

# Chapter 1: Introduction

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This study estimated the net economic value of the natural and artificial reef resources of southeast Florida to the local economies and the reef users. Southeast Florida is defined as the counties of Palm Beach, Broward, Miami-Dade and Monroe. Monroe County includes the Florida Keys. This study employed extensive survey research to measure the economic contribution and the use values of artificial and natural reefs over the twelve-month period of June 2000 to May 2001. The reef users surveyed were boaters who are recreational fishers (commercial fishers were not included), reef divers, reef snorkelers, and/or visitors viewing the reefs on glass-bottom boats.

The primary goals of this study are to estimate the following values:

- Total reef use of residents and visitors in each of the four counties over a twelve-month period as measured in terms of person-days
- Economic contribution of the artificial reefs as residents and visitors spend money in each of the four counties to participate in reef-related recreation
- Economic contribution of the natural reefs as residents and visitors spend money in each of the four counties to participate in reef-related recreation
- Willingness of reef users to pay to maintain the natural reefs of southeast Florida in their existing conditions
- Willingness of reef users to pay to maintain the artificial reefs of southeast Florida in their existing conditions
- Willingness of reef users to pay for additional artificial reefs in southeast Florida
- Socioeconomic characteristics of reef users

Economic contribution is measured by total sales, income, employment and tax revenues generated within each county. In addition, the opinions of residents regarding the existence or establishment of “no-take” zones as a tool to protect existing artificial and natural reefs are presented.

This study was funded by each of the four counties, the Florida Fish and Wildlife Conservation Commission through the use of Federal Aid in Sport Fish Restoration funds, and the National Oceanic and Atmospheric Administration (NOAA) through the Socioeconomic Monitoring Program for the Florida Keys National Marine Sanctuary.

## 1.1 Project Objectives

For each of the four counties, the population of reef users was divided into two groups – (1) visitors to the county and (2) residents of the county. Visitors are defined as nonresidents of the county that they are visiting. For example, a person from Broward County visiting the Florida Keys in Monroe County is considered a visitor to Monroe County. Likewise, a person from New York visiting the Florida Keys is considered a visitor. For each county, residents are defined as

persons living in the county who used the reefs on a private boat registered in that county. For example, a person who lives in Broward County and fishes for recreation on the reefs off the shores of Broward County using a private boat registered in Broward County is a resident of Broward County.

This study conducted four surveys as follows:

- Resident boater survey – conducted in the Fall of 2000
- General visitor survey – conducted in the Summer of 2000 and the Winter of 2001
- Visitor boater survey – conducted in the Summer of 2000 and the Winter of 2001
- Charter / Party boat survey – conducted in the Spring of 2001

The purpose of the resident boater survey and the visitor boater survey was to collect information to estimate the following characteristics:

- Percentage of boaters who fish, dive and / or snorkel on the reefs;
- Total of itemized expenditures related to using the reefs (lodging, food, gas, equipment, etc.);
- Number of person-visits and person-days of reef use by type of reef and activity;
- Willingness-to-pay to protect southeast Florida reefs in their existing condition; and,
- Willingness-to-pay for additional reefs in southeast Florida.

In addition, at the request of the counties, the resident survey also includes questions regarding “no-take” zones in their counties of residence.

The purpose of the general visitor survey was to obtain estimates of the total number of visitors to each county and the percentage of visitors who boat.

The charter/party boat survey was a survey of for-hire operations that take out passengers for recreational fishing, snorkeling, scuba diving and glass-bottom boat rides in saltwater off the coasts of the four counties. The primary purpose of this survey was to estimate the proportion of charter / party service activity that takes place on the artificial versus the natural reefs in each county.

**Resident Boater Survey.** The resident boater survey was a mail survey of boaters who own a boat 16 feet or greater and whose boats are registered in the counties of Palm Beach, Broward, Miami-Dade, or Monroe. The minimum boat size of 16 feet was selected because this is the minimum size that can safely navigate the harbor entrances of Palm Beach, Port Everglades and

Miami. In order to reach the Atlantic Ocean, a boat must use one of these entrances to navigate from the Intracoastal Waterway to the Atlantic Ocean and back.<sup>1</sup>

The survey research effort was comprised of two versions of the survey: Version 1 and Version 2. The two versions are identical except for the contingent valuation (CV) questions. In Version 1, the CV questions address willingness-to-pay to maintain the natural and artificial reefs in their current condition. In Version 2, the CV questions address willingness-to-pay for additional artificial reefs in southeast Florida.

The survey instruments for each county were identical except that, in Monroe county, additional questions addressed the importance of certain Florida Keys attributes to the respondent and the respondent's satisfaction with those attributes (Importance / Satisfaction Survey funded by NOAA). The results of the Importance / Satisfaction Survey are not included in this document, but will be provided in a future NOAA report.

The resident surveys and the cover letter are provided in Appendix A.

The resident survey began as a telephone survey. Boat owner information from Florida's boater registration files was used to identify boat owners in southeast Florida. Boater registration information includes owner's name and address, but not telephone number. The computerized boater registrations of boats 16 feet or greater were merged with the computerized White Pages directory to identify the telephone numbers of the registered boat owners. Boaters were randomly sampled from the merged file. The six-week telephone survey effort generated 72 completed surveys from 8,500 attempted telephone calls to boat owners. The reasons for such a low response rate included, in order of frequency, no answer; wrong telephone number; and refusal to complete the survey over the telephone. This low response rate for telephone interviews is a new phenomenon that has been noted in many other recent telephone surveys throughout the United States. Also, the resident boater survey is relatively long and appears to be too long to successfully complete over the telephone.

Because the response rate was so low, the telephone survey was converted to a mail survey. This approach was successful in meeting the survey goals. The resident boater addresses were obtained from the boater registration records. Based on recent survey experience, people appear to be more patient in completing a long mail survey than a long telephone survey.

The mailing list for each county was created by selecting a random sample of boat owners with boats 16 feet or greater from each county's boater registration file. The number of surveys that were mailed out by county is presented in Table 1.2-1.

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<sup>1</sup> *Smaller boats have been sighted trying to navigate the cuts in the Intracoastal Waterway to reach the ocean but this is not common and is considered to be dangerous. Residents and visitors can also reach the reefs via a small boat from the shore or by swimming to the reef. These residents are a small subset of total reef users and were not surveyed due to time and budget constraints. The study results represent most of the reef user-days in southeast Florida.*

**Table 1.2-1  
Number of Surveys Mailed to  
Resident Boaters by County**

<b>Survey Version Number</b>	<b>Palm Beach</b>	<b>Broward</b>	<b>Miami-Dade</b>	<b>Monroe</b>
1	1,500	1,500	1,500	1,750
2	1,500	1,500	1,500	1,750
<b>Total</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,500</b>

Surveys were mailed to 3,000 resident boaters in each of Palm Beach, Broward, Miami-Dade, and Monroe counties in order to meet the survey goals of 500 completed surveys per county for the Socioeconomic Study of Reefs in Southeast Florida. An additional 500 surveys were mailed to resident boaters in Monroe County to increase the number of completed Importance / Satisfaction surveys. The number of surveys mailed out presumed a response rate of about 17 percent. The actual response rate was 22 percent.

Florida State University mailed out the surveys. All surveys were mailed out by November 15, 2000. The response rates to the mail survey are provided in Table 1.2-2. The survey goals were met for each county.

**Table 1.2-2  
Summary of Resident Boater Survey Success**

<b>Item</b>	<b>Total</b>	<b>Monroe</b>	<b>Miami-Dade</b>	<b>Palm Beach</b>	<b>Broward</b>
Number Mailed to Residents	12,500	3,500	3,000	3,000	3,000
Number Returned Undeliverable	813	263	162	199	189
Number of Completed Surveys Received:					
Residents who used reefs in their county of residence in the past year	1,658	596	378	330	354
Residents who did not use reefs in their county of residence in the past year	885	194	174	286	231
<b>Total Completed Surveys Received</b>	<b>2,543</b>	<b>790</b>	<b>552</b>	<b>616</b>	<b>585</b>
Survey Goal - Number of Completed Surveys	2,300	800	500	500	500
Percent of Survey Goal Met	111%	99%	110%	123%	117%
Percent of Completed Surveys Received:					
Residents who used reefs in their county of residence in the past year	65.2%	75.4%	68.5%	53.6%	60.5%
Residents who did not use reefs in their county of residence in the past year	34.8%	24.6%	31.5%	46.4%	39.5%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>
Percent of Completed Surveys Received of All Mailed					
Percent of Completed Surveys Received of All Surveys not Returned Undeliverable	20.3%	22.6%	18.4%	20.5%	19.5%
<b>Percent of Completed Surveys Received of All Surveys not Returned Undeliverable</b>	<b>21.8%</b>	<b>24.4%</b>	<b>19.5%</b>	<b>22.0%</b>	<b>20.8%</b>

**Visitor Boater Survey and General Visitor Survey.** The visitor boater survey and the general visitor survey were intercept surveys where survey researchers canvassed locations where visitors were likely to be. The researchers conducted voluntary in-person surveys at these locations. The general visitor survey targeted all visitors to the county. The visitor boater survey targeted visitors who participated in reef-related recreation using a boat in that county in the past twelve months. For visitor boaters, the intercept locations included marinas, charter/party boat operations, hotels, and campgrounds. For general visitors, the intercept locations were airports, attractions and hotels. The surveys were conducted in the summer of 2000 and the winter of 2001 to adequately model the seasonality of visitation.

The surveys are presented in Appendix B. The list of interview site locations is provided in Appendix C.

The summer survey was conducted from June 21, 2000 through September 5, 2000. The winter survey was conducted from February 22, 2001 to April 12, 2001. Volunteers provided by Bicentennial Volunteers, Inc. conducted the intercept surveys at selected sites within each county. In the summer, Rife Market Research, Inc. also provided survey researchers to assist the Bicentennial Volunteers. The levels of survey research effort for each county during the summer and winter surveys are presented in Table 1.2-3 and Table 1.2-4.

**Table 1.2-3  
Survey Research Level of Effort  
Summer Survey Period**

<b>County</b>	<b>Survey Research Team</b>	<b>Survey Effort in Person-Days</b>	<b>Dates Surveyed</b>
Palm Beach	Bicentennial Volunteers - 1 couple	44	June 21 through July 19
	Rife Market Research	96	August 10 through September 5
Broward	Bicentennial Volunteers – 1 couple	84	June 21 through August 18
	Bicentennial Volunteers – 1 couple	36	July 7 through August 4
	Rife Market Research	20	August 20 through September 5
Miami-Dade	Bicentennial Volunteers – 1 couple	2	June 21 <sup>a</sup>
	Rife Market Research	140	July 17 through August 27
Monroe – Middle and Lower Keys	Bicentennial Volunteers – 3 couples	210	June 21 through August 8
	Rife Market Research	70	July 17 through August 27
<b>Total</b>		<b>702</b>	<b>June 21 through September 5</b>

*a All surveys in Miami-Dade County were stopped on June 22 due to the coastal sewage spill in North Miami. Surveys resumed on July 17.*

**Table 1.2-4**  
**Survey Research Level of Effort**  
**Winter Survey Period**  
**February 22 to April 12, 2001**

<b>County</b>	<b>Person-Days</b>
Palm Beach	130
Broward	150
Miami-Dade	140
Monroe	280
Total	700

The numbers of completed surveys of the general visitor survey and the visitor boater survey are provided in Table 1.2-5 and Table 1.2-6, respectively. The number of completed surveys was sufficient to adequately estimate the economic and use values of the reefs. The survey instrument is provided in Appendix D.

**Table 1.2-5**  
**General Visitor Survey Tally**  
**Number of Completed Surveys**

<b>County</b>	<b>Summer</b>	<b>Winter</b>	<b>Total</b>
Palm Beach	405	396	801
Broward	659	282	941
Miami-Dade	526	353	879
Monroe	648	586	1,234
Total	2,238	1,617	3,855

**Table 1.2-6**  
**Visitor Boater Survey Tally**  
**Number of Completed Surveys**

<b>County</b>	<b>Summer</b>	<b>Winter</b>	<b>Total</b>
Palm Beach	198	292	490
Broward	143	109	252
Miami-Dade	240	99	339
Monroe	504	888	1,392
Total	1,085	1,388	2,473

**Charter / Party Boat Survey.** A mail-back questionnaire was mailed to 500 charter / party boat operators who were believed to be operating in southeast Florida. Under a charter service, the boat owner / guide takes a group of six or fewer fishers (or divers / snorkelers) for a full- or half-

day of fishing (or diving / snorkeling) trip for a fee. Under a party service, the boat owner / guide takes from seven to several dozen (or more) fishers (or divers / snorkelers) on a trip for a fee per person. Experience in the Northwest Florida Artificial Reef Study (Bell, Bonn and Leeworthy, 1998) found that recreational fishermen who used charter and party boats did not know whether they were fishing on artificial or natural reefs. The captains and mates rarely, if ever, inform their passengers whether they are fishing on an artificial or a natural reef. The response rate for this survey was very low for two key reasons: (1) some owners did not operate in southeast Florida during year 2000-2001; (2) boat owners are reluctant to provide business information. The 70 responses to this survey were used to apportion the number of charter and party fishing days between artificial reefs, natural reefs and no reefs. The results of this survey are provided in Table 1.2-7.

**Table 1.2-7  
Percent of Recreational Fishing Passenger Days Spent on Artificial and Natural Reefs  
From Charter/Party Boat Survey**

County	Sample Size	Total Passenger Days in Past 12 Months – Survey Respondents	Percent Days Fished On:			
			Artificial Reefs	Natural Reefs	No Reefs	Sum of Percentages
Palm Beach	11	1,695	14%	46%	40%	100%
Broward	11	1,271	14%	16%	70%	100%
Miami-Dade	14	37,585	32%	40%	28%	100%
Monroe	34	16,340	5%	44%	51%	100%
All Counties	70	56,891	24%	41%	36%	100%

*Source: Charter / Party Boat Mail Survey conducted from March to May 2001*

## 1.2 Summaries, Modeling, and Statistical Evaluation

The survey responses were used to estimate the economic and use values of the reefs. The types of reef-related recreation that were considered in the survey included the following saltwater recreational boating activities:

- fishing
- diving
- snorkeling

For visitors, glass bottom boat tours were also considered. Also, for visitors, each activity was tied to a boating mode. These boating modes were charter boats; party boats; rental boats; and own or private boat.

Three types of evaluations were conducted as follows.

**Data Summaries.** Summaries of the survey responses were used to describe the characteristics of reef users. These characteristics include median age, household income, length of boat and years boating; and respondent distribution of sex, race, education and member of fishing or diving club.

**Modeling.** The survey responses and the Capacity Utilization Model (CAP) were used to calculate person-trips, person-days, and expenditures on reef-related activities for each county. The CAP is explained in more detail in Chapter 2.2.

For visitors, the number of person-trips to a county where the person participated in reef-related recreation was calculated. A person-trip is defined as one person making one trip to a county. That trip may last one day to many days. On any given day, the number of visitor person-trips and the number of visitors are the same. For resident boaters, a person-trip is one day's outing on a boat.

For both visitors and residents, the number of person-days was calculated by boating activity and boating mode (private boat, rental boat, charter boat, party boat). A person-day is defined as one person participating in an activity for a portion or all of a day.

For residents, the term "party-day" is used to convert the resident survey responses to person-days. A party-day is defined as one boat carrying one or more passengers for a day or partial day of recreation.

The average itemized expenditures per day while participating in each type of reef-related recreation activity were calculated from the resident boater and visitor boater survey responses. The type of expenditures included charter / party boat fees, lodging, food, gasoline, car rental, ramp and marina fees, bait, tackle, ice, equipment rental, and air refills. Only those expenditures that were made in the county were included. If the survey respondent participated in two reef-related boating recreation activities in one day, which only happened when a private boat was used, then the reported day's expenditures were halved for each activity. Total expenditure on reef-related recreation within the county was obtained by multiplying the average itemized expenditures per person-day for each activity and boat mode by the number of person-days associated with each activity and boat mode and summing over all the activities and boating modes.

The reef-related expenditures were always itemized in order to calculate the economic contribution of these expenditures. Economic contribution is the increase in sales, income, employment and tax revenues generated within the county from reef-related expenditures. The magnitude of the economic contribution depends on the types of goods and services purchased.

Expenditures by visitors generate income and jobs within the industries that supply reef-related goods and services, such as charter / party boat operations, restaurants and hotels. These industries are called direct industries. In addition, these expenditures create multiplier effects wherein additional income and employment is created as the income earned by the reef-related



industries is respend within the county. These additional effects of reef-related expenditures are called indirect and induced. Indirect effects are generated as the reef-related industries purchase goods and services from other industries in the county. Induced effects are created when the employees of the direct and indirect industries spend their money in the county.

For visitors, the direct, indirect and induced economic contribution of the reefs was estimated using the estimated reef-related expenditures and economic input-output models.

For residents, the expenditures were converted to sales, income and employment generated within the directly affected industries. The multiplier effect of reef-related spending by residents in the county was not estimated because this spending is also the result of multiplier effects from other economic activities within the county. The multiplier effect of resident spending on reef-related activities is attributed both to the reef system and to these other economic activities that generated the resident income used to purchase the reef-related goods and services. Thus, the economic importance of the reefs would be overstated if the multiplier effects were considered. To provide a conservative estimate of the economic contribution of resident use of the reef system, the multiplier effects were not included.

**Statistical Analysis.** The user values of the natural and artificial reefs were estimated using the survey responses and statistical models. Three user values were defined as follows.

*Natural Reefs* - The user value of natural reefs was defined in this study as the maximum amount of additional money a person would be willing to give up per trip to southeast Florida to use the natural reefs. This amount is over and above the respondent's expenditures the last time he/she used the natural reefs in southeast Florida. This money would be used to ensure that southeast Florida's natural reef system was maintained in its existing condition.

*Existing Artificial Reefs* - The user value of existing artificial reefs was defined in this study as the maximum amount of money a person would be willing to give up per trip to southeast Florida to use the artificial reefs. This amount is over and above the respondent's expenditures the last time he/she used the artificial reefs in southeast Florida. This money would be used to ensure that southeast Florida's artificial reef system was maintained in its existing condition.

*New Artificial Reefs with Maintenance* - The user value of new artificial reefs was defined in this study as the maximum amount of additional money a person would be willing to give up per year to fund a construction and maintenance program for new artificial reefs. Artificial reefs would be constructed and maintained using this fund.

Separate statistical evaluations were used to estimate resident values and visitor values. Within the resident or visitor category the responses to the contingent valuation questions were pooled over all four counties. This is because the respondent was asked to consider all reef-related trips within southeast Florida over the past 12 months, not just those within the county of interview.

The estimated user values per trip were converted to user value per person-day and multiplied by the number of person-days associated with artificial and natural reefs.

### **1.3 Report Organization**

This report begins with an Executive Summary and this Introduction, which is Chapter 1. Chapter 2 summarizes the economic contribution and use values of all four counties. Chapters 3, 4, 5 and 6 summarize the reef-related economic contribution and use value within Palm Beach, Broward, Miami-Dade and Monroe counties, respectively. Within each of these chapters, the values associated with both residents and visitors are provided. The appendices provide the survey instruments and the list of visitor intercept site locations. Details regarding evaluation of the survey data are provided in the Technical Appendix to this report.