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NATIONAL MARINE SANCTUARIES CONSERVATION SERIES

Florida Keys National Marine Sanctuary Restoration Blueprint:

Updated Socioeconomic Supporting Documentation for the 2019 Draft Environmental Impact Statement and 2022 Proposed Rule

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Cover photo: Snorkelers swim over shallow reef in Florida Keys National Marine Sanctuary. Photo: Matt McIntosh/NOAA

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The Office of National Marine Sanctuaries, part of the National Oceanic and Atmospheric Administration, serves as the trustee for a system of underwater parks encompassing more than 620,000 square miles of ocean and Great Lakes waters. The 15 national marine sanctuaries and two marine national monuments within the National Marine Sanctuary System represent areas of America's ocean and Great Lakes environment that are of special national significance. Within their waters, giant humpback whales breed and calve their young, coral colonies flourish, and shipwrecks tell stories of our nation's maritime history. Habitats include beautiful coral reefs, lush kelp forests, whale migration corridors, spectacular deep-sea canyons, and underwater archaeological sites. These special places also provide homes to thousands of unique or endangered species and are important to America's cultural heritage. Sites range in size from less than one square mile to almost 583,000 square miles. They serve as natural classrooms and cherished recreational spots, and are home to valuable commercial industries.

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Abstract

This document serves as an update to *Florida Keys National Marine Sanctuary: Socioeconomic Supporting Documentation for the Restoration Blueprint, 2019*. The 2019 report analyzed the various alternatives considered in the draft environmental impact statement. This report provides updated information and analyses to meet the requirements of the National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act. The document focuses on the economic effects of proposed regulatory changes to Florida Keys National Marine Sanctuary, including a cost-benefit analysis and an analysis of potential effects to small businesses. It also analyzes and compares economic effects of the draft environmental impact statement alternatives. The document updates the 2019 report with more recent socioeconomic information on activities like fishing and tourism in Florida Keys National Marine Sanctuary and incorporates new methods into the quantitative analysis of the economic effects of proposed marine zone boundary changes.

Key Words

Restoration Blueprint, Regulatory Flexibility Act, National Environmental Policy Act, cost-benefit analysis, economic analysis, commercial fishing, recreational fishing, non-consumptive recreation

Executive Summary

This document serves as an update to *Florida Keys National Marine Sanctuary: Socioeconomic Supporting Documentation for the Restoration Blueprint, 2019*. The 2019 report analyzed the various alternatives considered in the draft environmental impact statement (DEIS). This report provides updated information and analyses to meet the requirements of the National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act. The document focuses on the economic effects of proposed regulatory changes (i.e., the proposed rule) to Florida Keys National Marine Sanctuary (FKNMS), including a cost-benefit analysis and an analysis of potential effects to small businesses. It also analyzes and compares economic effects of DEIS alternatives. The document updates the 2019 report with more recent socioeconomic information on activities like fishing and tourism in FKNMS and incorporates new methods into the quantitative analysis of the economic effects of proposed marine zone boundary changes.

Chapter 1 of the report introduces FKNMS, describes the document's purpose, and provides information on data sources and methodology. Chapter 2 defines the study area and provides a description of the affected socioeconomic environment, including a sociodemographic profile and information on human activities and industries. Chapters 3 and 4 analyze the economic effects of proposed regulations and DEIS alternatives. The regulations analyzed herein can be separated into the following types: (1) sanctuary-wide regulations, which apply to the entirety of FKNMS, (2) marine zone regulations, which apply only within specific marine zone types, and (3) marine zone boundary changes. Chapter 3 analyzes the economic effects of sanctuary-wide regulations and marine zone regulations. The section on sanctuary-wide regulations includes the analysis completed for the 2019 DEIS, as these data have not been updated and much of this analysis is qualitative. Chapter 4 analyzes the economic effects of changes to marine zone boundaries. The section on marine zone boundary changes includes updated analysis for the 2019 DEIS alternatives and the 2022 proposed rule using new economic data and methods. Chapter 5 provides a cost-benefit analysis of the entirety of the regulations pursuant to Executive Order 12866, and Chapter 6 considers economic effects to small businesses pursuant to the Regulatory Flexibility Act.

This report shows that the estimated economic effects of the proposed rule are not considered economically significant as defined in Executive Order 12866. This means that the estimated annual effect of the proposed rule is less than $100 million and will not adversely affect in a material way the economy; a sector of the economy; productivity; competition; jobs; the environment; public health or safety; or state, local, or tribal governments or communities. Of the proposed regulations, marine zone boundary changes are expected to elicit the largest economic effects. As detailed in Chapter 4, losses to commercial fishing operations and recreational for-hire fishing operations resulting from proposed boundary changes are expected to be less than 1% of average revenue with the exception of the lobster fishery, which may experience a loss of roughly 2%. These predicted losses do not account for substitution of activity outside of the proposed zones (that is, the analysis does not attempt to predict whether fishers will minimize their losses by fishing in other areas or by targeting other species). Most targeted zones are small, and it is unlikely that the estimated maximum potential loss in revenue would occur. The analysis provided here also supports NOAA's decision to certify under the

Regulatory Flexibility Act that there will not be a significant economic impact on a substantial number of small business entities. This analysis also supports the finding in the 2019 DEIS that there will be no significant socioeconomic impacts from the proposed action.

Chapter 1: Introduction

The National Oceanic and Atmospheric Administration (NOAA) is proposing to make several changes to Florida Keys National Marine Sanctuary (FKNMS), including expanding the boundary of the sanctuary, updating sanctuary-wide regulations, and updating individual marine zone boundaries and regulations. FKNMS currently protects 3,800 square miles of waters surrounding the Florida Keys, from south of Miami westward to the Dry Tortugas. Within the boundary of the sanctuary lie spectacular, unique, and nationally significant marine resources, including North America's only coral barrier reef, extensive seagrass beds, mangrove-fringed islands, and more than 6,000 species of marine life. The sanctuary also protects pieces of our nation's history, such as shipwrecks and other archeological resources. The proposed rule for FKNMS follows NOAA's publication of a draft environmental impact statement (DEIS) and a supporting socioeconomic analysis (Leeworthy et al., 2019) in August 2019.

This document provides an updated socioeconomic analysis used to inform the FKNMS Restoration Blueprint, including information that satisfies requirements set forth by the National Environmental Policy Act, the Regulatory Flexibility Act (RFA), and Executive Order 12866. The report provides a description of the affected environment, the potential economic effects of regulatory changes, a cost-benefit analysis, and the economic effects to small businesses. More specifically, there are three general types of regulations analyzed here: (1) sanctuary-wide regulations, which are general regulations that apply across FKNMS, (2) regulations that apply in specific marine zones, and (3) marine zone boundary changes, which modify the locations where the specific marine zone regulations apply. Chapter 3 analyzes the economic effects of sanctuary-wide and marine zone regulations, and Chapter 4 analyzes the economic effects of changes to marine zone boundaries. Chapter 5 provides a cost-benefit analysis for the entirety of the proposed regulations pursuant to Executive Order 12866, and Chapter 6 considers economic effects to small businesses pursuant to the RFA.

The effects in this report are analyzed relative to a baseline of "no action" or the status quo. The "no action" alternative is not expected to change costs or benefits. The "no action" alternative may entail costs associated with the forgone benefits of conservation and increased protections; however, these opportunity costs are not discussed in this document. Instead, the "no action" alternative is the baseline from which changes are measured and the lens through which the impacts of the proposed alternatives are analyzed. The economic effects described throughout this document should be interpreted as the change in benefits and costs from the "no action" alternative to the action alternative being discussed, including the regulatory changes included in the proposed rule. These changes are referred to as "marginal changes," measured as benefits and costs of a given alternative. In all cases, a qualitative assessment is provided; this assessment identifies the type of users that will benefit or incur costs from the alternatives. Benefits and costs are quantified where economic data are available.

The alternatives considered in this report include (1) the 2019 DEIS alternatives (Alternative 1—the "no action" alternative—and alternatives 2, 3, and 4; Leeworthy et al., 2019; Office of National Marine Sanctuaries [ONMS], 2019) and (2) the 2022 proposed rule, which FKNMS based on the alternatives and developed after extensive public comment on the DEIS. The DEIS

alternatives for sanctuary-wide regulations are summarized in Chapter 3. The DEIS alternatives for marine zone boundary changes are considered in Chapters 4 of this analysis. Leeworthy et al. (2019) relied primarily on vessel trip reports submitted to the Florida Fish and Wildlife Conservation Commission (FWC) from 2009–2013 to analyze potential impacts to commercial fisheries most likely to be affected by the proposed regulatory changes. Data on recreational fishing were primarily from NOAA Fisheries' Marine Recreational Information Program (MRIP) for the years 2010–2014. The non-consumptive recreational analysis relied primarily on data from 2007 and earlier.

This document has made several changes to the economic analysis methodology used in the 2019 DEIS because of feedback received during the public comment period. More details on these changes are provided in each chapter, but a brief overview is provided here. First, data have been updated to primarily consider the years 2015–2019 for commercial fishing and 2014–2018 for recreational fishing, the latest data available at the time of this analysis. Second, the Office of National Marine Sanctuaries (ONMS) consulted with NOAA Fisheries to utilize estimates of economic impact and data from fishery management council reports to estimate changes to the commercial and recreational fishing sectors. These changes provide an updated analysis that closely aligns with the methods and approaches used by NOAA Fisheries to analyze the economic effects of regulatory changes on fisheries. Chapter 4 includes an updated analysis of the 2019 DEIS marine zone boundary alternatives and the 2022 proposed rule using the updated data and methodology.

The remainder of this report focuses on the potential effects of the proposed rule and alternatives using data available at the time of this analysis. The economic effects documented in the 2019 DEIS are analyzed and provided in this document in response to public comments received. The cost-benefit analysis and analysis of economic effects to small businesses are specific to the proposed rule.

Chapter 2:
Description of Affected Socioeconomic Environment

ONMS has developed sanctuary community profiles (SCPs) to describe the socioeconomics of the environment affected by national marine sanctuary regulations. SCPs are designed to provide social, economic, and cultural information on sanctuaries and provide an analytical baseline for local communities and economies' dependence on and relationships to sanctuary resources. SCPs also contain information on how sanctuary resources and programs support and add value to local communities.

SCPs include a county or collection of counties where the majority of economic contributions (e.g., output, income, and employment) and social effects associated with use of sanctuary resources take place. Information in SCPs includes population, population density, demographics, poverty rate, unemployment rate, income, and employment-related variables. All of these measurements are available from existing sources that can be easily updated. These data are then supplemented by studies on the socioeconomics of different uses and users. Additional supporting information will be made available in the FKNMS SCP (Samonte et al., 2022).

Study Area

Defining the geographic scope (i.e., collection of counties that define the study area) for socioeconomic studies of national marine sanctuaries is an evolving process. An initial assessment is done based on past studies of sanctuary resource use and local social and economic (socioeconomic) effects. In the case of FKNMS, a great deal of research has been done on the various uses of sanctuary resources since 1995–1996. The primary area where socioeconomic impacts related to use of sanctuary resources occur is Monroe County, Florida. Monroe County includes the Florida Keys and Everglades National Park (Figure 2.1). Therefore, for purposes of this profile, Monroe County and the Florida Keys are synonymous.

The study area, also referred to as the local sanctuary community, is identified by considering county locations relative to the sanctuary and commuter workflows. The study area is identified by first considering the county (or counties) that are adjacent to the sanctuary's boundaries. For FKNMS, this is Monroe County, which is considered a primary county. FKNMS is also adjacent to the southern portion of Miami-Dade County; however, this county was not included because the southern portion of Miami-Dade County includes only undeveloped, protected natural areas. The second step is to consider commuter workflows using data from the American Community Survey. The American Community Survey is an ongoing effort that provides information about the American people. More specifically, the American Community Survey collects information on U.S. residents that travel across county and state lines to work and reports the number of workers that commute into or out of a county and which counties those commuters travel to and from (U.S. Census Bureau, 2013).

The third step is to ensure that counties with a sizable number of residents who commute to primary counties are also included in the study area (as secondary counties). The final determination is based upon the percent and nominal number of commuters in consultation

with site staff with place-based knowledge. Commuters may be dependent upon the sanctuary and its resources, whether they are scientists, hospitality workers, recreational providers, or doctors providing services to workers who live in the primary county, or visitors who vacation in the primary county to enjoy the resources and activities offered by the sanctuary (both on and off shore). The reverse relationship is also considered to account for those who choose to live in a primary county and benefit from sanctuary resources and amenities offered by other businesses that utilize the sanctuary and/or its resources, goods, and services, but work elsewhere. Further, those who live in a primary county but commute to other counties are most likely spending much of their income within the primary county.

Net commuter flow was calculated for various counties in the FKNMS region. For the purposes of this assessment, net commuter flow is the number of people that commute from a county of interest to the primary county to work plus the number of primary county residents who work in the county of interest. If this number is greater than 10% of the total labor force of the county of interest, that county is included in the study area as a secondary county. There were no counties with a net commuter flow to or from Monroe County that met these criteria; thus, no secondary counties were identified for FKNMS.

This chapter details the socioeconomics of the study area (Monroe County), provides information on the industries and types of businesses that may be affected by regulatory changes to FKNMS, and considers the existing level of activity for commercial and recreational fishing and non-consumptive recreation.

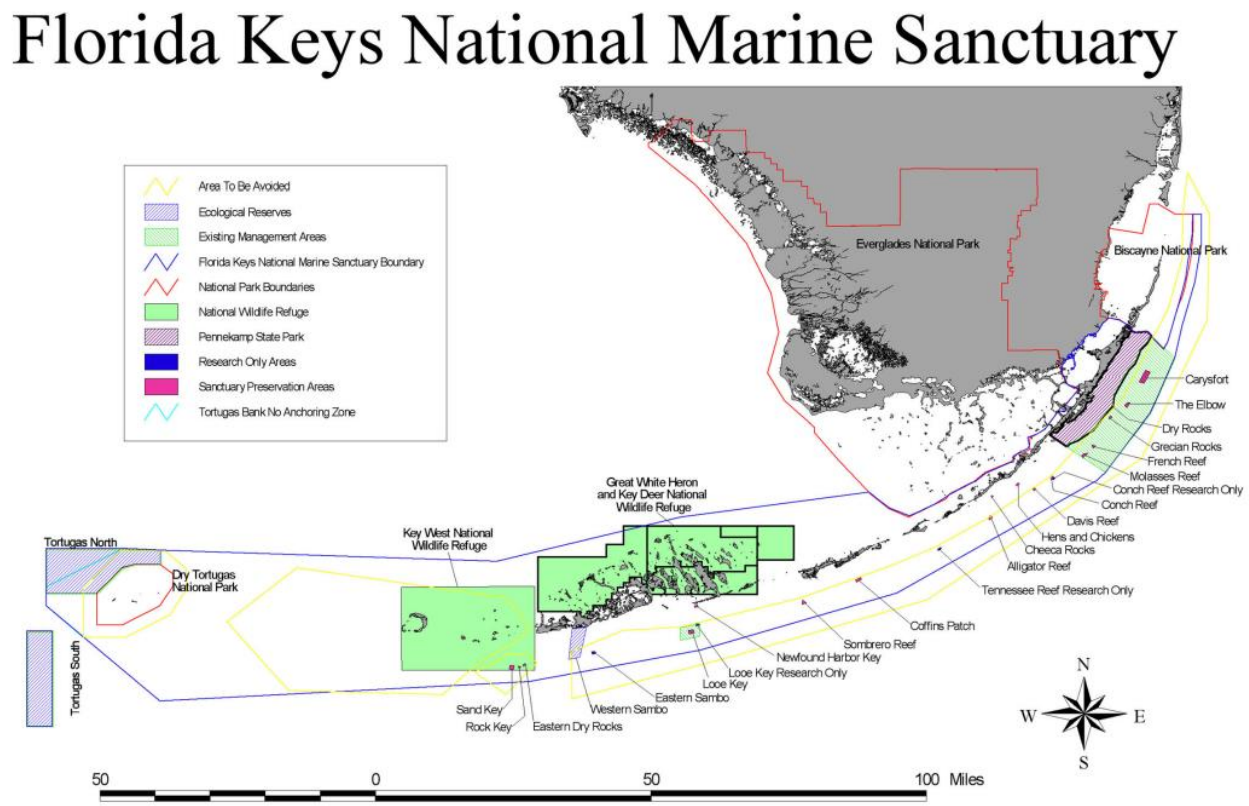

Figure 1. Map of current FKNMS boundaries.

Sociodemographics

Population

According to data from the U.S. Census Bureau, in 2019, the population in the study area was 74,228 while the population in Florida and the U.S. was 21,477,737 and 328,839,523, respectively. As described by Smart Preservation (2022), Monroe County has implemented measures to restrict population growth and development since 1985. Because of its geographic location and susceptibility to flooding, Monroe County restricts permanent population and population growth to ensure that evacuation is possible if necessary. Development restrictions are enforced to restrict population growth and to protect nearby ecosystems.

In 2019, Monroe County was 0.4% of Florida's total population. From 2010 to 2019, the study area's population grew 1.4%. This is slower than population growth in Florida and the U.S. for the same time period (Table 1). In 2019, population density for the study area (73.6 people per square mile) was also lower than population density of Florida and the U.S. (Table 1). For comparison, Miami-Dade County had a population density of 1,117.6 in 2019.

Table 1. Population metrics for the study area, the state of Florida, and the U.S., 2010–2019. Source: U.S. Census Bureau, 2021a

Location	Total Population (2010)	Total Population (2019)	Population Growth (2010–2019)	Population Density (2019)
Florida	18,511,620	21,477,737	14.0%	326.6
Monroe County	73,065	74,228	1.4%	73.6
U.S.	303,965,272	328,239,523	8.0%	92.9

Race

In 2019, the proportion of the study area population that identified as White was higher than that of any other racial category. The overall percentage of respondents in Monroe County who identified as White decreased slightly from 2010 to 2019, while the proportion of respondents who identified as Black, Asian, and two or more racial profiles increased slightly during this time. The portion of the population that identified as Alaskan Native or Native American, Native Hawaiian or other Pacific Islander, or selected "other" as a response did not have clear trends. In 2019, the study area and the U.S. had different distributions of races. The study area shared similar proportions of races to Florida (Table 2; Figure 2).

Table 2. Distribution of race in the study area, 2010–2019. Source: U.S. Census Bureau, 2021a

Year	White	Black	Alaskan Native or Native American	Asian	Native Hawaiian or Other Pacific Islander	Other	Two or More Racial Profiles
2010	90.1%	7.5%	0.2%	1.3%	0.1%	0.1%	0.8%
2011	89.8%	7.8%	0.2%	1.3%	0.0%	0.1%	0.9%
2012	89.6%	7.7%	0.2%	1.3%	0.0%	0.1%	1.1%
2013	89.1%	7.9%	0.2%	1.4%	0.0%	0.1%	1.3%
2014	88.8%	7.7%	0.5%	1.3%	0.0%	0.1%	1.6%
2015	88.5%	7.8%	0.6%	1.3%	0.0%	0.1%	1.7%
2016	88.2%	8.5%	0.3%	1.5%	0.0%	0.1%	1.5%
2017	87.9%	8.8%	0.2%	1.6%	0.0%	0.1%	1.4%
2018	87.8%	8.6%	0.2%	1.7%	0.2%	0.2%	1.4%
2019	87.6%	8.9%	0.1%	1.7%	0.2%	0.2%	1.4%

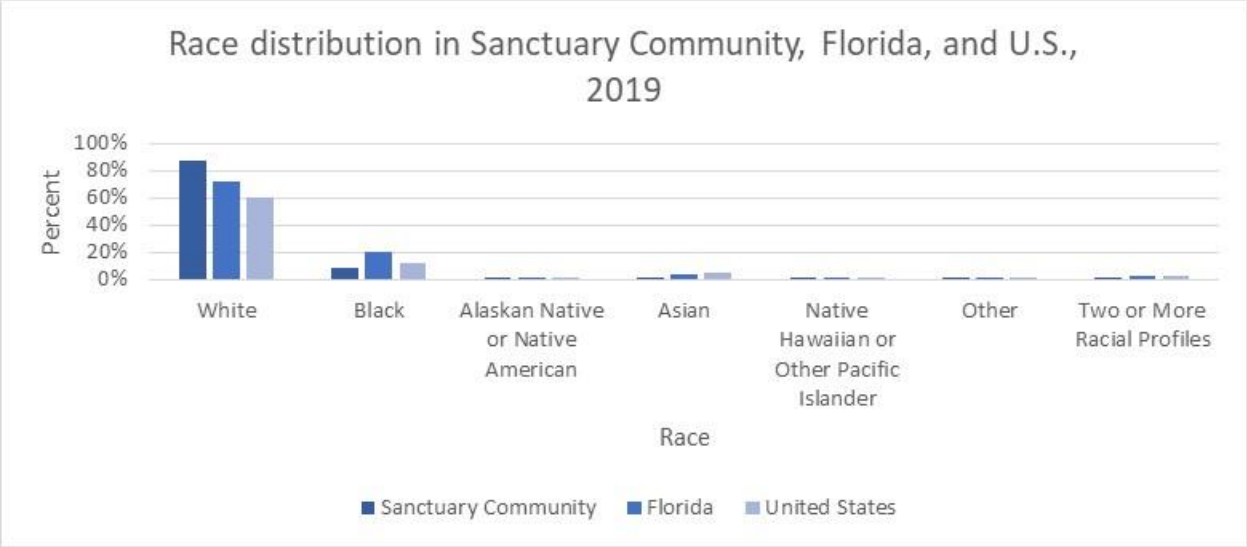

Figure 2. Distribution of race in 2019 for the sanctuary community (Monroe County), Florida, and the U.S. Source: U.S. Census Bureau, 2021a

Ethnicity

In the study area, the proportion of the population that identified as having Hispanic, Latino, or Spanish origin increased from 2010–2019. Monroe County's distribution of ethnicity reflected the distribution in Florida. The proportion of the population that identified as Hispanic in 2019 was higher in both the study area (24.3%) and in Florida (25.6%) than the U.S. in 2018 (18.0%).

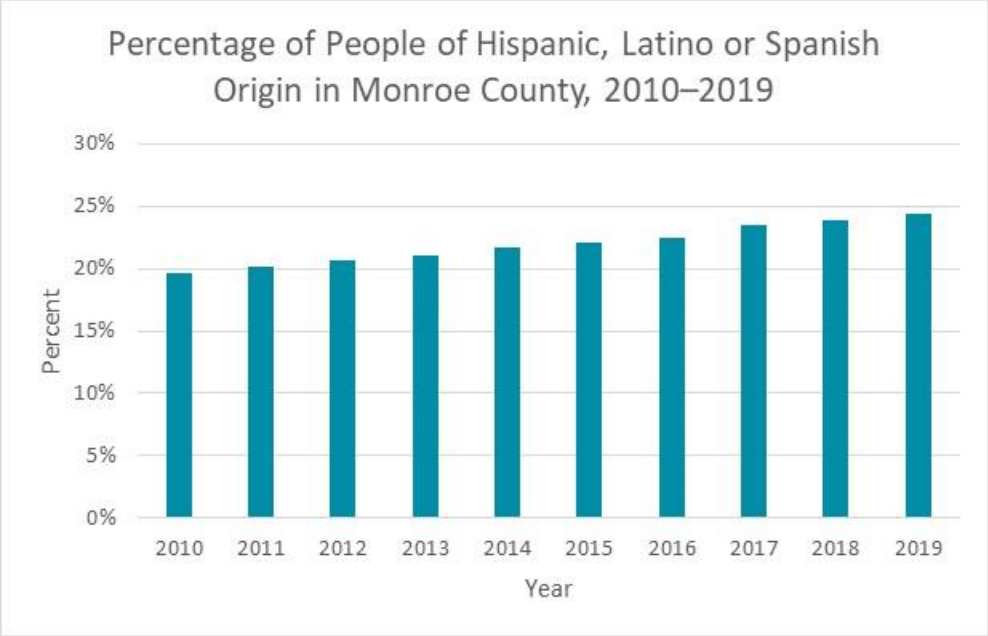

Figure 3. Percentage of Monroe County residents that identified as Hispanic, 2010–2019. Source: U.S. Census Bureau, 2021a

Income and Unemployment

This section describes sources of income and the status of the labor force in the study area. The labor force, total employment, and their respective growth rates are indicators of the health of the local economy and opportunities for employment. NOAA also analyzed economic measures related to proprietors (small business owners), including proprietors' income and employment, and the proportion of the study area's employment accounted for by proprietors. This can be an indicator of the importance of small businesses in their communities, which are often connected to resource use in national marine sanctuaries (e.g., recreation and tourism-related businesses, such as dive shops or recreational fishing charters).

Per capita income is the average income earned per person in a given area. It indicates the health and economic status of a community. In 2019, per capita income for Monroe County was $101,261. This figure is higher than 2019 per capita income in the state of Florida ($52,426) and the U.S. ($56,490). From 2010–2015, real per capita income (adjusted for inflation using the consumer price index[1]) for Monroe County grew slower than that of the state of Florida (2.0% and 16.8%, respectively). However, per capita income in Monroe County grew faster than that of the state of Florida from 2015–2019 (18.4% and -0.5%, respectively; Table 3).

The unemployment rate is another indicator of economic health. In 2019, the unemployment rate in Monroe County was 3.3%. For the same year, Florida had an unemployment rate of 2.1%. Unemployment rates in the study area and Florida were lower than the U.S. rate of 3.7% in 2019.

[1] The consumer price index is a measure of the average change in the prices paid over time by urban consumers for a set of goods and services (U.S. Bureau of Labor Statistics, 2022).

Table 3. Selected socioeconomic measures for Monroe County, the state of Florida, and the U.S. ($2019). Source: U.S. Census Bureau, 2021a

Location	Per Capita Income (2010)	Per Capita Income (2019)	Real Per Capita Income Growth Rate (2010–2015)	Real Per Capita Income Growth Rate (2015–2019)	Unemployment Rate (2010)	Unemployment Rate (2019)	Poverty Rate (2019)
Florida	$45,110	$52,426	16.8%	-0.5%	7.5%	2.1%	12.7%
Monroe County	$83,814	$101,262	2.0%	18.4%	10.8%	3.3%	8.7%
U.S.	$47,539	$56,490	11.2%	6.8%	9.6%	3.7%	10.5%

Further, in 2019, income by place of work as a percent of income by place of residence for the study area was 28.8% (income from work in the study area divided by total income in the study area). This means that the majority (nearly three quarters) of the income in the study area was earned outside the study area. This figure was less than that of the state of Florida (37.4%) in 2019; however, this value indicates that most of the income in Florida did not come from working in Florida in that year. (Income also includes government and business transfer payments).

Proprietors' (business owners) income and employment were examined as an indicator of the presence of small businesses and related resource use in the study area. The contribution of proprietors' income and employment to the study area was also analyzed. Typically, larger values for proprietors' income and employment indicate a larger number of small businesses in the area. The larger the contribution of proprietors to the study area's total income and employment, the more dependent the economy is on small businesses.

In 2019, there were 20,387 proprietors in the study area, representing nearly 45% of total employment in Monroe County. Proprietors accounted for a larger percentage of total employment in the study area than in Florida (35.2%), indicating that the economy in the study area may be especially dependent on small businesses. In 2019, proprietors' income was $409.8 million in Monroe County and $69.0 billion in Florida.

Human Uses

Commercial Fishing

In Florida, commercial fishing waters are divided into statistical areas (and subdivided into subareas) by NOAA Fisheries and FWC's Fish and Wildlife Research Institute (referred to as FWC from this point forward) to record where fish are caught. The waters off of Monroe County are divided into five statistical areas comprising 24 subareas, 15 of which overlap with FKNMS. Commercial fishing in the statistical areas associated with Monroe County supports the sanctuary community, the state of Florida, and the U.S. Commercial fishing represents a direct use of natural resources within FKNMS. FWC maintains information on Florida's commercial fisheries. Data for commercial fisheries and marine life collection from 2010–2019 were obtained by ONMS through a non-disclosure agreement that allows for analysis and provision of summary-level data without sharing individual observation data. FWC collects and compiles

data from "trip tickets" that contain information on where fish are caught (subarea) and landed, landings by weight, and harvest revenue.

The analysis provided here presents the total harvest revenue and pounds landed by species group and gear type for 2010–2019. Trend data[2] are shown for some of the top species by harvest revenue that are most likely to be affected by the proposed rule, including reef species. Table 1 describes the statistical subareas associated with Monroe County, their associated fishery management council, and whether they overlap with FKNMS. There are two fishery management councils (Gulf of Mexico and South Atlantic) responsible for fisheries in the 24 subareas adjacent to Monroe County. All data used in this analysis are from the trip tickets submitted to FWC.

Table 4. Monroe County statistical subarea information.

Statistical Subarea Description	Statistical Subarea Number	Fishery Management Council	Overlap with FKNMS?
South of US 1	1.0	South Atlantic	Yes
North of US 1	1.1	Gulf of Mexico	Yes
Federal waters north of US 1	1.8	Gulf of Mexico	No
Federal waters south of US 1	1.9	South Atlantic	Yes
State waters—Gulf	2.0	Gulf of Mexico	Yes
State waters—South Atlantic	2.2	South Atlantic	Yes
Federal waters—Gulf	2.8	Gulf of Mexico	Yes
Federal waters—South Atlantic	2.9	South Atlantic	No
Offshore waters	3.0	Gulf of Mexico	No
Whitewater Bay	3.1	Gulf of Mexico	No
All other inland waters	3.2	Gulf of Mexico	No
Federal waters	3.9	Gulf of Mexico	No
Offshore waters	744.0	Gulf of Mexico	Yes
Florida Bay	744.1	Gulf of Mexico	Yes
Biscayne Bay (non-national park)	744.3	South Atlantic	No
Biscayne Bay National Park (inside)	744.4	South Atlantic	Yes
Biscayne Bay National Park (outside)	744.5	South Atlantic	No
Biscayne Bay National Park (Federal)	744.8	South Atlantic	No
Card Sound	744.6	South Atlantic	Yes
Barnes Sound	744.7	South Atlantic	Yes
Federal waters	744.9	South Atlantic	Yes
South of US 1	748.0	South Atlantic	Yes
North of US 1 (Florida Bay)	748.1	Gulf of Mexico	Yes
Federal waters (south of US 1)	748.9	South Atlantic	Yes

[2] Trend data for both commercial and recreational fisheries are likely to be impacted by natural disturbances, such as Hurricane Irma (2017), a coral disease outbreak (2016), and a seagrass die-off (2015) that occurred in the Florida Keys.

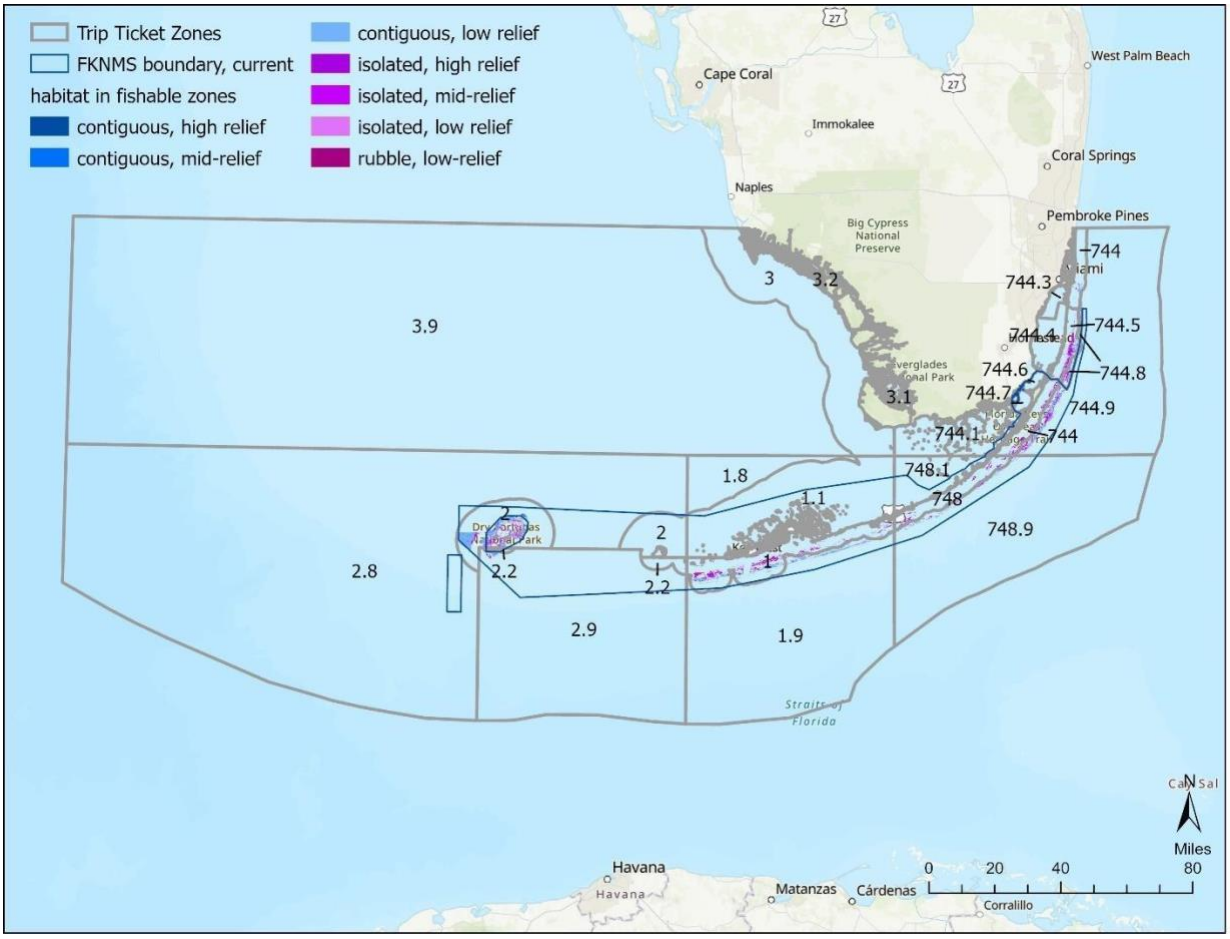

Figure 4. Map of current FKNMS boundary and statistical subareas.

Ten reef species (nine fishes and Caribbean spiny lobster), shrimp (including pink, rock, brown, royal red, white, and other shrimp), and stone crab were considered in this analysis. The reef fish considered were black, red, and gag grouper; grunts; hogfish; and gray, lane, mutton, and yellowtail snapper. There were several reasons the analysis focused on reef species. First, the spatial management zones considered are concentrated in the reef tract, and consequently will primarily impact reef-based fishing and species. Secondly, the species analyzed had species-habitat relationships, which allowed for a spatially explicit estimation of effort based on where the fish are known to congregate. Third, many of these species are among the most valuable reef species when considering total harvest revenue (ex-vessel price per pound multiplied by landings). While there are a number of species with large harvest revenues caught in FKNMS, they are not reef obligate and tend to be pelagic, with large habitat ranges; these species were therefore not included in the analysis. However, shrimp and stone crab were considered; although these species are not reef obligate, they fall within the top 10 fisheries in the region based on total harvest revenue and are generally more site attached, making these fisheries potentially more sensitive to regulatory changes within FKNMS. A more detailed description of the process used to identify species for further analysis may be found in Schwarzmann et al. (2022).

Summary of Commercial Fishing Activity in Statistical Areas Adjacent to Monroe County

The table below shows summary data for the periods from 2010–2019 and 2015–2019. Both time periods are presented to identify whether there have been any major shifts in trends or activity in terms of species targeted or gear used in the past 10 years or when considering the more recent five-year period for which data are available. During this time period, several events affected the FKNMS ecosystem, including coral bleaching and hurricanes. Despite this, the top species and gear type by harvest revenue were consistent between time periods. The 10 highest value species by harvest revenue were the same in Monroe County and FKNMS for the period from 2010–2019. For the 2015–2019 period, snowy grouper replaced swordfish as a top 10 species in Monroe County. More harvest revenue came from shrimp than stone crab from 2015–2019, but stone crab landings created more revenue over the whole decade. Caribbean spiny lobster was the most valuable species by harvest revenue in Monroe County and FKNMS. The top 10 species by value from 2010–2019 are presented in Table 5. Additionally, mutton and gray snapper are included in the table since they are part of the nine reef species analyzed in more detail throughout this report. King mackerel, swordfish, greater amberjack and golden crab are not reef associated and consequently not included in more detailed analysis outside of this section. Results are presented in 2019 dollars and converted using the consumer price index.

Table 5. Top commercially harvested species by total value in statistical areas adjacent to Monroe County from 2010–2019 and 2015–2019 ($2019). Asterisks (*) denote species that are not reef associated and were thus not included in subsequent analyses in this report. Source: Florida Fish and Wildlife Conservation Commission [FWC], 2021

	2010–2019			2015–2019		
Species	Rank	Total Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)	Rank	Total Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)
Caribbean spiny lobster	1	$437,653,634	$43,765,363	1	$209,870,754	$41,974,151
Stone crab	2	$190,119,826	$19,011,983	3	$100,746,664	$20,149,333
Shrimp	3	$184,308,597	$18,430,860	2	$104,113,636	$20,822,727
Yellowtail snapper	4	$67,938,240	$6,793,824	4	$37,128,817	$7,425,763
King mackerel*	5	$18,226,354	$1,822,635	5	$8,829,221	$1,765,844
Red grouper	6	$14,032,786	$1,403,279	6	$8,153,797	$1,630,759
Swordfish*	7	$6,315,632	$631,563	12	$1,650,511	$330,102
Greater amberjack*	8	$5,381,889	$538,189	7	$2,407,448	$481,490
Golden crab*	9	$4,648,788	$464,879	9	$1,794,663	$358,933
Black grouper (carberita)	10	$3,565,377	$356,538	8	$2,007,747	$401,549
Mutton snapper	11	$3,215,210	$321,521	11	$1,673,009	$334,602
Gray (mangrove) snapper	13	$2,972,987	$297,299	14	$1,499,215	$299,843

Figure 5 shows trends in harvest revenue for the top five species harvested from statistical subareas adjacent to Monroe County from 2010–2019. Graphs of harvest revenue and pounds harvested for individual species of interest from 2010–2019 are presented in Appendix A. There is no clear trend in Caribbean spiny lobster harvest revenue from 2010–2019. Lobster revenue peaked in 2014 at $62.4 million. Shrimp harvest revenue showed a moderately increasing trend with a peak in 2017 at roughly $27.7 million. Higher-than-average shrimp prices in 2013 and 2014 resulted in a small revenue spike. Stone crab revenue showed a weakly increasing trend over the decade. There was a statistically significant[3] increasing trend in yellowtail snapper harvest revenue with a peak in 2017 at nearly $8.8 million. There was no clear trend in harvest revenue for king mackerel; revenue reached a low in 2015 at roughly $1.25 million and a high in 2018 at over $2.4 million.

Harvest revenue for red grouper increased from a low of under $500,000 in 2010 to a maximum of roughly $2.18 million in 2014. Revenues gradually decreased over the latter half of the decade. Black grouper harvest revenues trended slightly upwards over 2010–2019. Years 2012 and 2013 were strong years for swordfish harvest revenue with over $1.1 million in landings for both years. Following that period, revenue fell to a low of approximately $220,000 in 2015.

There was a statistically significant, steady decline in grunt harvest revenue from 2010–2019. Hogfish harvest revenue was roughly $31,000 in 2010 and then increased to a peak of approximately $83,400 in 2015 before declining steeply to a low of roughly $7,000 in 2019. There was no clear trend in harvest revenue for mutton snapper in Monroe County from 2010–2019; revenue peaked at roughly $401,600 in 2014 and $421,000 in 2019. Gray (mangrove) snapper harvest revenue varied without trend over the study period. Lane snapper harvest and harvest revenue increased significantly from 2010–2019; harvest revenue peaked in 2018 at nearly $25,000. Gag grouper harvest revenue increased from a low of roughly $67,500 in 2011 to a high of over $235,000 in 2015. Following the 2015 peak, gag grouper revenue declined to around $90,000 in 2019.

[3] Statistical significance was assessed using a generalized linear model with $\alpha = 0.05$.

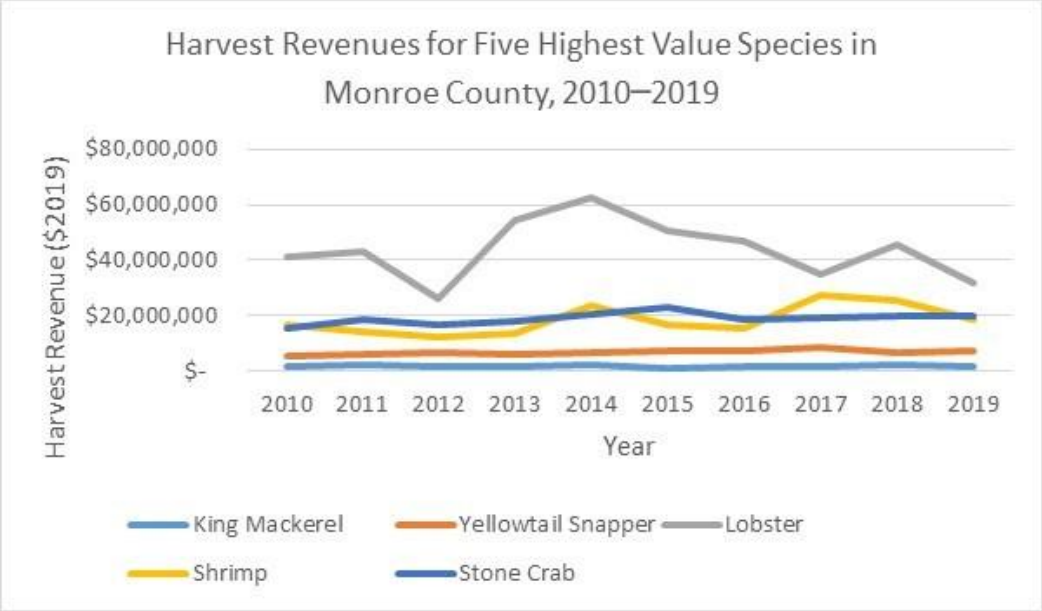

Figure 5. Harvest revenue for the five highest value species in statistical areas adjacent to Monroe County, 2010–2019. Source: FWC, 2021

Summary data for commercial harvest revenue in Monroe County by gear type are presented below. The top five gears by harvest revenue are the same for Monroe County and FKNMS, with the exception that stone crab traps generate more revenue than the "trawl, quad rig" gear category in Monroe County than in FKNMS. The list of the 10 highest revenue-generating gears for 2010–2019 is similar to the list for 2015–2019 in FKNMS, with slight differences in the order of ranking. As in statistical areas within FKNMS, the "traps (not specified)" gear type is ranked lower in the later study period than for the entire decade. Traps, trawl, and hook and line are the top three gear categories by harvest revenue when aggregating across similar gear types[4]. For each of the top five gear types, summary charts for harvest revenue and pounds landed in Monroe County are presented Appendix A.

Table 6. Top gear types by harvest revenue in statistical areas adjacent to Monroe County from 2010–2019 and 2015–2019 ($2019). Source: FWC, 2021

2010–2019				2015–2019		
Gear	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)
Lobster traps	1	$299,095,344	$29,909,534	1	$170,633,268	$34,126,654
Traps (not specified)	2	$167,391,168	$16,739,117	4	$45,925,187	$9,185,037
Stone crab traps	3	$145,569,829	$14,556,983	2	$85,389,199	$17,077,840

[4] Aggregated gear types include traps (lobster traps, traps [not specified], and stone crab traps), trawl (quad rig trawl, trawl [not specified], and double trawl), and hook and line (hook and line, rod and reel, and electric reel).

2010–2019				2015–2019		
Gear	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)
Quad rig trawl	4	$92,087,053	$9,208,705	3	$57,656,404	$11,531,281
Trawl (not specified)	5	$73,120,373	$7,312,037	5	$33,057,162	$6,611,432
Hook and line	6	$53,625,177	$5,362,518	6	$24,686,423	$4,937,285
Rod and reel	7	$33,674,063	$3,367,406	7	$19,883,679	$3,976,736
Longline	8	$24,381,855	$2,438,186	9	$12,088,431	$2,417,686
Double trawl	9	$15,505,083	$1,550,508	8	$12,373,065	$2,474,613
Electric reel	10	$12,809,161	$1,280,916	10	$7,820,166	$1,564,033

Figure 6 shows harvest revenue trends for the top five gear types. Harvest revenue from the traps (not specified) gear category experienced a statistically significant decline from 2010–2019 in Monroe County. There was a small spike in revenue from traps (not specified) in 2013–2014, when revenues reached just over $25 million. There was no significant trend in revenue from lobster traps, although the average revenue in the second part of the decade was slightly higher than the average for the first five years. From 2014–2016, lobster trap revenues hovered near a maximum of around $39 million. No trend in harvest revenue from trawl (not specified) was evident from 2010–2019. Trawl revenue during the study period peaked at over $12 million in 2010 and reached a low of $4.8 million in 2019. There were spikes in trawl revenue in 2014 and 2017. Revenue from stone crab traps increased significantly from 2010–2019, reaching a maximum of nearly $18.7 million in 2015. Harvest revenue from the quad rig trawl gear type also experienced a statistically significant increase over the study period. Quad rig trawl revenues spiked in 2014 at close to $13.3 million and peaked in 2017 at around $16.1 million.

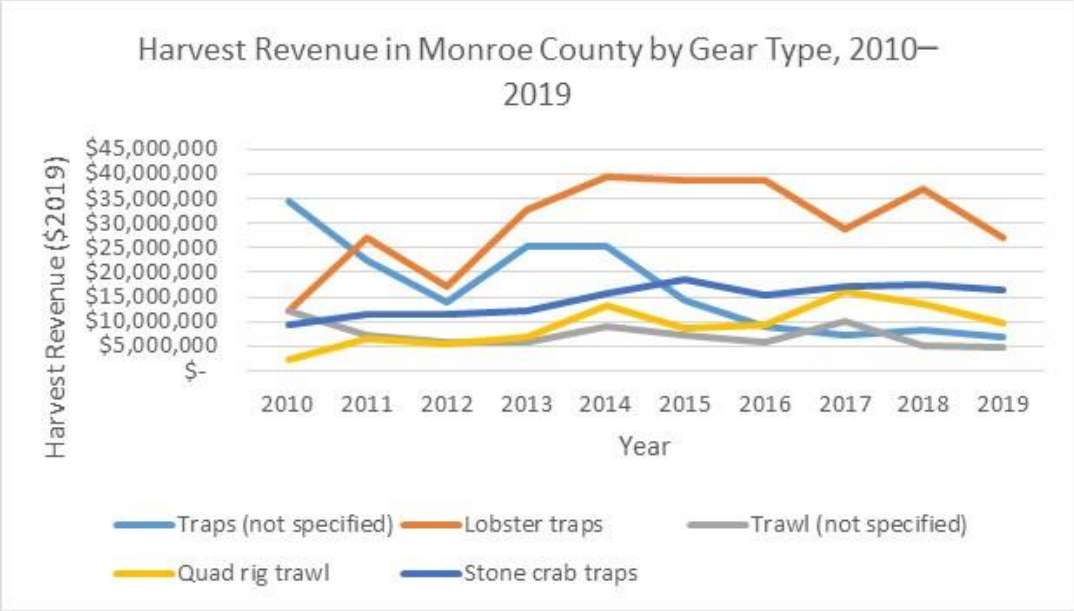

Figure 6. Top five gear types by harvest revenue in statistical areas adjacent to Monroe County from 2010–2019. Source: FWC, 2021

Summary of Commercial Fishing Activity in Statistical Areas that Overlap FKNMS

The top 12 species by total harvest revenue within statistical areas that overlap FKNMS are presented in Table 7. The top 12 species are presented so ensure additional species evaluated in this report are presented. For commercial fishery landings in FKNMS, the list of the 10 highest value species by harvest revenue (in 2019 dollars) was identical for 2010–2019 and 2015–2019. In both periods, the harvest revenue for Caribbean spiny lobster was more than double the value for shrimp, the next most valuable species. Stone crab and yellowtail snapper were the next most valuable species landed after Caribbean spiny lobster and shrimp. Harvest revenue for king mackerel, the fifth most valuable species, was roughly 10 times less than revenue for yellowtail snapper, the fourth ranked species.

A separate analysis of the economic effects of proposed zone changes on small business entities considered nine reef-associated fish, along with high-value shrimp, Caribbean spiny lobster, and stone crab. Six of those species—grunts, hogfish, mutton snapper, gray (mangrove) snapper, lane snapper, and gag grouper—did not fall within the top 10 species by harvest revenue. For context, landings summaries (harvest revenue and pounds landed) for those species are provided in Appendix A.

Table 7. Top commercially harvested species by harvest revenue in statistical areas that overlap FKNMS from 2010–2019 and 2015–2019 ($2019). Asterisks (*) denotes species that are not reef associated and thus were not included in subsequent analyses in this report. Source: FWC, 2021

	2010–2019			2015–2019		
Species	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)
Caribbean spiny lobster	1	$391,805,069	$39,180,507	1	$181,630,677	$36,326,135
Shrimp	2	$160,344,142	$16,034,414	2	$88,360,506	$17,672,101
Stone crab	3	$94,429,905	$9,442,990	3	$52,210,708	$10,442,142
Yellowtail snapper	4	$51,787,944	$5,178,794	4	$27,925,557	$5,585,111
King mackerel*	5	$7,391,524	$739,152	5	$2,506,993	$501,399
Great amberjack*	6	$4,896,423	$489,642	7	$2,198,025	$439,605
Swordfish*	7	$4,885,147	$488,515	10	$1,440,035	$288,007
Red grouper	8	$4,655,513	$465,551	6	$2,231,243	$446,249
Golden crab*	9	$4,484,499	$448,450	8	$1,794,663	$358,933
Black grouper (carberita)	10	$3,014,190	$301,419	9	$1,710,912	$342,182
Mutton snapper	11	$2,562,019	$256,202	11	$1,274,694	$254,939
Gray (mangrove) snapper	12	$2,428,694	$242,869	13	$1,200,752	$240,150

There is some variation in Caribbean spiny lobster harvest revenue from 2010–2019, with no clear trend. Revenue peaked at nearly $56.25 million in 2015 and subsequently declined to around $26.1 million in 2019. Shrimp harvest revenue shows a weakly increasing, but statistically insignificant, trend over the ten-year study period. Harvest revenue for shrimp caught in FKNMS peaked in 2017 at roughly $23.25 million. Harvest revenue for both stone crab and yellowtail snapper increased significantly from 2010–2019. Relatively large stone crab harvests in 2011 and 2016 were accompanied by declines in price per pound (roughly $11.11/lb and $11.92/lb, respectively, compared to a decadal average of $14.39/lb). Comparatively, the price of yellowtail snapper was less variable, and trends in harvest revenue closely track trends in harvest. King mackerel harvest revenue declined significantly over the study period, from a high of around $1.2 million in 2010 to a low of $0.3 million in 2017.

There was no trend in red grouper harvest or harvest revenue over the study period. Harvest revenue increased to a peak of roughly $870,000 in 2014 and subsequently decreased to $274,000 in 2019. Black grouper harvest revenue exhibited a weakly increasing trend from 2010–2019, rising above $400,000 in 2014 and 2017. Harvest revenue for grunts in FKNMS declined significantly over the time series from a peak of $47,241 to a low of just under $5,000 in 2019. Hogfish revenue increased gradually to a peak of around $77,700 in 2015, then declined considerably to a low of around $6,100 in 2019. There was no clear trend in harvest revenue or pounds landed for mutton snapper from 2010–2019. Lane snapper harvest revenue showed a statistically significant, increasing trend, peaking in 2018 at roughly $21,200 pounds. There was

no statistically significant trend in gray (mangrove) snapper harvest or harvest revenue over the study period. Harvest revenue for gag grouper increased from just under $18,000 in 2011 to nearly $87,500 in 2014. Revenue subsequently declined to around $25,200 in 2019 after another, smaller peak at $50,400 in 2018. The trends for the top five species by harvest revenue are shown in Figure 7. Figures showing trends in harvest revenue and pounds landed for additional species from 2010–2019 are shown in Appendix A.

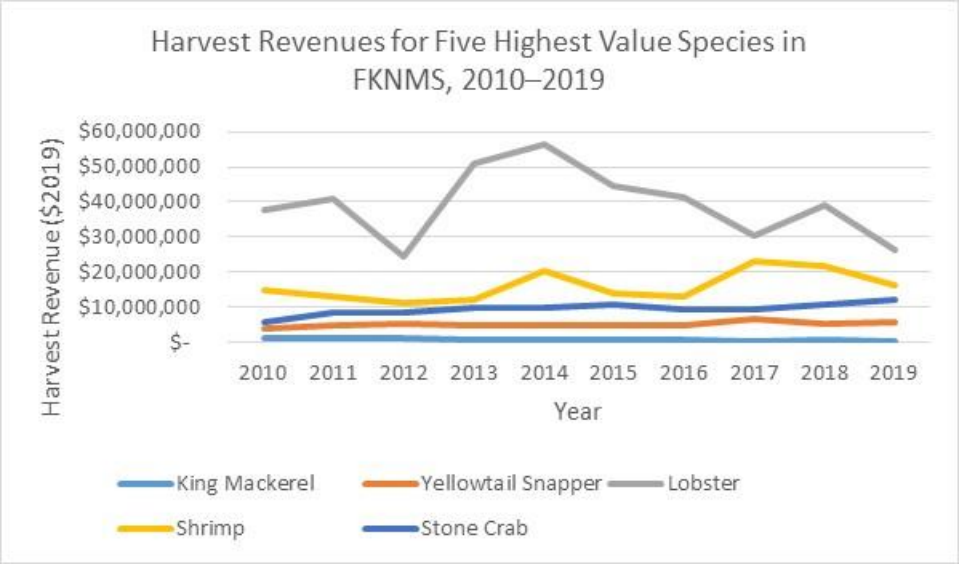

Figure 7. Harvest revenue for the five highest value species in statistical areas that overlap FKNMS. Source: FWC, 2021

The table below ranks the top commercial gear types by harvest revenue from 2010–2019 and 2015–2019. As with Monroe County, the top three gear categories were traps, trawl, and hook and line. The list of top five gear types by harvest revenue were identical for FKNMS in both study periods. For the 2015–2019 period, electric reel gear replaced scuba gear as the tenth ranked gear type on the list. Lobster traps were the top ranked gear type by harvest revenue in both study periods. The next top gear types over the entire decade were, in order: traps (not specified), quad rig trawls, stone crab traps, and trawls (not specified). In the 2015–2019 period, the “traps (not specified)” gear type fell to the fourth ranked position, but the rank order for the top five gear types were otherwise the same between the two periods.

Table 8. Top gear types by harvest revenue in statistical areas that overlap FKNMS from 2010–2019 and 2015–2019 ($2019). Source: FWC, 2021

	2010–2019			2015–2019		
Gear	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)	Rank	Harvest Revenue ($2019)	Average Annual Harvest Revenue ($2019)
Lobster traps	1	$265,302,932	$26,530,293	1	$148,585,212	$29,717,042
Traps (not specified)	2	$148,650,381	$14,865,038	4	$37,692,702	$7,538,540
Quad rig trawl	3	$89,374,295	$8,937,429	2	$55,950,409	$11,190,082
Stone crab traps	4	$56,539,031	$5,653,903	3	$38,911,621	$7,782,324
Trawl (not specified)	5	$55,505,876	$5,550,588	5	$22,570,160	$4,514,032
Hook and line	6	$41,569,445	$4,156,945	6	$17,700,033	$3,540,007
Rod and reel	7	$24,972,027	$2,497,203	7	$15,061,788	$3,012,358
Long line	8	$12,332,842	$1,233,284	9	$5,702,925	$1,140,585
Double trawl	9	$12,135,204	$1,213,520	8	$9,726,361	$1,945,272
Scuba	10	$8,645,515	$864,552	11	$4,412,868	$882,574
Electric reel	12	$7,990,994	$799,099	10	$4,482,538	$896,508

Figures showing harvest revenue and pounds landed by gear type are available in Appendix A.

Harvest revenue from the traps (not specified) gear type declined significantly from 2010–2019. Nearly $30 million in harvest revenue came from traps (not specified) in 2010, but that figure declined to under $5 million by 2019. There was a moderate spike in harvest revenue from traps (not specified) in 2013. There was no statistically significant trend in harvest revenue from lobster traps from 2010–2019, although revenue in the latter half of the decade was slightly higher on average compared to the first half. Lobster trap revenue from FKNMS peaked in 2014 at over $35.5 million. Harvest revenue from the general “trawl (not specified)” gear type declined over the study period from a maximum of roughly $10.5 million in 2010 to a low of around $2.6 million in 2019. Trawl (not specified) revenue spiked in 2014 and again in 2017. On the other hand, revenue from quad rig trawls increased significantly from 2010–2019, reaching a peak of nearly $15.5 million in 2017. Revenue from quad rig trawls was only about $2.2 million in 2010. Harvest revenue from stone crab traps also increased significantly over the study period, starting at approximately $1.3 million in 2010 and increasing to about $9.07 million by 2018. The figure below shows trends for the top five gear types by harvest revenue.

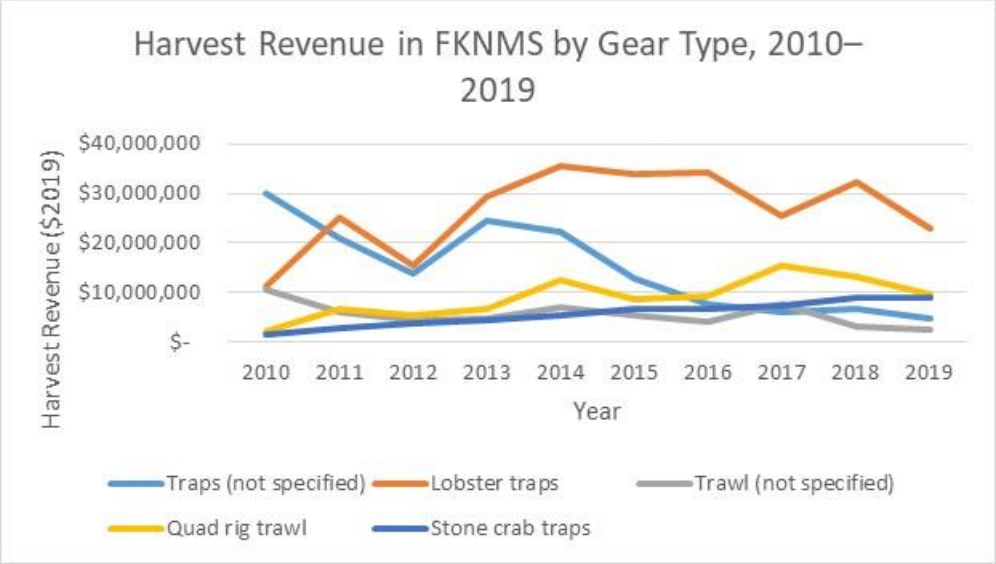

Figure 8. Top five gear types by harvest revenue in statistical areas that overlap FKNMS from 2010–2019. Source: FWC, 2021

Recreational Fishing

Wallmo et al. (2021a) analyzed recreational fishing on Florida Reefs. Although the study focused on use of the entire reef tract in Southeast Florida, estimates are provided at the county level. Utilizing data from NOAA Fisheries' National Marine Recreation Fishing Expenditure Survey and MRIP, Wallmo et al. (2021a) found that trip-based expenditures for recreational fishing on the Southeast Florida reef tract supported nearly 3,800 jobs and $400.5 million in output. The economic effects were highest in Monroe County, supporting nearly 1,700 jobs and $180.4 million in output. Additionally, there were 1,201,552 shore-based angler trips, 215,064 charter boat trips, and 1,287,848 private/rental boat trips in Monroe County in 2016.

Using MRIP data, researchers from University of Miami's Rosenstiel School of Marine and Atmospheric Science estimated a five-year average (2014–2018) for the number of charter and private vessel trips that specifically targeted reef-obligated species within Monroe County. Shoreline estimates were not provided, since the proposed marine zone changes would not affect the shoreline. Charter vessels that reported targeting reef fish had an average of 117,119 annual, non-duplicative angler trips for hook and line fishing. Private vessels targeting reef fish had an annual average of 983,006 non-duplicative hook and line trips and 123,863 non-duplicative spear fishing trips. Headboat vessels fishing within the current FKNMS boundary had an annual average of 298,846 angler-hours, or roughly 37,356 non-duplicative angler trips (Southeast Fisheries Science Center, 2021). The mean annual numbers of private and charter recreational angler-trips for 2014–2018 for nine reef-associated species are presented in Table 9. The table below may show duplicative trips, meaning that if someone reported targeting multiple species on the same trip, they would have an angler-trip added to each of the species categories.

Table 9. Mean annual angler-trips for charter and private vessels, 2014—2018. Source: S. Smith, personal communication, May 3, 2021; National Marine Fisheries Service, Fisheries Statistics Division, personal communication, January 15, 2021

Species	Mode	Average Annual Angler Trips (2014–2018)
Black grouper	Charter vessels	101,621
	Private vessels	598,505
Gag grouper	Charter vessels	91,473
	Private vessels	482,519
Red grouper	Charter vessels	89,731
	Private vessels	834,598
Gray snapper	Charter vessels	91,189
	Private vessels	876,181
Lane snapper	Charter vessels	83,401
	Private vessels	657,688
Mutton snapper	Charter vessels	111,930
	Private vessels	687,134
Yellowtail snapper	Charter vessels	98,724
	Private vessels	864,001
White grunt	Charter vessels	85,565
	Private vessels	848,761
Hogfish	Charter vessels	83,270
	Private vessels	895,367

Tourism and Visitation

Tourism (including recreation) is one of the most important economic sectors to the Monroe County economy. Both the status of demand and supply are discussed below. The number of visitors and residents in Monroe County were evaluated to inform the demand for recreation and tourism. The number of parks, recreational operators, and infrastructure all speak to the supply and capacity to provide these services to people. The number of visitors to the Florida Keys was estimated to be to be 5.13 million in 2018, 5.05 million in 2017, 5.07 million in 2016, 5.04 million in 2015, and 4.89 million in 2014 (Rockport Analytics, 2019). Tourism value to the Florida Keys economy was estimated at $2.4 billion (in 2018, the most recent year data were available), supporting 44% of jobs and employment in Monroe County and $500.9 million in tax receipts (Rockport Analytics, 2019). Without tourism, an additional amount of $3,818 would be needed in local annual taxes from each of the county's 30,200 households to maintain receipts. Although these estimates do not include COVID-19 impacts, the 10-year trend does include the impact of Hurricane Irma, which made landfall in the Florida Keys in September 2017, destroying infrastructure, shuttering businesses, and damaging visitor perceptions (Rockport Analytics, 2019). The Florida Keys were closed as a result of Hurricane Irma from September 10–October 1, 2017.

Insights, Inc. (2021) conducted a study of visitors to FKNMS for the years 2019 and 2020; data from this study were provided for quarters[5] 1, 3, and 4 of each year. During quarter 2 of 2020, the Florida Keys were closed to visitors due to the COVID-19 pandemic. Surveys did not occur from March 22, 2020 until the start of the third quarter of 2020, when the Florida Keys were reopened to visitors. In 2019, 63.1% of respondents reported visiting for recreation/vacation and 30.1% of respondents reporting visiting family and friends. In 2019, 95.1% of visitors to the Florida Keys also reported visiting Monroe County within the previous three years. Further, in 2019, 34.0% of respondents reported staying 1–3 nights, 52.3% reported staying 4–7 nights, and 13.7% reported staying 8 or more nights. In 2020, shorter stays were more common, with 40.8% of respondents reporting stays of 1–3 nights, 50.8% reporting 4–7 nights, and 8.4% reporting 8 or more nights. The mean size of the visitor party was 4.33 in 2019 and 4.07 in 2020, with an average of 0.77 visitors per group under the age of 17 in both 2019 and 2020. Lastly, 92.5% of visitors in 2019 and 90.5% of visitors in 2020 were likely to recommend the Florida Keys to a friend. The study did not include information on residents or non-resident day-trippers.

Table 10. Select information on overnight visitors to the Florida Keys (% of total respondents indicating each response). Source: Insights, Inc., 2021

Question		2019	2020
Which of the following best describes your trip?	Recreation/vacation trip	63.1%	64.1%
	Visiting family/friends	30.1%	31.3%
Did you visit the Florida Keys in the previous three years? (Yes)		95.1%	87.0%
Total nights spent in the Florida Keys	1–3	34.0%	40.8%
	4–7	52.3%	50.8%
	8 or more	13.7%	8.4%
How likely are you to recommend the Florida Keys to a friend? (Likely)		92.5%	90.5%

When assessing tourism, it is also useful to evaluate the frequency and methods of travel that are used to access Monroe County. Visitors may enter Monroe County via U.S. Route 1, fly into Key West International Airport, or arrive by boat. The number of arrivals via Key West International Airport has increased since 2015. The top three carriers in 2018 were Republic Airways, Delta Air Lines, and Silver Airways (which exclusively serves Florida and the Bahamas). These three carriers accounted for 93% of all passenger arrivals at Key West International Airport. However, there was a large, temporary drop in passengers in September 2017 due to Hurricane Irma, and the data do not include 2020 (Rockport Analytics, 2021).

[5] The periods for each quarter are: Quarter 1, January 1–March 31; Quarter 2, April 1–June 30; Quarter 3, July 1–September 30; Quarter 4, October 1–December 31

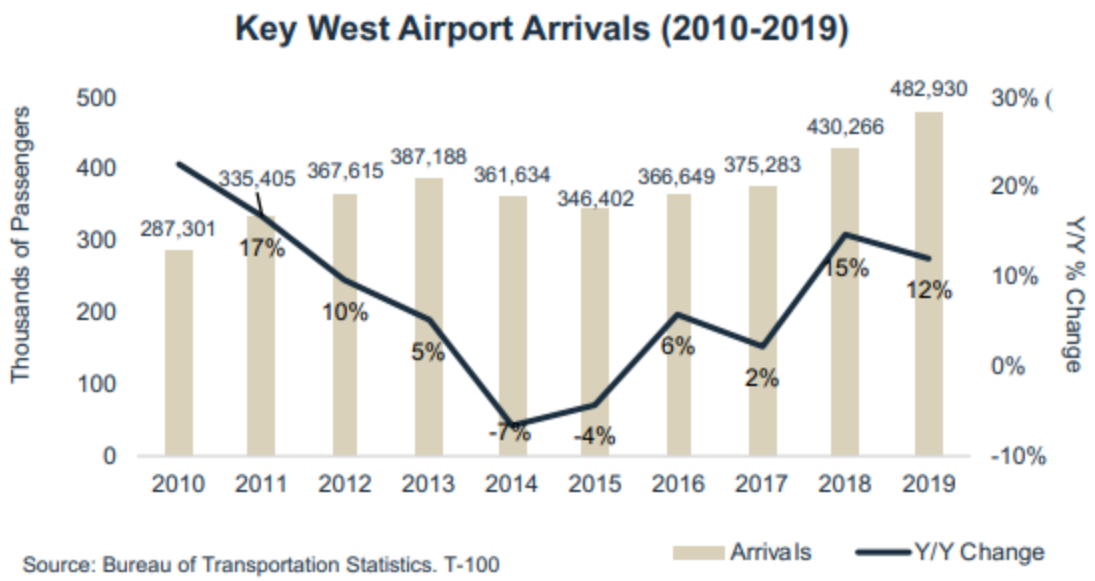

Figure 9. Key West International Airport arrivals and year-over-year (Y/Y) percent change, 2010–2019. Source: Rockport Analytics, 2021; Bureau of Transportation Statistics, 2021

During the same time period, vehicular traffic entering and traveling throughout Monroe County increased (Rockport Analytics, 2021). Annual daily traffic in Marathon and Islamorada increased consistently since 2013 (Figure 10).

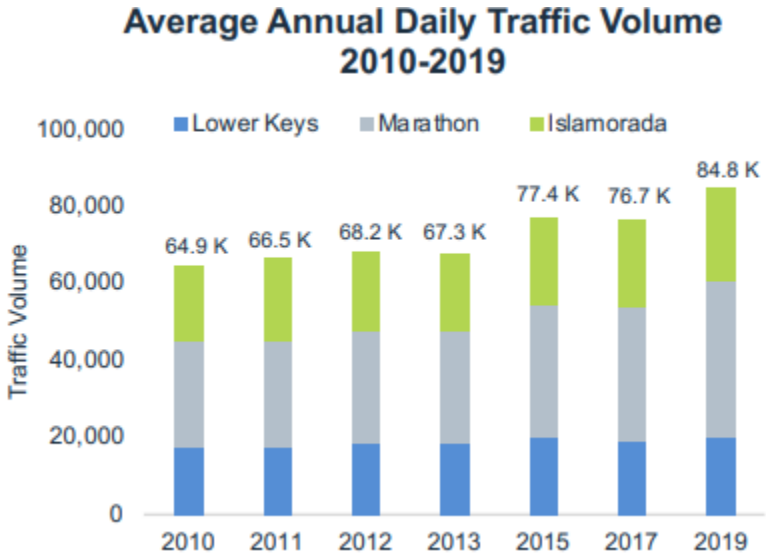

Figure 10. Average annual daily traffic volume (number of vehicles), 2010–2019. Source: Rockport Analytics, 2021

These data show that total visitor volume to the Florida Keys has increased steadily since 2014 (except for 2017, due to the passage of Hurricane Irma). The sharpest increase occurred from 2017–2019, when both the number of vehicles on U.S. Route 1 (the only road that leads into the Florida Keys) and passengers arriving via Key West International Airport increased (Rockport

Analytics, 2021). This increase in visitation resulted in increased travel delays due to congestion. This is important to note, as increased travel time and strain on infrastructure may impact visitor satisfaction in the long term without infrastructure improvement.

Cruise ship data are also available for the city of Key West. However, unlike other modes of transportation, cruise ship passengers primarily stay within Key West and are unlikely to participate in activities that use FKNMS resources at the same rates as non-cruise ship passengers due to the limited duration of their stays. The number of cruise ship passengers remained stable from 2010–2019, with a low point occurring in 2016 (E. Dawicki/Key West Chamber of Commerce, personal communication, May 11, 2021). The reduced number of passengers in 2020 is attributed to COVID-19. Analysis of monthly cruise ship passenger counts shows that peak cruise ship visitation consistently occurs in the winter (November–February).

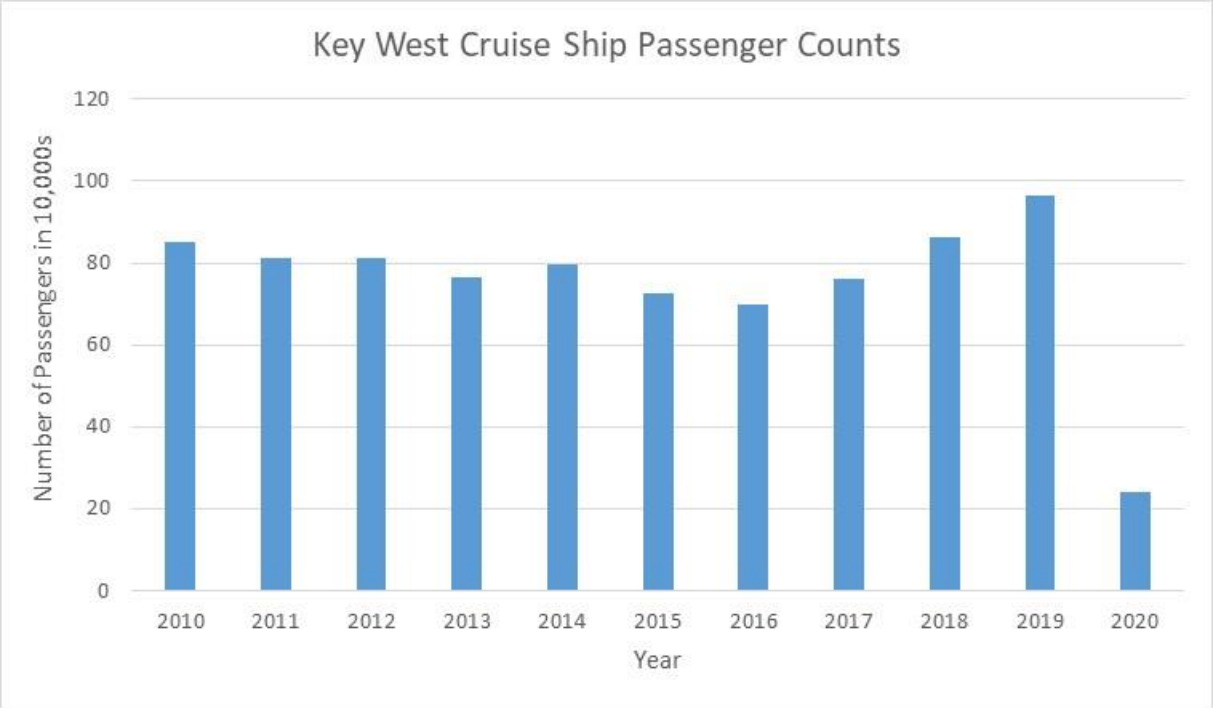

Figure 11. Key West cruise ship passenger counts. Source: E. Dawicki/Key West Chamber of Commerce, personal communication, May 11, 2021

Non-Consumptive Recreation

A comprehensive study of Monroe County visitors and residents has not been conducted since 2007–2008 (Leeworthy, 2010). A summary of these data can also be found in the socioeconomic supporting analysis for the DEIS, but is not presented here (Leeworthy et al., 2019). This section provides summary information from the Monroe County Tourism Development Council and a more recent study by West Virginia University focusing on the northern portion of Monroe County.

The table below summarizes participation in various activities across all areas of Monroe County in 2019 and 2020 (Insights, Inc., 2021). Although participation rates were lower in 2020 compared to 2019, the data show that visitors participate in a diverse set of activities. (It is

unknown whether lower participation rates in 2020 were a result of the COVID-19 pandemic.) In 2019, the most common activities that rely on FKNMS resources were beach activities, viewing wildlife, sightseeing, boating, and snorkeling. Non-sanctuary-related activities and the business that provide these services and goods may indirectly benefit from the existence of a healthy marine environment and sanctuary that people want to visit. Participation rates account for visitors participating in multiple activities during their visit to Monroe County.

Table 11. Rates of participation in recreational activities, 2019 and 2020 (reported as percentages of respondents who indicated they participated in a given activity). Source: Insights, Inc., 2021

Activity	2020	2019	Change from 2019–2020
Scuba diving	20.7%	21.4%	-0.7%
Snorkeling	28.7%	52.6%	-23.9%
Fishing	31.4%	47.8%	-16.4%
Viewing wildlife	50.9%	64.9%	-14.0%
Boating	48.3%	60.8%	-12.6%
Beach activities	59.7%	70.2%	-10.5%
Dining out	64.6%	74.4%	-9.8%
Visit museums/historical areas	40.1%	69.0%	-28.9%
Sightseeing and attractions	19.8%	64.6%	-14.8%
Cultural events	27.9%	53.9%	-26.0%
Wedding/commitment ceremony	16.9%	22.4%	-5.4%
Bars/nightlife	61.4%	70.3%	-8.8%
Spa/health club/gym	39.8%	51.8%	-12.0%

The report by Insights, Inc. (2021) also provides expenditure estimates for non-resident overnight visitors. In 2019, the average amount spent per party per night was $242 on lodging, $112 on transportation in the Florida Keys, $130 on water-related activities, $129 on land-oriented activities, $166 on food/beverages, and $48 on souvenirs, gifts, and clothing (sample size of 2,700). These values declined slightly across all categories except food and beverage in 2020. In 2020, average expenditures per party per night were $228 for lodging, $112 for transportation in the Florida Keys, $125 for water-related activities, $116 for land-oriented activities, $176 for food/beverages, and $39 for souvenirs, gifts, and clothing (sample size of 2,574). The table below summarizes this information.

Table 12. Mean expenditures per party per night (2019 dollars). Source: Insights, Inc., 2021

Expenditure	Mean expenditures per night, 2019 ($2019)	Mean expenditures per night, 2020 ($2019)
Lodging	$242	$228
Transportation	$112	$112
Water-oriented activities	$130	$125
Land-oriented activities	$129	$116
Food/beverages	$166	$176
Souvenirs, gifts, film, clothing	$48	$39

A more recent study found that reef-related diving and snorkeling trips support 1,756 jobs, nearly $52.2 million in labor income, and roughly $155.4 million in output (Wallmo et al., 2021b). Mean expenditure per respondent for trip-level goods was roughly $62 for charter dive/snorkeling trips, $47 for lodging, $45 for food and beverages from restaurants, $39 for food and beverages from stores, and $29 for boat fuel/oil. These data reflect responses from residents and non-residents, and expenditure estimates were not separated based on residency. This means that several zero values for lodging were included in the estimates. Additionally, 32% of respondents indicated that their most recent trip was a paid charter trip, 21% indicated their most recent trip was part of a longer work trip or vacation, and 20% indicated their most recent trip was from a private/rental boat.

Chapter 3: Economic Effects of Sanctuary-Wide and Marine Zone Regulations

This section summarizes the economic effects of sanctuary-wide regulations, including a boundary expansion, and marine zone regulations that are included in the 2022 proposed rule and the alternatives in the 2019 DEIS. This analysis is largely qualitative due to the lack of quantitative data on the number of businesses potentially affected by the proposed rule and the level of revenues, costs, and profits from their activities within FKNMS.

Sanctuary Boundary Expansion

No Action (Status Quo)

Under the no action alternative, FKNMS would continue to encompass approximately 3,800 square miles. For more information on the current and proposed boundaries and boundary alternatives, please visit the Restoration Blueprint website (Florida Keys National Marine Sanctuary [FKNMS], 2020).

Proposed Rule

The proposed rule includes expansion of the FKNMS boundary by 1,000 square miles for a total area of 4,800 square miles. There are three principal areas where NOAA is proposing changes to the FKNMS boundary. First, NOAA seeks to align the FKNMS seaward boundary with the northernmost Area to Be Avoided (ATBA) seaward boundary. In doing so, FKNMS would encompass two areas of the existing ATBA that currently fall outside the sanctuary boundary (two small areas of the ATBA along the Key West shipping channel; 475 square miles). The expanded boundary would also encompass the proposed modified Tortugas South Conservation Area (which is currently referred to as the Tortugas South Ecological Reserve; 271 square miles) and a non-contiguous area at Pulley Ridge (259 square miles).

The ATBA was established through the Florida Keys National Marine Sanctuary and Protection Act in 1990 (55 Fed. Reg. 19418 [May 9, 1990]), codified in regulation in 1997 (62 Fed. Reg. 32161 [Jun 12, 1997]), and slightly modified in 2001 (66 Fed. Reg. 34533 [Jun 29, 2001]) as four areas that tank vessels and vessels larger than 50 meters are prohibited from entering. The proposed rule aligns the geographic boundary of FKNMS with the existing ATBA boundaries. Existing sanctuary-wide regulations and proposed updated or new sanctuary-wide regulations would apply in this expanded area.

The proposed expansion in the Tortugas region aligns the FKNMS boundary with an existing Particularly Sensitive Sea Area, and both encompasses and extends slightly to the west of the Tortugas Ecological Reserve South. This expansion provides additional protections for important ecological resources and ecological connectivity in the region, particularly among Tortugas Ecological Reserve North, Tortugas Ecological Reserve South, and Tortugas Bank. The expansion would also align the sanctuary boundary with the Florida Keys Particularly Sensitive Sea Area, established by the International Maritime Organization in 2002. Particularly Sensitive

Sea Areas protect areas that have special ecological, socioeconomic, or scientific significance and are vulnerable to damage by international maritime activities. Existing sanctuary-wide regulations and proposed updated or new sanctuary-wide regulations would apply in this expanded area.

The proposed expansion would also include the southernmost portion of Pulley Ridge, a carbonate ridge that is 197 to 295 feet (60–90 m) deep. It extends nearly 186 miles along the southwestern Florida shelf in the northern Gulf of Mexico, approximately 41 miles west of the Dry Tortugas. The southern portion of Pulley Ridge, at depths of 200 to 262 feet (60–80 m), supports the deepest known photosynthetic coral reef off the continental United States. In addition to sanctuary-wide regulations, NOAA is proposing a no anchor regulation area for all vessels at Pulley Ridge to prevent and reduce the risk of damage to this fragile coral marine environment.

The proposed expansion overlaps with the existing Gulf of Mexico Fishery Management Council (GMFMC) habitat area of particular concern. GMFMC expanded the Pulley Ridge South habitat area of particular concern to include Pulley Ridge South Portion A (Gulf of Mexico Fishery Management Council [GMFMC], 2018a). The 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, is prohibited in Pulley Ridge South. In addition, anchoring by fishing vessels is prohibited. In Pulley Ridge South Portion A, all the same prohibitions apply except bottom longlines. The exception was granted to minimize impacts on commercial fishing operations. By expanding FKNMS boundaries to include Pulley Ridge, the proposed no anchor regulation in the area would apply to all vessels, not just fishing vessels.

Description of Benefits and Costs

The effects of the changes in the Tortugas region are assessed in Chapter 4 of this report. Addressed here are the effects of the boundary expansions related to the ATBA and Pulley Ridge. The proposed rule would add 475 square miles to the ATBA, which protects coral reef habitats from damage caused by groundings of large vessels transiting the region. Past groundings have resulted in millions of dollars in damages and restoration costs. The ATBA is designed to avoid both potential costs to the industry that is responsible for the damages and the losses of coral reef resources. Coral reef resources are utilized by commercial and recreational fisheries and non-consumptive recreation businesses, supporting the Monroe County economy.

There is minimal documentation of recreational fishing at 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 businesses that use these resources and thus generate future benefits. Some private households may also venture to Pulley Ridge, generating additional benefits. The greatest benefit would likely be from what economists call non-market values, which includes non-use, or passive use, value (see definition and discussion of this type of value in Chapter 5). As shown in Chapter 5, these potential benefits can be substantial. In addition, added protections might also offer increased benefits in terms of scientific value, especially in the long term.

There are costs associated with maintaining the ATBA, including the cost of technology required to monitor vessel traffic and alert and engage enforcement partners to keep vessels from grounding on coral reefs. For Pulley Ridge, the expansion will have little impact, since GMFMC regulations already apply to fishing vessels. Other sanctuary-wide regulations (e.g., those related to discharging wastes; grounding vessels, deserting vessels, and abandoning gear; and use of large vessel mooring buoys) would apply to commercial fishing operations. However, these costs are likely to be minimal and can be avoided. The marine transportation industry could potentially be affected by additional costs due to the no anchoring regulation. However, any cost is expected to be minimal, as there are other safe alternatives to anchoring, and this measure would not prevent vessels from traversing through the area.

Alternatives Analyzed in the DEIS and Proposed Rule

Table 13. Proposed FKNMS boundary expansion areas by alternative.[6]

Alternative	Total FKNMS Area (miles^2)	Total Proposed Expansion Area (miles^2)	Proposed ATBA Expansion Area (miles^2)	Proposed Tortugas Expansion Area (miles^2)	Proposed Pulley Ridge[7] Expansion Area (miles^2)
DEIS Alternative 1 (no action/status quo)	3,800	0	0	0	0
DEIS Alternative 2	4,541	741	472	271	0
DEIS Alternative 3	4,541	741	472	271	0
DEIS Alternative 4	4,800	1,000	472	271	259
Proposed rule[8]	4,800	1,000	472	271	259

Benefits: There are no new benefits associated with Alternative 1, as there is no proposed boundary expansion in this alternative. The proposed ATBA and Tortugas expansion areas are identical for Alternative 2 and Alternative 3. Alternative 4 and the proposed rule also include the same expansion of the ATBA and Tortugas areas, but also the expansion of Pulley Ridge, and thus the greatest potential for long-term benefits.

Costs: There are costs associated with expansion for all alternatives, which are expected to be the same. Under Alternative 4 and the proposed rule, the marine transportation industry could incur additional costs due to the no anchoring regulation in Pulley Ridge. However, these costs are expected to be minimal, as there are other safe alternatives for anchoring.

[6] A full description of the boundary alternatives may be found in the 2019 DEIS (ONMS, 2019).
[7] 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 (GMFMC, 2018a).
[8] The proposed rule boundary has slightly different area calculations due to the use of the most recent NOAA Continually Updated Shoreline Product to determine the landward boundary of FKNMS and the quality control conducted for the legal boundary coordinates and description required for a proposed rule. The proposed rule boundary is the same as that proposed in Alternative 4.

Sanctuary-Wide Regulations

Live Rock Aquaculture

No Action (Status Quo)

FKNMS regulations currently prohibit removal of, injury to, or possession of coral or live rock (15 C.F.R. § 922.163). There is an exception to this prohibition for live rock aquaculture activities permitted under the Magnuson-Stevens Fishery Conservation and Management Act (50 C.F.R. part 622) or permits/licenses issued by the Florida Department of Agriculture and Consumer Services for live rock aquaculture activities in state waters of FKNMS.

Proposed Rule

NOAA is proposing that no substantive change be made to the existing live rock prohibition. The proposed rule simplifies the language describing the exemption from the prohibition for activities already permitted by NOAA Fisheries or the State of Florida. However, recognizing that greater oversight of these activities by FKNMS is needed, NOAA is proposing 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 referenced here to provide the reader with a complete list of proposed actions related to live rock aquaculture. For more details of this management plan activity, see the full text of the proposed rule.

Description of Benefits and Costs

Since the mid-1990s, there have been 18 federally permitted live rock aquaculture sites within the boundaries of FKNMS, ranging from 0.12 to 1 acre in size. In addition, from 2009 to 2015, the state licensed ranged from six to eight aquaculture operations per year in FKNMS. Not all permits are active (i.e., the operations are neither depositing nor harvesting live rock) every year. From 2009 to 2015, there were between seven and 14 active sites each year (Florida Department of Agriculture and Consumer Services, 2019; NOAA Fisheries Southeast Regional Office, 2019). From 2009 to 2015, an annual average of 25,611 pounds of cultured live rock was harvested, equating to a value of $36,233. In all but two of these years, 100% of the harvest was landed in Monroe County.

Under the proposed rule, live rock aquaculture may continue to be permitted in the sanctuary (consistent with DEIS Alternative 1). The proposed rule will continue to require live rock aquaculture operations to seek state and federal permits as currently required, resulting in no change from the status quo with regard to the administrative burden on applicants. The development of a memorandum of agreement is not expected to increase costs for permit applicants.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Live rock aquaculture	Same as Alternative 1 (no action/status quo)	Retain existing regulation and 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 FKNMS.	Require FKNMS authorization for existing and any future live rock aquaculture activities.

Benefits: The benefits of alternatives 2 through 4 are largely administrative, although improved enforcement and reduced illegal poaching benefit the industry in both the short and long term. The proposed rule is the same as Alternative 1 (status quo). Alternative 4 has the greatest potential benefits by increasing the ability of FKNMS to provide direct regulatory oversight and enforcement by requiring FKNMS authorization.

Costs: For all of the alternatives, applicants will still be required to pay a nominal fee to apply for a state or federal live rock aquaculture permit. Alternative 3 and the proposed rule will have the lowest costs because they do not propose to change the current permitting system.

Discharge Regulation Exception

No Action (Status Quo)

Existing FKNMS regulations prohibit discharging or depositing materials or other matter within the boundary of the sanctuary (15 C.F.R. § 922.163). 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 special use 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.

Proposed Rule

NOAA is proposing to change the existing exception for discharge of water generated by routine vessel operations to prohibit certain discharges from cruise ships while inside the boundary of FKNMS.

> *Prohibit discharge of any material or other matter from a cruise ship except for cooling water.*

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 update is expected to increase protection of water quality and sanctuary resources from pollutants present in cruise ship graywater, bilge water, and other discharges. Cooling water may still be discharged because there currently is no method for storing cooling water. 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.

Description of Benefits and Costs

By helping to improve water quality, this regulation will continue to support existing sanctuary uses, described in Chapter 2. These uses include tourism, recreation, and commercial fishing. In 2007–2008, visitors and residents who used FKNMS generated $2.1 billion in spending, resulting in $2.36 billion in output, $1.02 billion in income, and 33,622 full- and part-time jobs in Monroe County. Recreation and tourism accounted for 63.3% of Monroe County's total economic output (Leeworthy & Ehler, 2010; Leeworthy & Morris, 2010). From 2015–2019, commercial fishing in FKNMS statistical areas supported roughly 11,700 jobs and $921 million in output (see Chapter 4 for additional details).

Cruise ship visitors also contribute significantly to Monroe County's economy. In 2018, cruise visitors spent approximately $73 million in Key West and supported an estimated 800 jobs (Oxford Economics, 2020). Costs to the cruise ship industry as a result of the proposed rule are minimal to non-existent, since cruise ships can discharge outside FKNMS boundaries and cruise ship operations in sanctuary waters are limited to entering and leaving the port of Key West, and time spent transiting through the sanctuary is minimal.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Discharge regulation exception	Prohibit discharge of any material or other matter from a cruise ship, except clean vessel engine cooling water, clean vessel generator cooling water, vessel engine or generator exhaust gas, clean bilge water, or clean anchor wash water.	Same as Alternative 2	Same as Alternative 2

Benefits: All of the DEIS alternatives would limit discharges from cruise ships, resulting in increased benefits to the recreational and commercial industries that rely on good water quality. Alternatives 2, 3, and 4 would only prohibit graywater discharges, so benefits from the proposed rule would be greater.

Costs: The costs to the cruise ship industry are minimal to non-existent for all alternatives and the proposed rule, since cruise ships can discharge materials other than cooling water once outside FKNMS boundaries.

Shoreline Slow Speed Zone

No Action (Status Quo)

Existing sanctuary-wide regulations prohibit operating a vessel at a speed greater than 4 knots or in a manner that creates a wake within 100 yards of residential shorelines (15 C.F.R. § 922.163). This regulation does not apply within officially marked channels.

Proposed Rule

The proposed rule would maintain the status quo.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Shoreline slow speed zone	Same as no action	Same as no action	Modify speed restriction to require "slow speed" within 100 yards of all shorelines adjacent to FKNMS. 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 that is reasonable and prudent under the prevailing circumstances to avoid the creation of excessive wake or other hazardous conditions that endanger or are likely to endanger other vessels or other persons using the waterway.

Benefits: Reduced speeds close to shore increase boating safety and reduce shoreline erosion, property damage, disturbance to wildlife, and in some cases strikes to manatees. Alternative 2, Alternative 3, and the proposed rule do not provide greater benefits than Alternative 1, since there are no changes to the status quo. Alternative 4 has increased benefits, since the regulation is extended to all shorelines, including wildlife areas.

Costs: There are no added costs for Alternative 2, Alternative 3, and the proposed rule, since no changes to current regulations are proposed. Added costs of reducing vessel speed are minimal for Alternative 4.

Temporary Regulation for Emergency Adaptive Management

No Action (Status Quo)

Current regulations allow for an emergency regulation to go into effect for up to 60 days with one 60-day extension.

Proposed Rule

NOAA is proposing to extend the time frame of temporary regulation from 60 days with one 60-day extension to six months with an option for a 186-day extension and establish three categories for temporary regulations. The first category would allow for temporary regulations to prevent or minimize destruction of, loss of, or injury to FKNMS resources from any human-made or natural circumstances, including a concentration of human use, change in migratory or habitat use patterns, vessel impacts, natural disaster or similar emergency, disease, or bleaching. Second, temporary regulations may be used to initiate restoration, recovery, or other activities where a delay would undermine the success of the activity. Lastly, NOAA may use temporary regulations to initiate research where an unforeseen event produces an opportunity for scientific research that may be lost if it is not initiated immediately.

These temporary regulations allow FKNMS to respond to emergencies and unforeseen impacts to sanctuary resources to prevent or minimize the destruction of, loss of, or injury to those resources or their quality. The proposed rule would provide a framework for FKNMS to establish individual short-term, temporary marine zones within the same categories found in the proposed marine zone boundary regulations.

Description of Benefits and Costs

Short-term benefits in public safety and long-term gains in protection of sanctuary resources are expected. In the short term, some activities might be displaced, but short-term substitution or relocation of activities will most likely be possible, minimizing short-term losses. In the long term, there will be no costs since the regulations in question are temporary.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Temporary regulation for emergency adaptive management	A temporary regulation may take effect for up to six months (180 days), with one six-month (186-day) extension. Eliminate zone-specific emergency regulations.	Same as Alternative 2	Same as Alternative 2

Benefits: All of the alternatives would provide authority for temporary emergency regulations for up to six months, with one six-month extension, and will benefit public safety in the short term and sanctuary resources in the long term.

Costs: All of the alternatives will result in temporary displacement of activities, but short-term substitution or relocation of activities will most likely be possible, minimizing short-term losses. In the long term, there will be no costs since the regulations in question are temporary.

Historical Resources Permitting

No Action (Status Quo)

The permit categories for activities involving historical resources include survey/inventory of historical resources, research/recovery of historical resources, and deaccession/transfer of historical resources (15 C.F.R. § 922.166). 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.

Proposed Rule

Based on over 20 years of historical resource management, issuance of dozens of historical resource permits, and evaluation of the efforts of permittees toward 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 of 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 Florida Administrative Code Chapter 1A-32 for archaeological research on state lands in Florida.*

This proposed change would align FKNMS historical resource permitting with state permitting regulations for archaeological research and optimize compliance with the federal archaeology program. The proposed archaeological research permit category would simplify permitting for research focused on historical resources in FKNMS, including those within state waters. Research that adversely affects historic properties would not qualify for this simplified permitting process.

By creating one permit category for archaeological research, NOAA is also proposing to eliminate the permit category allowing for the deaccession/transfer of historical resources. Eliminating the deaccession/transfer permit category is also consistent with Florida Administrative Code Chapter 1A-31 and the Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs and Standards for the Treatment of Historic Properties. To date, no deaccession/transfer permit has ever been issued and, as such, the impact of this change will be minimal.

NOAA believes that aligning its permit processes with that of DHR will improve the quality of historical research projects undertaken in FKNMS and project reporting, further aiding NOAA with its conservation mandate and advancing interpretation of sanctuary historical resources for the public.

In conjunction with the proposed change described above, a new definition for "archaeological research" would be added to clarify the specific applicability of this regulation.

> *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 Administrative Code Chapter 1A-32 archaeological research permit standards and the Secretary of the Interior's Standards for Archaeological Documentation.

There will not be a charge associated with the archaeological research permit. Further, by streamlining the permitting process, the time and effort to complete the permit application is likely to decline.

Description of Benefits and Costs

Although an economic valuation study has not been conducted on maritime heritage and cultural resources in the Florida Keys, 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 investment 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 improved archaeological research permitting process would be expected to yield more of the benefits described by Mires (2014) for the historical resources in FKNMS. Costs should decline due to the more streamlined and efficient nature of the proposed permitting process.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Historical resources permitting	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 Florida Administrative Code Chapter 1A-32 for archaeological research on state lands in Florida.	Same as Alternative 2	Same as Alternative 2

Benefits: The level of potential benefits are the same for the proposed rule and alternatives 2, 3, and 4.

Costs: The costs are the same for the proposed rule and alternatives 2, 3, and 4.

Fish Feeding

No Action (Status Quo)

Existing FKNMS regulations for discharges within the sanctuary boundary do not explicitly or adequately address activities associated with feeding fish, sharks, or other marine life from vessels or by divers. Existing FKNMS discharge regulations do, however, include an exception for fish, fish parts, chumming materials, or bait used incidental to and only while conducting a traditional fishing activity (15 C.F.R. § 922.163). Existing Florida Administrative Code 68B-5.005 prohibits divers from engaging in the practice of fish feeding and the operation of any for-hire vessel for the purpose of carrying passengers to any site in state salt waters to engage in fish feeding or to allow passengers to observe fish feeding. This regulation does not currently extend into the federal waters of FKNMS.

Proposed Rule

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 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 threat that the feeding of fish, sharks, or other marine species poses for human safety, the environment, and changes in fish behavior, NOAA is proposing the following regulation:

> *Prohibit attracting or feeding fish, including sharks, or other marine species from any vessel and/or while diving. Attracting or feeding does not include using bait or chum when conducting traditional fishing.*

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 (such as certain practices used in commercial fishing) in FKNMS. 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 offering, giving, or attempting to give any food or other substance to fish, including sharks, or other marine species, except for the purpose of harvesting such marine species during traditional fishing as defined in the proposed rule.*

In conjunction with this proposed requirement, a new definition of "diver" would be added to the regulations to clarify the 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 capable of being used as a means of transportation in or on the waters of a sanctuary. The term includes, but is not limited to, motorized and non-motorized watercraft, personal watercraft, airboats, and float planes while maneuvering on the water. For purposes of this part, the terms "vessel," "watercraft," and "boat" have the same meaning.*

Description of Benefits and Costs

There are very few non-consumptive recreational operations in Florida Keys that conduct fish feeding. (This is based on responses from operators that provided public comment on the DEIS, as well as an additional internet search.) The few businesses that do engage in this practice appear to be either scuba diving operations or shark diving tours. Therefore, the benefits are likely to be very small in the short term and potentially larger in the longer term, since additional fish feeding will not be permitted. The dive business is highly competitive and dive operations are always looking for a marketing edge. The costs are generally low in the short term, since few operations are known to engage in fish feeding. However, this regulation could have substantial impacts on those operations. The dive business is highly competitive and has a low profit margin. The few affected operations might struggle to remain in business if their market niche is eliminated. Over the long term, these costs could increase as the tourist market grows. However, existing eco tour operators may seek an ONMS permit to continue fish feeding (with certain conditions applied to protect sanctuary resources) if they are able to satisfy all general permit application requirements.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Fish feeding	Prohibit the feeding of fish, sharks, or other marine species from any vessel and/or while diving.	Same as Alternative 2	Same as Alternative 2

Benefits: Alternatives 2, 3, and 4 propose a prohibition on fish feeding, albeit with modified language. Therefore, the potential benefits are the same for the proposed rule and alternatives 2, 3, and 4.

Costs: The costs are the same for the proposed rule and alternatives 2, 3, and 4.

Grounded and Deserted Vessels and Harmful Matter

No Action (Status Quo)

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.

Proposed Rule

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 effects. The proposed regulation would:

> *Prohibit anchoring, mooring, or occupying a vessel at risk of becoming derelict, or deserting a vessel aground, at anchor, moored, or adrift in the sanctuary.*

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

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 24 hours of leaving it and, having failed to salvage it, without developing and presenting to the Director a preliminary salvage plan within 72 hours of such notification, 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 as determined by NOAA or Florida and the owner/operator fails to secure the vessel within the time prescribed by NOAA or Florida.*

Once a vessel is grounded, there is a high risk of discharge of harmful matter into the marine environment. 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 a regulation that would establish the following prohibition:

> *Prohibit leaving harmful matter aboard a grounded or deserted 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 its quantity, concentration, or physical, chemical, or infectious characteristics, may pose a present or potential threat of injury to sanctuary resources or qualities. Such substances or combination of substances may include, but are not limited to: fishing nets, fishing line, hooks, fuel, oil, and hazardous substances as defined by the*

Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601(14) and designated at 40 C.F.R. 302.4.

To enhance agency response time to vessel grounding incidents and potential threats to the marine environment, NOAA is proposing a regulation requiring 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 regulation would provide authority to address derelict vessel debris and associated effects. This proposed regulation is consistent with Florida Statute 403.93345 (Florida Coral Reef Protection Act).

Description of Benefits and Costs

These new prohibitions and requirements would reduce or eliminate harm to sanctuary resources from derelict vessels due to settling on or colliding with habitats or leakage of hazardous or harmful matter. NOAA would have the authority to order removal of deserted vessels to prevent potential groundings, collisions, or hazardous fuel leaks that could harm sanctuary 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 require vessel owners to remove deserted vessels before they become grounded and cause damage. If vessel owners fail to respond, NOAA has authority to impose civil monetary penalties.

The NOAA Office of General Counsel, Enforcement Section is the NOAA entity that prosecutes civil administrative penalty actions under Section 307 of the National Marine Sanctuaries Act (NMSA). That office imposes civil penalties under the NMSA, and other statutes, pursuant to a penalty policy (Office of General Counsel, 2019). NOAA's penalty policy incorporates the relevant statutory provisions in determining the penalty assessed, and improves consistency at a national level, provides greater predictability for the regulated community and the public, and promotes transparency in enforcement. The NMSA currently allows for a maximum penalty of $178,338 per violation per day, and this amount is adjusted periodically to account for inflation. If a sanctuary violation causes no more than a minor or *de minimis* impact, a summary settlement may be issued by the NOAA Office of Law Enforcement (Office of General Counsel, 2020). This schedule was updated in October 2020.

Civil penalty authorities under Section 307 are separate from the Natural Resource Damage Assessment (NRDA) authorities found under Section 312 of the NMSA. NRDA cases occur when a sanctuary resource, such as a coral reef, seagrasses, or a historical resource, has been destroyed, injured, or lost, and NOAA has the authority to recover costs associated with the response, assessment, restoration, and monitoring efforts of such restoration. NOAA may also recover the cost of curation and conservation of archaeological, historical, and cultural resources.

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, in part, was the impetus

for the designation of FKNMS. These additional regulations will further minimize future damage to resources and protect a multi-billion-dollar economy dependent on the sanctuary's resources. The costs to industry and individuals are minimal compared to the liability associated with damage to sanctuary resources caused by derelict or abandoned vessels or NRDA cases brought against those who damage sanctuary resources.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Grounded and deserted vessels and harmful matter	Prohibit anchoring, mooring, or occupying a vessel at risk of becoming derelict or deserting a vessel aground, at anchor, or adrift in the sanctuary. Prohibit leaving harmful matter aboard a grounded or deserted vessel in the sanctuary.	Same as Alternative 2	Same as Alternative 2

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 designation of FKNMS. Damage assessments and restorations resulting from vessel groundings have cost multiple millions of dollars. These additional regulations will reduce the likelihood of future damage to resources and protect a multi-billion-dollar economy dependent on sanctuary 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 the liability associated with damage to sanctuary resources caused by derelict or abandoned vessels or NRDA cases are brought to recover damages and restoration costs from responsible parties.

Marine Zone Regulations

Large Vessel Mooring Buoys

No Action (Status Quo)

Mooring buoys serve as an important management tool in FKNMS, allowing boaters to visit and use sanctuary resources without damaging coral reefs and other important ecosystems. 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 mooring buoy anchoring hardware and, in some cases, the substrate in which the hardware is secured.

Proposed Rule

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

> *Prohibits tying a large vessel to a mooring buoy not specifically designated for large vessels, or tying a vessel other than a large vessel to a mooring buoy specifically designated for large vessels.*

In addition, the proposed rule defines large vessel:

> *Large vessel means a vessel greater than 65 feet in length, or the combined lengths of two or more vessels if, when tied together, the vessels would be greater than 65 feet in length.*

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 the 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.

Description of Benefits and Costs

The proposed rule change could result in reduced damage of coral reef, hard bottom, and other habitats caused by large vessels pulling mooring buoys loose. Large vessel owners would also avoid fines for damaging the natural environment. Further, this regulation would help to reduce mooring buoy repair costs. Additional costs include supplying enough adequately sized mooring buoys and gathering input from the public on locations and number of buoys required.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Large vessel mooring buoys	Require vessels over 65 feet in length to use FKNMS mooring buoys designated for large vessels. Require vessels under 65 feet in length to use FKNMS mooring buoys designated for small vessels.	Same as Alternative 2	Same as Alternative 2

Benefits: Alternatives 2, 3, and 4 also propose a prohibition on the use of small mooring buoys by large vessels. Therefore, the level of potential benefits are the same for the proposed rule and alternatives 2, 3, and 4.

Costs: The costs are the same for the proposed rule and alternatives 2, 3, and 4.

Prohibition of Catch and Release Fishing by Trolling in Four Sanctuary Preservation Areas

No Action (Status Quo)

Existing FKNMS regulations include an exception for catch and release fishing by trolling in four sanctuary preservation areas (SPAs): Conch Reef, Alligator Reef, Sombrero Reef, and Sand Key (15 C.F.R. § 922.164).

Proposed Rule

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

Prohibit catch and release fishing by trolling in Conch Reef, Alligator Reef, Sombrero Reef, and Sand Key SPAs.

Updating this regulation will also meet the need (outlined in Chapter 2) to simplify and, where possible, make marine zone regulations and access restrictions consistent for each zone type. With this proposed update, regulations and access restrictions would be consistent across all SPAs. The prohibition on catch and release fishing by trolling would also be applied in any new proposed SPA.

Description of Benefits and Costs

This proposed rule change would help to reduce user conflicts within SPAs. The main benefit of SPAs has been a reduction in conflicts between fishing and other consumptive activities with non-consumptive activities, such as snorkeling and scuba diving (Shivlani et al., 2008). The fishers who troll in these areas may experience short- and long-term costs because of displacement. However, there are abundant places available to relocate this activity and therefore the likelihood of either short- or long-term costs is very low. A more detailed analysis of marine zone boundary changes is provided in Chapter 4. Isolating the effects of this proposed regulation to the specific fishers affected is not possible given the spatial limitations of the data available.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Prohibition of catch and release trolling in four SPAs	Remove the exception for catch and release fishing by trolling in Conch Reef, Alligator Reef, Sombrero Key, and Sand Key SPAs	Same as Alternative 2	Same as Alternative 2

Benefits: Alternatives 2, 3, and 4 also propose a prohibition of catch and release fishing by trolling in the same SPAs. Therefore, the potential benefits are the same for the proposed rule and alternatives 2, 3, and 4.

Costs: The costs are the same for the proposed rule and alternatives 2, 3, and 4.

Bait Fishing Permits

No Action (Status Quo)

Permits for limited bait fishing in SPAs have been issued by FKNMS since the initial 1997 management plan. Cast net permits are issued for and valid in all SPAs and are issued by calendar year. Hair hook permits are valid in only Davis, Conch, and Alligator SPAs and are issued for October 15 through April 15; fishing is allowed only from 5:00 a.m. until 10:00 a.m.

Proposed Rule

NOAA is proposing the following update to existing bait fish permits:

Eliminate, over a three-year period, the practice of issuing bait fishing permits of any kind in SPAs in federal waters and the practice of issuing cast net permits for bait fishing in SPAs in state waters.

The practice of issuing bait fish permits will be phased out over a three-year period. During this time, only individuals who have historically held bait fish permits will be issued any further permits. Bait fish permit data from 2015–2019 will be used to determine those eligible for permits in the three-year phase-out period. In addition, NOAA would work with state fishery managers to develop a process for fishers currently managed through the state's limited entry endorsement program to use lampara nets in existing SPAs in state waters.

Description of Benefits and Costs

Past Permit Issuance, Compliance, and Use

The information herein is updated to include data from 2015–2019, in addition to the 1997–2014 data included in Leeworthy et al. (2019). Currently, two types of bait fishing are issued in SPAs: a permit that authorizes fishing with cast net or lampara net and a hair hook permit. From 2015–2019, a total of 509 permits were issued for bait fishing in SPAs. Most of these permits (roughly 85%) were issued to cast net fishers. Ten percent of permits were issued to hair hook fishers, and the remaining 5% were issued to commercial lampara net fishers. Approximately two-thirds of permittees (roughly 65% of cast net permittees, 77% of lampara net permittees, and 79% of hair hook permittees) complied with FKNMS reporting requirements. There is no apparent trend in compliance with reporting requirements over time. The five-year average rate of non-compliance (2015–2019) was around 29%. Figures illustrating these data are provided in Appendix B.

Of the 509 permits issued from 2015–2019, 182 permits (or about 36%) were not used. Accordingly, over half (53%) of the permits for which log forms were returned (i.e., those in compliance) were not used. By gear type, the annual average percentage of unused or "did not use" permits (out of the total permits issued) from 2015–2019 was 36% for hair hooks, 51% for lampara net, and 35% for cast net. Over the period from 2015–2019, only 160 permits were used for bait fishing (129 for cast nets, 23 for hair hooks, and 8 for lampara nets).

For those in compliance with reporting requirements, there were 1,183 reports of catch by approximately 128 fishers[9] from 2015–2019. Many active permittees (71 unique fishers) fished using cast nets. Of the 1,183 fishing reports from 2015–2019, only 52 catches by six fishers used lampara nets. Two of the six lampara net fishers also reported using cast nets to catch bait fish at least once during the study period. There were also 83 fishing reports from seven hair hook fishers. The remaining fishing reports (1,058) used cast nets. The following statistics are based on the permits in compliance with reporting requirements, not the total number of permits issued.

Since FKNMS collects data from permit holders, a quantitative analysis of the proposed rule change is provided. This section provides annual averages from 2015–2019, as well as a 5-year

[9] It was assumed that very similar names (e.g., the same first initial and one letter difference in the last name) in log reports belonged to the same individual and that differences were attributable to transcription errors.

average for the entire period. The analysis here provides baseline data and estimates the cost to replace any potential lost activity because of the provision in the proposed rule related to bait fishing. From 2015–2019, an average of 56 cast net permits, 4 lampara net permits, and 8.4 hair hook permits were in compliance per year. Of the total number of bait fishing permits issued from 2015–2019, roughly 53% were not used (Table 14).

Table 14. Number of bait fish permits for SPAs, 2015–2019. Source: FKNMS, 2021

Year	# of Cast Net Permits	% Cast Net Permits	# of Lampara Net Permits	% Lampara Net Permits	# of Hair Hook Permits	% Hair Hook Permits	Total Bait Fish Permits	# of Unused Permits	% Unused Permits
2015	60	82.2%	2	2.7%	11	15.1%	73	39	53.4%
2016	53	80.3%	3	4.6%	10	15.2%	66	36	54.6%
2017	59	81.9%	5	7.0%	8	11.1%	72	37	51.4%
2018	61	82.4%	6	8.1%	7	9.5%	74	41	55.4%
2019	47	82.5%	4	7.0%	6	10.5%	57	29	50.9%
5-year annual average	56	81.9%	4	5.9%	8	12.3%	68	36	53.1%

Catch was reported for cast and lampara nets as number of fish and/or pounds of fish. For cast net landings, a conversion factor of 0.10 pounds per fish was used to convert between number and pounds of fish. Similarly, a conversion factor of 0.175 pounds per fish was used to convert lampara net catch from number of fish to pounds, and vice versa. Conversion factors were obtained using trip ticket data (FWC, 2021). Hair hook catch was always reported as number of fish. The five-year annual averages for baitfish catch in SPAs was 1,267 pounds for cast nets, 7,982 pounds for lampara nets, and 36 pounds for hair hooks, totaling 9,285 pounds. These figures correspond to an estimated five-year annual average catch of 13,941 fish from cast nets, 87,797 fish from lampara nets, and 360 fish from hair hooks (Table 15). Although cast net permit holders made up nearly 82% of the total permittees, they only harvested about 14% of the total reported catch. Lampara net permits holders made up less than 6% of total permit holders, but harvested around 86% of the total reported catch. Catch by hair hook permit holders was very small relative to the other two gear types.

Table 15. Bait fish catch from SPAs by permitted gear, 2015–2019. Source: FKNMS, 2021

Year	Number of Fish (Cast Net)	Number of Fish (Lampara Net)	Number of Fish (Hair Hook)	Total Number of Fish	Pounds of Fish (Cast Net)	Pounds of Fish (Lampara Net)	Pounds of Fish (Hair Hook)	Total Pounds of Fish
2015	10,272	0	373	10,645	934	0	37	971
2016	6,683	941	407	8,030	608	86	41	735
2017	9,018	74,558	426	84,002	820	6,778	43	7,641
2018	22,269	65,890	233	88,392	2,024	5,990	23	8,037
2019	21,465	297,594	359	319,418	1,951	27,054	36	29,041
5-year average	13,941	87,797	360	102,097	1,267	7,982	36	9,285

Dependence on SPAs for baitfish was estimated in terms of days of effort and catch inside versus outside SPAs. Cast net permit holders had a five-year annual average of 98 days fishing in SPAs and 118 days fishing outside SPAs (45.2% of bait fishing days in SPAs). Cast net permit holders caught 51.9% of their catch inside SPAs (Table B.1). Lampara net permit holders spent a relatively smaller proportion of days (40.5%) fishing in the SPAs. However, lampara net fishers were more dependent on SPAs for baitfish harvest (79.9% of catch; Table B.2). Hair hook permit holders spent a higher proportion of days (81.1%) fishing inside SPAs and caught 81.5% of their reported landings inside SPAs.

The total commercial catch for baitfish and ballyhoo was compiled from statistical subareas that overlap FKNMS and those associated with Monroe County. Although ballyhoo is a type of baitfish, the FWC database lists ballyhoo as its own category, separate from baitfish. A five-year annual average of 220,134 pounds of baitfish and ballyhoo was landed in Monroe County, equating to $95,865 in harvest revenue to fishers. Catch in SPAs by lampara and cast net permit holders accounted for 3.6% and 0.7% of Monroe County baitfish and ballyhoo landings, respectively (Table 16; Table B.1; Table B.2). Catch by hair hook permit holders comprised less than 0.02% of Monroe County landings. The five-year annual average catch of baitfish and ballyhoo in FKNMS was 212,872 pounds, worth $76,017 to the fishers (Table 17). Catch in SPAs by lampara and cast net permit holders accounted for 3.7% and 0.7% of the landings from FKNMS, respectively (Table 17; Table B.1; Table B.2). Hair hook catch also made up less than 0.02% of FKNMS landings.

Table 16. Bait fish and ballyhoo commercial landings in Monroe County, 2015–2019 ($2019). Source: FKNMS, 2021

Year	Bait Fish Landings (Pounds)	Ballyhoo Landings (Pounds)	Total Landings (Pounds)	Bait Fish Value ($2019)	Ballyhoo Value ($2019)	Total Value ($2019)
2015	73,145	95,136	168,280	$90,026	$20,198	$110,224
2016	47,315	49,552	96,866	$43,342	$18,049	$61,391
2017	50,149	160,885	211,034	$47,680	$31,807	$79,487
2018	57,195	64,621	121,816	$66,790	$18,076	$84,866
2019	51,747	450,928	502,675	$71,583	$71,776	$143,359
5-year average	55,910	164,224	220,134	$63,884	$31,981	$95,865

Table 17. Bait fish and ballyhoo commercial landings in FKNMS, 2015–2019 ($2019). Source: FKNMS, 2021

Year	Bait Fish Landings (Pounds)	Ballyhoo Landings (Pounds)	Total Landings (Pounds)	Bait Fish Value ($2019)	Ballyhoo Value ($2019)	Total Value ($2019)
2015	68,521	94,960	163,480	$57,080	$20,150	$77,230
2016	46,970	49,244	96,213	$39,667	$17,721	$57,388
2017	46,909	158,020	204,929	$34,042	$30,653	$64,695
2018	42,477	63,990	106,467	$46,253	$17,754	$64,007
2019	42,868	450,404	493,272	$45,250	$71,514	$116,764
5-year average	49,549	163,323	212,872	$44,458	$31,559	$76,017

Assuming cast net permit holders that are displaced by the prohibition must purchase bait to replace lost catch, it is estimated that the maximum average annual cost is between $17,426 (13,941 fish multiplied by $1.25 per frozen ballyhoo[10]) and $27,882 (13,941 fish multiplied by $2 per baitfish) to replace what the fishers were catching. The estimated average annual cost per active permit holder (i.e., those who report using the permit at least once) is between $681 and $1,089. The average annual cost to hair hook permit holders is estimated to be between $450 (360 fish multiplied by $1.25 per frozen ballyhoo) and $720 (360 fish multiplied by $2 per baitfish). The estimated average annual cost per active hair hook permit holder is between $94 and $150. Assuming lampara net fishers offload their catch at the average ex-vessel price for ballyhoo, the average annual replacement cost to lampara net permit holders is estimated to be $1,916 (7,982 pounds multiplied by $0.24/pound, the 5-year average ex-vessel price for ballyhoo in Monroe County) with an average loss of $684 per active permit holder (FWC, 2021). Given that a relatively small percentage of total Monroe County baitfish and ballyhoo catch comes from SPAs and fishers are still able to catch bait outside these relatively small areas, it is likely that bait fishers will move to other areas or choose to purchase their baitfish, based upon the lowest cost solution.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Bait fishing permits	Eliminate the practice of issuing permits to allow capture of baitfish from within SPAs by any gear type (a three-year phase-out).	Same as Alternative 2	Same as Alternative 2

Benefits: For alternatives 2, 3, and 4, as well as the proposed rule, consistent regulations in SPAs (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,

[10] Baitfish retail prices are approximate and based on the results of a Google search of baitfish vendors in the Florida Keys.

thereby enhancing the value of the non-consumptive recreation experience. There is also the benefit of eliminating the bait fishing permit system, which reduces administrative costs.

Costs: As part of the proposed rule, NOAA would work with state fishery managers to develop a process for fishers currently managed through the state's limited entry endorsement program to use lampara nets in existing SPAs in state waters. Accordingly, the costs of the proposed rule are expected to be less than alternatives 2, 3, and 4 because lampara net bait fishers may be eligible to obtain permits to continue bait fishing in existing SPAs in state waters.

Tortugas Ecological Reserve North Permits

No Action (Status Quo)

FKNMS regulations require permits to access Tortugas Ecological Reserve North for any activity other than passage without interruption through the reserve, law enforcement, or monitoring (15 C.F.R. § 922.167). A Tortugas Ecological Reserve North access permit must be requested at least 72 hours, but no more than one month, before the desired effective date of the permit. In addition, current regulations state that FKNMS must be notified by telephone or radio no less than 30 minutes before entering and no more than six hours after leaving the reserve and include a two-week maximum permit duration.

Proposed Rule

Tortugas Ecological Reserve North remains an important marine zone for continued protection, management, and controlled access through permitting. Over a four-year period (2012–2015), FKNMS 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, as well as one or two research missions per year.

Based on over 20 years of management and permitting, NOAA is proposing minor modifications to the regulations for Tortugas Ecological Reserve North access permits. Access permits will still be required; however, the proposed 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 advanced planning is needed for commercial operators. Based on the level and types of activity conducted in the Tortugas Ecological Reserve North, time restrictions for permit requests were deemed unnecessary. Permits will still be required for access to Tortugas Ecological Reserve North, as they serve a valuable purpose in tracking activity and informing enforcement personnel of the vessels approved for operation within the reserve.

Description of Benefits and Costs

The proposed change would yield benefits by creating a less burdensome permit process, which might lead to expanded economic opportunities for commercial operations or private

households that want to bring boats to Tortugas Ecological Reserve North for diving. Further, costs may be reduced by a trivial amount because of the removal of time limitations on permit requests.

Alternatives Analyzed in the DEIS

Topic	Alternative 2	Alternative 3	Alternative 4
Tortugas Ecological Reserve North permits	Remove the current requirement to request 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.	Same as Alternative 2	Same as Alternative 2

Benefits: The proposed change would make the permit process less burdensome, which might lead to expanded economic opportunities for commercial operations or private households that want to bring boats to Tortugas Ecological Reserve North for diving. The benefits are the same for all of the alternatives and the proposed rule.

Costs: There is a minor reduction in costs by eliminating the time limit for requesting access permits. The impact is the same for all of the alternatives and the proposed rule.

Chapter 4:
Economic Effects of Marine Zone Boundary Changes

This section analyzes the economic impacts of FKNMS marine zone boundary changes described in the 2019 DEIS alternatives and the proposed rule. This analysis reflects changes to the methodology of the economic analysis found in the 2019 DEIS (ONMS, 2019) and accompanying socioeconomic report (Leeworthy et al., 2019) made in response to feedback and comments received during the public comment period. First, data have been updated to primarily consider the years 2015–2019 for commercial fishing and 2014–2018 for recreational fishing, the latest data available at the time of this analysis. Second, ONMS consulted with NOAA Fisheries to utilize estimates of economic impacts and data from fishery management council reports to estimate changes to commercial and recreational fishing sectors. These changes provide an updated analysis that closely aligns with the methods and approaches used by NOAA Fisheries to analyze the economic effects of the marine zone boundary changes included in the proposed rule.

NOAA is proposing new marine zone areas not previously identified in the DEIS, including six new nursery restoration area marine zones and four new habitat restoration area marine zones, which range in size from five to 220 acres. NOAA also decided not to carry forward several other marine zones, including three large contiguous areas, and modified the boundaries or the nature of the regulations for a small number of other marine zones. Specifically, nine wildlife management areas were modified slightly from the DEIS alternatives. In total, the marine zone areas described in the proposed rule comprise 694 square miles, compared to the maximum total of 771 square miles analyzed in DEIS Alternative 4. In all, the modifications to the spatial extent of marine zones and their associated regulations in the proposed rule are consistent with the range of alternatives considered in the DEIS.

In general, marine zone changes in the proposed rule (compared to the status quo) include additional area in sanctuary preservation areas (addition of 6 square miles) and conservation areas (addition of 20 square miles), a proposed new restoration area zone type that includes a total of 1.4 square miles across nine proposed nursery areas and four proposed habitat areas, and both modified and proposed new wildlife management areas, resulting in a net change of 28 square miles.

There are five designated zone types that are either existing and/or proposed for the proposed rule. The following section provides the name of the zone type, a broad overview of its purpose, and a summary of actions that are prohibited in each zone type (as included in the proposed rule).

Management Areas

Management areas were established by NOAA prior to the designation of FKNMS and have protections in place beyond sanctuary-wide prohibitions.

- *Summary of prohibited activities:* Taking coral, marine invertebrates, plants, rocks, or other material (lobstering and stone crab fishing are allowed); collecting tropical fish;

fishing with wire fish traps or other bottom equipment; and fishing with or carrying spearguns.

Conservation Areas

Conservation areas provide natural spawning, nursery, and residence areas for sanctuary marine life, and seek to protect and preserve groups of habitats and species from certain activities through limited restrictions and prohibitions. These areas consist of contiguous, diverse habitats, protect a variety of sanctuary resources, and/or facilitate research that supports sanctuary management or recovery of sanctuary resources. The conservation area zone type will replace the existing special use area and ecological reserve zone type.

- *Summary of prohibited activities:* Discharging any material except vessel cooling water; collecting, injuring, or possessing any living or dead organism; anchoring (except in Western Sambo, where anchoring is allowed shoreward of the reef tract); entering except for continuous transit without interruption (except in Western Sambo, where entering is allowed).

Sanctuary Preservation Areas

Sanctuary preservation areas encompass discrete, biologically important areas, within which activities are subject to conditions and prohibitions to avoid concentrations of uses that could impact species populations or habitats, reduce conflicts between uses, protect areas that encompass important marine species or habitats, or provide opportunities for scientific research.

- *Summary of prohibited activities:* Discharging any material except vessel cooling water; collecting, injuring, or possessing any living or dead organism; anchoring.

Habitat and Nursery Restoration Areas

Restoration areas are a proposed new zone type. Restoration areas are designed to support species or habitat recovery, including protection for ecological restoration sites (referred to as habitat restoration areas) and short- and long-term nurseries for propagating organisms to be used in restoration (referred to as nursery restoration areas). Activities in restoration areas are subject to conditions, restrictions, and prohibitions to achieve restoration objectives.

- Habitat restoration areas have the same regulations as sanctuary preservation areas.
- Nursery restoration areas have the same regulations as conservation areas.

Wildlife Management Areas

Wildlife management areas are areas of the sanctuary in which various access and use restrictions are applied to manage, protect, preserve, and minimize disturbance to sanctuary wildlife resources, including, but not limited to, endangered or threatened species, or the habitats, special places, or conditions on which they rely.

- *Summary of prohibited activities:* Each wildlife management area is established to meet location-specific resource management or protection goals. Thus, access and use

restrictions are zone specific. Prohibitions could include: idle speed no wake, no motor, no anchor, or no entry.

This chapter considers the economic effects on recreational and commercial fishing activities resulting from the marine zone boundary alternatives in the 2019 DEIS and the proposed rule. The spatial extent of the first four alternatives are available in the 2019 DEIS (ONMS, 2019) and on the FKNMS Restoration Blueprint homepage (FKNMS, 2020). Additional information on the proposed zones is available in the proposed rule.

Table 18. Total number of existing and proposed new marine zones by type.

Marine Zone Type	DEIS Alternative 1 (Status Quo)	DEIS Alternative 2	DEIS Alternative 3	DEIS Alternative 4	Proposed Rule
Management Area	4	4	4	4	2*
Sanctuary Preservation Area	18	25	26	22	17
Special Use Area	4	N/A**	N/A**	N/A**	N/A**
Ecological Reserve	3	N/A**	N/A**	N/A**	N/A**
Conservation Area	0	8	8	13	6
Nursery Restoration Area	0	0	0	0	9
Habitat Restoration Area	0	0	0	0	4
Wildlife Management Area (nearshore)	27	58	59	58	45
Tortugas Bank Wildlife Management Area (offshore)	1	1	1	1	1
Pulley Ridge Wildlife Management Area (offshore)	0	0	0	1	1
Total Number of Marine Zones	57	96	98	98	85
Total Area of Marine Zones (square miles)*	377	473	485	777	703

*The proposed rule no longer categorizes national wildlife refuges as management areas. The area encompassed by Key West and Great White Heron national wildlife refuges is 656 square miles. For comparison purposes, this area has been subtracted from each of the 2019 DEIS alternatives.
**Special use areas and ecological reserves are combined into one zone type (conservation areas).

Commercial Fishing

The analysis provided here updates the socioeconomic supporting documentation for commercial fishing provided by Leeworthy et al. (2019). As in the previous report, the data used here were provided by FWC. These data include the year in which fishing activity was recorded, the statistical area, the subarea and its written description, the species name, units (weight of the product based on how it is landed [e.g., whole, gutted, tails, heads-on, heads-off]), the unit price based on how the species was landed, and conversion units. Although unique trip data were preserved, dealer, fisher, commercial fishing license, and vessel identification information were replaced with unique sequential numbers to ensure privacy while allowing for analysis of impacts at various levels. When assessing potential impacts to producer surplus, the variable "fisher" was used to calculate the range of impacts and distribution of those impacts across fishers. It was assumed that each fisher represents a unique fishing business. The analyses in the 2019 DEIS analysis were based upon five-year averages for the years 2009–2013 (Leeworthy et al., 2019). This report uses five-year averages for the years 2015–2019.

Further, data on market channel distributions and mark-ups used in the 2019 commercial fishing analysis were from 1986 (Rockland, 1988; Adams & Mulkey, 1988; Adams, 1992). These mark-ups were used in the 2019 DEIS to estimate the economic impact of changes to commercial fisheries catch from FKNMS on the Monroe County economy. This report utilizes newer data and methods. More specifically, the national and coastal state input/output model was used to estimate the impacts associated with both finfish and shellfish harvest by U.S. commercial fishers and industries (seafood and retail) dependent upon those fish, and does not rely on the same methods used in the 2019 DEIS (National Marine Fisheries Service, 2011). The input/output model used here estimates the impacts of commercial harvest as the catch moves through national and state supply chains, ending with the final sale to consumers in each respective area (U.S. or Florida) and is built using Impact Analysis for Planning (IMPLAN)[11] data to describe economic conditions that affect the harvesting and seafood industry. Impacts[12] are presented in terms of total jobs (full- and part-time jobs combined), income, total value added (contribution to gross domestic product), and output (sales) in either the U.S. or the state of Florida. The scope of the impacts reflects the maximum potential loss because of potential changes to commercial fish harvesting in U.S. waters off Monroe County due to the proposed rule. The impacts also include effects to commercial-fishing-related businesses, such as processors, wholesalers/distributors, retail grocers, and restaurants.

[11] IMPLAN is a software system used to assess economic impact using a set of databases that include economic factors, multipliers, and demographic statistics (Regional Economic Studies Institute, 2006).
[12] Impacts include direct, indirect, and induced effects. IMPLAN describes direct effects as the set of expenditures applied to the input/output multipliers for analysis; this is defined as one or more production changes or expenditures made by producers/consumers. Indirect effects are defined as economic effects stemming from business-to-business purchases in the supply chain. Induced effects are defined as the economic effects stemming from household spending of labor income after the removal of taxes, savings, and commuter income (Impact Analysis for Planning [IMPLAN], 2021).

Table 19. FWC statistical areas included in baseline commercial harvest activity for Monroe County, including those likely to be affected by the proposed rule.

Region	Statistical Subarea Description	Statistical Subarea Number	Fishery Management Council	Affected by Proposed Rule?
Tortugas	State waters—Gulf	2.0	Gulf of Mexico	No
	State waters—South Atlantic	2.2	South Atlantic	No
	Federal waters—Gulf	2.8	Gulf of Mexico	No
	Federal waters—South Atlantic	2.9	South Atlantic	No
Key West	South of US 1	1.0	South Atlantic	Yes
	North of US 1	1.1	Gulf of Mexico	No
	Federal waters north of US 1	1.8	Gulf of Mexico	No
	Federal waters south of US 1	1.9	South Atlantic	Yes
Marathon	South of US 1	748.0	South Atlantic	Yes
	North of US 1 (Florida Bay)	748.1	Gulf of Mexico	No
	Federal waters (south of US 1)	748.9	South Atlantic	Yes
Everglades	Offshore waters	3.0	Gulf of Mexico	No
	Whitewater Bay	3.1	Gulf of Mexico	No
	All other inland waters	3.2	Gulf of Mexico	No
	Federal waters	3.9	Gulf of Mexico	No
Miami	Offshore waters	744.0	Gulf of Mexico	Yes
	Florida Bay	744.1	Gulf of Mexico	No
	Biscayne Bay (non-national park)	744.3	South Atlantic	No
	Biscayne Bay National Park (inside)	744.4	South Atlantic	No
	Biscayne Bay National Park (outside)	744.5	South Atlantic	No
	Biscayne Bay National Park (federal)	744.8	South Atlantic	No
	Card Sound	744.6	South Atlantic	No
	Barnes Sound	744.7	South Atlantic	No
	Federal waters	744.9	South Atlantic	Yes

As described in Chapter 2, nine reef fish species, Caribbean spiny lobster, shrimp (including pink, rock, brown, royal red, white, and other shrimp), and stone crab were considered in this analysis. NOAA's National Centers for Coastal and Ocean Science (NCCOS) provided additional analysis of sanctuary habitats, primarily reef habitats, and associated use by selected fish species to identify species of interest. NCCOS evaluated the potential change in fishing access due to the proposed marine zone alternatives, which in turn directly informed the economic analyses described in this section and Chapter 6. Florida's Unified Reef Map (FWC, 2022; Brandt et al., 2009), fishery landings data, and harvest revenue (FWC, 2021) were used in this analysis. The analysis described here also used ArcGIS Pro 2.8.0.

Landings and harvest revenue were averaged across five years (2015–2019) for each fishery within each statistical subarea overlapping FKNMS. Species-habitat relationships for the nine reef fish species and Caribbean spiny lobster were derived from reef monitoring studies for seven reef habitats: continuous high relief, continuous medium relief, continuous low relief,

isolated high relief, isolated medium relief, isolated low relief, and rubble reef (Smith et al., 2011; Brandt et al., 2009). Habitat distributions were identified using the Unified Reef Map. Shrimp and stone crab were analyzed using a different set of assumptions to estimate the spatial distribution of effort. Shrimp analyses were based on effort reported in the Gulf of Mexico commercial reporting system. Stone crab catch was assumed to be evenly distributed throughout the statistical areas, as there were no habitat-species maps or effort data available. The use of effort data for shrimp and the assumption of even stone crab catch distribution throughout statistical subareas was necessary to estimate the potential impacts of small-scale zone changes and designations described in the proposed rule. For all other species analyzed, the proportion of total catch from a given area was assumed to correspond directly to the distribution of the species within that area. This assumption allowed for an estimation of the reduction in catch associated with each spatial change. Estimated reduction in catch was aggregated across all zone changes and multiplied by the five-year average price for each species to estimate maximum potential loss.

Table 20 shows the level of activity that occurs within Monroe County statistical areas and the projected maximum potential loss of harvest revenue and pounds landed due to proposed marine boundary changes for each DEIS alternative and the proposed rule. The baseline values reflect the five-year average from 2015–2019 within Monroe County statistical areas. Alternatives 2 and 3 have identical marine zone boundary changes (for more information, see the Restoration Blueprint website; FKNMS, 2020). The values presented do not account for substitution across species fished or geographies.

Table 20. Maximum average annual (2015–2019) potential loss of harvest revenue (2019 dollars) and pounds landed as a result of proposed marine zone boundary changes for DEIS alternatives and the proposed rule.

Category	Baseline (Status Quo)	DEIS Alternatives 2 and 3 (Net Change)	DEIS Alternative 4 (Net Change)	Proposed Rule (Net Change)
Black grouper (revenue)	$403,367	-$90	-$13,443	-$1,343
Black grouper (pounds landed)	84,539	-19	-2,711	-283
Red grouper (revenue)	$1,659,793	-$13	-$21,772	-$389
Red grouper (pounds landed)	445,373	-3	-5,837	-96
Grunts (revenue)	$14,905	-$7	-$722	-$53
Grunts (pounds landed)	12,028	-5	-665	-41
Hogfish (revenue)	$44,128	-$41	-$1,389	-$305
Hogfish (pounds landed)	9,800	-9	-320	-70
Gray snapper (revenue)	$302,068	-$21	-$21,660	-$726
Gray snapper (pounds landed)	110,552	-7	-8,806	-259
Lane snapper (revenue)	$19,086	$0	-$891	-$22

Category	Baseline (Status Quo)	DEIS Alternatives 2 and 3 (Net Change)	DEIS Alternative 4 (Net Change)	Proposed Rule (Net Change)
Lane snapper (pounds landed)	7,215	0	-472	-10
Mutton snapper (revenue)	$337,168	-$129	-$13,270	-$1,539
Mutton snapper (pounds landed)	109,547	-36	-4,368	-435
Yellowtail snapper (revenue)	$7,432,618	-$1,149	-$877,682	-$16,839
Yellowtail snapper (pounds landed)	2,289,397	-345	-256,187	-5,221
Caribbean spiny lobster (revenue)	$42,004,990	-$1,802	-$955,666	-$965,833
Caribbean spiny lobster (pounds landed)	5,023,736	-207	-102,200	-115,236
Gag grouper (revenue)	$145,776	-$3	-$2,922	-$53
Gag grouper (pounds landed)	30,800	-1	-615	-11
Stone crab (revenue)	$20,159,926	-$13,728	-$118,735	-$37,714
Stone crab (pounds landed)	1,443,427	-931	-8,356	-2,564
Shrimp (revenue)	$20,884,677	$42	-$9,467	$5
Shrimp (pounds landed)	8,951,302	18	-3,999	2

The data from the table above was used to estimate potential economic impacts resulting from estimated revenue losses. The maximum potential impacts presented are inclusive of direct, indirect, and induced impacts. The NOAA Fisheries input/output model that utilizes IMPLAN is capable of estimating impacts for the entire country and 23 marine coastal states. The results presented here measure the existing level of economic activity and resulting potential marginal changes (compared to the baseline) to the U.S. (Table 21) and Florida (Table 22), specifically, for fish landed from the FWC statistical areas surrounding Monroe County (with respect to each DEIS alternative and the proposed rule). The U.S. multipliers in the input/output model are greater than the state multipliers because they account for interstate and interregional trading.

As expected, the estimated impacts for the U.S. were larger than those for the state of Florida (Table 21; Table 22). Alternatives 2 and 3 had the smallest estimated impacts, followed by the proposed rule, and finally Alternative 4, which is consistent with the total area of zone changes. The proposed rule may result in an estimated loss of 42 jobs, including 28 harvester jobs within the state of Florida. Further, it is estimated that $4.1 million in output and $1.1 million in income will be lost in Florida. This represents a 1.1% loss in both output and income compared to the baseline.

Table 21. Average annual U.S. business activity (2015–2019) associated with commercial sale of finfish and shellfish species harvested in FKNMS statistical areas and proposed management zones[13] ($2019).

Alternative	Average Ex-vessel Value ($ thousands)	Total Jobs	Harvester Jobs	Output (Sales) Impacts ($ thousands)	Income Impacts ($ thousands)	Value Added Impacts ($ thousands)
Baseline (status quo)	$93,409	11,722	2,752	$921,761	$337,934	$478,379
DEIS Alternative 2 (net change)	-$17	-2	-1	-$168	-$62	-$88
DEIS Alternative 3 (net change)	-$17	-2	-1	-$168	-$62	-$88
DEIS Alternative 4 (net change)	-$2,038	-258	-62	-$20,210	-$7,463	-$10,536
Proposed rule (net change)	-$1,025	-130	-32	-$10,168	-$3,773	-$5,324

Table 22. Average annual Florida business activity (2015–2019) associated with commercial sale of finfish and shellfish species harvested in FKNMS statistical areas and proposed management zones[12] ($2019).

Alternative	Average Ex-vessel Value ($ thousands)	Total Jobs	Harvester Jobs	Output (Sales) Impacts ($ thousands)	Income Impacts ($ thousands)	Value Added Impacts ($ thousands)
Baseline (status quo)	$93,409	3,741	2,423	$385,429	$101,683	$156,200
DEIS Alternative 2 (net change)	-$17	-1	0	-$68	-$19	-$28
DEIS Alternative 3 (net change)	-$17	-1	0	-$68	-$19	-$28
DEIS Alternative 4 (net change)	-$2,038	-84	-56	-$8,215	-$2,251	-$3,405
Proposed rule (net change)	-$1,025	-42	-28	-$4,130	-$1,133	-$1,713

The values presented in Table 21 and Table 22 are the maximum potential impacts to jobs, output, income, and value added. When estimating the maximum potential impact, it was assumed that substitution of current fishing areas for other areas and similar resources will not occur. However, each spatial zone proposed to be added to the existing suite of marine zones is small, and it is likely that, over time, commercial harvesters will find replacement areas and/or benefit from spillover resulting from improvements to reef habitats and fish communities within closed areas. Further, the values presented assume upstream producers and consumers would not substitute other goods (e.g., other domestic fish, imports, or other types of food products) and services (e.g., food service at other restaurants) for species affected management zone changes, even though it is very that such substitutions would occur. The model also assumed inputs other than fish used in the production process would not be shifted elsewhere to generate similar economic activity.

[13] The net change accounts for marginal changes across all species when compared to the baseline (status quo). The net change accounts for both gains and losses in commercial fishing activity.

Several studies over the past two decades have shown that the estimated maximum potential impact did not occur following previous fishing area closures. Jeffrey et al. (2012) analyzed impacts to commercial fisheries resulting from the creation of the Tortugas Ecological Reserve no-take area from 1997 to 2006. The reserve, located within FKNMS, was created in 2001 by state and federal agencies. For saltwater product license holders that fished in the Tortugas region, revenues derived in that region increased and revenues derived from other areas in Key West and Florida decreased following the establishment of the no-take reserve (Jeffrey et al., 2012). This finding supports the idea that, even in the event of displacement from specific fishing areas, spatial substitution within the region is likely to occur. The same study also found that landings of shrimp, stone crab, and king mackerel increased in the Tortugas region following the establishment of Tortugas Ecological Reserve. Total reef fish catch in the Tortugas region also increased from about 5.9 million pounds to over 6.8 million pounds following the establishment of Tortugas Ecological Reserve, as fishers caught more reef fish in previously unfished areas. Caribbean spiny lobster catch was already in decline prior to the creation of the reserve, and the decline in catch between the two periods is best explained by impacts from hurricanes and larval disease rather than the establishment of Tortugas Ecological Reserve. Caribbean spiny lobster fishers may have been able to offset losses by substituting stone crab and king mackerel (Jeffrey et al., 2012).

A study published in 2008 demonstrated few to no negative impacts following the establishment of a marine reserve network in California's Channel Islands (California Department of Fish and Game [CDFG] et al., 2008). Changes in commercial fisheries are linked to many factors, including environmental shifts, market forces, and fishery regulations. To account for other forces, scientists compared how well fisheries performed in Channel Islands reserves compared to the rest of the state. Researchers found that the value of California sheephead and rockfish experienced greater declines in Channel Islands reserves compared to the rest of the state. The value of California spiny lobster and squid increased in the reserves, but by a smaller amount compared to outside the reserves. Rock crab and sea urchin fisheries increased in value within the reserves and decreased in the rest of California. Lastly, the value of sea cucumber decreased in the reserves, but by a smaller amount compared to the rest of the state. Scientists concluded that the size and abundance of many of the marine species typically targeted outside the reserves were greater within the reserves, while species non-targeted species were equally abundant inside and outside the reserves.

A ten-year analysis found that the average biomass of targeted fish species increased more quickly inside than outside marine protected areas in California. Additionally, average biomass of non-targeted fish species also increased in general, but there were no clear differences inside versus outside marine protected areas. These findings suggest that the shift in fishing effort resulting from the creation of marine protected areas has not resulted in overfishing of species outside of the protected areas (Partnership for Interdisciplinary Studies of Coastal Oceans [PISCO], 2013). An additional study found that commercial and recreational fisheries have remained profitable in California (Murray & Hee, 2019). Despite initial concerns by fishers, studies have found that 86% of California's north coast fishers surveyed reported either no change in income or increased income following the establishment of reserves (Hackett et al., 2017).

Recreational Fishing

The analysis provided for private and charter boats was based on estimates provided by the University of Miami's Rosenstiel School of Marine and Atmospheric Science (S. Smith, personal communication, May 3, 2021) that utilized NOAA Fisheries MRIP data (National Marine Fisheries Service, Fisheries Statistics Division, personal communication, January 15, 2021). Shoreline estimates were not considered because the proposed zone changes would not affect fishing from the shoreline. Additionally, the analysis only considered charter vessel activity in the South Atlantic, where the bulk of MRIP data are concentrated, as proposed zone changes do not occur in the Gulf of Mexico. NCCOS used habitat species maps and estimates of the average annual non-duplicative target trips for reef species of interest from MRIP (Table 9) to estimate the maximum potential loss of private and charter boat angler-days as a result of the proposed zone changes (Table 23). For charter boats, effort data were not available by statistical subarea, but instead for Monroe County as a whole. As a result, the loss of angler-days was estimated by distributing effort according to reef fish distributions and removing activity that would take place in the proposed zones.

Impacts to headboat operations were estimated using data from the Southeast Region Headboat Survey, which records fishing locations to the degree-minute, as well as the number of anglers on board and the length of each fishing trip. Records also indicate which fish species were caught and how many were kept and released. Since the economic impact to headboats relates to the number of paying passengers, not the value of the fish, a trip was counted regardless of which species were caught. As a result, the estimated maximum potential loss in headboat angler-days is only presented as a total and not by species (Table 23). To determine the potential loss of angler-days, fishing activity was assumed to be equally distributed throughout the area of each reported location that intersected with proposed zone changes.

Ultimately, it is unlikely that the estimated maximum loss of angler-days due to the proposed rule (roughly 6,200) would occur. This analysis assumed that trips would not shift to alternate locations following proposed changes to marine zones, although it is likely that such shifts would occur. In the event of a reduction in angler-days, some recreational fishers would also likely spend money elsewhere, resulting in a transfer of economic activity as opposed to a loss of economic activity, which was not captured in this analysis. This is supported by the five-year analysis of the California marine reserve network, which found that commercial passenger fishing vessel effort did not decline, but did shift from the areas that became marine reserves to areas still open to fishing (CDFG et al., 2008).

Table 23. Average annual angler-days and estimated potential annual maximum loss of angler-days[14] for DEIS alternatives and the proposed rule (based on data from 2014–2018).

Species	Type of Trip	Average Annual Angler-Days (2014–2018)[15]	DEIS Alternatives 2 and 3 Estimated Angler-Days Lost	DEIS Alternative 4 Estimated Angler-Days Lost	Proposed Rule Estimated Angler-Days Lost
Black grouper	Charter	101,621	2	357	34
	Private	598,505	13	2,233	211
Gag grouper	Charter	91,473	4	320	58
	Private	482,519	23	1,793	326
Red grouper	Charter	89,731	6	379	59
	Private	834,598	62	3,740	580
Gray snapper	Charter	91,189	1	322	30
	Private	876,181	8	3,285	304
Lane snapper	Charter	83,401	2	276	25
	Private	657,688	1	2,313	207
Mutton snapper	Charter	111,930	8	540	77
	Private	687,134	52	3,515	498
Yellowtail snapper	Charter	98,724	2	356	36
	Private	864,001	22	3,305	334
White grunt	Charter	85,565	4	343	44
	Private	848,761	38	3,605	463
Hogfish	Charter	83,270	6	389	62
	Private	895,367	123	7,969	1,278
Total	Charter	117,119	36	3,283	424
	Headboat	37,356[16]	1,103	1,931	1,548
	Private	1,106,869	343	31,757	4,198

The economic effects from the potential loss of angler-days are presented below. These values were determined using expenditure estimates provided by NOAA Fisheries (Lovell et al., 2020). These estimates are provided at the state level by mode of fishing. Expenditure estimates, in

[14] The changes reported are marginal changes in activity compared to the baseline (status quo).
[15] Total numbers for the baseline were based on duplicative trips. Data included reports for single trips that targeted multiple species, which is reflected in the baseline angler-days by species. However, anger-days lost were estimated based on non-duplicative trips. To do this, the percentage of trips by species was estimated and multiplied by the number of non-duplicative trips by type. Charter vessels that reported targeting reef fish had an annual average of 117,119 non-duplicative angler-days for hook and line fishing. Private vessels targeting reef fish had an annual average of 983,006 non-duplicative angler-days for hook and line fishing and 123,863 non-duplicative angler-days for spear fishing. Headboat vessels that reported targeting reef fish had an annual average of 37,356 non-duplicative angler-days (see footnote 15).
[16] This estimate is based on an annual average of 298,846 angler-hours using a conversion rate of 8 angler-hours per angler-day. This conversion rate was chosen based on the definition of angler-day used for the Southeast Region Headboat Survey (Fitzpatrick et al., 2017): "An [angler-day] is the amount of effort expended by one angler, using rod and reel, on a full day fishing trip (usually 8 hours), and includes travel time to and from the fishing grounds."

addition to the estimated potential loss of angler-days, allows for the estimation of the maximum potential total loss of expenditures. Total estimated loss of value added, sales, income, and employment were estimated using NOAA Fisheries' Economic Impacts of Recreational Fishing tool (D. Records/NOAA Fisheries, personal communication, June 22, 2021). The basis for the tool is IMPLAN Version 3 software and the 2018 IMPLAN base data year. All expenditures were matched to their relevant industry or retail sector in IMPLAN. A more detailed explanation of this process may be found in Lovell et al. (2020).

Table 24 presents the aggregate maximum potential loss from the marine zone changes proposed in the DEIS alternatives and the proposed rule. For information on potential effects to small businesses, please see Chapter 6. For the proposed rule, a maximum average annual potential loss of $475,000 in income, $1.45 million in sales, and 10.2 jobs in the U.S. was estimated. When considering only Florida, a maximum average annual potential loss of $331,000 in income, $949,000 in sales, and 9.3 jobs was estimated. The maximum potential loss of income, sales, and jobs represents roughly 0.9% of income, sales, and jobs in Florida across all reef-associated charter and private/rental boat trips.

Table 24. Average annual maximum potential loss (2019 dollars)[17] to recreational fishing in the U.S. resulting from proposed marine zone boundary changes in FKNMS (based on data from 2014–2018).

Alternative	Mode	Number of Angler-Days	Value Added ($ thousands)	Sales ($ thousands)	Income ($ thousands)	Employment (Jobs)
Baseline (status quo)	Charter	117,119	$35,465	$62,275	$20,743	490.8
Baseline (status quo)	Headboat	37,356[15]	$11,312	$19,863	$6,616	157.0
Baseline (status quo)	Private/ Rental	1,106,869	$60,069	$105,816	$33,203	624.3
Baseline (status quo)	Total	1,261,344	$106,846	$187,954	$60,562	1,272.1
DEIS Alternatives 2 and 3 (net change)	Charter	-36	-$11	-$19	-$6	-0.2
DEIS Alternatives 2 and 3 (net change)	Headboat	-1,103	-$334	-$587	-$195	-5.0
DEIS Alternatives 2 and 3 (net change)	Private/ Rental	-343	-$19	-$33	-$10	-0.2
DEIS Alternatives 2 and 3 (net change)	Total	-379	-$30	-$52	-$16	-0.4

[17] Net change values account for marginal changes across all species when compared to the baseline (no action alternative). Alternatives 2 and 3 have the same marine zone boundary changes in the 2019 DEIS and thus have the same potential effects.

Alternative	Mode	Number of Angler-Days	Value Added ($ thousands)	Sales ($ thousands)	Income ($ thousands)	Employment (Jobs)
DEIS Alternative 4 (net change)	Charter	-3,283	-$994	-$1,746	-$581	-13.8
DEIS Alternative 4 (net change)	Headboat	-1,931	-$585	-$1,027	-$342	-8.0
DEIS Alternative 4 (net change)	Private/ Rental	-31,757	-$1,723	-$3,036	-$953	-17.9
DEIS Alternative 4 (net change)	Total	-35,040	-$2,717	-$4,782	-$1,534	-31.7
Proposed Rule (net change)	Charter	-424	-$128	-$225	-$75	-1.8
Proposed Rule (net change)	Headboat	-1,548	-$469	-$823	-$274	-6.0
Proposed Rule (net change)	Private/ Rental	-4,198	-$228	-$401	-$126	-2.4
Proposed Rule (net change)	Total	-6,170	-$825	-$1,449	-$475	-10.2

Table 25. Average annual maximum potential loss (2019 dollars)[16] to recreational fishing in Florida resulting from proposed marine zone boundary changes in FKNMS (based on data from 2014–2018).

Alternative	Mode	Number of Trips	Value Added ($ thousands)	Sales ($ thousands)	Income ($ thousands)	Employment (Jobs)
Baseline (status quo)	Charter	117,119	$24,459	$46,083	$16,237	435.1
Baseline (status quo)	Headboat	37,356	$8,758	$14,698	$5,179	139.0
Baseline (status quo)	Private/ Rental	1,106,869	$30,491	$45,492	$15,064	439.4
Baseline (status quo)	Total	1,261,344	$63,708	$106,273	$36,480	1,013.5
DEIS Alternatives 2 and 3 (net change)	Charter	-36	-$8	-$14	-$5	-0.1
DEIS Alternatives 2 and 3 (net change)	Headboat	-1,103	-$259	-$434	-$153	-4.0
DEIS Alternatives 2 and 3 (net change)	Private/ Rental	-343	-$9	-$14	-$5	-0.1

Alternative	Mode	Number of Trips	Value Added ($ thousands)	Sales ($ thousands)	Income ($ thousands)	Employment (Jobs)
DEIS Alternatives 2 and 3 (net change)	Total	-379	-$17	-$28	-$10	-0.2
DEIS Alternative 4 (net change)	Charter	-3,283	-$770	-$1,292	-$455	-12.2
DEIS Alternative 4 (net change)	Headboat	-1,931	-$453	-$760	-$268	-7.0
DEIS Alternative 4 (net change)	Private/ Rental	-31,757	-$875	-$1,305	-$432	-12.6
DEIS Alternative 4 (net change)	Total	-35,040	-$1,645	-$2,597	-$887	-24.8
Proposed Rule (net change)	Charter	-424	-$99	-$167	-$59	-1.6
Proposed Rule (net change)	Headboat	-1,548	-$363	-$609	-$215	-6.0
Proposed Rule (net change)	Private/ Rental	-4,198	-$116	-$173	-$57	-1.7
Proposed Rule (net change)	Total	-6,170	-$578	-$949	-$331	-9.3

Non-Consumptive Recreation

The increased protection of habitat through the proposed spatial alternatives is expected to increase the quality of these areas for non-consumptive recreation and, consequently, the experience of users. Although improvements to resources may lead to increased visitation and use, they are unlikely to increase tourism by a substantial amount due to the limited supply of hotels and housing. Except for 2010 and 2020, the average year-round occupancy rate of hotels in Key West was above 80% (Key West Travel Guide, 2021). Further, Table 26 shows that January through April tend to see the highest occupancy rates, with occupancy exceeding 90% in many of these months. (Occupancy rates from March–June 2020 reflect tourism closures due to the COVID-19 pandemic. Additional factors that likely affected occupancy rates include the Deepwater Horizon oil spill in September 2010 and Hurricane Irma in September 2017).

Table 26. Hotel occupancy rates in Key West, Florida by month and year. Source: Key West Travel Guide, 2021

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
January	79%	81%	86%	85%	94%	93%	86%	87%	85%	89%	90%
February	90%	93%	92%	94%	95%	96%	94%	93%	93%	95%	94%
March	93%	95%	94%	95%	94%	93%	94%	93%	94%	95%	52%
April	89%	91%	89%	89%	89%	92%	89%	91%	90%	91%	10%
May	83%	84%	86%	86%	88%	87%	85%	86%	81%	87%	15%
June	77%	84%	85%	86%	87%	86%	82%	84%	87%	87%	51%
July	82%	90%	91%	91%	88%	90%	92%	91%	90%	88%	53%
August	71%	77%	74%	85%	86%	80%	79%	81%	81%	78%	52%
September	57%	63%	65%	72%	72%	70%	70%	31%	66%	58%	59%
October	70%	74%	76%	82%	83%	78%	72%	69%	75%	75%	66%
November	76%	84%	82%	88%	86%	81%	83%	79%	85%	86%	64%
December	71%	76%	77%	86%	85%	79%	83%	79%	83%	80%	74%
Average	78%	83%	83%	87%	87%	85%	84%	80%	84%	84%	56%

The most relevant effects of marine zone boundary changes in the proposed rule for current and prospective non-consumptive users will be increased quality of habitat and reduced user conflicts. Both will improve the experience of the user, potentially increasing the value (consumer surplus) of their experience within FKNMS. However, without survey data, this increase in value could not be quantified. The DEIS estimated that as the area of protected waters increased, there would be a similar increase in person-days of use. After extensive public comment and additional research, NOAA has revised the approach to estimating the benefits of the proposed rule to non-consumptive users. Hotels are near capacity year-round (Table 26), Monroe County has restrictions on development, there are limited entry points to Monroe County, and the distance of the protected areas would, in some cases, require overnight trips on larger vessels. These factors limit the potential increase in visitation and consequently the person-days of non-consumptive recreation. The benefits likely to accrue to non-consumptive users are improved quality of experience and some increase in person-days, but this cannot be estimated without further data from both current and potential users. Increasing the number of person-days may have a measurable impact on the local economy if users spend more money in Monroe County because of improvements to FKNMS. If users simply substitute non-consumptive activities for other activities without changing their overall expenditures, this would result in a transfer of economic activity from one industry (or business) to another. Additionally, improved quality of experience may increase consumer surplus.

Summary of Economic Impact

Benefits: Managing use through the creation of marine zones has been shown to increase the quality of marine life, thus benefiting those engaged in both consumptive use and non-consumptive forms of recreation. Increasing the number of protected areas may also result in increases in non-market value. This value alone has swamped other economic values in other places (Tortugas Ecological Reserve: Leeworthy & Wiley, 2000; Hawai'i: Bishop et al., 2011; Flower Garden Banks National Marine Sanctuary: Stefanski & Shimshack, 2016). In addition, there may be long-term benefits in terms of scientific value.

Costs: In the short term, there may be some losses due to the closure of new areas to fishing and anchoring. In the longer term, if these areas have replenishment effects (increasing total stock sizes), as observed in the Tortugas region, commercial fisheries may actually receive benefits instead of costs. However, this may not occur if, for example, more catch is allocated to recreational fisheries or the size of the commercial fishery is reduced.

Net benefits: The no action alternative (DEIS 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, 4, and the proposed rule. It is expected that alternatives 2 and 3 would have greater net benefits than Alternative 1, but fewer net benefits than Alternative 4. Similarly, Alternative 3 would have greater net benefits than alternatives 1 and 2, but fewer net benefits than Alternative 4, with Alternative 4 having the greatest net benefits. This proposed rule combines individual aspects of each of the four alternatives presented in the DEIS and is directly informed by the thousands of public and agency comments received on the DEIS. Thus, the net benefits of the proposed rule are likely to be between that of alternatives 2 and 3 and Alternative 4.

The maximum potential costs of the proposed rule to fisheries (commercial and recreational; Table 24; Table 25) and associated impacts on the Monroe County economy are not likely to occur. In the long term, if there are positive impacts to fishery resources outside the protected areas (spillover effect), then there will likely be net benefits to fisheries and overall positive impacts to the Monroe County economy. Additionally, 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. When non-market values are included, the net benefits of the proposed rule are likely to be positive.

Chapter 5:
Cost-Benefit Analysis of the Proposed Rule

This section includes a Regulatory Impact Review analysis to satisfy NOAA's obligations under Executive Order 12866. The White House Office of Management and Budget's Office of Information and Regulatory Affairs determined that the proposed rule is a significant regulatory action. Therefore, in accordance with Executive Order 12866, this chapter provides a detailed description of the need for the proposed rule and an explanation of how the proposed rule will meet that need. In addition, this chapter provides an assessment of the potential costs and benefits of the proposed rule. The analysis provided here considers the effects of the proposed rule on commercial fishing, recreational fishing, non-consumptive recreation, and other relevant sectors. Table 27 provides a summary overview of the qualitative benefits, costs, and net economic benefits of the proposed rule.

Need for the Proposed Rule

The proposed rule is required to respond to threats to marine resources of the Florida Keys, consistent with the purposes and policies of both the NMSA and the Florida Keys National Marine Sanctuary and Protection Act. FKNMS currently operates under its original regulations (including marine zone regulations), which became effective in 1997, and a 2007 revised management plan, which directs the sanctuary's non-regulatory management activities. To ensure long-term resource viability and ecosystem function, this management framework must be updated to address current and foreseeable future threats. Generally, the marine resources within FKNMS face increased threats from local, regional, and global impacts, as well as changes in visitor numbers, use patterns, use types, and recreational interests. Specifically, these threats include water quality impacts originating from both within and outside the sanctuary; significant decreases in coral cover; and habitat degradation from vessel impacts, including anchor damage, prop scarring, and groundings, among others. Each of these threats has major implications for FKNMS.

Additionally, regulatory updates are needed to respond to the 2011 FKNMS condition report, which concluded that resources in the Florida Keys appeared to be in fair to fair/poor condition, and were generally either stable or in decline (ONMS, 2011). Since the release of the condition report, sanctuary resources have been further impacted by Hurricane Irma (2017); a serious, widespread coral disease outbreak; and a seagrass die-off, among other threats.

Description of Affected Industries

Chapter 2 provides descriptions of the affected industries (commercial fishing, recreational fishing, non-consumptive recreation, and travel and tourism). Further, Chapter 3 provides a summary of the proposed sanctuary-wide and marine zone regulations. To the extent available, data on the industries likely to be impacted by the updated regulations are presented in Chapter 3. Chapter 4 provides an analysis of the maximum potential effects of marine zone boundary changes to commercial and recreational fishing.

Economic Effects of the Proposed Rule

Boundary Expansion to Include Existing Areas to be Avoided

This section only analyzes the cost and benefits of the expansion of the FKNMS boundary to encompass existing ATBAs. The proposed rule includes expansion of the FKNMS boundary by approximately 1,000 square miles (2,590 square km), which comprises 472 square miles (1,229 square km) of ATBAs; 271 square miles (702 square km) of Tortugas Ecological Reserve; and 259 square miles (670 square km) of Pulley Ridge. The ATBAs are areas, originally proposed by the U.S. Coast Guard (55 Fed. Reg. 19418 [May 9, 1990]) and codified through the Florida Keys National Marine Sanctuary and Protection Act, where operating any tank vessel or vessel over 50 meters length is prohibited. However, the current FKNMS boundary is not inclusive of all ATBAs. The proposed rule extends the sanctuary boundary to align with the existing ATBA boundary. Chapter 3 provides a discussion of benefits and costs related to this proposed expansion.

Benefits: This provision of the proposed rule would result in an alignment of existing ATBAs with the FKNMS boundary, which may provide *de minimis* administrative benefits.

Costs: There would not be any additional incremental costs, since the ATBA already exists.

Sanctuary-Wide Regulations

Live Rock Aquaculture

NOAA is proposing that no substantive change be made to the existing live rock prohibition. Accordingly, there is no anticipated impact of this proposed action.

Discharge Regulation Exception

Benefits: Water quality is fundamental to all water-based recreation-tourism uses in FKNMS, as well as commercial fishing (and the quality of food supplied by this industry). Chapter 2 provides information on the importance of the recreation and tourism industry to Monroe County. Protecting water quality in FKNMS has enormous potential to provide both short-term and long-term ecosystem service benefits (such as recreation) by improving and sustaining the resources on which users rely. A study found that "visitor and resident reef users in Monroe County are willing to pay[18] $72.1 million per year to maintain artificial and natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs" (Johns et al., 2001, p. ES-8). This estimate was based upon whether respondents would be willing to pay an additional amount within their trip cost to maintain the condition of artificial and natural reefs.

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

[18] Willingness to pay is mathematically defined as the area below the demand curve for a good or service and includes both use and non-use value.

Temporary Regulation for Emergency and Adaptive Management

Benefits: Temporary regulations allow FKNMS to respond to emergencies and unforeseen events to prevent or minimize the destruction of, loss of, or injury to sanctuary resources or their quality. In the short term, some activities might be displaced. However, it is expected that there would be short-term benefits in terms of public safety and long-term gains in resource protection to ensure the future flow of benefits. Existing emergency regulations have been used three times in FKNMS. For example, an area was closed to facilitate large-scale coral reef restoration, which used large barges and other heavy equipment. Closing this area protected the public from interaction with these vessels and equipment. Future temporary regulations could improve recovery of resources following anchor damage, protect nesting birds, and facilitate response to natural disturbances.

Costs: Potential costs include temporary displacement of activities due to temporary regulations. In the short term, substitution or relocation of activities would likely be possible, minimizing disruption to activity. There would be no long-term costs associated with each temporary regulation, but future temporary regulations would incur the same short-term costs. Additionally, depending on the temporary regulation, there may be increased costs associated with enforcement.

Historical Resources Permitting

Benefits: Improvements to the research permitting process would yield benefits to both users and non-users via increased protection of resources, knowledge, research, and educational opportunities. Many of the goods and services provided by cultural and heritage resources do not require market transactions to derive benefit. These benefits are split into two types: use value and non-use value. Use value may be impacted by the number of shipwrecks protected and the level of investments in museum exhibits, maritime heritage trails (including virtual trails that use video and mobile phone technology), educational workshops on maritime heritage, and training in maritime archaeology.

While use value comes from the direct use of resources, non-use value is derived from those who may never use the resource and is comprised of option value (the value people place on the option to use the resource in the future), existence value (the value of knowing a resource or place exists), and bequest value (the value of knowing that the resource will be available to future generations). Non-use value is typically estimated using stated preference surveys that measure non-users' willingness to pay. Although no studies have been conducted specific to the use or non-use value of shipwrecks in FKNMS, there is evidence that both users and non-users are willing to pay for the protection of these resources (Whitehead & Finney, 2003; Mires, 2014). A more recent study that evaluated the total economic value of national parks to the American public found that nearly 95% of responding households indicated it was important to protect national parks, including historic sites, for current and future generations (Haefele et al., 2016). The same study also found that households placed a marginal value of $3.87 (2014$) on each history-focused national park. Although this estimate may seem small, extrapolating across all households in the U.S. yields a value in the millions.

Costs: Reducing the number of permit categories and aligning the permit with existing state of Florida requirements is expected to reduce the burden of the permit application and, consequently, the cost of compliance.

Fish Feeding

Benefits: There are very few operations that engage in this activity within the Florida Keys. Provided these existing operations can verify they have been engaged in fish feeding, they will be able to obtain an ONMS certification permit. This will allow them to continue this practice; however, new businesses or existing businesses that do not currently engage in fish feeding will not be able to initiate this practice. Consequently, the benefits are expected to be small in the short and long term.

Costs: The costs are minimal in the short term, since few operations are known to engage in this practice and, if they meet all permit requirements, those that do would be able to apply for a permit to continue the practice. If these operators are issued a permit, diver/snorkeler experiences are not expected to decline since the recreational opportunity will not change, resulting in no loss of benefits to users.

Grounded and Deserted Vessels and Harmful Matter

Benefits: The potential for harm to sanctuary resources from derelict and/or abandoned vessels is very high. Multiple vessel groundings have occurred in the Florida Keys; these incidents were, in part, what led to the designation of FKNMS. Damage assessment and restoration costs due to vessel groundings have totaled multiple millions of dollars. The additional proposed regulations are expected to minimize future damage to sanctuary resources and protect a multi-billion-dollar economy dependent on those resources. There is potential for both substantial short- and long-term benefits from these protections.

Costs: The cost of vessel removal is minimal compared to the cost of liability if derelict or abandoned vessel damage sanctuary resources and damage assessment cases are brought to recover damages from responsible parties. As described in greater detail in Chapter 3, vessel groundings may result in civil penalty under the NMSA or a more substantial penalty if a court case is pursued. Derelict and abandoned vessels present costs to the county, state, or federal government if a responsible party cannot be identified, in addition to the cost of damage and resulting restoration as required.

Marine Zone Regulations

Large Vessel Mooring Buoys

Benefits: Benefits of large vessel mooring buoys include the avoidance of smaller mooring buoy repair costs and damage to habitat caused by large vessels pulling smaller mooring buoys loose. Large vessel owners would also benefit by avoiding fines for damaging FKNMS resources. Further, this proposed rule provision will help to mitigate and reduce crowding, thus improving visitor use experience.

Costs: Costs include those associated with supplying enough mooring buoys to accommodate existing and future use by large vessels (or rafting of vessels that would be the equivalent of a

large vessel). Additionally, with the assistance of its advisory council, FKNMS proposes to collect information from different user groups to determine appropriate numbers and locations for the installation of buoys of various sizes.

Prohibition of Catch and Release Fishing by Trolling in Four Sanctuary Preservation Areas

Benefits: The main benefit of SPAs has been the reduction in conflicts between fishing and other consumptive activities with non-consumptive activities, such as snorkeling and scuba diving. During initial public scoping and after the release of the DEIS, public comments indicated the existence of conflicts between trolling activity and diving/snorkeling. Reducing such conflicts is likely to improve visitor experience and satisfaction. Consequently, this regulatory alternative has both short- and long-term benefits to non-consumptive user groups.

Costs: Fishers who troll in SPAs would potentially suffer both short- and long-term costs from displacement. However, there are abundant locations outside of SPAs available to relocate this activity; therefore, the likelihood of either short- or long-term costs is very low.

Bait Fishing Permits

Benefits: Reducing exemptions such as bait fishing within SPAs (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, particularly divers and snorkelers, thereby enhancing the value of the non-consumptive recreation experience[19]. Elimination of the bait fishing permit system would also reduce administrative costs.

Costs: Fishers who catch their own bait might have to shift to either buying bait or catching bait outside SPAs. If fishers must pay for bait, the replacement cost could be between $20,859 and $33,375 for all cast net permit holders per year ($815–1,304 per active permit holder annually). Lampara net fishers may lose a total of $1,916 in harvest revenue. If costs incurred can be transferred to customers, profits would not be affected; however, transferring losses to customers would reduce consumer surplus. If permit holders catch bait outside SPAs (lampara and cast net fishers currently catch close to 20.0% and 37.8% of baitfish outside SPAs, respectively), their costs would be reduced to zero or the additional time and effort needed to replace the catch.

Tortugas Ecological Reserve North Permits

Benefits: The benefits of this proposed change are relatively minor. The permit process would become less burdensome, which might lead to expanded economic opportunities for diving operations or private households that want to visit Tortugas Ecological Reserve North for diving.

Costs: Costs may be expected to decrease by a trivial amount due to decreased permit requirements.

[19] Johns et al. (2001) found that reef users in Monroe County are willing to pay $72.2 million per year to maintain artificial and natural reefs in their current condition, which includes preventing overuse of the reefs.

Marine Zone Boundary Changes

A detailed quantitative analysis and discussion of the expected economic effects of the proposed rule to commercial and recreational fishing is provided in Chapter 4. The following section summarizes the expected economic effects of the proposed draft rule.

Commercial Fishing

The proposed rule would establish new zone types, expand existing zone types, and update the regulations specific to each zone type, with the goal of improved conservation, management, and preservation of each zone. The economic effects on individual commercial harvesters would depend on each vessel owner's profit maximization strategy, their dependence on reef-associated species caught within each spatial management zone, and their ability to adapt to changing regulations.

The expected change in average harvest revenues across the species of interest for the period 2015–2019 were used to approximate the anticipated change in net economic benefits. Across each of the nine reef species, the average annual loss of harvest revenue across all fishers who landed each species from Monroe-County-associated statistical areas is less than 1%. Caribbean spiny lobster harvest revenue is estimated to decrease by an average of $966,000 annually, equating to 2.3% of total Caribbean lobster harvest revenue within Monroe County statistical areas. Stone crab harvest revenue is expected to decrease by 0.2%, and shrimp harvest revenue is not expected to change.

These estimated changes in harvest revenue do not reflect changes in profit or producer surplus[20], since any changes in costs (fuel, time, labor) due to the proposed rule were not estimated. If the maximum potential effects occur and fishers do not substitute species or locations, then fishers may reduce effort, thereby reducing costs (fuel, time, labor). These estimates also do not account for the potential impact to seafood dealers; indirect economic effects (net costs or benefits) for this group cannot be estimated due to a lack of data on net revenue and profit. However, dealers are generally indirectly affected whenever gross revenues to commercial fishing vessels are expected to change. As discussed in Chapter 4, previous studies demonstrate that estimated maximum potential losses do not occur in the long run (five years). Ultimately, it is possible that some commercial harvesters may benefit from the proposed regulatory changes via reduced effort and cost required to land the same catch as a result of enhanced habitat and larger fish populations.

Recreational Fishing

The proposed rule would establish new zone types, expand existing zone types, and update the regulations specific to each zone type, with the goal of improved conservation, management, and preservation of each zone. A separate analysis is provided for charter boat operations and private/rental boats.

[20] Producer surplus is the difference between how much a business is willing to accept for a good or service and the market price.

For-hire Charter Operations

The economic effects on individual for-hire charter operations would depend on each vessel owner's profit maximization strategy, their dependence on the reef-associated species caught within each spatial management zone, and their ability to adapt to changing regulations.

Based upon the analysis provided in Chapter 4, the total maximum potential loss in terms of average annual charter boat angler-days is 424, equivalent to a loss of 0.36% angler-days from the baseline (117,119 angler-days). Individual angler-days do not represent the number of potential charter vessel trips lost. (For example, a vessel may take three trips in a week, with six people on each trip. This would yield three charter vessel trips and 18 angler-days.) The net cash flow per angler is $113 for charter operations in the South Atlantic; this value should be considered an upper bound for producer surplus. This amounts to a maximum average potential loss of $47,912 per year across all charter operations in the Florida Keys that target reef-associated species. However, the areas proposed to be closed to fishing are small, and it is likely that charter operations will be able to fish in other locations. In the long run, it is possible that some for-hire operations may benefit from the proposed regulatory changes via reduced effort and cost required to land the same catch as a result of enhanced habitat and larger fish populations.

Private/Rental Boat Fishing

A potential reduction of nearly 4,200 (0.38%) annual angler-days was estimated. Reduced angler-days could result in less satisfaction and a reduction in benefits that recreational fishers derive from FKNMS. Ultimately, the level of reduced benefits will depend on fishers' ability and willingness to fish other locations and even target other fish species. However, the proposed rule is intended to aid in conservation management and stewardship and support reef-associated species for sustainable future use.

Non-Consumptive Recreation

The proposed rule would establish new zone types, expand existing zone types, and update the regulations specific to each zone type, with the goal of improved conservation, management, and preservation of each zone. A separate analysis is provided here for non-consumptive charter boat operations and private/rental boats. The primary non-consumptive recreation activities considered here are scuba diving, snorkeling, and wildlife viewing.

The economic effects on non-consumptive recreation for-hire charter operations would depend on each vessel owner's profit maximization strategy, their dependence on the use of the reefs in each spatial management zone, and their ability to adapt to changing regulations.

There are limited cost and earnings data available for non-consumptive recreation businesses. From a qualitative perspective, potential costs to operators may exist related to no-entry and no anchoring zones (e.g., if operators are unable to locate a buoy within their desired dive/snorkeling location). FKNMS plans to minimize such costs through thorough stakeholder engagement to identify the optimal size and number of buoys to install. Ultimately, the use of buoys will help reduce damage to habitats and improve user experience. In addition, user satisfaction is expected to increase as a result of reduced user conflict and expansion of the buoy

program. Additionally, the intent of the proposed rule is to improve resource quality, which may yield increased demand for non-consumptive operations.

Indirect benefits are likely to exist, as measured by scuba divers and snorkelers' willingness to pay for the conservation and restoration of coral habitats (Johns et al., 2001). Additionally, if users substitute non-consumptive recreation activities for other activities not directly affected by the regulations (i.e., culture or arts), this may lead to a transfer of economic activity to other businesses and industries within Monroe County.

Determination of Significant Regulatory Action

As stated in Executive Order 12866, a regulation is considered a "significant regulatory action" if it is likely to: (1) result in an annual effect of $100 million or more or adverse material effects to the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the president's priorities, or the principles set forth in Executive Order 12866. As noted above, NOAA has updated the analysis of the potential benefits presented in Table 5.5 of the DEIS (ONMS, 2019) to reflect that the tourism market is likely saturated, which limits the potential for significant economic growth as a result of this proposed rule. As for adverse impacts, changes to marine zones (that may restrict certain commercial and recreational uses in those areas) are spatially small compared to the area of FKNMS that will remain available for those uses. As such, users are expected to move to other available areas. Further, NOAA estimated maximum potential loss without accounting for costs or relocation of activities. Even at maximum potential loss, NOAA's proposed rule is well below the $100 million threshold.

Based upon the information provided throughout this document, the proposed rule does not meet the economic criteria for a significant regulatory action as defined in Executive Order 12866. This means the estimated annual effect is less than $100 million and the action will not adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.

Table 27. Qualitative summary of costs, benefits, and net economic benefits from the proposed rule provisions.

Draft Rule Provision	Economic Benefits	Economic Costs	Net Economic Benefits
Boundary expansion			
Boundary expansion to include existing ATBAs	De minimis	No costs	No change
Sanctuary-wide regulations			
Discharge regulation exception	Positive	De minimis	The potential net benefits are expected to be higher in the long term than the short term.
Temporary regulation for emergency and adaptive management	Positive	Temporary	By increasing the agency's ability to respond to emergencies, FKNMS will be able to more effectively manage emergencies, reducing long-term effects to sanctuary resources while minimizing costs. It is unknown what the net economic benefits will be, given that it is not possible to predict the types or extent of emergencies.
Historical resources permitting	Positive	Reduction in costs	Based on the benefits and reduction of costs, positive short- and long-term net benefits are expected as a result of the proposed rule.
Fish feeding	Positive	Minimal	The net benefits are likely to be low in the short term but potentially greater in the long term by restricting fish feeding and thus reducing impacts on the behavior of various marine species.
Grounded and deserted vessels and harmful matter	Positive	Reduction in costs and damages	By minimizing potential damage to resources, there is potential for net benefits in both the short and long term from this set of regulations.
Marine zone regulations			
Large vessel mooring buoys	Positive	Costs of infrastructure to site	It is expected there will be both short- and long-term net benefits for this regulatory action.
Prohibition of catch and release fishing by trolling in four SPAs	Positive	Costs to trolling fishers	It is expected that there will be both short- and long-term net benefits for this regulatory action, including reduced potential user conflicts and improved non-consumptive user experience.
Bait fishing permits	Positive	Costs to bait fishers	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. A phase-out of the baitfish permit program is also expected to reduce administrative and enforcement costs. Net benefits from this proposed rule provision are expected.

Draft Rule Provision	Economic Benefits	Economic Costs	Net Economic Benefits
Tortugas Ecological Reserve North permits	De minimis	Reduction in costs	A small net economic benefit is expected from this proposed rule provision due to the slight increase in benefits and slight decrease in costs due to reduced permit requirements.
Marine zone boundary changes			
Designation of marine zone boundaries and associated regulations	Positive benefits to non-consumptive industry and users	Potential loss in revenue to commercial and recreational for-hire operations	Net benefits are expected as a result of the proposed rule provisions regarding marine zone boundaries. Additionally, based upon existing studies cited throughout this analysis, the maximum potential losses to fishers are unlikely to occur, especially over time. In the long term, it is likely that net benefits will increase.

Chapter 6:
Economic Effects on Small Entities

The RFA requires federal agencies to prepare an analysis of a rule's impact on small entities whenever the agency is required to publish a notice of proposed rulemaking, unless the agency can certify, pursuant to 5 U.S.C. 605, that the action will not have significant economic impact on a substantial number of small entities. This section quantifies the potential effects of marine zone boundary changes on small entities. A qualitative analysis of the effects of sanctuary-wide and marine zone regulations on small entities is provided at the end of this chapter. There are three primary industries considered in this section: commercial fishing, recreational for-hire fishing, and dive/snorkeling for-hire operations. The quantitative assessment provided here is an overestimate of the negative potential impacts of the proposed rule. The true economic impacts of the proposed rule are expected to be much smaller because, as observed in other studies of marine protected areas, fishers are likely to relocate their effort to other areas or other species.

The RFA requires agencies to consider, but not necessarily minimize, the effects of proposed rules on small entities. There are no decision criteria in the RFA. Instead, the goal of the RFA is to inform the agency and public of expected economic effects of the proposed rule and to ensure the agency considers alternatives that minimize the expected economic effects on small entities while meeting applicable goals and objectives.

This analysis supports NOAA's decision to certify that the proposed rule will not have a significant economic impact on a substantial number of small entities, and therefore no further analysis is needed under the RFA (U.S. Equal Employment Opportunity Commission, 2021).

Small entities are defined by the U.S. Small Business Administration (SBA). The definitions of each relevant small business category are from the most recent size standards published by the SBA (2019). Size standards are based upon the average annual receipts (all revenue) or the average employment of a firm. The commercial size standard is $22.0 million for finfish fishing (North American Industry Classification System [NAICS] code—114111), $6.0 million for shellfish fishing (NAICS code—114112), and $8.0 million for other marine fishing (NAICS code—114119). Water-based scenic and sightseeing transportation (NAICS code—487210), such as for-hire recreational fishing operations and dive/snorkeling for-hire operations, have size standards of $8.0 million.

Commercial Fishing

All values presented in this chapter are based on data provided by FWC and use five-year averages for 2015–2019. The data only include landings within the statistical areas and subareas described in Chapter 4. It is possible that some of the vessels analyzed also had landings outside the statistical areas considered in the data set. This means that some of the vessels evaluated may not be classified as small businesses as defined by the SBA if their landings within and outside Monroe-County-associated statistical areas surpass the SBA size standards. Additionally, complete ownership and cost data for businesses and vessels that participate in commercial fishing and other industries were not available. Consequently, NOAA was not able to determine affiliations between vessels and businesses. As a result, NOAA assumed that each vessel was independently owned by a single business. Either of these factors could result in an

overestimate of the actual number of small businesses directly impacted by the proposed rule. Additionally, the spatial data provided were for the statistical subareas as a whole, and it was not possible to assess catch or the number of businesses that operated within proposed marine zones. Thus, there is a spatial mismatch between the data available and the size of the marine zones that are likely to affect commercial and recreational activity. Chapter 4 documents the assumptions made when estimating the effects to these industries.

Description and Estimate of the Number of Small Entities to Which the Proposed Action Would Apply

NOAA calculated the potential number of vessels that may be impacted by the proposed rule. Vessels that operated in a statistical subarea that has a proposed zone designation or zone change that would impact commercial fishing were considered. Unless otherwise stated, Table 4 in Chapter 2 lists the statistical areas associated with the Gulf of Mexico or South Atlantic regions and whether they are affected by proposed rule zone changes that would restrict commercial fishing. In total, there are six statistical areas affected by proposed zone changes within habitat that species of interest are associated with. Impacts are considered by species group below. It is likely that vessels target multiple species and are thus accounted for in several of the groups described below.

Reef Fish

Reef fish analyzed here include red grouper, grunts, hogfish, mutton snapper, gray snapper (mangrove), lane snapper, black grouper (carberita), gag grouper, and yellowtail snapper. Please see Chapter 4 for a more detailed explanation of why these reef-associated species were selected for analysis. The analysis for reef-associated species included Gulf of Mexico and South Atlantic fisheries. In the Gulf of Mexico and South Atlantic regions, an average of 39 and 231 vessels, respectively, reported at least $1 or more of harvest revenue for these species in statistical areas affected by the proposed rule annually (2015–2019). (The estimated number of vessels should not be summed to derive the total number of vessels across regions, as some vessels may fish in both regions and this approach would result in double counting.) The maximum annual average revenue (2011–2015) of vessels operating within the Gulf of Mexico reef fish fishery was $4.9 million (GMFMC, 2017a). Within the South Atlantic snapper/grouper fishery, the maximum annual average revenue (2012–2016) was $1.7 million (South Atlantic Fishery Management Council [SAFMC], 2019). The SBA commercial size standard for finfish is $22.0 million; vessels that reported $1 or more of reef fish harvest revenue did not surpass this threshold. Consequently, all the vessels potentially affected by the proposed rule were considered small entities.

Shrimp

Commercial vessels that fished pink, brown, white, royal red, rock, and “other” shrimp species (as reported in FWC trip tickets) were considered in this analysis. The number of vessels engaged in the shrimp fishery was estimated for the Gulf of Mexico and South Atlantic regions. Statistical subarea 2.8 (Federal Waters Gulf of Mexico) is the only statistical subarea in which the shrimp fishery may be affected by the proposed rule; thus, no South Atlantic region vessels engaged in the shrimp fishery would be affected. From 2015–2019, an average of 108 vessels per

year reported at least $1 or more of harvest revenue in statistical subarea 2.8. The SBA commercial size standard for shell fishing is $6.0 million. From 2011–2014, the maximum annual average revenue for a single vessel harvesting shrimp in the Gulf of Mexico was $2.0 million (GMFMC, 2017b). Consequently, all vessels potentially affected by the proposed rule were considered small entities.

Caribbean Spiny Lobster

The analysis for Caribbean spiny lobster is not differentiated by South Atlantic and Gulf of Mexico regions. An annual average of 521 vessels reported at least $1 or more of harvest revenue for Caribbean spiny lobster in statistical areas affected by the proposed rule from 2015–2019. The maximum annual average revenue (2012–2016) from all species reported by a single vessel that harvested lobster was $2.0 million (GMFMC, 2018b). The SBA commercial size standard for shell fishing is $6.0 million; thus, all vessels potentially affected by the proposed rule were considered small entities.

Stone Crab

The analysis for stone crab is not differentiated by region and only considered harvesters in the state of Florida. An annual average of 282 vessels reported $1 or more in stone crab revenue in statistical subareas affected by the proposed rule from 2015–2019. The SBA commercial size standard for shell fishing is $6.0 million; vessels that reported $1 or more of stony crab harvest revenue did not surpass this threshold. Consequently, all vessels potentially affected by the proposed rule were considered small entities.

Significance of Economic Effects on Small Entities

Reef Fish

Substantial Number Criterion

The proposed rule is likely to impact fishers within the statistical areas affected by the proposed rule zone changes. On average (2011–2015), 585 vessels landed at least one pound of all species in all statistical areas managed under the GFMFC reef fish fishery each year (GMFMC, 2017a). Of these, approximately 39 vessels (based on the annual average from 2015–2019) may be affected by the proposed rule based on the statistical areas fished and the species targeted. The maximum annual average revenue earned by a single vessel was approximately $4.9 million (GMFMC, 2017a).

An annual average of 584 vessels were engaged in the South Atlantic snapper/grouper fishery between 2012 and 2016 (SAFMC, 2019). Of these, an annual average (2015–2019) of 231 vessels used the statistical areas likely to be affected by the proposed draft rule. In the South Atlantic, the maximum annual average (2012–2016) revenue for a single vessel within the snapper/grouper fishery was about $1.7 million (SAFMC, 2019). Based on the maximum average revenue reported, each of the commercial reef fishing businesses assessed were considered to be small entities. Consequently, the proposed rule would affect a substantial number of small entities within the South Atlantic reef fishery (39.6%), but not the Gulf of Mexico reef fishery (3.8%).

Significant Economic Impact

Significant economic impact was assessed by examining disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All businesses affected by the proposed rule were determined to be small businesses. Thus, the issue of disproportionality is not relevant.

Profitability: Do the regulations significantly reduce profits for a substantial number of small entities?

The maximum potential annual average loss of harvest revenue across all vessels is an estimated $19,900 for the South Atlantic snapper/grouper fishery and $1,400 for the Gulf of Mexico reef fish fishery for the species analyzed. (The above estimates are totals across each fishery, not maximum potential losses per vessel.) Although profit loss was not analyzed, the loss in profit would be less compared to the loss of harvest revenue. Profit loss considers the costs avoided by not spending time and effort fishing, whereas harvest revenue does not. It is unknown how the loss of harvest revenue would be distributed across individual vessels. However, the areas proposed to be closed to fishing comprise a small fraction of FKNMS. The targeted zones, of which 95% are less than 5 square kilometers and 90% are less than 1 square kilometer, are spread throughout the sanctuary. Consistent with previous studies that analyzed the impact of marine zone changes, it is likely that fishers would not experience the maximum potential loss and would be able to substitute areas within the proposed zones for areas just outside the zones or elsewhere (CDFG et al., 2008; Hackett et al., 2017; Jeffrey et al., 2012; Murray & Hee, 2019; PISCO, 2013). Further, each zone is small, and it is likely that commercial harvesters will find replacement areas and/or benefit from spillover from improvements to reefs and fish communities within closed areas in the long run. Thus, a significant reduction in profits for a substantial number of small entities engaged in the reef fish fishery is not expected as a result of the proposed rule.

Caribbean Spiny Lobster

Substantial Number Criterion

On average (2012–2016), 770 commercial fishing businesses reported landings of Caribbean spiny lobster in the state of Florida (GMFMC, 2018b). During the same time period, these businesses earned an annual average revenue of approximately $84,000 ($2017), and Caribbean spiny lobster accounted for 67% of revenue (GMFMC, 2018b). The maximum annual average revenue from all species reported by a single business that harvested Caribbean spiny lobster from 2012 to 2016 was about $2.0 million (GMFMC, 2018b). An annual average (2015–2019) of 521 vessels may be affected by the proposed rule. Since these commercial fishing businesses are considered small entities, it is assumed that the proposed rule would affect a substantial number of small entities.

Significant Economic Impact

Significant economic impact was assessed by examining disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All businesses affected by the proposed rule were determined to be small businesses. Thus, the issue of disproportionality is not relevant.

Profitability: Do the regulations significantly reduce profits for a substantial number of small entities?

Based on data from 2015–2019, the maximum potential annual average loss of Caribbean spiny lobster harvest revenue was estimated to be $966,000. The total annual average harvest revenue in Monroe County statistical areas was roughly $42.0 million. Thus, the maximum potential annual average loss equates of 2.3% of total Caribbean spiny lobster harvest revenue. If this potential loss of harvest revenue is evenly distributed across each of the 521 affected vessels, the annual average loss per vessel would be $1,900. Although profit loss was not analyzed, the loss in profit would be less compared to the loss of harvest revenue. Profit loss considers the costs avoided by not spending time and effort fishing, whereas harvest revenue does not. Additionally, most proposed zones are small, and it is therefore unlikely that the maximum potential loss would occur. A significant reduction in profits for a substantial number of small entities engaged in the Caribbean spiny lobster fishery is not expected as a result of the proposed rule.

Shrimp

Substantial Number Criterion

On average (2011–2014), 1,140 permitted vessels reported landings in the Gulf of Mexico shrimp fishery each year. From 2011–2014, annual average revenue was about $413,900 for vessels with a shrimp permit (GMFMC, 2019). Based on 2015–2019 data, an average of 108 vessels per year may be affected by the proposed rule.

From 2014–2018, an average of 262 permitted vessels reported landings in the South Atlantic shrimp fishery each year (SAFMC, 2020). However, none of these vessels would be affected by the proposed rule.

These commercial fishing businesses are considered to be small entities. However, less than 10% of vessels engaged in the Gulf of Mexico shrimp fishery and no vessels in the South Atlantic shrimp fishery would be affected by the proposed rule. Thus, it is assumed that the proposed rule would not affect a substantial number of small entities engaged in the shrimp fishery.

Significant Economic Impact

Significant economic impact was assessed by examining disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All businesses affected by the proposed rule were determined to be small businesses. Thus, the issue of disproportionality is not relevant.

Profitability: Do the regulations significantly reduce profits for a substantial number of small entities?

The zone changes within the proposed rule are not expected to affect the South Atlantic shrimp fishery, and a de minimis effect is expected for the Gulf of Mexico shrimp fishery. Small marginal areas of zones that were previously closed to shrimping will be opened, while other areas that are currently closed may slightly increase in size due to boundary changes. Although the analysis found a resulting estimated benefit of $5 in harvest revenue across the fishery, it is likely that these small marginal boundary changes will have no economic impact or alter the location of effort. Consequently, a significant reduction in profits for a substantial number of small entities engaged in shrimp fisheries is not expected as a result of the proposed rule.

Stone Crab

Substantial Number Criterion

On average (2015–2019), 754 commercial fishing vessels reported stone crab landings in Florida each year, and 282 of these vessels harvested stone crab in the statistical areas affected by the proposed rule. In the absence of more specific data, it was assumed that a maximum of 282 vessels may be affected within the stone crab fishery. Each of these vessels were considered to be small entities; thus, it is assumed that the proposed rule would affect a substantial number of small entities engaged in the stone crab fishery.

Significant Economic Impact

Significant economic impact was assessed by examining disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All businesses affected by the proposed rule were determined to be small businesses. Thus, the issue of disproportionality is not relevant.

Profitability: Do the regulations significantly reduce profits for a substantial number of small entities?

The average maximum potential loss of harvest revenue across all vessels as a result of the proposed rule is roughly $37,700 per year. Within all Monroe County statistical subareas, the average annual total harvest revenue was $20.2 million. Thus, the maximum potential loss represents 0.2% of total harvest revenue. A significant reduction in profits for a substantial number of small entities is therefore not expected as a result of the proposed rule. Although profit loss was not analyzed, the loss in profit would be less compared to the loss of harvest revenue. Profit loss considers the costs avoided by not spending time and effort fishing, whereas harvest revenue does not.

Summary of Effects to Commercial Fisheries

Table 28 summarizes maximum average harvest revenue and average harvest revenue for each fishery considered. (Revenue values are based on total catch, regardless of targeted species.) The estimated loss of harvest revenue as a result of the proposed rule is also provided, along with the average loss of revenue to each vessel that reported fishing in the affected statistical areas. The last column provides the percent of annual average harvest revenue lost per vessel. Except for the Caribbean spiny lobster fishery, losses are expected to be less than 1%. Vessels engaged in

the Caribbean spiny lobster fishery may experience a loss of roughly 2%. The losses were assumed to be evenly distributed across vessels operating in the statistical subareas affected by the proposed zone changes. Data on the costs, harvest revenues, and profits to individual businesses are not available to NOAA.

These estimates of losses are considered the maximum potential loss, which is not expected to occur. First, maximum potential loss is based on gross revenue, which does not consider the reduction in costs (e.g., fuel, labor) associated with decreased fishing effort. Further, these losses do not account for substitution of activity outside of the proposed zones or harvest of other species.

Most targeted zones are small, and it is unlikely that the maximum potential loss would occur. The proposed nursery restoration areas are each roughly one half square kilometer or less in size. This new zone type results in the addition of 2.4 square kilometers of transit-only areas. Regulations for wildlife management areas may vary, and can include idle speed, no wake; no motor; or no entry. In total, the proposed rule adds 4.0 square kilometers of new or expanded wildlife management areas. The smallest proposed zone change adds 0.001 square kilometers and the largest adds 0.56 square kilometers. Additionally, as noted above, several studies across multiple geographies have demonstrated that maximum potential loss does not occur because of the ability to substitute target areas within proposed zones with alternative areas (CDFG et al., 2008; Hackett et al., 2017; Jeffrey et al., 2012; Murray & Hee, 2019; PISCO, 2013). Each new proposed zone is small, and it is likely that commercial harvesters will find substitute areas and benefit from spillover from the proposed closed areas. A significant economic effect on a substantial number of small commercial fishing businesses is therefore not expected as a result of the proposed rule.

Table 28. Summary of estimated maximum potential effects to small commercial businesses.

	Maximum Annual Average Harvest Revenue (2019$)[21]	Annual Average Harvest Revenue (2019$)[22]	Number of Vessels in Fishery	Number of Vessels Affected[23]	Loss of Harvest Revenue (2019$)	Loss of Harvest Revenue per Affected Vessel (2019$)[24]	Loss of Harvest Revenue as a Percent of Average Annual Revenue per Affected Vessel[25]
Gulf of Mexico reef fish[26]	$4,853,899	$133,047	585	39	$1,443	$37	1.08%
South Atlantic snapper/grouper[27]	$1,704,330	$46,869	584	231	$19,826	$86	0.18%
Caribbean spiny lobster[28]	$1,960,816	$87,611	770	521	$965,833	$1,854	2.12%
Stone crab[29]	N/A	$34,435	754	282	$37,714	$134	0.36%
Gulf of Mexico shrimp[30]	$1,997,860	$413,857	1,140	108	-$5	$0	0.00%
South Atlantic shrimp[31]	$2,647,111	$422,212	262	0	$0	$0	0.00%

[21] Revenue values reflect all species harvested by a vessel.
[22] Revenue values reflect all species harvested by a vessel.
[23] The number of vessels affected is calculated by determining the average number of vessels that have landed a given species (or species group) within statistical areas that overlap with proposed zone changes.
[24] Based on a qualitative assessment, we conclude that the maximum potential loss will not occur.
[25] Based on a qualitative assessment, we conclude that the maximum potential loss will not occur.
[26] Maximum annual average harvest revenue is based data for 2011–2015 (GMFMC, 2017a). Average annual harvest revenue is based on data for 2014–2016 (Overstreet et al., 2017; Overstreet et al., 2018a, 2018b).
[27] Maximum annual and annual average harvest revenues are based data for 2012–2016 (SAFMC, 2019).
[28] Maximum annual and annual average harvest revenues are based data for 2012–2016 (GMFMC, 2018b).
[29] The number of vessels engaged in this fishery is based on FWC data (S. Brown/FWC, personal communication, September 2, 2021).
[30] Maximum annual and annual average harvest revenues are based data for 2011–2014 (GMFMC, 2017b; GMFMC, 2019).
[31] Maximum annual and annual average harvest revenues are based data for 2014–2018 (SAFMC, 2020).

Recreational For-Hire Fishing

Description and Estimate of the Number of Small Entities to Which the Proposed Action Would Apply

For-hire recreational fishing includes both charter boats and headboats. Charter boats are fishing vessels that are typically hired to take up to six anglers on a fishing trip. In general, charter boats charge on a per-trip basis. Headboats usually operate on a schedule and may provide several trips in a single day, taking multiple fishing parties per trip, and charging on a per-person basis. Headboats are usually larger and able to accommodate more anglers than a charter boat. Headboats are defined by Souza and Liese (2019) as vessels (1) with a passenger capacity of 18 or more individuals or (2) that were included in the Southeast Region Headboat Survey. (This definition differs from the definition used by NOAA Fisheries.) Based on this definition, 172 headboats were identified, 51% of which (87 vessels) operated in Florida (Souza & Liese, 2019).

From September to October 2017, 1,166 charter vessels had active federal permits in the South Atlantic, 29% of which reported they had not taken a trip within the past year, yielding 828 active charter vessels in the South Atlantic. Within the Gulf of Mexico, 956 charter vessels had active federal permits, 24% of which reported they were not active within the last year, yielding 727 active charter vessels. Only actively operating vessels were considered in subsequent analyses, as these would be affected by the proposed rule (Souza & Liese, 2019).

The maximum annual gross revenue for a single headboat in the South Atlantic in 2017 was about $779,100. On average, annual gross revenue for charter vessels is less than half that of headboats, so it was assumed that the maximum annual gross revenue for charter vessels in the South Atlantic was less than $779,100 (85 Fed. Reg. 43135 [July 16, 2020]). As of 2018, annual average gross revenue was estimated to be approximately $89,600 for for-hire charter vessels in the Gulf of Mexico (85 Fed. Reg. 43135 [July 16, 2020]). In 2017, the maximum annual gross revenue for a single headboat in the Gulf of Mexico was about $1.3 million, so it was assumed that the maximum annual gross revenue for a single charter vessel was less than $1.3 million (85 Fed. Reg. 45363 [July 28, 2020]). The annual average revenue for headboats in the southeast region (i.e., Gulf of Mexico and South Atlantic) was approximately $701,500 (Souza & Liese, 2019). Because all for-hire fishing businesses are considered small entities, it was assumed that the proposed rule would affect a substantial number of small entities.

Significance of Economic Effects on Small Entities

Significant economic impact was assessed by examining disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All businesses affected by the proposed rule were determined to be small businesses. Thus, the issue of disproportionality is not relevant.

Profitability: Do the regulations significantly reduce profits for a substantial number of small entities?

Including labor, annual average trip revenue was $554 for South Atlantic charters, $781 for Gulf of Mexico charters, and $1,815 for southeast region headboats. The average number of passengers for each vessel category was 4.7, 5.5, and 28.2, respectively (Souza & Liese, 2019). The estimated annual average number of angler-trips for charter vessels (from 2014–2018) was 117,119 (MRIP, 2020). As a result of the proposed rule, up to 424 angler-trips (0.36%) may be lost. All lost person-trips would occur in the South Atlantic, and equate to a loss of roughly $50,000 in average revenue each year (average trip revenue*number of lost angler-trips/average number of people per trip). The distribution of this loss across individual businesses is not known. For southeast region headboats, it was estimated that up to 1,548 angler-trips may be lost as a result of the proposed rule. Calculated the same way (average trip revenue*number of lost angler-trips/average number of people per trip), this loss equates to up to $103,919 in revenue losses. However, proposed zones are small, and headboat fishing is not dependent upon harvest of specific species, even if passengers may have a preferred target. It is likely that both for-hire operations and passengers will adapt to locations outside of the proposed marine zones and/or shift effort toward other species. A significant reduction in profits for a substantial number of small entities is therefore not expected as a result of the proposed rule

Table 29. Summary of estimated maximum potential effects on small for-hire fishing businesses.

	Maximum Revenue (2019$)	Average Revenue (2019$)	Total Number of Vessels	Number of Vessels Affected	Loss of Revenue (2019$)	Loss of Revenue per Affected Vessel (2019$)	Loss of Revenue as a Percent of Average Annual Revenue per Affected Vessel
South Atlantic charter vessels[32]	<$779,065	$122,809	828	455	$48,000	$105	0.09%
South Atlantic and Gulf of Mexico headboat vessels[33]	$1,300,000	$701,544	172	9.6	$103,919	$10,825	1.54%

[32] Maximum revenue estimates assume that maximum revenues for charter vessels are less than those for headboats, since, on average, charter vessels generate less than half the annual gross revenue of headboats (85 Fed. Reg. 45363 [July 28, 2020]). Average revenue was calculated by multiplying the average number of trips per vessel in 2017 by the average revenue per trip in 2017 (Souza & Liese, 2019).

[33] Maximum revenue is based on estimates for a single year, 2017, in the Gulf of Mexico and South Atlantic regions (Souza & Liese, 2019; 85 Fed. Reg. 43135 [July 16, 2020]). Average revenue per vessel was calculated by multiplying the average revenue per trip by the average number of trips per vessel for all active headboats in the southeast region in 2017 (Souza & Liese, 2019). Estimates of the number of affected vessels and loss of revenue are based on the spatial analysis described in Chapter 4 and represent averages for the years 2014–2018.

Non-Consumptive Recreation Industry

This section considers the potential effects of the proposed rule on small businesses operating within the non-consumptive recreation industry. Businesses considered include dive and snorkel operations, rental equipment operations, wildlife viewing operations, and other businesses that either utilize or whose customers utilize, but do not take, sanctuary resources.

Description and Estimate of the Number of Small Entities to Which the Proposed Action Would Apply

There are currently 30 recognized Blue Star[34] dive/snorkel operators (M. Tumolo/NOAA, personal communication, July 27, 2021). However, this number should be viewed as a minimum and regularly changes as operations close and new operators sign up for the program. The exact number of dive and snorkel operations is not known, as many of these small businesses do not operate from brick and mortar locations. Further, several other watersport operations were identified using Tripadvisor (Table 30). The table does not reflect the unique number of businesses, as those that provide multiple services may be identified in multiple rows. Utilizing NAICS code 487210 (scenic and sightseeing transportation), the U.S. Census identified 73 establishments in 2017 in Monroe County, Florida (U.S. Census Bureau, 2021b).

Table 30. Number of operations by watersport. Source: Tripadvisor, 2021

Watersport	Number of Operations
Kayak/canoe	73
Stand-up paddle boarding	44
Waterskiing and jet skiing	28
Parasailing and paragliding	16
Rafting and tubing	2
Surfing, windsurfing, and kitesurfing	10
Speed boating	5

Based upon FKNMS knowledge, these non-consumptive businesses are considered small entities, and it is thus assumed that the proposed rule would affect a substantial number of small entities.

Significance of Economic Effects on Small Entities

Significant economic impact was assessed by examining disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

[34] Blue Star is an FKNMS program that recognizes tour operators who are committed to promoting responsible and sustainable diving, snorkeling, and fishing practices to reduce the impact of these activities on the sanctuary (FKNMS, 2022).

All businesses affected by the proposed rule were determined to be small businesses. Thus, the issue of disproportionality is not relevant.

Profitability: Do the regulations significantly reduce profits for a substantial number of small entities?

Although some of the proposed marine zone boundary changes will affect non-consumptive recreation, the majority of zones that limit activity are small. Areas currently designated as ecological reserves and special use areas will be renamed to conservation areas under the proposed rule. Conservation areas will maintain the transit-only regulations within a total area of 502.5 square kilometers. The Tortugas South Conservation Area will be expanded by one mile to the west, adding an additional 46.6 square kilometers.

Nursery restoration areas are each roughly one half square kilometer or less in size. This new zone type results in the addition of 2.4 square kilometers of transit-only areas. Regulations for wildlife management areas may vary, and can include idle speed, no wake; no motor; or no entry. In total, the proposed rule adds 4.0 square kilometers of new or expanded wildlife management areas. The smallest proposed zone change adds 0.001 square kilometers and the largest adds 0.56 square kilometers.

Data on revenue, costs, and profits of non-consumptive business are not available. However, the proposed zone changes, with the exception of Tortugas South Conservation Area (46.5 sq. km) and Tennessee Reef Conservation Area (1.8 sq. km), are all roughly one-half square kilometer or less. Further, these additional protections will help to conserve and sustain resources to ensure the future health of the individual reefs and, consequently, the larger reef tract, facilitating continued use of FKNMS to support businesses.

Anchoring prohibitions in some zones may also affect small businesses if a sufficient number of mooring buoys is not available. Additionally, proposed sanctuary-wide regulations require vessels 65 feet in length or greater to use a mooring buoy, which may affect non-consumptive recreation entities. However, as part of the management action, FKNMS plans to work with its Sanctuary Advisory Council to determine the number of mooring buoys needed and the locations at which they should be placed. The intent of these regulations is primarily to protect sensitive reef habitat by building better infrastructure to support access to these areas. Ultimately, a significant reduction in profits for a substantial number of small entities engaged in non-consumptive recreation is not expected as a result of the proposed rule.

Sanctuary-Wide and Marine Zone Regulations

Due to the lack of quantitative data on the number of businesses directly affected by the proposed rule and their revenues, costs, and profits from activities within FKNMS, the analysis provided here is qualitative. The types of small entities that may be impacted by the proposed rule include cruise lines, non-consumptive and consumptive recreational charter businesses, and commercial fishing businesses.

Based on this analysis, NOAA concludes that the proposed rule would have no effect or negligible effects on small business entities. No effect means that the proposed action would have no impact to small entities, and negligible means that the proposed action would cause less than 1% change in profit to small businesses and is unlikely impact to revenue, costs, or profits.

Discharge Regulation Exception

The costs to cruise ship businesses are minimal to non-existent since cruise ships are able to discharge once outside FKNMS boundaries. Additionally, cruise ships are limited to the Key West ship channel and spend little time transiting the sanctuary. Any costs associated with the discharge regulations would be minor compared to overall costs of operating a cruise ship

Temporary Regulation for Emergency Adaptive Management

Temporary regulations allow FKNMS to prevent or minimize the destruction of, loss of, or injury to sanctuary resources or the quality of the resources, upon which many small businesses (e.g., commercial fishing, consumptive recreational charters, dive operations) rely. Potential costs include temporary displacement of activities from the initiation of the temporary regulation. In the short term, substitution or relocation of activities will most likely be possible and short-term disruption to activity would thus be minimal. There would be no long-term costs associated with each temporary regulation, but future temporary regulations would have the same short-term costs. Although these regulations may result in short-term costs to small entities, they are expected to provide large net benefits to small entities in the long term through improved resource condition. The effect of this proposed regulation on small entities would be negligible.

Historical Resources Permitting

The revised historical resources permitting system would eliminate deaccession permits, thereby removing the ability of individuals to take possession of historic resources. This will not have any economic effects because FKNMS has never issued such permits. This proposed regulation would have no effect on small entities.

Fish Feeding

The fish feeding regulation would not apply to feeding for the purpose of harvesting marine species during traditional fishing. There are very few non-consumptive recreational operations in FKNMS that conduct fish feeding activities. There is a lack of data on how fish feeding activities generate revenue for small businesses. Existing eco-tour operators may seek a permit for fish feeding if they are able to satisfy all general permit application requirements, which would serve to mitigate any costs associated with the proposed regulation. This regulation would have negligible effects on small entities.

Grounded and Deserted Vessels and Harmful Matter

The grounding or desertion of vessels is not essential to the operations of any type of small entity operating in FKNMS. Additionally, any costs to small entities to remove derelict and/or abandoned vessels are minimal compared to their liability if the derelict or abandoned vessel damages sanctuary resources or damage assessment cases are brought against those who damage sanctuary resources. The proposed regulation would have negligible effects on small entities.

Large Vessel Mooring Buoy

In conjunction with this regulation, NOAA will work with user groups to ensure that an adequate number of large vessel mooring buoys are available and sited at appropriate locations. Accordingly, this regulation would have no effect on small entities.

Prohibition of Catch and Release Fishing by Trolling in Four Sanctuary Preservation Areas

The regulation only applies to catch and release fishing, so commercial fishing operations would not be impacted. Isolating the effects of the regulation to specific charter fishing businesses is not possible given the spatial limitations of the data available. However, the spatial extent of the SPAs in question is small and any costs to small entities are likely to be offset by spatial substitution to similar areas nearby. Accordingly, costs to small entities would be negligible.

Bait Fishing Permits

The SPA baitfish permit database does not contain information on businesses affiliated with permit holders. However, it is assumed that some permit holders use baitfish catch for either commercial or charter fishing operations. Estimated average annual replacement costs per active permit holder (i.e., those who report using the permit at least once) are $684 for lampara net fishers, between $815 and $1304 for cast net fishers, and between $94 and $150 for hair hook fishers. These estimates represent maximum potential replacement costs, as they do not account for the likelihood of spatial substitution away from the relatively small SPAs. Additionally, from 2015–2019, there were only three active lampara net permit holders, 26 active cast net permit holders, and 5 active hair hook permit holders. The proposed rule would not affect a substantial number of small commercial or charter fishing entities.

Tortugas Ecological Reserve North Permits

This proposed regulation is an administrative change that would result in no costs to small entities.

Additional Information

1. Description of the projected reporting, recordkeeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records

The proposed regulatory action would not establish any new reporting or record-keeping requirements.

2. Identification of all relevant federal rules that may duplicate, overlap, or conflict with the proposed rule

No duplicative, overlapping, or conflicting federal rules have been identified.

3. Description of significant alternatives to the proposed action and attempts to minimize economic impacts on small entities

This proposed rule, if implemented, is not expected to reduce the profits of any small businesses. This is partly due to the potential to shift activity to alternate locations, as well as the fact that that the proposed rule is informed by and responsive to comments from the potentially impacted user groups (e.g., two specific marine zones included in the DEIS were not included in the proposed rule, in part due to comments from lobster fishers regarding their expected maximum potential loss of access and use). As a result, the issue of significant alternatives is not relevant.

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Glossary of Acronyms

ATBA	area to be avoided
DEIS	draft environmental impact statement
DHR	Florida Department of State Division of Historical Resources
FKNMS	Florida Keys National Marine Sanctuary
FWC	Florida Fish and Wildlife Conservation Commission
GMFMC	Gulf of Mexico Fishery Management Council
IMPLAN	Impact Analysis for Planning
MRIP	Marine Recreational Information Program
NAICS	North American Industry Classification System
NCCOS	National Centers for Coastal and Ocean Science
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
ONMS	Office of National Marine Sanctuaries
RFA	Regulatory Flexibility Act
SBA	Small Business Administration
SCP	sanctuary community profile
SPA	Sanctuary Preservation Area

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Appendix A:
Commercial Harvest Trends for Species of Interest

Trends in Harvest Revenue and Pounds Landed for Monroe-County-Associated Statistical Areas

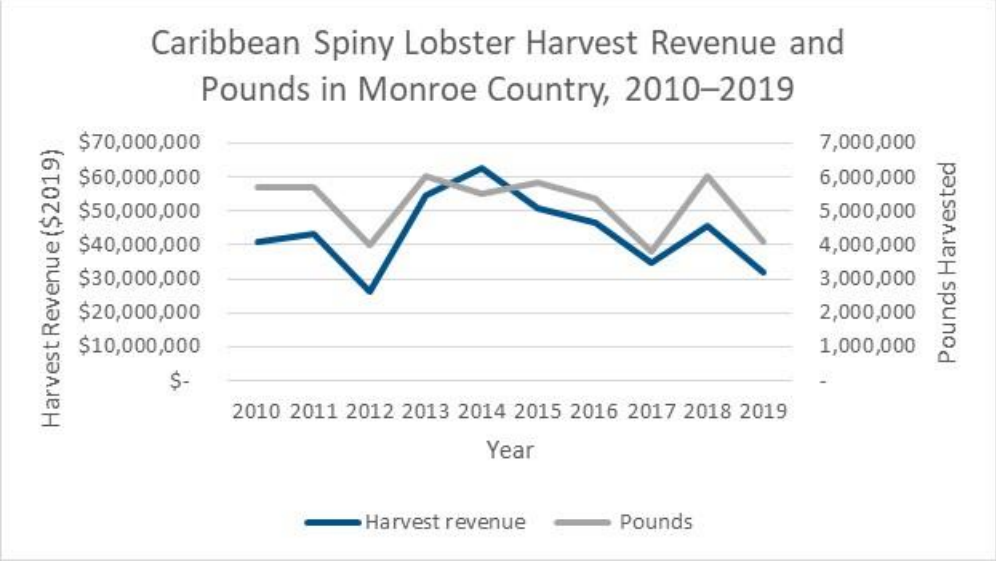

Figure A.1. Caribbean spiny lobster harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

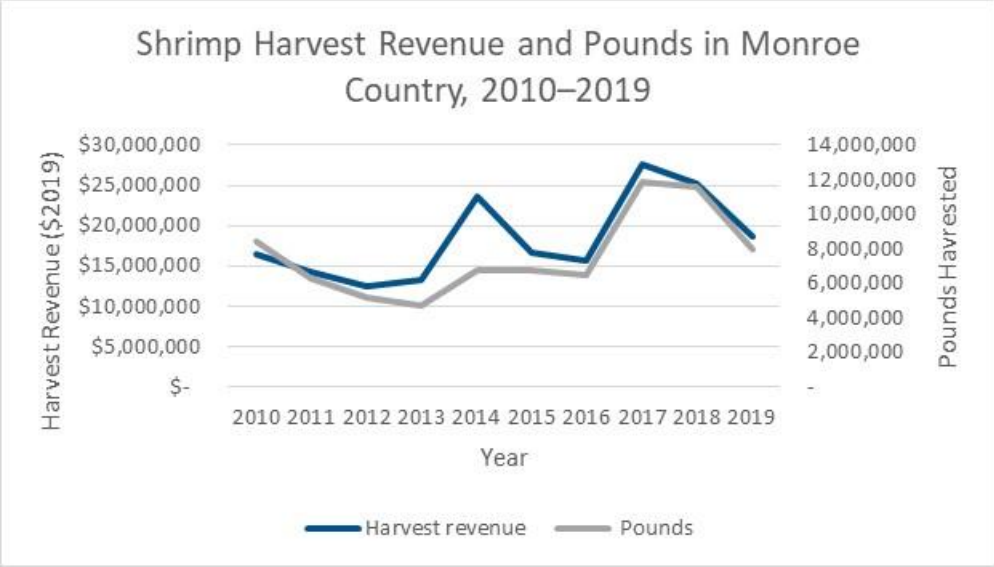

Figure A.2. Shrimp harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

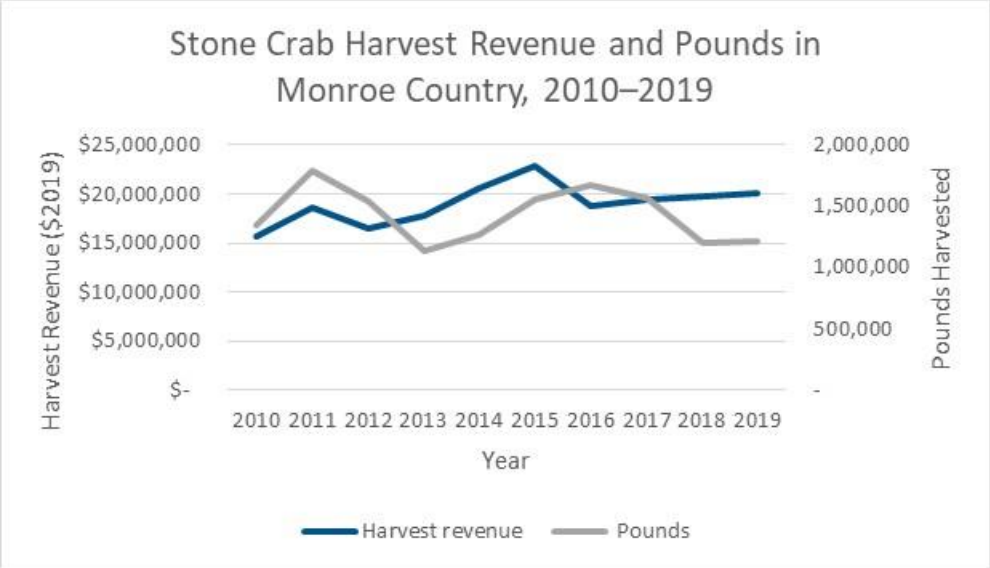

Figure A.3. Stone crab harvest revenue and pounds landed within statistical areas associated with Monroe County, 2010–2019 (2019 dollars). Source: FWC, 2021

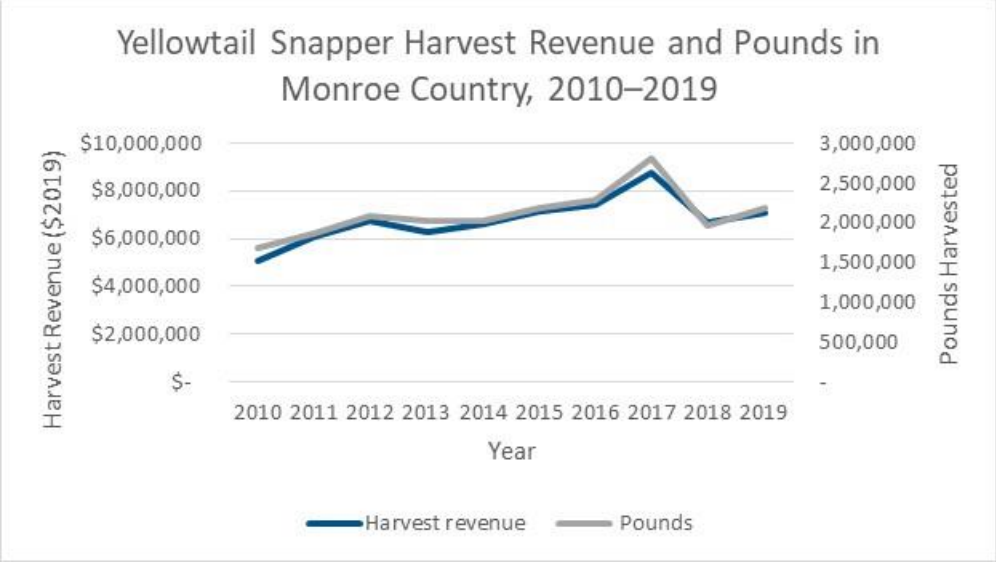

Figure A.4. Yellowtail snapper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

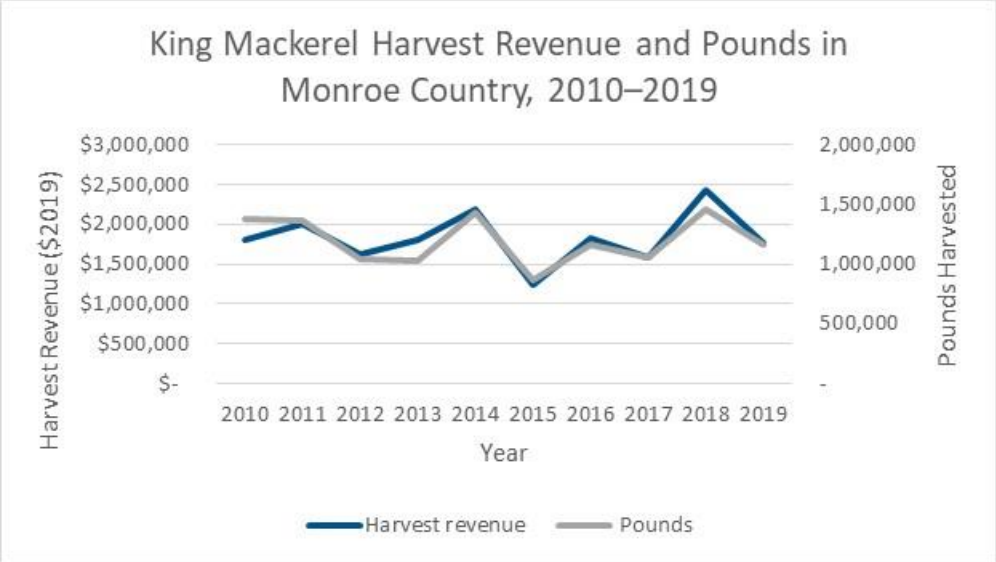

Figure A.5. King mackerel harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

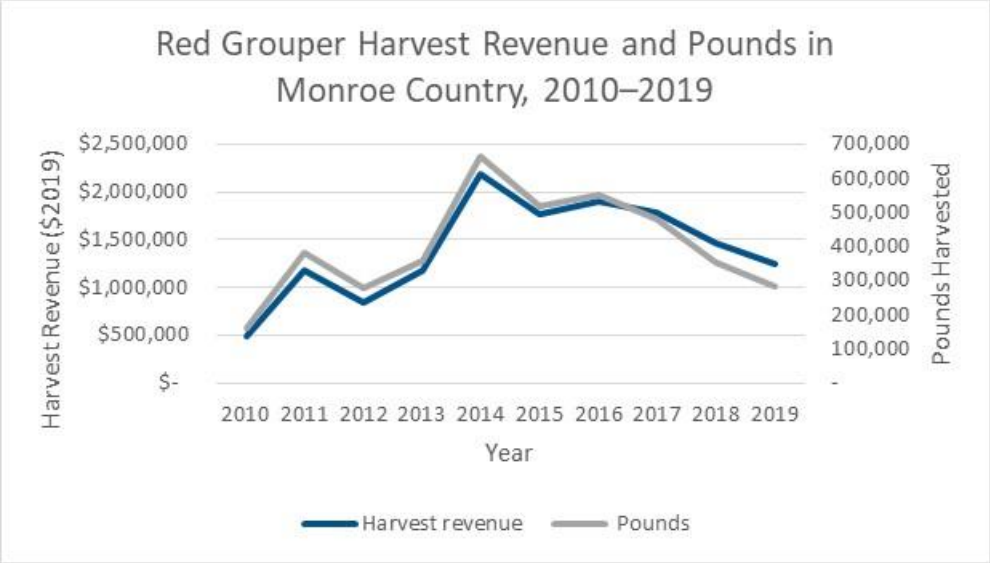

Figure A.6. Red grouper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

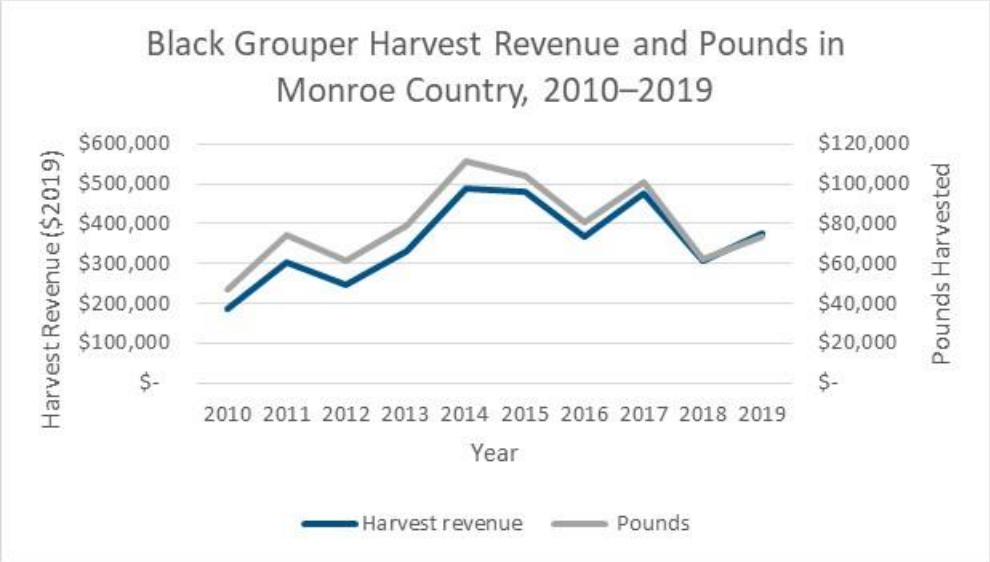

Figure A.7. Black grouper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

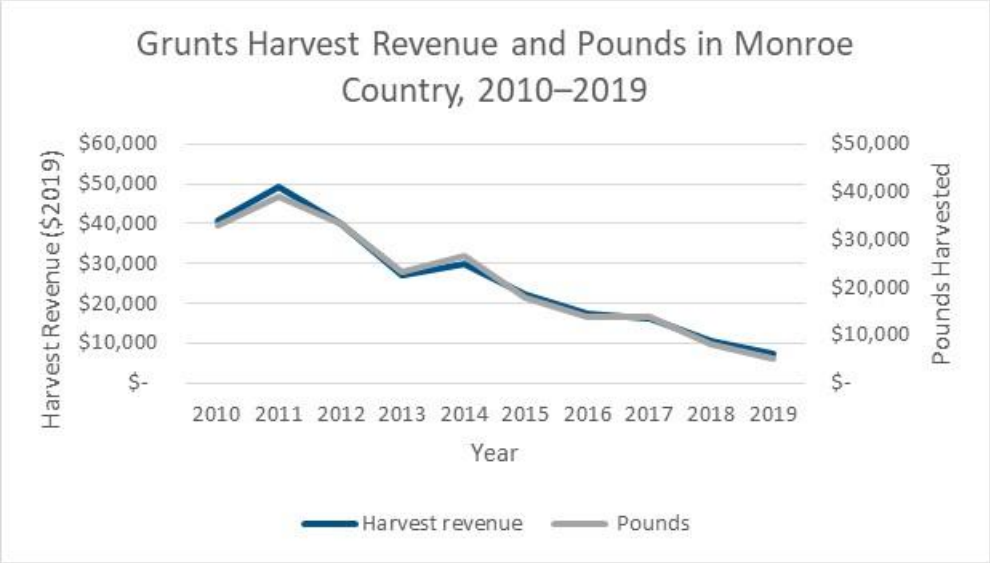

Figure A.8. Grunts harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

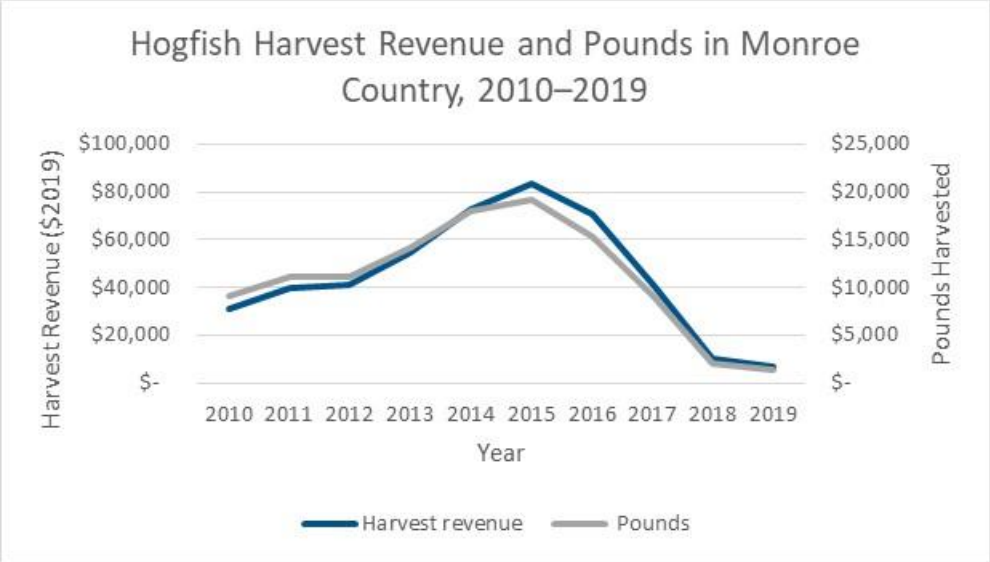

Figure A.9. Hogfish harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

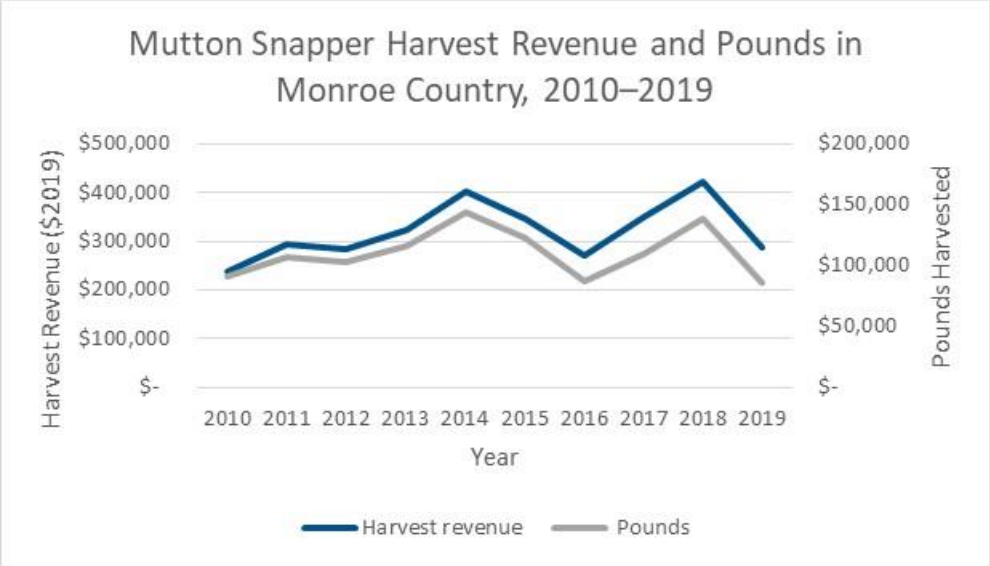

Figure A.10. Mutton snapper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

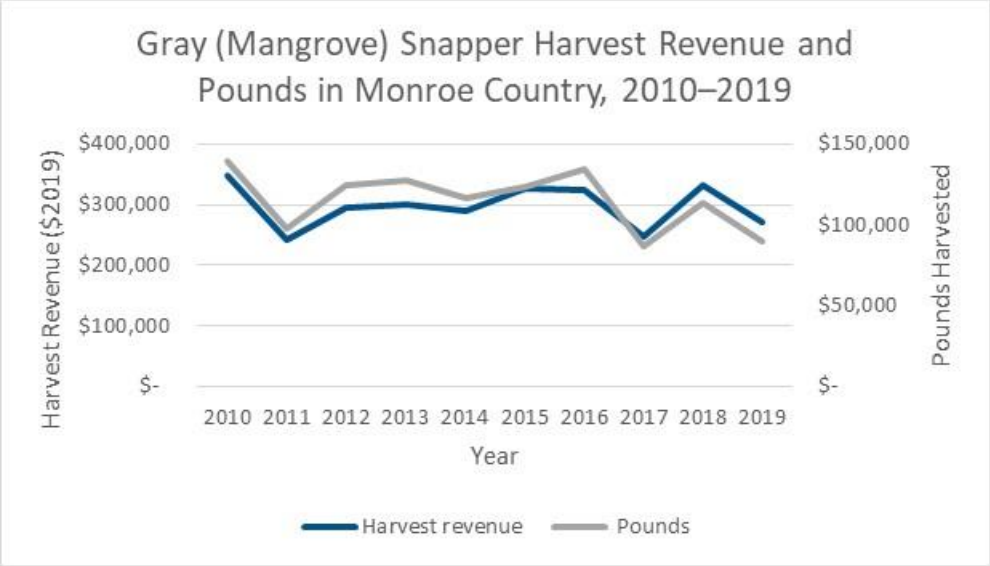

Figure A.11. Gray (mangrove) snapper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

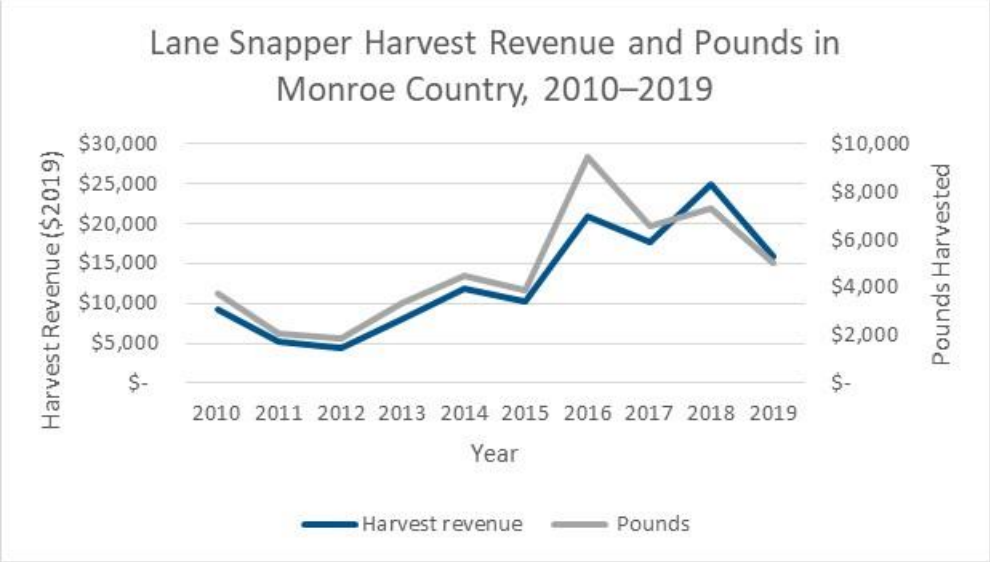

Figure A.12. Lane snapper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

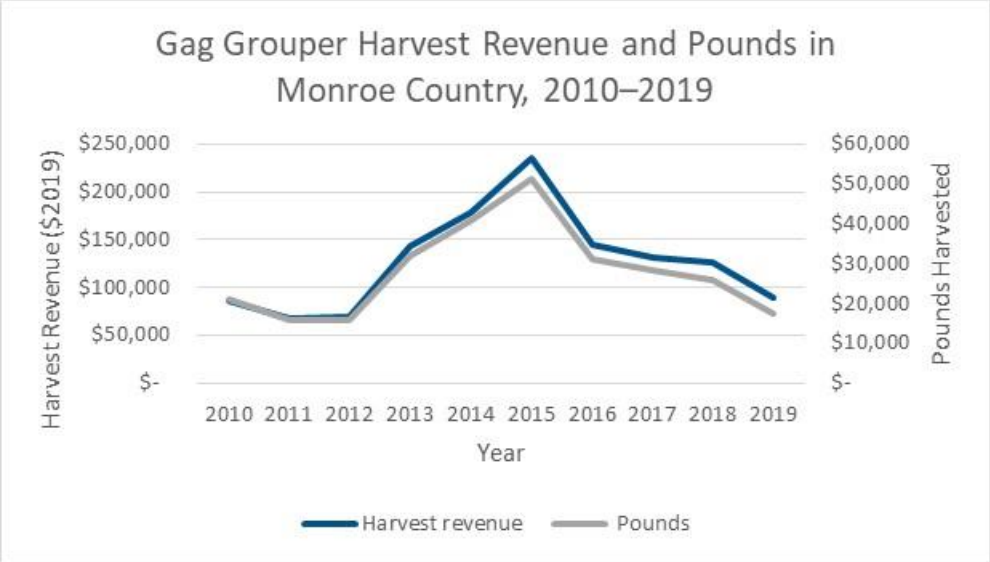

Figure A.13. Gag grouper harvest revenue and pounds landed within Monroe-County-associated statistical areas, 2010–2019 (2019 dollars). Source: FWC, 2021

Trends in Gear Type by Harvest Revenue and Pounds for Monroe-County-Associated Statistical Areas

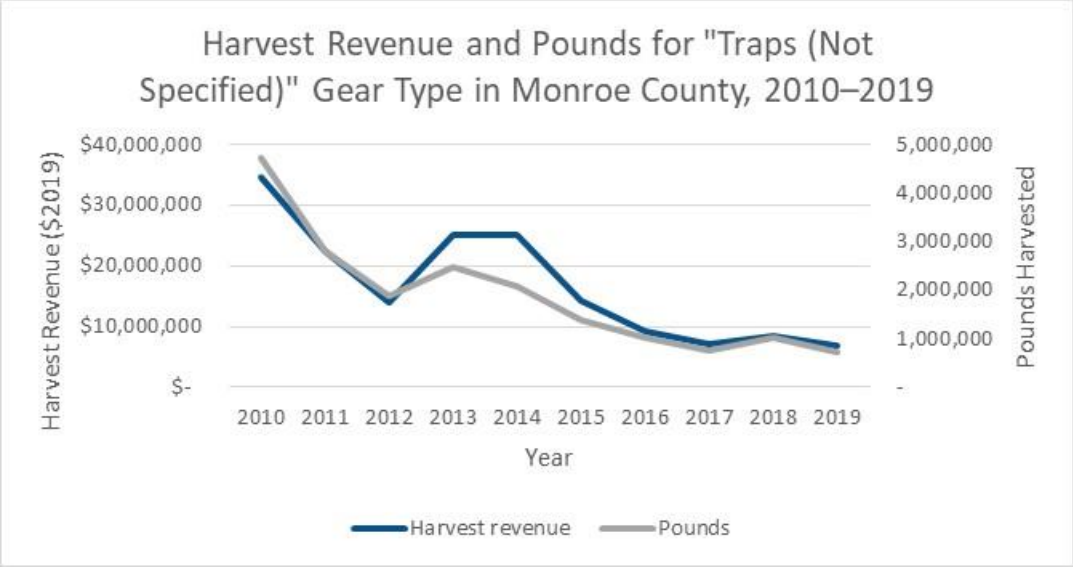

Figure A.14. Harvest revenue and pounds landed for traps (not specified) gear in Monroe County, 2010–2019 (2019 dollars). Source: FWC, 2021

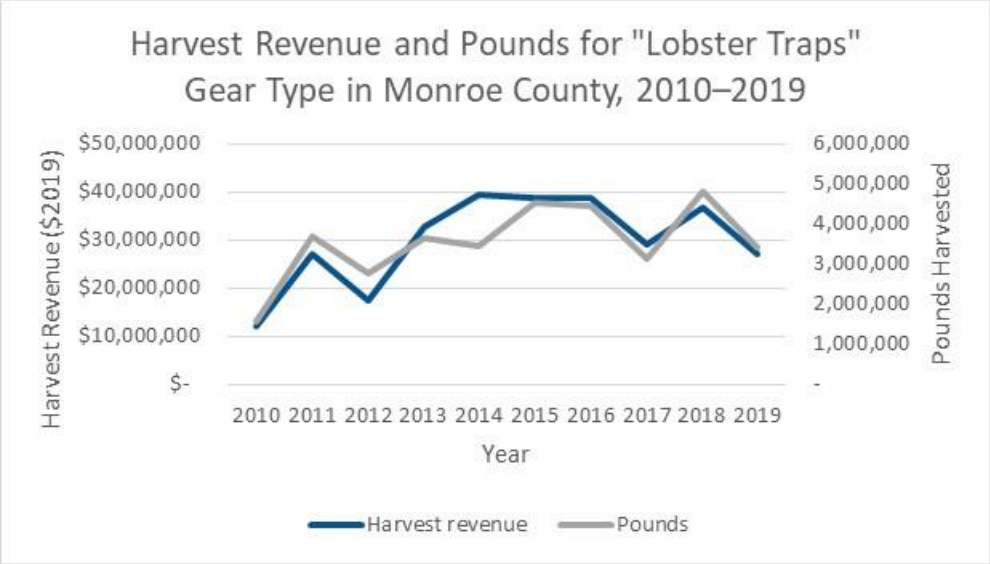

Figure A.15. Harvest revenue and pounds landed for lobster traps in Monroe County, 2010–2019 (2019 dollars). Source: FWC, 2021

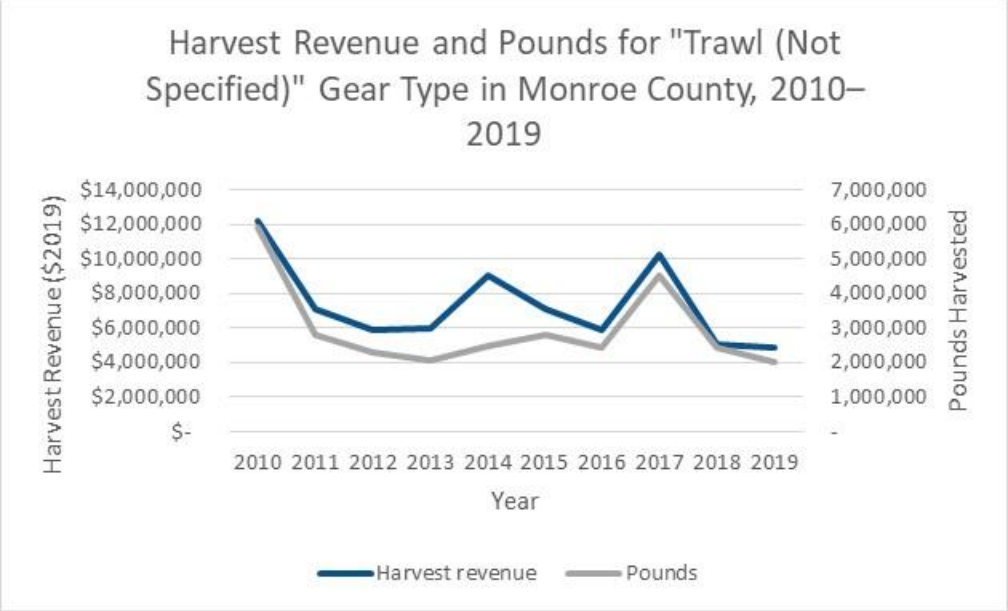

Figure A.16. Harvest revenue and pounds landed for trawl (not specified) gear in Monroe County, 2010–2019 (2019 dollars). Source: FWC, 2021

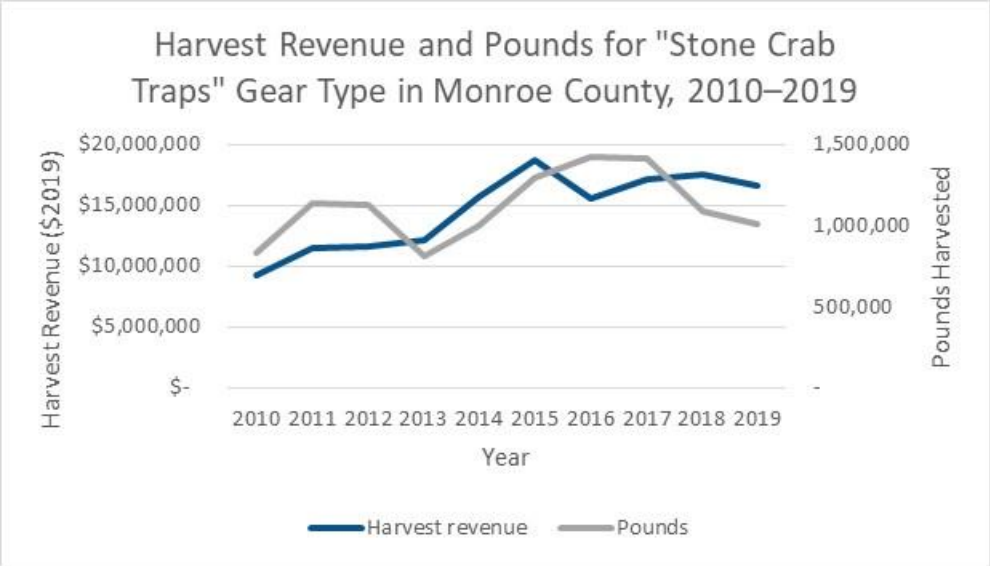

Figure A.17. Harvest revenue and pounds landed for stone crab traps in Monroe County, 2010–2019 (2019 dollars). Source: FWC, 2021

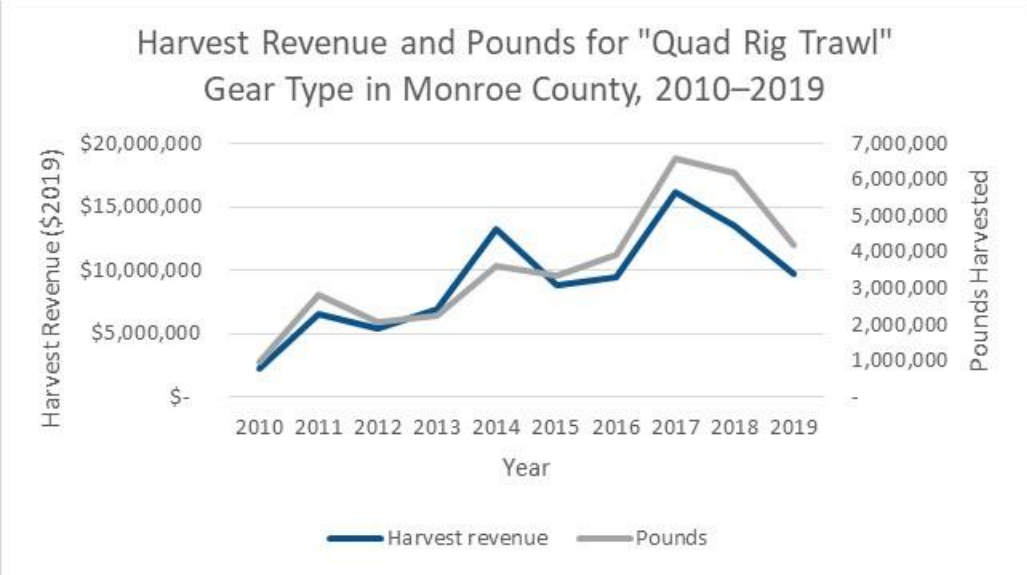

Figure A.18. Harvest revenue and pounds landed for quad rig trawl gear in Monroe County, 2010–2019 (2019 dollars). Source: FWC, 2021

Trends in Harvest Revenue and Pounds Landed for FKNMS-Associated Statistical Areas

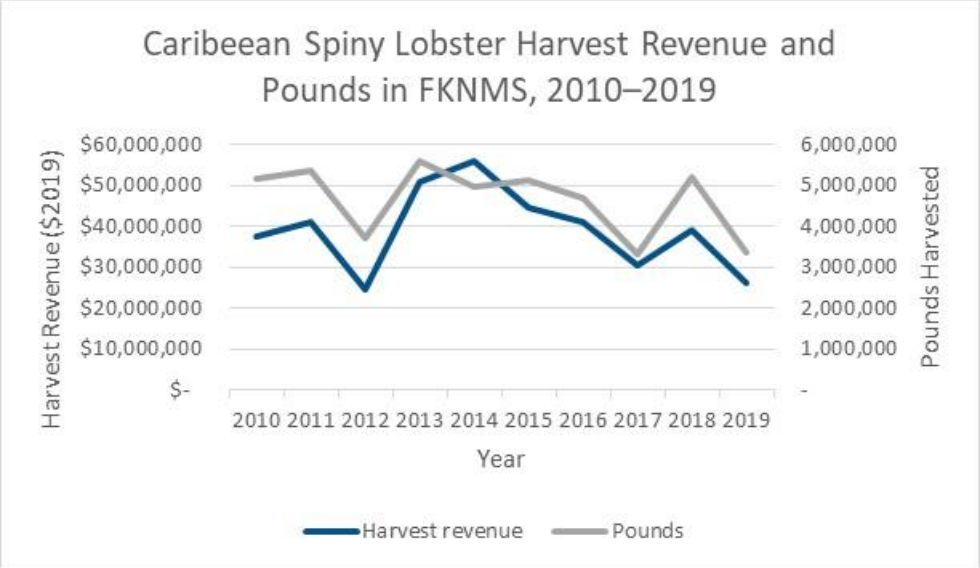

Figure A.19. Caribbean spiny lobster harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

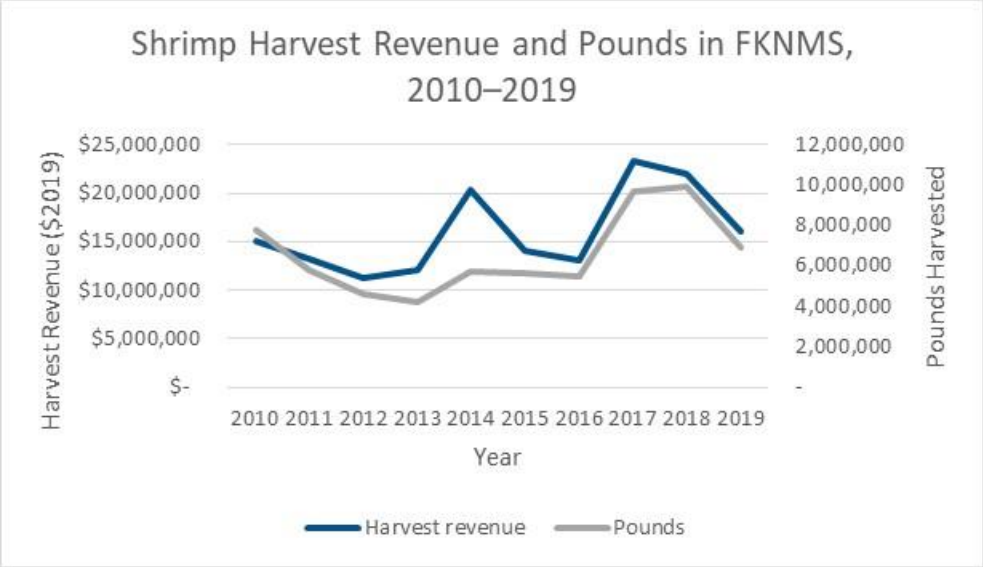

Figure A.20. Shrimp harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

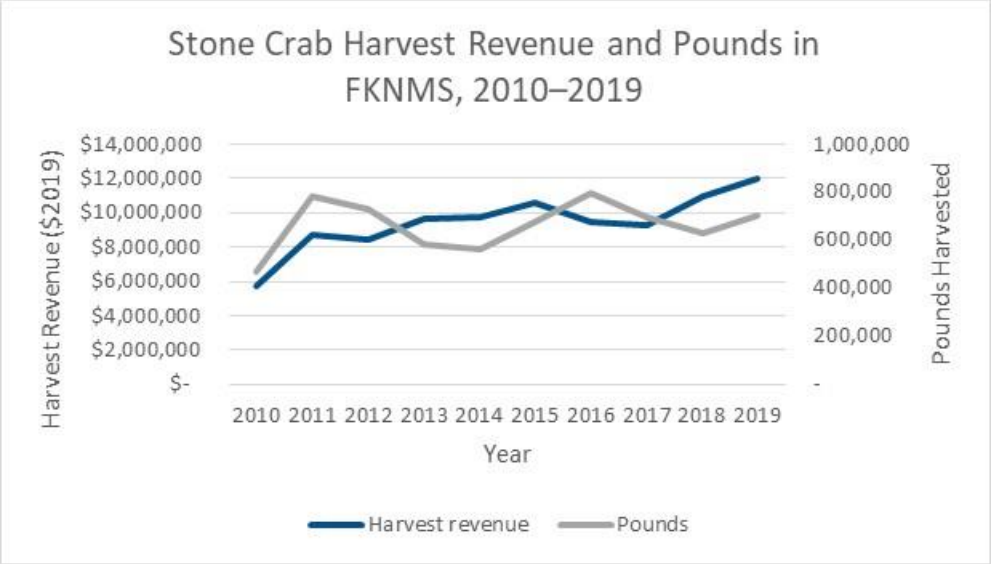

Figure A.21. Stone crab harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

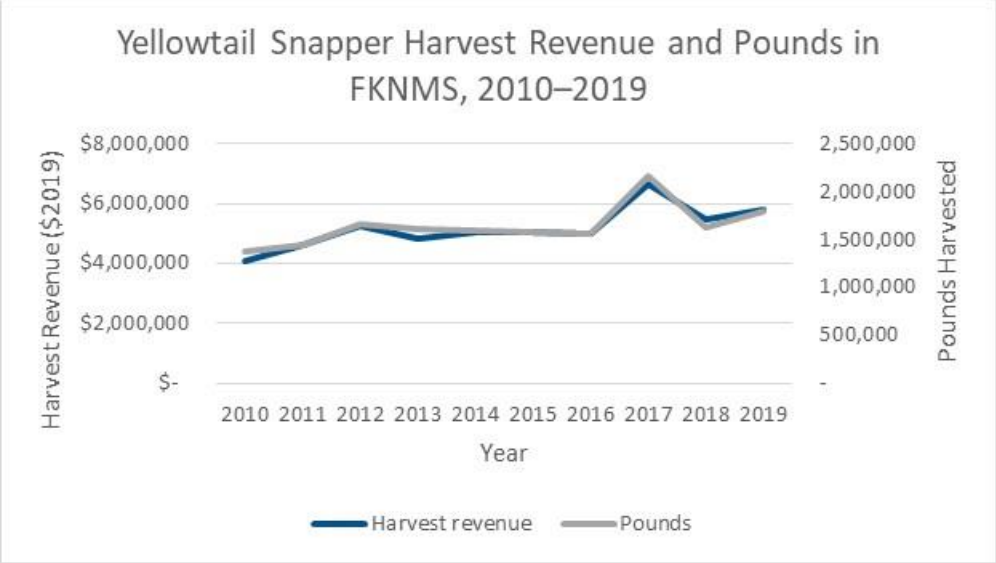

Figure A.22. Yellowtail snapper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

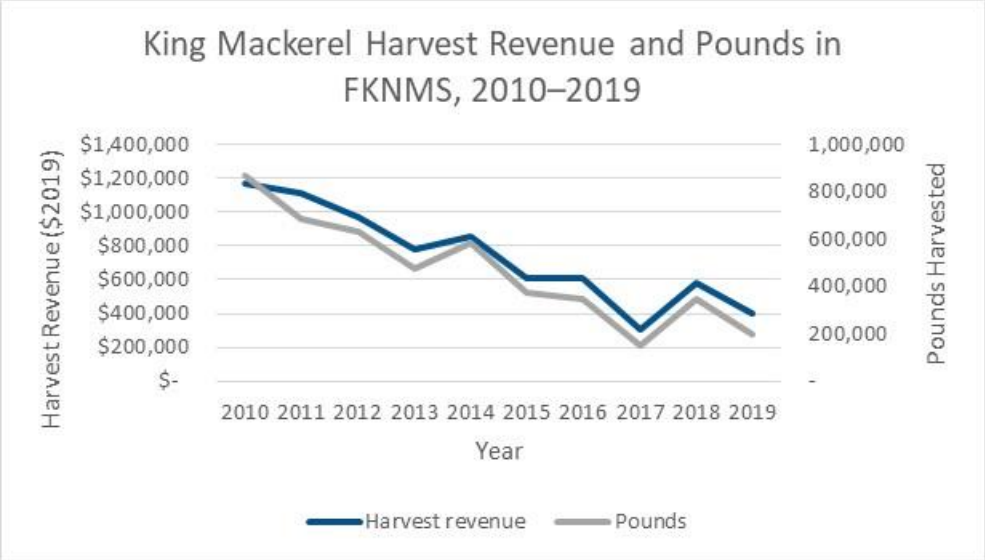

Figure A.23. King mackerel harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

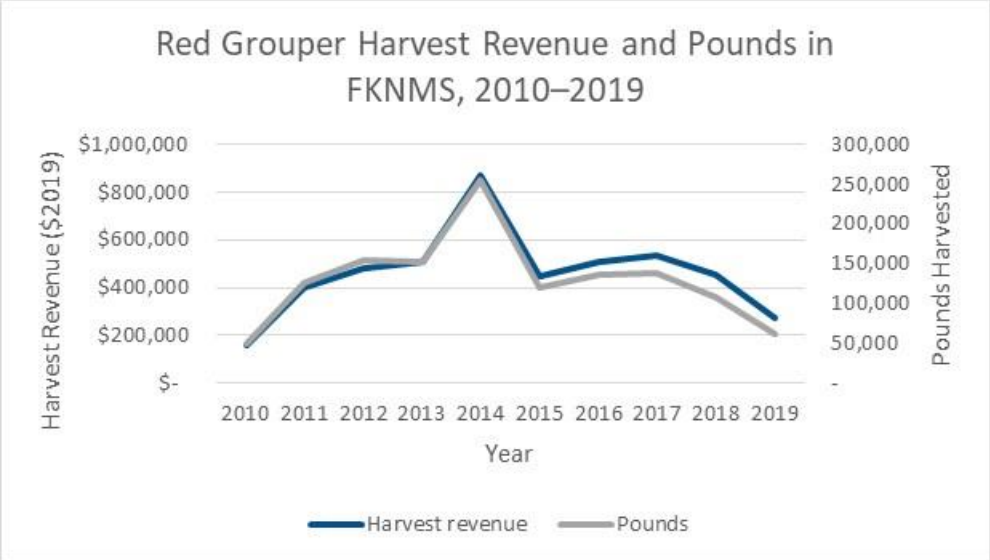

Figure A.24. Red grouper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

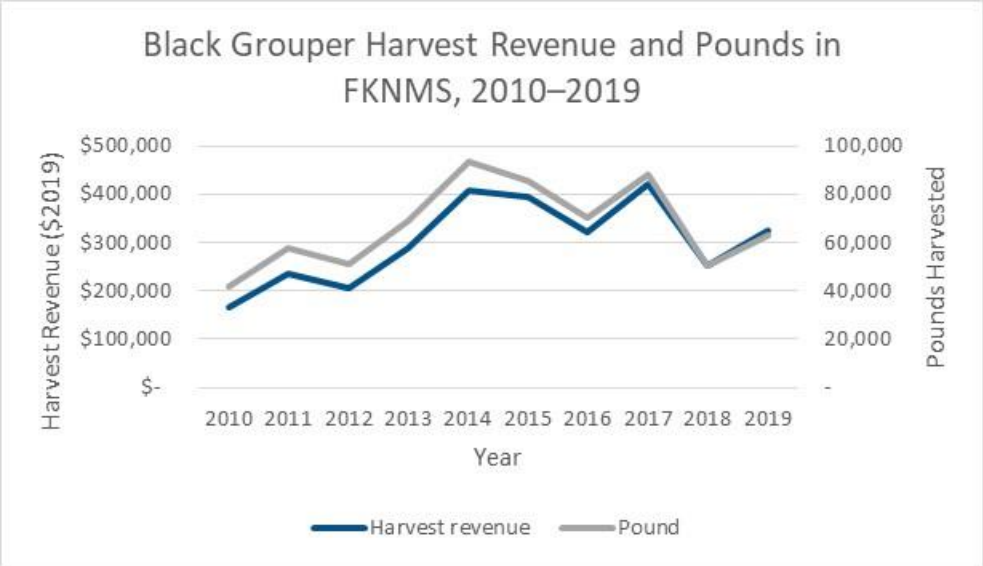

Figure A.25. Black grouper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

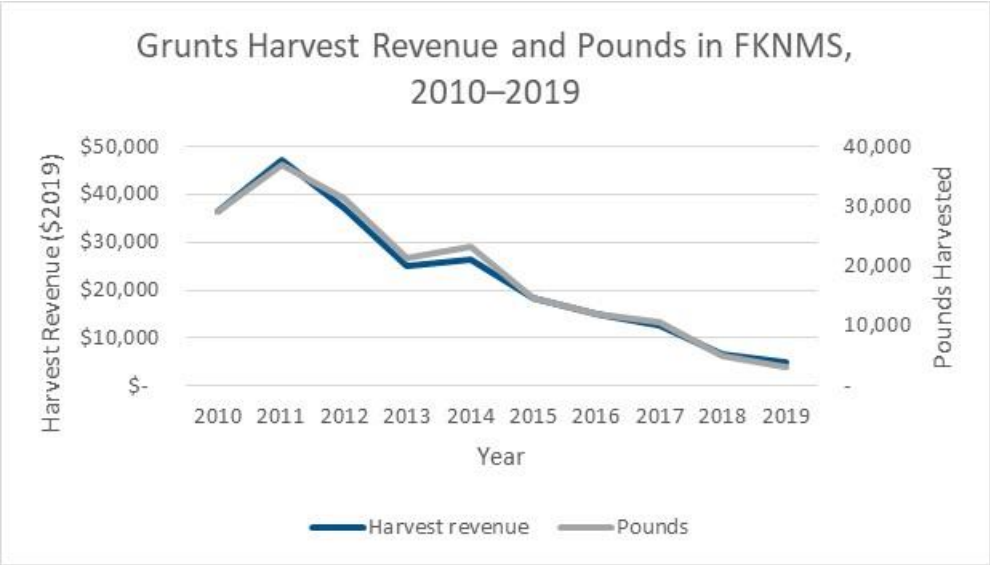

Figure A.26. Grunts harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

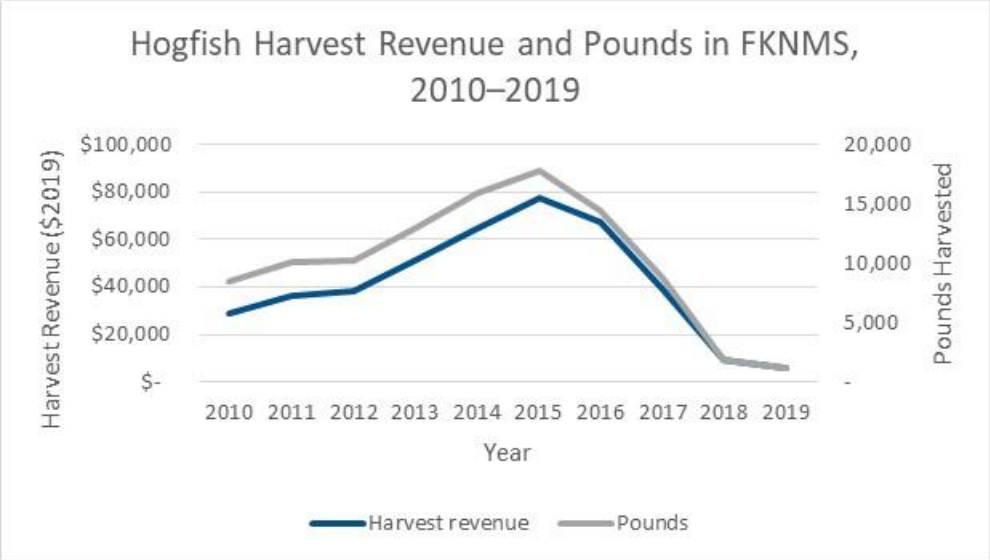

Figure A.27. Hogfish harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

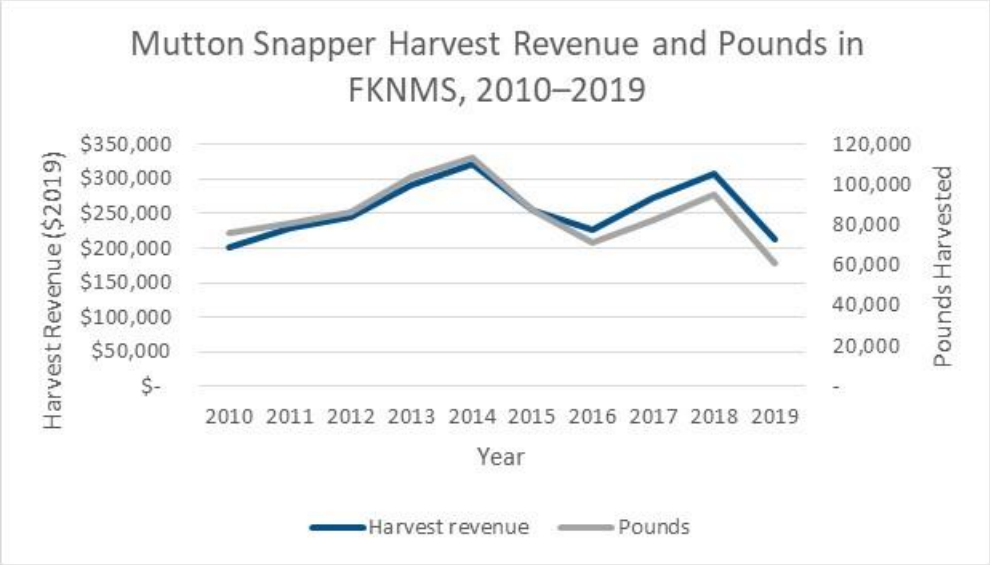

Figure A.28. Mutton snapper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

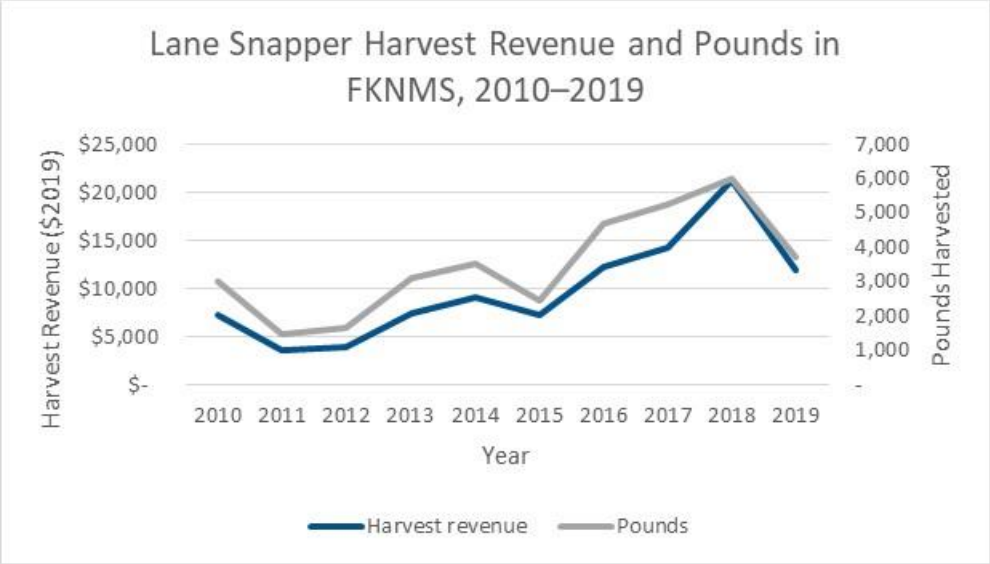

Figure A.29. Lane snapper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

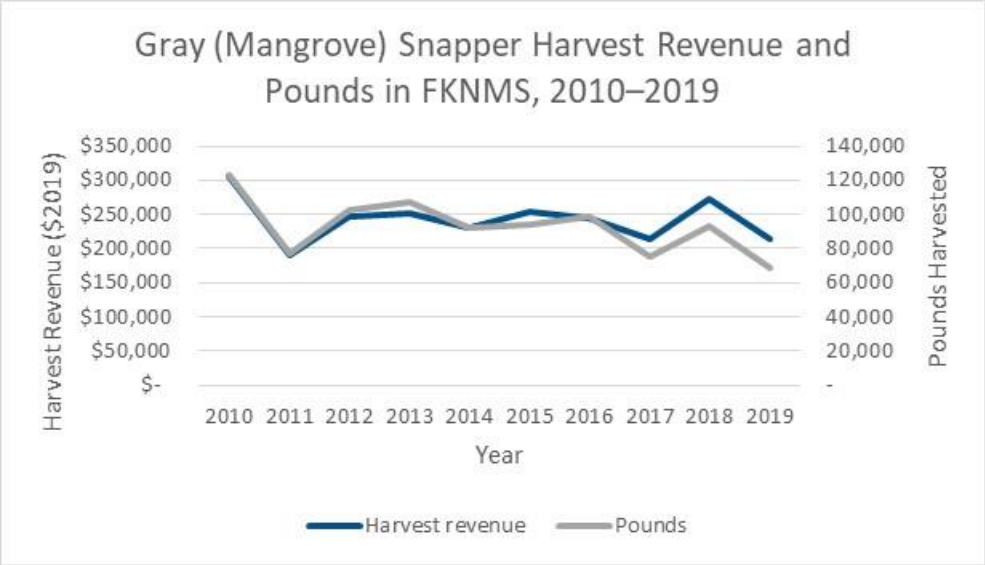

Figure A.30. Gray (mangrove) snapper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

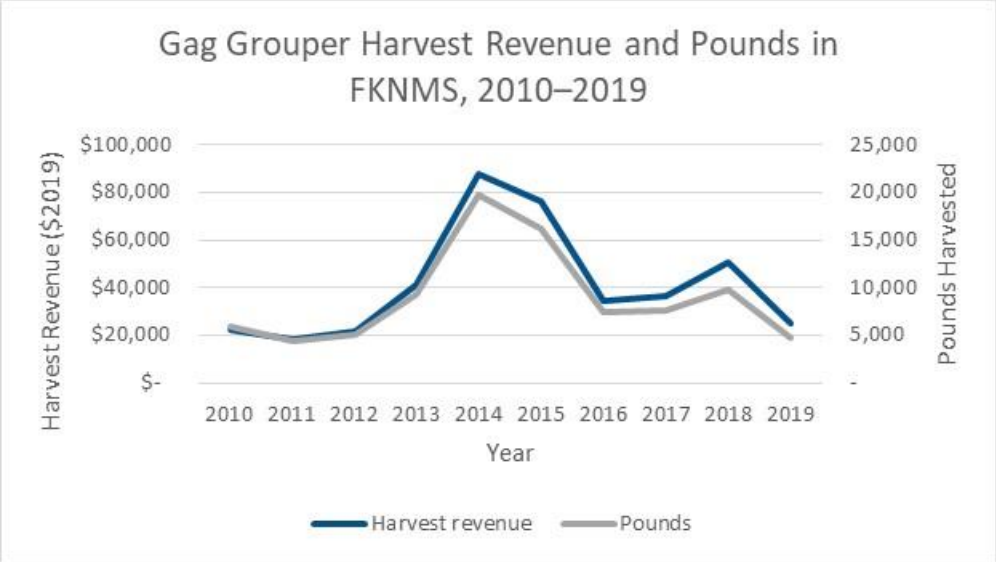

Figure A.31. Gag grouper harvest revenue and pounds landed within FKNMS-associated statistical areas (2019 dollars). Source: FWC, 2021

Trends in Gear Type by Harvest Revenue and Pounds for FKNMS Associated Statistical Areas

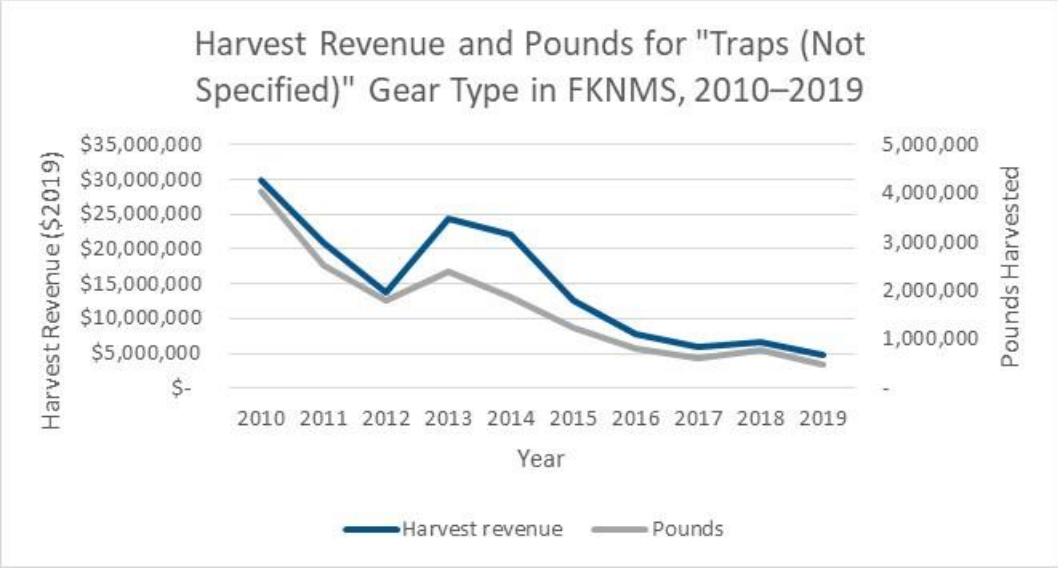

Figure A.32. Harvest revenue and pounds landed for traps (not specified) in FKNMS, 2010–2019 (2019 dollars). Source: FWC, 2021

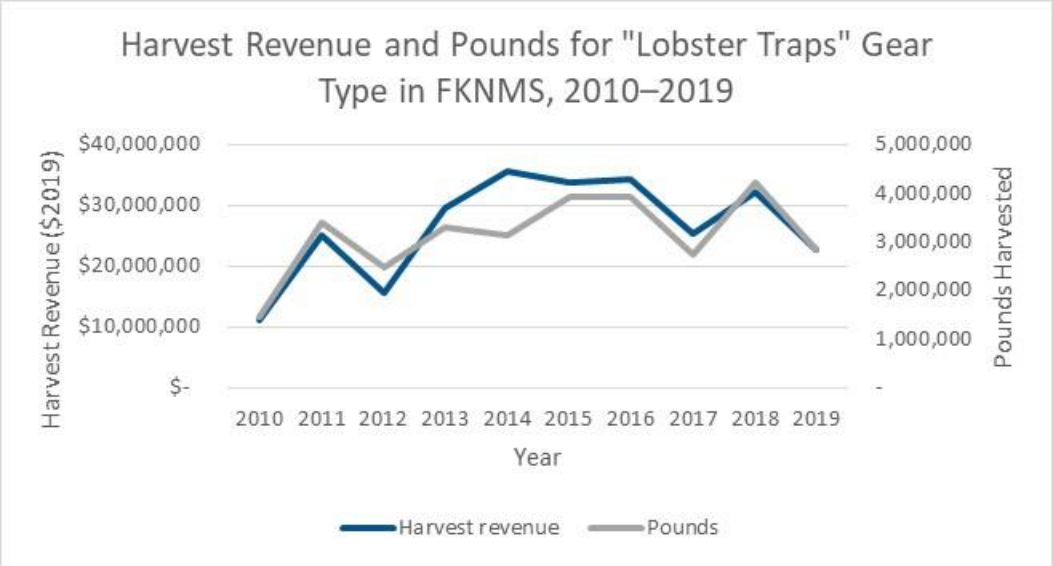

Figure A.33. Harvest revenue and pounds landed for lobster traps in FKNMS, 2010–2019 (2019 dollars). Source: FWC, 2021

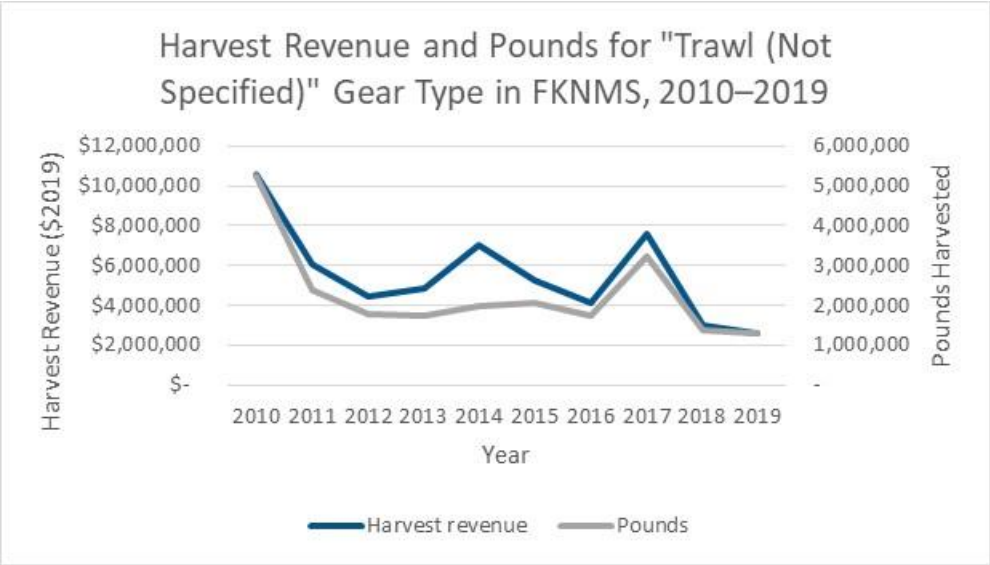

Figure A.34. Harvest revenue and pounds landed for trawl (not specified) gear in FKNMS, 2010–2019 (2019 dollars). Source: FWC, 2021

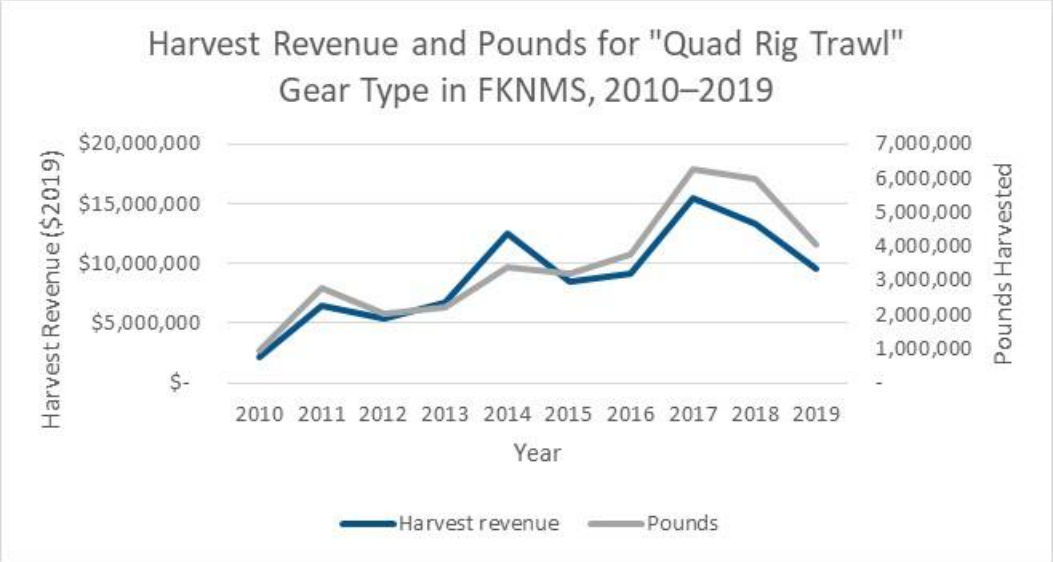

Figure A.35. Harvest revenue and pounds landed for quad rig trawl gear in FKNMS, 2010–2019 (2019 dollars). Source: FWC, 2021

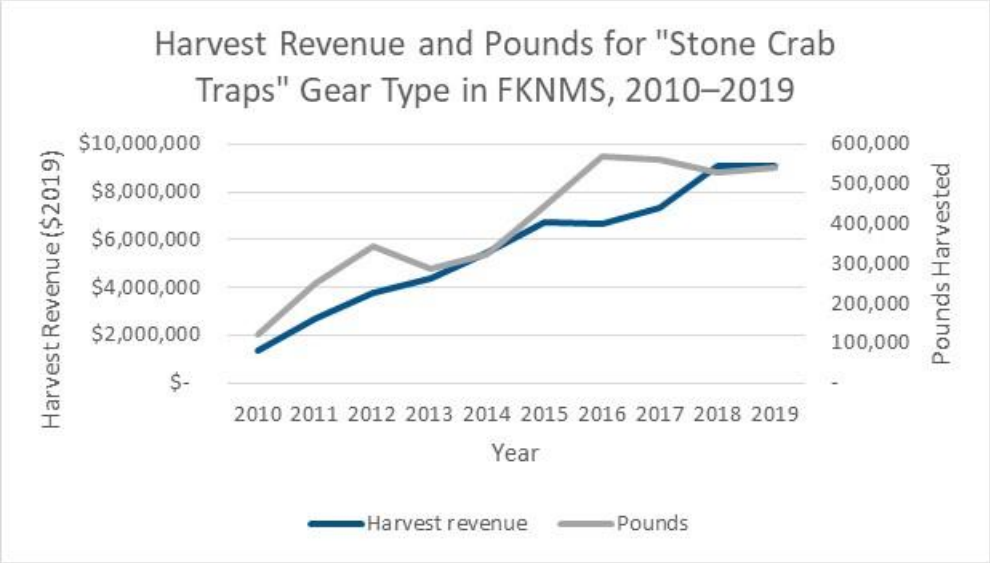

Figure A.36. Harvest revenue and pounds landed for stone crab traps in FKNMS, 2010–2019 (2019 dollars). Source: FWC, 2021

Appendix B:
Baitfishing Analysis Supplementary Tables and Figures

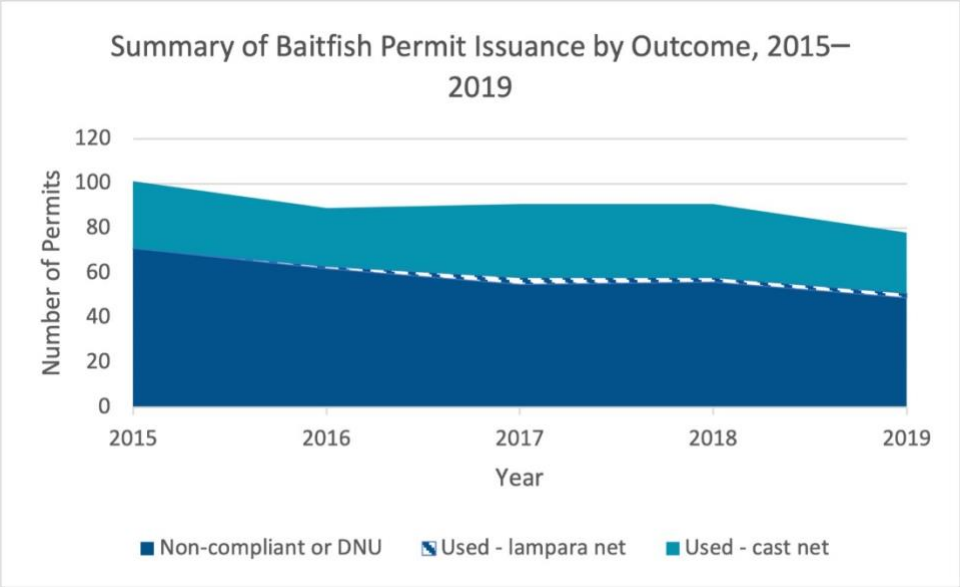

Figure B.1. Number of baitfish permits issued by outcome, 2015–2019 (DNU = “did not use”). Source: FKNMS, 2021

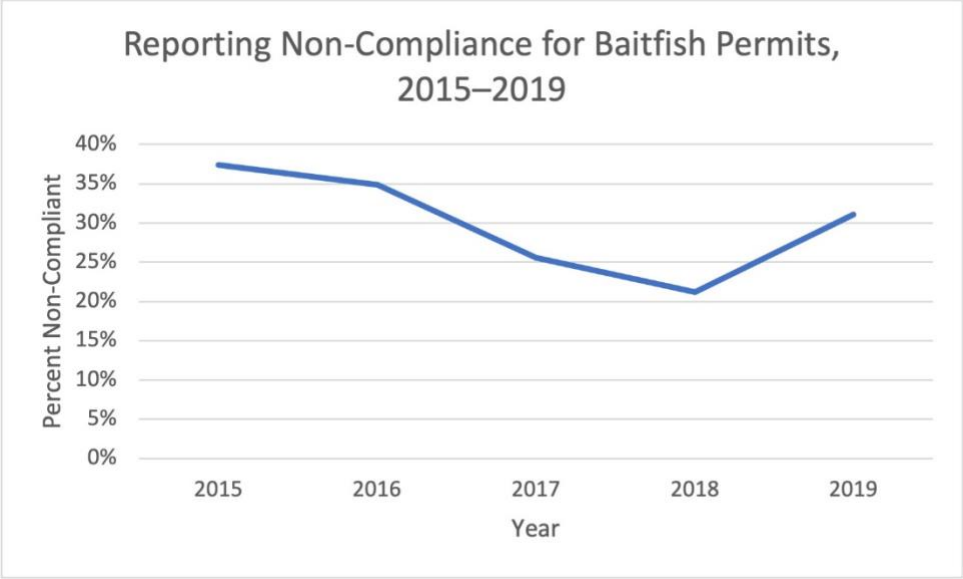

Figure B.2. Rate of non-compliance with baitfish reporting requirements, 2015–2019. Source: FKNMS, 2021

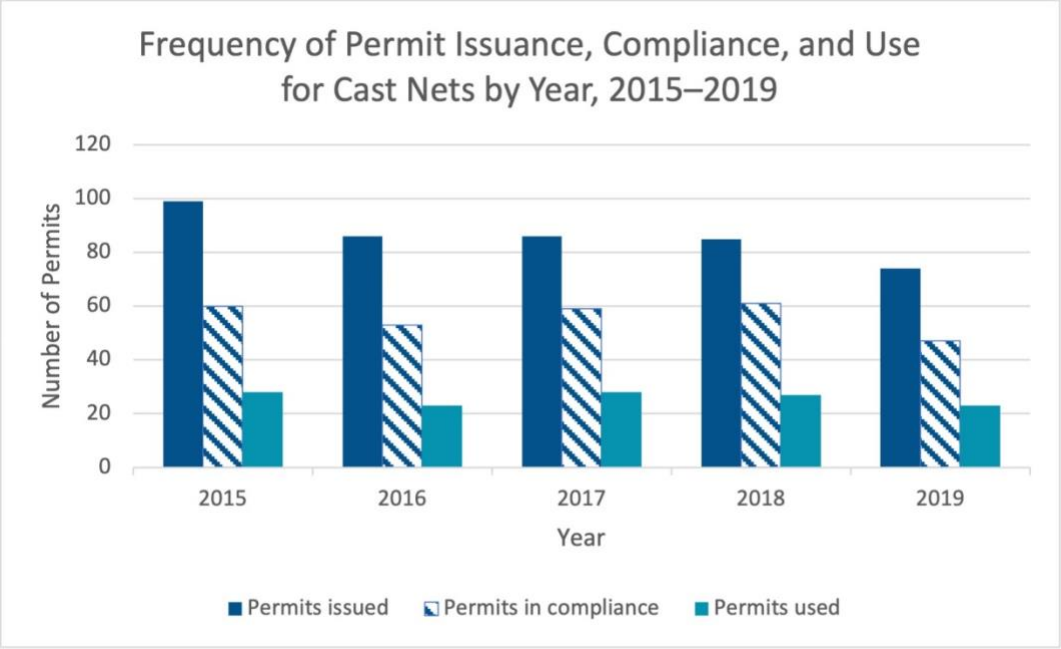

Figure B.3. Summary of cast net permit compliance and use, 2015–2019. Source: FKNMS, 2021

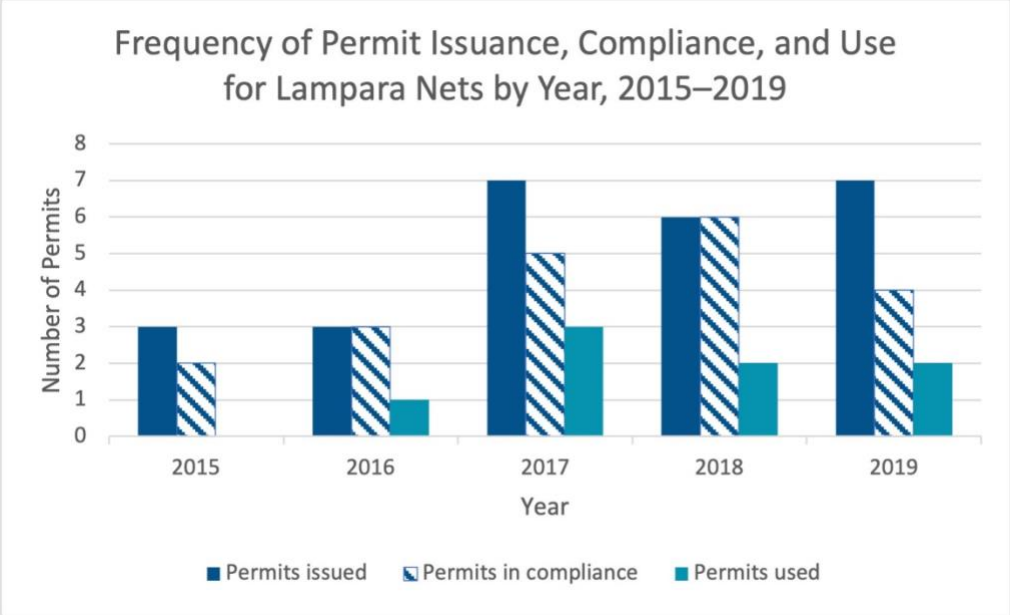

Figure B.4. Summary of lampara net permit compliance and use, 2015–2019. Source: FKNMS, 2021

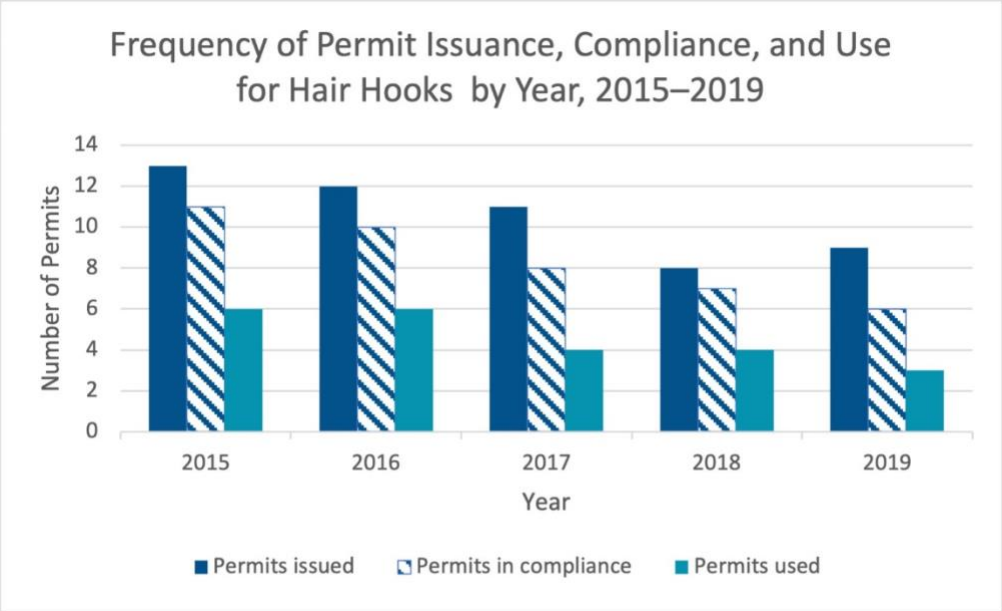

Figure B.5. Summary of hair hook permit compliance and use, 2015–2019. Source: FKNMS, 2021

Table B.1. Sanctuary preservation area (SPA) cast net baitfish permit holders' dependency on SPAs: Catch and effort, 2015–2019. Source: FKNMS, 2021

Year	Days in SPAs	Days Out of SPAs	Total Days Bait Fishing	% of Days in SPAs	Catch in SPAs (lbs)	Catch Out of SPAs (lbs)	Total Baitfish Catch (lbs)	% of Catch in SPAs
2015	134	87	221	60.6%	934	403	2,585	36.1%
2016	92	137	229	40.2%	608	738	1,346	45.1%
2017	86	143	229	37.6%	820	1,265	2,085	39.3%
2018	94	115	209	45.0%	2,024	1,762	3,786	53.5%
2019	83	110	193	43.0%	1,951	446	2,397	81.4%
5-year average	98	118	216	45.2%	1,267	923	2,440	51.9%

Table B.2. Sanctuary preservation area (SPA) lampara net baitfish permit holders' dependency on SPAs: Catch and effort, 2015–2019. Source: FKNMS, 2021

Year	Days in SPAs	Days Out of SPAs	Total Days Bait Fishing	% of Days in SPAs	Catch in SPAs (lbs)	Catch Out of SPAs (lbs)	Total Baitfish Catch (lbs)	% of Catch in SPAs
2015	0	3	3	0.0%	0	17	17	0.0%
2016	3	0	3	100.0%	86	0	86	100.0%
2017	0	4	4	0.0%	6,778	7	6,785	99.9%
2018	5	9	14	35.7%	5,990	12	6,002	99.8%
2019	12	6	18	66.7%	27,054	18	27,072	99.9%
5-year average	4	4.4	8.4	40.5%	7,982	11	7,992	79.9%

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