.2996	\$487	29,901	0.02
Physician, dentist, and other medical services	\$0.26	\$37,366	0.3893	\$14,547	48,108	0.30
Total trip	\$136.64	\$19,999,187		\$4,533,488		182.35

Table D.11b. Derivation of total output and income for Monroe County visitor recreational scuba diving and snorkeling: Alternative 3

Person-days (from GIS analysis)	146,363
x	
Expenditures per person-trip	\$136.64
=	
Total expenditures (Table D.11a)	\$19,999,187
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$13,999,431
x	
Output multiplier	1.6
=	
Total output	\$22,399,089
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.48
Wages & salaries income (direct) (from Table D.11a)	\$4,533,488
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$6,287,948
x	
Income multiplier	1.6
=	
Total income	\$10,060,717
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.3849

Table D.11c. Derivation of total employment in Monroe County for visitor recreational scuba diving and snorkeling: Alternative 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.11a)	182.35
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	237.06
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.11a)	\$4,533,488
=	
Proprietor's income (direct)	\$738,052
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	45.36
x	
Employment multiplier	1.3
=	
Total proprietor's employment	58.97
Total direct employment	227.71
Total employment	296.03
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.4715

Table D.12a. Derivation of direct wages and salaries income and employment for Monroe County visitor recreational scuba diving and snorkeling: Alternative 4

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$8,534,583		\$2,118,625		71.11
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$468,142	0.1964	\$91,943	17,715	5.19
Camping site (RV/tent/camper)	\$0.07	\$12,710	0.1964	\$2,496	17,715	0.14
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$6,986,114	0.2652	\$1,852,717	30,973	59.82
Rental home, cottage, cabin, condo	\$5.13	\$978,649	0.1581	\$154,724	30,526	5.07
Camping site (RV/tent/camper)	\$0.47	\$88,968	0.1882	\$16,744	18,807	0.89
Food and beverages	\$51.80	\$9,886,051		\$2,476,025		112.39
Food & drinks consumed at restaurants & bars	\$40.54	\$7,735,988	0.2913	\$2,253,493	21,596	104.35
Beverages purchased at a store for carry-out	\$2.84	\$542,282	0.1035	\$56,126	27,682	2.03
Food purchased at a store for carry-out	\$8.42	\$1,607,781	0.1035	\$166,405	27,682	6.01
Transportation	\$12.60	\$2,404,257		\$330,035		13.08
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$552,873	0.1804	\$99,738	26,680	3.74
Gas & oil - auto or RV	\$5.35	\$1,021,015	0.0395	\$40,330	22,835	1.77
Repair & services - auto or RV	\$0.60	\$114,388	0.2353	\$26,915	40,146	0.67
Parking fees & tolls	\$1.08	\$205,474	0.2367	\$48,636	15,197	3.20
Taxi fare	\$0.44	\$84,732	0.2891	\$24,496	26,660	0.92
Bus fare						
a) Package tour	\$0.04	\$8,473	0.2067	\$1,751	29,456	0.06
b) Any other bus fare	\$0.18	\$33,893	0.2067	\$7,006	29,456	0.24
Airline fare		\$0				
a) Package tours	\$1.19	\$226,657	0.2067	\$46,850	33,375	1.40
b) Any other airline fares	\$0.63	\$120,742	0.2067	\$24,957	33,375	0.75
Ferry fare	\$0.19	\$36,011	0.2598	\$9,356	28,044	0.33
Boating	\$6.74	\$1,285,801		\$292,357		9.72
Boat, jet ski, and wave runner rental	\$1.70	\$324,098	0.2191	\$71,010	23,993	2.96
Boat fuel and oil	\$0.72	\$137,689	0.0395	\$5,439	22,835	0.24
Boat repairs	\$3.53	\$673,616	0.2603	\$175,342	33,878	5.18
Boat launch fees	\$0.03	\$6,355	0.2224	\$1,413	28,029	0.05
Boat slip or marina fees (this trip only)	\$0.04	\$8,473	0.2224	\$1,884	28,029	0.07
Sailing charters or sunset cruises	\$0.71	\$135,570	0.2749	\$37,268	30,379	1.23

Table D.12a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$3.01	\$574,056		\$149,889		5.21
Rental fee for equipment	\$0.74	\$141,925	0.2191	\$31,096	23,993	1.30
Charter/party boat/guide service	\$2.26	\$432,131	0.2749	\$118,793	30,379	3.91
Sightseeing	\$0.00	\$0		\$0		0.00
Sightseeing tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Glass-bottom boat rides	\$0.00	\$0	0.2749	\$0	30,379	0.00
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$3,325,712		\$520,952		25.72
Film purchases	\$0.31	\$59,312	0.1034	\$6,133	22,745	0.27
Film development	\$0.01	\$2,118	0.1034	\$219	22,745	0.01
Footwear	\$0.83	\$158,872	0.1307	\$20,765	19,247	1.08
Clothing	\$8.88	\$1,694,630	0.1307	\$221,488	19,247	11.51
Souvenirs and gifts (not including clothing)	\$6.29	\$1,201,069	0.2087	\$250,663	21,054	11.91
Other general merchandise	\$1.10	\$209,711	0.1034	\$21,684	22,745	0.95
Services	\$0.34	\$65,667		\$23,148		0.55
Barber, laundry, and other personal services	\$0.08	\$14,828	0.2392	\$3,547	27,355	0.13
Telephone, fax, other business services	\$0.01	\$2,118	0.2996	\$635	29,901	0.02
Physician, dentist, and other medical services	\$0.26	\$48,721	0.3893	\$18,967	48,108	0.39
Total trip	\$136.64	\$26,076,127		\$5,911,031		237.76

Table D.12b. Derivation of total output and income for Monroe County visitor recreational scuba diving and snorkeling: Alternative 4

Person-days (from GIS analysis)	190,837
x	
Expenditures per person-trip	\$136.64
=	
Total expenditures (Table D.12a)	\$26,075,936
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$18,253,155.06
x	
Output multiplier	1.6
=	
Total output	\$29,205,048
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.62
Wages & salaries income (direct) (from Table D.12a)	\$5,911,031
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$8,198,599.81
x	
Income multiplier	1.6
=	
Total income	\$13,117,760
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.5019

Table D.12c. Derivation of total employment in Monroe County for visitor recreational scuba diving and snorkeling: Alternative 4

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.12a)	237.76
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	309.09
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.12a)	\$5,911,031
=	
Proprietor's income (direct)	\$962,316
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	59.15
x	
Employment multiplier	1.3
=	
Total proprietor's employment	76.89
Total direct employment	296.91
Total employment	385.98
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.6148

Table D.13a. Derivation of direct wages and salaries income and employment for Monroe County resident recreational wildlife viewing: Alternative 2

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$5.06	\$42,315		\$11,002		0.37
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$0.20	\$1,670	0.1964	\$328	17,715	0.02
Camping site (RV/tent/camper)	\$0.03	\$278	0.1964	\$55	17,715	0.00
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$4.70	\$39,253	0.2652	\$10,410	30,973	0.34
Rental home, cottage, cabin, condo	\$0.00	\$0	0.1581	\$0	30,526	0.00
Camping site (RV/tent/camper)	\$0.13	\$1,114	0.1882	\$210	18,807	0.01
Food and beverages	\$32.21	\$269,294		\$61,280		2.74
Food & drinks consumed at restaurants & bars	\$21.28	\$177,890	0.2913	\$51,819	21,596	2.40
Beverages purchased at a store for carry-out	\$5.46	\$45,656	0.1035	\$4,725	27,682	0.17
Food purchased at a store for carry-out	\$5.47	\$45,748	0.1035	\$4,735	27,682	0.17
Transportation	\$4.65	\$38,882		\$2,986		0.16
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$0.04	\$371	0.1804	\$67	26,680	0.00
Gas & oil - auto or RV	\$3.79	\$31,643	0.0395	\$1,250	22,835	0.05
Repair & services - auto or RV	\$0.03	\$278	0.2353	\$66	40,146	0.00
Parking fees & tolls	\$0.69	\$5,753	0.2367	\$1,362	15,197	0.09
Taxi fare	\$0.10	\$835	0.2891	\$241	26,660	0.01
Bus fare						
a) Package tour	\$0.00	\$0	0.2067	\$0	29,456	0.00
b) Any other bus fare	\$0.00	\$0	0.2067	\$0	29,456	0.00
Airline fare						
a) Package tours	\$0.00	\$0	0.2067	\$0	33,375	0.00
b) Any other airline fares	\$0.00	\$0	0.2067	\$0	33,375	0.00
Ferry fare	\$0.00	\$0	0.2598	\$0	28,044	0.00
Boating	\$23.19	\$193,851		\$8,846		0.38
Boat, jet ski, and wave runner rental	\$0.07	\$557	0.2191	\$122	23,993	0.01
Boat fuel and oil	\$22.47	\$187,819	0.0395	\$7,419	22,835	0.32
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.12	\$1,021	0.2224	\$227	28,029	0.01
Boat slip or marina fees (this trip only)	\$0.33	\$2,784	0.2224	\$619	28,029	0.02
Sailing charters or sunset cruises	\$0.20	\$1,670	0.2749	\$459	30,379	0.02

Table D.13a. (Continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$1.98	\$16,518		\$4,541		0.15
Sightseeing tours	\$1.22	\$10,208	0.2749	\$2,806	30,379	0.09
Glass-bottom boat rides	\$0.08	\$650	0.2749	\$179	30,379	0.01
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.68	\$5,661	0.2749	\$1,556	30,379	0.05
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$145,690		\$22,821		1.13
Film purchases	\$0.31	\$2,598	0.1034	\$269	22,745	0.01
Film development	\$0.01	\$93	0.1034	\$10	22,745	0.00
Footwear	\$0.83	\$6,960	0.1307	\$910	19,247	0.05
Clothing	\$8.88	\$74,237	0.1307	\$9,703	19,247	0.50
Souvenirs and gifts (not including clothing)	\$6.29	\$52,615	0.2087	\$10,981	21,054	0.52
Other general merchandise	\$1.10	\$9,187	0.1034	\$950	22,745	0.04
Services	\$0.34	\$2,877		\$1,014		0.02
Barber, laundry, and other personal services	\$0.08	\$650	0.2392	\$155	27,355	0.01
Telephone, fax, other business services	\$0.01	\$93	0.2996	\$28	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$2,134	0.3893	\$831	48,108	0.02
Total trip	\$84.86	\$709,425		\$112,490		4.94

Table D.13b. Derivation of total output and income for Monroe County resident recreational wildlife viewing: Alternative 2

Person-days (from GIS analysis)	8,360
x	
Expenditures per person-trip	\$84.86
=	
Total expenditures (Table D.13a)	\$709,425
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$496,598
x	
Output multiplier	1.6
=	
Total output	\$794,556
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.02
Wages & salaries income (direct) (from Table D.13a)	\$112,490
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$156,024
x	
Income multiplier	1.6
=	
Total income	\$249,638
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0096

Table D.13c. Derivation of total employment in Monroe County for resident recreational wildlife viewing: Alternative 2

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.13a)	4.94
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	6.42
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.13a)	\$112,490
=	
Proprietor's income (direct)	\$18,313
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	1.13
x	
Employment multiplier	1.3
=	
Total proprietor's employment	1.46
Total direct employment	6.07
Total employment	7.89
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0126

Table D.14a. Derivation of direct wages and salaries income and employment for Monroe County resident recreational wildlife viewing: Alternative 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$5.06	\$47,599		\$12,376		0.41
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$0.20	\$1,879	0.1964	\$369	17,715	0.02
Camping site (RV/tent/camper)	\$0.03	\$313	0.1964	\$62	17,715	0.00
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$4.70	\$44,155	0.2652	\$11,710	30,973	0.38
Rental home, cottage, cabin, condo	\$0.00	\$0	0.1581	\$0	30,526	0.00
Camping site (RV/tent/camper)	\$0.13	\$1,253	0.1882	\$236	18,807	0.01
Food and beverages	\$32.21	\$302,924		\$68,932		3.08
Food & drinks consumed at restaurants & bars	\$21.28	\$200,105	0.2913	\$58,291	21,596	2.70
Beverages purchased at a store for carry-out	\$5.46	\$51,357	0.1035	\$5,315	27,682	0.19
Food purchased at a store for carry-out	\$5.47	\$51,462	0.1035	\$5,326	27,682	0.19
Transportation	\$4.65	\$43,737		\$3,358		0.18
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$0.04	\$418	0.1804	\$75	26,680	0.00
Gas & oil - auto or RV	\$3.79	\$35,595	0.0395	\$1,406	22,835	0.06
Repair & services - auto or RV	\$0.03	\$313	0.2353	\$74	40,146	0.00
Parking fees & tolls	\$0.69	\$6,472	0.2367	\$1,532	15,197	0.10
Taxi fare	\$0.10	\$939	0.2891	\$272	26,660	0.01
Bus fare						
a) Package tour	\$0.00	\$0	0.2067	\$0	29,456	0.00
b) Any other bus fare	\$0.00	\$0	0.2067	\$0	29,456	0.00
Airline fare						
a) Package tours	\$0.00	\$0	0.2067	\$0	33,375	0.00
b) Any other airline fares	\$0.00	\$0	0.2067	\$0	33,375	0.00
Ferry fare	\$0.00	\$0	0.2598	\$0	28,044	0.00
Boating	\$23.19	\$218,059		\$9,951		0.42
Boat, jet ski, and wave runner rental	\$0.07	\$626	0.2191	\$137	23,993	0.01
Boat fuel and oil	\$22.47	\$211,274	0.0395	\$8,345	22,835	0.37
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.12	\$1,148	0.2224	\$255	28,029	0.01
Boat slip or marina fees (this trip only)	\$0.33	\$3,132	0.2224	\$696	28,029	0.02
Sailing charters or sunset cruises	\$0.20	\$1,879	0.2749	\$517	30,379	0.02

Table D.14a. (continued)

Appendix D: Economic impact models for recreational activities by spatial alternatives

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$1.98	\$18,580		\$5,108		0.17
Sightseeing tours	\$1.22	\$11,482	0.2749	\$3,156	30,379	0.10
Glass-bottom boat rides	\$0.08	\$731	0.2749	\$201	30,379	0.01
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.68	\$6,367	0.2749	\$1,750	30,379	0.06
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$163,884		\$25,671		1.27
Film purchases	\$0.31	\$2,923	0.1034	\$302	22,745	0.01
Film development	\$0.01	\$104	0.1034	\$11	22,745	0.00
Footwear	\$0.83	\$7,829	0.1307	\$1,023	19,247	0.05
Clothing	\$8.88	\$83,508	0.1307	\$10,914	19,247	0.57
Souvenirs and gifts (not including clothing)	\$6.29	\$59,186	0.2087	\$12,352	21,054	0.59
Other general merchandise	\$1.10	\$10,334	0.1034	\$1,069	22,745	0.05
Services	\$0.34	\$3,236		\$1,141		0.03
Barber, laundry, and other personal services	\$0.08	\$731	0.2392	\$175	27,355	0.01
Telephone, fax, other business services	\$0.01	\$104	0.2996	\$31	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$2,401	0.3893	\$935	48,108	0.02
Total trip	\$84.86	\$798,019		\$126,538		5.56

Table D.14b. Derivation of total output and income for Monroe county resident recreational wildlife viewing: Alternative 3

Person-days (from GIS analysis)	9,404
x	
Expenditures per person-trip	\$84.86
=	
Total expenditures (Table D.14a)	\$798,019
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$558,613
x	
Output multiplier	1.6
=	
Total output	\$893,781
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.02
Wages & salaries income (direct) (from Table D.14a)	\$126,538
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$175,508
x	
Income multiplier	1.6
=	
Total income	\$280,813
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0107

Table D.14c. Derivation of total employment in Monroe County for resident recreational wildlife viewing: Alternative 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.14a)	5.56
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	7.23
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.14a)	\$126,538
=	
Proprietor's income (direct)	\$20,600
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	1.27
x	
Employment multiplier	1.3
=	
Total proprietor's employment	1.65
Total direct employment	6.83
Total employment	8.87
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0141

Table D.15a. Derivation of direct wages and salaries income and employment for Monroe County resident recreational wildlife viewing: Alternative 4

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$5.06	\$62,071		\$16,139		0.54
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$0.20	\$2,450	0.1964	\$481	17,715	0.03
Camping site (RV/tent/camper)	\$0.03	\$408	0.1964	\$80	17,715	0.00
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$4.70	\$57,579	0.2652	\$15,270	30,973	0.49
Rental home, cottage, cabin, condo	\$0.00	\$0	0.1581	\$0	30,526	0.00
Camping site (RV/tent/camper)	\$0.13	\$1,633	0.1882	\$307	18,807	0.02
Food and beverages	\$32.21	\$395,020		\$89,890		4.02
Food & drinks consumed at restaurants & bars	\$21.28	\$260,942	0.2913	\$76,012	21,596	3.52
Beverages purchased at a store for carry-out	\$5.46	\$66,971	0.1035	\$6,932	27,682	0.25
Food purchased at a store for carry-out	\$5.47	\$67,107	0.1035	\$6,946	27,682	0.25
Transportation	\$4.65	\$57,034		\$4,380		0.23
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$0.04	\$544	0.1804	\$98	26,680	0.00
Gas & oil - auto or RV	\$3.79	\$46,417	0.0395	\$1,833	22,835	0.08
Repair & services - auto or RV	\$0.03	\$408	0.2353	\$96	40,146	0.00
Parking fees & tolls	\$0.69	\$8,439	0.2367	\$1,998	15,197	0.13
Taxi fare	\$0.10	\$1,225	0.2891	\$354	26,660	0.01
Bus fare						
a) Package tour	\$0.00	\$0	0.2067	\$0	29,456	0.00
b) Any other bus fare	\$0.00	\$0	0.2067	\$0	29,456	0.00
Airline fare						
a) Package tours	\$0.00	\$0	0.2067	\$0	33,375	0.00
b) Any other airline fares	\$0.00	\$0	0.2067	\$0	33,375	0.00
Ferry fare	\$0.00	\$0	0.2598	\$0	28,044	0.00
Boating	\$23.19	\$284,355		\$12,976		0.55
Boat, jet ski, and wave runner rental	\$0.07	\$817	0.2191	\$179	23,993	0.01
Boat fuel and oil	\$22.47	\$275,507	0.0395	\$10,883	22,835	0.48
Boat repairs	\$0.00	\$0	0.2603	\$0	33,878	0.00
Boat launch fees	\$0.12	\$1,497	0.2224	\$333	28,029	0.01
Boat slip or marina fees (this trip only)	\$0.33	\$4,084	0.2224	\$908	28,029	0.03
Sailing charters or sunset cruises	\$0.20	\$2,450	0.2749	\$674	30,379	0.02

Table D.15a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$1.98	\$24,229		\$6,661		0.22
Sightseeing tours	\$1.22	\$14,973	0.2749	\$4,116	30,379	0.14
Glass-bottom boat rides	\$0.08	\$953	0.2749	\$262	30,379	0.01
Backcountry excursions, kayak tours	\$0.00	\$0	0.2749	\$0	30,379	0.00
Park entrance fees	\$0.68	\$8,303	0.2749	\$2,283	30,379	0.08
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$213,708		\$33,476		1.65
Film purchases	\$0.31	\$3,811	0.1034	\$394	22,745	0.02
Film development	\$0.01	\$136	0.1034	\$14	22,745	0.00
Footwear	\$0.83	\$10,209	0.1307	\$1,334	19,247	0.07
Clothing	\$8.88	\$108,896	0.1307	\$14,233	19,247	0.74
Souvenirs and gifts (not including clothing)	\$6.29	\$77,180	0.2087	\$16,107	21,054	0.77
Other general merchandise	\$1.10	\$13,476	0.1034	\$1,393	22,745	0.06
Services	\$0.34	\$4,220		\$1,488		0.04
Barber, laundry, and other personal services	\$0.08	\$953	0.2392	\$228	27,355	0.01
Telephone, fax, other business services	\$0.01	\$136	0.2996	\$41	29,901	0.00
Physician, dentist, and other medical services	\$0.26	\$3,131	0.3893	\$1,219	48,108	0.03
Total trip	\$84.86	\$1,040,638		\$165,008		7.25

Table D.15b. Derivation of total output and income for Monroe County resident recreational wildlife viewing: Alternative 4

Person-days (from GIS analysis)	12,263
x	
Expenditures per person-trip	\$84.86
=	
Total expenditures (Table D.15a)	\$1,040,644
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$728,450.63
x	
Output multiplier	1.6
=	
Total output	\$1,165,521
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.02
Wages & salaries income (direct) (from Table D.15a)	\$165,008
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$228,866.46
x	
Income multiplier	1.6
=	
Total income	\$366,186
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.0140

Table D.15c. Derivation of total employment in Monroe County for resident recreational wildlife viewing: Alternative 4

Type of employment	Number full- and part- time
Wages & salaries employment direct (from Table D.15a)	7.25
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	9.43
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.15a)	\$165,008
=	
Proprietor's income (direct)	\$26,863
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	1.65
x	
Employment multiplier	1.3
=	
Total proprietor's employment	2.15
Total direct employment	8.90
Total employment	11.57
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.0184

Table D.16a. Derivation of direct wages and salaries income and employment for Monroe County visitor recreational wildlife viewing: Alternative 2

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$2,746,238		\$681,726		22.88
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$150,638	0.1964	\$29,585	17,715	1.67
Camping site (RV/tent/camper)	\$0.07	\$4,090	0.1964	\$803	17,715	0.05
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$2,247,975	0.2652	\$596,163	30,973	19.25
Rental home, cottage, cabin, condo	\$5.13	\$314,907	0.1581	\$49,787	30,526	1.63
Camping site (RV/tent/camper)	\$0.47	\$28,628	0.1882	\$5,388	18,807	0.29
Food and beverages	\$51.80	\$3,181,110		\$796,729		36.16
Food & drinks consumed at restaurants & bars	\$40.54	\$2,489,268	0.2913	\$725,124	21,596	33.58
Beverages purchased at a store for carry-out	\$2.84	\$174,494	0.1035	\$18,060	27,682	0.65
Food purchased at a store for carry-out	\$8.42	\$517,348	0.1035	\$53,546	27,682	1.93
Transportation	\$12.60	\$773,636		\$106,198		4.21
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$177,902	0.1804	\$32,094	26,680	1.20
Gas & oil - auto or RV	\$5.35	\$328,540	0.0395	\$12,977	22,835	0.57
Repair & services - auto or RV	\$0.60	\$36,807	0.2353	\$8,661	40,146	0.22
Parking fees & tolls	\$1.08	\$66,117	0.2367	\$15,650	15,197	1.03
Taxi fare	\$0.44	\$27,265	0.2891	\$7,882	26,660	0.30
Bus fare						
a) Package tour	\$0.04	\$2,726	0.2067	\$564	29,456	0.02
b) Any other bus fare	\$0.18	\$10,906	0.2067	\$2,254	29,456	0.08
Airline fare						
a) Package tours	\$1.19	\$72,933	0.2067	\$15,075	33,375	0.45
b) Any other airline fares	\$0.63	\$38,852	0.2067	\$8,031	33,375	0.24
Ferry fare	\$0.19	\$11,588	0.2598	\$3,010	28,044	0.11
Boating	\$6.74	\$413,742		\$94,074		3.13
Boat, jet ski, and wave runner rental	\$1.70	\$104,288	0.2191	\$22,849	23,993	0.95
Boat fuel and oil	\$0.72	\$44,305	0.0395	\$1,750	22,835	0.08
Boat repairs	\$3.53	\$216,754	0.2603	\$56,421	33,878	1.67
Boat launch fees	\$0.03	\$2,045	0.2224	\$455	28,029	0.02
Boat slip or marina fees (this trip only)	\$0.04	\$2,726	0.2224	\$606	28,029	0.02
Sailing charters or sunset cruises	\$0.71	\$43,624	0.2749	\$11,992	30,379	0.39

Table D.16a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$6.07	\$372,845		\$102,495		3.37
Sightseeing tours	\$4.76	\$292,414	0.2749	\$80,385	30,379	2.65
Glass-bottom boat rides	\$0.53	\$32,718	0.2749	\$8,994	30,379	0.30
Backcountry excursions, kayak tours	\$0.24	\$14,996	0.2749	\$4,122	30,379	0.14
Park entrance fees	\$0.53	\$32,718	0.2749	\$8,994	30,379	0.30
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$1,070,140		\$167,631		8.28
Film purchases	\$0.31	\$19,085	0.1034	\$1,973	22,745	0.09
Film development	\$0.01	\$682	0.1034	\$70	22,745	0.00
Footwear	\$0.83	\$51,121	0.1307	\$6,682	19,247	0.35
Clothing	\$8.88	\$545,294	0.1307	\$71,270	19,247	3.70
Souvenirs and gifts (not including clothing)	\$6.29	\$386,477	0.2087	\$80,658	21,054	3.83
Other general merchandise	\$1.10	\$67,480	0.1034	\$6,977	22,745	0.31
Services	\$0.34	\$21,130		\$7,449		0.18
Barber, laundry, and other personal services	\$0.08	\$4,771	0.2392	\$1,141	27,355	0.04
Telephone, fax, other business services	\$0.01	\$682	0.2996	\$204	29,901	0.01
Physician, dentist, and other medical services	\$0.26	\$15,677	0.3893	\$6,103	48,108	0.13
Total trip	\$139.70	\$8,578,840		\$1,956,302		78.21

Table D.16b. Derivation of total output and income for Monroe County visitor recreational wildlife viewing: Alternative 2

Person-days (from GIS analysis)	61,407
x	
Expenditures per person-trip	\$139.70
=	
Total expenditures (Table D.16a)	\$8,578,840
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$6,005,188
x	
Output multiplier	1.6
=	
Total output	\$9,608,301
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.20
Wages & salaries income (direct) (from Table D.16a)	\$1,956,302
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$2,713,391
x	
Income multiplier	1.6
=	
Total income	\$4,341,425
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.1661

Table D.16c. Derivation of total employment in Monroe County for visitor recreational wildlife viewing: Alternative 2

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D16a)	78.21
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	101.67
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.16a)	\$1,956,302
=	
Proprietor's income (direct)	\$318,486
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	19.58
x	
Employment multiplier	1.3
=	
Total proprietor's employment	25.45
Total direct employment	97.79
Total employment	127.12
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.2025

Table D.17a. Derivation of direct wages and salaries income and employment for Monroe County visitor recreational wildlife viewing: Alternative 3

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Lodging	\$44.72	\$3,089,121		\$766,843		25.74
<i>Publicly owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$169,445	0.1964	\$33,279	17,715	1.88
Camping site (RV/tent/camper)	\$0.07	\$4,600	0.1964	\$904	17,715	0.05
<i>Privately owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$2,528,647	0.2652	\$670,597	30,973	21.65
Rental home, cottage, cabin, condo	\$5.13	\$354,225	0.1581	\$56,003	30,526	1.83
Camping site (RV/tent/camper)	\$0.47	\$32,202	0.1882	\$6,060	18,807	0.32
Food and beverages	\$51.80	\$3,578,289		\$896,205		40.68
Food & drinks consumed at restaurants & bars	\$40.54	\$2,800,067	0.2913	\$815,659	21,596	37.77
Beverages purchased at a store for carry-out	\$2.84	\$196,281	0.1035	\$20,315	27,682	0.73
Food purchased at a store for carry-out	\$8.42	\$581,942	0.1035	\$60,231	27,682	2.18
Transportation	\$12.60	\$870,229		\$119,457		4.73
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$200,114	0.1804	\$36,101	26,680	1.35
Gas & oil - auto or RV	\$5.35	\$369,560	0.0395	\$14,598	22,835	0.64
Repair & services - auto or RV	\$0.60	\$41,403	0.2353	\$9,742	40,146	0.24
Parking fees & tolls	\$1.08	\$74,372	0.2367	\$17,604	15,197	1.16
Taxi fare	\$0.44	\$30,669	0.2891	\$8,866	26,660	0.33
Bus fare						
a) Package tour	\$0.04	\$3,067	0.2067	\$634	29,456	0.02
b) Any other bus fare	\$0.18	\$12,268	0.2067	\$2,536	29,456	0.09
Airline fare						
a) Package tours	\$1.19	\$82,039	0.2067	\$16,958	33,375	0.51
b) Any other airline fares	\$0.63	\$43,703	0.2067	\$9,033	33,375	0.27
Ferry fare	\$0.19	\$13,034	0.2598	\$3,386	28,044	0.12
Boating	\$6.74	\$465,400		\$105,820		3.52
Boat, jet ski, and wave runner rental	\$1.70	\$117,308	0.2191	\$25,702	23,993	1.07
Boat fuel and oil	\$0.72	\$49,837	0.0395	\$1,969	22,835	0.09
Boat repairs	\$3.53	\$243,817	0.2603	\$63,466	33,878	1.87
Boat launch fees	\$0.03	\$2,300	0.2224	\$512	28,029	0.02
Boat slip or marina fees (this trip only)	\$0.04	\$3,067	0.2224	\$682	28,029	0.02
Sailing charters or sunset cruises	\$0.71	\$49,070	0.2749	\$13,489	30,379	0.44

Table D.17a. (continued)

Category	Expenditures per person per day	Total expenditures	Wages to sales ratio	Total wages	Wages to employment ratio	Total employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$6.07	\$419,397		\$115,292		3.80
Sightseeing tours	\$4.76	\$328,923	0.2749	\$90,421	30,379	2.98
Glass-bottom boat rides	\$0.53	\$36,803	0.2749	\$10,117	30,379	0.33
Backcountry excursions, kayak tours	\$0.24	\$16,868	0.2749	\$4,637	30,379	0.15
Park entrance fees	\$0.53	\$36,803	0.2749	\$10,117	30,379	0.33
Admission to tourist, amusement, festivals, and other tourist attractions	\$0.00	\$0	0.2749	\$0	30,379	0.00
Other activity expenditures	\$0.00	\$0		\$0		0.00
Rental fee for recreation equipment (bicycles, golf carts, or others not listed above)	\$0.00	\$0	0.2191	\$0	23,993	0.00
Guides service, tour, or outfitters (not listed above, like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to movies, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous expenditures	\$17.43	\$1,203,753		\$188,560		9.31
Film purchases	\$0.31	\$21,468	0.1034	\$2,220	22,745	0.10
Film development	\$0.01	\$767	0.1034	\$79	22,745	0.00
Footwear	\$0.83	\$57,504	0.1307	\$7,516	19,247	0.39
Clothing	\$8.88	\$613,377	0.1307	\$80,168	19,247	4.17
Souvenirs and gifts (not including clothing)	\$6.29	\$434,731	0.2087	\$90,728	21,054	4.31
Other general merchandise	\$1.10	\$75,905	0.1034	\$7,849	22,745	0.35
Services	\$0.34	\$23,768		\$8,379		0.20
Barber, laundry, and other personal services	\$0.08	\$5,367	0.2392	\$1,284	27,355	0.05
Telephone, fax, other business services	\$0.01	\$767	0.2996	\$230	29,901	0.01
Physician, dentist, and other medical services	\$0.26	\$17,635	0.3893	\$6,865	48,108	0.14
Total trip	\$139.70	\$9,649,956		\$2,200,557		87.97

Table D.17b. Derivation of total output and income for Monroe County visitor recreational wildlife viewing: Alternative 3

Person-days (from GIS analysis)	69,074
x	
Expenditures per person-trip	\$139.70
=	
Total expenditures (Table D.17a)	\$9,649,956
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$6,754,969
x	
Output multiplier	1.6
=	
Total output	\$10,807,951
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.23
Wages & salaries income (direct) (from Table D.17a)	\$2,200,557
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$3,052,173
x	
Income multiplier	1.6
=	
Total income	\$4,883,476
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.1868

Table D.17c. Derivation of Total Employment in Monroe County for Visitor Recreational Wildlife Viewing: Alternative 3

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.17a)	87.97
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	114.36
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D.17a)	\$2,200,557
=	
Proprietor's income (direct)	\$358,251
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	22.02
x	
Employment multiplier	1.3
=	
Total proprietor's employment	28.62
Total direct employment	109.99
Total employment	142.99
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.2278

Table D.18a. Derivation of Direct Wages and Salaries Income and Employment for Monroe County Visitor Recreational Wildlife Viewing: Alternative 4

Category	Expenditures Per Person Per Day	Total Expenditures	Wages to Sales Ratio	Total Wages	Wages to Employment Ratio	Total Employment
Lodging	\$44.72	\$4,028,104		\$999,937		33.56
<i>Publicly Owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$2.45	\$220,951	0.1964	\$43,395	17,715	2.45
Camping site (RV/tent/camper)	\$0.07	\$5,999	0.1964	\$1,178	17,715	0.07
<i>Privately Owned</i>						
Hotel/motel/bed & breakfast/cabin, etc.	\$36.61	\$3,297,266	0.2652	\$874,435	30,973	28.23
Rental home, cottage, cabin, condo	\$5.13	\$461,897	0.1581	\$73,026	30,526	2.39
Camping site (RV/tent/camper)	\$0.47	\$41,991	0.1882	\$7,903	18,807	0.42
Food and Beverages	\$51.80	\$4,665,962		\$1,168,620		53.04
Food & Drinks consumed at restaurants & bars	\$40.54	\$3,651,188	0.2913	\$1,063,591	21,596	49.25
Beverages purchased at a store for carry-out	\$2.84	\$255,943	0.1035	\$26,490	27,682	0.96
Food purchased at a store for carry-out	\$8.42	\$758,831	0.1035	\$78,539	27,682	2.84
Transportation	\$12.60	\$1,134,748		\$155,768		6.17
Rental automobile, motor home, trailer, motorcycle, or other recreation vehicle	\$2.90	\$260,942	0.1804	\$47,074	26,680	1.76
Gas & Oil - auto or RV	\$5.35	\$481,893	0.0395	\$19,035	22,835	0.83
Repair & Services - auto or RV	\$0.60	\$53,988	0.2353	\$12,703	40,146	0.32
Parking fees & tolls	\$1.08	\$96,978	0.2367	\$22,955	15,197	1.51
Taxi fare	\$0.44	\$39,991	0.2891	\$11,561	26,660	0.43
Bus Fare						
a) Package tour	\$0.04	\$3,999	0.2067	\$827	29,456	0.03
b) Any other bus fare	\$0.18	\$15,996	0.2067	\$3,306	29,456	0.11
Airline Fares						
a) Package tours	\$1.19	\$106,976	0.2067	\$22,112	33,375	0.66
b) Any other airline fares	\$0.63	\$56,987	0.2067	\$11,779	33,375	0.35
Ferry Fare	\$0.19	\$16,996	0.2598	\$4,416	28,044	0.16
Boating	\$6.74	\$606,865		\$137,985		4.59
Boat, jet ski, and wave runner rental	\$1.70	\$152,966	0.2191	\$33,515	23,993	1.40
Boat fuel and oil	\$0.72	\$64,986	0.0395	\$2,567	22,835	0.11
Boat repairs	\$3.53	\$317,929	0.2603	\$82,757	33,878	2.44
Boat launch fees	\$0.03	\$2,999	0.2224	\$667	28,029	0.02
Boat slip or marina fees (this trip only)	\$0.04	\$3,999	0.2224	\$889	28,029	0.03
Sailing charters or sunset cruises	\$0.71	\$63,986	0.2749	\$17,590	30,379	0.58

Table D.18a. (Continued)

Category	Expenditures Per Person Per Day	Total Expenditures	Wages to Sales Ratio	Total Wages	Wages to Employment Ratio	Total Employment
Fishing	\$0.00	\$0		\$0		0.00
Cut bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Live bait	\$0.00	\$0	0.2749	\$0	30,379	0.00
Daily or special fishing permits/licenses	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fishing lines, fly lines, fish nets, traps	\$0.00	\$0	0.2749	\$0	30,379	0.00
Charter/party boat/guide fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Scuba diving/snorkeling	\$0.00	\$0		\$0		0.00
Rental fee for equipment	\$0.00	\$0	0.2191	\$0	23,993	0.00
Charter/party boat/guide service	\$0.00	\$0	0.2749	\$0	30,379	0.00
Sightseeing	\$6.07	\$546,878		\$150,337		4.95
Sightseeing tours	\$4.76	\$428,905	0.2749	\$117,906	30,379	3.88
Glass-bottom boat rides	\$0.53	\$47,989	0.2749	\$13,192	30,379	0.43
Backcountry excursions, kayak tours	\$0.24	\$21,995	0.2749	\$6,046	30,379	0.20
Park entrance fees	\$0.53	\$47,989	0.2749	\$13,192	30,379	0.43
Admission to tourist, amusement, festivals and other tourist attractions	\$0.00	\$0				
Other Activity Expenditures	\$0.00	\$0	0.2749	\$0	30,379	0.00
Rental fee for recreation equipment (bicycles, golf carts or others not listed above)	\$0.00	\$0		\$0		0.00
Guides service, tour, or outfitters (not listed above like parasailing)	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to motion pictures, museums, etc.	\$0.00	\$0	0.2749	\$0	30,379	0.00
Admission to concerts or other musical	\$0.00	\$0	0.2749	\$0	30,379	0.00
Spa treatments	\$0.00	\$0	0.2749	\$0	30,379	0.00
Fitness activity fees	\$0.00	\$0	0.2749	\$0	30,379	0.00
Miscellaneous Expenditures	\$17.43	\$1,569,651		\$245,876		12.14
Film purchases	\$0.31	\$27,994	0.1034	\$2,895	22,745	0.13
Film development	\$0.01	\$1,000	0.1034	\$103	22,745	0.00
Footwear	\$0.83	\$74,983	0.1307	\$9,800	19,247	0.51
Clothing	\$8.88	\$799,822	0.1307	\$104,537	19,247	5.43
Souvenirs and gifts (not including clothing)	\$6.29	\$566,874	0.2087	\$118,307	21,054	5.62
Other general merchandise	\$1.10	\$98,978	0.1034	\$10,234	22,745	0.45
Services	\$0.34	\$30,993		\$10,925		0.26
Barber, laundry, and other personal services	\$0.08	\$6,998	0.2392	\$1,674	27,355	0.06
Telephone, fax, other business services	\$0.01	\$1,000	0.2996	\$300	29,901	0.01
Physician, dentist and other medical services	\$0.26	\$22,995	0.3893	\$8,952	48,108	0.19
Total Trip	\$139.70	\$12,583,200		\$2,869,448		114.71

Table D.18b. Derivation of Total output and Income for Monroe County Visitor Recreational Wildlife Viewing: Alternative 4

Person-days (from GIS analysis)	90,070
x	
Expenditures per person-trip	\$139.70
=	
Total expenditures (Table D.18a)	\$12,582,786
x	
Percent of inputs purchased locally	0.7
=	
Direct output	\$8,807,950.03
x	
Output multiplier	1.6
=	
Total output	\$14,092,720
Reported gross sales 2015 in 2016\$	\$4,711,094,075
Percent of gross sales	0.30
Wages & salaries income (direct) (from Table D.18a)	\$2,869,448
x	
Total income-to-wages & salaries	1.387
=	
Direct income	\$3,979,924
x	
Income multiplier	1.6
=	
Total income	\$6,367,879
Reported income 2015 in 2016\$	\$2,613,758,800
Percent of income	0.2436

Table D.18c. Derivation of total employment in Monroe County for visitor recreational wildlife viewing: Alternative 4

Type of employment	Number full- and part-time
Wages & salaries employment direct (from Table D.18a)	114.71
x	
Employment multiplier	1.3
=	
Total wages & salaries employment	149.12
Proprietor's employment	
Proprietor's income to wages & salaries ratio	0.1628
x	
Direct wages & salaries (from Table D18a)	\$2,869,448
=	
Proprietor's income (direct)	\$467,146
divided by	
Proprietor's income-to-employment ratio	16,270
=	
Proprietor's direct employment	28.71
x	
Employment multiplier	1.3
=	
Total proprietor's employment	37.33
Total direct employment	143.42
Total employment	186.45
Total Monroe County employment 2015	62,780
Percent of Monroe County employment	0.2970

Table D.19. Potential benefits of spatial alternatives for non-consumptive recreation on the Monroe County economy

Type of user/activity	Alternative 2	Alternative 3	Alternative 4
Residents			
<i>Scuba diving & snorkeling from a boat</i>			
Person-days	21,591	24,393	31,806
Spending (2018\$)	\$2,060,616.01	\$2,254,096.68	\$2,939,057.42
Output (2018\$)	\$2,307,889.56	\$2,524,588.58	\$3,291,744.31
Income (2018\$)	\$753,191.27	\$814,986.90	\$1,062,673.09
Jobs (number of full and part-time jobs)	22.43	24.31	31.69929906
<i>Wildlife viewing from a boat</i>			
Person-days	8360	9404	12263.06571
Spending (2018\$)	\$742,234.95	\$834,926.30	\$1,088,772.13
Output (2018\$)	\$831,303.14	\$935,117.17	\$1,219,424.78
Income (2018\$)	\$261,183.42	\$293,800.22	\$383,121.97
Jobs (number of full and part-time jobs)	7.89	8.87	11.57275961
Total residents			
Person-days	29951	33797	44069.43513
Spending (2018\$)	\$2,802,850.96	\$3,089,022.99	\$4,027,829.54
Output (2018\$)	\$3,139,192.70	\$3,459,705.74	\$4,511,169.09
Income (2018\$)	\$1,014,374.69	\$1,108,787.12	\$1,445,795.06
Jobs (number of full and part-time jobs)	30.32	33.18	43.27
Visitors			
<i>Scuba diving & snorkeling from a boat</i>			
Person-days	130,116.00	146,363.00	190,836.77
Spending (2018\$)	\$18,601,443.09	\$20,924,122.42	\$27,281,912.66
Output (2018\$)	\$20,833,616.68	\$23,435,016.65	\$30,555,742.18
Income (2018\$)	\$9,357,573.65	\$10,526,011.59	\$13,724,438.38
Jobs (number of full and part-time jobs)	263.17	296.03	385.98
<i>Wildlife viewing from a boat</i>			
Person-days	61,407.00	69,074.00	90,070.05
Spending (2018\$)	\$8,975,599.78	\$10,096,253.45	\$13,164,722.63
Output (2018\$)	\$10,052,671.96	\$11,307,804.15	\$14,744,489.35
Income (2018\$)	\$4,542,210.05	\$5,109,330.18	\$6,662,384.61
Jobs (number of full and part-time jobs)	127.12	142.99	186.4489623
Total visitors			
Person-days	191,523.00	215,437.00	280,906.82
Spending (2018\$)	\$27,577,042.87	\$31,020,375.87	\$40,446,635.29
Output (2018\$)	\$30,886,288.64	\$34,742,820.81	\$45,300,231.52
Income (2018\$)	\$13,899,783.70	\$15,635,341.77	\$20,386,822.99
Jobs (number of full and part-time jobs)	390.29	439.02	572.43

Appendix E: Visitation estimates for Monroe County

Table E.1. Visitor person-trips to Monroe County and percent of cruise ship passengers 2008-09 to 2013-14

Year	All visitors person-trips (millions)	Cruise ship person-trips (millions)	Percent cruise ship
2008-2009	2.766	0.859	31.1
2009-2010	2.906	0.850	29.2
2010-2011	2.955	0.811	27.4
2011-2012	2.985	0.814	27.3
2012-2013	2.859	0.765	26.8
2013-2014	2.911	0.797	27.4

Source: Jessica Bennett, Director of Marketing Research Monroe County Tourist Development Council , 2015 (personal communication)

Table E.2. Estimates of domestic and international visitors to Monroe County 2013 to 2015

	2013	2014	2015
Type of Visitor	Person-trips (millions)	Person-trips (millions)	Person-trips (millions)
Domestic¹			
All visitors	4.92	4.99	5.18
Leisure visitors	4.51	4.58	4.74
Overnight visitors	3.53	3.59	3.74
	2013	2014	2015
	Person-days (millions)	Person-days (millions)	Person-days (millions)
Domestic¹			
All visitors	17.40	17.58	17.93
Leisure visitors	15.98	16.22	16.52
Overnight visitors	15.24	15.48	15.77
	2013	2014	2015
	Person-trips (millions)	Person-trips (millions)	Person-trips (millions)
International^{2,3}			
	N/A	N/A	1.16
	2013	2014	2015
	Person-days (millions)	Person-days (millions)	Person-days (millions)
	N/A	N/A	4.05
	2013	2014	2015
Domestic & International	Person-trips (millions)	Person-trips (millions)	Person-trips (millions)
	N/A	N/A	5.90
	2013	2014	2015
	Person-days (millions)	Person-days (millions)	Person-days (millions)
	N/A	N/A	20.57

¹ For domestic visitors, cruise ship passengers should be included.

² International visitor methodology initiated in 2015 includes overnight and day visitors.

³ International visitor person-days approximated by assuming length of stay is the same as that for domestic visitors (3.49 days).

Appendix F: Definitions

This appendix includes many definitions for key terms specified in the regulations and the definitions of the different types of marine zones. These definitions are included in the draft environmental impact statement (DEIS) and many are based on the Florida Administrative Code (FAC).

Key terms

- (1) *Diver*. A definition will be added to be consistent with state law at Rule 68B-5.005. New definition: *Diver* means any person who is wholly or partially submerged in the water, and is equipped with a face mask, face mask and snorkel, or underwater breathing apparatus.
- (2) *Fish feeding*. A definition will be added to be consistent with state law at Rule 68B-5.005. New definition: *Fish feeding* means the introduction of any food or other substance into the water by a diver for the purpose of feeding or attracting marine species, except for the purpose of harvesting such marine species as otherwise allowed by rules of the Fish and Wildlife Conservation Commission.
- (3) *Idle speed no wake* will be updated to be consistent with state law at Rule 68D-23.103(3)(b), (d)-(f), FAC, for boating restricted areas. All other references to *idle speed no wake* in FKNMS regulations will be updated (e.g., officially marked channel). Updated definition: *Idle speed no wake* means that a vessel must proceed at a speed no greater than that which will maintain steerageway and headway. At no time is any vessel required to proceed so slowly that the operator is unable to maintain control over the vessel or any other vessel or object that it has under tow.
- (4) *Idle speed no wake zone* will be updated to be consistent with state law at Rule 68D-23.103(3)(b), (d)-(f), FAC, for boating restricted areas. All other references to this zone type in FKNMS regulations will be updated. Updated definition: *Idle speed no wake zone* means a portion of the sanctuary where a vessel must proceed at a speed no greater than that which will maintain steerageway and headway. At no time is any vessel required to proceed so slowly that the operator is unable to maintain control over the vessel or any other vessel or object that it has under tow.
- (5) *Marine life species* will be updated to correct the state code citation. Updated definition: *Marine life species* means any species of fish, invertebrate, or plant included in 68B-42 of the Florida Administrative Code.
- (6) *No entry area* will be added to be consistent with state law at Rule 68D-23.103(3)(b), (d)-(f), FAC, for boating restricted areas. All other references to this zone type in FKNMS regulations will be updated. New definition: *No entry area* means all vessels and

all persons, either in vessels or swimming, diving, or wading, are prohibited from entering the area. This term and definition will replace the term and definition *closed*, which is the term currently used in FKNMS regulations.

- (7) *No vessel zone* will be updated to be consistent with state law at Rule 68D- 23.103(3)(b), (d)-(f), FAC, for boating restricted areas. All other references to this zone type in FKNMS regulations will be updated. Updated definition: *No vessels zone* means a portion of the sanctuary where all vessels of any type are prohibited from entering the area. This term and definition will replace the term and definition *no access buffer zone* which is the term currently used in FKNMS regulations.
- (8) *Tropical fish* will be updated to correct the state code citation. Updated definition: *Tropical fish* means any species included in 68B-42 of the Florida Administrative Code.
- (9) *Vessel* means a watercraft of any description, including, but not limited to, motorized and non-motorized watercraft, personal watercraft, airboats, and float planes while maneuvering on the water, capable of being used as a means of transportation in/on the waters of the sanctuary. For purposes of this part, the terms “vessel,” “watercraft,” and “boat” have the same meaning.
- (10) *Conservation area* (existing EMA definition: means an area of the sanctuary that is within or is a resource management area established by NOAA or by another federal authority of competent jurisdiction as of the effective date of these regulations where protections above and beyond those provided by sanctuary-wide prohibitions and restrictions are needed to adequately protect resources.
- (11) *Existing management area* term and definition will be struck from the regulations. A new definition for *conservation area* will be included (see above for that proposed definition).
- (12) *Protected wildlife*. A definition will be added to specify application of the *take or possession of protected wildlife* regulation. New definition: *Protected wildlife* means any species managed and protected by the Marine Mammal Protection Act (MMPA), as amended, 16 U.S.C. 1361 et seq.; the Endangered Species Act (ESA), as amended, 16 U.S.C. 1531 et seq.; the Migratory Bird Treaty Act (MBTA), as amended, 16 U.S.C. 703 et seq.; the Florida Endangered and Threatened Species Act of 1997 (Section 379.2291, F.S); and Chapter 68 of the Florida Administrative Code, including 68A-27.0012.
- (13) *Traditional fishing*. The term and definition for traditional fishing will be updated to provide additional clarity and specificity for what is intended as traditional fishing. The current definition will be maintained as follows: *Traditional fishing* means those commercial or recreational fishing activities that were customarily conducted within the sanctuary prior to its designation as identified in the environmental impact statement and

management plan for this sanctuary, as managed by the appropriate federal (South Atlantic Fishery Management Council, Gulf of Mexico Fishery Management Council) and state (Florida Fish and Wildlife Conservation Commission) agencies. The following clarifying text will be added: *Traditional fishing* does not include use of novel or new gear types to catch species that were fished by other means as identified in the environmental impact statement and management plan; does not include use of gear types (modified or not) identified in the environmental impact statement and management plan to catch species those gear types were not originally intended to catch; or does not include use of gear or harvest of species outside of the seasons/time of year identified in the environmental impact statement and management plan.

- (14) The term seabed will be replaced by the term submerged lands (§ 922.163(a)(3) *Alteration of, or construction on, the seabed*). All other references to this term in FKNMS regulations will be updated (e.g., definitions for *prop dredging* and *prop scarring*).
- (15) Terms will be added and/or updated for activities and projects that are exempt from § 922.163(a)(3)(v) *Alteration of, or construction on, the seabed* regulation. Additional terms will include swim platforms, boat ramps, boat notches, boatlifts, mooring piles, riprap revetments, and bulkheads; the term breakwaters will be removed.
- (16) The term littering will be added to § 922.163(a)(4) *Discharge or deposit of material or other matter* regulation.

Zone definitions

The proposed action and alternatives include modifications to existing marine zones and creation of new marine zones. As this is the most complex and complicated portion of the proposed action and alternatives, the following background is provided to help the reader better understand the approach taken and the management intent for each of the marine zone types included in the alternatives.

In general, FKNMS marine zones serve to protect and manage three areas:

- (1) Wildlife management areas: shallow water habitats and wildlife dependent on those and other near-shore habitats;
- (2) Sanctuary preservation areas: significant patch and fore-reef coral reef areas; and
- (3) Ecological reserves: larger contiguous habitats which include a wide range of habitats, including shallow water seagrass, hard bottom, and coral reef, that support life cycle needs of marine wildlife (e.g., spawning sites, nursery habitat, etc.).

In addition, there are special use areas, which is a larger category of marine zones that can be applied for specific management goals including:

- (1) Recovery area;
- (2) Restoration area;
- (3) Research-only area; and
- (4) Facilitated-use area.

In the current FKNMS marine zoning scheme, the only special use area type used is research-only area. In all but the no action alternative, special use areas are included for both research-only areas and restoration areas.

A final marine zone type – existing management area – is included in the current FKNMS marine zoning scheme. Details about how this marine zone type will be carried through alternatives is outlined in the existing management zone section below.

In addition to the protection of habitats and ecosystems, each marine zone has associated regulations designed to meet the stated purpose of the marine zone type and specific resource protection goals at each location. While the primary goal of the marine zone alternatives is resource protection, a secondary goal of the proposed action is to simplify and create consistency within each zone type and associated regulations to enhance user understanding and compliance.

Wildlife management areas

Wildlife management areas are included in all alternatives. These marine zones are intended to protect habitat including seagrass, hard-bottom, and other critical shallow water habitats and the wildlife that depend on these habitats from impacts of boat operations and concentrated and high use activities. The proposed regulations in these marine zones include vessel restrictions on access, anchoring, vessel speed, and channel marking and can be further categorized by their specific access restrictions (e.g., idle speed/no wake zones, no motor zones, no entry zones, etc.). Throughout the alternatives some of these marine zones are proposed as no entry to protect sensitive wildlife. Some are used to resolve conflicts between flats/backcountry recreational fishing and boating.

Sanctuary preservation areas

Sanctuary preservation areas are included in all alternatives. These marine zones are intended to protect significant patch and fore-reef coral reef areas and to separate conflicting uses, primarily fishing and diving/snorkeling. For these marine zones the existing sanctuary preservation area regulations will be maintained in all alternatives with proposed modifications including idle speed/no wake (alternatives 2, 3, and 4) and no anchoring (Alternative 4) to further protect coral reef ecosystems in these marine zones. In addition, in all but the no action alternative, permits for

bait fishing in all sanctuary preservation areas will either be phased out (Alternative 2) or will no longer be issued (alternatives 3 and 4) and the exception for catch and release by trolling in four sanctuary preservation areas will be eliminated (Conch Reef, Alligator Reef, Sombrero Reef, and Sand Key).

Ecological reserves

Ecological reserves are included in all alternatives. These marine zones are intended to protect large contiguous habitats, including those habitats necessary to support the full life cycle of a range of species. These marine zones are generally transit-only, with certain activities allowed by permit. The Tortugas Ecological Reserve North and the Western Sambo Ecological Reserve allow non-consumptive recreation.

Special use areas

Special use areas are included in all alternatives. By current sanctuary regulations there are four types of special use areas: recovery area, restoration area, research-only area, and facilitated-use area. Only one type of special use area – research-only area – is currently used in the sanctuary marine zoning scheme. special use areas are included in all alternatives, specifically research-only areas or restoration areas. These marine zones are small, targeted areas and are generally transit-only, with research or other specific activities allowed by permit.

Existing management areas

Existing management areas are those areas that were currently zoned when FKNMS was designated in 1990. These include Key Largo Existing Management Area, Looe Key Existing Management Area, and the four national wildlife refuges: Crocodile Lake, Key Deer, Great White Heron and Key West. Each individual existing management area will be updated independently in all but the no action alternative. The Key Largo and Looe Key existing management areas will be renamed the Key Largo and Looe Key conservation areas. The national wildlife refuges will no longer be referred to as existing management areas; they will simply be referred to as national wildlife refuges with overlapping and complementary jurisdiction to the sanctuary.



NATIONAL MARINE
SANCTUARIES

AMERICA'S UNDERWATER TREASURES