

Socioeconomic Impact Analysis of Boundary Expansion in Flower Garden Banks National Marine Sanctuary, 2013



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Cover Photo:

Fish swim at a brightly colored reef in Flower Garden Banks National Marine Sanctuary. Photo: G.P. Schmahl/NOAA





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Abstract

This report provides a socioeconomic impact analysis for expanding the boundaries of Flower Garden Banks National Marine Sanctuary (FGBNMS). Quantitative aspects of the analysis are based on a baseline study of use for a study area in the northwest Gulf of Mexico containing several banks that are being evaluated for expanding the current sanctuary. Use is by commercial fishing operations, for-hire recreational fishing operations more commonly referred to as charter and party/head boat operations, and the for-hire recreational dive operations. For the commercial fishery, use is measured as pounds and revenue received by the fishermen by species/species groups and type of gear. For the recreational for-hire industry, use is measured in person-days. Costs-and-earnings are obtained for all operations and from that economic performance measures are derived. For the commercial fishing operations, performance measures developed were profits per unit of revenue and return on investment, while for the recreational for-hire industry performance measures were profits per person-day and return on investment. Demographic profiles of owner/operators of the operations were also obtained to support socioeconomic impact assessments of regulations. Spatial use was also obtained to assess impacts of boundary expansion of the sanctuary or any future marine zoning. Results for the “for-hire” recreational dive industry use could not be reported here because there is only one operation currently operating in the northwest Gulf of Mexico study area. Quantitative assessments were limited to three of the five alternatives assessed here since two alternatives include areas outside the northwest Gulf of Mexico study area. Only longlining is displaced for the commercial fishing industry and spearfishing for recreational fishing, both of which are very small impacts for which we conclude could be offset by substituting to other areas. An additional possible impact to the commercial and recreational fishing industries is the no anchoring regulation, but this is limited to a very small portion of total fishing catch and effort and could be offset and/or mitigated by substituting to other areas or provision of mooring buoys. The oil and gas industry is also potentially impacted by the requirement to vertically shunt their pollutants for platforms inside sanctuary boundaries, but these costs are judged to be minor. The benefits of expanding the sanctuary is dominated by what are called passive economic use values or non-use values. Even using lower bound estimates for these benefits, the benefits of boundary expansion far exceed the costs and are net benefit to the nation.



Key Words

commercial fishing, recreational fishing, recreational diving, for-hire operations, charter boat, party boat, costs-and-earnings, demographic profiles, socioeconomic, passive economic use value, oil and gas

CHAPTER 1. INTRODUCTION

This report provides a socioeconomic impact analysis of different boundary expansion alternatives for Flower Garden Banks National Marine Sanctuary (FGBNMS). The quantitative analyses of the socioeconomic impact is limited to the additional banks in the northwest Gulf of Mexico (NWGOM) geographic area that includes a 5,775 one-minute by one-minute (one nautical square mile) grid cell, or 5,775 nautical square miles. This area is called the NWGOM Study Area (Figure 1.1). Information was obtained on the uses of this area from a survey of commercial fishing operations, for-hire recreational fishing operations (more commonly known as charter boats and party boats), and for-hire diving operations.¹ The potential impacts for the oil and gas industry were conducted in a separate report in 2010 (Wolfe 2010). Information obtained on access for recreation use by private vessels was obtained through the surveys of commercial fishing operations, for-hire recreational fishing operations, and for-hire diving operations by asking them if they see private vessels operating in the NWGOM Study Area. All said they did not. However, personal communications with one FGBNMS Sanctuary Advisory Council member and for-hire guide provided estimates for the number of private vessels that access Stetson Bank for fishing when weather permits (Stout 2010). We also accessed satellite data for seven years and the most boats at Stetson Bank on any given day was a maximum of four. Passive economic use value or more commonly referred to as non-use economic value is based on a study by Stefanski and Shimshack (2016).

The boundary expansion evaluation took place over many years. The NWGOM Study Area was the original scope of area for considering adding new banks by FGBNMS management and the Sanctuary Advisory Council. Subsequent to the survey data collections and oil and gas analysis, the National Oceanic and Atmospheric Administration (NOAA)/FGBNMS management added two boundary expansion alternatives that included additional banks to the east of the NWGOM Study Area, so our analyses here can only address these additional banks from a qualitative perspective on potential socioeconomic impacts. All the banks in NOAA's preferred alternative and Alternative 2 are in the NWGOM Study Area.

¹ This research was paid for by a grant with the National Marine Sanctuary Foundation provided to Will Heyman, with Texas A&M University, who completed the data collection effort.

Originally, the contractor collecting the survey information reported that all commercial fishing operations, for-hire recreational fishing operations, and for-hire diving operations that operated in the NWGOM Study Area were included in the survey. Thus, we thought we had a “census” of all operations potentially impacted. Subsequently we learned that some operators refused the survey. The operators were informed of the FGBNMS evaluation of boundary expansion, but these operators did not think their operations would be significantly impacted since they did not depend on the area for much of their business.

Baseline socioeconomic profiles of the six commercial fishing operations and eight for-hire recreational fishing operations are presented here. For the for-hire dive industry, only two operations were identified and completed the survey, and one is no longer operating in the area. Therefore, due to the requirement of protecting privacy, the for-hire diving operation data cannot be summarized here, but can be used in the analyses.

Boundary Expansion Alternatives. Five boundary expansion alternatives are analyzed here. One alternative is labeled the “preferred alternative,” which is the alternative preferred by NOAA and FGBNMS management. Two alternatives (four and five) extend to banks east of the NWGOM Study Area; for these two alternatives, the quantitative analysis is limited to the banks in the in the NWGOM Study Area. Each of the alternative geographic areas are detailed in the regulatory analysis section.

Time Dimension of the Regulatory Analysis. The time dimensions of analyses include a short-term potential impact (five years or less) and a long-term potential impact (beyond five years) for assessing potential costs and benefits of each boundary expansion alternative.

Potential Costs

The potential costs of boundary expansion include the economics concept of “opportunity costs” of extending the existing regulations of FGBNMS to the boundary expansion areas. Opportunity costs include lost revenue and profits to businesses and value lost to consumers, called consumer surplus or the amount of value over above what a consumer pays for a good or service. Opportunity costs can also include benefits lost by the lack of resource protection or improvement and can include lost potential revenue and profits to businesses and consumers’ surplus that could potentially be achieved by future resource protections.



For the commercial fisheries, potential costs include the displacement of all non-hook-and-line fishing. Long-lines are considered non-hook-and-line fishing and are prohibited. The no anchoring regulation may impact some hook-and-line fishing which may require anchoring at night (e.g., fishing for vermillion snapper). The amount of catch impacted is not likely to be of a magnitude to affect the prices of fish and therefore would cause zero to minimal impacts to consumer's surplus for fishery products. All costs are potentially mitigated or offset by substitution to other areas for fishing or installation of mooring buoys. An additional opportunity cost would potentially include future fishing by operations not currently fishing in the boundary expansion areas that might want to fish there in the future.

For the recreational fisheries, potential costs include the displacement of all non-hook-and-line fishing. Spearfishing is the only type of recreational fishing that is prohibited. Businesses that provide goods and services could potentially lose revenues and profits and recreational fishermen could suffer losses in consumers' surplus. As with the commercial fisheries, the no anchoring regulation may potentially impact those fishing at night for vermillion snapper, but this is a very small portion of recreational fishing effort in the NWGOM Study Area. All costs are potentially mitigated or offset by substitution to other areas to fish or installation of mooring buoys.

For-hire dive operations would only be potentially impacted by the no anchoring regulation. The costs of this regulation could be mitigated or offset by substitution to other areas, and could be mitigated or eliminated by installation of mooring buoys.

Access by private vessels are currently limited to those recreational fishing for a few days per year when the weather permits (Stout 2010). Since all this fishing is hook-and-line fishing, no costs are expected on this user group. In the long-term, scarcity of fish stocks due to rising demand relative to supply could result in opportunity costs in the banks of the expansion areas and losses to businesses in revenue and profits that provide goods and services to recreational fishermen and losses in consumers' surplus to recreational fishermen. This might occur if there were no good substitutes available to fish. However, due to the long distances from ports to the banks in the NWGOM Study Area and the many other areas available, the probability of any negative impacts is extremely small.

The oil and gas industry is not prohibited in FGBNMS. One platform currently exists in FGBNMS but must avoid sensitive benthic communities and must shunt all drill cuttings and fluids to within 10 meters of the seafloor.

Benefits

If the added protections provided by FGBNMS regulations on the boundary expansion areas results in improvements in the quantity and quality of resources, all existing and future user groups, except oil and gas, could potentially benefit, especially over the long-term. Commercial and recreational fishers could potentially benefit from improved fishery stocks and/or larger fish. Divers could potentially benefit from improved abundance and diversity of resources. Businesses that supply goods and services could potentially benefit with increases in revenue and profits and recreational users could receive increases in consumers' surplus. Those who derive passive economic use value, more commonly referred to as non-use value, would potentially benefit from protections that maintain or improve resources in the future.

Baseline Profiles of Existing Users

The following profiles are limited to those operating in the NWGOM Study Area in 2013.

Commercial Fishing Operations. In June of 2010, NOAA's Office of National Marine Sanctuaries (ONMS) obtained vessel monitoring system (VMS) data on all commercial fishing vessels that operated in the NWGOM Study Area from NOAA Fisheries' Office of Law Enforcement.² VMS data provides latitude and longitude coordinates for all commercial fishing vessels in places where the vessels go. ONMS requested a list of all vessels observed in the NWGOM Study Area over a two-year period (2009-2010). ONMS received a list containing 76 vessels. The U.S. Coast Guard vessel identification numbers in the VMS data were then sent to the U.S. Coast Guard to get the name of the vessels, the vessel owners, and the addresses of the vessel owners. This information was later provided to the contractor hired to conduct the surveys of the commercial fishing operations operating in the NWGOM Study Area.

² Since ONMS is a managing agency, it has access to proprietary information for management purposes.

The contractor contacted the owners of all 76 vessels. Many owned several vessels on the list: about 40 different owners from Texas to Florida operated the 76 vessels. Operators were contacted by both mail and telephone and asked if they fished on any of the banks in the NWGOM Study Area (maps of the study area were sent via mail). Those who said they operated on the banks in the NWGOM Study Area were also asked who else they see out on the banks or if they knew of others that operate on the banks. Six operations were identified that fished on the banks in the NWGOM Study Area. Three operations refused the survey. They were informed about the plans to evaluate expanding FGBNMS to other banks. These operators did not think their operations would be significantly impacted so they did not think it worth providing information. We conclude that the estimates presented here represent as close to a census of all operations fishing on the banks in the NWGOM Study Area as is practical.

For-Hire Recreational Fishing Operations. The contractor identified all for-hire fishing operations through telephone books and other sources of information. Much of this effort was started as part of a class project and a follow-up effort between ONMS and Texas A&M University under the direction of Professor Will Heyman. The major focus was on all Texas ports and harbors that would access the NWGOM Study Area.

Again, all operations were screened for having fished on any of the banks in the NWGOM Study Area, and were asked who they saw or knew of who also operated on the banks. Eight fishing operations were identified. Three operators refused the survey. They were informed about the plans to evaluate expanding FGBNMS to other banks. These operators did not think their operations would be significantly impacted so they did not think it worth providing information. As with the commercial fishing operations, this was considered as close to a census as is practical for all for-hire recreational fishing operations that fish on the banks in the NWGOM Study Area.

For-Hire Recreational Diving Operations. As with the for-hire recreational fishing operations, the contractor identified all for-hire recreational diving operations through telephone books and other sources of information. Again, much of the effort was started as a class project at Texas A & M University. In conducting the surveys in 2013, each operator was asked for others they see or knew of who operate on the banks in the NWGOM Study Area. Only two operations were identified and one of these has moved out of the area and will no longer operate in the NWGOM Study Area. Because of rules for publishing results to protect privacy of the operations, the results are not presented here, but are used in the analyses.



Profiles of all operations include the following:

- Demographics of the operators/owners.
- Profiles of the businesses (e.g., ports of launch, number of years in operation, type of operation, number of vessels, and number of employees).
- Use, including total use and the spatial distribution of use throughout the NWGOM Study Area. Use for commercial fishing was measured in pounds of catch and revenue received for the catch by species groups, while person-days was measured for all for-hire recreational operations.
- Costs and earnings, including: total investment (replacement value of all vessels, equipment, and gear), trip-related costs, fixed costs, and profits. This information was then used to develop measures of performance: profits per unit of revenue and return on investment.
- Dependency: This included percentage of household and personal income from the business operation, and percentage of use dependent on the NWGOM Study Area and FGBNMS. This information can also be used to assess dependency on proposed expansion areas for FGBNMS.
- Knowledge, attitudes, and perceptions of FGBNMS management strategies and regulations. Some questions in this section refer to larger areas 1, 2, 3, and 4 (see Figure 1.2).

The report is organized as follows: first, baseline profiles are provided for each use/user group. Chapter 2 presents the results and discussion of findings of the survey questionnaires for commercial fishermen. Chapter 3 presents the results and discussion of findings of the survey questionnaires for for-hire recreational charter fishing boats. Chapter 4 presents the results and discussion of findings for private vessel access for recreational fishing, oil and gas, and passive economic use value. Chapter 5 presents the results of the socioeconomic impact analysis.

Northwest Gulf of Mexico Study Area

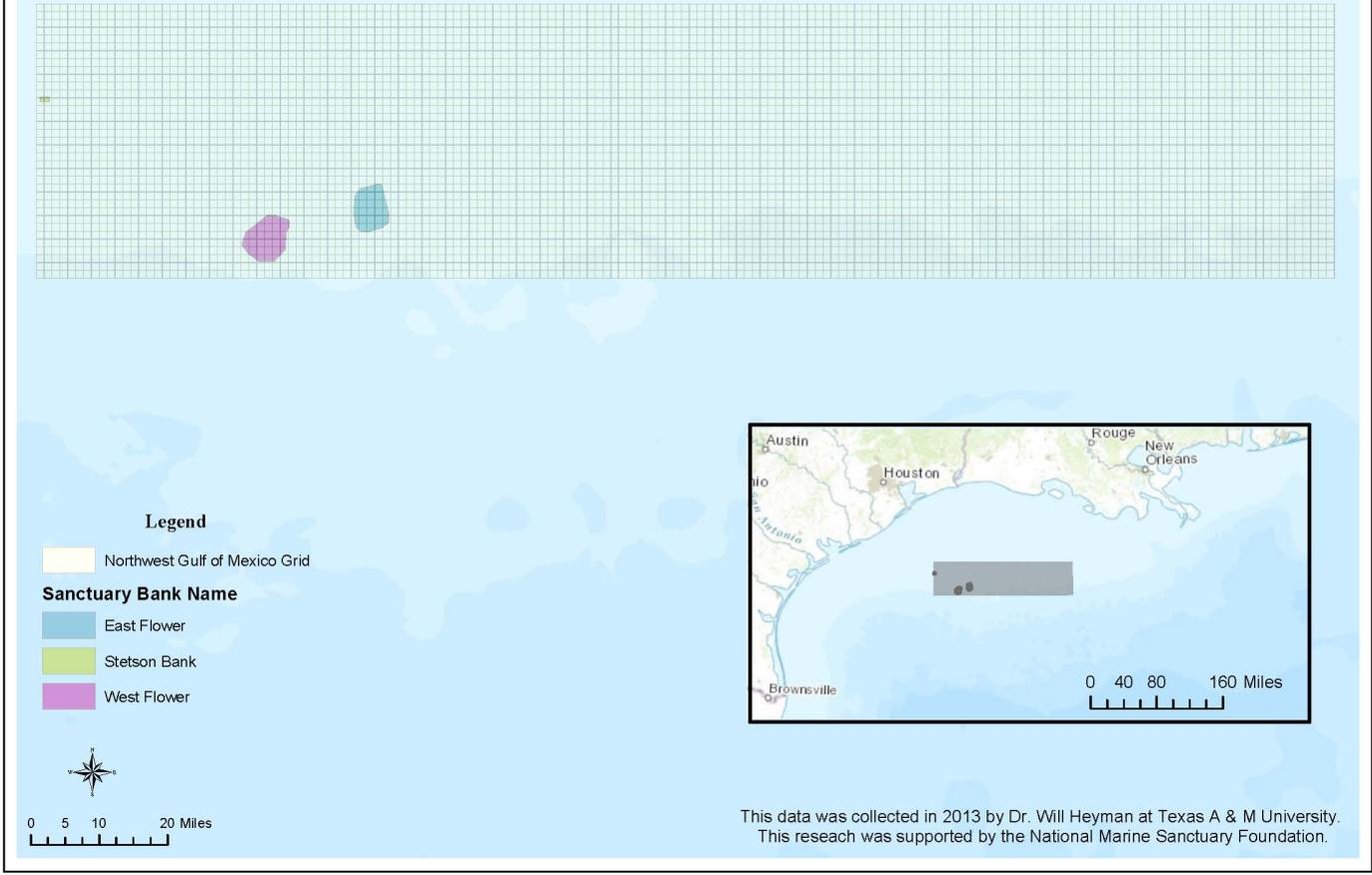


Figure 1.1 Northwest Gulf of Mexico Study Area and FGBNMS. Image: Tony Reyer/ONMS

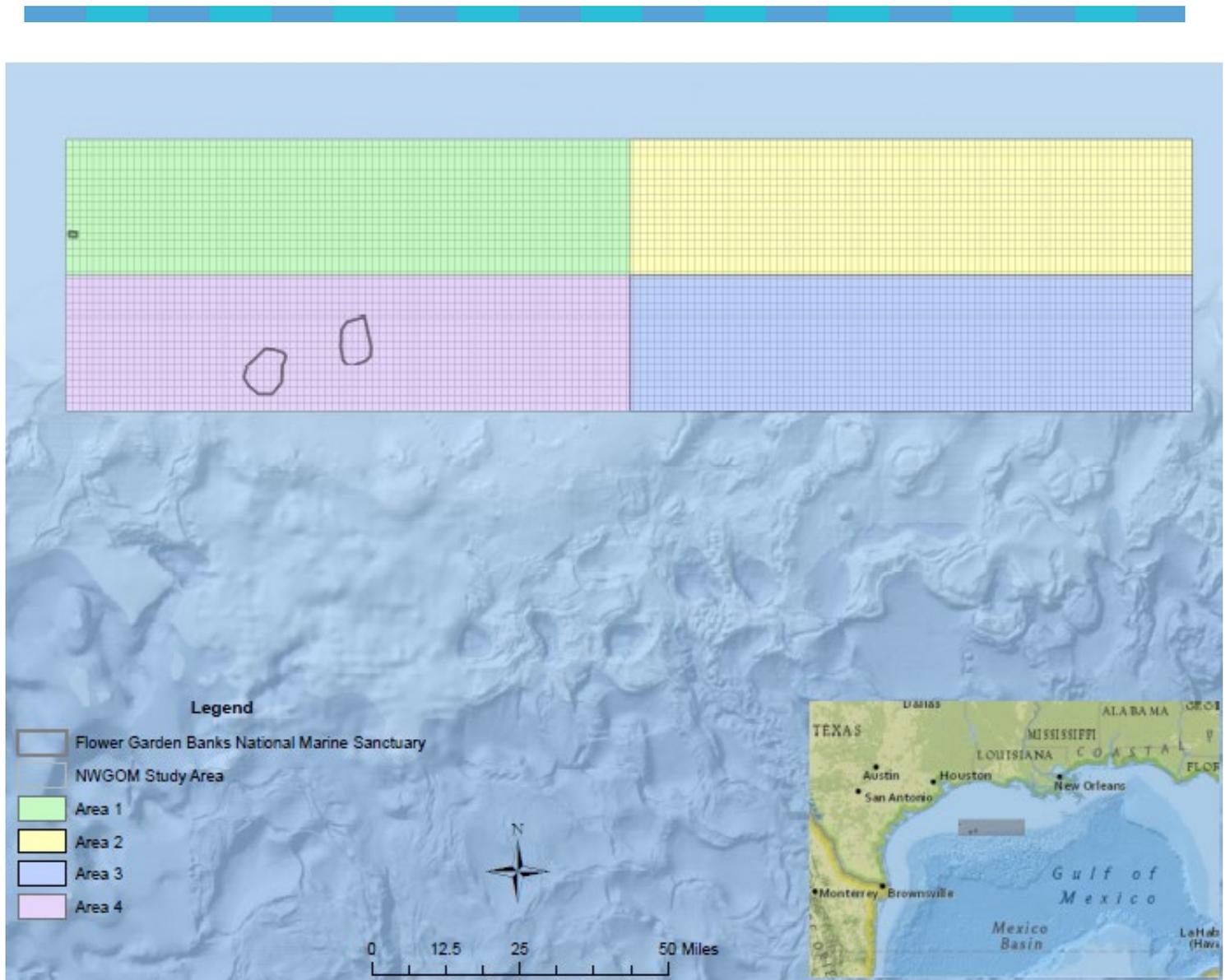


Figure 1.2 Northwest Gulf of Mexico Zones. Image: Tony Reyer/ONMS

CHAPTER 2. COMMERCIAL FISHING

Demographic Profiles

A total of six commercial fishing operation owners/operators responded to the survey.

Half the respondents were between 51 and 60 years old. The remaining three respondents were dispersed evenly among the other age categories. See Figure 2.1.

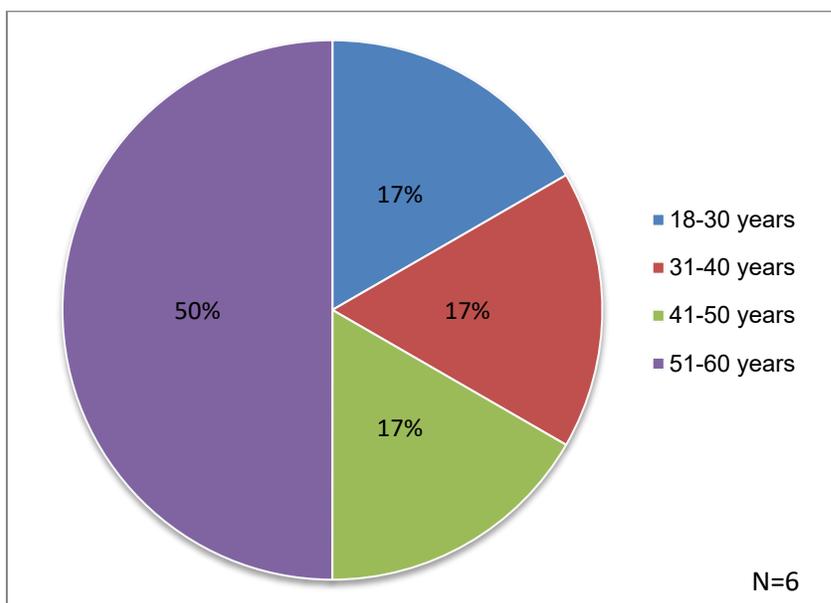


Figure 2.1 Age of Commercial Fishermen

All of the respondents were Caucasian and none of the respondents reported being Hispanic or Latino. The average number of family members of each commercial fishing operation owner/operator was 3.5 members. The largest family was six and the smallest was one. Figure 2.2 shows the distribution of family size.

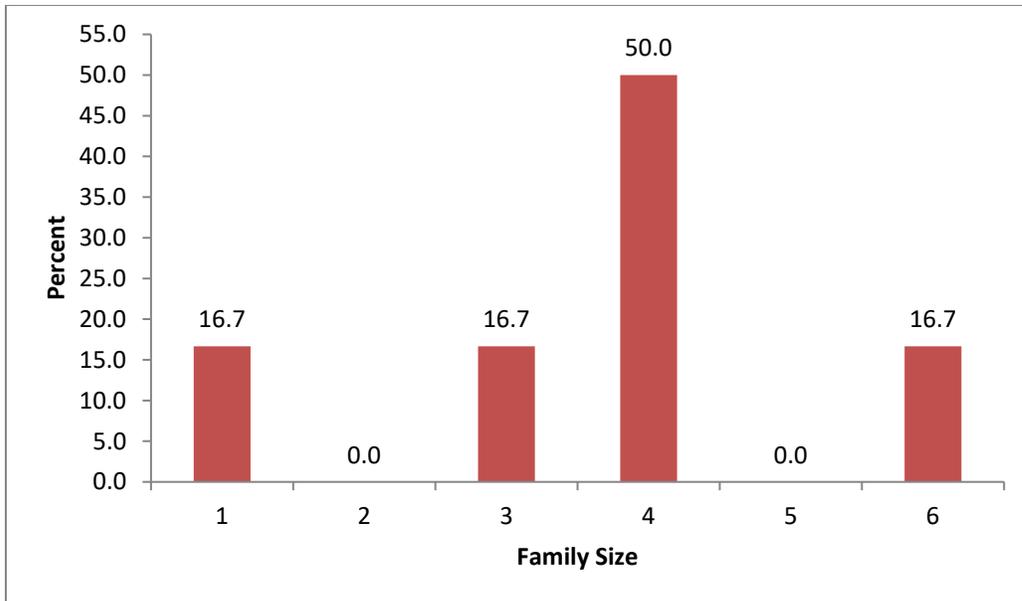


Figure 2.2 Distribution of Commercial Fishermen Family Size

Additionally, five of the six respondents belonged to a commercial fishing organization. Other organizations that respondents reported belonging to were chambers of commerce, environmental organizations, and veterans' groups (Figure 2.3).

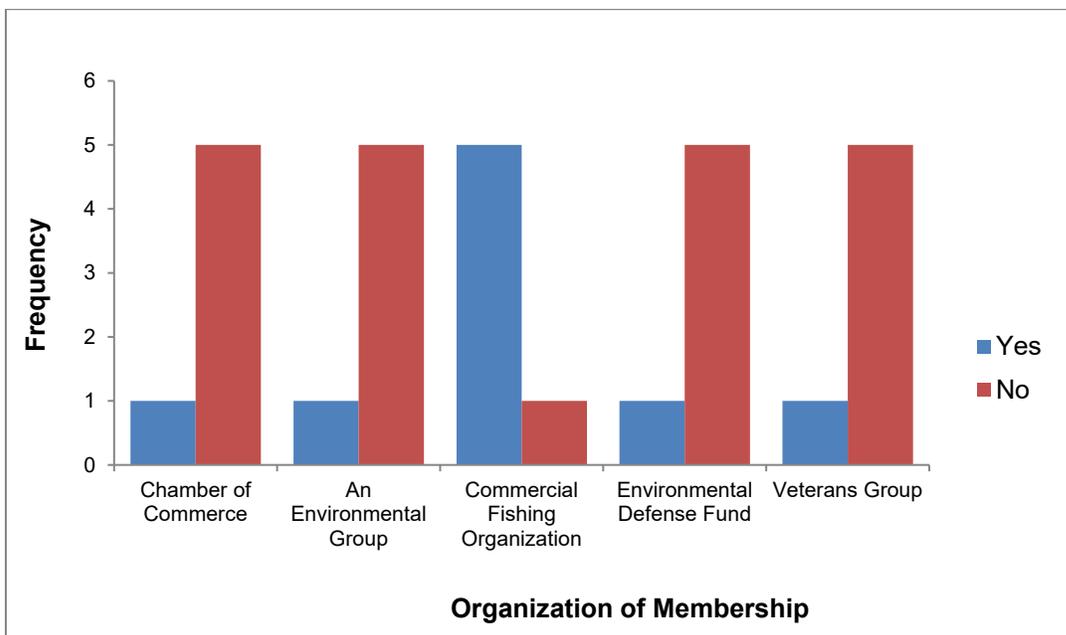


Figure 2.3 Memberships of Commercial Fishermen

Profile of Operations

Respondents were also asked about the primary and secondary ports from which they launch their boats. The primary port used by five of the six respondents was Galveston. Only two respondents reported using a secondary port, either Anahuac or Freeport (Table 2.1).

Table 2.1 Ports of Launch

Primary Port	Frequency	Percentage	Secondary Port	Frequency	Percentage
Bolivar	1	16.7%	Anahuac	1	16.7%
Galveston	5	83.3%	Freeport	1	16.7%

All the fishermen have at least 11 years of experience operating in the Gulf of Mexico. Five of the six respondents have fished in FGBNMS (Table 2.2). Additionally, all the respondents reported working as commercial fishermen full-time (Table 2.3).

Table 2.2 Frequency of Number of Years Commercial Fishing

Number of Years	As a Commercial Fisher		As a Commercial Fisher in the Gulf of Mexico		As a Commercial Fisher in FGBNMS	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1-10 years	0	-	0	-	1	16.7%
11-20 years	2	33.3%	2	33.3%	4	66.7%
21-30 years	2	33.3%	2	33.3%	0	-
31-40 years	2	33.3%	2	33.3%	1	16.7%

Respondents also answered questions about whether they had full-time, seasonal, or part-time employees and the number of employees they have hired. Two respondents operated full-time; the remaining commercial fishing operations are either seasonal or part-time. In total, part-time operations have more employees than full-time operations.

Table 2.3 Number of Employees in the Commercial Fishing Operations¹

Type of Employee	Total	Mean	Median	Minimum	Maximum
Full-time (N=2)	14	2.33	0	0	8
Part-time (N=3)	24	6.23	1.5	0	16
Seasonal (N=2)	7	1.17	0	0	4

¹ Number in parentheses is the number of operations with values greater than zero.

The average number of vessels across operations was two, while the minimum number of vessels of any operation was one. The maximum number of vessels any operation owns is five (Table 2.4).

Table 2.4 Number of Vessels in Operations¹

	Total	Mean	Median	Minimum	Maximum
Number of Vessels (N=6)	13	2.17	2	1	5

¹ Number in parentheses is the number of operations with values greater than zero.

Pounds and Revenue of Catch

This section presents several maps that show both the total pounds and revenue generated within 1-minute by 1-minute (one nautical square mile) cells within the NWGOM. All dollar values are for the year 2013. Respondents were asked to provide the percentage of pounds and revenue for each grid cell by type of species based on what they expect to do in the future. The results of their expected future use are presented in the maps below. Data were analyzed by mode of fishing: hook-and-line fishing, which is allowed in the sanctuary boundaries, and longline fishing, which is not permitted in the sanctuary. The next set of figures present the heat maps of use for the study area. The number in parenthesis is the total pounds or revenue for the study area.

Hook-and-Line

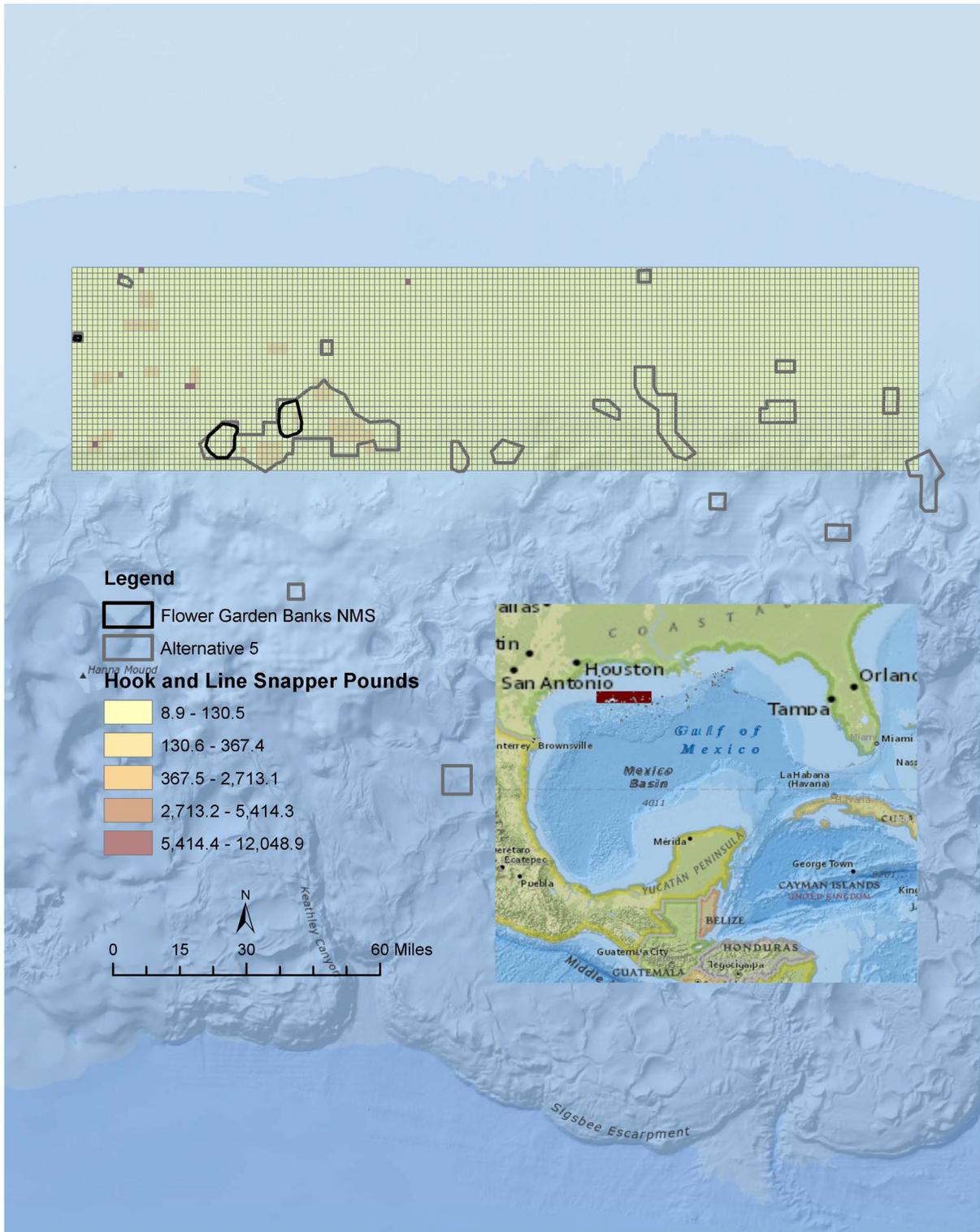


Figure 2.4 Commercial Hook-and-Line Fishing for Snapper in Pounds (Total=175,471 lbs.). Image: Danielle Schwarzmann/NOAA

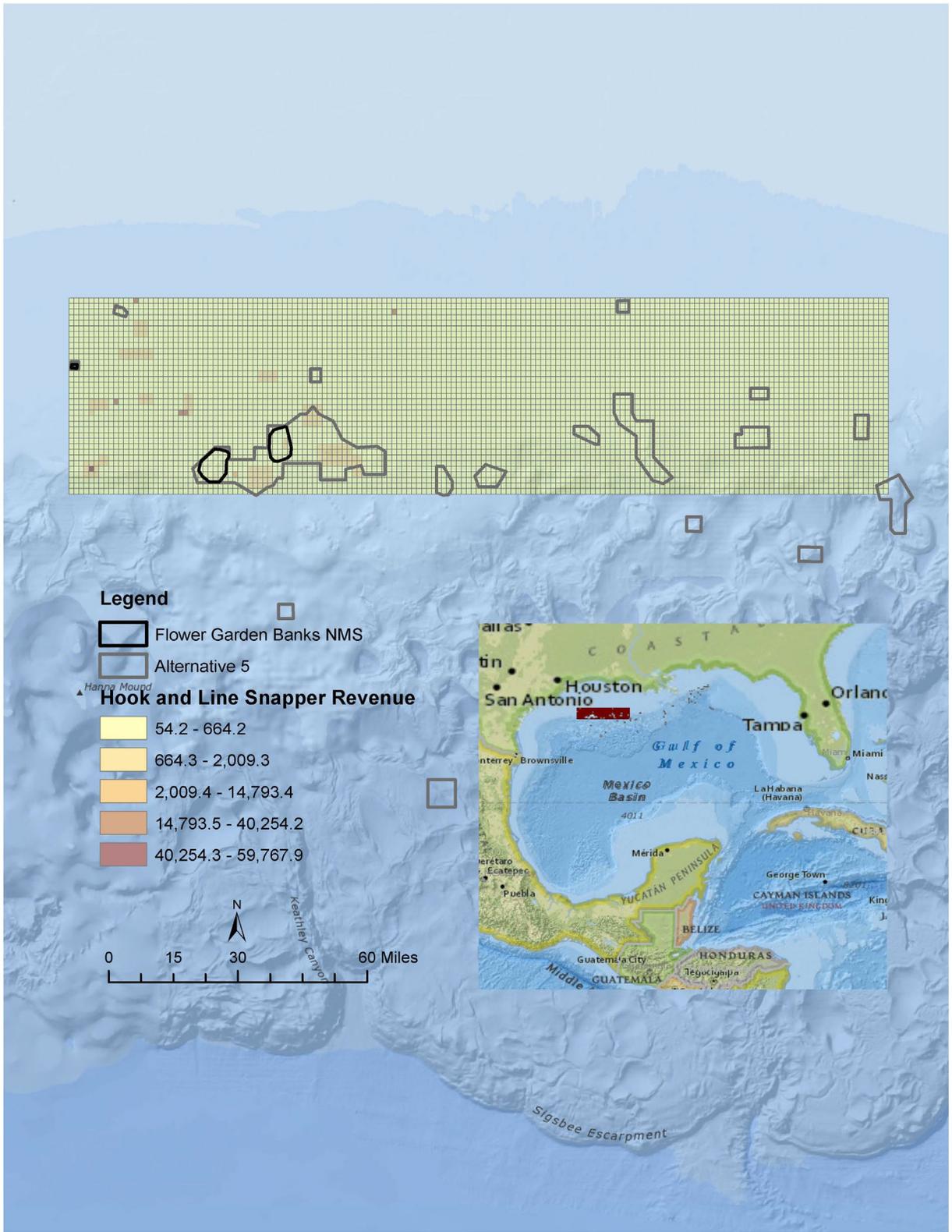


Figure 2.5 Commercial Hook-and-Line Fishing for Snapper, Revenue (Total=\$856,557 in 2013\$).
Image: Danielle Schwarzmann/NOAA

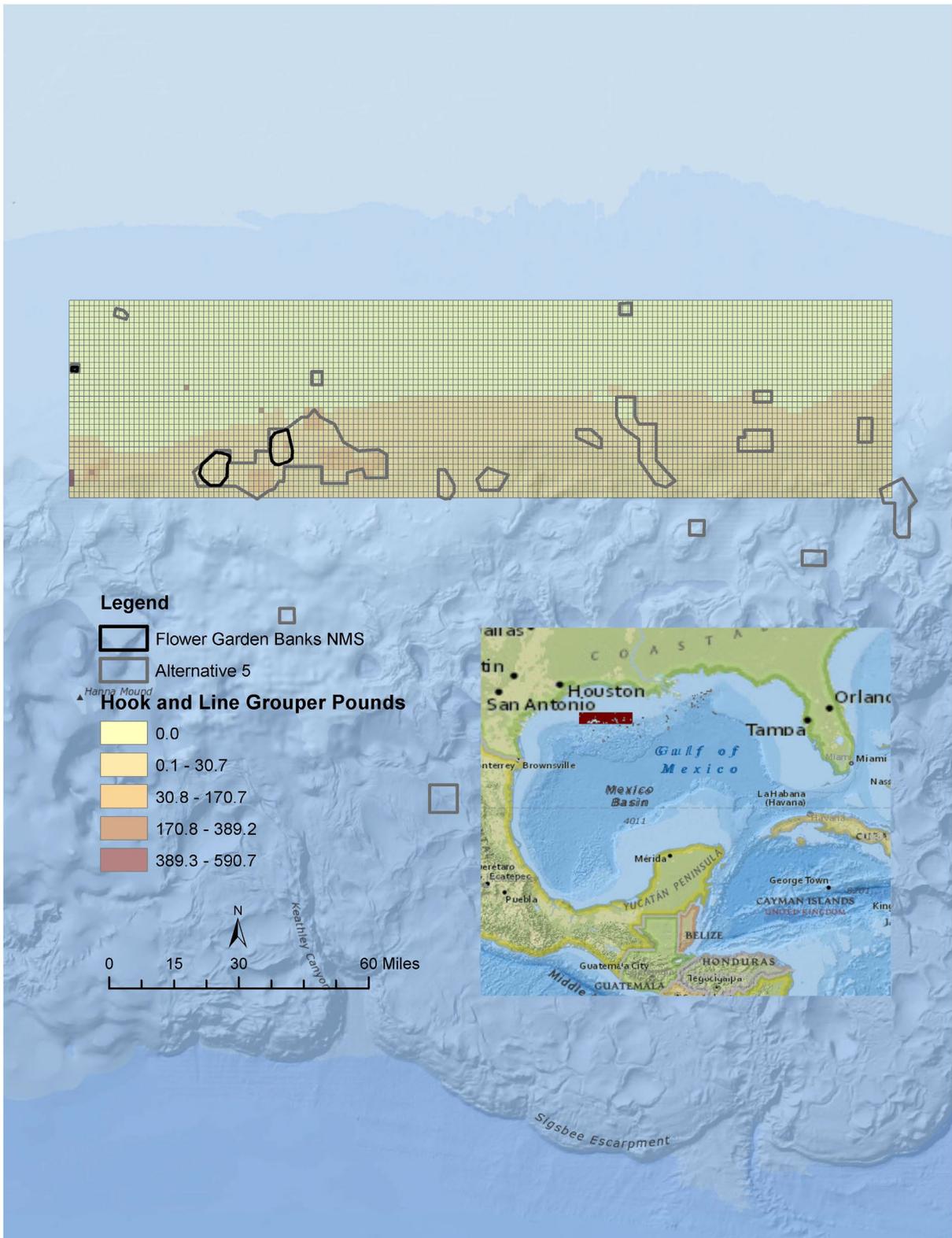


Figure 2.6 Commercial Hook-and-Line Fishing for Grouper in Pounds (Total=92,724 lbs.). Image: Danielle Schwarzmann/NOAA

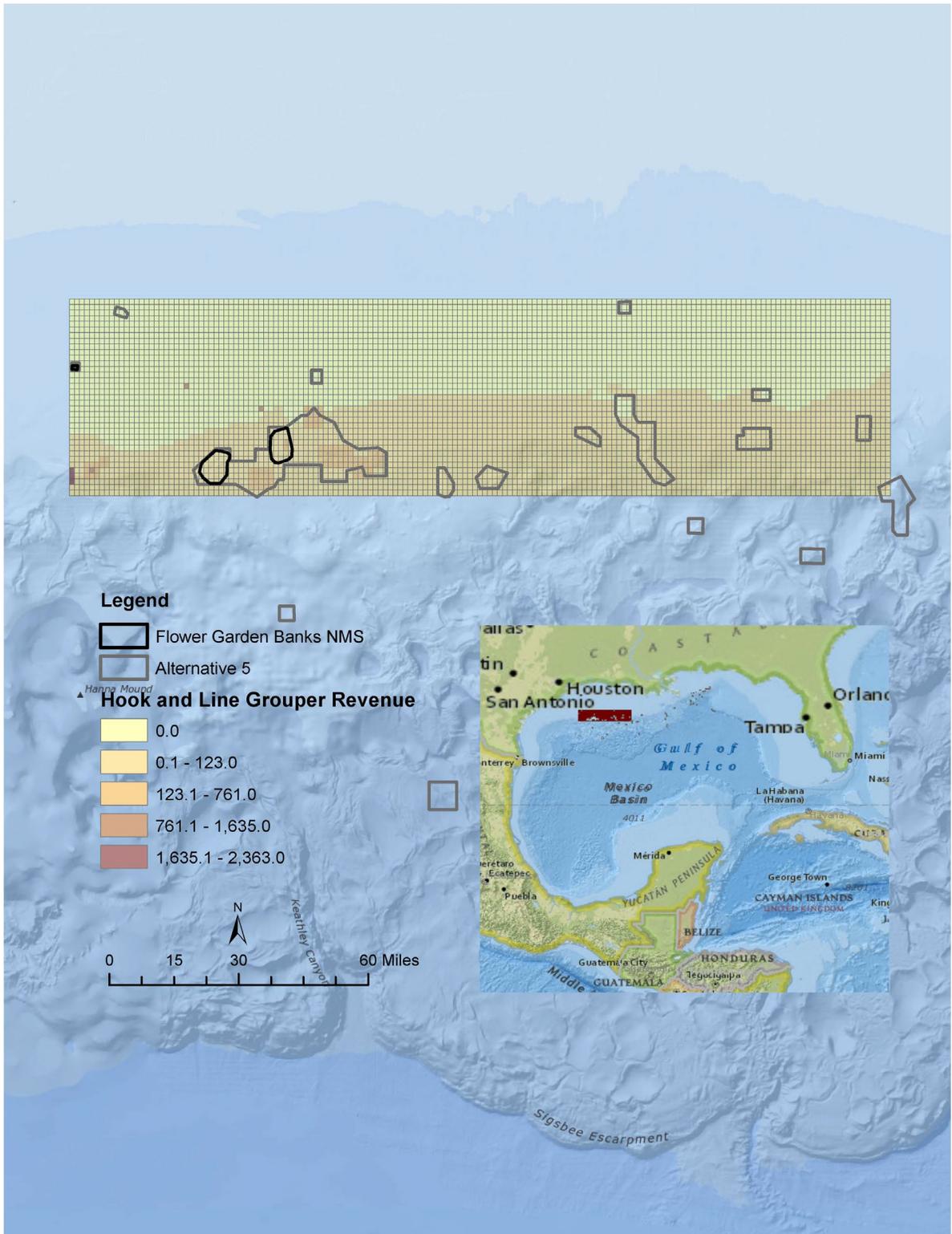


Figure 2.7 Commercial Hook-and-Line Fishing for Grouper, Revenue (Total=\$380,936 in 2013\$).
Image: Danielle Schwarzmann/NOAA

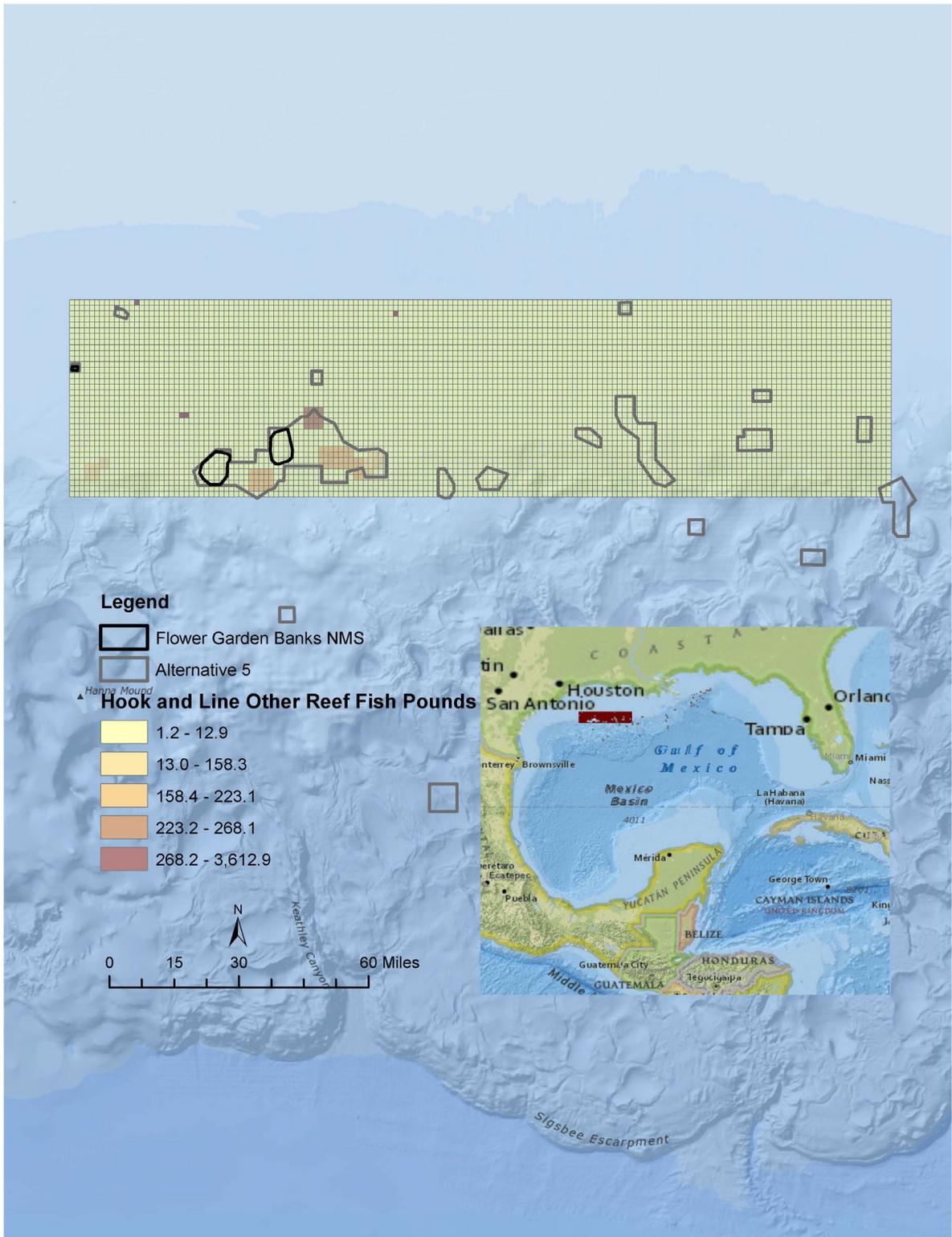


Figure 2.8 Commercial Hook-and-Line Fishing for Other Reef Fish in Pounds (Total=82,093 lbs.).
Image: Danielle Schwarzmann/NOAA

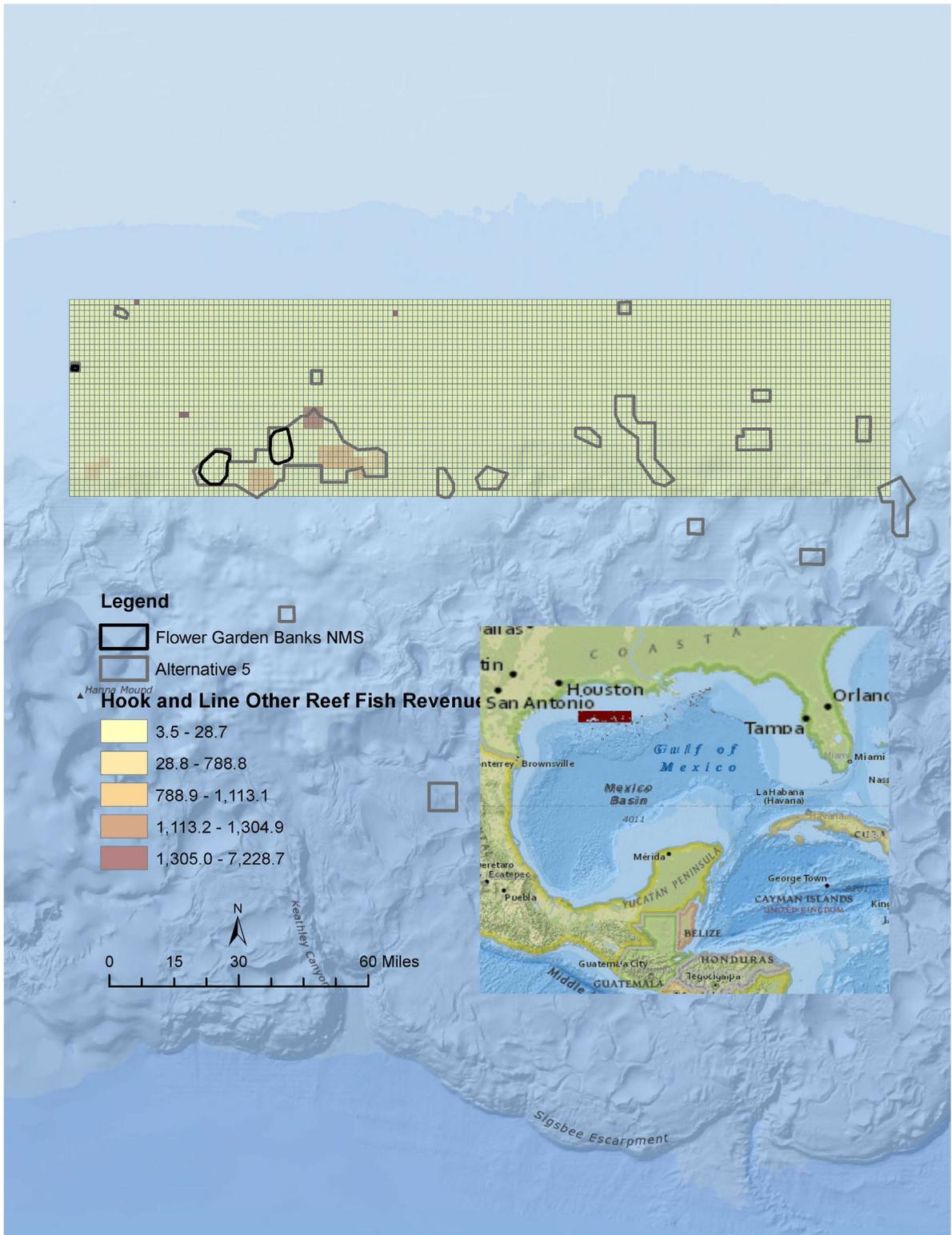


Figure 2.9 Commercial Hook-and-Line Fishing for Other Reef Fish, Revenue (Total=\$236,081 in 2013\$). Image: Danielle Schwarzmann/NOAA

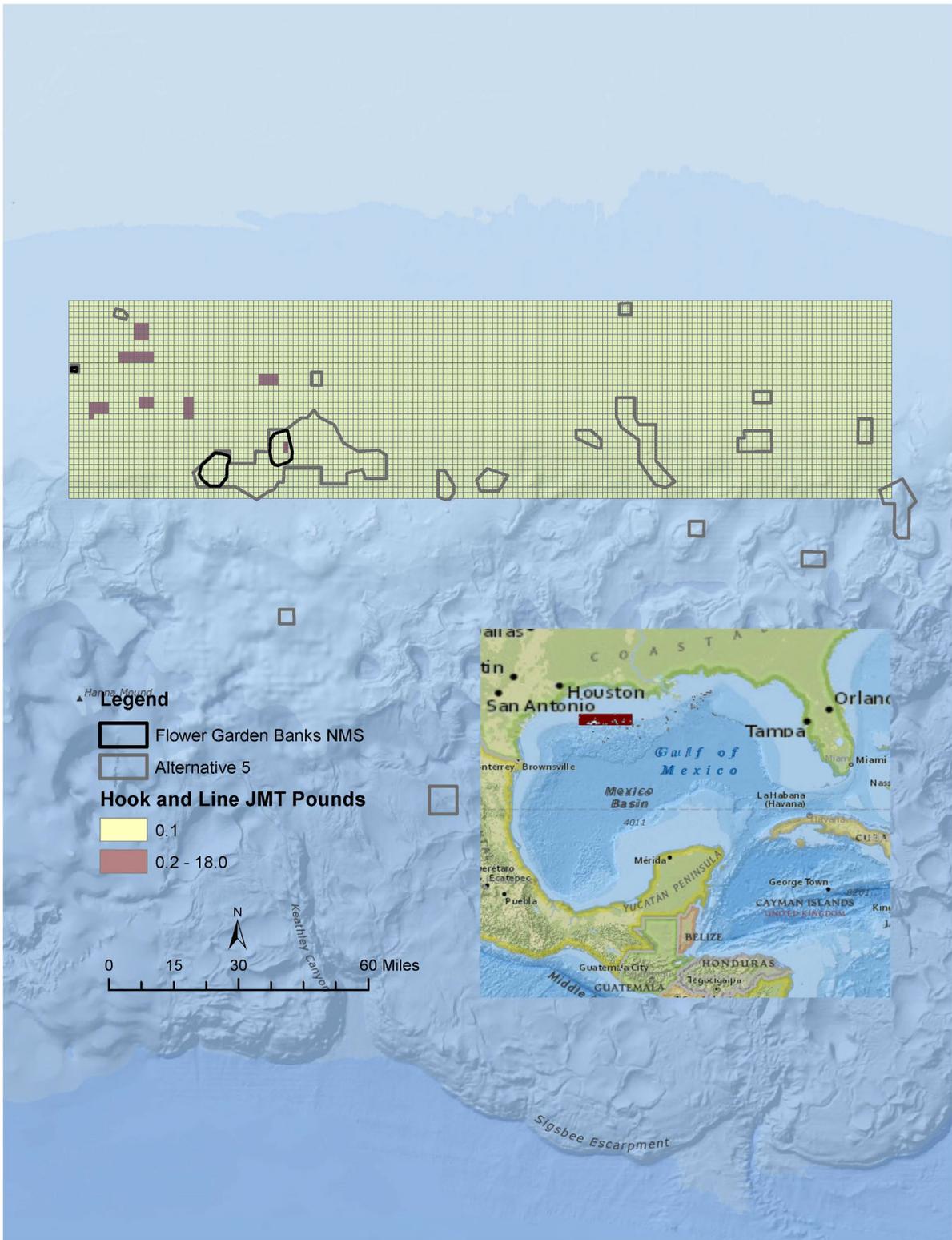


Figure 2.10 Commercial Hook-and-Line Fishing for Jack/Mackerel/Tuna in Pounds (Total=1,599 lbs.). Image: Danielle Schwarzmann/NOAA

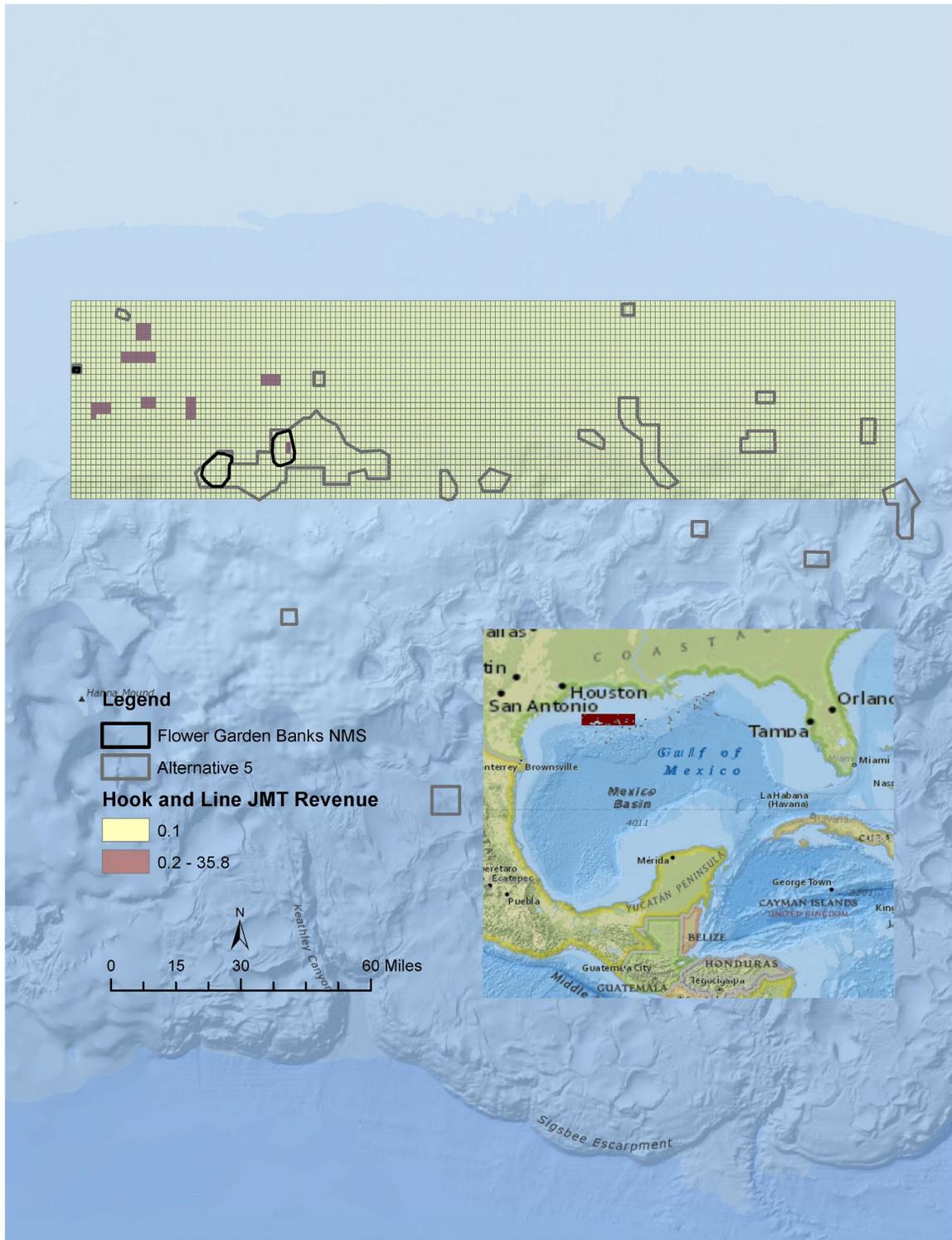


Figure 2.11 Commercial Hook-and-Line Fishing for Jack/Mackerel/Tuna, Revenue (Total=\$2,748 in 2013\$). Image: Danielle Schwarzmann/NOAA

Cost and Earnings

Respondents were asked several questions about their investments, revenue, and fixed and trip costs. From this information, measure of performance (return on investments and profits per dollar of revenue) were derived. Information was also obtained to assess their dependence for personal and household income on their fishing operation. The results of this information are presented in the following sections. Longline vessel information is not reported here because only one longline vessel fished in the study area, but longline trip costs are in aggregated totals of trip costs and fixed costs since these are not broken out by gear type.

Investment. Respondents were asked several questions about the equipment they use and the associated replacement costs. Vessel and equipment composed the highest level of investment, followed by longlines and bandit rigs (Table 2.5).

Table 2.5 Investment in Vessel, Equipment, and Gear (Replacement Value in 2013\$)

Item	Total (\$)	Mean	Median	Minimum	Maximum
Vessel & Equipment	\$2,300,000	\$383,333	\$450,000	\$180,000	\$500,000
Nets	\$27,000	\$4,500	\$0	\$0	\$27,000
Longline ¹					
Dive Gear	\$600	\$100	\$0	\$0	\$600
Bandit Rigs	\$86,000	\$14,333	\$43,000	\$0	\$32,000
Total (N=5)			\$482,500	\$204,000	\$580,000
	\$2,413,600	\$402,266	0	0	0

1. Longlines not included to protect privacy because only one longline vessel was included in the survey.

Trip Costs. These are variable costs that are dependent upon the number of trips taken. Captain wages and salaries, crew wages and salaries, and fuel/oil are the three expenditure categories that compose the largest share of trip costs. Other trip costs include bait, ice, and food/supplies (Table 2.6).

Table 2.6 Annual Trip Costs for Commercial Fishing Operations (2013\$)

Item	Total (\$)	Mean	Median	Minimum	Maximum
Fuel/Oil	\$231,350	\$38,558	\$22,500	\$1,100	\$103,750
Ice	\$79,125	\$13,187	\$6,800	\$325	\$56,500
Bait	\$118,100	\$19,683	\$10,800	\$500	\$70,700
Food/Supplies	\$84,250	\$14,042	\$5,750	\$300	\$55,850
Captain Wages & Salaries (if not owner-captain)	\$367,518	\$61,253	\$25,000	\$0	\$177,518
Crew Wages & Salaries	\$231,883	\$38,647	\$50,000	\$183	\$70,000
Miscellaneous	\$8,233	\$1,372	\$0	\$0	\$7,933
Other	\$40,000	\$6,667	\$0	\$0	\$40,000
Total	\$1,160,459	\$193,410	\$167,000	\$2,708	\$527,451

Fixed Costs. Fixed costs occur regardless of the number of trips a commercial fishing operation makes in a year. The snapper quota fee was the largest fixed expense of commercial fishing operations, followed by maintenance and repair expenditures for vessels and electronic equipment (Table 2.7). However, the amounts are what fishing operations provided and they may have not differentiated the fees when responding.

Table 2.7 Annual Fixed Costs of Commercial Fishing Operations (2013\$)

Item	Total (\$)	Mean	Median	Minimum	Maximum
Snapper Quota Fee (allocation lease fee)	\$454,135	\$75,689	\$40,500	\$135	\$250,000
Fishing Permits/Licenses	\$70,350	\$11,725	\$1,200	\$200	\$50,000
Docking Fees	\$55,900	\$9,317	\$5,250	\$0	\$33,000
Interest Payments on Vessel	\$32,800	\$5,467	\$0	\$0	\$16,800
P&I Insurance on Vessel, Crew	\$55,000	\$9,167	\$6,500	\$0	\$21,000
Maintenance/Repair on Vessel/Electronic Equip.	\$314,500	\$52,417	\$52,500	\$8,000	\$100,000
Maintenance/Repair on Nets	\$7,000	\$1,167	\$0	\$0	\$7,000
Maintenance/Repair on Longlines	\$10,500	\$1,750	\$250	\$0	\$5,000
Maintenance/Repair on Other Gear	\$17,800	\$2,967	\$2,000	\$0	\$10,000
Office Rent/Mortgage	\$147,000	\$24,500	\$500	\$0	\$144,000
Office Utilities	\$16,800	\$2,800	\$2,400	\$0	\$6,000
Depreciation on Vessel and Equipment	\$22,000	\$3,667	\$0	\$0	\$20,000
Business Taxes	\$285,000	\$47,500	\$27,500	\$0	\$140,000
VMS and Tackle	\$58,400	\$9,733	\$0	\$0	\$58,400
Satellite Phone	\$5,000	\$833	\$0	\$0	\$5,000
Membership Fees	\$2,625	\$437	\$0	\$0	\$2,625
Medical	\$11,120	\$1,853	\$0	\$0	\$11,120
Federal Recovery Fee	\$35,000	\$5,833	\$0	\$0	\$35,000
Total	\$1,600,930	\$266,822	\$257,950	\$48,385	\$504,245

Revenue. The questionnaire also asked respondents about the revenue they earn by fish species groups and gear. Longline fishing accounts for only a small percentage of revenues from the NWGOM Study Area, as most commercial fish are caught via hook-and-line gear (tables 2.8 and 2.9). Only one respondent reported longline fishing as their primary method of fishing. This is important because all hook-and-line fishing is allowed in FGBNMS and boundary expansion areas, while longline fishing will be prohibited.

Table 2.8 Total Commercial Catch by Operators in the Northwest Gulf of Mexico: Hook-and-Line Gear (2013\$)

Species/ Species Group	NWGOM Pounds Caught	Percentage of Total Caught in NWGOM	NWGOM Fishing Revenues	Percentage of Revenues from NWGOM
Snapper	175,500	99.72	\$865,720	99.43
Grouper	92,760	94.89	\$381,000	99.35
Other Reef Fish	72,100	93.51	\$176,100	92.15
Jacks/Mackerel/Tuna	1,600	20.38	\$2,750	18.03
Other Finfish	0	-	\$0	-
Shrimp	0	-	\$0	-
Other Invertebrates	0	-	\$0	-
Other (Not Specified)	0	-	\$0	-
Total	341,960	90.18	\$1,425,570	93.45

Only one respondent reported using longline gear, which accounted for a small percentage of the fishing revenues for all operations in the NWGOM. Again, because there was only one operation, the information has been removed from reporting to protect privacy.

Snappers were the most important species group for both pounds and revenue to the fishing operations. They accounted for almost 58% of revenue from all fishing anywhere and 57% of the revenue derived from total catch in the NWGOM. This was followed by groupers, which accounted for almost 17% of all fishing revenues from anywhere and 25% of the revenues from catch in the NWGOM. Reef fishes (snappers, groupers, and other reef fish) accounted for almost 85% of the revenue from all fishing anywhere and almost 95% of the revenue from catch in the NWGOM.

By species group, the highest proportion of the operations' total revenues from the NWGOM was groupers (55.43%), followed by other reef fish (46.55%) and snappers (36.67%). Overall, the operations derived 37.23% of their total fishing revenues from catch in the NWGOM (Table 2.9).

Table 2.9 Total Commercial Fishing Catch by Operators in the Northwest Gulf of Mexico Study Area

Species/Species Group	Total Pounds Caught	NWGOM Pounds Caught	Percentage of Total Caught in NWGOM	Total Fishing Revenues (2013\$)	NWGOM Fishing Revenues (2013\$)	Percentage of Revenues from NWGOM
Snapper	461,000	176,500	38.29	\$2,374,600	\$870,720	36.67
Grouper	179,800	97,760	54.37	\$691,900	\$383,500	55.43
Other Reef Fish	153,000	77,100	50.39	\$410,500	\$191,100	46.55
Jacks/Mackerel/Tuna	35,250	7,850	22.27	\$68,250	\$15,250	22.34
Other Finfish	1,200	0	0.00	\$7,800	\$0	0.00
Shrimp	40,000	0	0.00	\$100,000	\$0	0.00
Other Invertebrates	100,000	20,000	20.00	\$325,000	\$65,000	20.00
Other (Not Specified)	-	0	0.00	\$120,000	\$0	0.00
Total	970,250	379,210	39.08	\$4,098,050	\$1,525,570	37.23

Performance. Performance refers to profits per unit of revenue and return on investment. Return on investment is the level of income (profits) generated per dollar value of investment in the business measured as replacement value. Replacement value represents the opportunity cost of the investment. Annual total revenue across all operations was slightly over \$4 million. Fixed costs are the largest portion of total costs (trip + fixed costs). Annual profits across all operations were a little over \$1.3 million. Profits per dollar of revenue across all operations were \$0.33 and return on investment was more than 53%. A general standard on return on investment for businesses is 20%, so one might conclude that fishing operations here are earning what economists call “economic rent” or a rate of return above normal profits. However, not all operations are earning economic rents, since the minimum return on investment was 11.21% (Table 2.10). More importantly, costs did not include wages and salary for owner/operators. Once owner/operator wages and salaries are included, profits would not indicate much if any economic rents. These performance measures will be used in future assessments of boundary expansion or other regulatory changes that might affect these operations.

Table 2.10 Annual Revenue, Costs, Profits, and Return on Investment (2013\$)

Item	Total All Operations	Mean	Median	Minimum	Maximum
Annual Total Revenue	\$4,098,050	\$683,008	\$500,000	\$340,000	\$1,774,000
Annual Trip Costs	\$1,160,459	\$193,410	\$167,000	\$2,708	\$527,451
Annual Fixed Costs	\$1,600,930	\$266,822	\$257,950	\$48,385	\$504,245
Annual Total Costs	\$2,761,389	\$460,232	\$400,500	\$98,985	\$1,031,696
Annual Profits	\$1,336,661	\$222,777	\$104,846	\$49,650	\$742,304
Total Investment ¹	\$2,511,600	\$418,600	\$482,500	\$204,000	\$580,000
Return on Investment(%) ²	53.22%	58.38%	33.31%	11.21%	138.1%
Profits Per Dollar of Revenue	\$0.33	\$0.31	\$0.22	\$0.09	\$0.71

1. Replacement value of all vessels, equipment, and gear.

2. Annual profits divided by total investment (%).

Dependency

In assessing potential socioeconomic impacts of proposed regulations, it is important to understand how dependent users are for their livelihoods on the resources being regulated. All the fishing operations operating in the NWGOM are dependent on their business income from fishing. As a percentage of owner/operator's household income and total personal income, all were highly dependent, with a minimum of 90%, a maximum of 100%, and an average of 98.33% (Table 2.11).

Overall, the fishing operations derived a little over 37% of their total fishing revenue from the NWGOM, but this varied from a low of 16.67% to a high of 72.35%. Fishing operations were not very dependent on FGBNMS for their fishing revenues, with only a fraction of one percent of their total fishing revenues derived from catch in FGBNMS (Table 2.11).

An important fact here is that more than 93% of all fishing revenue derived from catch in the NWGOM is from hook-and-line gear, which is allowed in the current FGBNMS and will be allowed in any future expansion areas of the sanctuary.

Table 2.9 Dependency of Commercial Fishing Operations on NWGOM and FGBNMS

Measure	Total	Mean	Median	Min	Max
% of Business Income Derived from Fishing Operation (N=6)	100	100.00	100	100	100
% of Total Household Income from Fishing Operation (N=6)	-	98.33	100	90	100
% of Total Personal Income from Fishing Operation (n=6)	-	98.33	100	90	100
% of Fishing Revenue from NWGOM (N=6)	37.23	39.10	38	16.17	72.35
% NWGOM Fishing Revenue from Hook-and-Line Gear (N=5)	93.45	83.33	100	0	100
Longlines ¹					
% of Hook & Line Fishing Revenue in East Flower Garden Bank	.68	0.028%	0.013%	0.013%	0.192%
% of Hook & Line Fishing Revenue in West Flower Garden Bank	.01	0.006%	0.006%	0.006%	0.006%
% of Hook & Line Fishing Revenue in Stetson Bank	.36	0.013%	0.013%	0.013%	0.013%

1. Longlines are not reported because there was only one longline vessel included in the survey.

Knowledge, Attitudes, and Perceptions

In addition to completing survey questions about themselves and their businesses, respondents also answered questions regarding their knowledge, attitudes, and perceptions of FGBNMS management strategies and regulations.

In regards to the sanctuary, respondents cited the FGBNMS website and word of mouth as being the most common sources from which they had received information. Respondents did not receive information from the Sanctuary Advisory Council (SAC), FGBNMS signage, newspapers, radio, or television. The two most important sources were the FGBNMS website and word of mouth, followed by brochures and literature (Table 2.12).

Table 2.12 Sources of Information and their Importance

Source	Used	Median Rank of Importance	Mean Rank of Importance	N
FGBNMS Website	50%	2	0.7	6
Word of Mouth	50%	1	0.8	6
FGBNMS Brochures/Literature	33.3%	0.5	0.3	6
FGBNMS Staff	-	-	-	6
Sanctuary Advisory Council	-	-	-	6
FGBNMS Signage	-	-	-	6
Information in Newspapers	-	-	-	6
Radio	-	-	-	6
TV	-	-	-	6

The next set of questions asked respondents how they felt about the process of developing rules and regulations for FGBNMS. Half (50%) of commercial fishermen did not know how they felt about the process NOAA used to develop rules and regulations. For the half that did answer these questions, respondents were negative regarding “FGBNMS being open and fair to all groups” and “FGBNMS zones was open and fair to all groups.” For both questions, one third of the respondents strongly disagreed that the process was open and fair to all groups. However, once the regulations were in effect respondents did think there was a way for their voices to be heard (Table 2.13).

As to participation in the public processes and whether respondents perceived that NOAA listened to other agencies in developing rules and regulations, the proportion of respondents that responded “don’t know” increased. The few who did answer the questions were either split, with equal numbers agreeing and disagreeing, or were neutral. The last question in this section asked if the procedures established to deal with violations of regulations had been fair and just. Again, half of respondents did not answer the question, but of those who did, the majority were negative and disagreed with the statement (Table 2.13).

Respondents also reported how they felt about the establishment of FGBNMS and how they felt about possible expansions in the NWGOM or establishments of research-only areas. Except for one person on one question, respondents answered these sets of questions. Respondents were split with equal numbers agreeing and disagreeing with the statement “I support FGBNMS as it is currently established.” The majority (66.7%) did not support the establishment of a research-only area in FGBNMS. Half of the respondents did not agree that a research-only area would have a positive impact on the marine environment (Table 2.14).

On boundary expansion of the sanctuary in different areas of the NWGOM (see Figure 1.2 for the areas), the most were against it (66.7% to 83.3%). As to establishment of a research-only area on one of the existing banks in FGBNMS, the highest level of support occurs in East Flower Garden Bank (33.3%), but still two-thirds of respondents are against it in Stetson and East Flower Garden banks and 83.3% are against it in West Flower Garden Bank (Table 2.14).

One-third of the respondents believe the banks have benefited environmentally from the management by FGBNMS and half the respondents believe that boundary expansion of the sanctuary would have a positive impact on the marine environment (Table 2.14).

As to specific regulations, the majority of respondents support the no anchoring regulation in FGBNMS. The same is true for the current no discharge regulations in FGBNMS. Half the respondents (a plurality) also supported the restriction on harvesting bottom formations or invertebrates inside FGBNMS. All respondents support the no-take regulation for marine mammals and sea turtles and that all dive vessels fly a blue and alpha flag. Most (83.3%) support the use of a mooring buoy in FGBNMS instead of anchoring, with the limit of vessel size at a mooring to 100 feet or less. A majority of respondents also supported the use of a mooring buoy for fishing and diving and the regulation on minimum distance and speed for vessels (Table 2.15).

Respondents generally did not support fishing-related regulations. Half of respondents (a plurality) did support only hook-and-line fishing being allowed in FGBNMS, but did not support the number of hook limitations. And most (83.3%) were against a reservation system for mooring buoys inside FGBNMS. Half the respondents (a plurality) were also against stricter regulations on the discharging of pollutants in FGBNMS. A majority of respondents did not support the requirement that all vessels entering FGBNMS have an automatic identification system (AIS) monitoring system (Table 2.15).

Table 2.13 Attitudes towards FGBNMS and Regulatory Development

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
The process that NOAA has used to develop rules and regulations for FGBNMS was open and fair to all groups.	-	-	16.7%	-	33.3%	50.0%	6
The process has used by NOAA to develop boundaries and regulations for FGBNMS zones was open and fair to all groups.	-	-	16.7%	-	33.3%	50.0%	6
It has not mattered whether the average person participated in the workshops and meeting on FGBNMS because the average person could not influence the final decisions.	16.7%	-	16.7%	-	16.7%	50.0%	6
NOAA has not addressed the concerns of other federal and state governments in developing rules and regulations for FGBNMS.	16.7%	-	-	-	16.7%	66.6%	6
NOAA has not addressed the concerns of individual citizens in developing rules and regulations for FGBNMS.	-	-	16.7%	-	-	83.3%	6
Once that FGBNMS regulations have been in effect, there has been no way for the average person to voice his/her opinion on the usefulness of the regulations.	16.7%	-	-	16.7%	33.3%	33.3%	6
The procedures that NOAA has established to deal with violations of FGBNMS regulations have been fair and just.	16.7%	-	-	16.7%	16.7%	50.0%	6



Table 2.14 Level of Support Towards Boundary Expansions

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
I support FGBNMS as it is currently established.	50.0%	-	-	33.3%	16.7%	-	6
I support the establishment of a research-only area in FGBNMS.	33.3%	-	-	-	66.7%	-	6
A research-only area in FGBNMS would have a positive impact on the marine environment.	33.3%	-	-	-	50.0%	16.7%	6
There should be more than one bank set aside as a research-only area in FGBNMS.	16.7%	-	16.7%	-	66.6%	-	6
I support establishment of boundary expansion of FGBNMS for the banks in Area 1.	16.7%	-	-	-	83.3%	-	6
I support establishment of boundary expansion of FGBNMS for the banks in Area 2.	33.3%	-	-	-	66.7%	-	6
I support establishment of boundary expansion of FGBNMS for the banks in Area 3.	33.3%	-	-	-	66.7%	-	6
I support establishment of boundary expansion of FGBNMS for the banks in Area 4.	16.7%	-	16.7%	-	66.6%	-	6



Table 2.14 Level of Support Towards Boundary Expansions (continued)

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
I support establishment of a research-only area on Stetson bank.	16.7%	-	16.7%	-	66.6%	-	6
I support establishment of a research-only area on East Flower Garden Bank.	33.3%	-	-	-	66.7%	-	6
I support establishment of a research-only area on West Flower Garden Bank.	16.7%	-	-	-	83.3%	-	6
Boundary expansion of FGBNMS would have a positive impact on the marine environment.	50.0%	-	-	-	33.3%	16.7%	6
Stetson and East & West Flower Garden Banks have benefited environmentally from the management by FGBNMS.	33.3%	-	-	-	33.3%	33.3%	6

Table 2.15 Level of Support for Regulations and Requirements in FGBNMS

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
I support the no anchoring regulations in FGBNMS.	66.7%	-	-	-	33.3%	-	6
I support the current no discharge regulations in FGBNMS.	66.7%	-	-	-	33.3%	-	6
I support the current no harvest of bottom formations or takings of invertebrates inside FGBNMS.	50.0%	-	16.7%	-	33.3%	-	6
I support the hook-and-line only fishing regulation in FGBNMS.	50.0%	-	16.7%	-	33.3%	-	6
I support a one hook-and-line limit in FGBNMS.	-	-	-	33.3%	66.7%	-	6
I support a two hook-and-line limit in the FGBMNS.	-	16.7%	-	16.7%	66.6%	-	6
I support that all vessels entering FGBNMS to have a (AIS) monitoring system.	16.7%	-	16.7%	-	66.6%	-	6
I support the no taking of marine mammals and turtles in FGBNMS.	100.0%	-	-	-	-	-	6
I support the requirement of using a mooring buoy instead of anchoring in FGBNMS with the limit of vessel size for the mooring use of 100 feet or less.	83.3%	-	-	-	16.7%	-	6
I support specific use of the mooring buoy for fishing and diving in FGBNMS.	66.7%	-	-	-	33.3%	-	6
I support reservation of buoy use at FGBNMS.	16.7%	-	-	-	83.3%	-	6
I support stricter regulations on discharging of pollutants in FGBNMS.	33.3%	-	16.7%	-	50.0%	-	6
I support regulations on minimum distance and speed from vessels.	66.6%	-	16.7%	-	16.7%	-	6
I support the requirement that all dive vessels fly a blue and alpha flag.	100.0%	-	-	-	-	-	6

Respondents were generally negative in their opinion of the level of economic benefit they have had as a result of FGBNMS, but two-thirds said they didn't know in response to the first question. One respondent did not agree and one was neutral about the net benefits to the economy from the establishment of FGBNMS. However, a majority of respondents did feel that charter/party boat fishing operations have not benefited from the establishment of FGBNMS. Additionally, half of respondents (a plurality) felt that the regulations in FGBNMS have had no effect on their business (Table 2.16).

Table 2.16 Extent of Impact of FGBNMS on Economy and Business

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
There has been a net economic benefit to the economy from the establishment of FGBNMS	-	-	16.7%	-	16.7%	66.6 %	6
The charter/party boat fishing operations have benefited from the establishment of FGBNMS.	-	-	-	33.3%	33.3%	33.3%	6
FGBNMS regulations have had no effect on my business.	16.7%	33.3%	16.7%	-	33.3%	-	6

In regards to the environment, of those who felt the questions were relevant to them, most were either neutral or felt that the status of environmental resources is worse since the implementation of FGBNMS (Table 2.17). However, most respondents felt that FGBNMS was not responsible for the status/condition of the resources.

Table 2.17 Status/Condition of Environmental Resources since the Implementation of FGBNMS

Resource/Question	Much Better	Better	Neutral	Worse	Much Worse	N/A	N
Water Quality	-	16.7%	50.0%	-	33.3%	-	6
Sea-Based Pollution/Marine Debris	-	16.7%	50.0%	-	33.3%	-	6
Coral Reefs	-	16.7%	33.3%	16.7%	-	33.3%	6
Other Bottom Habitat	-	-	50.0%	-	-	50.0%	6
Fisheries	33.3%	-	50.0%	-	-	16.7%	6
Mooring Buoys	16.7%	-	33.2%	16.7%	16.7%	16.7%	6

CHAPTER 3. RECREATIONAL FISHING

Demographic Profiles

A total of eight recreational for-hire fishermen responded to the survey.

The age of respondents was evenly distributed among four of the five age categories. Twenty-five percent of respondents reported belonging to age ranges 18-30, 31-40, 41-50 or over 60 years (Figure 3.1).

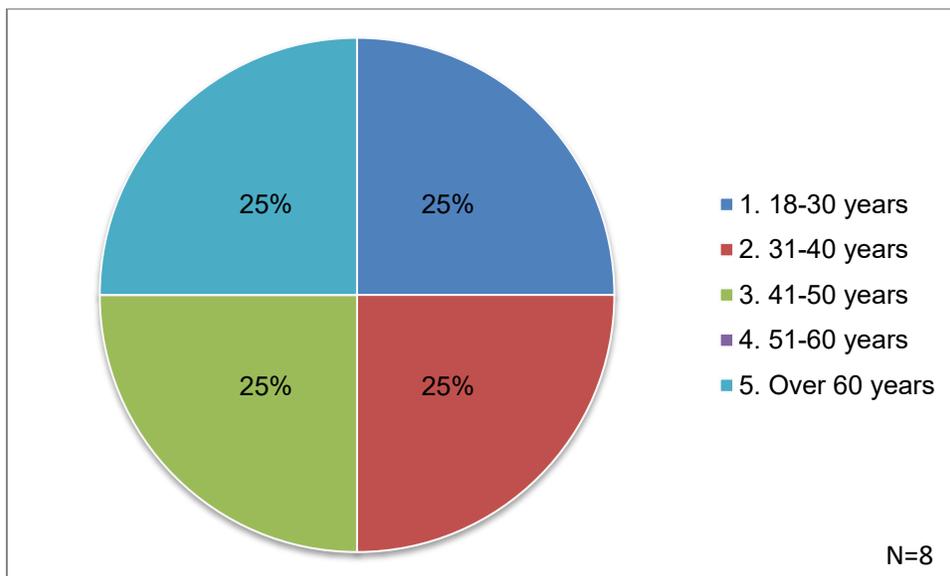


Figure 3.1 Age of Recreational Fishing For-Hire Operation Owner/Operators

All of the respondents were Caucasian and none of the respondents reported being Hispanic or Latino. The average number of family members of each recreational fishing operation's owner/operator was 3.1 members and half the respondents had a family size of four. The largest family was four and the smallest was one (Figure 3.2).

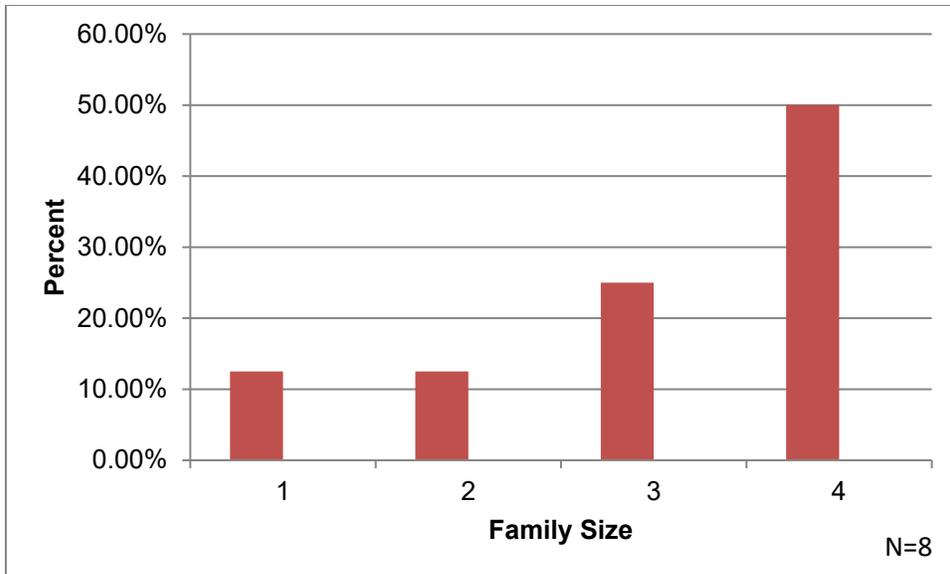


Figure 3.2 Distribution of Recreational For-Hire Owner/Operator Family Size

Respondents also answered questions about their professional memberships. The highest level of membership among owners/operators of the fishing operations was to the Chamber of Commerce. Respondents belonged to a variety of organizations (Figure 3.3).

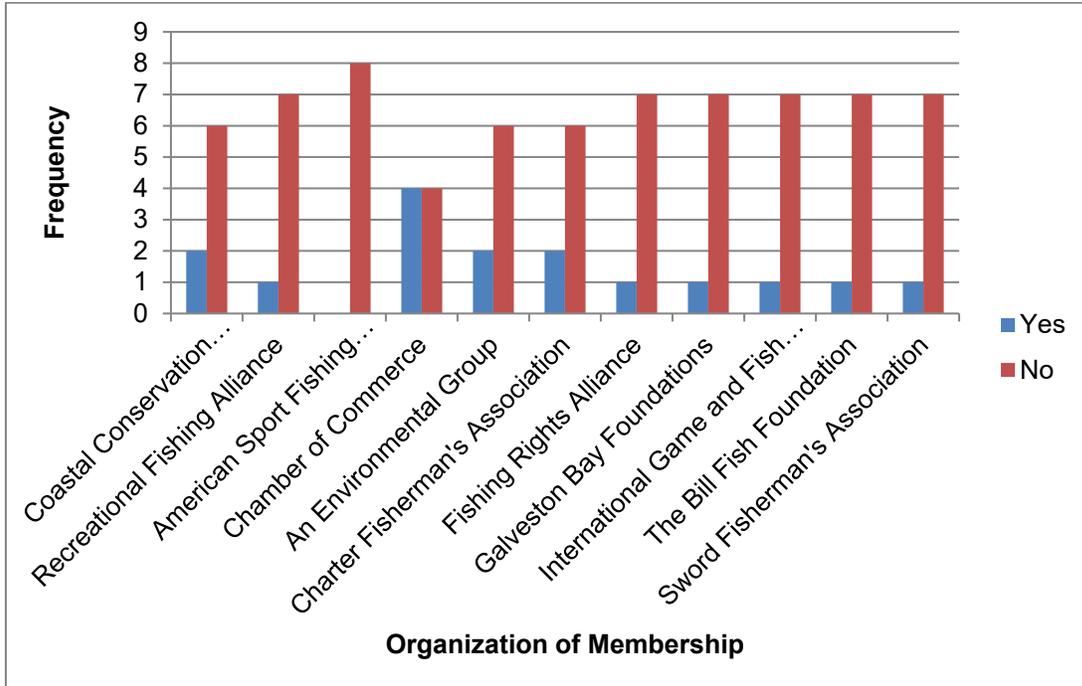


Figure 3.3 Memberships of For-Hire Recreational Fishing Owner/Operators

Profile of Operations

This next section discusses the locations and type of fishing operation and size of operation. Respondents were also asked about the primary and secondary ports from which they launch their boats. The most common primary port amongst respondents was Galveston. Freeport, Sabine Pass Port Authority, and Surfside Marina were also used as primary reports. None of the respondents use a secondary port (Table 3.1).

Table 3.1 Ports of Launch

Primary Port	Frequency	Percentage
Galveston	3	37.5%
Galveston Yacht Basin	2	25%
Freeport	1	12.5%
Sabine Pass Port Authority	1	12.5%
Surfside Marina	1	12.5%

Half the respondents have 1-10 years of experience operating a charter boat. One respondent has been operating a charter boat in the Gulf of Mexico for 31-40 years. Additionally, seven of the eight respondents have reported fishing in FGBNMS (Table 3.2).

Table 3.2 Number of Years Operating a Charter/Party Boat

Number of Years	As a Charter/Party Boat Operator		As a Charter/Party Boat Operator in Gulf of Mexico		As a Charter/Party Boat Operator in FGBNMS	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
0 years	0	0%	0	0%	1	12.5%
1-10 years	4	50%	4	50%	4	50%
11-20 years	1	12.5%	1	12.5%	1	12.5%
21-30 years	2	25%	2	25%	2	25%
31-40 years	1	12.5%	1	12.5%	0	0%

Three respondents work full-time as recreational charter or party/head boat fishing operators. The remaining five operators work either part-time or seasonally (Table 3.3, Figure 3.4).

Table 3.3 Type of Fishing Operation

Type of Fishing Operation	Frequency	Percentage
Full-Time Charter Boat Operation	2	25%
Part-Time Charter Boat Operation	3	37.5%
Seasonal Charter Boat Operation	2	25%
Full-Time Party/Head Boat Operation	1	12.5%
Part-Time Party/Head Boat Operation	0	0%
Seasonal Party/Head Boat Operation	0	0%

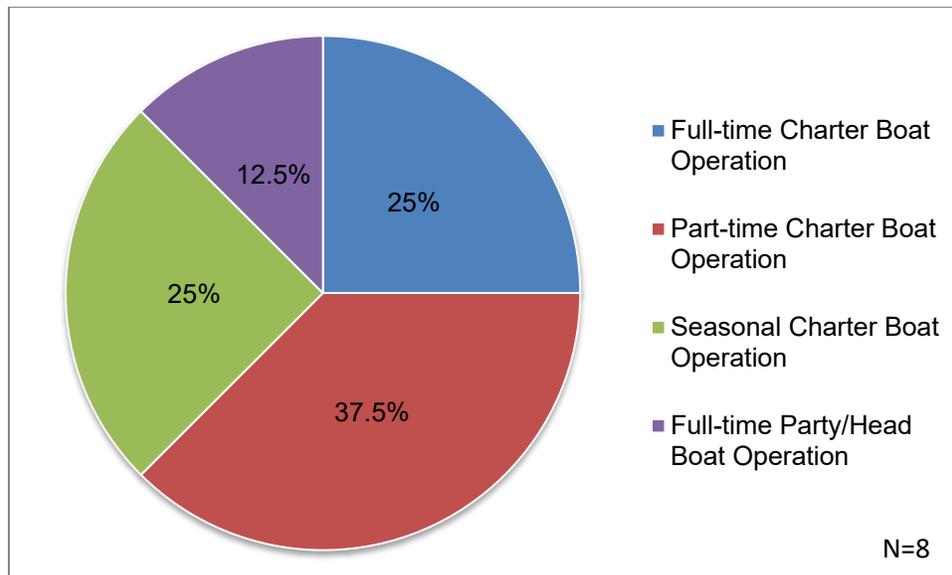


Figure 3.4 Distribution of Employment Status as Charter Boat Operator

One respondent operates four vessels within their operation. Half the respondents operate only one vessel for their operation. The largest vessel can carry up to 83 passengers and the smallest can carry two passengers (Table 3.4).

Table 3.4 Number and Capacity of Vessels (Number of Passengers)¹

	Mean	Median	Minimum	Maximum
Number of Vessels	1.75	1.5	1	4
Capacity (Number of Passengers)				
Vessel 1 (N=8)	15.37	6	4	83
Vessel 2 (N=4)	17.75	6	2	57
Vessel 3 (N=1)	6	6	6	6
Vessel 4 (N=1)	6	6	6	6

¹ Number in parentheses is the number of operations with values greater than zero.

All but one operation hires additional employees to aid their operations. Three respondents hired a total of 12 full-time employees. Two of those operations also

hired additional part-time and/or seasonal employees. Five operations hired a total of nine part-time employees and three operations hired a total of 13 seasonal employees. Two operations only hire seasonal employees and another two operations hire only part-time employees (Table 3.5).

Table 3.5 Number of Employees in For-Hire Fishing Operations¹

Type of Employee	Number of Employees				
	Total	Mean	Median	Minimum	Maximum
Full-Time (N=3)	12	1.5	0	0	7
Part-Time (N=5)	9	1.12	1	0	4
Seasonal (N=3)	13	2.39	0	0	6

¹ Number in parentheses is the number of operations with values greater than zero.

Person-Days

The number of person-days of recreational fishing was also calculated. A person-day is one person for a whole day or any part of a day. If an operator took 10 people out to fish for an overnight trip, this would be counted as 20 person-days.

Respondents provided the number of person-days by type of fishing activity and provided an estimate of the percentage of person-days that occurred within the NWGOM. The total person-days in the NWGOM were used as the control total to estimate the number of person-days that occur within the sanctuary. To estimate the number of person-days within the sanctuary, respondents provided their future expected percentage of person-days to occur in 1-minute by 1-minute (one nautical square mile) grid cells within the NWGOM for each type of fishing activity. Figure 1.1 in Chapter 1 shows the grid cells that respondents used in providing their future estimates of use.

In total, operators reported 18,552 person-days of recreational fishing. Of the total person-days, approximately 12% occurred within the NWGOM and almost 2% in FGBNMS. Spearfishing accounted for roughly 1% of all person-days of fishing, but 5.6% of all person-days within the NWGOM (Table 3.6).

Table 3.6 Person-Days of Recreational Fishing

Activity	Total Person- Days in All Areas	Total Person- Days in NWGOM	Total Person- Days in FGBNMS	Percentage of Person- Days in NWGOM	Percentage of Person- Days in FGBNMS
Hook-and-Line Fishing	18,348	2,127	362	11.59	1.97%
Spearfishing	204	127	0	62.25	0%
All Activities	18,552	2,254	362	12.15	1.95%

The next set of figures present the heat maps of use for the study area. The number in parenthesis is the total number of person-days by fishing mode within the NWGOM Study Area.

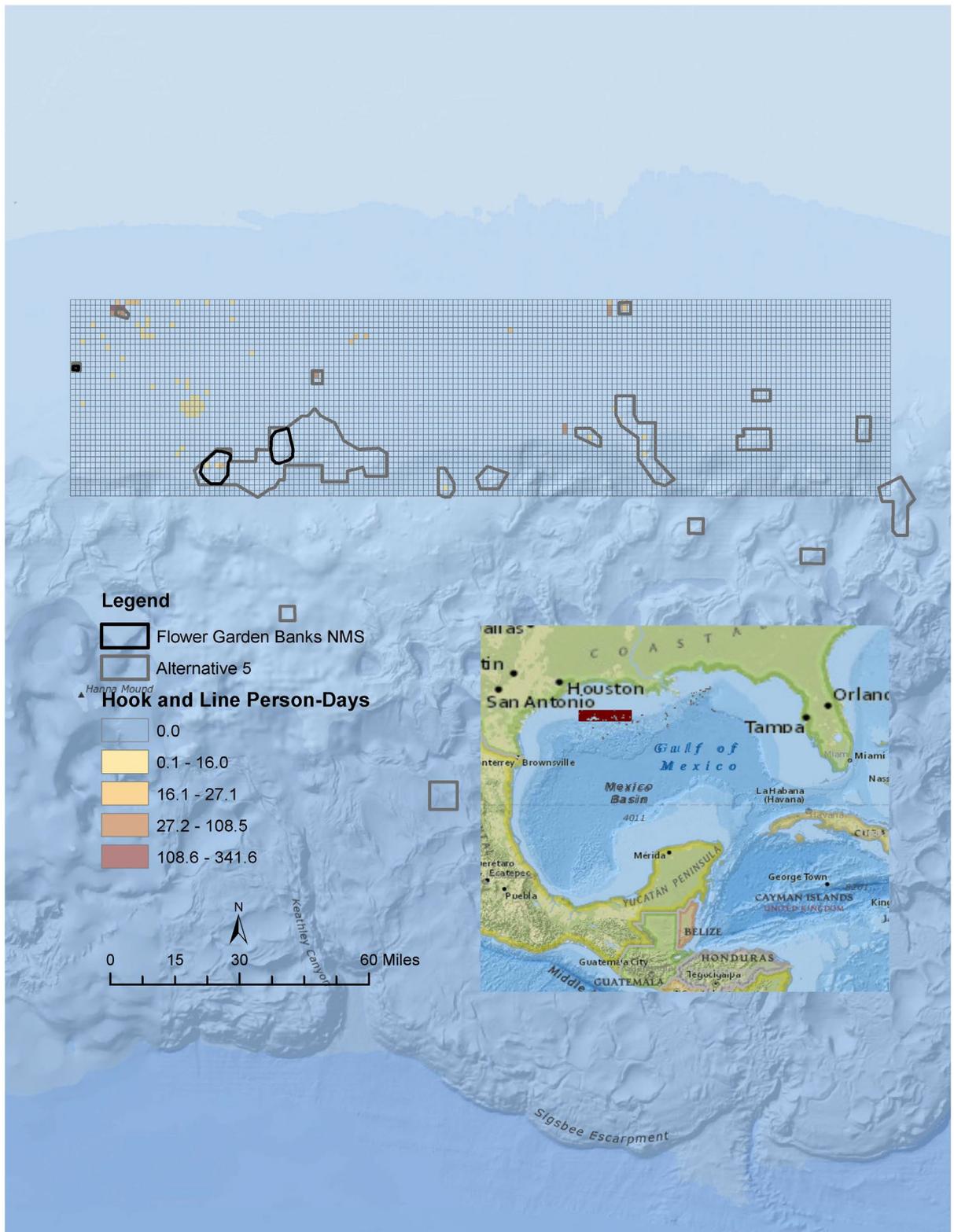


Figure 3.5 For-Hire Recreational Hook-and-Line Fishing Person-Days (Total=2,127 Days). Image: NOAA

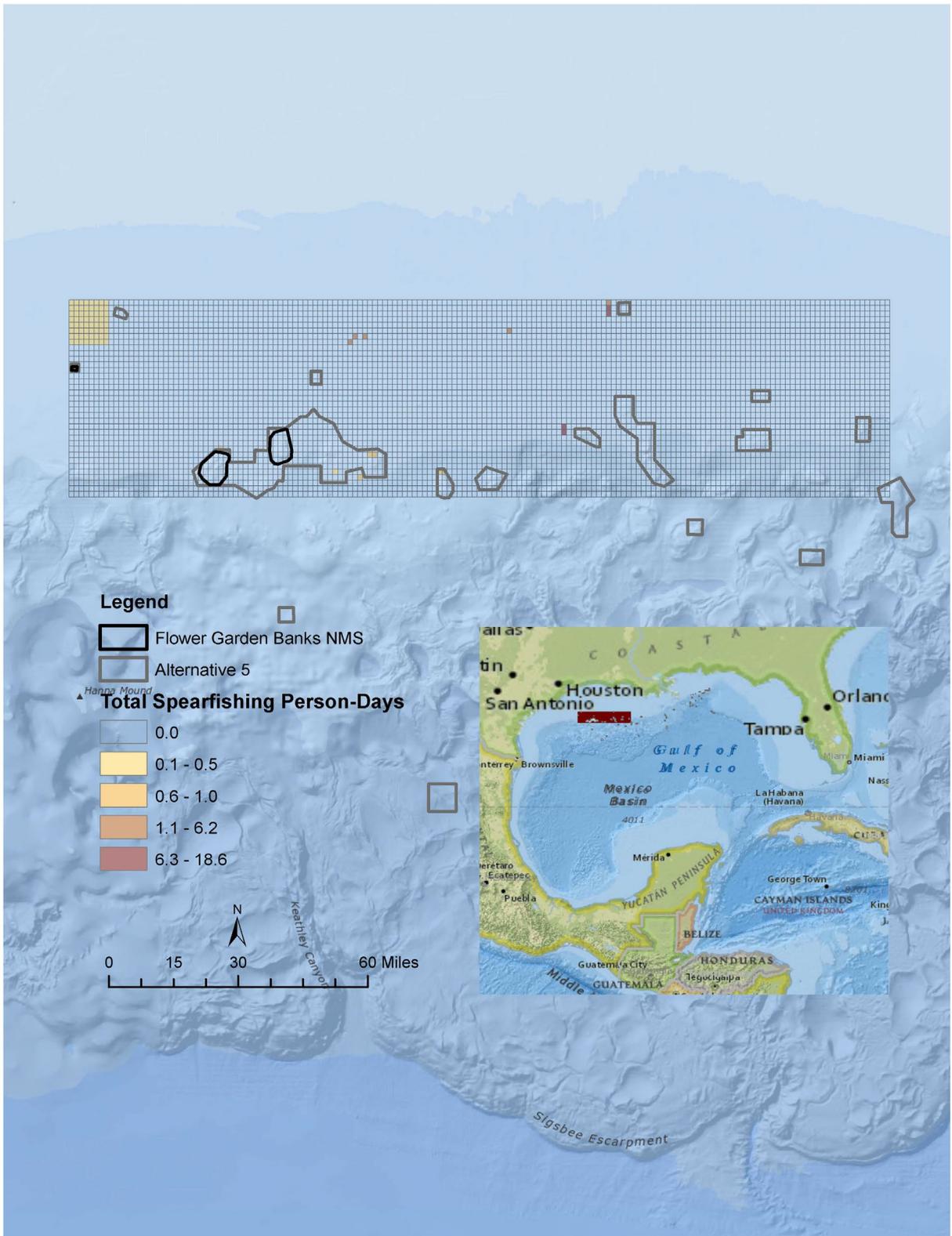


Figure 3.6 For-Hire Recreational Spearfishing Person-Days (Total=127 Days). Image: NOAA

Cost and Earnings

Respondents were asked several questions about their investments, revenue, and fixed and trip costs. This information was then used to calculate performance measures (profits per dollar of revenues and return on investment).

Investment. Respondents were asked to provide the best estimate of the replacement value of their vessels, equipment, and gear (Table 3.7). Across all operations, vessels and electronic equipment accounted for over 97% of total investment. Rods and reels were the second highest level of investment. Only two operators reported going spearfishing, which accounts for the low level of investment in spearfishing equipment when compared to hook-and-line equipment.

Table 3.7 Total Investment in Vessels, Equipment, and Gear (Replacement Value in 2013\$)¹

Item	Total Value (\$)	Mean	Median	Minimum	Maximum
Vessels & Electronic Equipment (N=8)	\$4,435,000	\$554,375	\$212,500	\$150,000	\$2,700,00
Diving and Snorkeling Gear (N=3)	\$25,300	\$3,162	\$0	\$0	\$15,000
Rods & Reels (N=8)	\$87,125	\$10,891	\$10,000	\$2,000	\$19,125
Spear Guns (N=1)	\$5,000	\$625	\$0	\$0	\$5,000
Other Gear & Equipment (N=2)	\$1,500	\$187	\$0	\$0	\$1,200
Total	\$4,553,925	\$569,241	\$225,000	\$173,300	\$2,719,125

¹ Number in parentheses is the number of operations with values greater than zero.

² Other gear included emergency position-indicating radio beacon (EPIRB), satellite phone, and other not specified.

Trip Costs. Respondents also provided estimates of their trip-related costs. These are considered variable costs and are dependent upon the number of trips the operation provides throughout the year. If the operator provides zero trips in a year, then their trip costs would also be zero. Fuel costs were the largest trip-related expenditure, composing nearly two thirds of their variable expenses. Crew wages and salaries are the second largest expense, and tackle is the smallest (Table 3.8).

Table 3.8 Annual Total Trip-Costs for the For-Hire Recreational Fishing Operations¹-2013 \$

Item	Total Trip Cost (\$)	Mean	Median	Minimum	Maximum
Fuel/Oil (N=8)	\$509,000	\$63,625	\$46,250	\$600	\$250,000
Ice (N=8)	\$57,800	\$9,597	\$5,100	\$100	\$30,000
Food/Supplies (N=6)	\$31,950	\$3,994	\$800	\$0	\$25,000
Bait (N=8)	\$60,700	\$7,587	\$7,100	\$50	\$25,000
Captain Wages & Salaries (if not owner; N=2)	\$70,000	\$8,750	\$0	\$0	\$40,000
Crew Wages & Salaries (N=7)	\$77,425	\$9,678	\$8,600	\$0	\$30,500
Tackle (N=1)	\$25	\$3	\$0	\$0	\$25
Total	\$806,900	\$100,862	\$71,250	\$1,650	\$400,500

¹ Number in parentheses is the number of operations with values greater than zero.

Respondents provided their best estimate for the cost per day for a typical day of operation. The per-day trip expense, on average, was higher for spearfishing than hook-and-line fishing (\$1,470 for spearfishing and \$1,411 for hook-and-line). However, the maximum per-day trip costs were higher for hook-and-line fishing than for spearfishing (tables 3.9 and 3.10).

Table 3.9 Typical Cost per Day for For-Hire Recreational Hook & Line Fishing Operations (2013\$)¹

Type of Fishing/Item	Mean	Median	Minimum	Maximum
Fuel/Oil (N=7)	\$950	\$650	\$500	\$2,500
Ice (N=7)	\$88	\$50	\$10	\$300
Bait (N=7)	\$94	\$80	\$50	\$250
Food/Supplies (N=6)	\$62	\$20	\$15	\$250
Crew Wages & Salaries (N=6)	\$155	\$113	\$100	\$305
Captain Wages & Salaries (if not owner; N=2)	\$325	\$325	\$250	\$400
Total (N=7)	\$1,411	\$995	\$575	\$4,005

¹ Number in parentheses is the number of operations with values greater than zero.

Table 3.10 Typical Cost per Day for For-Hire Recreational Spearfishing Operations (2013\$)¹

Type of Fishing/Item	Mean	Median	Minimum	Maximum
Fuel/Oil (N=2)	\$625	\$625	\$600	\$650
Ice (N=2)	\$438	\$438	\$75	\$800
Bait (N=2)	\$50	\$50	\$50	\$50
Food/Supplies (N=2)	\$58	\$58	\$15	\$100
Crew Wages & Salaries (N=2)	\$300	\$300	\$100	\$500
Captain Wages & Salaries (if not owner; N=0)	\$0	\$0	\$0	\$0
Total (N=2)	\$1,470	\$1,470	\$1,290	\$1,650

¹ Number in parentheses is the number of operations with values greater than zero.

Fixed Costs. Fixed costs are the expenditures that are incurred regardless of the number of fishing trips. These expenses may be necessary for the business to operate successfully and include items like insurance, rent, licenses, and inspection fees. The highest cost to respondents, on average, was P&I insurance for vessels. All respondents paid for permits and licenses and maintenance on vessels. Table 3.11 provides further details about fixed costs.

Table 3.11 Annual Fixed Costs of For-Hire Recreational Fishing Operations (2013\$)¹

Item	Total Costs (\$)	Mean	Median	Minimum	Maximum
Permit/Licenses (N=8)	\$24,420	\$3,052	\$500	\$70	\$11,000
Docking Fees (N=7)	\$52,460	\$6,557	\$4,920	\$0	\$20,400
Interest Payments On Vessels (N=6)	\$55,244	\$6,905	\$3,122	\$0	\$36,000
P&I Insurance on Vessels (N=7)	\$110,150	\$13,769	\$2,700	\$0	\$90,000
Maintenance-Repair: Vessels & Equipment (N=8)	\$70,450	\$8,806	\$4,500	\$250	\$37,500
Maintenance-Repair: Rods & Reels (N=7)	\$7,050	\$881	\$325	\$0	\$5,000
Maintenance-Repair: Other Equipment & Gear (N=5)	\$39,750	\$4,969	\$625	\$0	\$35,000
Advertising (N=7)	\$55,850	\$6,981	\$3,600	\$0	\$20,000
Office Rent/Mortgage (N=3)	\$6,200	\$775	\$0	\$0	\$3,000
Office Utilities (N=3)	\$12,900	\$1,612	\$0	\$0	\$11,500
Depreciation on Vessel & Equipment (N=3)	\$20,000	\$2,500	\$0	\$0	\$8,500
Business Taxes (N=4)	\$22,000	\$2,750	\$500	\$0	\$12,000
Coast Guard Inspection Fee (N=1)	\$1,000	\$125	\$0	\$0	\$1,000
Total (N=8)	\$477,474	\$59,684	\$29,665	\$720	\$267,500

¹ Number in parentheses is the number of operations with values greater than zero.

Performance. Performance refers to the revenue, profits, and return on investment. Return on investment is the level of income generated per dollar invested in the business. On average, the respondents' return on investment is 12.37%. This means they see a 12% return for every dollar invested. However, the range of return on investment is 0.83% to 44.73%. The average profit per person-day is \$121.15 (Table 3.12). These measures can be used in future assessments of regulations.

Table 3.12 Annual Financial Performance for For-Hire Recreational Fishing Operations (2013\$)

Item	Total All Operations	Mean	Median	Minimum	Maximum
Annual Total Revenue	\$1,648,381	\$206,048	\$131,333	\$5,000	\$800,000
Annual Trip Costs	\$806,900	\$100,862	\$71,250	\$1,650	\$400,500
Annual Fixed Costs	\$477,474	\$59,684	\$29,665	\$720	\$267,500
Annual Total Costs	\$1,284,374	\$160,547	\$105,065	\$2,420	\$668,000
Annual Profits	\$364,007	\$45,501	\$26,269	\$2,580	\$132,000
Total Investment ¹	\$4,553,925	\$569,241	\$225,000	\$173,300	\$2,719,125
Return on Investment ²	7.99%	12.37%	7.83%	0.83%	44.73%
Profits Per Person-Day ³	\$19.62	\$121.15	\$59.14	\$8.52	\$434.29

1. Replacement value of all vessels, equipment and gear.

2. Annual profits divided by total investment (%).

3. Annual profits divided by total person-days accommodated by the operations.

Dependency

In socioeconomic impact analyses of regulations, dependency on the resources used is assessed for estimating impacts on people's lives and livelihoods. We developed a suite of measures for this purpose (Table 3.13). On average, fishing operations depended on fishing in the NWGOM for 67.5% of their business income, but this ranged from a low of 20% to a high of 100%. As a percentage of owner/operator's household and personal income, fishing operation owner/operators were moderately dependent on their fishing operations, with an average of more than 40% for household income and average of almost 49% for personal income. This ranged from a low of 20% to a high of 75% for household income and 100% for personal income.

Operations, on average, received 44.45% of their total revenue from fishing in the NWGOM and this ranged from a low of 0.6% to a high of 70%. On average, a little over 39% of all hook-and-line fishing days were done in the NWGOM, while 60% of all spearfishing days were done in the NWGOM. Fishing operations were not very dependent on East or West Flower Gardens Banks for their recreational fishing. Stetson Bank was the most highly used, with five out of the eight operations using this bank. On average, the operations did almost 10% of their fishing on Stetson Bank. One operation did 34% of its fishing on Stetson Bank (Table 3.13).

Table 3.13 Dependency of Recreational For-Hire Fishing Operations in NWGOM and FGBNMS

Measure	Mean	Median	Minimum	Maximum
% of Business Income Derived from Fishing Operation	67.50	75	20	100
% of Total Household Income from Fishing Operation	40.60	35	20	75
% of Total Personal Income from Fishing Operation	48.75	35	20	100
% of Charter/Party Boat Revenue from NWGOM	44.45	50	0.6	70
% of Charter/Party Boat Revenue from Other Gulf of Mexico	55.17	50	30	99.4
% of Hook-and-Line Fishing Days in NWGOM (N=7)	39.29	50	7	70
% of Spearfishing Days in NWGOM (N=2)	60.00	60	50	70
% of All Activities in NWGOM	40.67	50	7	70
% of Hook-and-Line Fishing Days in East Flower Garden Bank (N=3)	0.68	0	0	2.4
% of Hook & Line Fishing Days in West Flower Garden Bank (N=3)	1.17	0	0	5.1
% of Hook & Line Fishing Days in Stetson Bank (N=5)	9.82	8.3	0	34.0

Knowledge, Attitudes, and Perceptions

In addition to completing survey questions about themselves and their businesses, respondents also answered questions regarding their knowledge and attitudes of FGBNMS management strategies and regulations, and their perceptions of the conditions of the natural resources.

In regards to the sanctuary, respondents reported FGBNMS website, word of mouth, and the Sanctuary Advisory Council as being the most common sources from which they had received information. Respondents did not receive information from FGBNMS signage, newspapers, radio, or television. Respondents were also asked to rank sources of information in terms of importance and the rankings followed the same pattern as the use (Table 3.14).

Table 3.14 Sources of Information and Their Importance

Source	Used	Median Rank of Importance	Mean Rank of Importance
FGBNMS Website	87.5%	1	0.9
Word of Mouth	87.5%	0.5	0.9
Sanctuary Advisory Council	75.0%	0.5	0.8
FGBNMS Staff	50.0%	0.5	0.5
FGBNMS Brochures/Literature	37.5%	0.5	0.4
FGBNMS Signage	0%	0	0
Information in Newspapers	0%	0	0
Radio	0%	0	0
TV	0%	0	0

The next set of questions asked respondents how they felt about the process of developing rules and regulations for FGBNMS. Equal numbers of respondents agreed and disagreed that the process used by NOAA to develop boundaries and regulations for FGBNMS was open and fair to all groups. However, a majority of respondents did agree the process used to develop boundaries and regulations for FGBNMS was open and fair to all groups (Table 3.15).

With respect to how individuals or other agencies were able to influence the development of rules and regulations, respondents had mixed opinions. A majority thought that they could not influence decisions by participating in the process. However, half of respondents (a plurality) did think that NOAA did address the concerns of other federal and state agencies and individual citizens in developing the rules and regulations and thought that once the regulations were in effect, they still had a voice on the usefulness of the regulations. On the procedures that NOAA has established to deal with violations of FGBNMS regulations, half of respondents said they didn't know. Of the remaining respondents, a plurality (25%) did not think the procedures were fair and just (Table 3.16).

Respondents also reported how they felt about the establishment of FGBNMS and how they felt about possible expansions in the NWGOM or establishments of research-only areas. The majority of respondents support FGBNMS as it is currently established and more than half the respondents support the establishment of a research-only area in FGBNMS. A majority of respondents also think a research-only area in FGBNMS would have a positive impact on the environment. However, a majority are against setting aside more than one bank for research-only in FGBNMS (Table 3.17)

The highest level of support for a research-only area occurs in East Flower Garden Bank and there is no support among respondents for a research area in Stetson Bank, the closest bank to shore. Also, a majority of respondents do not support a research-only area in West Flower Garden Bank (Table 3.17).

With respect to boundary expansion, a majority of respondents supported boundary expansion in all four areas of the NWGOM and most respondents (87.5%) believe that boundary expansion of the sanctuary would have a positive impact on the marine environment. Most respondents (87.5%) also believe that the three banks currently in FGBNMS have benefited environmentally from the management by FGBNMS (Table 3.17).

As to how respondents felt about existing and possible future regulations, all but one respondent supports the no anchoring regulation in FGBNMS. The same is true for the current no discharge regulations in FGBNMS. Most respondents (87.5%) support the no taking of marine mammals and turtles in FGBNMS. Seventy-five percent of the respondents support stricter restrictions on discharging of pollutants within FGBNMS. All of the respondents support the current no harvest of bottom formations or takings of invertebrates inside FGBNMS and support the use of mooring buoys instead of anchoring in FGBNMS with a vessel size limit of 100 feet or less. Half the respondents support stricter restrictions on discharging of pollutants within FGBNMS (Table 3.18).

A majority of users support the use of mooring buoys for fishing and diving in FGBNMS, minimum speed and distance from vessels, and that all dive vessels fly a blue and alpha flag. None of the respondents supported the mooring buoy reservation system. Less than half, but a plurality, of respondents support the regulation that all vessels entering FGBNMS have AIS monitoring systems (Table 3.17).

On the fishing regulations, respondents were generally positive. Three-fourths supported hook-and-line only in FGBNMS. A plurality (42.9%) supported the one-hook limit and disagreed with the two-hook limit (Table 3.17).



Table 3.15 Attitudes towards FGBNMS and Regulatory Development

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
The process that NOAA has used to develop rules and regulations for FGBNMS was open and fair to all groups.	-	50.0%	-	50.0%	-	-	8
The process has used by NOAA to develop boundaries and regulations for FGBNMS zones was open and fair to all groups.	25.0%	37.5%	12.5%	12.5%	12.5%	-	8
It has not mattered whether the average person participated in the workshops and meeting on FGBNMS because the average person could not influence the final decisions.	37.5%	25.0%	12.5%	12.5%	12.5%	-	8
NOAA has not addressed the concerns of other federal and state governments in developing rules and regulations for FGBNMS.	-	-	12.5%	12.5%	37.5%	37.5%	8
NOAA has not addressed the concerns of individual citizens in developing rules and regulations for FGBNMS.	25.0%	12.5%	12.5%	25.0%	25.0%	-	8
Once FGBNMS regulations have been in effect, there has been no way for the average person to voice his/her opinion on the usefulness of the regulations.	25.0%	-	12.5%	12.5%	50.0%	-	8
The procedures that NOAA has established to deal with violations of FGBNMS regulations have been fair and just.	-	12.5%	12.5%	-	25.0%	50.0%	8



Table 3.16 Level of Support towards Boundary Expansions

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
I support FGBNMS as it is currently established.	71.4%	-	-	14.3%	14.3%	-	7
I support the establishment of a research-only area in FGBNMS.	50.0%	12.5%	-	-	37.5%	-	8
A research-only area in FGBNMS would have a positive impact on the marine environment.	50.0%	12.5%	-	-	25.0%	12.5%	8
There should be more than one bank set aside as a research-only area in FGBNMS.	25.0%	-	12.5%	12.5%	50.0%	-	8
I support establishment of boundary expansion of FGBNMS for the banks in Area 1.	57.1%	-	14.3%	-	28.6%	-	7
I support establishment of boundary expansion of FGBNMS for the banks in Area 2.	57.1%	-	14.3%	-	28.6%	-	7
I support establishment of boundary expansion of FGBNMS for the banks in Area 3.	57.1%	-	14.3%	-	28.6%	-	7
I support establishment of boundary expansion of FGBNMS for the banks in Area 4.	57.1%	-	14.3%	-	28.6%	-	7



Table 3.16 Level of Support towards Boundary Expansions (continued)

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
I support establishment of a research-only area on Stetson bank.	0.0%	-	25.0%	12.5%	62.5%	-	8
I support establishment of a research-only area on East Flower Garden Bank.	42.9%	14.3%	0.0%	-	42.9%	-	7
I support establishment of a research-only area on West Flower Garden Bank.	14.3%	-	14.3%	-	71.4%	-	7
Boundary expansion of FGBNMS would have a positive impact on the marine environment.	62.5%	25.0%	12.5%	-	-	-	8
Stetson and East and West Flower Garden banks have benefited environmentally from the management by FGBNMS.	75.0%	12.5%	12.5%	-	-	-	8

Table 3.17 Level of Support for Regulations and Requirements in FGBNMS

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know	N
I support the no anchoring regulations in FGBNMS.	87.5%	-	-	-	12.5%	-	8
I support the current no discharge regulations in FGBNMS.	87.5%	-	-	-	12.5%	-	8
I support the current no harvest of bottom formations or takings of invertebrates inside FGBNMS.	100.0%	-	-	-	-	-	8
I support the hook-and-line only fishing regulation in FGBNMS.	75.0%	-	-	-	25.0%	-	8
I support a one hook-and-line limit in FGBNMS.	42.9%	-	28.6%	-	28.6%	-	7
I support a two hook-and-line limit in the FGBMNS.	14.3%	-	42.9%	-	42.9%	-	7
I support that all vessels entering FGBNMS to have a (AIS) monitoring system.	42.9%	-	28.6%	-	28.6%	-	7
I support the no taking of marine mammals and turtles in FGBNMS.	87.5%	-	-	-	12.5%	-	8
I support the requirement of using a mooring buoy instead of anchoring in FGBNMS with the limit of vessel size for the mooring use of 100 feet or less.	100.0%	-	-	-	-	-	8
I support specific use of the mooring buoy for fishing and diving in FGBNMS.	57.1%	-	14.3%	14.3%	14.3%	-	7
I support reservation of buoy use at FGBNMS.	0.0%	-	-	14.3%	85.7%	-	7
I support stricter regulations on discharging of pollutants in FGBNMS.	50.0%	25.5%	-	12.5%	25.0%	-	8
I support regulations on minimum distance and speed from vessels.	62.5%	-	37.5%	-	-	-	8
I support the requirement that all dive vessels fly a blue and alpha flag.	75.0%	12.5%	12.5%	-	-	-	8

Respondents were equally split in their opinion of the level of economic benefit they have had as a result of FGBNMS. Equal numbers agreed and disagreed about the net benefits to the economy from the establishment of FGBNMS with the remaining being neutral or responding “Don’t Know.” Equal numbers of respondents agreed and disagreed whether or not charter/party boat fishing operations have benefited from the establishment of FGBNMS with the remaining being neutral. And finally, there were equal numbers of respondents who agreed and disagreed about whether or not the regulations in FGBNMS has had an effect on their business with the remaining being neutral or responded “Don’t Know” (Table 3.18).

Table 3.18 Extent of Impact of FGBNMS on Economy and Business

Question	Strongly Agree	Moderately Agree	Neutral	Moderately Disagree	Strongly Disagree	Don't Know
There has been a net economic benefit to the economy from the establishment of FGBNMS.	37.5%	-	12.5%	12.5%	25.0%	12.5%
The charter/party boat fishing operations have benefited from the establishment of FGBNMS.	37.5%	-	25.0%	-	37.5%	-
FGBNMS regulations have had no effect on my business.	37.5%	-	12.5%	-	37.5%	12.5%

In regards to the environment, of those who felt the questions were relevant to them, most agreed that the status of environmental resources is better since these implementations of FGBNMS. Only one person felt there was a decline in the fisheries (Table 3.19). Additionally, most respondents felt that FGBNMS was mostly responsible for the improvement to the resources.

Table 3.19 Status/Condition of Environmental Resources Since the Implementation of FGBNMS

Resource/Question	Much Better	Better	Neutral	Worse	Much Worse	N/A	N
Water quality	25%	25%	25%	-	-	25%	8
Sea-Based Pollution/Marine Debris	38%	13%	25%	-	-	25%	8
Coral Reefs	50%	13%	25%	-	-	13%	8
Other Bottom Habitat	25%	25%	25%	-	-	25%	8
Fisheries	38%	13%	25%	13%	-	13%	8
Mooring Buoys	63%	13%	0%	-	-	25%	8

CHAPTER 4. PRIVATE VESSELS, OIL AND GAS, AND PASSIVE USE

Private Vessels

Information on access for recreation use by private vessels was obtained through the surveys of commercial fishing operations, for-hire recreational fishing operations, and for-hire diving operations by asking them if they see private vessels operating in the NWGOM Study Area. All said they did not. However, personal communications with one FGBNMS Sanctuary Advisory Council member and for-hire guide provided estimates for the number of private vessels that access Stetson Bank for fishing when weather permits (Stout 2010). We also accessed satellite data for seven years and the most boats at Stetson Bank on any given day was a maximum of four.

Stetson Bank is approximately 70 nautical miles from Freeport and gets considerably more fishing pressure than other banks. On good weather days (less than 10 per year), most small craft can go out 70 to 80 miles. Some boats (30-40 feet in length) can go out 100 to 110 miles. About 85% of small boats with outboards can make it out to Stetson Bank.

On weekends, depending on weather, there may be 20 to 30 private type boats (30 ft. center consoles) that can make it out to Stetson. Assuming all the good weather days happen on weekends, the maximum number of small boats going out on 10 weekend days would be 200 to 300 boat trip days. From most studies of private vessels that are fishing, it is estimated that 2.5 persons are onboard which would translate into 500 to 750 person-days of use.

East and West Flower Garden Banks are too far for smaller boats and it is not a day trip (requires an overnight trip live-aboard). Very few private vessels do this and a very low volume of charter boats do.

All the recreational fishing by private vessels is hook-and-line fishing, which is not affected by boundary expansion.

Oil and Gas

Offshore oil and gas in the Gulf of Mexico is a major source of oil and natural gas production in the United States. The western and central planning areas in the Gulf of Mexico, which include offshore Texas, Louisiana, Mississippi, and Alabama, are among the major petroleum-producing areas of the U.S. The Gulf of Mexico region contributed 54% of total U.S. crude oil production from 2008 to 2010, and 52% of total U.S. natural gas production from 2007 to 2009 (NOAA 2011). This percentage has dropped (possibly as a result of factors such as declining Gulf of Mexico gas production and increased onshore production by hydraulic fracturing) to the point that, in 2013, Gulf of Mexico federal offshore oil production accounted for 17% of total U.S. crude oil production, and federal offshore natural gas production in the Gulf of Mexico accounted for 5% of total U.S. dry production (EIA 2015). Over 45% of total U.S. petroleum refining capacity is located along the Gulf of Mexico coast, as well as 51% of total U.S. natural gas processing plant capacity (EIA 2015).

The oil and gas industry is a significant component of the regional economy, supporting 120,676 jobs in 2009 and paying \$15.6 billion in wages to workers in the region in the same year (NOAA 2011).

Current sanctuary regulations allow for the exploration and production of oil and gas inside sanctuary boundaries subject to the restrictions imposed by the Bureau of Ocean Energy Management (BOEM) for the protection of topographic features, potentially sensitive biological features, and live bottom as described in section 4.6.1.4. of the draft environmental impact statement (NOAA 2016).

BOEM divides the Gulf of Mexico into three planning areas: (1) Western, (2) Central, and (3) Eastern. The alternatives analyzed here fall within all three planning areas. There were approximately 2,323 active oil and gas platforms in the Gulf of Mexico in November 2015 (BOEM & BSEE 2015), though that number was greater in recent years. The platforms in the Gulf of Mexico were producing oil and gas from 4,158 wells in 2014; note that more than one well can tie to a platform. The most comprehensive sanctuary expansion alternative (Alternative 5) encompasses 18 active platforms, while the preferred alternative (Alternative 3) encompasses eight.

Passive Economic Use Value

National marine sanctuaries are national resources and sometimes they are recognized internationally. Many people have economic value (a willingness to pay) to ensure



natural and cultural resources are protected in a certain condition. Passive economic value is a term currently used by economists to describe this source of value. In the past, it was more commonly referred to as non-use value and was described as being motivated by desires to protect resources for future generations (bequeath value) or to simply know that the resources would be protected in a certain condition in the future (existence value). The reason for the change in terminology is that people must know about the current conditions of the resources to place a value on them. People learn about the conditions of resources and the threats against their future conditions through various media sources (e.g., newspapers, magazines, television, radio, books, and the internet).

In a recently published paper (Stefanski and Shimshack 2016), passive economic use value was estimated for expanding the boundaries of FGBNMS from its current three banks to an additional nine banks recommended by the FGBNMS SAC. A national survey of 1,526 households in the U.S. was conducted in May 2012. It was estimated that the average household was willing to pay \$35 to \$107 per year to add the current protections in FGBNMS to the other nine banks. Using the lower bound estimate of \$35 per household per year and extrapolating this to 114 million U.S. households, and applying discounts rates of 3%, 5%, and 7% (recommended by the U.S. Office of Management and Budget for water projects), the authors calculated the value over a five-year period. The estimates ranged from \$16.4 to \$18.3 billion for the five-year period. This was compared to the \$15 million estimated for the costs of implementing the boundary expansion for the same five-year period in the 2012 FGBNMS management plan.

If these estimates are put on an annual basis, the range in benefits would be from \$3.99 billion to \$12.2 billion per year and the cost of implementation of about \$3 million per year.

CHAPTER 5. ANALYSIS OF ALTERNATIVES

Description of Alternatives

FGBNMS is considering five alternatives for boundary expansion. The starting point for the alternative development was the Sanctuary Advisory Council recommendation outlined in the FGBNMS 2012 management plan. The alternatives range from being smaller in scope than the Sanctuary Advisory Council recommendation (Alternative 1, the “no action” alternative) to being larger in scope than that recommendation (alternatives 3, 4, and 5).

NOAA determined that all of the sites evaluated in the alternatives described below possess conservation, recreational, ecological, historical, scientific, educational, cultural, archaeological, or aesthetic qualities which give them special national, and in some instances, international, significance. In the early development of the proposed sanctuary expansion, NOAA’s emphasis was on the areas and resources in the immediate vicinity of the existing FGBNMS. However, NOAA also recognized that the sanctuary is part of a larger ecological system: the north-central Gulf of Mexico. Accordingly, in development of the alternatives, resources throughout that system were considered. Under this approach, NOAA is better able to evaluate the nationally significant features in the region, considering the multiple ecological and human use benefits of sanctuary expansion within the larger ecosystem.

Alternative 1

As required by Section 1502.14(d) of the National Environmental Policy Act (NEPA), NOAA has included the evaluation of a no action alternative in this report (Alternative 1, Table 5.1 and Figure 5.1). “No action” in this case means that none of the proposed sanctuary restrictions in the expansion alternatives would take place, and the resulting environmental effects from leaving the existing sanctuary boundaries and regulations in place are compared with the effects of implementing the various restrictions in the different alternatives. Those boundaries encompass three distinct geologic features and associated benthic biological communities at East Flower Garden Bank, West Flower Garden Bank, and Stetson Bank, and include an area of approximately 56 square miles.

Table 5.1 Alternative 1, No Action

	Nationally Significant Biological and Geological Features	Area (square miles)
1	Stetson Bank	0.84
2	West Flower Garden Bank	29.94
3	East Flower Garden Bank	25.43
	Net Increase in Area Over Current Sanctuary	0.00
	Alternative 1 Total Area	56.21

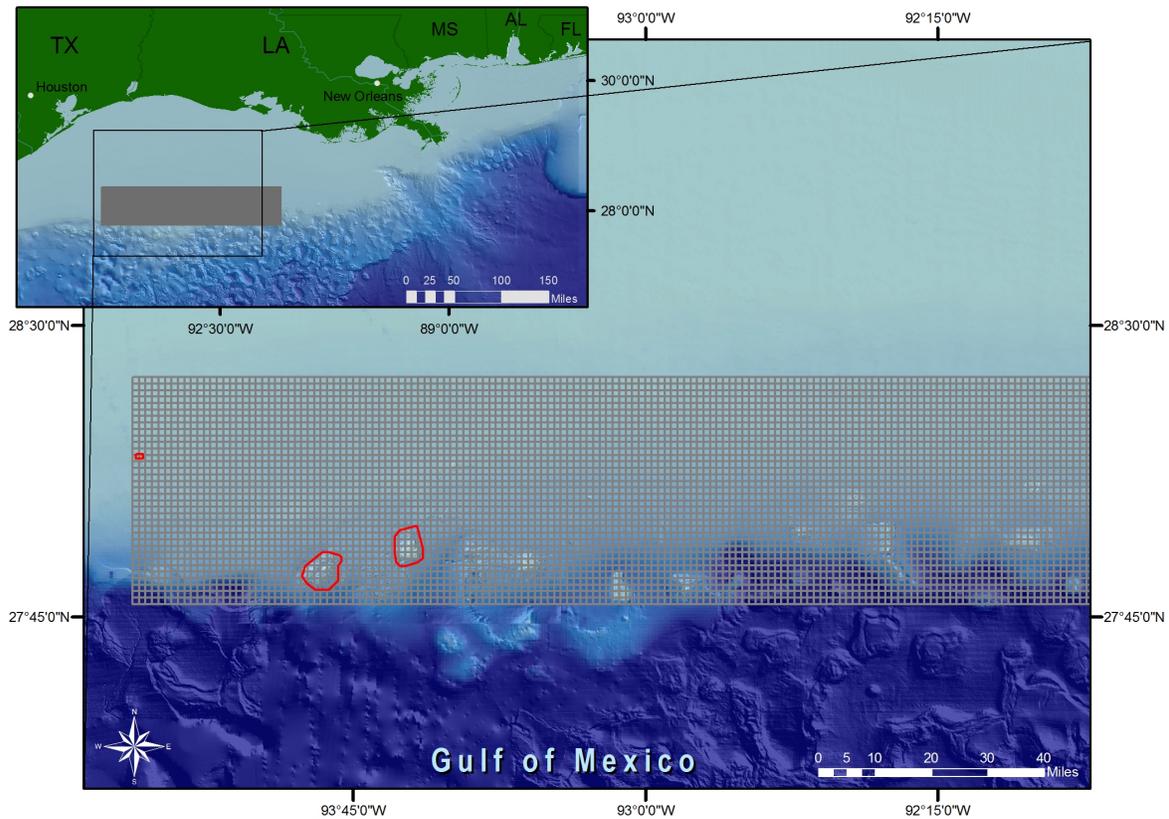


Figure 5.1 Alternative 1, Current sanctuary boundaries. Image: NOAA

The grey area is the study area of the economic analysis. Boundary polygons are numbered as shown in Table 5.1.

Alternative 2

The recommendation for sanctuary expansion that was developed by the Sanctuary Advisory Council (Alternative 2, Table 5.2 and Figure 5.2) was formulated in 2007 and based on the work of a subcommittee called the Boundary Expansion Working Group (BEWG), which consisted of representatives from the Sanctuary Advisory Council, ONMS, and other federal

agencies. The BEWG evaluated an initial list of 19 potential sanctuary expansion sites compiled from public scoping comments, advisory council and sanctuary staff recommendations, and information collected and compiled from scientific literature available at the time (Texas A&M University, Northern Gulf of Mexico Topographic Features Study Final Report, 1981). The BEWG developed and presented seven sanctuary expansion alternatives to the Sanctuary Advisory Council, recommending eight of those 19 sites be included in the expansion proposal, based on a ranking process evaluating factors including a “zone priority index,” structural connectivity, biological connectivity, a threat index, and public and FGBNMS prioritization. Based on additional input from the full Sanctuary Advisory Council membership and from the public, the Sanctuary Advisory Council augmented the BEWG recommendation, adopting a final recommendation for an expansion incorporating 11 of the 19 sites initially evaluated by the BEWG within nine discrete recommended boundary polygons.

The Sanctuary Advisory Council recommended that irregularly shaped polygons be developed and submitted for consideration so as to limit conflicts with oil and gas infrastructure and activity. Core biological areas were identified based on visual interpretation of seafloor topography and previous scuba and submersible investigations demonstrating the presence of high-diversity coral reefs, coralline algal reefs, and deep coral reef zones. Identified core biological zones were intended to include the main topographic feature supported by the underlying salt dome, and deep-water carbonate mounds associated with faults and ridges. Prominent features are defined as carbonate mounds greater than three meters (10 feet) in vertical relief and 25 meters (82 feet) in diameter, and the boundary of the core biological zones was developed by identifying the outermost series of prominent features as landmarks, forming the vertices of an irregular polygon. Buffer zones of various widths (250-1000 meters; 820-3,280 feet) were considered from the outer landmarks of the core polygon, radiating from an approximate midpoint of the bank. The BEWG proposed, and the full Sanctuary Advisory Council adopted, irregularly shaped boundary proposals for each of the sites reflecting a 500 meter (1,640 foot) buffer zone, based on literature detailing effects of pollutants associated with shunted drilling muds resulting from oil and gas drilling activities. Oil and gas infrastructure was considered, and recommendations were made to either include existing platforms (3) or exclude existing platforms, dependent upon the distance from the core biological area.

Additional detail about the process used by the Sanctuary Advisory Council to arrive at its recommendation is provided in the 2012 FGBNMS management plan and in [presentations posted](#) on the FGBNMS website.

Table 5.2 Alternative 2, 2007 Advisory Council Sanctuary Expansion Recommendation

	Nationally Significant Biological and Geological Features	Area (square miles)
1	Stetson Bank	2.90
2	West Flower Garden Bank	46.60
3	East Flower Garden Bank and Horseshoe Bank	99.84
4	MacNeil Bank	7.40
5	Rankin Bank, 28 Fathom Bank, and Bright Bank	83.20
6	Geyer Bank	15.96
7	McGrail Bank	11.90
8	Sonnier Bank	5.24
9	Alderdice Bank	8.12
	Net Increase in Area Over Current Sanctuary	224.94
	Alternative 2 Total Area	281.15

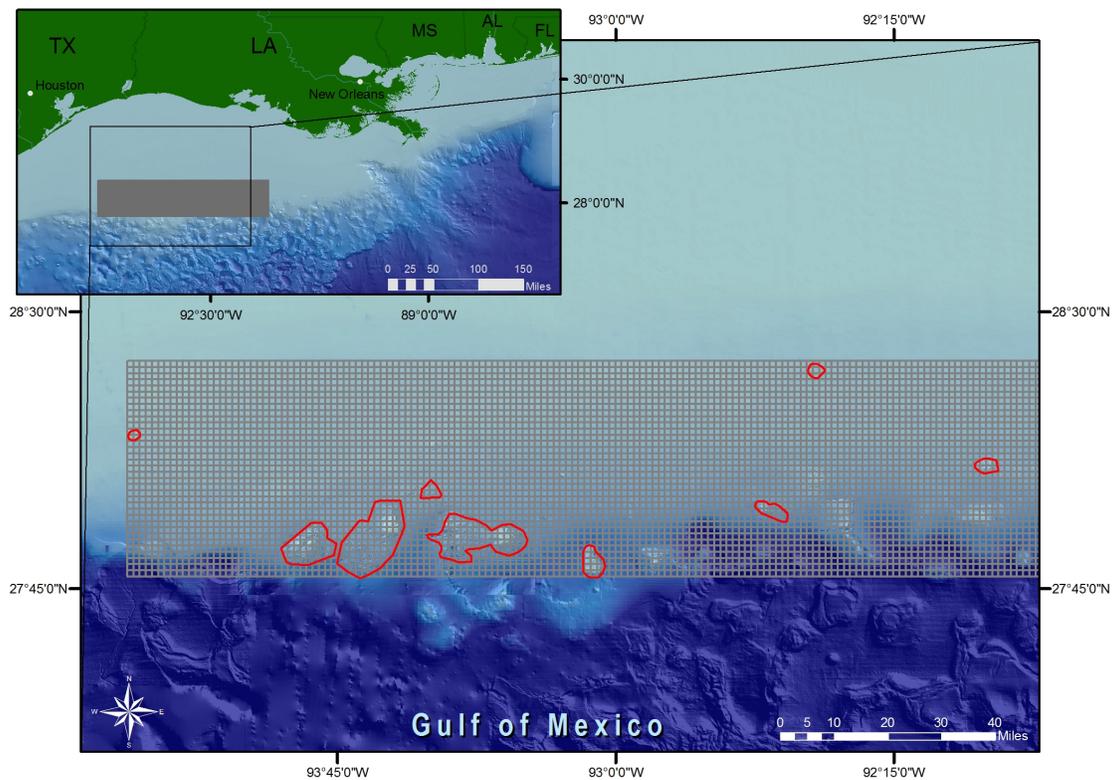


Figure 5.2 Alternative 2, 2007 Advisory Council recommended sanctuary expansion. Image: NOAA

Alternative 3 – Preferred Alternative

NOAA's preferred alternative (Alternative 3, Table 5.3 and Figure 5.3) was developed by ONMS and incorporates additional input from other NOAA offices and federal agencies, the research community, and the public. In developing this alternative, NOAA applied the same principle as the Sanctuary Advisory Council in evaluating features separately with discrete potential boundaries, rather than a single all-encompassing boundary, to minimize conflicts with user groups and result in a network of protected areas. The proposed boundary polygons presented in Alternative 3 were developed using a more rigorous, replicable process than the method employed in developing Alternative 2 by applying the same objective, algorithmic approach (i.e., a standardized, stepwise process) to each site in a geographic information system (GIS) (see FGBNMS draft environmental impact statement, Appendix D for an overview of this process). Alternative 3 modifies and augments the recommendation of the Advisory Council, using substantially the same evaluation criteria applied by the BEWG but taking into account the considerable additional scientific information about the areas under consideration that has been generated in the eight years since the Sanctuary Advisory Council recommendation was made, and simplifying the recommended boundaries for ease of enforcement and consistency with existing regulatory regimes. In particular, the acquisition of additional high-resolution multi-beam bathymetric data and additional site surveys by scuba or remotely operated vehicle (ROV) made both opportunistically and in the context of formal study designs, provide a basis for revision of the site rankings determined by the BEWG and the recommendation made by the Sanctuary Advisory Council. Since 2002, the FGBNMS research team and partners have conducted over 200 remotely operated vehicle surveys during 17 research cruises to characterize the biological communities of the reefs and banks in the northwestern Gulf of Mexico outside of the current sanctuary boundaries. A cooperative study (Sammarco et al, in prep) characterizing the biological communities of shelf potentially sensitive biological features, funded by BOEM and undertaken by the Louisiana Universities Marine Consortium and FGBNMS staff, is particularly informative regarding the ecology of low-relief areas surrounding high-relief banks. In that study, five of the features added to the Sanctuary Advisory Council recommendation in Alternative 3 (Bouma, Rezak, Sidner, Elvers, and Parker banks) were explored.

Table 5.3 Alternative 3, 2015 FGBNMS staff recommendation for sanctuary expansion and NOAA's preferred alternative

	Nationally Significant Biological and Geological Features	Area (square miles)
1	Stetson Bank	2.33
2	West Flower Garden Bank, East Flower Garden Bank, and Horseshoe Bank	147.41
3	MacNeil Bank	8.31
4	Rankin Bank, 28 Fathom Bank, and Bright Bank	82.94
5	Geyer Bank	15.27
6	McGrail Bank	12.02
7	Sonnier Bank	5.58
8	Alderdice Bank	7.98
9	Elvers Bank	20.10
10	Bouma Bank, Bryant Bank, Rezak Bank, and Sidner Bank	53.56
11	Parker Bank	27.69
	Net Increase in Area Over Current Sanctuary	326.98
	Alternative 3 Total Area	383.19

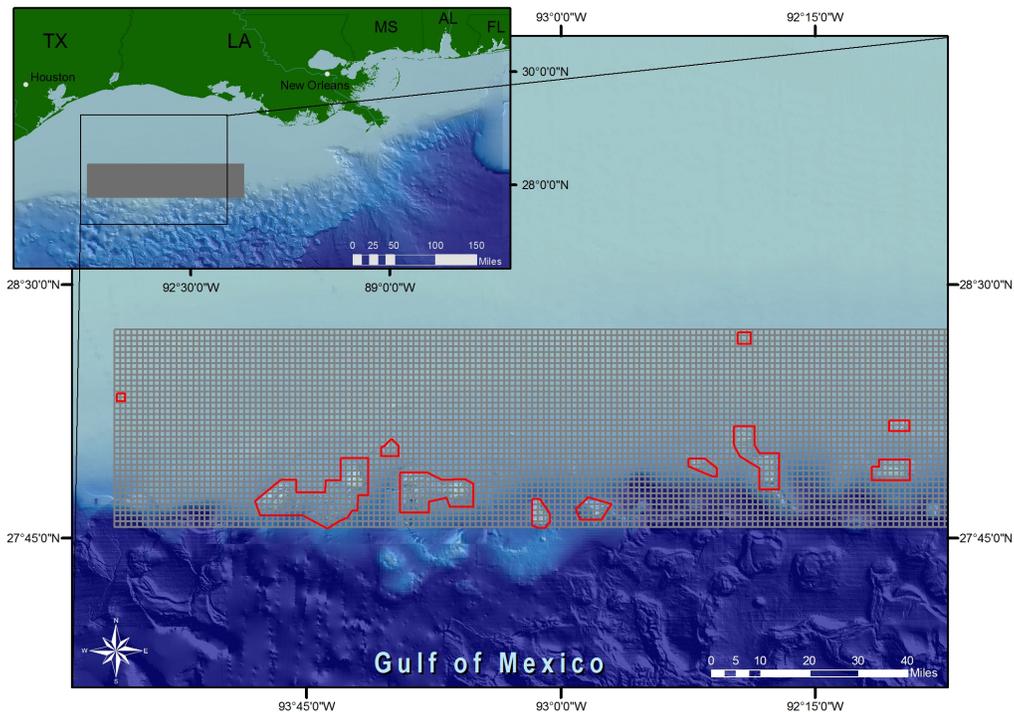


Figure 5.3 Alternative 3. Image: NOAA

2015 FGBNMS staff recommendation for sanctuary expansion and NOAA's preferred alternative. Boundaries modified from Alternative 2 are shown in purple; additional proposed areas are shown in red. The grey area is the study area of the economic analysis. Boundary polygons are numbered as shown in Table 5.3.

Alternative 4

Alternative 4 (Table 5.4 and Figure 5.4) incorporates additional mesophotic and deep benthic coral ecosystem sites across the north central Gulf of Mexico. Some of these sites, such as those in the Pinnacles area (also referred to in BOEM documents as the “pinnacle trend”) off the coast of Louisiana, Mississippi, and Alabama, were considered by the Sanctuary Advisory Council but not included in the recommendation for sanctuary expansion. Other sites included in Alternative 4 were not considered by the Sanctuary Advisory Council, but are included and evaluated here. Alternative 4 is included in this analysis despite being outside the scope of the sanctuary’s current operational capacity and budgetary resources. As described above, it must still be evaluated in the draft environmental impact statement if it is reasonable. NOAA determined it to be reasonable due to these sites’ presence within the distinct biogeographic region of the north central Gulf of Mexico (i.e., their relatively consistent geologic/sedimentary and hydrologic/oceanographic settings, as well as biological communities) and due to the significant advances in understanding and heightened awareness of the importance of these sites that have developed in the last decade. The sites included in Alternative 4 were also evaluated using substantially the same evaluation criteria applied by the BEWG, supplemented by the factors developed by ONMS in 2014 for evaluating new sanctuary nominations (see FGBNMS draft environmental impact statement, Appendix E), and simplifying the recommended boundaries for ease of enforcement and consistency with existing regulatory regimes. The proposed boundaries for each site were also developed using the GIS algorithm applied to sites in Alternative 3.

The 11 deep coral sites included in this alternative represent the most important known deep benthic habitat sites in the Gulf of Mexico, discovered through hundreds of hours of cruise preparation, dozens of cruises to dozens of different sites, and years of laboratory analysis of coral diversity, coral population genetics, macrofaunal diversity, geological analysis, water chemistry, and other information. They have been identified for inclusion in Alternative 4 based on information primarily collected during the 2008-2011 “Lophelia II” study (Brooks et al., in review) funded by BOEM and NOAA’s Office of Ocean Exploration and Research (OER). In addition, many of these sites were discovered prior to that project as part of the earlier BOEM (then Minerals Management Service [MMS]) funded “Chemo I,” “Chemo II,” “Chemo III,” and “Lophelia I” studies (MacDonald et al 1995, MacDonald et al 2002, Brooks et al 2014, and CSA 2007), and through other National Science Foundation and OER

work. These investigations date to the early 1990s when researchers began to have access to the expanding MMS 3D seismic database and developed conceptual models for the location and exploration of hard bottom associated with hydrocarbon seepage (MacDonald et al 1995). These were accompanied by historical records of coral occurrence from trawls, and early observations from the Johnson Sea-Link and Navy NR-1 submersibles. Following the 2010 Deepwater Horizon spill, intensive surveys revealed more coral communities in the immediate vicinity of the well-head; several of these sites are also included in Alternative 4. More detailed descriptions of these sites can be found in White et al. 2012, Fisher et al. 2014, and Fisher et al. 2014. More recently, multiple visits by the NOAA Ship *Okeanos Explorer* led to the discovery of a few additional sites (most significantly the Hidalgo Basin Rim site).

Similarly, observations of mesophotic zone habitats in the Pinnacles area found an unexpected abundance and diversity of subtropical fish and corals. The seven sites identified for inclusion in Alternative 4 were first mapped with single-beam echo sounder by Ludwick and Walton in 1957. Successive mapping efforts by BOEM (formerly MMS), NOAA, and the U. S. Geological Survey have incrementally improved the spatial extent and resolution of bathymetric profiles of the area. High-resolution multi-beam bathymetric [surveys](#) from 2000, combined with ROV and submersible surveys that have occurred in the area since the mid-1980s, have allowed accurate characterization of the geomorphology of mesophotic reefs and low-relief hard substrates throughout the tract as well as documentation of their importance as benthic habitats for fisheries. Nine significant features were characterized in the high-resolution multi-beam bathymetric map surveys from 2000, though further surveying is needed to characterize the full extent of hard bottom reefs and low-relief features and substrates in the area.

Table 5.4 Alternative 4, NOAA’s preferred alternative plus high priority mesophotic and deep coral sites

	Nationally Significant Biological and Geological Features	Area (square miles)
1	Stetson Bank	2.33
2	West Flower Garden Bank, East Flower Garden Bank, and Horseshoe Bank	147.41
3	MacNeil Bank	8.31
4	Rankin Bank, 28 Fathom Bank, and Bright Bank	82.94
5	Geyer Bank	15.27
6	McGrail Bank	12.02
7	Sonnier Bank	5.58
8	Alderdice Bank	7.98
9	Elvers Bank	20.10
10	Bouma Bank, Bryant Bank, Rezak Bank, and Sidner Bank	53.56
11	Parker Bank	27.69
12	Hidalgo Basin Rim	6.98
13	Assumption Dome	45.63
14	St. Tammany Basin Rim	7.23
15	Henderson Ridge North	5.85
16	Henderson Ridge South	31.36
17	Biloxi Dome	12.82
18	Mountain Top	2.03
19	Viosca Knolls West	15.92
20	Gloria Dome	3.01
21	Alabama Alps, 36 Fathom Ridge	4.04
22	West Addition Pinnacles	1.03
23	Dauphin Dome	7.61
24	Shark Reef, Double Top, Triple Top	6.26
25	Viosca Knolls East	9.36
26	Ludwick-Walton and West Delta Mounds	19.06
27	Yellowtail, Cat's Paw, Roughtongue, Corkscrew	42.05
28	Far Tortuga	5.01
29	Desoto Canyon/West Florida Escarpment	25.30
	Net Increase in Area Over Current Sanctuary	577.55
	Alternative 4 Total Area	633.76
	Total Area Not Included in Socioeconomic Study Area	245.59

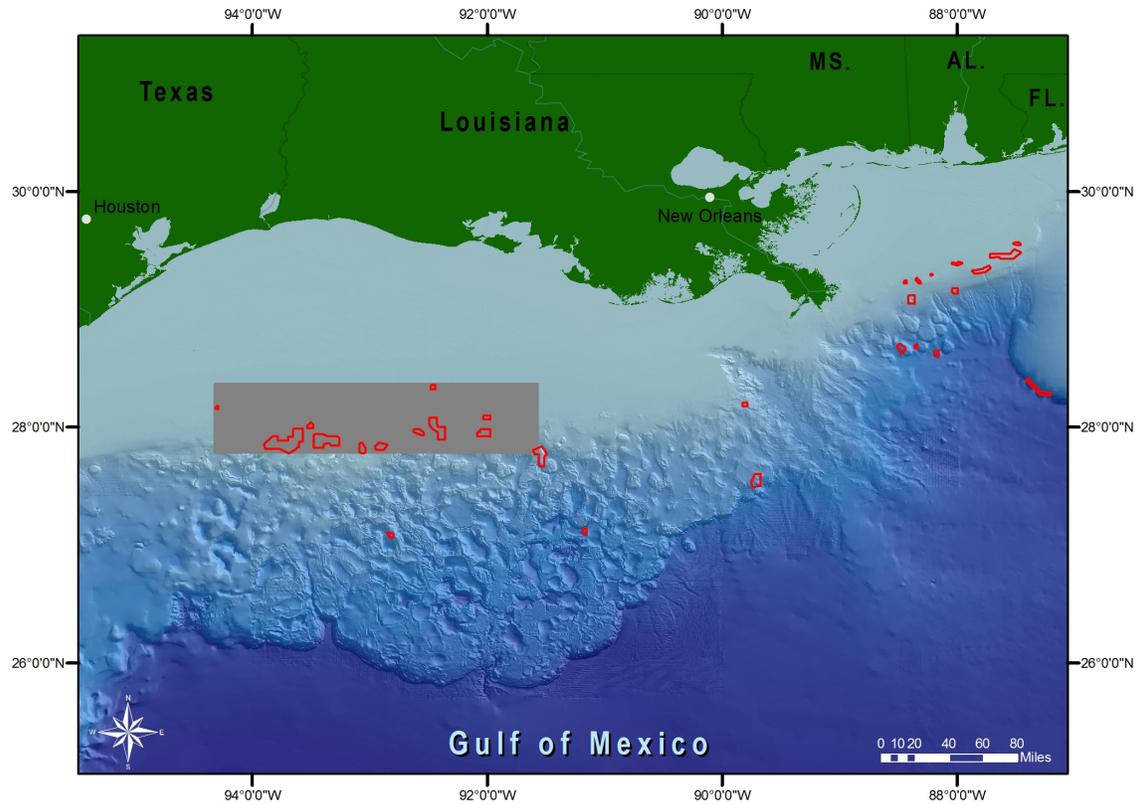


Figure 5.4 Alternative 4. Image: NOAA

NOAA's preferred alternative plus high priority mesophotic and deep coral sites. Boundaries carried forward from Alternative 3 are shown in blue; additional proposed areas are shown in red. The grey area is the study area of the economic analysis. Boundary polygons are numbered as shown in Table 5.4.

Alternative 5

Alternative 5 (Table 5.5 and Figure 5.5) incorporates additional mesophotic and deep benthic coral ecosystem sites, as well as important shipwreck sites, across the north central Gulf of Mexico. Some of these sites, such as 29 Fathom Bank and Jakkula Bank, were considered by the Sanctuary Advisory Council but not included in their 2007 recommendation for sanctuary expansion. Other sites, such as Claypile Bank, Ewing Bank, and the mesophotic and deep benthic sites and shipwrecks, included in Alternative 5 were not considered by the Sanctuary Advisory Council, but are included and evaluated here. Alternative 5 is included in this analysis despite being outside the scope of the sanctuary's current operational capacity and budgetary resources. As described above, it must still be evaluated in the draft environmental impact statement if it is reasonable. NOAA determined it to be reasonable due to these sites' presence within the distinct biogeographic region of the north central Gulf of Mexico (i.e., their relatively

consistent geologic/sedimentary and hydrologic/oceanographic settings, as well as biological communities) and due to the significant advances in understanding and heightened awareness of the importance of these sites that have developed in the last decade. Shipwrecks are included in this alternative because the National Marine Sanctuaries Act specifically identifies the need to protect nationally significant historical, cultural, and archaeological sites. Both public scoping for FGBNMS draft environmental impact statement and NOAA's internal and cooperating agency consultations identified the included sites as nationally significant.

The sites included in Alternative 5 were also evaluated using substantially the same evaluation criteria applied by the BEWG, supplemented by the factors developed by ONMS in 2014 for evaluating new sanctuary nominations (see FGBNMS draft environmental impact statement, Appendix E), and simplifying the recommended boundaries for ease of enforcement and consistency with existing regulatory regimes. The proposed boundaries for each site were also developed using the GIS algorithm applied to sites in alternatives 3 and 4. In total, the 45 proposed boundaries included in Alternative 5 would protect the most comprehensive suite of known high-value benthic habitats and cultural resources across the north central Gulf of Mexico region of all of the proposed alternatives.

Alternative 5 combines three of the proposed boundaries included in Alternative 4 into a single large complex of seven significant features extending east from West Flower Garden Bank to Bright Bank in recognition of the substantial structural and functional connectivity among these features, as demonstrated by the extent of the "core sensitivity zone" mapped between these features using the GIS algorithm applied to develop proposed boundaries under alternatives 3, 4, and 5.

This alternative also modifies one of the other proposed boundaries included in Alternative 4 in the northwestern banks subregion, extending the proposed boundary around the Bouma/Bryant/Rezak/Sidner complex to the south to encompass Tresslar and Antoine banks. Two of the proposed deep coral site boundaries from Alternative 4 are also modified in Alternative 5; the Biloxi Dome site boundary is extended to the southwest to incorporate the historically important wrecks of the S.S. *Robert E. Lee* and the U-166, and the Gloria Dome site is extended to the northeast to incorporate the culturally significant and scientifically important (e.g., for long-term study of impacts) wreck of the Deepwater Horizon oil platform and wellhead.



Advances in understanding of the maritime archeological resources present in the Gulf of Mexico over the last decade support the inclusion and evaluation of such resources in Alternative 5. In addition to the two shipwrecks identified above, six discontinuous boundaries are added in Alternative 5 to encompass eight additional historically significant shipwrecks: the USS *Hatteras* on the continental shelf and the three “Monterrey” wrecks, the *Gulf Oil*, the *Gulf Penn*, the “Mardi Gras” wreck, and the wreck of the *Anona* on the continental slope.

Additional discontinuous boundaries are also proposed under Alternative 5 to encompass four biologically and geologically significant sites in the northwest banks sub region on the continental shelf: Claypile Bank, 29 Fathom Bank, Jakkula Bank, and Ewing Bank. 29 Fathom Bank and Jakkula Bank were considered by the Sanctuary Advisory Council but not included in their recommendation for sanctuary expansion, though their inclusion in this analysis is warranted by the advances in scientific understanding of these sites that have been made in the intervening time since that recommendation. Similarly, Claypile Bank and Ewing Banks were not considered by the Sanctuary Advisory Council, but are included and evaluated here due to the significant advances in understanding and heightened awareness of the significance of these sites that have developed in the last decade.

Finally, eight additional discontinuous boundaries are proposed under Alternative 5 to incorporate additional mesophotic and deep benthic coral ecosystem sites across the north central Gulf of Mexico. Proposed boundaries around the Galvez/Frye Basins Rim site, Tunica Mound site, Jeanerette Dome site, Penchant Basin Rim site, Henderson Ridge Mid-South and Mid-North sites, Whiting Dome site, and Horn Dome site would extend protections around additional high value mesophotic and deep benthic habitats.

Table 5.5 Alternative 5, comprehensive protection for high value north central Gulf of Mexico benthic habitats and cultural resources

	Nationally Significant Biological and Geological Features and/or Cultural and Historic Resources (* = Shipwreck Sites)	Area (square miles)
1	Stetson Bank	2.33
2	West Flower Garden Bank, East Flower Garden Bank, Horseshoe Bank, MacNeil Bank, Rankin Bank, 28 Fathom Bank, and Bright Bank	306.65
3	Geyer Bank	15.27
4	McGrail Bank	12.02
5	Sonnier Bank	5.58
6	Alderdice Bank	7.98
7	Elvers Bank	20.10
8	Bouma Bank, Bryant Bank, Rezak Bank, Sidner Bank, Tresslar Bank, and Antoine Bank	73.68
9	Parker Bank	27.69
10	Hidalgo Basin Rim	6.98
11	Assumption Dome	45.63
12	St. Tammany Basin Rim	7.23
13	Henderson Ridge North	5.85
14	Henderson Ridge South	31.36
15	Biloxi Dome, R. E. Lee*, and U-166*	19.12
16	Mountain Top	2.03
17	Viosca Knolls West	15.92
18	Gloria Dome and Deepwater Horizon*	10.02
19	Alabama Alps, 36 Fathom Ridge	4.04
20	West Addition Pinnacles	1.03
21	Dauphin Dome	7.61
22	Shark Reef, Double Top, Triple Top	6.26
23	Viosca Knolls East	9.36
24	Ludwick-Walton and West Delta Mounds	19.06
25	Yellowtail, Cat's Paw, Roughtongue, Corkscrew	42.05
26	Far Tortuga	5.01
27	Desoto Canyon/West Florida Escarpment	25.30
28	USS Hatteras*	0.17
29	Claypile Bank	3.76
30	Galvez/Frye Basins Ridge	9.00
31	29 Fathom Bank	5.71
32	Monterrey Wrecks*	32.25
33	Tunica Mound	9.00
34	Jeanerette Dome	14.15

35	Jakkula Bank	13.72
36	Penchant Basin Rim	18.98
37	Ewing Bank	19.52
38	Henderson Ridge Mid-South	9.00
39	GulfOil*	9.00
40	Henderson Ridge Mid-North	10.73
41	GulfPenn*	9.00
42	Whiting Dome	9.67
43	Mardi Gras*	9.00
44	Horn Dome	8.34
45	Anona*	9.00
	Net Increase in Area Over Current Sanctuary	878.97
	Alternative 5 Total Area	935.18
	Total Area Not Included in Socioeconomic Study Area	435.70

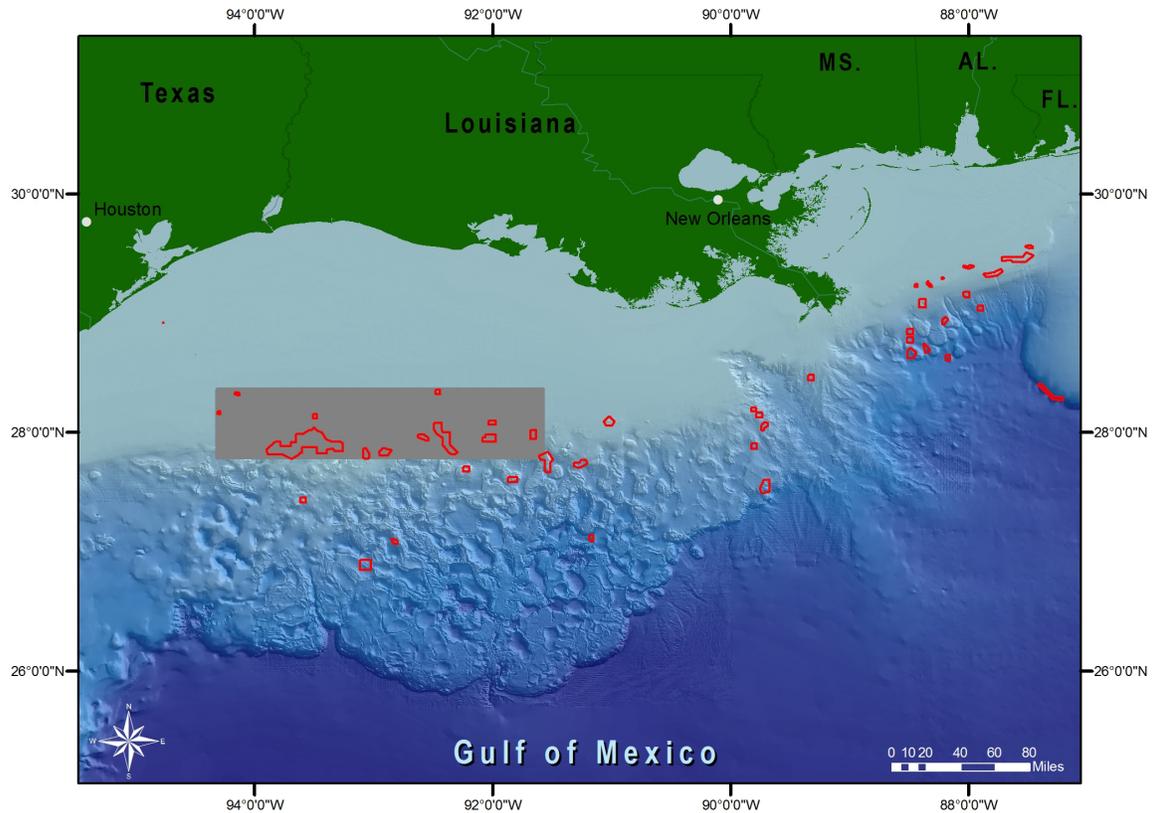


Figure 5.5 Alternative 5. Image: NOAA

Comprehensive protection for high value north central Gulf of Mexico benthic habitats and cultural resources. Boundaries carried forward from Alternative 4 are shown in blue; boundaries modified from Alternative 4 are shown in purple; additional proposed areas are shown in red. The grey area is the study area of the economic analysis. Boundary polygons are numbered as shown in Table 5.5.

Step 1: Introduction

In Step 1 of the analysis, we look at the activities that are impacted by the proposed expansion areas and then translate these activities into socioeconomic measures. Any factor that could mitigate the impact to these activities, such as relocation to another area, is not addressed in Step 1. Step 1 of the analysis presents the “maximum potential losses” associated with any change. The “potential” costs associated with these changes are addressed in Step 1. Further, only impacts to the cost side of the impacts are discussed in Step 1, In Step 2, the likelihood that the costs will actually occur or if there are benefits of expansion are discussed.

Alternative 1 is the “no action alternative” and thus the results presented in this section represent no change to the status quo. Costs of expansion can be avoided

by choosing the status quo, but benefits of expansion are the costs of choosing the status quo alternative, i.e., what is given up by not expanding the boundaries.

The next five figures present maps of the alternatives overlaid on the grid that was used to collect spatial data (study area).

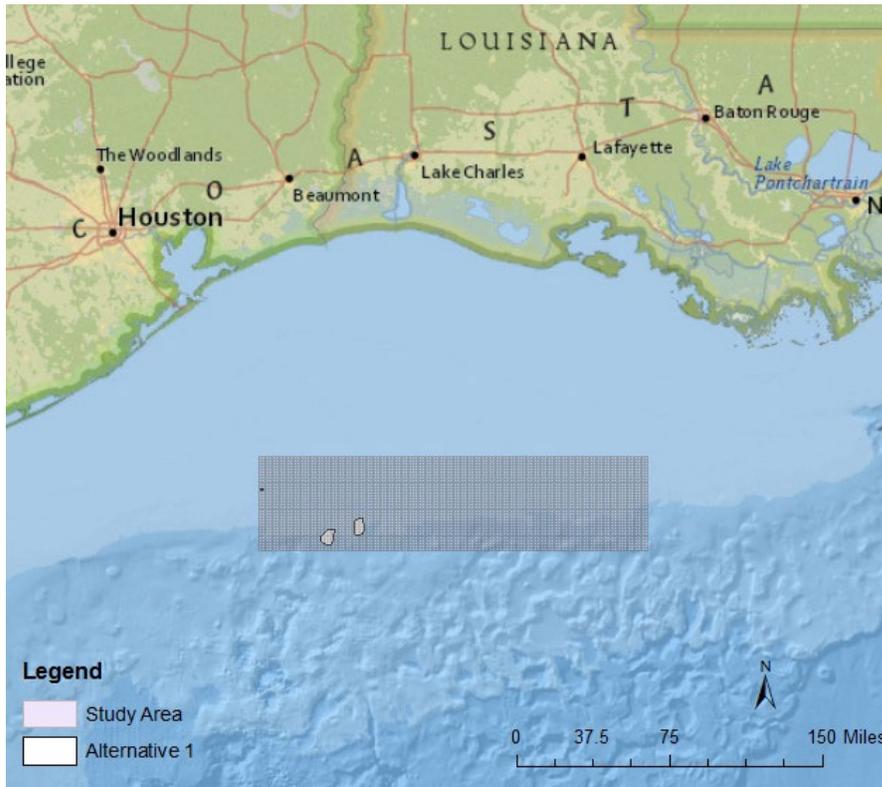


Figure 5.6 Alternative 1. Image: NOAA



Figure 5.7 Alternative 2. Image: NOAA

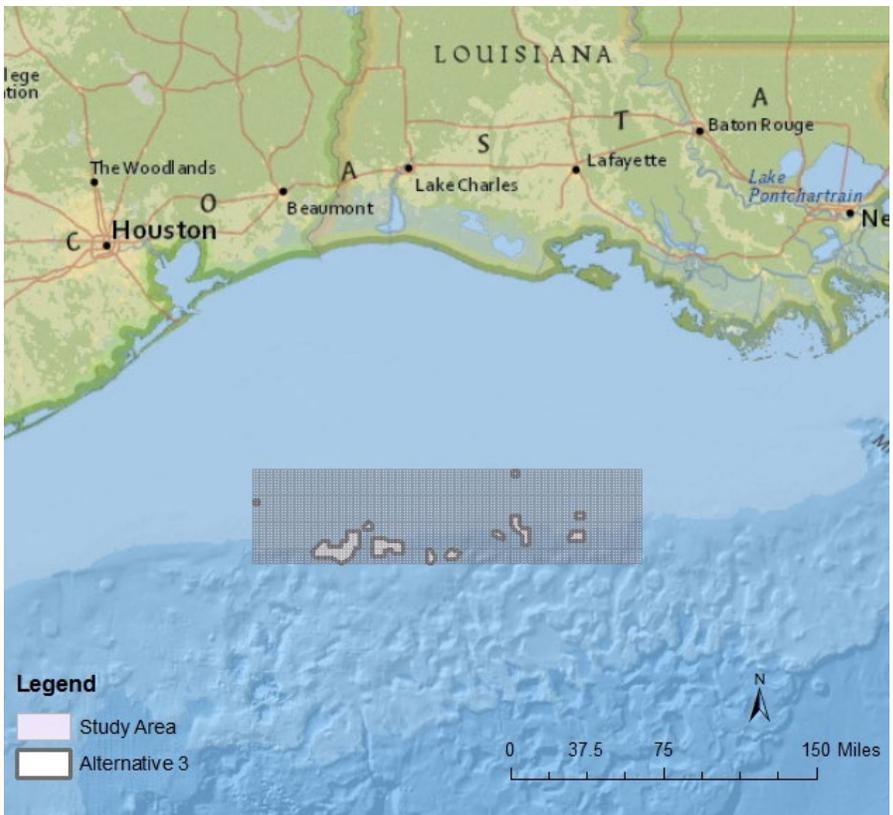


Figure 5.8 Alternative 3. Image: NOAA

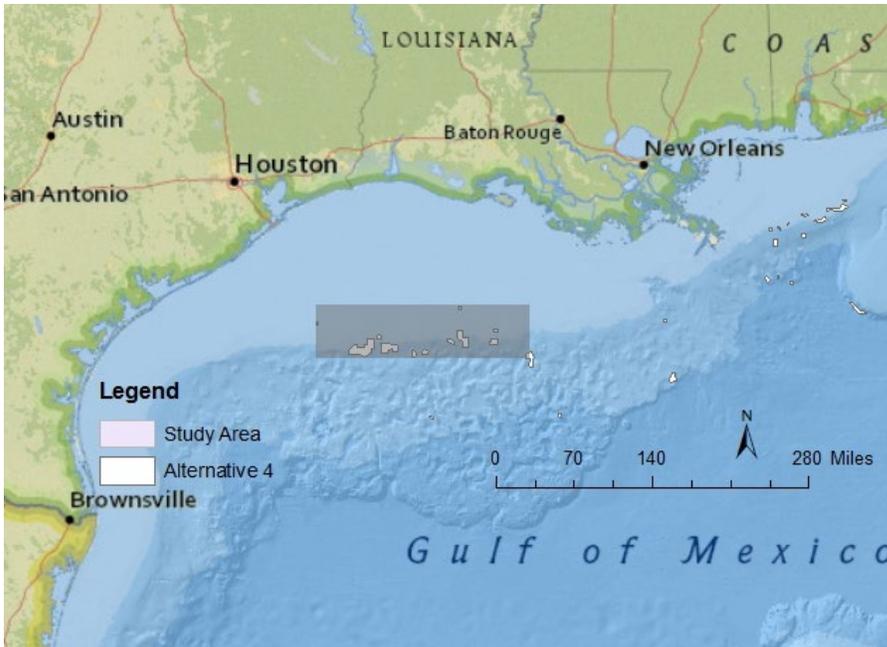


Figure 5.9 Alternative 4. Image: NOAA



Figure 5.10 Alternative 5. Image: NOAA

Step 1: Commercial Fishing Analysis of Alternatives

This section reviews the profit and revenue generated by the commercial fishermen within each alternative. Alternative 1 is the status quo or no change alternative. Socioeconomic data for assessing the impacts of alternatives are available for only those areas inside the NWGOM Study Area. Boundary expansion areas in alternatives 2 and 3 are inside the NWGOM Study Area,

whereas only some of the expansion areas are in the NWGOM Study Area for alternatives 4 and 5. (See tables 5.3 and 5.4 for the amount of area of each alternative outside the NWGOM Study Area for which no socioeconomic data is available.)

Alternative 1. This regulatory alternative has zero additional impact on commercial fisheries. All the commercial fishing in the current FGBNMS is hook-and-line fishing, which is allowed in current regulations. The no anchoring regulation is also in effect and mooring buoys are installed to mitigate the no anchoring regulation. Very little commercial fishing exists in the current FGBNMS, with less than \$15,000 in annual revenue representing only 0.4% of all fishing revenue of the commercial fishing operations fishing in the NWGOM Study Area from fishing in all areas. As for dependency, mean revenue and profits from fishing in the current FGBNMS has a mean of 0.3% and ranges from 0% to 1.1% of their revenues and profits for their fishing in all areas, including those areas outside the NWGOM Study Area (Table 5.6).

Table 5.6 Profits and Revenue Within Alternative 1 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Total Revenue Generated in Alternative	\$14,647	\$2,441	\$0	\$8,987
Percent of Revenue in Alternative	0.4%	0.3%	0.0%	1.1%
Profit Generated in Alternative	\$5,545	\$924	\$0	\$4,183
Percent of Profit in Alternative	0.4%	0.3%	0.0%	1.1%

Alternative 2. This alternative expands upon Alternative 1 to include more areas. There are two tables presented below. It is important to make the distinction between the revenue generated in Alternative 2 and the maximum potential loss as a result of an expansion. The maximum potential impact would be the loss to revenue or profits in the newly expanded areas. Alternative 1 is the status quo; the existing sanctuary and no regulatory changes are proposed in that area. Thus, the existing activity within Alternative 1 will not be impacted by the expansion. The maximum potential loss to revenue is about \$2,500. The total maximum potential loss of profits is \$600 across the sample (Table 5.8).

Table 5.7 Profits and Revenue within Alternative 2 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Total Revenue Generated in Alternative	\$188,741	\$31,457	\$2,521	\$101,841
Percent of Revenue in Alternative	4.6%	5.8%	0.5%	20.4%
Profit Generated in Alternative	\$45,224	\$7,537	\$600	\$19,599
Percent of Profit in Alternative	3.4%	3.0%	0.6%	8.1%

Table 5.8 Commercial Maximum Potential Loss in Alternative 2 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Revenue	\$2,521	\$420	\$0	\$2,521
Percent of Total Revenue	0.1%	0.01%	0.0%	0.1%
Profit	\$600	\$100	\$0	\$600
Percent of Total Profit	0.04%	0.01%	0.0%	0.6%
Percent of Personal Income	0.04%	0.01%	0.0%	0.6%
Percent of Household Income	0.04%	0.01%	0.0%	0.6%

Alternative 3. This is the preferred alternative of FGBNMS. The maximum potential loss to revenue is about \$4,000. The total maximum potential loss of profits is slightly less than \$1,000 across the sample. Tables 5.9 and Table 5.10 present the full results below. The most any respondents' income would be impacted by is 1.1%.

Table 5.9 Profits and Revenue within Alternative 3 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Total Revenue Generated in Alternative	\$215,906	\$35,984	\$3,651	\$98,513
Percent of Revenue in Alternative	5.3%	6.4%	0.7%	19.7%
Profit Generated in Alternative	\$55,345	\$9,224	\$988	\$25,013
Percent of Profit in Alternative	4.1%	3.9%	1.1%	8.1%

Table 5.10 Commercial Maximum Potential Loss in Alternative 3 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Revenue	\$4,151	\$692	\$0	\$4,151
Percent of Total Revenue	0.1%	0.02%	0.0%	0.8%
Profit	\$988	\$165	\$0	\$988
Percent of Total Profit	0.1%	0.01%	0.0%	1.1%
Percent of Personal Income	0.1%	0.01%	0.0%	1.1%
Percent of Household Income	0.1%	0.01%	0.0%	1.1%

Alternative 4. Alternative 4 includes additional areas when compared to the previous three alternatives and spans further east and north of the grid that was used to collect special data. Given this, the analysis of impacts to profits/revenues completed here is not complete. There are some areas in this alternative for which data was not collected or available.

Similar to the preferred alternative, the maximum potential loss to revenue is about \$4,000. The total maximum potential loss of profits is slightly less than \$1,000 across the sample. Table 5.11 and Table 5.12 present the full results below.

Table 5.11 Profits and Revenue within Alternative 4 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Total Revenue Generated in Alternative	\$216,652	\$36,109	\$3,696	\$98,513
Percent of Revenue in Alternative	5.3%	6.5%	0.7%	19.7%
Profit Generated in Alternative	\$55,688	\$9,281	\$988	\$25,339
Percent of Profit in Alternative	4.2%	3.9%	1.1%	8.1%

Table 5.12 Commercial Maximum Potential Loss in Alternative 4 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Revenue	\$4,151	\$692	\$0	\$4,151
Percent of Total Revenue	0.1%	0.02%	0.0%	0.8%
Profit	\$988	\$165	\$0	\$988
Percent of Total Profit	0.1%	0.01%	0.0%	1.1%
Percent of Personal Income	0.1%	0.01%	0.0%	1.1%
Percent of Household Income	0.1%	0.01%	0.0%	1.1%

Alternative 5. Like Alternative 4, Alternative 5 also includes additional areas when compared to the first three alternatives and spans further west and south of the grid that was used to collect special data. Given this, the analysis of impacts to profits/revenues completed here is not complete. There are some areas in this alternative for which data was not collected or available.

The maximum potential profits lost are less than \$1,000. The revenue lost is roughly \$4,000. When looking at the percentage of their total household income, this would be roughly 1.1% of their total household income lost (Table 5.14).

Table 5.13 Profits and Revenue within Alternative 5 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Total Revenue Generated in Alternative	\$290,835	\$48,472	\$4,151	\$114,741
Percent of Revenue in Alternative	7.1%	9.2%	0.8%	22.9%
Profit Generated in Alternative	\$90,394	\$15,066	\$988	\$45,730
Percent of Profit in Alternative	6.8%	6.1%	1.1%	19.0%

Table 5.14 Commercial Maximum Potential Loss in Alternative 5 (N=6, 2013\$)

	Total	Mean	Minimum	Maximum
Revenue	\$4,151	\$692	\$0	\$4,151
Percent of Total Revenue	0.1%	0.02%	0.0%	0.8%
Profit	\$988	\$165	\$0	\$988
Percent of Total Profit	0.1%	0.01%	0.0%	1.1%
Percent of Personal Income	0.1%	0.01%	0.0%	1.1%
Percent of Household Income	0.1%	0.01%	0.0%	1.1%

Alternative 2 Hook-and-Line Heat Maps

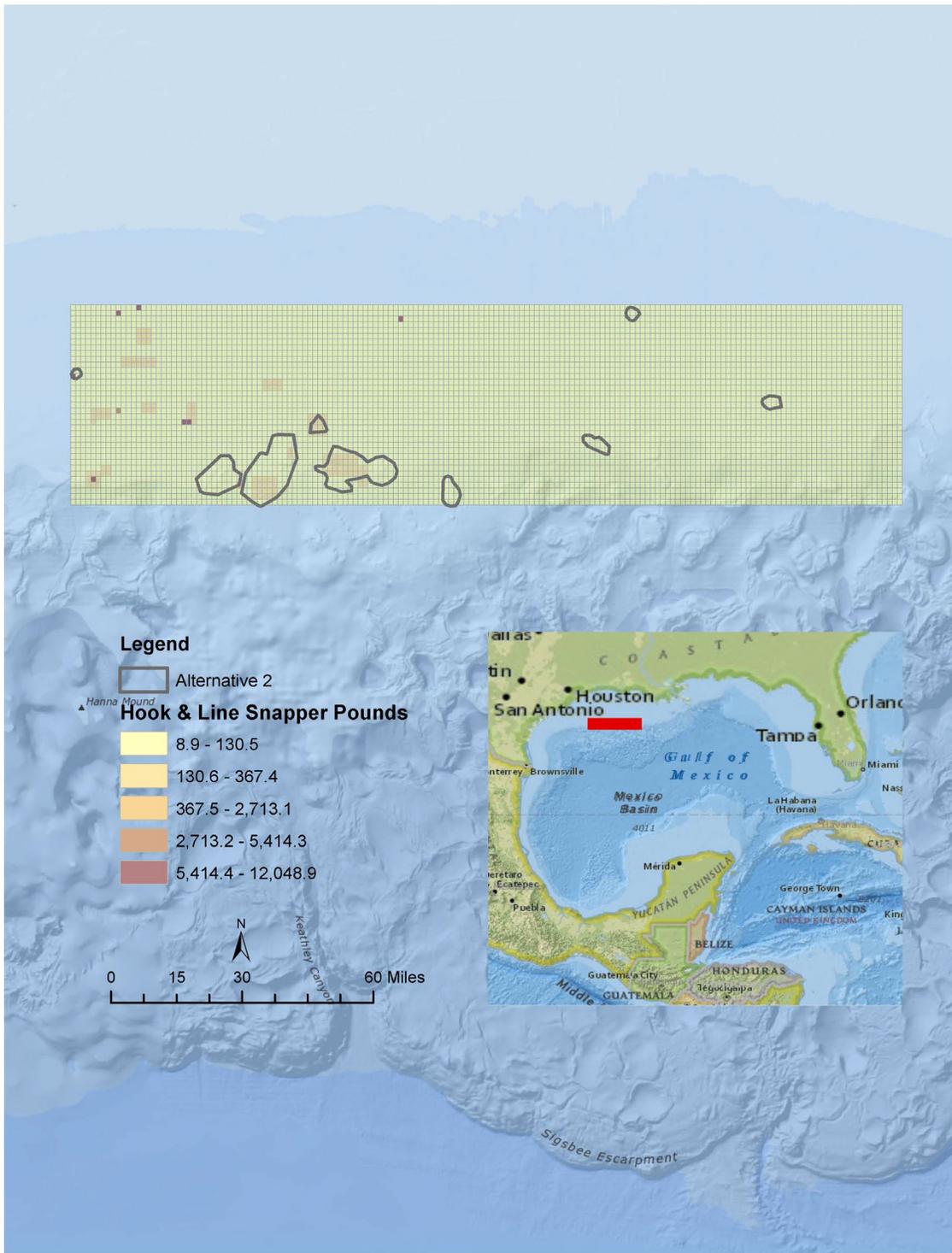


Figure 5.11 Alternative 2 Commercial Hook-and-Line Fishing Snapper Pounds (Total=26,910 lbs.). Image: Schwarzmann/NOAA

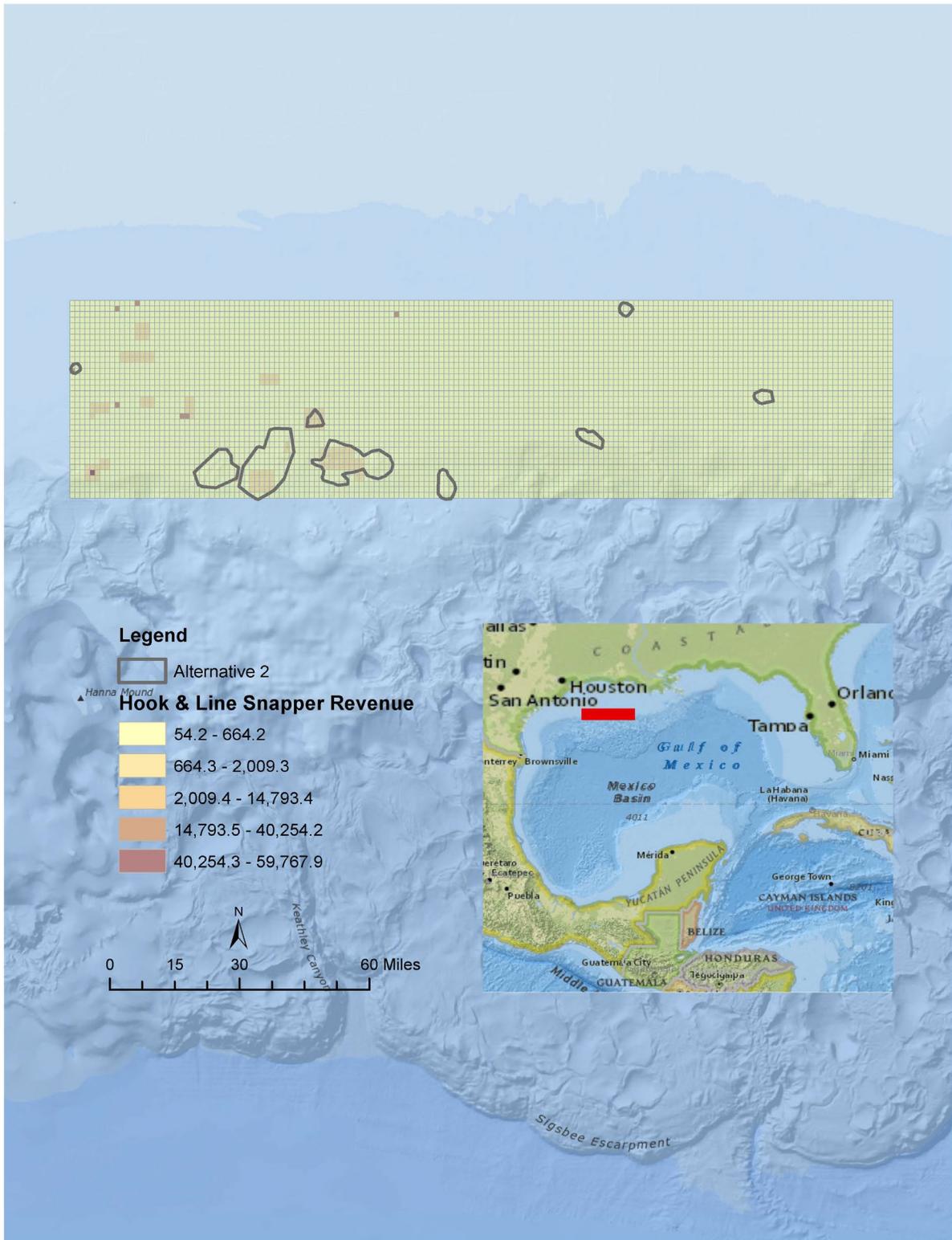


Figure 5.12 Alternative 2 Commercial Hook-and-Line Fishing Snapper Revenue (Total=\$123,197, in 2013\$). Image: Schwarzmann/NOAA

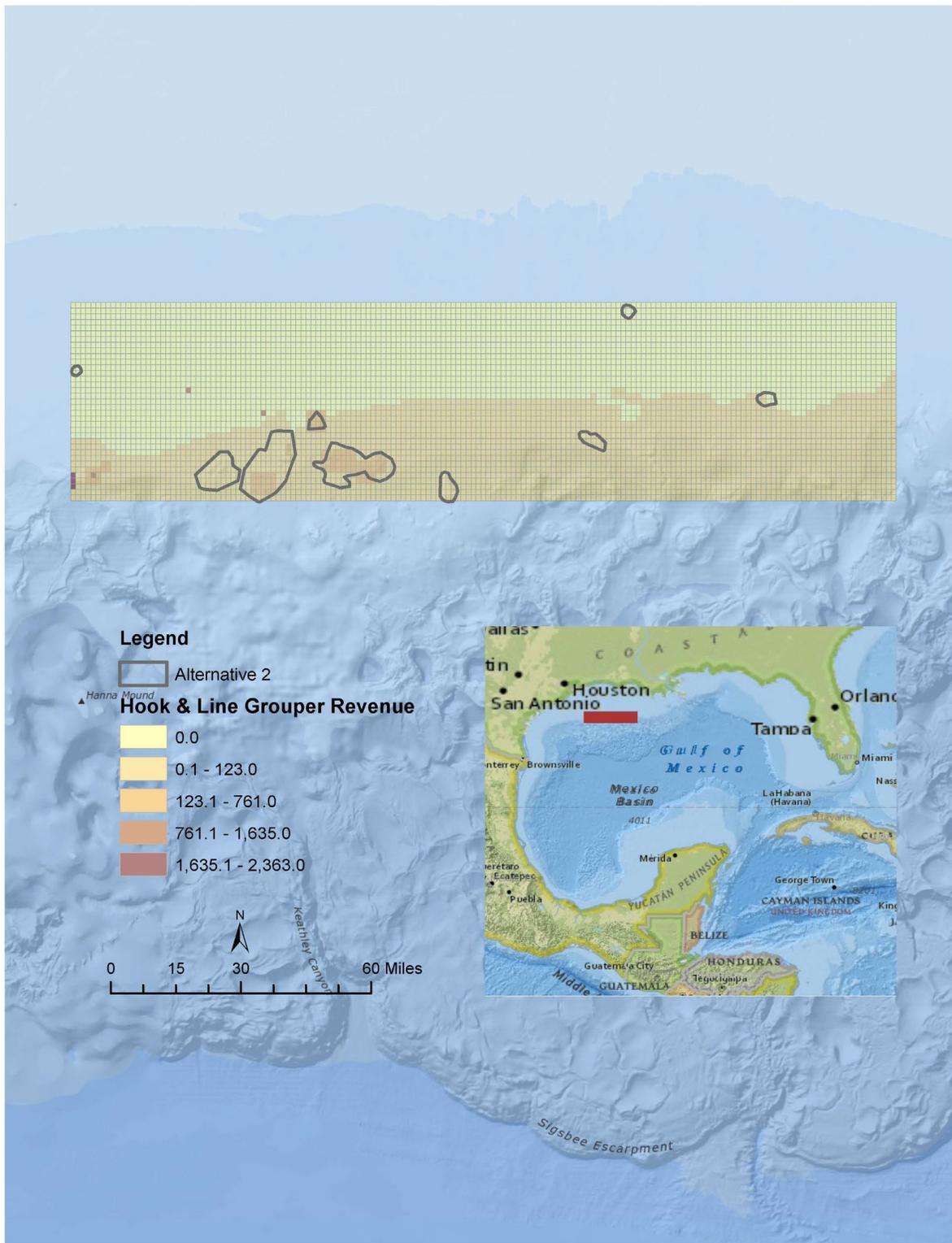


Figure 5.14 Alternative 2 Commercial Hook-and-Line Fishing Grouper Revenue (Total=\$62,920, in 2013\$). Image: Schwarzmann/NOAA

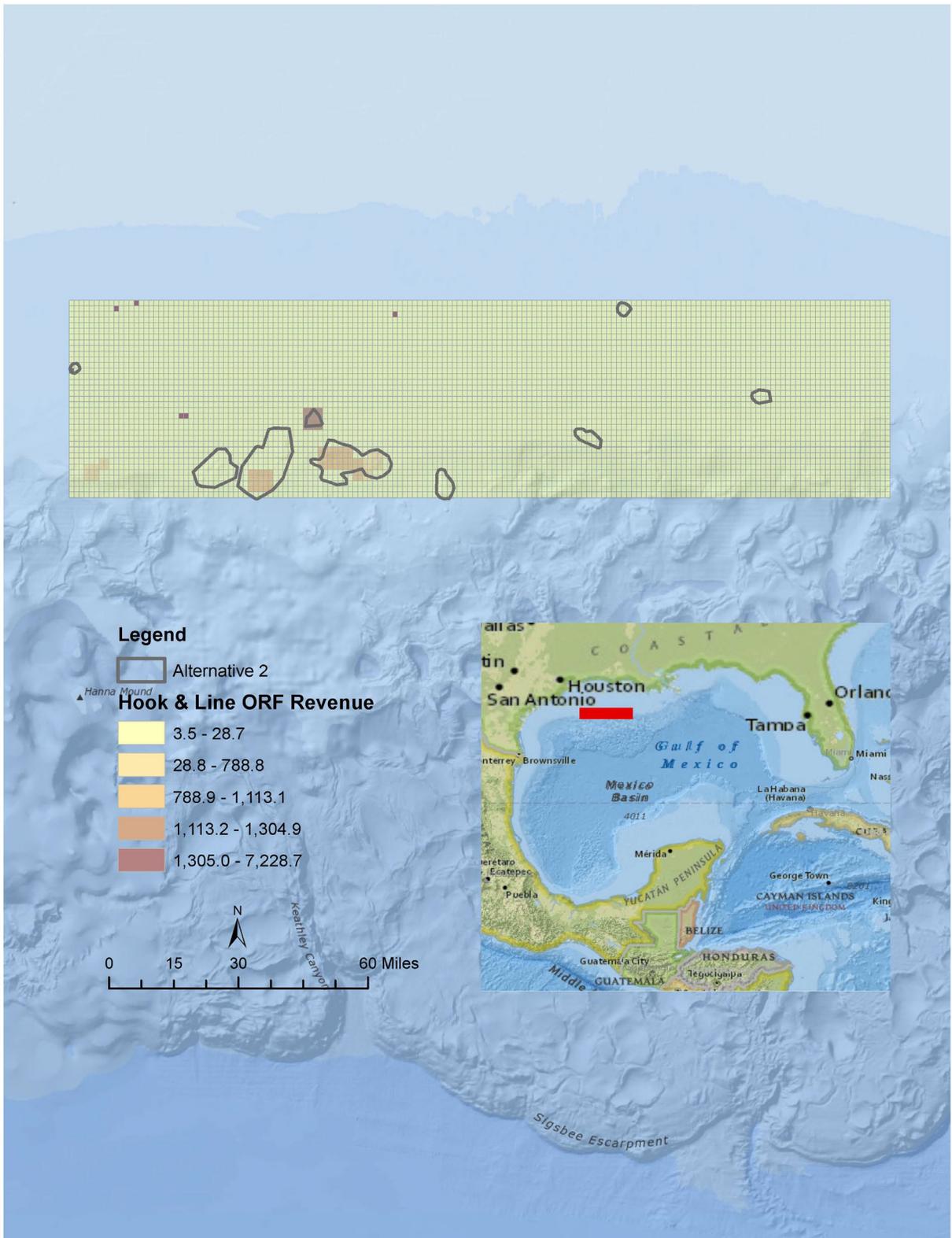


Figure 5.16 Alternative 2 Commercial Hook-and-Line Fishing Other Reef Fish Revenue (Total=\$33,842, in 2013\$). Image: Schwarzmann/NOAA

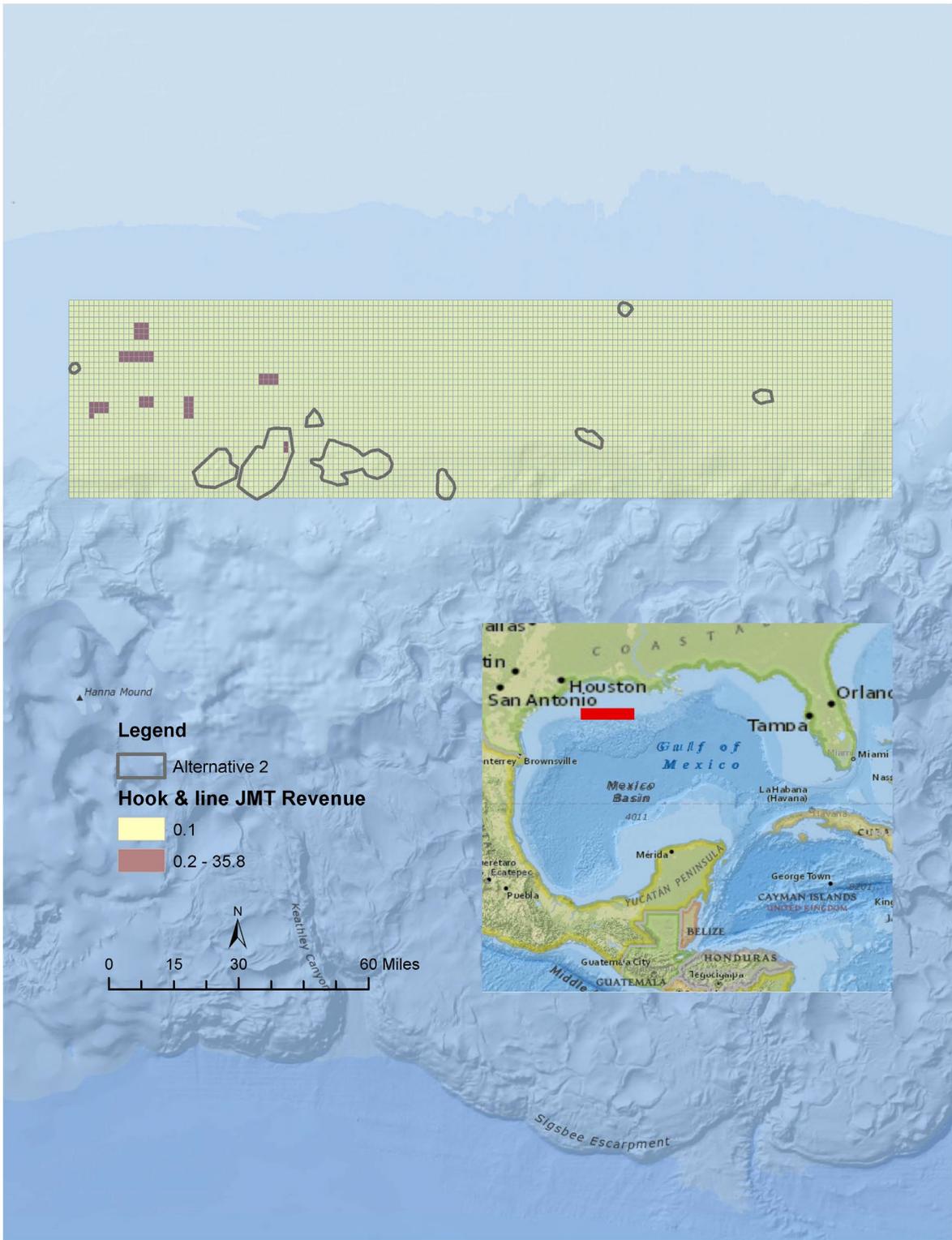


Figure 5.18 Alternative 2 Commercial Hook-and-Line Fishing Jack/Mackerels/Tunas Revenue (Total=\$103, in 2013\$). Image: Schwarzmann/NOAA

Alternative 3 Hook-and-Line Heat Maps

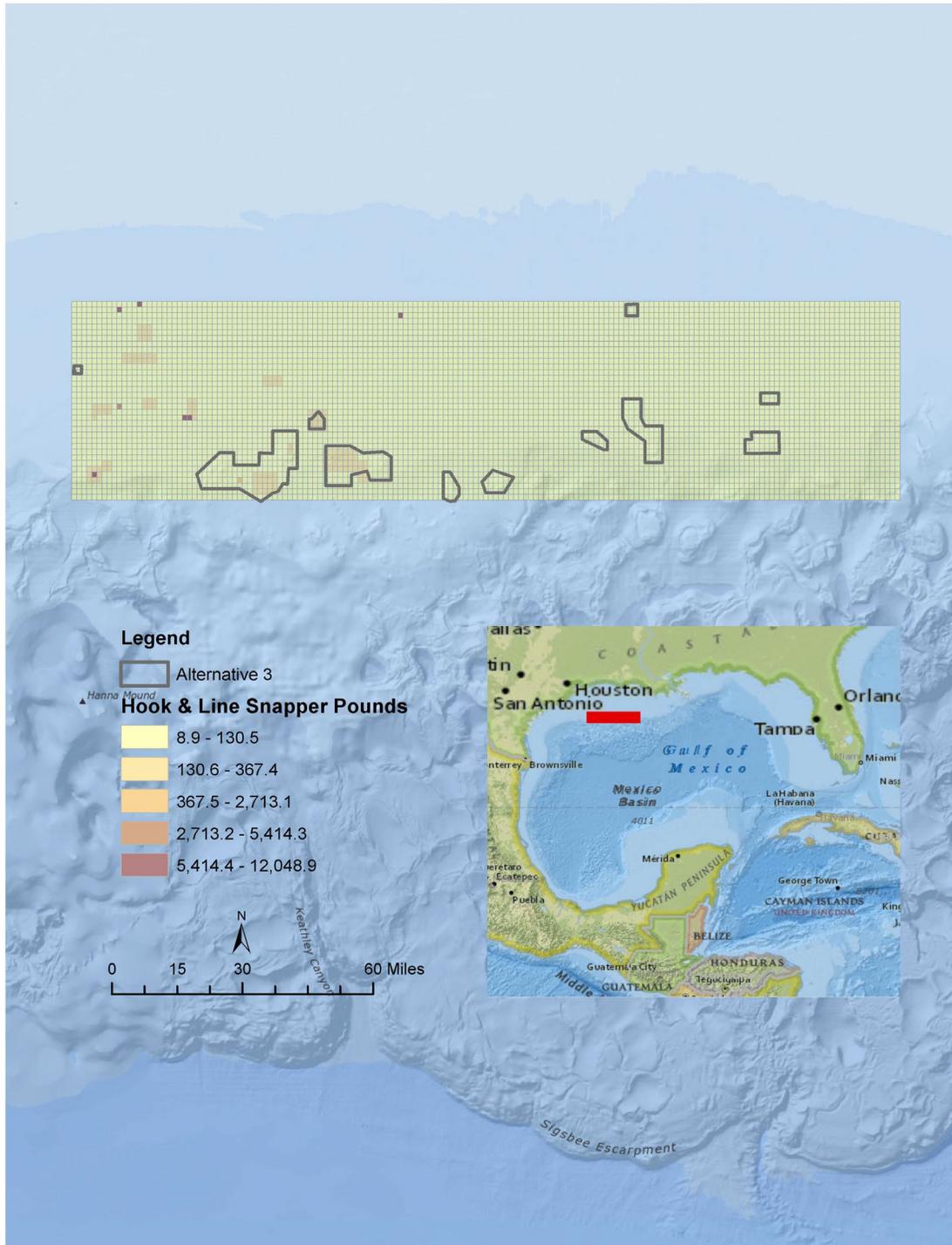


Figure 5.19 Alternative 3 Commercial Hook-and-Line Fishing Snapper Pounds (Total=30,032 lbs.). Image: Schwarzmann/NOAA

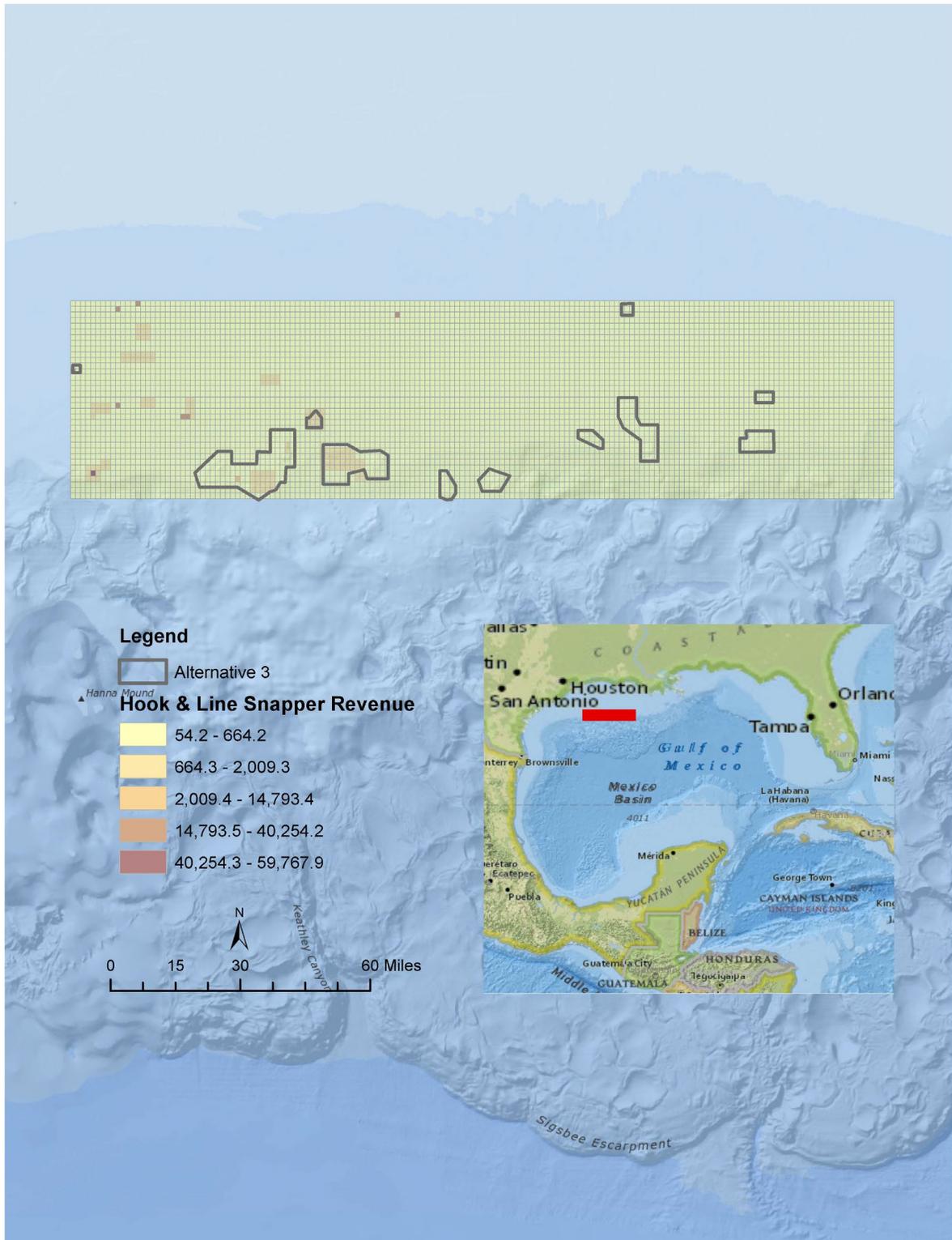


Figure 5.20 Alternative 3 Commercial Hook-and-Line Fishing Snapper Revenue (Total=\$140,995, 2013\$). Image: Schwarzmann/NOAA

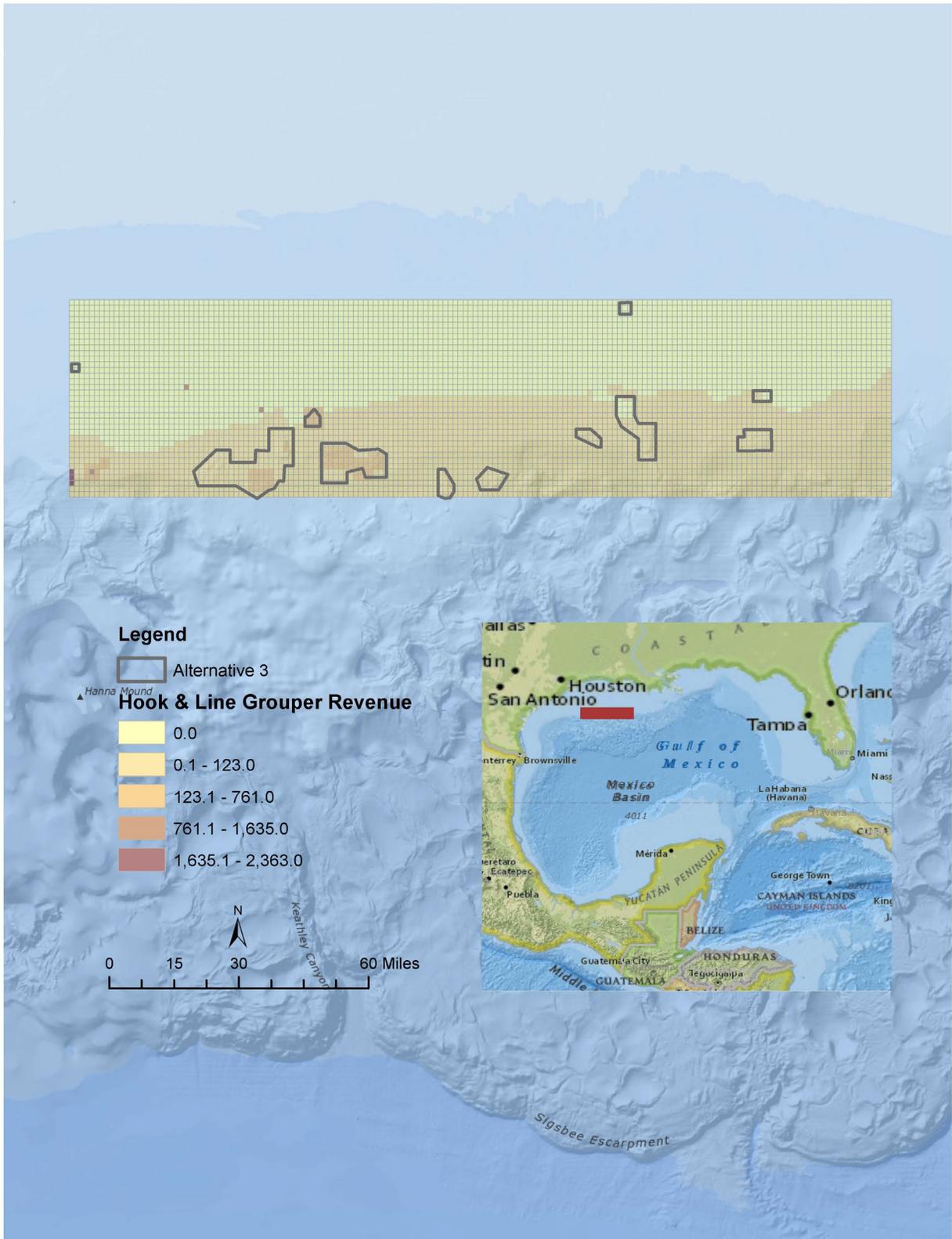


Figure 5.22 Alternative 3 Commercial Hook-and-Line Fishing Grouper Revenue (Total=\$70,645 in 2013\$). Image: Schwarzmann/NOAA

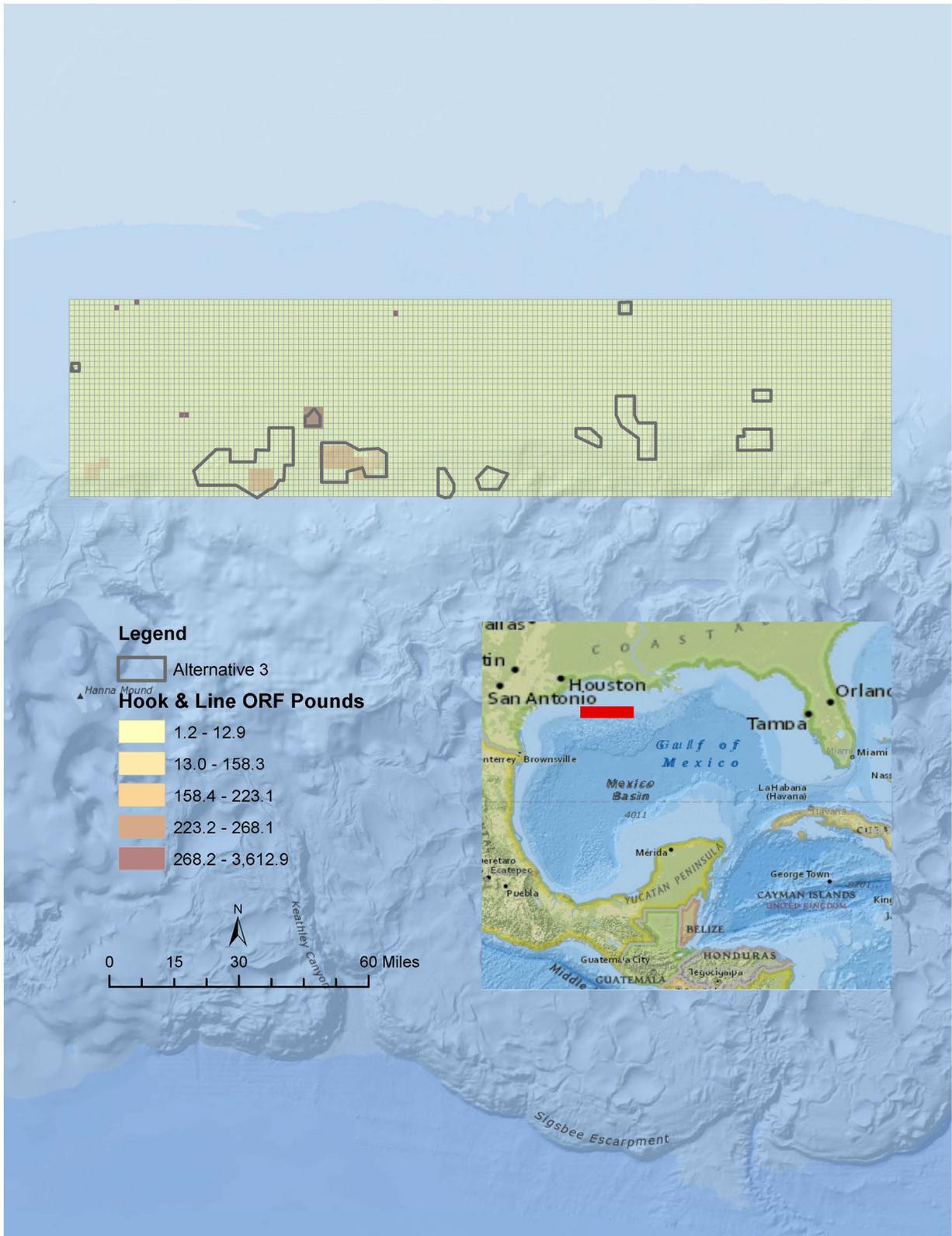


Figure 5.23 Alternative 3 Commercial Hook-and-Line Fishing Other Reef Fish Pounds (Total=10,017 lbs.). Image: Schwarzmann/NOAA

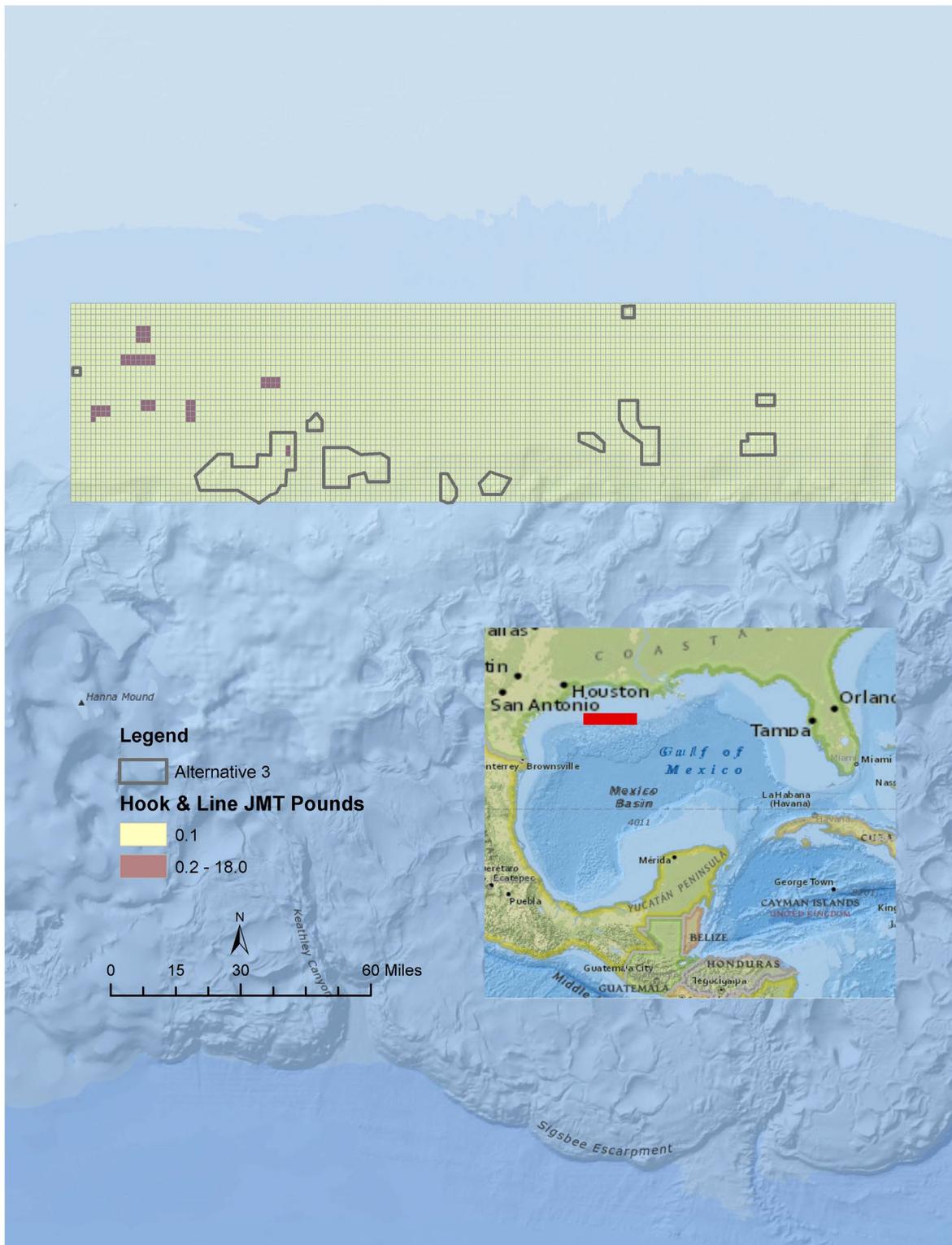


Figure 5.25 Alternative 3 Commercial Hook-and-Line Fishing Jack/Mackerels/Tunas Pounds (Total=70 lbs.). Image: Schwarzmann/NOAA

Alternative 4 Hook-and-Line Heat Maps

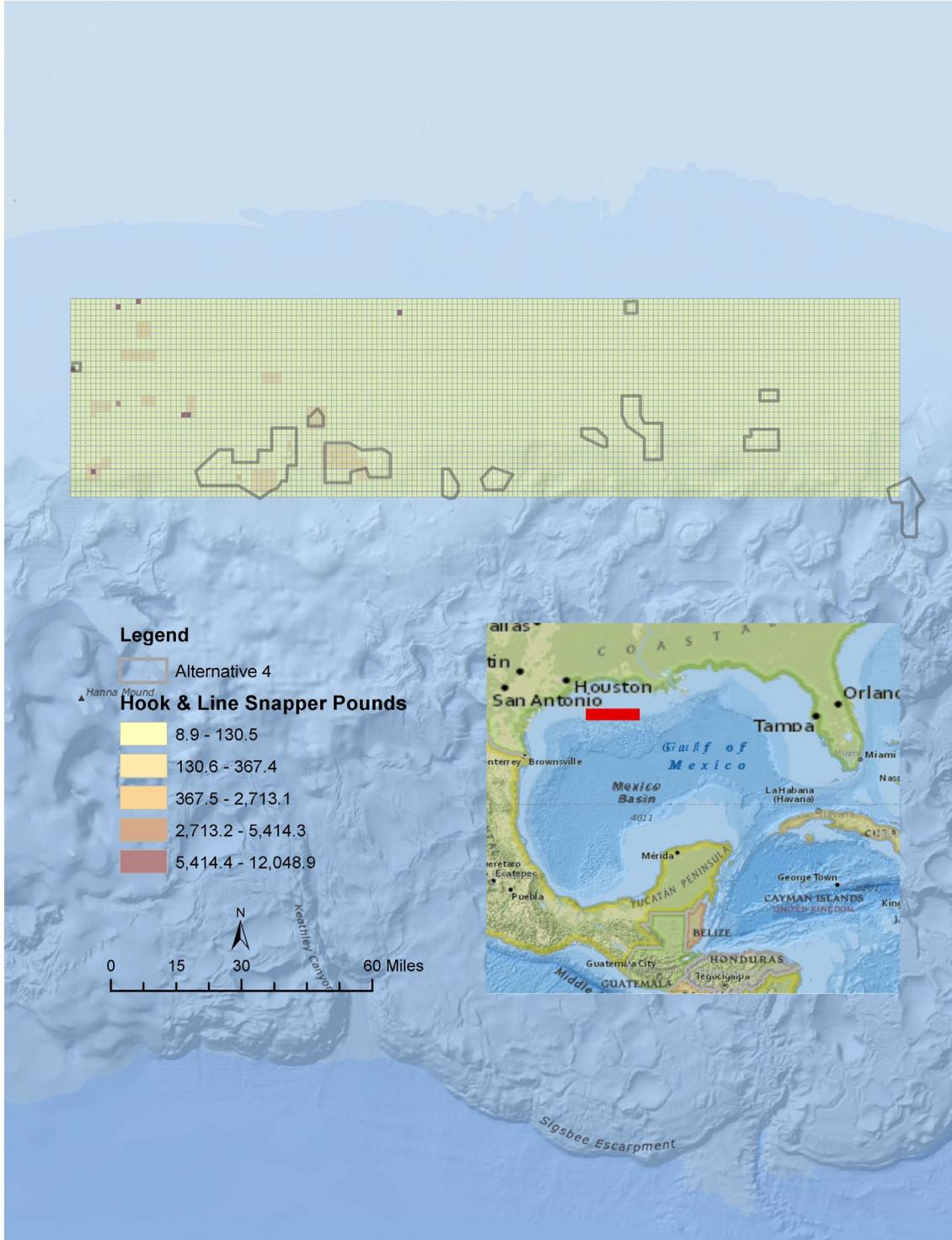


Figure 5.27 Alternative 4 Commercial Hook-and-Line Fishing Snapper Pounds (Total=30,074 lbs.). Image: Schwarzmann/NOAA

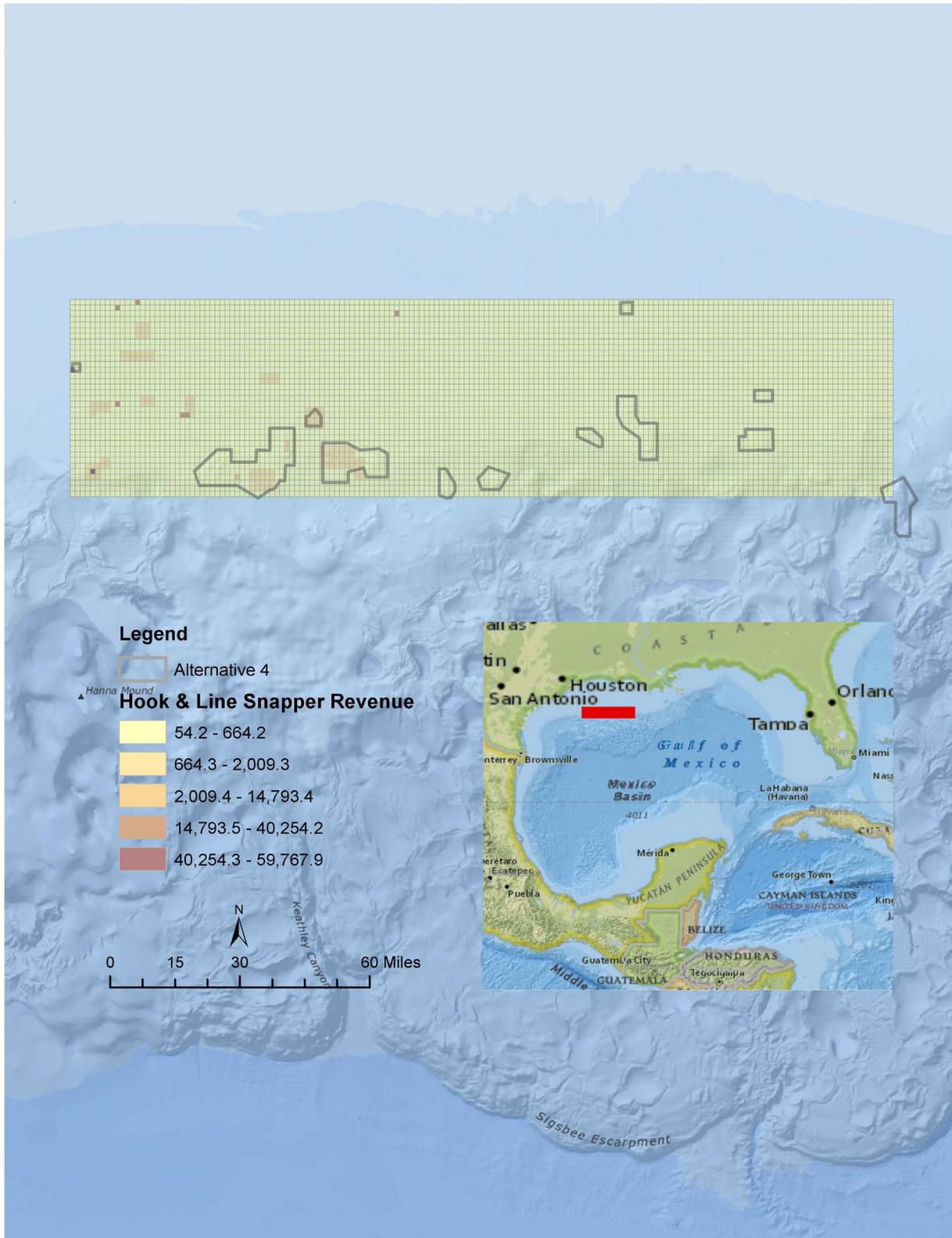


Figure 5.28 Alternative 4 Commercial Hook-and-Line Fishing Snapper Revenue (Total=\$141,250 in 2013\$).
Image: Schwarzmann/NOAA

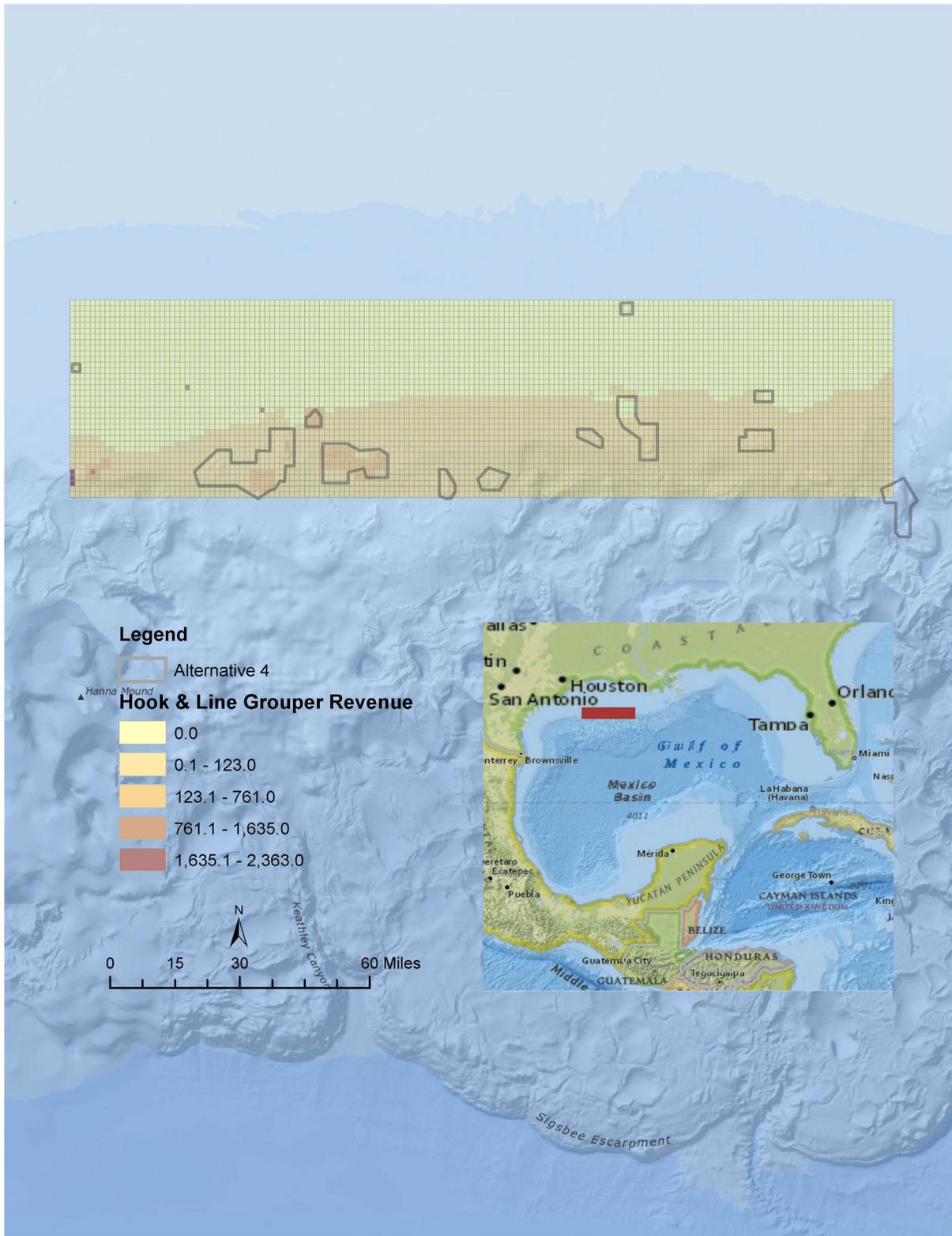


Figure 5.30 Alternative 4 Commercial Hook-and-Line Fishing Grouper Revenue (Total=\$71,136 in 2013\$). Image: Schwarzmann/NOAA

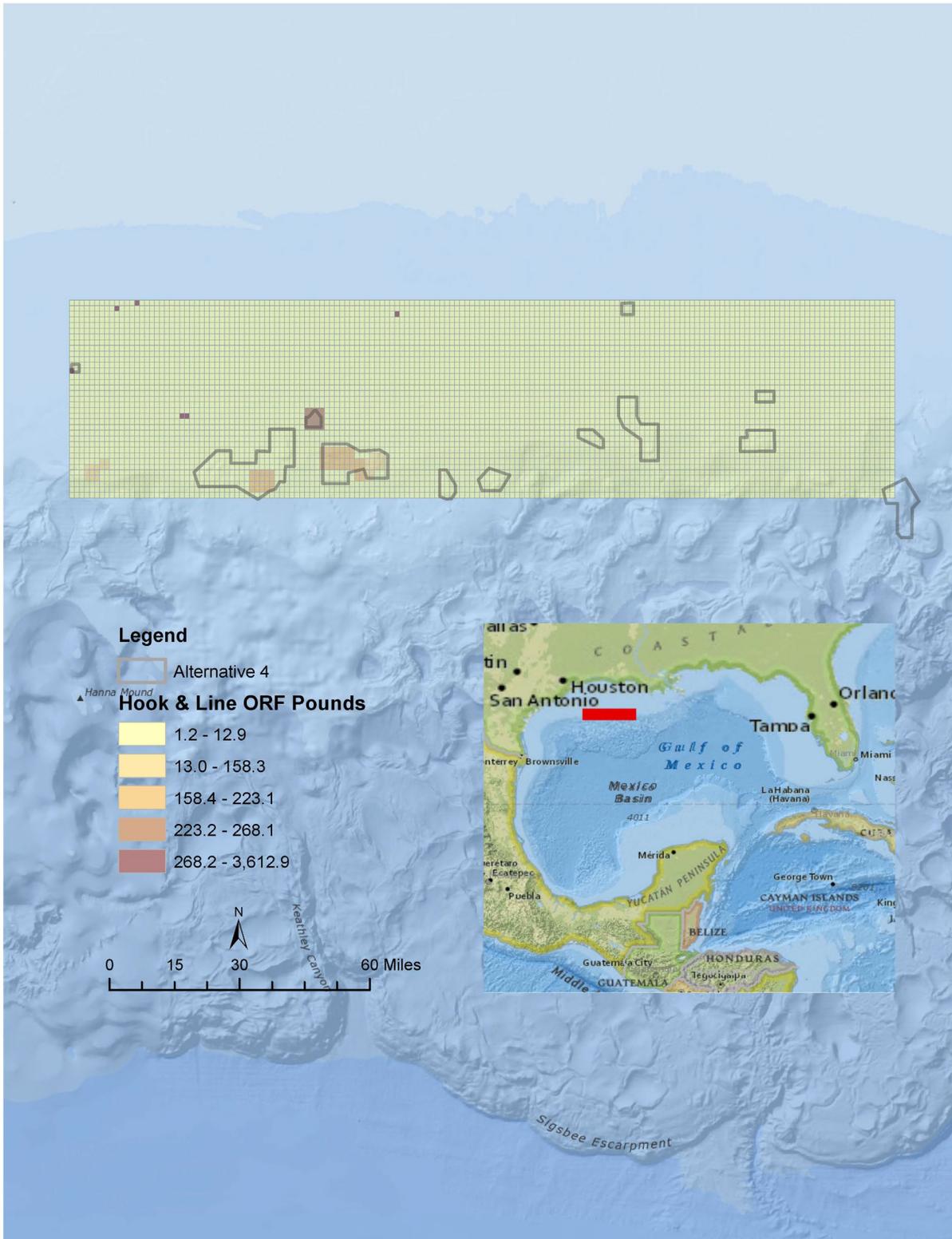


Figure 5.31 Alternative 4 Commercial Hook-and-Line Fishing Other Reef Fish Pounds (Total=10,022 lbs.). Image: Schwarzmann/NOAA

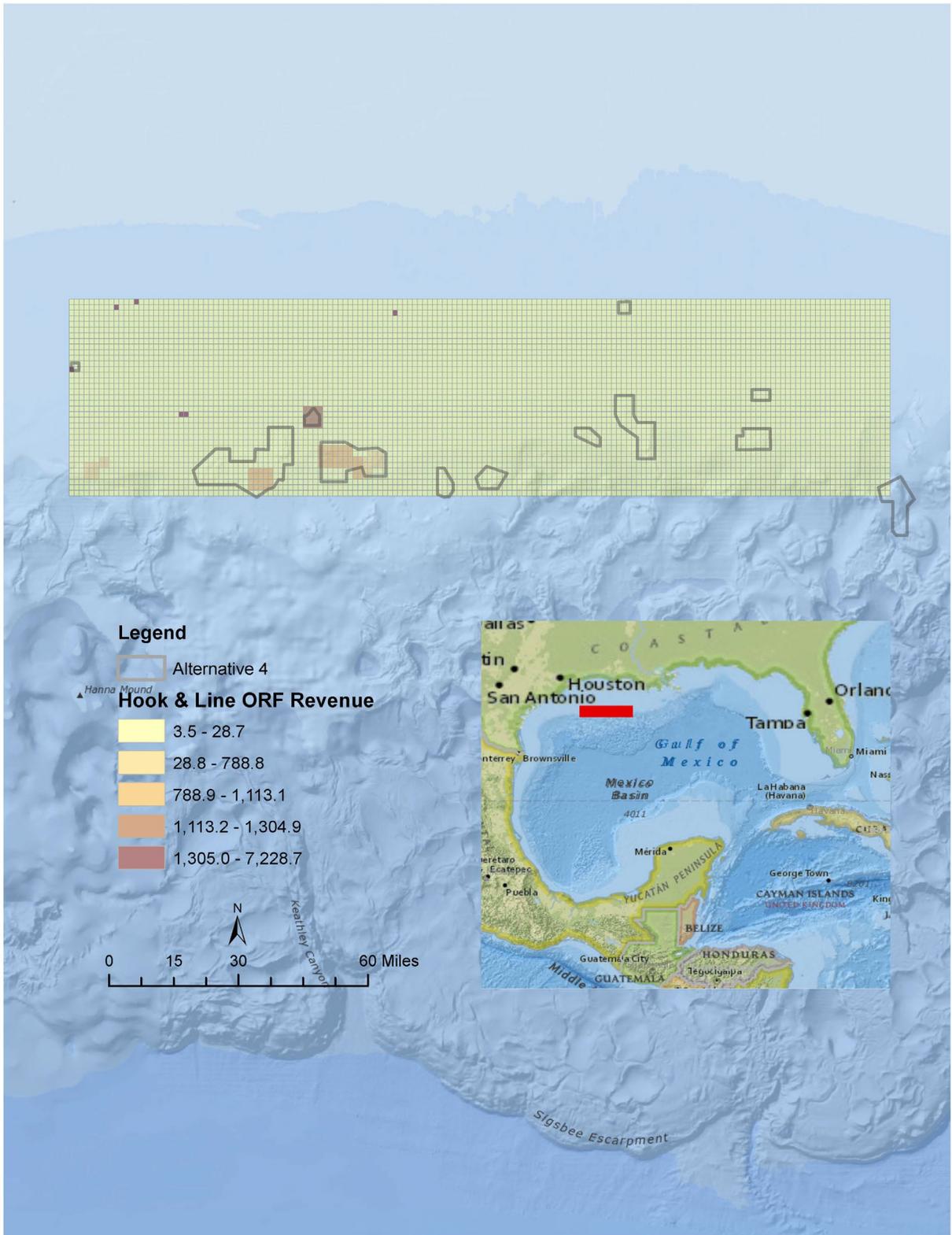


Figure 5.32 Alternative 4 Commercial Hook-and-Line Fishing Other Reef Fish Revenue (Total=\$33,594 in 2013\$). Image: Schwarzmann/NOAA

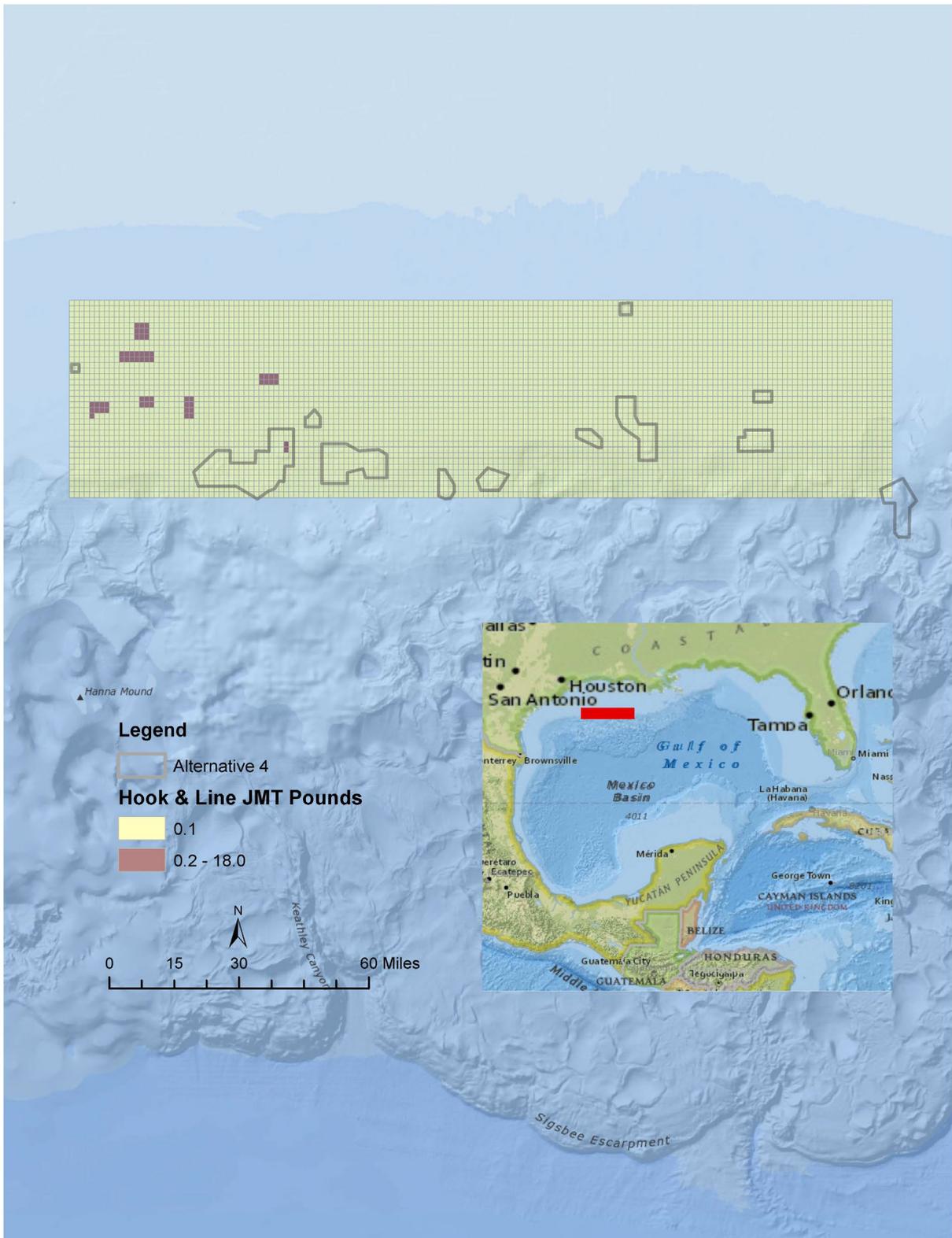


Figure 5.33 Alternative 4 Commercial Hook-and-Line Fishing Jack/Mackerels/Tunas Pounds (Total=70 lbs.). Image: Schwarzmann/NOAA

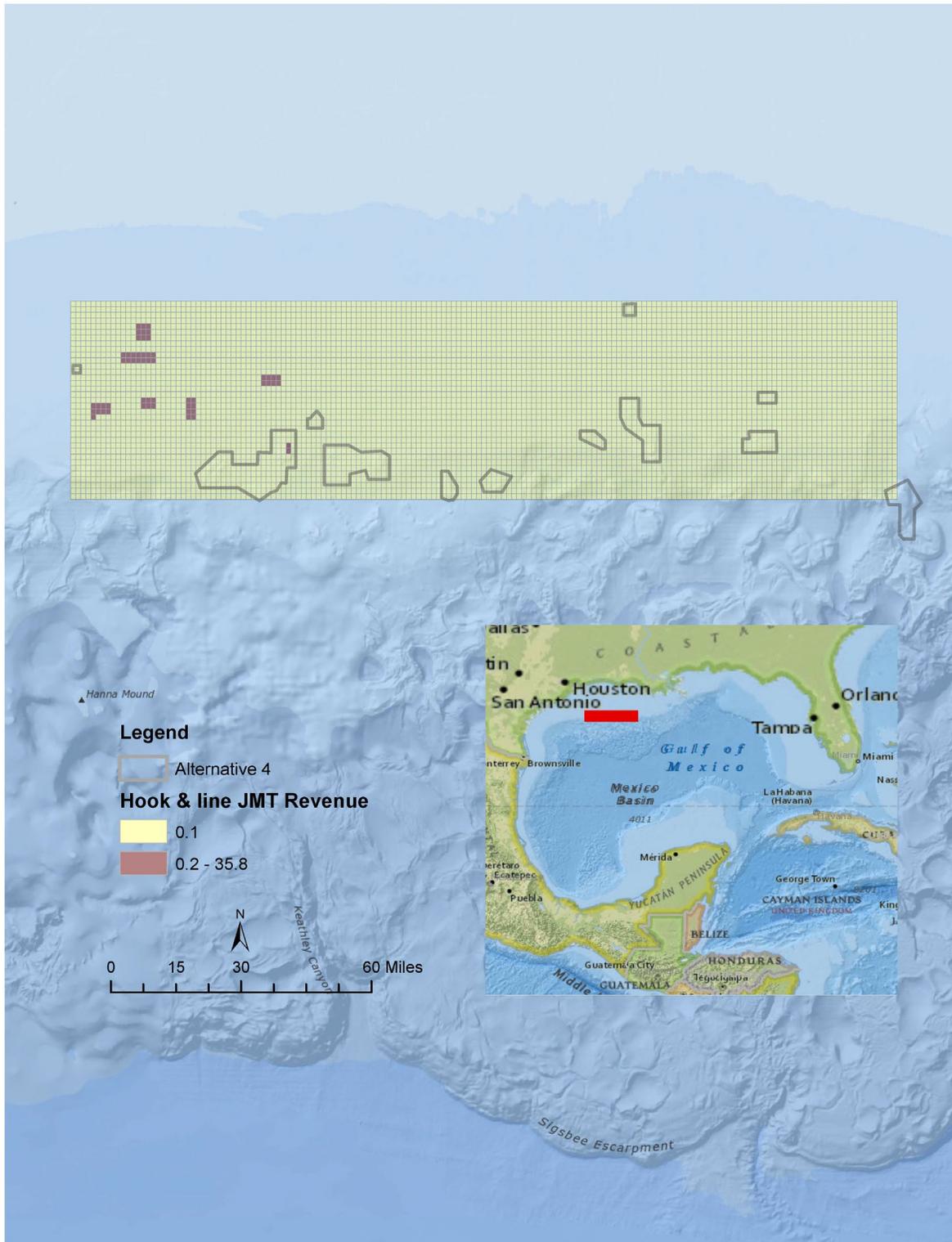


Figure 5.34 Alternative 4 Commercial Hook-and-Line Fishing Jack/Mackerels/Tunas Revenue (Total=\$115 in 2013\$). Image: Schwarzmann/NOAA

Alternative 5 Hook-and-Line Heat Maps

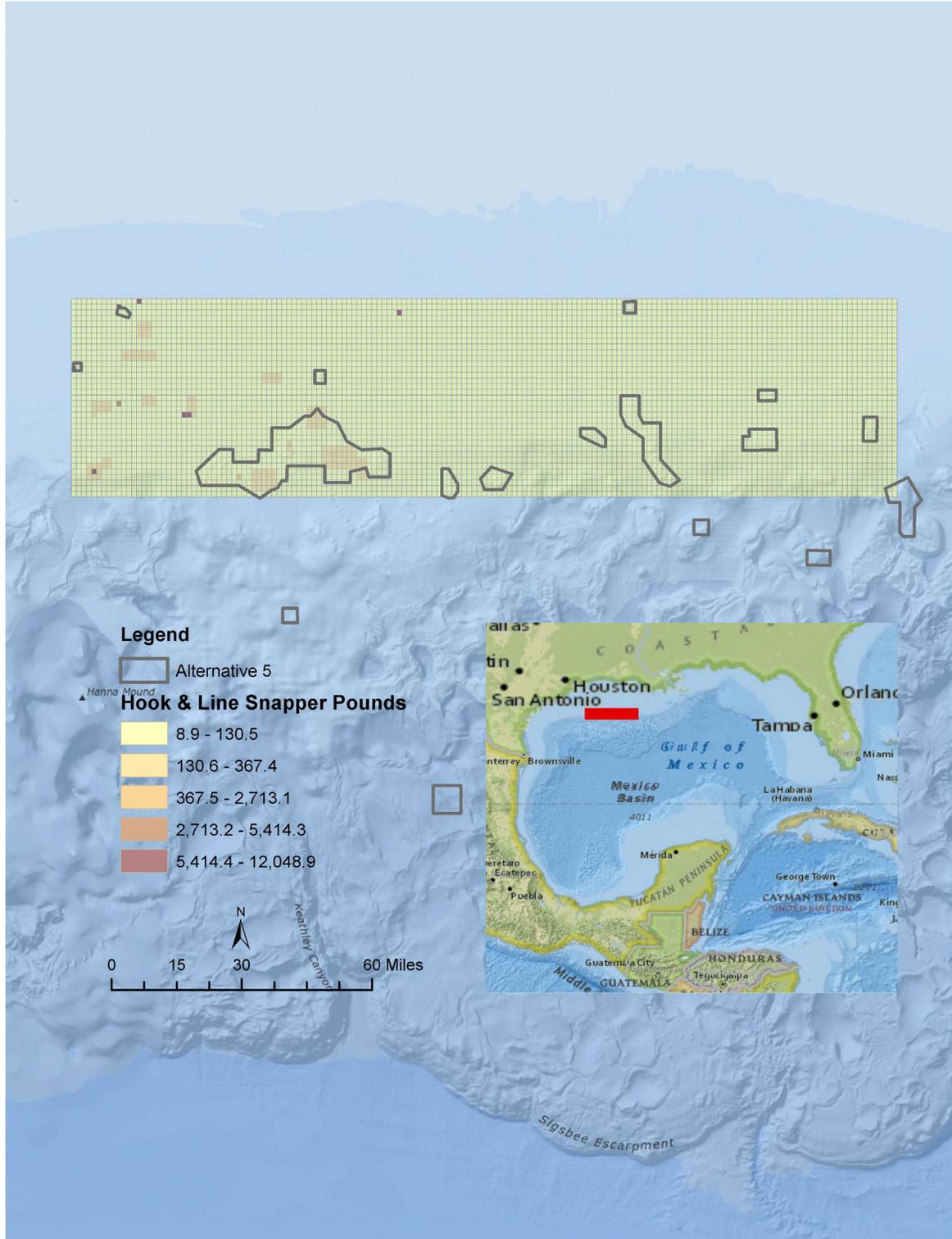


Figure 5.35 Alternative 5 Commercial Hook-and-Line Fishing Snapper Pounds (Total=45,330 lbs.). Image: Schwarzmann/NOAA

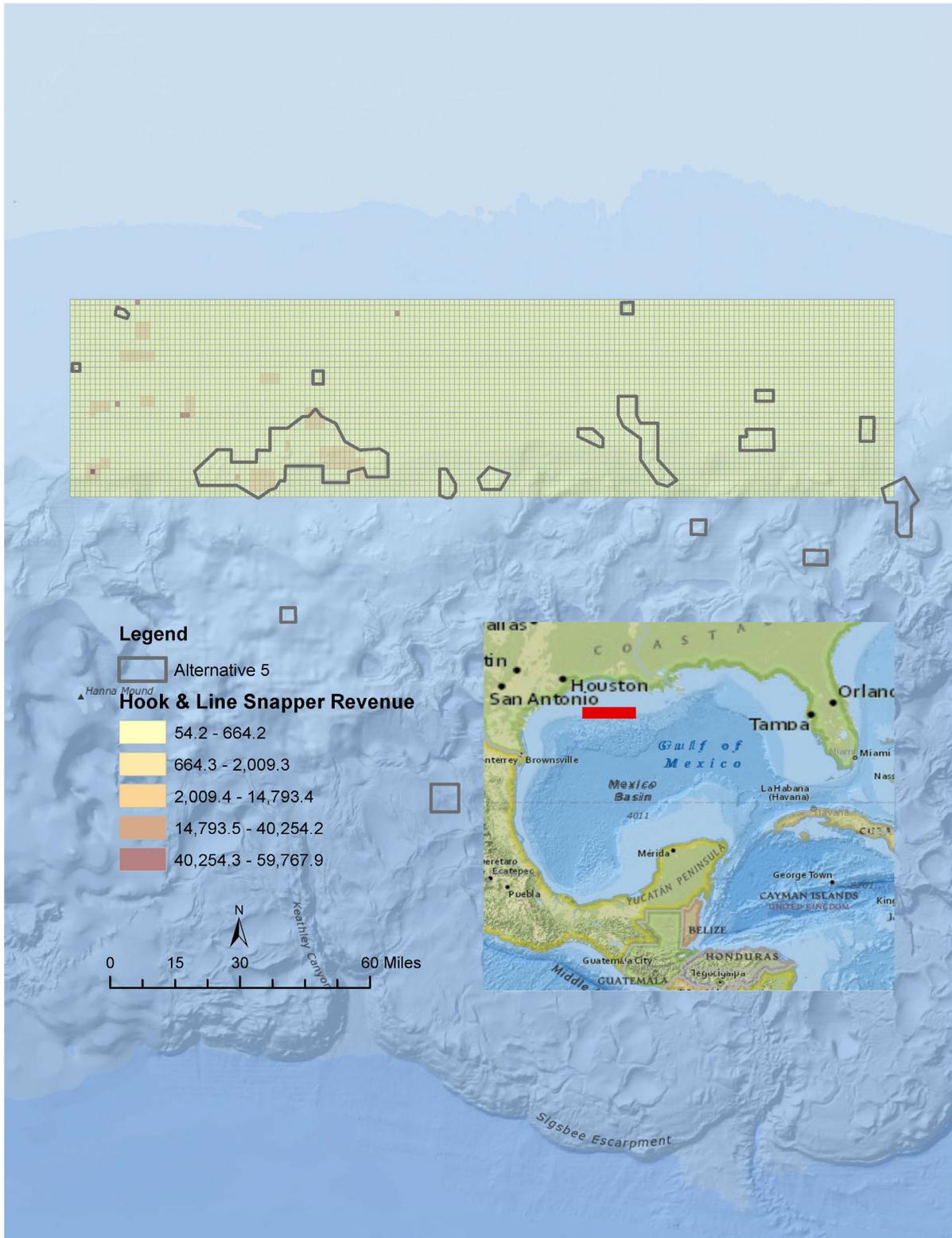


Figure 5.36 Alternative 5 Commercial Hook-and-Line Fishing Snapper Revenue (Total=\$198,721 in 2013\$).
Image: Schwarzmann/NOAA

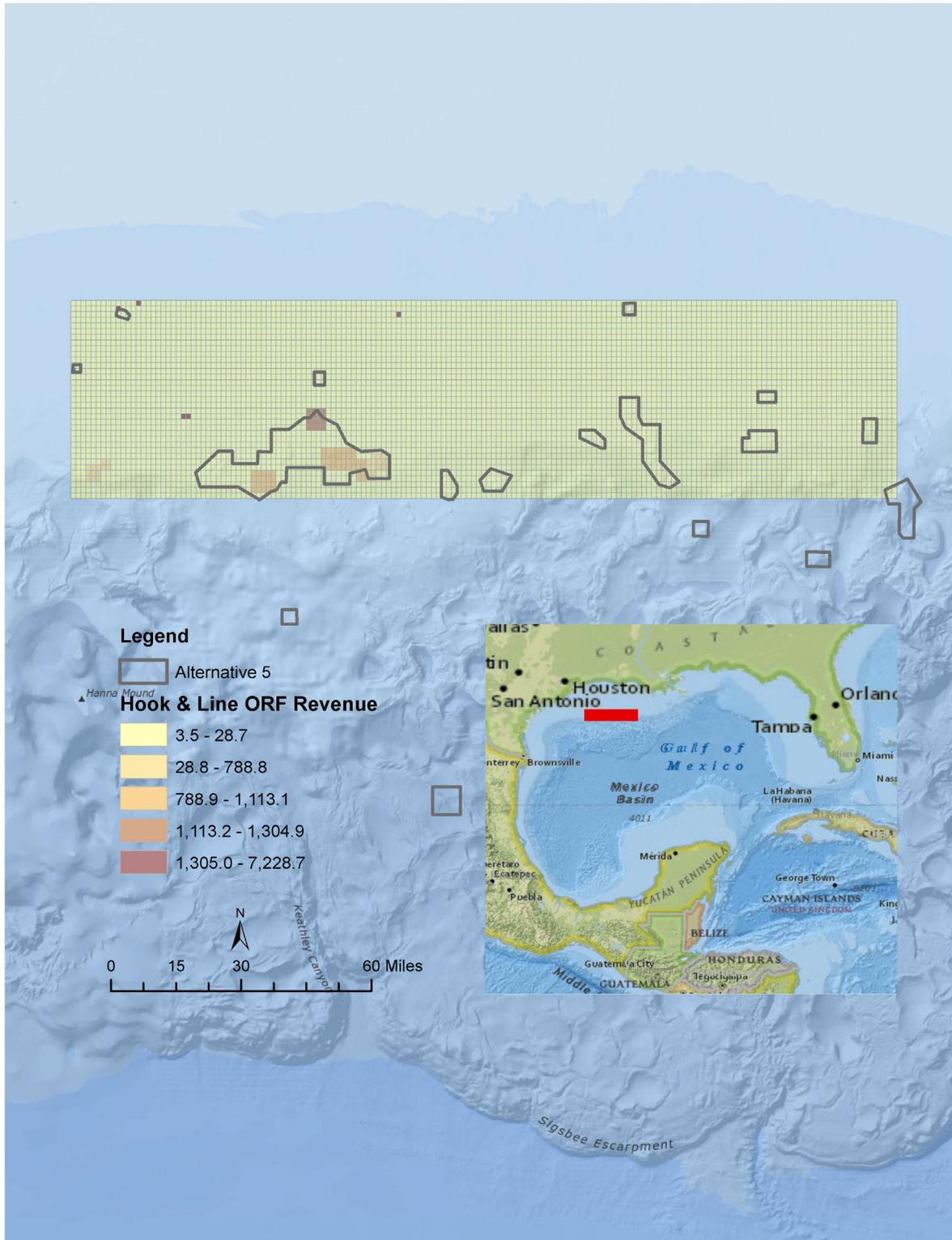


Figure 5.40 Alternative 5 Commercial Hook-and-Line Fishing Other Reef Fish Revenue (Total=\$45,760 in 2013\$). Image: Schwarzmann/NOAA

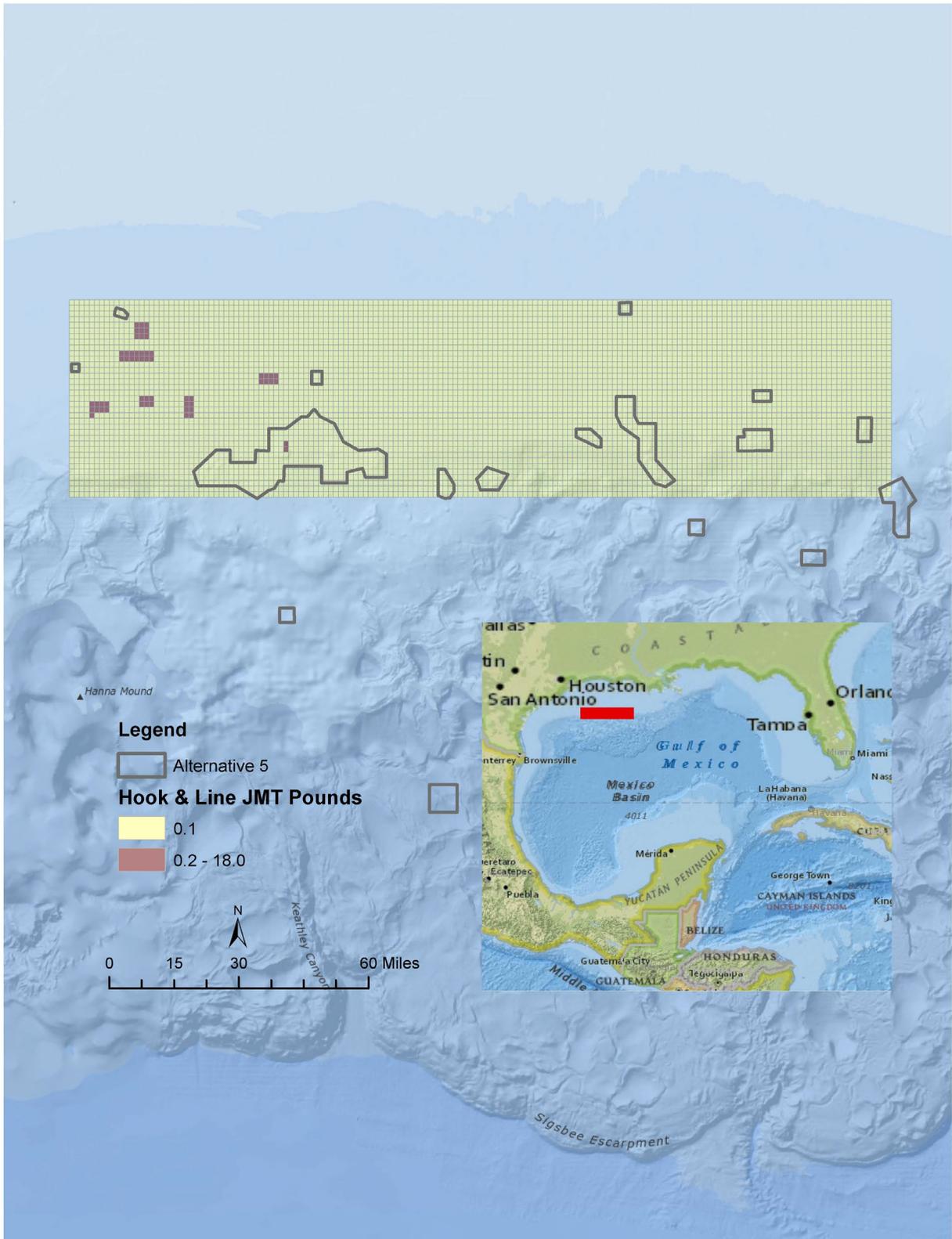


Figure 5.41 Alternative 5 Commercial Hook-and-Line Fishing Jack/Mackerels/Tunas Pounds (Total=81 lbs.). Image: Schwarzmann/NOAA

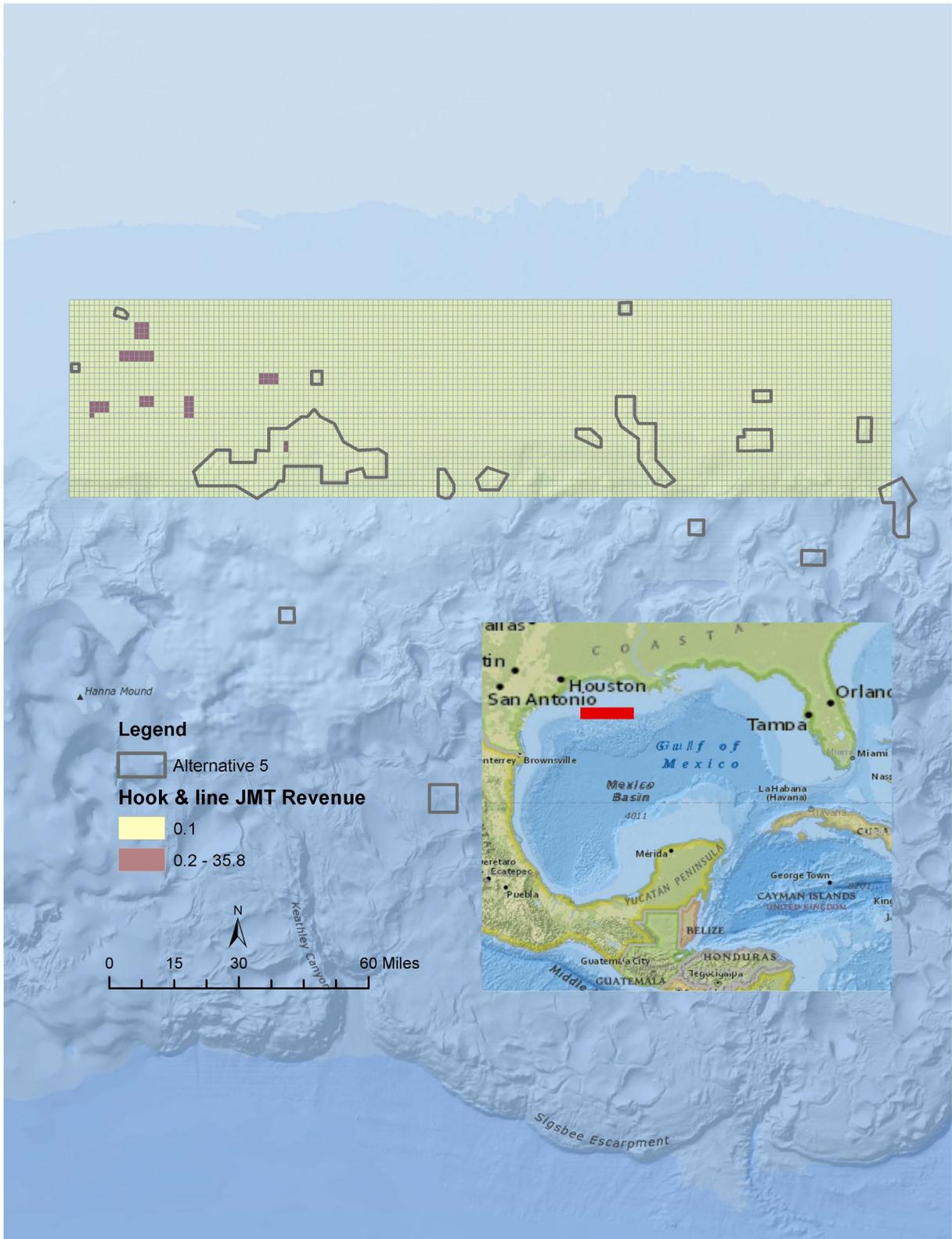


Figure 5.42 Alternative 5 Commercial Hook-and-Line Fishing Jack/Mackerels/Tunas Revenue (Total=\$128, in 2013\$). Image: Schwarzmann/NOAA

Step 1: Recreational Fishing Analysis of Alternatives

This section reviews the profit and revenue generated by the recreational for-hire fishing operations within each alternative. Alternative 1 is the status quo or no change alternative.

Alternative 1. Alternative 1, the existing sanctuary, has a total of 360 person-days of hook and line fishing. There are no spearfishing person-days because the regulations do not permit the activity. Slightly less than \$70,000 of revenue and \$14,000 in profit (3.9% of all profits of the eight operations) is generated within Alternative 1 as result of hook and line recreational fishing (Table 5.15).

Table 5.15 Person-Days, Revenue, and Profit in Alternative 1 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Hook & Line Person-Days in Alternative	362	45	0	217
Spear Fishing Person-Days in Alternative	0	0	0	0
Revenue Generated in Revenue	\$68,239	\$8,530	\$0	\$24,000
Profit Generated in Revenue	\$14,116	\$1,765	\$0	\$4,169
Percentage of Profit Generated in Alternative	3.9%	4.5%	0.0%	15.0%

Alternative 2. Alternative 2 adds an average of \$7,000 in revenue to each respondent. Only one respondent reported spearfishing in the proposed expansion area, and they engaged in six person-days of spearfishing. Roughly 6.6% of the average respondents' profit is generated within the expansion area (Table 5.16). Spearfishing is the only activity displaced, so maximum potential loss is only six person-days of spearfishing representing only a small fraction of one percent of fishing effort, revenue, and profits for the industry and for any individual operation (Table 5.17).

Table 5.16 Person-Days, Revenue, and Profit in Alternative 2 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Hook & Line Person-Days in Alternative	552	69	0	271
Spear Fishing Person-Days in Alternative	6	1	0	6
Revenue Generated in Revenue	\$123,468	\$15,434	\$0	\$67,500
Profit Generated in Revenue	\$24,154	\$3,019	\$0	\$8,338
Percentage of Profit Generated in Alternative	6.6%	9.1%	0.0%	15.0%

Table 5.17 Recreational Maximum Potential Loss in Alternative 2 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Total Person-Days	6	0.7	0	6
Percent of Total Person-Days	0.003%	0.0%	0.0%	0.003%
Revenue Generated	\$714	\$89	\$0	\$714
Percentage of Revenue Generated	0.043%	\$0	0%	3.6%
Profit Generated in Revenue	\$375	\$47	\$0	\$375
Percentage of Profit Generated	0.21%	0.0%	0.0%	0.2%
Percentage of Business Income	0.07%	0.009%	0.0%	0.1%
Percentage of Household Income	0.05%	0.006%	0.0%	0.1%

Alternative 3. The preferred alternative, Alternative 3, includes slightly less total recreational activity for both hook-and-line fishing and spearfishing than Alternative 2 (Table 5.18). It results in a maximum potential loss of \$1,300 in profit, which is only a very small fraction of one percent of the average respondents' total profits or the total profits of the industry (Table 5.19). In regard to the profits as a percentage of a respondents' income, the maximum potential loss to any one respondent ranges from 0 to 0.2%. When considering profits as a percent of household income, the maximum potential loss ranges from 0 to less than 0.01%.

Table 5.18 Person-Days, Revenue, and Profit in Alternative 3 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Hook & Line Person-Days in Alternative	528	66	0	244
Spearfishing Person-Days in Alternative	5	1	0	5
Revenue Generated in Revenue	\$123,468	\$15,434	\$0	\$67,500
Profit Generated in Revenue	\$24,587	\$3,073	\$0	\$8,338
Percentage of Profit Generated in Alternative	6.8%	12.6%	0.0%	43.5%

Table 5.19 Recreational Maximum Potential Loss in Alternative 3 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Total Person-Days	5	0.6	0	5
Percent of Total Person-Days	0.002%	0.0%	0.0%	0.002%
Revenue Generated	\$714	\$89	\$0	\$714
Percent of Revenue Generated	0.043%	\$0	0%	3.6%
Profit Generated	\$307	\$38	\$0	\$307
Percentage of Profit Generated	0.17%	0.0%	0.0%	0.2%
Percentage of Business Income	0.06%	0.008%	0.0%	0.1%
Percentage of Household Income	0.04%	0.005%	0.0%	0.0%

Alternative 4. Alternative 4 has the same maximum potential losses as Alternative 3 to recreational for-hire fishing operations for the areas within the NWGOM Study Area (tables 5.20 and 5.21). An additional unknown amount could be potentially lost in the areas included in the alternative outside the NWGOM Study Area.

Table 5.20 Person-Days, Revenue, and Profit in Alternative 4 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Hook & Line Person-Days in Alternative	528	66	0	244
Spearfishing Person-Days in Alternative	5	1	0	5
Revenue Generated in Revenue	\$123,468	\$15,434	\$0	\$67,500
Profit Generated in Revenue	\$24,587	\$3,073	\$0	\$8,338
Percentage of Profit Generated in Alternative	6.8%	12.6%	0.0%	43.5%

Table 5.21 Recreational Maximum Potential Loss in Alternative 4 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Total Person-Days	5	0.6	0	5
Percentage of Total Person-Days	0.002%	0.0%	0.0%	0.002%
Revenue Generated	\$714	\$89	\$0	\$714
Percentage of Revenue Generated	0.043%	\$0	0%	3.6%
Profit Generated	\$307	\$38	\$0	\$307
Percentage of Profit Generated	0.17%	0.0%	0.0%	0.2%
Percentage of Business Income	0.06%	0.008%	0.0%	0.1%
Percentage of Household Income	0.04%	0.005%	0.0%	0.0%

Alternative 5. Alternative 5 includes more hook-and-line fishing and the same amount of spearfishing as alternatives 3 and 4 and 10% of industry profits are earned within the NWGOM Study Area portion of the alternative (Table 5.22). Again, spearfishing is the only activity displaced and is the same as for alternatives 3 and 4 within the NWGOM Study Area. The maximum total potential loss of profits across the sample would be slightly more than \$700. Looking across individuals, the maximum potential loss of profit to any one person would be 0.2%. The maximum potential impact to their business income ranges from 0 to 0.1%. Zero to less than 0.1% is the maximum potential impact to their household income (Table 5.23). Again, some unknown additional losses are possible in the areas in Alternative 5 outside the NWGOM Study Area.

Table 5.22 Person-Days, Revenue, and Profit in Alternative 5 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Hook & Line Person-Days in Alternative	940	117	0	515
Spearfishing Person-Days in Alternative	5	1	0	5
Revenue Generated in Revenue	\$123,468	\$15,434	\$0	\$67,500
Profit Generated in Revenue	\$36,389	\$4,549	\$0	\$8,848
Percentage of Profit Generated in Alternative	10.0%	18.2%	0.0%	48.0%

Table 5.23 Recreational Maximum Potential Loss in Alternative 5 (N=8, 2013\$)

	Total	Mean	Minimum	Maximum
Total Person-Days	5	0.6	0	5
Percent of Total Person-Days	0.002%	0.0%	0.0%	0.002%
Revenue Generated	\$714	\$89	\$0	\$714
Percentage of Revenue Generated	0.043%	\$0	0%	3.6%
Profit Generated	\$307	\$38	\$0	\$307
Percentage of Profit Generated	0.17%	0.0%	0.0%	0.2%
Percentage of Business Income	0.06%	0.008%	0.0%	0.1%
Percentage of Household Income	0.04%	0.005%	0.0%	0.0%

Alternative 2 For-Hire Person-Days

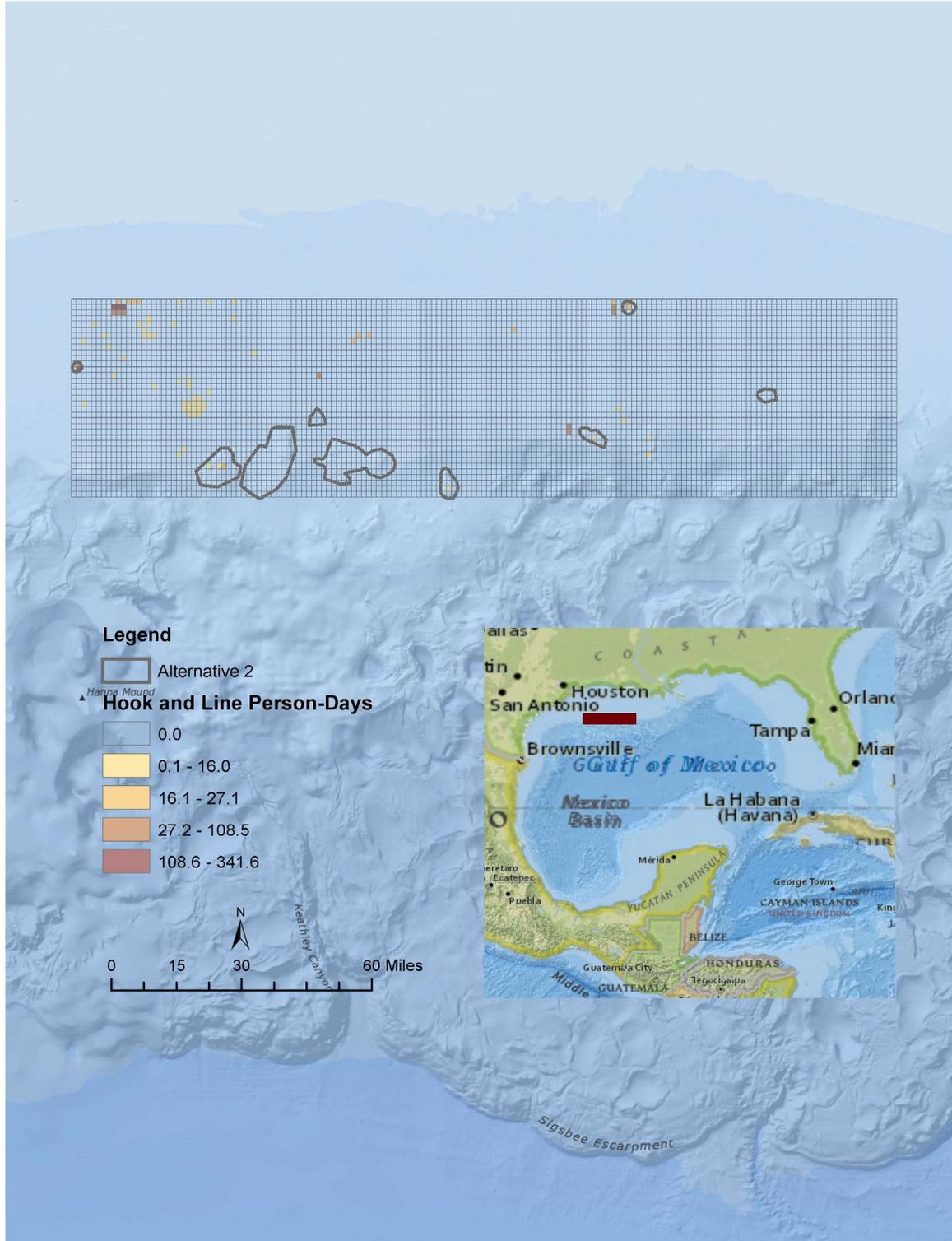


Figure 5.43 Alternative 2 For-Hire Recreational Hook-and-Line Fishing Person-Days (Total=552 Days). Image: Schwarzmann/NOAA

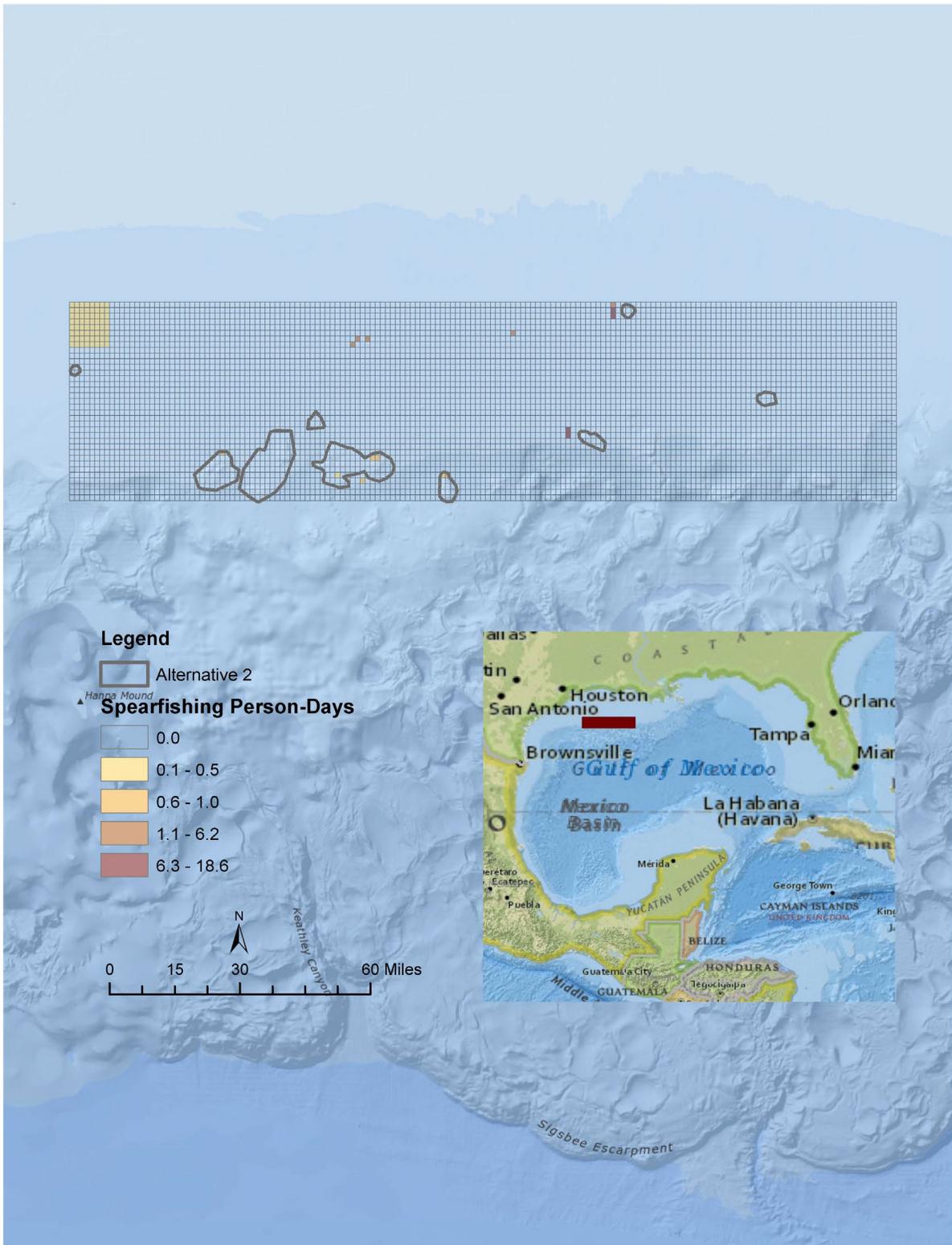


Figure 5.44 Alternative 2 For-Hire Recreational Spear Fishing Person-Days (Total=6 Days). Image: Schwarzmann/NOAA

Alternative 4 For-Hire Person-Days

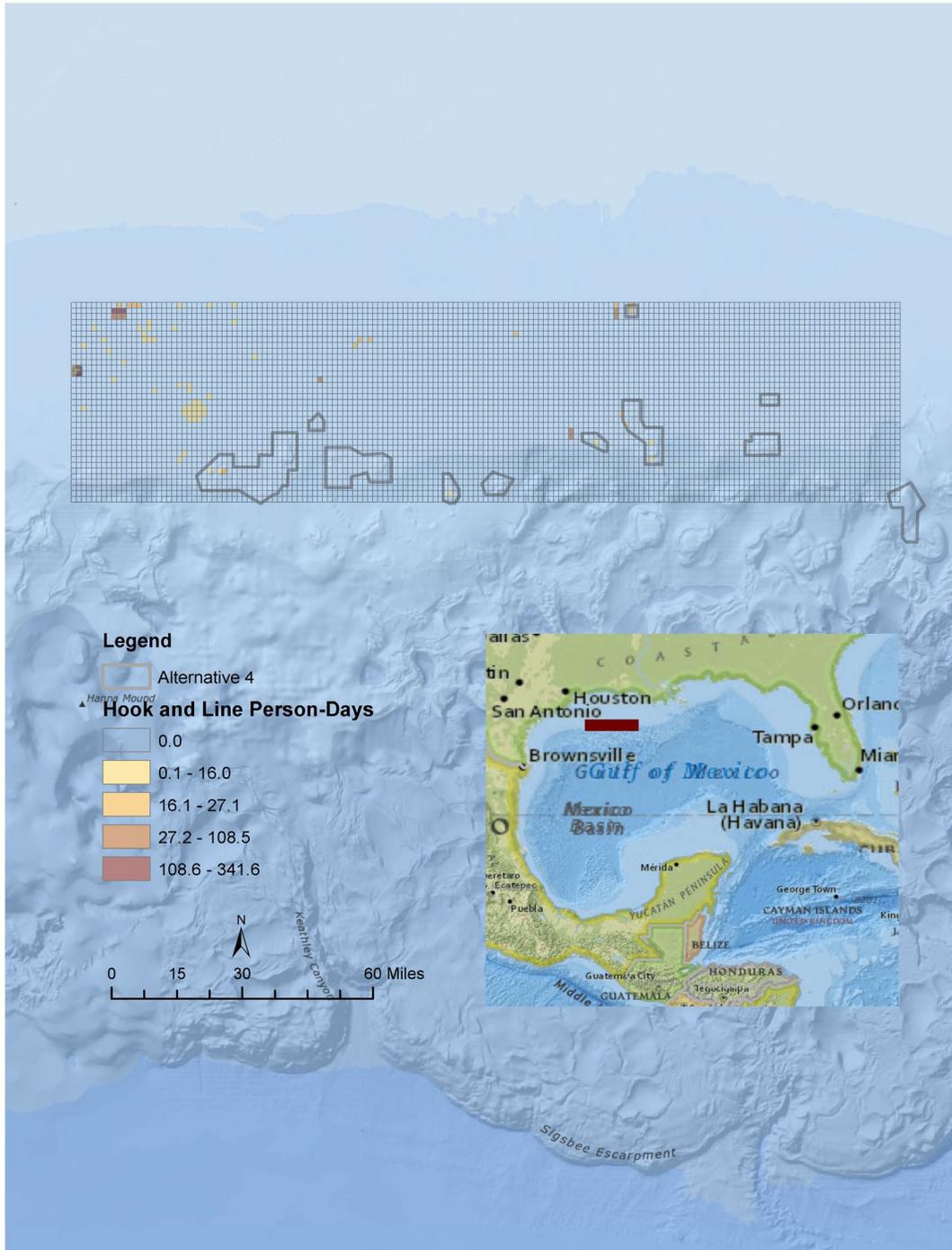


Figure 5.47 Alternative 4 For-Hire Recreational Hook-and-Line Fishing Person-Days (Total=528 Days). Image: Schwarzmann/NOAA

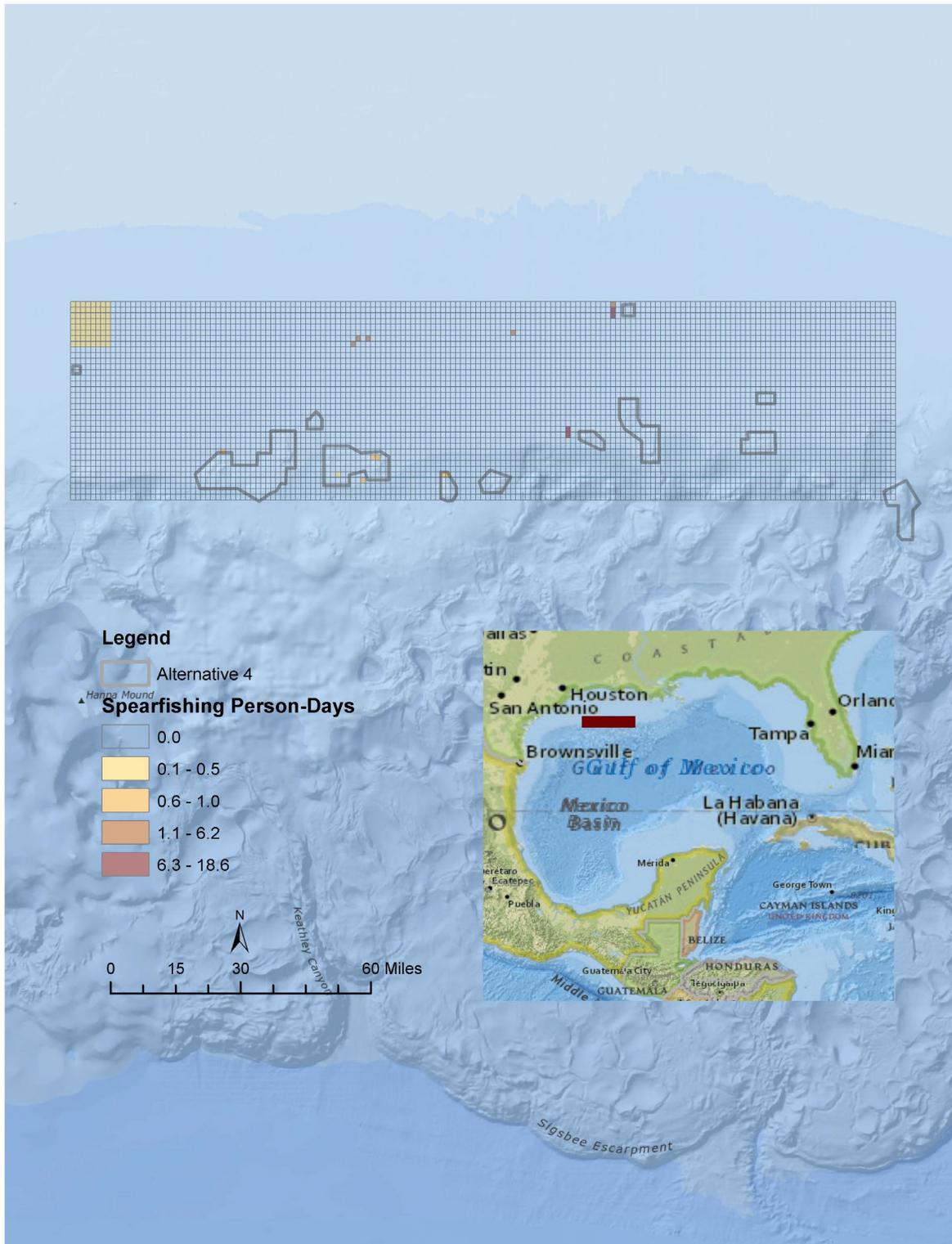


Figure 5.48 Alternative 4 For-Hire Recreational Spear Fishing Person-Days (Total=5 Days). Image: Schwarzmann/NOAA

Alternative 5 For-Hire Person-Days

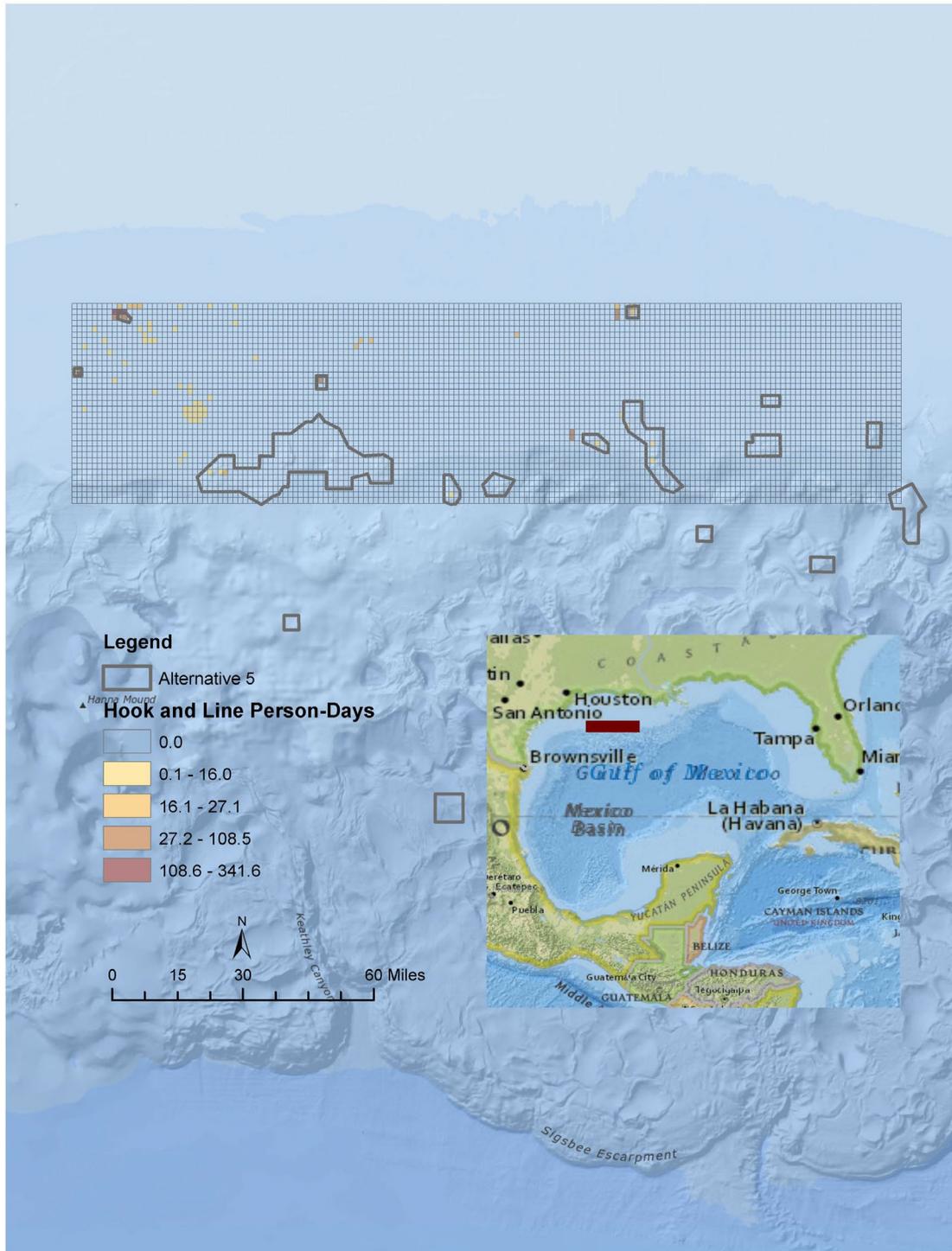


Figure 5.49 Alternative 5 For-Hire Recreational Hook-and-Line Fishing Person-Days (Total=940 Days). Image: Schwarzmann/NOAA

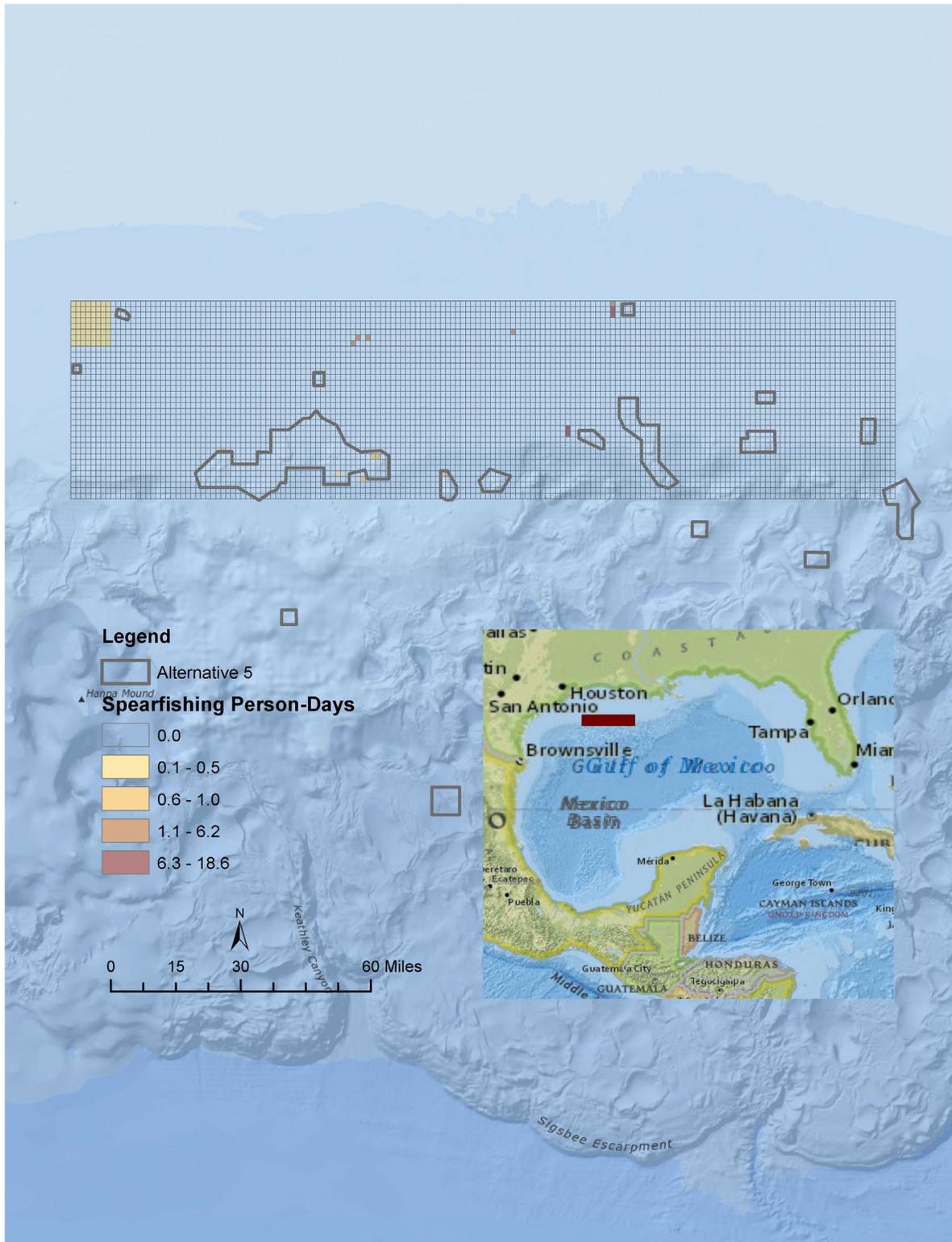


Figure 5.50 Alternative 5 For-Hire Recreational Spearfishing Person-Days (Total=5 Days). Image: Schwarzmann/NOAA

Oil and Gas

The proposed alternatives would not result in the prohibition of offshore oil and gas development in the expansion area, but could make oil and gas exploration more difficult or costly in these areas. The potential additional burden associated with accessing the small fraction of oil and gas reserves in the proposed expansion areas would have a minor impact on offshore energy development in the context of all Gulf of Mexico outer continental shelf oil and gas industry operations. The overall cumulative impact on oil and gas development is minor due to the fact that BOEM lease sales and the associated leasing stipulations protect topographic features, potentially sensitive biological features, live bottoms, etc., in the region and will continue for the foreseeable future. The amount of oil and gas activities in each of the five alternatives is shown in Table 5.24.

Table 5.24 Oil and Gas Industry Resources Intersected by Each Alternative

Alternative	Lease Blocks Intersected	Reserves BOE MMbbl	Leased Blocks	Lease Holders	Platforms	Pipeline Miles
1	19	5.3	4	2	1	0.68
2	91	10.1	19	8	5	33.64
3	108	13	25	11	8	73.23
4	192	55.2	51	24	12	157.47
5	256	98.9	76	30	18	270.07

In 2010, an analysis was done on the potential economic impacts of boundary expansion for the proposed FGBNMS boundary expansion. At the time of that analysis, the scope of the boundary analysis was limited to Alternative 2. Wolfe (2010) concluded the following:

1. As the FGBNMS management team believes that all five platforms (one already in a buffer zone and four to be added) are within four miles of sensitive and productive algal-sponge zones, all would already be required to shunt drilling materials to within 10 meters of the sea bottom. Furthermore, expansion of buffer zones would have no impact distances from the platforms to the edge of the new buffer zones as there are no requirements for horizontal shunting of materials. Hence, it is believed that no incremental costs are associated with the proposal to expand buffer zones.
2. To put shunting costs into perspective (if such infrastructure were not already in place) for the four additional platforms which will be encompassed by the expanded buffer zones, estimates to construct a 30-inch pipe built to handle high

standard products (e.g., natural gas or hydrogen on land) were developed. With current estimated costs running about \$1,260 per meter to construct a pipe capable of handling much more than discarded drilling mud, incremental runs of between 74 and 96 meters to extend shunt pipes from an estimated 25 meters below the ocean's surface to the mandatory 10 meters above the seafloor would run between \$93,000 and \$121,000 per platform. Based on actual depths (at mean high water levels) for the four platforms, incremental costs for pipe construction would run less than \$441,000. Even doubling that figure to account for hydraulic pumps to transport the drilling materials to greater depths, one-time total costs would not be expected to exceed \$882,000.

3. In 1995, total well drilling cost in the Gulf of Mexico has been reported to run between \$10.6 and \$18.3 million each (\$16.6 and \$28.7 million in 2009 dollars) with the cost of water-based drilling mud representing about 13% of those costs. With synthetic drilling mud's greater efficiency, well costs were reported to drop to between \$3.7 and \$7.8 million (\$5.8 and \$12.2 million in 2009 dollars). In these cases, synthetic mud represented higher proportion of overall well cost.
4. Under a worst-case scenario, one-time added costs for four platforms would have to be borne. With average U.S. wells producing in excess of 9,400 barrels of crude oil per day, recent values of \$80 per barrel suggest gross earnings of \$752,000 per day. With as many as 30 wells per platform, gross earnings could exceed \$22.5 million per platform per day. Using recent oil industry profit margins of about 8% (\$1.8 million per platform), one-time incremental costs of a little more than \$220,000 per platform could be paid off well within one day of operation (closer to six hours) from a 30-well platform. One well's profit alone would pay the one-time costs within four days of operation. In any event, the costs associated with boundary expansion are *de minimis*.

Wolfe's summary under point number 4 above has the price per barrel a little over twice the current market price, so gross earnings are now a little less than half his calculation as are profits, so his estimated payoff times are a little more than double his estimate. However, over the long-term prices are likely to rise and be somewhere between current and the prices Wolfe used.

Using a range of prices Wolfe's results could be extended by platform to the other alternatives with the number of platforms by alternative (Table 5.24). Alternative 3 intersects eight platforms, so the impacts to Alternative 3 would be 1.6 times those from Alternative 2. Alternative 4 has 12 platforms, so its impact would be 2.4 times that of Alternative 2. Alternative 5 has 18 platforms and would have an expected impact 3.6 times that of Alternative 2. In any case, it seems the general conclusions by Wolfe would hold for all alternatives and costs would be *de minimis*.



Private Vessels

From all sources of information obtained, there was no known activity from private vessels in the boundary expansion areas. Therefore, there is no expected impact on this user group for any alternative.

CHAPTER 6. NET ASSESSMENT OF COSTS AND BENEFITS

Alternative 1: The No Change Alternative

There would be no impact on any of the current uses of FGBNMS. The potential loss associated with this alternative is the lost benefits of not doing the boundary expansion. It was estimated that expanding the boundaries of FGBNMS could have benefits to the nation of \$3.99 billion to \$12.2 billion per year compared to the costs of about \$3 million per year to implement boundary expansion. ***Thus, this alternative would be expected to result in negative net benefits to the nation.***

Alternative 2: SAC Recommendation

This alternative has extremely small impacts to all current uses. For the commercial and recreational fisheries, the impacts are so small that we expect that the potential losses will not occur as the users will be able to substitute to other sites. For oil and gas, the potential losses are small to industry, but are likely to occur. There are no losses to consumers as the losses are so small they would not be expected to change prices for oil and gas to consumers. In the long-term, there will potentially be some benefits to the recreational dive industry if protection of the additional banks leads to quality increases in the resources to be protected. The dive industry and related businesses where recreational divers spend money undertaking recreational diving activity could potentially benefit and divers could benefit, resulting in increases in consumer's surplus. The greatest potential benefits of expansion to the nation are from increases in passive economic use value or non-use economic value of \$3.99 billion to \$12.2 billion per year versus a cost of about \$13 million per year to implement. ***Thus, this alternative results in positive net benefits to the nation.***

Alternative 3: NOAA's Preferred Alternative

This alternative has extremely small impacts to all current uses. For the commercial and recreational fisheries, the impacts are so small that we expect that the potential losses will not occur as the users will be able to substitute to other sites. For oil and gas, the

potential losses are small to industry, but are likely to occur. No losses to consumers as the losses are so small they would not be expected to change prices for oil and gas to consumers. In the long-term, there will potentially be some benefits to the recreational dive industry if protection of the additional banks leads to quality increases in the resources to be protected. The dive industry and related businesses where recreational divers spend money undertaking recreational diving activity could potentially benefit and divers could benefit, resulting in increases in consumer's surplus. The greatest potential benefits of expansion to the nation are from increases in passive economic use value or non-use economic value of \$3.99 billion to \$12.2 billion per year versus a cost of around \$3 million per year to implement. ***Thus, this alternative results in positive net benefits to the nation.***

Alternative 4: The preferred alternative plus high priority mesophotic and deep coral sites

This alternative has potentially small impacts to all current uses, but larger than alternatives 2 and 3. For commercial and recreational fishing, the potential impacts within that portion of the activity in the NWGOM Study Area are not expected to occur as it is expected that these losses are so small operators can substitute to other areas. For areas in this alternative outside the NWGOM Study Area, an unknown amount of activity would be potentially impacted for the commercial and recreational fisheries. For oil and gas, the losses would be expected to be small for the requirement to shunt vertically all pollutants, as would be increased costs of the permitting process, but these costs would be expected to occur and would be greater than the costs for alternatives 2 and 3. The long-term benefits to the dive industry are unknown, especially outside the NWGOM Study Area, since no data were obtained on the extent of the dive industry currently in the areas of this alternative outside the NWGOM Study Area. However, if added protections increased the quality of the resources in the areas covered by this alternative, it is expected that there would be benefits to the dive industry and related industries impacted by spending by recreational divers, and increases in consumer's surplus to the divers. The greatest potential benefits of expansion to the nation are from increases in passive economic use value or non-use economic value. It would be expected that increasing significantly the extent of resource protection would yield benefits greater than for alternatives 2 and 3, but the extent of the additional benefits are unknown since the study by Stefanski and Shimshack (2016) did not evaluate extending the expansion to areas outside of what was included in alternatives 2 and 3. However, just including the benefits of the areas covered by the areas in the alternative included in alternatives 2 and 3, the net benefits to the nation would be expected to

exceed the costs of implementation. ***Thus, this alternative would be expected to result in net benefits to the nation.***

Alternative 5: Comprehensive protection for high-value north central Gulf of Mexico benthic habitats and cultural resources

This alternative has potentially small impacts to all current uses, but larger than alternatives 2, 3, and 4. For commercial and recreational fishing, the potential impacts within that portion of the activity in the NWGOM Study Area are not expected to occur as it is expected that these losses are so small that operators can substitute to other areas. For areas in this alternative outside the NWGOM Study Area, an unknown amount of activity would be potentially impacted for the commercial and recreational fisheries. For oil and gas, the losses would be expected to be small for the requirement to shunt vertically all pollutants, as would be increased costs of the permitting process, but these costs would be expected to occur and would be greater than the costs for alternatives 2, 3, and 4. The long-term benefits to the dive industry are unknown, especially outside the NWGOM Study Area, since no data were obtained on the extent of the dive industry currently in the areas of this alternative outside the NWGOM Study Area. However, if added protections increased the quality of the resources in the areas covered by this alternative, it is expected that there would be benefits to the dive industry and related industries impacted by spending by recreational divers and increases in consumer's surplus to the divers. The greatest potential benefits of expansion to the nation are from increases in passive economic use value or non-use economic value. It would be expected that increasing significantly the extent of resource protection would yield benefits greater than for alternatives 2, 3, and 4, but the extent of the additional benefits are unknown since the study by Stefanski and Shimshack (2016) did not evaluate extending the expansion to areas outside of what was included in alternatives 2 and 3. However, just including the benefits of the areas covered by the areas in the alternative included in alternatives 2 and 3, the net benefits to the nation would be expected to exceed the costs of implementation. ***Thus, this alternative would be expected to result in net benefits to the nation.***

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Glossary of Acronyms

AIS	Automatic identification system
BEWG	Boundary Expansion Working Group
BOEM	Bureau of Ocean Energy Management
EPIRB	Emergency position-indicating radio beacon
FGBNMS	Flower Garden Banks National Marine Sanctuary
GIS	Geographic information system
HAPC	Habitat Area of Particular Concern
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NWGOM	Northwest Gulf of Mexico
OER	NOAA Office of Ocean Exploration and Research
ONMS	NOAA Office of National Marine Sanctuaries
P&I	Protection and indemnity
ROV	Remotely operated vehicle
SAC	Sanctuary Advisory Council
VMS	Vessel monitoring system



AMERICA'S UNDERWATER TREASURES