

# Socioeconomic Study of Reefs in Southeast Florida



Final Report  
October 19, 2001 for

Broward County

Palm Beach County

Miami-Dade County

Monroe County

Florida Fish and Wildlife  
Conservation Commission

National Oceanic and  
Atmospheric Administration

Principal Investigators:

Grace M. Johns, Ph.D., Project Manager

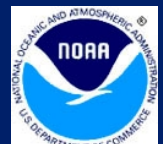
Vernon R. Leeworthy, Ph.D.

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**HAZEN AND SAWYER**  
Environmental Engineers & Scientists

In association with



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October 19, 2001

Ms. Pamela Fletcher  
Natural Resource Specialist II  
**BROWARD COUNTY DEPARTMENT OF PLANNING AND  
ENVIRONMENTAL PROTECTION**  
218 Southwest 1<sup>st</sup> Avenue  
Fort Lauderdale, Florida 33301

Socioeconomic Study of Reefs in  
Southeast Florida - Final Report

Dear Ms. Fletcher:

We are pleased to submit ten bound and one unbound copies of the final report for the Socioeconomic Study of Reefs in Southeast Florida. This report is the product of a significant survey research effort and analysis of the uses and values of the artificial and natural reefs in southeast Florida. This project's success was directly attributable to the assistance and support of many individuals involved in this 20-month long effort.

The study provides estimates of the following values that represent the time period June 2000 to May 2001:

- Total reef use of residents and visitors in each of the four counties as measured in terms of person-days.
- Economic contribution of the natural and artificial 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 and 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, and employment generated within each county from residents and visitors who use the reefs. 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.

We thank you, Pamela Fletcher, for your consistent support and guidance during this project. We know you spent significant effort in making sure this project was a success. We have enjoyed working with the funding agencies and you and your staff at Broward County.

Very truly yours,

**HAZEN AND SAWYER, P.C.**



Grace M. Johns, Ph.D.  
Senior Associate  
Economist and Project Manager

*Enclosures*  
c: File 40289

# Acknowledgements

## Socioeconomic Study of Reefs in Southeast Florida, 2000-2001

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This project's success was directly attributable to the assistance and support of all those individuals involved in this 20-month long effort.

Funding for this project was provided by the four counties; the Florida Fish and Wildlife Conservation Commission; and the National Oceanic and Atmospheric Administration. The representatives of these agencies were key to the success of this project. They solicited the funding for this project and assisted in obtaining site permissions for the visitor intercept surveys. They are Jon Dodrill, Florida Fish and Wildlife Conservation Commission; Vernon (Bob) Leeworthy, Ph.D., NOAA; Julie Bishop, Palm Beach County; Pamela Fletcher and Ken Banks, Broward County; Brian Flynn, Miami-Dade County; and George Garrett and Julie Malko, Monroe County. Danah Kozma and Linda MacMinn of the Monroe County Tourist Development Council obtained the site permissions to conduct the visitor intercept interviews in the Florida Keys.

The principal investigators and their responsibilities included Grace Johns, Ph.D. of Hazen and Sawyer who served as project manager; Professors Fred Bell and Mark Bonn of Florida State University who were responsible for the resident surveys and resident data analysis; Vernon (Bob) Leeworthy, Ph.D. of NOAA who designed the draft surveys, conducted the statistical analysis of reef user values and assisted with report writing; and J. Walter Milon, Ph.D. who reviewed and edited the draft surveys and provided valuable guidance.

We wish to thank our survey researchers who worked with energy and in earnest, often in the hot sun, to conduct the visitor intercept interviews in southeast Florida. Without these organizations and individuals, the study of visitor reef users to southeast Florida would not have been possible. The survey researchers included members of the Bicentennial Volunteers – E.P. and Rosa Kirk; Jay and Linda Parsons; John and Martha Autry; Jon and Kathy Sweet; Bennie and Becky Miller; Robert and Betty Shirley; Peter and Betty Germann; George and Maxine Haynes; J.W. & Bobbie Thomasson; Wendell and Margaret Thomasson; and Glenn and Delores Tankersley. We also thank Rife Market Research and their survey researchers who provided valuable survey research assistance at short notice during the summer survey.

Dave Sayers of Hazen and Sawyer assisted in managing the survey researchers, the completed surveys, and the data entry for the visitor surveys. Carole Blood of Hazen and Sawyer produced the thousands of mailings to site owners and charter boat operators, with assistance from Danielle Monziona, and formatted this report. William Taylor, Chris Julien and Jeff Jones of Hazen and Sawyer produced the thousands of visuals and documents for this study. Hazen and Sawyer's data entry staff diligently entered the responses to over 6,000 visitor surveys: Abe Kuruvilla; Andrea Stonom; Jabrina Howard; and Jesse Van Eyk.

With respect to the resident survey, Patricia Fountain of Florida State University supervised the telephone and mail survey data collection. She spent countless hours training and supervising numerous employees needed for this task. Monique Jenkins and Jamie White also deserve



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Of special note, Pamela Fletcher of Broward County provided consistent support and guidance during this project. She spent significant effort in making sure this project was a success.

# Socioeconomic Study of Reefs in Southeast Florida

## Final Report

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# Executive Summary

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Investment in and maintenance of public resources is a prime function of government. Artificial and natural reefs are public resources that provide recreational benefits to reef users and income to local economies. This study determined, in a comprehensive manner, the net economic value of southeast Florida's natural and artificial reef resources to the local economies and the reef users. Southeast Florida is defined as the counties of Palm Beach, Broward, Miami-Dade and Monroe. This study area includes, from north to south, the cities of West Palm Beach, Fort Lauderdale, and Miami, and 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. This study estimated the following values:

- Use of artificial and natural reefs by 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 investment in and maintenance of 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 resident reef-using boat owners 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 through the Socioeconomic Monitoring Program for the Florida Keys National Marine Sanctuary.

**Study Methods.** This study conducted four surveys as follows:

- Resident boaters – mail survey conducted in the Fall of 2000
- General visitors – intercept survey conducted in the Summer of 2000 and the Winter of 2001
- Visitor boaters – intercept survey conducted in the Summer of 2000 and the Winter of 2001
- Charter / Party boats – mail survey conducted in the Spring of 2001

Visitors are defined as nonresidents of the county that they are visiting. Residents are those who live within the county.

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

- Percentage of all boaters who fish, dive and / or snorkel on the reefs;
- Itemized expenditures in the county related to using the reefs (lodging, food, gas, equipment, etc.);
- Number of person-trips and person-days of reef use by type of reef and activity;
- Willingness of reef users to pay to protect southeast Florida’s natural and artificial reefs in their existing condition;
- Willingness of reef users to pay for additional artificial reefs in southeast Florida; and,
- Socioeconomic characteristics of reef users.

In addition, at the request of the counties, the resident survey also included questions regarding “no-take” zones in southeast Florida and 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. This information was necessary to estimate reef use.

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. The results of this survey were used to allocate charter/party boat fishing days between artificial and natural reefs.

The results of this study are based on the responses to these surveys. The resident mail survey resulted in 2,543 completed surveys. The general visitor intercept survey resulted in 3,855 completed surveys. The visitor boater intercept survey resulted in 2,473 completed surveys. These completed surveys provided sufficient information to estimate the economic value of the reefs to reef users and the economies of each of the southeast Florida counties.

**Definitions.** Certain terminology is used in this report to represent units of recreational activity. These terms are person-trip and person-day. 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 to participate in saltwater recreation activities. A person-day is defined as one person participating in an activity for a portion or all of a day.

**Number of Days People Participated in Recreational Use of the Reefs.** The number of person-days of reef use by county and by reef type is presented in Table ES-1. Visitors and residents spent 28 million person-days using artificial and natural reefs in southeast Florida during the 12-month period from June 2000 to May 2001. Reef users spent 10 million person-days using artificial reefs and 18 million person-days using natural reefs. The breakdown of reef use by residents and visitors is provided in Table ES-2. Overall, residents and visitors each spent about 14 million person-days using the reefs of southeast Florida but the proportions vary by county.

A summary of reef use by type of activity is provided in Table ES-3. Overall, fishing activity on the reefs appears to dominate when snorkeling and scuba diving are compared separately. When snorkeling and scuba diving are considered together as diving activities, diving and fishing contribute about equally to total reef use in southeast Florida. In Palm Beach County, diving is a bit more prevalent than fishing while in Miami-Dade County, fishing is more prevalent than diving. In Broward and Monroe counties, the levels of diving and fishing are about equal.

**Table ES-1  
Number of Person-Days Spent on Artificial and Natural Reefs in  
Southeast Florida  
Residents and Visitors by County  
June 2000 to May 2001**

County	Number of Person-Days (in millions)		
	Artificial Reefs	Natural Reefs	All Reefs
Palm Beach	1.41	2.83	4.24
Broward	3.98	5.46	9.44
Miami-Dade	2.95	6.22	9.17
Monroe	1.47	3.64	5.11
Total	9.81	18.15	27.96

**Table ES-2**  
**Number of Person-Days Spent on All Reefs**  
**Comparison of Visitor Versus Resident Use in Southeast Florida**  
**June 2000 to May 2001**

County	Number of Person-Days (in millions)		
	Residents	Visitors	All Users
Palm Beach	2.98	1.26	4.24
Broward	3.72	5.72	9.44
Miami-Dade	4.51	4.66	9.17
Monroe	3.03	2.08	5.11
Total	14.24	13.72	27.96

**Table ES-3**  
**Number of Person-Days on All Reefs by Recreational Activity**  
**June 2000 to May 2001 – Residents and Visitors (in millions)**

Activity	Palm Beach County	Broward County	Miami-Dade County	Monroe County	Total – Southeast Florida
Snorkeling	0.74	1.09	2.11	1.75	5.69
Scuba Diving	1.73	3.85	1.14	0.83	7.55
Fishing	1.76	4.45	5.90	2.45	14.56
Glass Bottom Boats	0	0.05	0.02	0.08	0.15
Total	4.23	9.44	9.17	5.11	27.95

*a Residents were not asked about their participation in glass bottom boat sightseeing. Therefore, glass bottom boats include only visitors.*

*Note: Difference in Total – Southeast Florida between Tables ES-2 and ES-3 is due to rounding (27.96 versus 27.95).*

Glass bottom boat sightseeing is available in Broward, Miami-Dade and Monroe counties. The reported number of person-days associated with viewing the reefs using glass bottom boats applies to visitors, not residents. Resident boaters were not asked for their level of activity on glass bottom boats. Visitors spent about 150,000 person days on glass bottom boats in southeast Florida.

**Contribution of Reef-Related Spending to the County Economies.** The total economic contribution of the reefs to each county is the contribution of reef-related expenditures to county sales, income and employment. As residents and visitors spend money in the county to participate in reef-related recreation, income and jobs are created within the county as a result. Economic contribution includes the direct, indirect and induced effects of visitor spending and the direct effects of resident spending.

The economic contributions of the reefs to each of the counties are provided in Table ES-4. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. Income is the amount of money that remains in the economy. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

**Table ES-4**  
**Economic Contribution of Reef-Related Expenditures to Each County<sup>1</sup>**  
**June 2000 to May 2001 – Residents and Visitors**

Type of Economic Contribution	Palm Beach County	Broward County	Miami-Dade County	Monroe County
Sales – All Reefs (in millions of 2000 dollars)	\$505	\$2,069	\$1,297	\$490
Artificial Reefs	\$148	\$961	\$419	\$127
Natural Reefs	\$357	\$1,108	\$878	\$363
Income – All Reefs (in millions of 2000 dollars)	\$194	\$1,049	\$614	\$139
Artificial Reefs	\$52	\$502	\$195	\$33
Natural Reefs	\$142	\$547	\$419	\$106
Employment – All Reefs (number of full- and part-time jobs)	6,300	36,000	19,000	10,000
Artificial Reefs	1,800	17,000	6,000	2,000
Natural Reefs	4,500	19,000	13,000	8,000

Reef-related expenditures generated \$505 million in sales in Palm Beach County, \$2.1 billion in sales in Broward County, \$1.3 billion in sales in Miami-Dade County and \$490 million in sales in Monroe County during the 12-month period from June 2000 to May 2001. These sales resulted in \$194 million in income to Palm Beach County residents, \$1.1 billion in income to Broward County residents, \$614 million in income to Miami-Dade County residents and \$139 million in income to Monroe County residents during the same time period. Reef-related

<sup>1</sup> *The economic contributions cannot be summed over the four counties to get the total economic contribution of the reefs to southeast Florida. This is because the concept of economic contribution looks at the economy of the individual geographic area as a separate entity from its neighbors. In this study, visitors were asked how much they spent in the county they were visiting. They were not asked how much they spent in the other three counties. Also, visitors to a county can come from one of the other three southeast Florida counties. When looking at southeast Florida as a whole, only the indirect and induced contribution of visitors from outside the four counties can be considered as 100 percent reef-related. To get the economic contribution of the reefs to all of southeast Florida, the southeast Florida expenditures of visitor reef users to southeast Florida would have to be estimated wherein a visitor lives outside the four county area.*

expenditures provided 6,300 jobs in Palm Beach County, 36,000 jobs in Broward County, 19,000 jobs in Miami-Dade County and 10,000 jobs in Monroe County.

In Palm Beach and Miami-Dade counties, artificial reef-related expenditures comprised about a third and natural reef-related expenditures comprised about two-thirds of the economic contribution associated with the reef system. In Broward County, artificial and natural reef-related expenditures contributed equally to the economic contribution of the reef system. In Monroe County, artificial reef-related expenditures comprised about 25 percent of the economic contribution associated with the reef system.

**Value that Reef Users Place on the Reefs.** In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to artificial and natural reef users of maintaining both the artificial and natural reefs in their existing condition; and (4) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value was measured in terms of per party per trip for existing natural and artificial reefs and per party per year for new artificial reefs. For presentation, values were normalized to values per person-day of reef-related activity so that the use values can be compared to use values estimated in other studies. Use value is also presented in aggregate for all users of the reef system.

The reef user values associated with maintaining the reefs in their existing conditions for each county are provided in Table ES-5. Use value per person-day means the value per person-day of artificial, natural or all reef use, as specified in the table. Values for all reefs were taken from statistical analysis of responses to Question 38 of the Visitor Boater Survey: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs?” The dollar values provided to the respondents were rotated from respondent to respondent and were \$20, \$100, \$200, \$400, \$1,000 and \$2,000. The responses were then statistically analyzed to calculate average values. Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition. For the individual reef types (artificial or natural), the dollar values provided to the respondents were rotated and were \$10, \$50, \$100, \$200, \$500, and \$1,000.

**Table ES-5**  
**Annual Use Value From June 2000 to May 2001 and Capitalized Value associated With Reef Use**  
**Southeast Florida – Residents and Visitors**

<b>Item</b>	<b>Palm Beach County</b>	<b>Broward County</b>	<b>Miami-Dade County</b>	<b>Monroe County</b>	<b>Total<sup>a</sup></b>
<b>All Reefs - Artificial and Natural</b>					
Person-Days of Reef Use (in millions)	4.24	9.44	9.17	5.11	<b>27.96</b>
Use Value Per Person-Day	\$7.34	\$13.35	\$5.12	\$9.87	<b>\$9.10</b>
Annual Use Value in million dollars	\$31.30	\$126.02	\$46.95	\$50.44	<b>\$254.51</b>
Capitalized Value @ 3 percent Discount Rate in billion dollars	\$1.0	\$4.2	\$1.6	\$1.7	<b>\$8.5</b>
<b>Artificial Reefs</b>					
Person-Days of Reef Use (in millions)	1.41	3.97	2.95	1.47	<b>9.80</b>
Use Value Per Person-Day	\$6.47	\$14.07	\$3.50	\$6.36	<b>\$8.63</b>
Annual Use Value in million dollars	\$9.09	\$55.86	\$10.33	\$9.35	<b>\$84.63</b>
Capitalized Value @ 3 percent Discount Rate in billion dollars	\$0.3	\$1.9	\$0.3	\$0.3	<b>\$2.8</b>
<b>Natural Reefs</b>					
Person-Days of Reef Use (in millions)	2.83	5.47	6.22	3.64	<b>18.15</b>
Use Value Per Person-Day	\$14.86	\$15.16	\$7.54	\$16.34	<b>\$12.74</b>
Annual Use Value in million dollars	\$42.12	\$83.60	\$46.71	\$55.22	<b>\$227.65</b>
Capitalized Value @ 3 percent Discount Rate in billion dollars	\$1.4	\$2.8	\$1.6	\$1.8	<b>\$7.6</b>

<sup>a</sup> Use Value per Person per Day is the average among the counties.

Note: Use value per person day means per person day of artificial, natural or all reef use. Values for all reefs taken from statistical analysis of responses to Question 38 of Visitor Boater Survey: Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If you total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs. Values for artificial reefs taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition. Therefore, the sum of the values for the individual reef programs may be different from the value for both programs. These results were estimated using the logit model. Alternate methods of estimation are provided in the Technical Appendix to this report.



Visitor and resident reef users in Palm Beach County are willing to pay \$31 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$9 million to protect the artificial reefs and \$42 million to protect the natural reefs.

Visitor and resident reef users in Broward County are willing to pay \$126 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$56 million to protect the artificial reefs and \$84 million to protect the natural reefs.

Visitor and resident reef users in Miami-Dade County are willing to pay \$47 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$10 million to protect the artificial reefs and \$47 million to protect the natural reefs.

Visitor and resident reef users in Monroe County are willing to pay \$50 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$9 million to protect the artificial reefs and \$55 million to protect the natural reefs.

Visitor and resident reef users in all four counties are willing to pay \$255 million per year to maintain both the artificial reefs and the natural reefs in southeast Florida in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users in all four counties are willing to pay \$85 million per year to protect the artificial reefs and \$228 million per year to protect the natural reefs in southeast Florida.

The sum of the values for the individual reef programs can be different from the value for the combined programs. This result is not inconsistent with the literature on embedded values. Randall and Hoehn (1992) have shown that this type of result is consistent with economic theory. The combined programs have exceeded the income constraints of many respondents and/or many respondents had value for only one of the programs. So we conclude that our estimated values for the natural and artificial reefs valued separately and together are valid estimates. Bear in mind that willingness to pay for the combined programs is a different scenario from willingness to pay for the individual programs.

The capitalized value of the reef user values is equal to the present value of the annual values calculated at three percent discount rate. It represents the “stock” value analogous to land market values. The capitalized reef user value for all southeast Florida reefs is \$8.5 billion. Bear in mind that this value only includes the value that reef users place on the reefs and does not include the values that non-reef-users place on the reefs or the economic contribution of the reefs. The estimation of the value of the reefs to non-reef users was not part of this study.

Visitor and resident reef users’ willingness to pay to invest in and maintain “new” artificial reefs is provided in Table ES-6. The use value per person-day is the value per day or a portion of a day of artificial reef use. In Palm Beach County, reef users are willing to pay \$4.8 million annually for this program in Palm Beach County. Broward County reef users are willing to pay \$16 million per year while Miami-Dade County reef users are willing to pay \$4.1 million per year. Monroe County reef users are willing to pay \$2.1 million annually per year to fund this program in Monroe County. These values are those that are appropriate to use in a benefit-cost analysis of providing new artificial reefs.

**Table ES-6**  
**Estimated Use Value of Investing in and Maintaining "New" Artificial Reefs**  
**Southeast Florida – Residents and Visitors**

Item	Palm Beach County	Broward County	Miami-Dade County	Monroe County	Total <sup>a</sup>
Person-Days of Artificial Reef Use (in millions)	1.40	3.97	2.95	1.47	9.80
Use Value Per Person-Day for "New" Artificial Reefs	\$3.37	\$3.95	\$1.38	\$1.46	\$2.72
Annual Use Values for "New" Artificial Reefs in million dollars	\$4.78	\$15.70	\$4.07	\$2.14	\$26.69
Capitalized Value @ 3 percent Discount Rate in million dollars	\$158.0	\$523.5	\$135.4	\$71.5	\$888.4

<sup>a</sup> Use Value per Person per Day is the average among the counties.

Note: Use value per person-day is a day or portion of a day of artificial reef use.

**Resident Opinions of “No Take” Zones.** Both the economic contribution and the use value of the reef system are based upon its management or lack thereof. In each of the four counties, resident reef-users were asked questions regarding “no take” zones. A “no take” zone is a designated area of the reef system in which nothing is to be taken from this area including fish and shellfish.

Because the reefs play a vital role in the entire oceanic ecosystem by providing habitat and protection for young fish and other creatures, it is argued that “no-take” zones would actually increase recreational, commercial, and natural resource benefits even though takings would be banned in certain areas. No one knows exactly where and to what degree “no-take” zones must be employed to increase net benefits. As a result, “no-take” zones have become a controversial issue. Therefore, as part of this study, resident respondents were asked their opinions regarding the establishment of “no-take” zones as a management tool for artificial and natural reefs in southeast Florida.

These opinions are summarized in Table ES-7. It is apparent from this table that a majority of resident reef-users endorse the idea of “no-take” zones in their county and in the other southeast Florida counties. A majority of residents would support “no take” zones on 20 to 25 percent of the existing natural reefs. About 75 percent of respondents in all counties supported the existing “no take” zones in the Florida Keys. About 60 percent of respondents supported “no take” zones in their own counties and about the same percentage supported “no take” zones on some of the reefs in Palm Beach, Broward and Miami-Dade counties. Such a result provides public officials with information important to the management of the reef system from Palm Beach County to Monroe County.

**Table ES-7**  
**A Summary of the Opinion of Resident Reef-Users on**  
**"No Take" Zones in Southeast Florida, 2000**

<b>Question: "Support Existing "No Take" Zones in the Florida Keys"</b>			
<b>County</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>
Palm Beach	76%	15%	9%
Broward	75%	18%	7%
Miami-Dade	74%	19%	7%
Monroe	78%	18%	4%
<b>Question: "Support "No Take" Zones on Some Reefs in Your County"</b>			
<b>County</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>
Palm Beach	65%	23%	12%
Broward	63%	27%	10%
Miami-Dade	61%	28%	11%
Monroe <sup>1</sup>	57%	21%	22%
<b>Question: "Support "No Take" Zones on Some Reefs off Palm Beach, Miami-Dade and Broward Counties"</b>			
<b>County</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>
Palm Beach	65%	21%	14%
Broward	64%	24%	12%
Miami-Dade	61%	28%	11%
Monroe	44%	39%	17%
<b>Question: "What Percentage of Coral or Natural Reefs in Your County Would Be Reasonable to Protect Using "No Take" Zones?"</b>			
<b>County</b>	<b>Average Percentage</b>	<b>Median Percentage</b>	
Palm Beach	30%	20%	
Broward	35%	25%	
Miami-Dade	30%	20%	
Monroe	32%	20%	

<sup>1</sup> Since Monroe County already has "no take" zones, the word "additional" was inserted into this question for Monroe County surveys.

**Demographic Characteristics of Reef Users.** Demographic characteristics were obtained from the resident boater survey and the visitor boater survey. They are summarized in Tables ES-8 and ES-9. The typical reef user is a non-Hispanic white male, in his forties, with an annual household income from \$55,000 to \$90,000. However, the demographic picture provided in Table ES-8 also shows that females, non-whites and Hispanic persons also use the reefs. Visitor reef-users tend to be younger than resident reef users. Also, larger proportions of visitors than residents are women and/or non-white.

**Table ES-8**  
**Demographic Characteristics of Resident and Visitor Reef-Users in Southeast Florida, 2000**

<b>Median Age of Respondent</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
Palm Beach	48			41		
Broward	48			39		
Miami-Dade	46			41		
Monroe	54			44		
<b>Sex Of Respondent</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
	<b>Male</b>	<b>Female</b>		<b>Male</b>	<b>Female</b>	
Palm Beach	91%	9%		79%	21%	
Broward	92%	8%		77%	23%	
Miami-Dade	93%	7%		75%	25%	
Monroe	86%	14%		70%	30%	
<b>Race Of Respondent</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
Palm Beach	97%	0%	3%	94%	2%	4%
Broward	93%	2%	5%	89%	7%	4%
Miami-Dade	88%	1%	11%	83%	7%	10%
Monroe	94%	0.2%	5.8%	95%	2%	3%
<b>Percent Hispanic/Latino</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
Palm Beach	4%			5%		
Broward	5%			13%		
Miami-Dade	33%			29%		
Monroe	7%			8%		
<b>Median Household Income</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
Palm Beach	\$71,695			\$87,500		
Broward	\$72,310			\$87,500		
Miami-Dade	\$69,722			\$55,000		
Monroe	\$56,393			\$87,500		

From Table ES-9, it is clear that residents have been boating in southeast Florida for a significantly longer period of time than visitors – about 22 years versus 7 years. Overall, visitor and resident boat owners have similar sized boats and both resident and visitor reef users have about the same probability of belonging to a fishing or diving club.

**Table ES-9  
Boater Profile of Resident and Visitor Reef-Users in Southeast Florida, 2000**

<b>Average Years Boating in South Florida</b>		
<b>County</b>	<b>Residents</b>	<b>Visitors</b>
Palm Beach	21	9
Broward	22	7
Miami-Dade	25	7
Monroe	22	7

<b>Average Length of Boat Used for Salt Water Activities in Feet</b>		
<b>County</b>	<b>Residents</b>	<b>Visitors</b>
Palm Beach	25	25
Broward	25	27
Miami-Dade	23	26
Monroe	24	22

<b>Percentage of Respondents Who Belong to Fishing and/or Diving Clubs</b>		
<b>County</b>	<b>Residents</b>	<b>Visitors</b>
Palm Beach	20%	24%
Broward	19%	12%
Miami-Dade	18%	6%
Monroe	15%	11%

# 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%
Total	100%	100%	100%	100%	100%
Percent of Completed Surveys Received of All Mailed					
Percent of Completed Surveys Received of All Surveys not Returned Undeliverable	21.8%	24.4%	19.5%	22.0%	20.8%

**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.



## Chapter 2: Socioeconomic Values of Reefs in Southeast Florida

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The artificial and natural reefs of southeast Florida provide benefits to those who use the reefs and to those who depend on the local economies. Investment in and maintenance of public resources, such as the reef system, is a prime function of government. Policy makers need to know the extent of reef use by the public and the importance of reefs to the public in order to prioritize investments that protect the reefs and provide for new artificial reefs.

The reef users evaluated in this study are the visitors and residents who fish off the reefs using a boat; who scuba dive and/or snorkel on the reefs using a boat; and/or who view the reefs from glass-bottom boats. The southeastern part of Florida is the focus of this study and includes Palm Beach, Broward and Miami-Dade counties which border the Atlantic Ocean and Monroe County which borders both the Atlantic Ocean and the Gulf of Mexico. Monroe County includes the Florida Keys.

This chapter summarizes the results of a detailed analysis of the socioeconomic value of reefs in southeast Florida to residents and visitors. Chapters 3 through 6 discuss the results for each of the four counties mentioned above. Each chapter includes the following information.

- 1) Boater activity on the reef system by residents and visitors;
- 2) Economic contribution of artificial and natural reefs to the county's economy;
- 3) Resident and visitor use value from recreating on artificial and natural reefs;
- 4) Demographic and boater profile of reef users; and
- 5) For residents, their opinions regarding "no-take" zones as a tool to maximize the public value of the reef system.

The goal of this research is to aid public policy makers in their efforts to deploy additional artificial reefs, to care for the existing natural and artificial reef systems and to formulate management strategies which will be in the best interest of the residents and visitors to each county.

Economic contribution of the reefs refers to the sales, income, and employment generated in each county as a result of visitors and residents spending money in the county to use the reefs. The income and employment represents money and employment that stays within the county as a result of reef use.

Although the economic contribution of the reef system is important, it does not measure the recreational value derived by reef users. The reef is called a "common property" resource because it is not owned by one individual, but by society in general. There is no one selling tickets to admit fishers to a reef. However, a recreational experience on a reef yields "value"

expressed in dollar terms to fishers and divers. This value, however, is not measured by ordinary market forces. In this case, economists are able to simulate the market value of these resources using various methodologies. There is a “use value” associated with reef systems that should be measured, if possible. The reason for such a measurement is to provide information to the government on the benefits of the reefs to reef users. This value can be compared to the investments that are made to create artificial reefs and/or to maintain artificial and natural reefs. An earlier study by Bell, et al (2000) focused on the benefits and costs of artificial reef systems in Northwest Florida.

There is also a value of reefs to non-reef users that is in addition to the values enjoyed by reef users. *Therefore, the total value of natural reefs is the sum of the values to reef users and non-reef users. The estimation of the value of the reefs to non-reef users was not part of this study.*

### 2.1 Residents

The focus of this section is the socioeconomic values of the reefs in Southeast Florida to resident boaters. Resident boaters are those individuals who live within one of the four counties in the study area, who used a boat that is owned by a resident of that county, and who used the boat for saltwater recreational activities offshore of that county during the study period. For this study, the population of resident boaters was treated separately from visitors. For example, resident boaters of Palm Beach County are those individuals who used a boat owned by a resident of Palm Beach County to participate in saltwater recreational activities off shore of Palm Beach County during the study period. A resident of Palm Beach County who uses a Palm Beach County registered boat to visit the reefs off Broward County is considered a visitor to Broward County for the purposes of this study. Resident boats are defined as those greater than or equal to 16 feet in length and registered with the Florida Department of Highway Safety and Motor Vehicles.

#### 2.1.1 User Activity - Residents

There are two fundamental measures of natural resource user activity such as scuba diving the reef systems off southeast Florida. First, user activity can be measured by the number of boating days. This is usually called “party-days” since each boat carries one or more individuals depending, for the most part, on the size of the boat. Party-days gives us a “boating measure” of activity. This measure is important for several purposes. For instance, this measure can be used to estimate boat ramp use for planning purposes. In addition, this measure can be used to estimate the number of boats that are expected to arrive at artificial and/or natural reefs in a given day.

Finally, the term “party-days” is used in economic analysis because the party is the principal spending unit. When we multiply the number of party-days by the number in the party, we obtain “person-days”. This second measure of boating activity is important since it tells us how many people will be fishing and/or diving on a particular reef during a day. In the case of fishing, a person-day is the principal measure of fishing effort or pressure on a renewable resource (e.g., fishery biomass).

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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Person-days is of particular significance when estimating the “user value” of recreating while using a reef. The principal unit of both consumption and production of an activity involving the reefs is a “person-day”. If it were determined that recreational fishers valued a day of fishing at a reef at \$10 per person per day, then a party of four (i.e., the party-day) would receive \$40 in “use value” (four person days multiplied by the value per person per day from recreational fishing). Thus, while the party-day is boat oriented in terms of accommodating a boatload of fishers, a person-day measures both fishing effort on a resource and the unit of output of the resource available to the user. Thus, the first order of business in this project was to estimate the number of party-days and person-days by residents involved in reef-related activities off the southeastern coast of Florida.

Table 2.1.1-1 presents resident boater user activity on artificial and natural reefs for Palm Beach, Broward, Miami-Dade and Monroe counties as measured in party-days and person-days. These activity measures were estimated in a two-step procedure. First, a mail survey was sent to a sample of registered boat owners in the four counties in the study area during the Fall of 2000. A total of 12,500 surveys were mailed out to registered boat owners in the study area who owned boats at least 16 feet long. The boat size distinction was made because reef visitations are heavily concentrated among larger boats and we wished to target the segment of the boater population that are heavy reef users. This allowed us to obtain a larger sample of our targeted group with greater statistical reliability. Florida State University received 2,543 completed surveys from resident boaters. Of the surveys received, 65.2 percent of respondents reported using artificial and/or natural reefs in the last 12 months. Eliminating those not using reefs, we obtained 1,658 surveys from resident boaters who indicated they do use the reefs.

The distribution of resident reef users who responded to the survey is provided in the table below.

**Boat Length Distributions of Resident Reef Users Who Responded to the 2000 Survey  
(Percent)**

Boat Length Category	Palm Beach	Broward	Miami-Dade	Monroe	Total
16' to 25' 11"	66	65	79	73	71
26' to 39' 11"	29	30	18	23	25
40' to 64' 11"	5	5	3	4	4
65' to 109' 11"	0	0	0	0	0
110' and Greater	0	0	0	0	0
	100	100	100	100	100

The number of registered boats in the county at least 16 feet long, that are owned by a county resident, and that carried parties to the reef in the last 12 months was estimated using the inventory of boat registrations furnished by the Florida Department of Highway Safety and Motor Vehicles (2000). From this inventory, boats less than 16 feet and owners who live outside

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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of the county were excluded. The remaining number of boats in each county was multiplied by the proportion of survey respondents who said they used their boats on the county's reefs in the last 12 months. The resulting target population of boats carrying parties that used the reefs at least once in the past 12 months is provided below.

**Target Population of Resident Boats by County in Southeast Florida**

<b>County</b>	<b>Total Registered Boats in County</b>	<b>Target Population - Number of Boats Carrying Parties that Used the Reefs</b>
Palm Beach	56,924	19,465
Broward	61,124	23,855
Miami-Dade	67,936	30,695
Monroe	26,564	12,996

The sample data obtained from the survey was then used in combination with the target population of boats to estimate the total number of party-days spent using artificial and natural reefs off the coast of each county. The results are provided in Table 2.1.1-1. Reef-using respondents were asked to estimate their total days spent on or about the reefs over the last 12 months. For example, we estimated that resident boaters of Palm Beach County spent a total of 779,000 party-days on reefs over the last 12 months. Total party-days was estimated as follows. Respondents told us they spent, on average, 40 days over the 12-month period using their boat to visit the reef system. Thus, we multiplied the 40 days by the target population of boaters for Palm Beach County (i.e., 19,465 times 40 days). All other estimates of party-days for each county in Table 2.1.1-1 were derived in the same manner.

Miami-Dade County had the most party-days while Palm Beach County had the least party-days among the four counties evaluated. This was primarily due to the fact that Miami-Dade County has the largest number of boats in the target population. Among all counties, resident boaters took over 3.7 million party-days to visit the reef system.

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.1.1-1 (Residents)  
A Summary of Resident Boater User Activity on  
Artificial and Natural Reefs in Southeast Florida, 2000**

<b>Total "Party-Days" on All Reefs</b>		
<b>County</b>	<b>Total Party-Days</b>	<b>Percentage for Each County</b>
Palm Beach	779,000	21%
Broward	930,000	25%
Miami-Dade	1,105,000	30%
Monroe	910,000	24%
<b>Total All Counties</b>	<b>3,724,000</b>	<b>100%</b>
<b>Total "Party-Days" on Artificial Reefs</b>		
<b>County</b>	<b>Total Party-Days</b>	<b>Percent Spent on Artificial Reefs in County</b>
Palm Beach	281,000	36%
Broward	319,000	34%
Miami-Dade	376,000	34%
Monroe	309,000	34%
<b>Total All Counties</b>	<b>1,285,000</b>	<b>35%</b>
<b>Total "Party-Days" on Natural Reefs</b>		
<b>County</b>	<b>Total Party-Days</b>	<b>Percent Spent on Natural Reefs in County</b>
Palm Beach	497,000	64%
Broward	612,000	66%
Miami-Dade	729,000	66%
Monroe	600,000	66%
<b>Total All Counties</b>	<b>2,438,000</b>	<b>65%</b>
<b>Total Person-Days on All Reefs</b>		
<b>County</b>	<b>Total Person-Days</b>	<b>Percentage for Each County</b>
Palm Beach	2,978,000	21%
Broward	3,718,000	26%
Miami-Dade	4,506,000	32%
Monroe	3,034,000	21%
<b>Total All Counties</b>	<b>14,236,000</b>	<b>100%</b>
<b>Total "Person-Days" on Artificial Reefs</b>		
<b>County</b>	<b>Total Person-Days</b>	<b>Percent Spent on Artificial Reefs in County</b>
Palm Beach	1,075,000	0.36
Broward	1,281,000	0.34
Miami-Dade	1,540,000	0.34
Monroe	990,000	0.33
<b>Total All Counties</b>	<b>4,886,000</b>	<b>0.34</b>
<b>Total Person-Days on Natural Reefs</b>		
<b>County</b>	<b>Total Person-Days</b>	<b>Percent Spent on Natural Reefs in County</b>
Palm Beach	1,903,000	0.64
Broward	2,437,000	0.66
Miami-Dade	2,965,000	0.66
Monroe	2,044,000	0.67
<b>Total All Counties</b>	<b>9,349,000</b>	<b>0.66</b>

*Note: A party-day is a one day visit by a party of people. A person-day is a one day visit by one individual.*

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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Respondents were asked to distribute their reef activities by the type of reef used. Without much variation among counties, resident reef-users spent two-thirds of their party-days on natural as opposed to artificial reefs. Boater preference for natural reefs is hardly surprising, but it does show that artificial reefs are apparently substitutes for natural reefs. This is of interest to the artificial reef program managed by state and local officials.

The second half of Table 2.1.1-1 summarizes the estimated number of person-days for residents by county and reef type. For this estimate, we purposely netted out any nonresidents since they are, in fact, tourists. This is a significant factor in the Florida Keys which attracts more friends and relatives from outside Monroe County than any other county in the study area. Using the results of the survey, the average resident party size was estimated to be 3.8 individuals. The total number of person-days per county is equal to the resident party size times the number of party-days per county. For all four counties, the number of person-days was estimated at 14.2 million. As expected, about two-thirds of these person-days were spent on natural as opposed to artificial reefs.

Respondents were then asked to breakdown their time on reefs by recreational activity. These activities were (1) fishing, (2) snorkeling and (3) scuba diving. Table 2.1.1-2 summarizes the breakdown of party-days by activity for all the counties. Alternatively, Table 2.1.1-3 shows the number of party-days and person-days broken down by this classification for each county separately.

**Table 2.1.1-2 (Residents)  
Party-Days by Activity for All Counties**

<b>Activity</b>	<b>Number of Party-Days Spent on Reef System by Activity</b>	<b>Percentage of Total Party-Days by Activity</b>
Fishing	1,986,000	53%
Snorkeling	882,000	24%
Scuba Diving	855,000	23%
<b>Total</b>	<b>3,723,000</b>	<b>100%</b>

Resident fishing constitutes about 53 percent of all resident party-days in the four county study area. Snorkeling and Scuba diving are evenly split in terms of the number of party-days at about 850,000 for each. Thus, reefs accommodate three rather important recreational activities as indicated in these two tables. These percentages remain pretty much the same for both artificial and natural reefs. That is, about two-thirds of fishing, snorkeling and scuba diving are spent on natural as opposed to artificial reefs using party-days as a measure of user activity. Person-days follow the same pattern as discussed for party-days. The activity tables will come into greater play as we progress to other sections of this summary chapter. We now turn to using the party-day as a spending unit in conjunction with the information on party spending per day obtained from our sample survey of reef users.

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.1.1-3 (Residents)**  
**Summary of the Kinds of Recreational Activities on Reefs in Southeastern Florida, 2000**

<b>(A) Party-Days</b>						
<b>Kind of Activity</b>	<b>All Reefs</b>		<b>Artificial Reefs</b>		<b>Natural Reefs</b>	
	<b>Total Party-Days</b>	<b>Percentage of Total Party-Days for Each County</b>	<b>Total Party-Days</b>	<b>Percentage of Total Party-Days for Each County</b>	<b>Total Party-Days</b>	<b>Percentage of Total Party-Days for Each County</b>
<b>Fishing</b>						
Palm Beach	405,000	20%	146,000	20%	259,000	20%
Broward	512,000	26%	205,000	29%	307,000	24%
Miami-Dade	597,000	30%	227,000	31%	370,000	29%
Monroe	473,000	24%	142,000	20%	331,000	26%
Total	1,987,000	100%	720,000	100%	1,267,000	100%
<b>Snorkeling</b>						
Palm Beach	164,000	18%	77,000	30%	87,000	14%
Broward	177,000	20%	39,000	15%	138,000	22%
Miami-Dade	287,000	33%	80,000	31%	207,000	33%
Monroe	255,000	29%	64,000	24%	191,000	31%
Total	883,000	100%	260,000	100%	622,000	100%
<b>Scuba Diving</b>						
Palm Beach	210,000	25%	59,000	19%	151,000	28%
Broward	242,000	28%	75,000	25%	167,000	30%
Miami-Dade	221,000	26%	69,000	22%	153,000	28%
Monroe	182,000	21%	104,000	34%	78,000	14%
Total	855,000	100%	307,000	100%	549,000	100%
<b>(B) Person-Days</b>						
<b>Kind of Activity</b>	<b>Total Person-Days</b>	<b>Percentage of Total Person-Days for Each County</b>	<b>Total Person-Days</b>	<b>Percentage of Total Person-Days for Each County</b>	<b>Total Person-Days</b>	<b>Percentage of Total Person-Days for Each County</b>
<b>Fishing</b>						
Palm Beach	1,551,000	20%	558,000	20%	992,000	20%
Broward	2,154,000	27%	862,000	30%	1,293,000	26%
Miami-Dade	2,578,000	33%	980,000	34%	1,598,000	32%
Monroe	1,566,000	20%	470,000	16%	1,096,000	22%
Total	7,849,000	100%	2,870,000	100%	4,979,000	100%
<b>Snorkeling</b>						
Palm Beach	616,000	17%	290,000	28%	327,000	13%
Broward	732,000	20%	161,000	15%	571,000	23%
Miami-Dade	1,230,000	35%	344,000	33%	885,000	35%
Monroe	991,000	28%	248,000	24%	743,000	29%
Total	3,569,000	100%	1,043,000	100%	2,526,000	100%
<b>Scuba Diving</b>						
Palm Beach	811,000	29%	227,000	23%	584,000	32%
Broward	832,000	30%	258,000	26%	574,000	31%
Miami-Dade	698,000	24%	217,000	23%	482,000	26%
Monroe	477,000	17%	272,000	28%	205,000	11%
Total	2,818,000	100%	974,000	100%	1,845,000	100%

### 2.1.2 Economic Contribution

This section presents the economic contribution of resident reef-users to the economies of the counties in the study area. Economic contribution is measured in terms of the impact of expenditures by reef-users on county wages and employment. Regional economies grow by an expansion in their export industries. Export industries either sell goods and services to individuals outside the local economy or experience an injection of cash by visitors from outside the area. For example, boating visitors to Palm Beach County inject cash into this economy and stimulate economic growth. Such injections have a multiplier effect as discussed in the next section of the report under “Visitors”.

However, local spending is somewhat different in that it is a result of the expansion in many local export industries, not just the reef industry. As money circulates through the local economy, local residents receive income from this flow and use it to purchase goods and services such as boats, supplies, food, and fuel. Although resident spending on reef-related boating does not create multiplier effects that can be directly tied to the reefs, the existence of the reefs does keep money in the local economy. If the reef system did not exist off the coast of a particular county, residents may go elsewhere and spend their income. Generally, the more money kept in the local economy, the greater will be the multiplier effect of many local exports. In effect, reef-related spending by residents keeps the wages and employment in the home economy rather than exiting the economy as residents go elsewhere to recreate. It is this economic contribution that we seek to measure in this section.

The estimated economic contribution of reef-related expenditures by local residents is summarized in Table 2.1.2-1. For example, for the four counties in the study area, resident reef-users spent about \$873 million during the 12-month period. This spending created about \$116 million in wages and supported 7,300 employees. Without the artificial and natural reefs existing off the coasts of these counties, much of this spending might take place in other coastal counties. It is difficult to predict how many jobs might be lost without the existing reef system. However, given the intense demand for this kind of recreation, it is possible that losses would be considerable. Such potential losses were not estimated.

Estimated spending by resident reef-users was derived as follows using Palm Beach County as an example. In 2000, there were an estimated 779,000 party-days spent visiting the reefs off the coast of Palm Beach County as shown in Table 2.1.1-1. The mail survey respondents were asked to estimate their local spending per party-day.<sup>1</sup> Spending per party-day was asked separately for fishing, snorkeling and scuba diving. The weighted average expenditures by residents for all these activities was then calculated as \$251 per party-day and the average party size was 3.8 residents. Respondents were also asked to breakdown their reef-related expenditures into 12 categories that are discussed in detail below. These categories range from marina fees to eating in restaurants during a reef trip. Multiplying the number of party-days by resident spending per

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<sup>1</sup> This is why “party-day” is referred to as the spending unit.



## 2.0 Socioeconomic Value of Reefs in Southeast Florida

party-day, we arrive at \$195.4 million (i.e. 778,523 times \$251). This is the reef-related spending estimate for Palm Beach County as summarized in Table 2.1.2-1.<sup>2</sup>

**Table 2.1.2-1 (Residents)**  
**A Summary of the Economic Contribution of Reef-Related Recreational Activities by County in Southeast Florida, 2000**

<b>Economic Contribution: All Reefs</b>				
<b>County</b>	<b>Expenditures (Million 2000\$)</b>	<b>County Expenditures as Percentage of Total Reef- Related Expenditures</b>	<b>Employment (Full and Part-Time Jobs)</b>	<b>Wages (Million 2000\$)</b>
Palm Beach	195.4	22%	1,500	22.4
Broward	269.8	31%	2,500	37.7
Miami-Dade	275.6	32%	2,100	38.9
Monroe	132.3	15%	1,200	17.2
<b>Total</b>	<b>873.1</b>	<b>100%</b>	<b>7,300</b>	<b>116.2</b>
<b>Economic Contribution: Artificial Reefs</b>				
<b>County</b>	<b>Expenditures (Million 2000\$)</b>	<b>County Expenditures as Percentage of Total Reef- Related Expenditures</b>	<b>Employment (Full and Part-Time Jobs)</b>	<b>Wages (Million 2000\$)</b>
Palm Beach	67.0	22%	500	7.7
Broward	90.9	31%	800	12.5
Miami-Dade	95.2	32%	700	13.4
Monroe	44.3	15%	400	5.8
<b>Total</b>	<b>297.4</b>	<b>100%</b>	<b>2,400</b>	<b>39.4</b>
<b>Economic Contribution: Natural Reefs</b>				
<b>County</b>	<b>Expenditures (Million 2000\$)</b>	<b>County Expenditures as Percentage of Total Reef- Related Expenditures</b>	<b>Employment (Full and Part-Time Jobs)</b>	<b>Wages (Million 2000\$)</b>
Palm Beach	128.4	22%	1,000	14.7
Broward	178.9	31%	1,700	25.2
Miami-Dade	180.4	32%	1,400	25.5
Monroe	88	15%	800	11.4
<b>Total</b>	<b>575.7</b>	<b>100%</b>	<b>4,900</b>	<b>76.8</b>

<sup>2</sup> The 3.8 persons per party includes residents only. Actual party size is somewhat larger than 3.8 individuals because it includes nonresidents. In areas such as the Florida Keys (i.e., Monroe County), nonresidents may be up to a third of the actual party. Respondents were asked about the composition of their party in terms of residents and non-residents because the nonresident component is really part of the visitor sector. The goal of the resident section was to cover only residents of the county under study. The above procedure was used for all spending entries in Table 2.1.2-1.

**Table 2.1.2-2 (Residents)**  
**A Summary of Estimated Expenditures by Reef-Related Recreational Activity**  
**By Residents Off the Southeast Coast of Florida, 2000**

Recreational Activity	Estimated Expenditures Per County (Million 2000\$)				Total Expenditures	Percentage of Total Expenditures
	Palm Beach	Broward	Miami-Dade	Monroe		
Fishing	\$121	\$134	\$165	\$80	\$499	57%
Snorkeling	\$26	\$52	\$59	\$30	\$167	19%
Scuba Diving	\$49	\$84	\$52	\$22	\$207	24%
<b>Total</b>	<b>\$196</b>	<b>\$270</b>	<b>\$276</b>	<b>\$132</b>	<b>\$873</b>	<b>100%</b>

Estimated spending had to be translated into its generated wages and employment. The percent of wages generated by spending in certain industrial categories was obtained from the U.S. Census of Business (1997). For example, in Palm Beach County, spending on marinas generated \$130,000 per employee annually expressed in 2000 dollars. Out of this spending, 11 percent goes to payments for wages or \$15,000 per employee annually. Thus, if reef-related boating generated \$130,000 (i.e., derived as outlined above) in spending, this would create one part or fulltime job paying \$15,000 per year based on the labor market data from Palm Beach County. Using this method, Table 2.1.2-1 shows that the \$195.4 million of spending in Palm Beach County generated a payroll for all reef-related spending of \$22.4 million supporting 1,500 full and part-time employees.

It is of interest to breakdown spending between artificial and natural reefs. About two-thirds of all resident spending was related to natural reefs while the balance was attributed to artificial reefs. The distribution of spending is closely linked to the distribution of party-days and person-days discussed above. In addition, there was not much difference between party spending per day on artificial as opposed to natural reefs. Expenses such as marina fees, eating at restaurants and boat oil and gas will not vary depending upon the type of the reef. Any differences we found were assumed to be due to sampling error associated with smaller sample sizes (i.e., a further breakdown of categories reduces the sample size per category).

In terms of spending, there is a difference in spending per party-day depending on the kind of recreational activity on the reef system. In general, fishing is more expensive per day than various kinds of diving. Table 2.1.2-2 presents a breakdown of expenditures by county in terms of the kind of resident-related recreational pursuit involving the coastal reef system. Over all counties, expenditures on reef-related fishing were 57 percent of total spending on all activities. Scuba diving comprised 24 percent of total spending and snorkeling comprised 19 percent of total spending. Nearly \$500 million was spent on reef-related fishing during the 12-month period (1999-2000). This was followed by spending on scuba diving of \$207 million and \$167 million on snorkeling.

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The industries that benefit from resident expenditures for reef-related recreation are provided in Table 2.1.2-3. As discussed above, reef-users were asked to breakdown their total expenditures per party-day into 12 categories. These individual categories are shown in Table 2.1.2-3. Aggregate spending in each category was derived by multiplying average spending per party-day for that category by the number of party-days per year (i.e., Table 2.1.1-3). As might be expected, the greatest spending by reef users is for travel to and from the reef system and for boat storage. Thus, boat oil and gas; and marina fees are the two largest expenditures as shown in Table 2.2.2-3. In the four counties, reef users spent \$220 million on boat oil and gas (i.e., travel to a reef) and \$146 million on marina fees (i.e., large boat storage). These two items were nearly 42 percent of all reef-user spending. This was followed by expenditures on food and drink. Expenditures for food in restaurants and from stores constituted \$86 million (10%) and \$78 million (9%), respectively, of total spending.

The retention of resident spending by the existence of artificial and natural reefs in the four county area helps keep jobs in the local economy as discussed above. Table 2.2.2-3 illustrates which industries benefited from having reefs off the coast of these four counties. The Technical Appendix to this report contains a more detailed discussion of the data and methodology used to estimate the economic contribution of resident's use of the reef system.

**Table 2.1.2-3  
A Summary of the Economic Contribution by Expenditure Category for Reef Related  
Recreational Activities for Southeast Florida, 2000**

Expenditure Category	Total Itemized Expenditures by County (Million 2000\$)				Total Expenditures
	Palm Beach	Broward	Miami- Dade	Monroe	
1. Boat Oil and Gas	\$50	\$67	\$67	\$36	\$220
2. Marina Slip Rentals and Dockage	\$35	\$47	\$53	\$11	\$146
3. Food and Beverages from Restaurants	\$16	\$36	\$17	\$17	\$86
4. Food and Beverages from Stores	\$15	\$22	\$26	\$15	\$78
5. Tackle	\$11	\$25	\$16	\$11	\$63
6. Bait	\$9	\$12	\$19	\$8	\$48
7. Gas for Auto	\$9	\$10	\$16	\$5	\$40
8. Ice	\$5	\$6	\$7	\$5	\$23
9. Equipment Rentals	\$5	\$7	\$7	\$4	\$23
10. Boat Ramp and Parking Fees	\$4	\$5	\$20	\$2	\$31
11. Sundries Such as Sun Screen, Sickness Pills, etc.	\$5	\$7	\$7	\$4	\$23
12. All Other	\$32	\$25	\$20	\$13	\$90
<b>Total Expenditures</b>	<b>\$196</b>	<b>\$269</b>	<b>\$275</b>	<b>\$131</b>	<b>\$871</b>

### 2.1.3 Use Value

This section provides a summary of the value that southeast Florida resident reef users place on being able to use the reefs in their existing condition. For technical details and alternative use value estimates, please see the technical appendix to this report

In general, use value is measured as the willingness of reef users to pay for a recreational day on the reef. Because reef-users are not charged a price to use the reefs, they receive all of the utility or satisfaction possible from a recreational reef day. Such satisfaction is by its very nature incremental. In other words, reef-users have higher use values for experiences associated with the reef than those who participate in the same activity without the reef. For example, fishers can fish in reef areas or non-reef areas of the Atlantic Ocean or Gulf of Mexico. However, most reef users feel that reefs are responsible for increasing catch rates. This is one factor that increases the satisfaction of the fishing day near the reefs. This phenomenon has been documented by Green (1984), Glassure (1987) and Bell (1992) to mention just a few studies using fishing as an example.

We asked the reef-using respondents a series of questions dealing with their willingness to pay for the reef program. The respondents were asked to consider the total cost of their last boating trip to Southeast Florida including travel expenses, lodging, and all boating expenses. Then, the respondent was asked the following:

“If your total cost per trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the \_\_\_\_\_ (kind of reef) in their existing condition.”

Payment amounts (or cost increases) were put in the survey instrument on a random basis (\$10, \$50, \$100, \$200 and \$500). Thus, some respondents received questions asking about a \$10 increase while others were asked about a \$50, \$100 or even \$500 increase in trip cost. Each respondent was asked for their willingness to pay to maintain the natural reefs and their willingness to pay to maintain the artificial reefs in their existing conditions. For the combined artificial and natural reef program, the payment amounts were doubled.

The purposes of these survey questions were to establish the use value per day from artificial and natural reefs. The expectation is that as the payment is increased, the percent of reef-users willing to pay the added cost would decline. If the percentage of respondents accepting the additional cost starts high and declines very gradually then the willingness to pay (WTP) or use value per trip is high for a particular kind of reef. Respondents were also given the option to say “NO” to all trip cost increases. It would be expected that the percentage of respondents answering “NO” to each cost increase (i.e., payment amount) would increase with the amount of payment since it would become too costly to maintain the reef system for recreational enjoyment at the higher payment values.

Two statistical procedures were used to analyze this question. One is called the Turnbull Distribution and the other is called Dichotomous Choice. An explanation of these procedures is

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provided in the Technical Appendix to this report. The results using the Dichotomous Choice approach are presented in this Final Report.

The above willingness to pay question was asked in three forms: (1) natural reefs separately; (2) artificial reefs separately and (3) a combination of natural and artificial reefs. Since the primary spending unit is the “party”, we interpreted the willingness to pay response to an increase in trip cost to the entire party.

To estimate values per party per trip, the data were pooled for all counties. A logit model was used to estimate the values per-party-per-trip. The logit model tested for differences by county, activity, household income, age of respondent, years of boating experience in South Florida, race/ethnicity, sex, length of boat owned, and whether the respondent is a member of a fishing or diving club.

Separate models were estimated for each of the four reef programs (e.g., natural reefs, existing artificial reefs, natural & artificial reefs combined and new artificial reefs). For the natural reef, existing artificial reefs and the combined programs, the only significant differences found were for those with income greater than \$100,000. This group had a higher willingness to pay than other reef users. There were no other differences found. The logit model did not produce different values per party per trip among counties. Also, because party sizes were not significantly different among the counties, the estimated values per person-trip were also the same across counties for each of the reef valuation programs. For residents, a person-trip is equal to one day. Therefore, a person-trip equals a person-day and a party-trip equals a party-day.

To estimate total annual use values for each county, we multiplied the number of party-days times the estimated values per party-day. We then estimated the value per person-day by dividing the total annual use value by the total number of person-days. This normalized value per person-day can be compared with results from other studies.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. Across all counties, the average per person-day value of the natural reefs was \$8.49 versus \$2.97 for artificial reefs. Total use is also higher for natural versus artificial reefs. Across all counties, natural reef use by residents was over 9.3 million person-days versus about 4.9 million person-days for artificial reefs. This translated into an estimate of total annual use value by residents of over \$79 million for natural reefs and \$15 million for artificial reefs. Capitalizing the annual use values, using a three percent interest rate, yields asset values of about \$2.6 billion for the natural reefs and about \$485 million for the artificial reefs. These results are summarized in Table 2.1.3-1.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs. This includes investments such as deployment of new artificial reefs and enhancements of natural reefs. In addition, government entities incur variable costs each year to support marine patrol,

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biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs would provide a conservative or lower bound estimate of the total natural and artificial reef values.

For the four counties combined, the best estimate is that the total resident use value per year for artificial and natural reefs expressed in 2000 dollars is \$48.2 million. Thus, reef-users receive about \$48 million dollars in recreational use value from participating in fishing, snorkeling and scuba diving near the reef systems compared to not having any reef system at all. Governmental authorities can consider this outcome as the economic benefits that could be sustained with proper maintenance of the existing reef system. On a county level, Miami-Dade has the largest flow of recreational value for the simple reason that they have more person-days which results from a larger number of registered boats participating in the use of the reef system.

The estimates of use value for the reef system by county become important for public policy programs such as those that protect the existing reef resources. One kind of program involving “No-Take” zones will be discussed below. But, first, we consider the asset value of reefs.

All private land that is owned is rigorously assessed for real estate transactions and taxation. It is often suggested that public lands be sold or rented to private interests. However, little attention is given to what is called the “asset” value of natural resources and man-made resources. In this case, natural reefs are an illustration of the former while artificial reefs are an illustration of the latter.

The capitalized value of reef resources can be calculated by dividing the annual flow of user value by the real discount rate which is approximately 3 percent. Private land owners and businesses do the same thing only they use the future flow of profits as their annual flow of economic benefits. The last column in Table 2.1.3-1 shows the capitalized value of artificial and natural reefs as calculated using this method. For example, the capitalized value of the artificial reef system deployed by government agencies and other interested groups is estimated to be about \$485 million. Miami-Dade County once again has the largest capitalized value since this county also has the largest flow of use value benefits as discussed above. The natural reef system has a capitalized value of \$2.6 billion or nearly 5.4 times that of the artificial system. This is the case because the use value for natural reefs is much higher than artificial reefs. In addition, more than two-thirds of the total person-days spent on the total reef system are spent on natural reefs.

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**Table 2.1.3-1 (Residents)  
Annual Use Value and Capitalized Value Associated with  
Resident Reef Use in Southeast Florida, 2000**

County	Total Person-Days	Use Value Per Person-Day of Reef Use	Total Estimated Annual Use Value (Million Dollars)	Capitalized Value at 3% Discount Rate (Million Dollars)
<b>Artificial And Natural Reefs</b>				
Palm Beach	2,978,274	\$3.38	\$10.1	\$335.8
Broward	3,718,019	\$3.24	\$12.0	\$401.3
Miami-Dade	4,505,773	\$3.17	\$14.3	\$476.6
Monroe	3,034,067	\$3.88	\$11.8	\$392.5
<b>Total</b>	<b>14,236,033</b>	<b>\$3.38</b>	<b>\$48.2</b>	<b>\$1,606.2</b>
<b>Artificial Reefs</b>				
Palm Beach	1,075,067	\$2.96	\$3.2	\$106.1
Broward	1,280,601	\$2.81	\$3.6	\$120.1
Miami-Dade	1,540,343	\$2.76	\$4.3	\$141.6
Monroe	989,872	\$3.54	\$3.5	\$116.7
<b>Total</b>	<b>4,885,883</b>	<b>\$2.97</b>	<b>\$14.6</b>	<b>\$484.5</b>
<b>Natural Reefs</b>				
Palm Beach	1,903,208	\$8.50	\$16.2	\$539.3
Broward	2,437,418	\$8.17	\$19.9	\$663.8
Miami-Dade	2,965,429	\$8.01	\$23.7	\$791.3
Monroe	2,044,195	\$9.56	\$19.5	\$651.4
<b>Total</b>	<b>9,350,150</b>	<b>\$8.49</b>	<b>\$79.3</b>	<b>\$2,645.8</b>

Finally, some reef-users refuse to pay anything for their use of the reef in terms of increased trip costs. We sometimes call these “protestors” since they really would pay something, but just like to protest government in general. Policy makers will have to deal with this group when it comes to reef management budgets so it is wise to analyze the reasons given for saying “NO” to our hypothetical question. For respondents who answered no to the willingness-to-pay questions, their reasons for saying no are summarized in Table 2.1.3-2.

**Table 2.1.3-2 (Residents)**  
**Reason Given by Respondents for "No" Answers to WTP Question**

<b>Reason for "No" Answer to WTP Question</b>	<b>Percentage of "NO" Responses for Artificial Reefs</b>	<b>Percentage of "NO" Responses for Natural Reefs</b>
1. Government waste should be reduced to pay for water quality protection and management of the natural reefs.	17.10%	17.00%
2. Not Enough Information	11.10%	10.60%
3. Pay Too Much to Government Already	9.10%	9.80%
4. Reef Not Worth That Contribution	8.90%	2.60%
5. Cannot Calculate Reef Worth	4.70%	2.10%
6. Cannot Understand Question	1.90%	2.80%
7. No Water Quality Problems	1.60%	1.30%
8. Numerous Miscellaneous Concerns	45.60%	53.80%

For artificial reefs, negative reaction was concentrated on the feeling that there is too much government waste already to impose additional cost on users. This was the feeling of natural reef users as well. In addition, some reef users who responded no to the willingness-to-pay questions felt that there was not enough information provided with the question and that they already pay too much to government. Other artificial reef users felt that reef preservation is not worth the incremental trip cost presented to them while natural reef users were less concerned with this cost.

Government programs dealing with reef recreation may be divided into two areas. The first area is the maintenance of the existing artificial and natural reef system. This was the object of the first three willingness-to-pay questions aimed at determining use value of the existing reef system. The second area is that government may add artificial reefs to the existing system.

The resident survey included a question to solicit resident reef users' willingness-to-pay for new artificial reefs. The question is as follows.

Local and state government agencies are being asked to evaluate how users of artificial reefs value new artificial reefs. Artificial reef programs cost money. Suppose that the government proposed that all users of the artificial reefs would pay for all newly constructed reefs. Fishermen and divers with their own boats would pay for a decal as part of their boat registration and/or, if they used a charter/party boat or a rental boat (pay operation), they would pay for the costs through higher fees charged by the pay operation. The money would go into a



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trust fund that could only be used for the construction and maintenance of artificial reefs in southeast Florida.

14. Would you be willing to pay \$ \_\_\_\_\_ per year when you renew your boat registration and/or the amount in higher fees to a charter/party boat or rental boat operation to fund this program?

Payment amounts of \$5, \$10, \$20, \$30, \$50 and \$100 were assigned randomly. The survey results were statistically analyzed using the logit model.

The logit model estimated for the new artificial reef program found some statistically significant differences. Residents in Palm Beach and Broward counties had higher willingness-to-pay than those from Miami-Dade and Monroe counties. Snorkelers and scuba divers had higher values than those who participated in fishing activities. The only other statistically significant variable was household income. As household income levels increased so did willingness-to-pay for new artificial reefs. On a per party per day basis, the estimated values ranged from a high of \$3.60 for snorkelers and scuba divers from Palm Beach and Broward counties to a low of \$0.63 for those who participated in fishing activities off Miami-Dade and Monroe counties.

As with the other three programs, the estimated per party per day values were multiplied by the total party-days spent on artificial reefs by artificial reefs users in each county to get total annual use value for each county. The total annual use values were then divided by the total annual person-days of artificial reef use in each county to get an estimate of the value per person-day. Again, this normalized value per person-day can be compared with results from other studies.

On a per person-day basis, the estimated values ranged from a low of 28 cents in Miami-Dade County to a high of 72 cents in Palm Beach County. Across all four counties, the average was 49 cents per person-day of reef use.

**Table 2.1.3-3 (Residents)  
Estimated Resident Use Value of Investing in and Maintaining “New” Artificial Reefs**

County	Total Person-Days for Artificial Reefs	Use Value Per Person-Day of Artificial Reef Use	Total Estimated Annual Use Value (Million Dollars)	Capitalized Value at 3% Discount Rate (Million Dollars)
Palm Beach	1,075,067	\$0.72	\$0.777	\$25.9
Broward	1,280,601	\$0.60	\$0.762	\$25.4
Miami-Dade	1,540,343	\$0.28	\$0.436	\$14.5
Monroe	989,872	\$0.42	\$0.419	\$14.0
<b>Total</b>	<b>4,885,883</b>	<b>\$0.49</b>	<b>\$2.394</b>	<b>\$79.8</b>

The addition of “new” artificial reefs is estimated to add \$2.4 million to the use value for resident artificial reef-users in the four county area. This program will add a capitalized value of \$79.8

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million dollars to an artificial reef system worth nearly \$485 million according to our estimates in Table 2.1.3-1. Even though Miami-Dade County had the highest amount of artificial reef use, it did not have the highest total annual use value because of the relatively low value per person-day. For government benefit/cost analysis, the annual use value would be compared to the annual cost of artificial reef deployment and associated maintenance and administration costs.

It is of interest that slightly over 75 percent of the respondents refused to pay the amount given to them in the question for additional artificial reefs. Of course, these amounts varied from \$10 to \$100 per year. Those answering “NO” to the increased annual cost felt that government should fund this program out of general revenue (15.5 percent) rather than levy a specific tax on reef-users. Other “protestors” felt that there was presently too much government waste (13.3 percent) and that the increased cost was more than the new reef would be worth (10.6 percent). Finally, the theme that government already receives too much in taxes was repeated by 8.3 percent of the respondents.

### 2.1.4 Role of “No-Take” Zones

Reefs play a vital role in the entire oceanic ecosystem by providing habitat and protection for young fish and other creatures. A no-take zone is a designated area of the reef systems in which nothing is to be taken from this area, including fish and shellfish. To provide a net benefit, it is argued that “no-take” zones would actually increase the total pie available to users. Supporters of “no-take” zones point to the overuse of common property resources such as ocean fisheries by both recreational and commercial interests. In effect, “no-take” zones would vest the property right with the government. In theory, “no-take” zones would increase fish and coral populations to the carrying capacity of the specified area with benefits spilling over into areas used by recreational and even commercial users. Some question these alleged benefits and opposed the imposition of such zones. Therefore, as part of this study, we were asked to obtain the opinion of resident artificial and natural reef-users regarding “no-take” zones as management tools. The results are shown in Table 2.1.4-1.

Under the National Marine Sanctuary Act, 23 areas or zones were created where the taking of anything including fish and shellfish has been prohibited since 1997 in the Florida Keys. It is reasonable to assume that residents of neighboring counties may have formed an opinion about this management effort. Apparently, it is a favorable opinion because of the respondents surveyed from the four counties, about three quarters support “no-take” zones in the Florida Keys. However, do respondents want this management tool used in “their own backyard”? Although somewhat less supportive, between 57 percent to 65 percent of all respondents support the use of “no-take” zones off their county shores. Since the Florida Keys are in Monroe County, we asked the residents of that county whether they would be willing to support additional “no-take” zones off their county. Nearly 60 percent were still in favor of extending this management tool to additional areas.

**Table 2.1.4-1 (Residents)**  
**A Summary of the Opinion of Resident Reef-Users on "No Take" Zones in Southeast Florida, 2000**

<b>Question: "Support "No Take" Zones in the Florida Keys"</b>			
<b>County</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>
Palm Beach	75.7%	14.5%	9.8%
Broward	74.9%	17.9%	7.2%
Miami-Dade	73.6%	18.8%	7.6%
Monroe	78.1%	17.9%	3.8%
<b>Question: "Support "No Take" Zones on Some Reefs in Your County"</b>			
<b>County</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>
Palm Beach	65.1%	22.9%	11.9%
Broward	63.4%	26.6%	9.7%
Miami-Dade	60.6%	27.7%	10.6%
Monroe <sup>1</sup>	56.9%	20.5%	21.9%
<b>Question: "Support "No Take" Zones on Some Reefs Off Palm Beach, Miami-Dade and Broward Counties"</b>			
<b>County</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>
Palm Beach	64.7%	21.2%	13.9%
Broward	63.9%	23.9%	12.1%
Miami-Dade	61.4%	27.6%	9.7%
Monroe	44.3%	38.5%	16.9%
<b>Question: "What Percentage of Coral or Natural Reefs in Your County Would Be Reasonable to Protect Using "No Take" Zones?"</b>			
<b>County</b>	<b>Average Percentage</b>		<b>Median Percentage</b>
Palm Beach	29.9%		20.0%
Broward	35.0%		25.0%
Miami-Dade	30.0%		20.0%
Monroe	32.0%		20.0%

<sup>1</sup> Since Monroe County already has "no take" zones, the word "additional" was inserted into this question for Monroe County surveys.

Since resident reef-users in the Florida Keys have been the subject of this experiment, it is indeed impressive that they are convinced enough of the "net benefits theory" to extend this management tool to other areas off the shores of their counties. A clear majority of the respondents in three of the four counties were in favor of having "no-take" zones (e.g. Palm Beach, Broward and Miami-Dade Counties). Only 44.3 percent of the respondents in Monroe

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County were in favor of extending such zones northward. It is not clear why the “no-take” zones in northern areas lost majority support by the resident respondents in Monroe County.

Finally, we asked what percentage of natural reefs should be protected using this management tool. Respondents from all counties indicated on average that 30 percent to 35 percent of natural reefs should be protected using this method. This gives the regulatory authority some idea of what reef-users feel is reasonable regarding this protection strategy.

However, the imposition of “no-take” zones is not necessarily consistent with maximizing net benefits to all users. This is still under study in the Florida Keys and elsewhere in the world. Since averages may be skewed by exceptionally larger answers, we also looked at the median answer (i.e., half the distance between the highest and lowest answer). The median was much lower than the average reported above and ranged from 20 percent to 25 percent. This may be a better estimate to use since it is both conservative and minimizes the influence of high and low responses including protest responses (e.g. respondents that answer no or zero to every proposal). Apparently, reef-users endorse the idea of the “no-take” zones and desire over 20 percent of the existing natural reefs to be designated off limits to recreational activity to benefit the entire group of reef-users. Such a result provides public officials with information important to the management of the reef system from Palm Beach to Monroe County.

### 2.1.5 Demographic Information

The mail survey included questions regarding demographic characteristics of respondents. The reason for collecting this type of information is to determine just what segment of the population will benefit from deploying artificial reefs, continued preservation of natural reefs and/or designating “no-take” zones as discussed in the last section. Respondents were asked to provide some background on both themselves and their boating experience. Table 2.1.5-1 provides the results from the mail survey combined with comparable information for the counties in the study area.

In general, owners of registered boats who use the reef system are older than the general population as measured by the median age. In Monroe County, the age difference is quite substantial. Among the four counties, the average respondent is predominately male. For example, 93 percent of respondents in Miami-Dade County were male compared to 48.4 percent in the general population of that county.

With respect to race, boat owners responding to the survey were predominately white in all counties. Palm Beach County had the highest percentage of boat owners who indicated they were white at 97 percent while none of the respondents indicated they were black. This is consistent with county data showing Palm Beach with the lowest percentage of blacks in the population among the four counties surveyed. As a percent of the population, those respondents identifying themselves as Hispanic/Latino were less than 7 percent except in Miami-Dade County where nearly 33 percent of the respondents were in this category. This distribution follows the Hispanic/Latino concentration in each county except that as a percentage of registered boat owners it is lower than countywide percentages.

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For all the counties, about one-half of the respondents had completed college or a more advanced degree. This is higher than the percentage of individuals that have completed these education levels in the general population for 1990.<sup>3</sup> Although these percentages have certainly risen for the general public since 1990, there is no question that boat owners responding to the survey are more highly educated than the general population. The reason for this statement is the very high correlation between education and income. The median income level reported by boat owners in the survey is much higher than the general population in all counties in the study area. The median household income reported by respondents is nearly double that of the general population. Of course, the purchase of a relatively large pleasure craft is associated with higher income as found by Bell and Leeworthy (1986). Thus, boat owners tend to be older, affluent white males with a higher degree of education.

The results of the survey were also used to estimate the lower bound on how many residents in the four county area participated in reef-using recreational activities. We did this by multiplying the number of estimated reef-using boats by the average size of the party. In the four county area, it was estimated that there are 87,010 registered boats that use the reef system with an average party size of 3.83 individuals per trip. Thus, there are 333,249 residents at a minimum that participated in reef-based outdoor recreation. The reason we say minimum is that the turnover rate of the party is unknown. That is, the same residents may not go boating on every trip. Therefore, 3,801,268 residents 15 years and older in the four county area can be characterized as the population from which the boating party is drawn. At a minimum, we estimated that 8.8 percent of this population may be engaged in recreation based upon the use of the artificial and natural reef system. This may be useful in answering questions of public policy dealing with just how many and what percent of the population may gain from programs directed at the reef system.

Finally, we obtained information on what is called the “boater profile”. This is included in Table 2.1.5-2. The average reef-using boater has lived in his or her present county from 16 (Monroe) to 33 (Miami-Dade) years. In addition, the average resident boater has been boating from his or her county of residence for almost as long. The average boat owned by the reef-users ranges from 23 feet in length in Miami-Dade County to 25 feet in length in both Palm Beach and Broward Counties. These sample values are comparable to the average size of boats over 16 feet in length in the boat registration database which average 25 feet long. Finally, from 15.4 percent (Monroe) to 19.9 percent (Palm Beach) of the reef using population are members of fishing and/or diving clubs.

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<sup>3</sup> 1990 was the last time the U.S. Census Bureau obtained educational levels at the county level.

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.1.5-1 (Residents)**  
**A Summary of the Demographic Characteristics of Reef-Users in Southeast Florida, 2000**

<b>Median Age of Respondent</b>	<b>Reef-Users</b>			<b>County Population</b>		
Palm Beach	48			45.5		
Broward	48			39.8		
Miami-Dade	46			35.9		
Monroe	54			41.0		
<b>Sex Of Respondent</b>	<b>Reef-Users</b>			<b>County Population</b>		
	<b>Male</b>	<b>Female</b>		<b>Male</b>	<b>Female</b>	
Palm Beach	91.10%	8.90%		48.00%	52.00%	
Broward	92.10%	7.90%		48.10%	51.90%	
Miami-Dade	93.50%	6.50%		48.40%	51.60%	
Monroe	85.60%	14.40%		50.60%	49.40%	
<b>Race Of Respondent</b>	<b>Reef-Users</b>			<b>County Population</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
Palm Beach	97.30%	0%	2.70%	79.10%	13.80%	7.10%
Broward	93.10%	2.20%	4.80%	70.60%	20.50%	8.90%
Miami-Dade	87.90%	1.30%	10.80%	69.70%	20.30%	10.00%
Monroe	93.60%	0.20%	6.20%	90.70%	2.30%	7.00%
<b>Percent Hispanic/Latino</b>	<b>Reef-Users</b>			<b>County Population</b>		
Palm Beach	4.30%			12.40%		
Broward	4.70%			15.50%		
Miami-Dade	32.70%			57.30%		
Monroe	6.80%			15.80%		
<b>Education Level: Percentage Completed College Or More</b>	<b>Reef-Users</b>			<b>County Population<sup>1</sup></b>		
Palm Beach	52.50%			16.20%		
Broward	49.60%			13.40%		
Miami-Dade	56.70%			12.40%		
Monroe	56.60%			16.70%		
<b>Median Household Income</b>	<b>Reef-Users</b>			<b>County Population</b>		
Palm Beach	\$71,695			\$39,560		
Broward	\$72,310			\$37,431		
Miami-Dade	\$69,722			\$36,846		
Monroe	\$56,393			\$31,922		

*1 Latest available data on educational level by county is for 1990.*

**Table 2.1.5-2 (Residents)  
Boater Profile of Reef-Users in Southeast Florida, 2000**

<b>Average Years Living in County</b>	
<b>County</b>	<b>Average Years</b>
Palm Beach	23
Broward	26
Miami-Dade	33
Monroe	16

<b>Average Years Boating in South Florida</b>	
<b>County</b>	<b>Average Years</b>
Palm Beach	21
Broward	22
Miami-Dade	25
Monroe	22

<b>Average Length of Boat Used for Salt Water Activities</b>	
<b>County</b>	<b>Average Length</b>
Palm Beach	25
Broward	25
Miami-Dade	23
Monroe	24

<b>Percentage of Respondents That Belong to Fishing and/or Diving Clubs</b>	
<b>County</b>	<b>Percent</b>
Palm Beach	19.9%
Broward	18.9%
Miami-Dade	17.7%
Monroe	15.4%

## 2.2 Visitors

The focus of this section is the socioeconomic value of the reefs associated with visitors to each of the four southeast Florida counties. As defined in Chapter 1, Introduction, visitors to a county 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 to be a visitor to Monroe County. Likewise, a person from New York visiting the Florida Keys is considered to be a visitor to Monroe County.

This section provides the following information regarding visitors to each of the four counties: reef user activity, economic contribution of the reefs, use value of the reefs and demographic information.

### 2.2.1 User Activity

The activity of reef users is summarized in person-days of reef use. For visitors, the number of person-trips to use the reefs is also of interest. In order to measure person-days and person-trips associated with reef use, the total number of person-trips by all visitors to each county must be estimated. Total visitation includes visits to a county by non-residents of that county to participate in any activity be it recreation, business or family matters. The total number of person-trips by all visitors to the county was estimated using the Capacity Utilization Model. This model uses a variety of information obtained from the counties and the responses to the General Visitor Survey.

The model uses the following information for each county. The number of hotel/motel rooms in each county during the study period (June 2000 to May 2001) and the average hotel/motel occupancy rate during the summer and winter of the same study period was obtained from the counties. Summer is defined from June 2000 to November 2000 and winter is defined from December 2000 to May 2001. The model also requires estimates of average party size for those using hotel and motel accommodations, the average trip length in nights for those staying in hotels/motels, and the proportion of visitors who stay in hotels/motels. This information was obtained from the general visitor survey responses.

The equation for the Capacity Utilization Model is as follows.

$$\begin{aligned} &\text{Total Number of Person-Trips by All Visitors to the County During a Season} = \\ &\quad (\text{Hotel/Motel Occupancy Rate} \times \text{Number of Hotel/Motel Rooms} \times \\ &\quad 183 \text{ Days in the Season} \times \text{Average Party Size for those Using Hotels/Motels}) \\ &\quad \text{divided by} \\ &\quad \text{Average Trip Length in Nights for those staying in Hotels/Motels} \\ &\quad \text{divided by} \\ &\quad \text{Proportion of Visitors who Stay at Hotels/Motels} \end{aligned}$$

The results for each of the four counties are provided in Table 2.2.1-1 and Table 2.2.1-2, for the summer and winter seasons, respectively.



2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.1-1 (Visitors)  
Results of Capacity Utilization Model  
Calculation of Number of Person-Trips to County  
Summer Season (June 2000 to November 2000)**

Variable	Summer			
	Palm Beach	Broward	Miami-Dade	Monroe
Hotel/Motel Occupancy Rate (k) <sup>a</sup>	0.629	0.662	0.660	0.673
Average Number of Hotel/Motel Rooms During the Year (R) <sup>b</sup>	16,076	28,600	48,000	8,916
Number of Days in Season (p)	183	183	183	183
Average Size of Party for those using hotels/motels (SP) <sup>c</sup>	1.80	2.55	2.86	2.65
Average Trip Length in Nights for those staying in hotels/motels (LS) <sup>d</sup>	3.99	6.26	5.94	4.03
Proportion of Visitors who stay at hotels/motels (g) <sup>e</sup>	0.43	0.42	0.42	0.56
Estimated Number of Person Trips by Visitors who used hotels/motels = $k \times R \times p \times SP / LS$	832,110	1,404,824	2,782,827	720,322
<b>Estimated Total Number of Person Trips by All Visitors to County = <math>k \times R \times p \times SP / LS / g</math></b>	<b>1,938,327</b>	<b>3,314,292</b>	<b>6,574,428</b>	<b>1,288,464</b>

<sup>a</sup> Palm Beach County - For year ending September 30, 2000; Broward, Miami-Dade and Monroe Counties - For calendar year 2000. Sources: Palm Beach County Tourist Development Council, Greater Fort Lauderdale Convention and Visitors Bureau, Greater Miami Convention and Visitors Bureau; Monroe County Tourist Development Council. All rates are from Smith Travel Research.

<sup>b</sup> Data represent 1999. Source: Florida Department of Professional Regulation, Division of Hotels and Restaurants.

<sup>c</sup> From General Visitor Survey responses to Question 25 for parties who stayed in hotels/motels and party size was five or fewer people.

<sup>d</sup> From General Visitor Survey responses to Questions 8 (On this trip, how many nights will you have spent in county?) for those respondents who stayed at hotels/motels on this trip.

<sup>e</sup> From General Visitor Survey responses to Question 10 (Where are you staying on this trip?). Proportion equal to number of respondents staying at hotel or motel divided by all respondents. All respondents include all accommodation modes and day trippers (no accommodation) and excludes cruise ship passengers who disembark at Key West for a day trip.

**Table 2.2.1-2 (Visitors)**  
**Results of Capacity Utilization Model**  
**Calculation of Number of Person-Trips to County**  
**Winter Season (December 2000 to May 2001)**

Variable	Winter			
	Palm Beach	Broward	Miami-Dade	Monroe
Hotel/Motel Occupancy Rate (k) <sup>a</sup>	0.744	0.763	0.738	0.730
Average Number of Hotel/Motel Rooms During the Year (R) <sup>b</sup>	16,076	28,600	48,000	8,916
Number of Days in Season (p)	183	183	183	183
Average Size of Party for those using hotels/motels (SP) <sup>c</sup>	1.92	2.35	2.24	2.46
Average Trip Length in Nights for those staying in hotels/motels (LS) <sup>d</sup>	8.28	5.00	6.27	5.08
Proportion of Visitors who stay at hotels/motels (g) <sup>e</sup>	0.22	0.31	0.38	0.46
Estimated Number of Person Trips by Visitors who used hotels/motels = $k \times R \times p \times SP / LS$	506,882	1,873,450	2,306,184	575,605
<b>Estimated Total Number of Person Trips by All Visitors to County = <math>k \times R \times p \times SP / LS / g</math></b>	<b>2,313,013</b>	<b>6,088,714</b>	<b>6,039,217</b>	<b>1,263,466</b>

Note: See Table 2.2.1-1 for footnotes.

The number of person-trips for the year 2000-2001 is summarized in Table 2.2.1-3 for each county. The number of cruise ship passengers who disembarked at Key West during the study period was added to the number of person-trips for Monroe County. The number of cruise ship passengers docking at Key West by month was obtained from the Monroe County Tourist Development Council. These numbers were multiplied by an estimate of the proportion of passengers who actually disembark to visit Key West for a half-day (0.9883 for summer and 0.9547 for winter). This proportion was obtained from Leeworthy, 1996 and is based on a NOAA study of cruise ship passengers in Key West.

**Table 2.2.1-3 (Visitors)**  
**Number of Person-Trips to Each County**  
**All Visitors**  
**June 2000 to May 2001**

County	Number of Person-Trips (millions)		
	Summer - 00	Winter - 01	Total
Palm Beach	1.94	2.31	4.25
Broward	3.31	6.09	9.40
Miami-Dade	6.57	6.04	12.61
Monroe <sup>a</sup>	1.51	1.60	3.11
<b>Total</b>	<b>13.33</b>	<b>16.04</b>	<b>29.37</b>

<sup>a</sup> Includes cruise ship passengers who disembark at Key West for day trip.

Next, the number of person-trips was converted to number of person-days. For each county, the number of person-trips, as presented on the last rows of Tables 2.2.1-1 and 2.2.1-2 (net of cruise ship passengers), was distributed to the different types of accommodation modes and day trippers. This distribution was based on the general survey responses to Question 10 (Where are you staying on this trip?) and Question 8 (On this trip, how many nights will you have spent?). The proportions of respondents by accommodation are provided in Table 2.2.1-4.

**Table 2.2.1-4 (Visitors)**  
**Proportion of General Visitor Respondents Surveyed by Accommodation**

Accommodation	County							
	Palm Beach		Broward		Miami-Dade		Monroe	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Day Trippers	0.12	0.20	0.13	0.21	0.25	0.34	0.15	0.09
Hotel/Motel/Guest House/Bed & Breakfast	0.43	0.22	0.42	0.31	0.42	0.38	0.56	0.46
Home of Family and Friends	0.36	0.40	0.32	0.24	0.27	0.18	0.07	0.07
Campground	0.00	0.07	0.03	0.11	0.01	0.04	0.16	0.32
Condominium or Second Home (own)	0.08	0.09	0.04	0.04	0.03	0.03	0.04	0.03
Vacation Rental	0.00	0.02	0.02	0.04	0.01	0.01	0.02	0.03
Time Share	0.01	0.01	0.03	0.05	0.01	0.01	0.00	0.01
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No. of Respondents	396	397	486	260	378	364	635	529

Then, for each accommodation mode and the day trippers, the number of person-trips was multiplied by average number of days per trip from Question 8. The average number of days per

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trip is provided in Table 2.2.1-5. Then the number of person-trips by accommodation mode and day trippers was summed over all accommodation modes and day trippers. The numbers of cruise ship passengers who disembark at Key West for the day were added to the Monroe County results. The numbers of person-days all visitors spent in each county are presented in Table 2.2.1-6.

**Table 2.2.1-5 (Visitors)**  
**Average Number of Days Per Trip by Accommodation**  
**General Visitor Survey**

Accommodation	County – Summer				County – Winter			
	Palm Beach	Broward	Miami-Dade	Monroe	Palm Beach	Broward	Miami-Dade	Monroe
Day Trippers	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hotel/Motel/Guest House/Bed & Breakfast	4.99	7.26	6.94	5.03	9.28	6.00	7.27	6.08
Home of Family and Friends	8.46	10.79	10.31	5.36	11.66	10.24	12.44	6.26
All Other Accommodations <sup>a</sup>	17.83	9.02	12.39	5.03	40.85	21.06	16.03	11.54

<sup>a</sup> All Other Accommodations include campground, condo or second home, vacation rental and time share.

Source: General Visitor Survey responses to Question 8 (on this trip, how many nights have you spent in this county) plus 1.

**Table 2.2.1-6 (Visitors)**  
**Number of Person-Days Spent in Each County**  
**All Visitors**  
**June 2000 to May 2001**

County	Number of Person-Days (Millions)		
	Summer - 00	Winter - 01	Total
Palm Beach	13.41	33.44	46.85
Broward	25.94	58.69	84.63
Miami-Dade	44.19	56.43	100.62
Monroe <sup>a</sup>	5.54	6.60	12.13
<b>Total</b>	<b>89.08</b>	<b>155.16</b>	<b>244.23</b>

<sup>a</sup> Includes cruise ship passengers who disembark at Key West for day trip.

The number of person-trips by all visitors is used as the basis for estimating the number of person-days visitors spent using the artificial and natural reefs in each county. For each season, the number of boating person-trips is equal to the total number of person-trips by all visitors times the proportion of person-trips taken by visitors who participated in saltwater boating in the county in the past twelve months. This proportion was taken from the General Visitor Survey answer to Question 13 (Which activities and boating modes did you participate in over the past

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

12 months in this county?) for one boating activity per respondent divided by the total number of respondents.

To get the number of boating person-trips when the person used the reefs, the number of boating person-trips is multiplied by the proportion of boating person-trips when the respondent used the reefs. This proportion was obtained from the Visitor Boater Screening Tally sheets. These sheets indicated the proportion of boaters intercepted who used the reefs at least once in the past 12 months. The results for the summer, winter and the year are summarized in Tables 2.2.1-7 to 2.2-9.

**Table 2.2.1-7 (Visitors)  
Person-Trips of Visitors Who Boated  
And Visitors Who Used the Reefs Over the Past 12 Months  
Summer 2000**

County	Summer – June 2000 to November 2000				
	Total Person Trips to County - All Visitors	Proportion of Person Trips Taken By Visitors Who Boated <sup>a</sup>	Boating Person Trips	Proportion of Boating Person Trips When the Reef was Used for Recreation <sup>b</sup>	Boating Person Trips When the Reef was Used for Recreation
Palm Beach	1,938,327	0.16	306,304	0.98	299,522
Broward	3,314,292	0.20	668,204	0.99	663,312
Miami- Dade	6,574,428	0.28	1,843,418	0.91	1,682,421
Monroe	1,513,099	0.33	502,031	0.90	450,077
<b>Total</b>	<b>13,340,147</b>		<b>3,319,957</b>		<b>3,095,332</b>

<sup>a</sup> Saltwater Boating Only. From General Visitor Survey Answer to Question 13 (Which activities\_modes did you participate in over the past 12 months in this county) for one boating activity divided by total number of respondents.

<sup>b</sup> From the Visitor Boater Tally Sheets:  $= 1 - (Q6/(Q6+Q7+Q8+Q10))$

**Table 2.2.1-8 (Visitors)  
Person-Trips of Visitors Who Boated  
And Visitors Who Used the Reefs Over the Past 12 Months  
Winter 2001**

County	Winter - December 2000 to May 2001				
	Total Person Trips to County - All Visitors	Proportion of Person Trips Taken By Visitors Who Boated <sup>a</sup>	Boating Person Trips	Proportion of Boating Person Trips When the Reef was Used for Recreation <sup>b</sup>	Boating Person Trips When the Reef was Used for Recreation
Palm Beach	2,313,013	0.14	330,430	0.98	323,115
Broward	6,088,714	0.19	1,145,612	0.99	1,137,225
Miami- Dade	6,039,217	0.13	768,919	0.91	701,764
Monroe	1,596,298	0.26	413,226	0.90	370,462
<b>Total</b>	<b>16,037,242</b>		<b>2,658,187</b>		<b>2,532,566</b>

Note: See Table 2.2.1-7 for an explanation of the footnotes.

**Table 2.2.1-9 (Visitors)  
Person-Trips of Visitors Who Boated  
And Visitors Who Used the Reefs Over the Past 12 Months  
June 2000 to May 2001**

County	Year Round - June 2000 to May 2001		
	Total Person Trips – All Visitors	Boating Person Trips	Boating Person Trips When the Reefs Were Used for Recreation
Palm Beach	4,251,341	636,734	622,637
Broward	9,403,006	1,813,816	1,800,537
Miami-Dade	12,613,645	2,612,337	2,384,185
Monroe	3,109,397	915,257	820,539
<b>Total</b>	<b>29,377,389</b>	<b>5,978,144</b>	<b>5,627,898</b>

Next, the total number of person-days that visitor boaters who used the reefs spent visiting the county was estimated. This estimate is the total boating person-trips when reefs were used times the average days per visit by boaters who use the reefs. The average days per visit by boaters who used the reefs was obtained from the answers to Question 10 of the Visitor Boater Survey (How many nights are you spending on this trip?) where a 1 was added to each answer to represent number of days. The average number of days and the total person days reef users spent in the county in 2000-2001 are provided in Table 2.2.1-10 for each county.

**Table 2.2.1-10 (Visitors)  
Average Number of Days Visiting County  
And Total Person-Days in County  
By Visitor Boaters Who Used the Reefs**

County	Average Days Visiting the County Per Trip	Total Person-Days Spent Visiting the County
Palm Beach	5.36	3,336,923
Broward	8.47	15,252,053
Miami-Dade	7.58	18,068,870
Monroe	8.39	6,887,497
<b>Total</b>		<b>43,545,343</b>

To allocate the total person-days spent visiting the county to actual days using the artificial and natural reefs, the daily participation rates of the different boating activities were calculated using the responses to Questions 12, 15, 16 and 17 of the Visitor Boater Survey. Participation rate is the proportion of total days that respondents spent in the county in the last 12 months when the respondent actually participated in a saltwater activity and boat mode. It represents the probability that a visitor boater who uses the reefs will participate in a particular saltwater boating activity and boating mode on any given day.

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Question 12 asked the respondent to examine a list of saltwater boating activities and boat modes and read the number corresponding to the activity-boat mode that he/she or someone in his/her party participated in over the past 12 months. The saltwater activity-boat mode list is provided in Appendix B with the Visitor Boater Survey. Question 13 asked if the respondent participated in the activity and boating mode. Question 15 asked how many days in the past 12 months that the respondent participated in the activity-boat mode. From the responses to these questions, the proportions of total visiting days respondents actually spent participating in the activity-boat mode were obtained.

To allocate the total number of days in an activity-boat mode to the use of artificial reefs versus natural reefs versus no reefs, the proportion of fishing days and the proportion of dives spent on each reef/no reef was calculated from the Visitor Boater Survey responses. Question 16 asked the respondent how many days he/she spent on the artificial reef and Question 17 asked the respondent how many days he/she spent on the natural reef. For scuba divers and snorkelers, Question 18 asked for the total number of dives and Questions 19 and 20 asked for the number of dives on artificial versus natural reefs. A dive is defined as exiting and reentering the boat and applies to both divers and snorkelers. From the responses to these questions, the proportions of fishing days spent on the artificial and natural reefs and the proportions of dives spent on the artificial and natural reefs were obtained. For fishing charter and party boats, the proportion of days spent on artificial versus natural versus no reefs was taken from the fishing-related responses to the charter/party boat operator survey.

The proportions of visitor days that visitor boaters who use the reefs participated in fishing and diving/snorkeling are presented in Tables 2.2.1-11 and 2.2.1-12. These tables also provide the proportion of fishing days and scuba/snorkeling dives that visitor boaters spent on the artificial, natural and no reefs. For example, visitor boaters who came to Broward County to use the reefs spent 27 percent of their visiting days participating in saltwater fishing from either a charter, party, rental or private boat. Of these fishing days, 47 percent of days were spent fishing near artificial reefs, 52 percent of days were spent fishing near natural reefs and 1 percent of days were spent fishing near no reefs. In Palm Beach County, visitor boaters who came to the county to use the reefs spent 32 percent of their visiting days scuba diving or snorkeling. Of these diving/snorkeling days, 25 percent of days were spent on artificial reefs, 74 percent of days were spent on natural reefs, and 1 percent of days were spent on no reefs.

**Table 2.2.1-11 (Visitors)**  
**Percent of Visitor Person-Days That Reef-Using Boaters Went Saltwater Fishing**  
**And Percent of Fishing Days Spent on Artificial, Natural and No Reefs**  
**From Visitor Boater Survey**

County	Total Respondents	Percent of Visitor Days	Percent of Fishing Days on:			Sum of Proportions
			Artificial Reefs	Natural Reefs	No Reefs	
Palm Beach	490	10%	21%	45%	34%	100%
Broward	252	27%	47%	52%	1%	100%
Miami-Dade	339	22%	24%	61%	15%	100%
Monroe	1,392	26%	20%	40%	40%	100%

*Note: Boating Modes are Charter, Party, Rental, and Private (Own or Friend's) Boat.*

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.1-12 (Visitors)**  
**Percent of Visitor Person-Days That Reef-Using Boaters Went Scuba Diving or Snorkeling**  
**And Percent of Diving/Snorkeling Dives Spent on Artificial, Natural and No Reefs**  
**From Visitor Boater Survey**

County	Total Respondents	Percent of Visitor Days	Percent of Dives on:			
			Artificial Reefs	Natural Reefs	No Reefs	Sum of Proportions
Palm Beach	490	32%	25%	74%	1%	100%
Broward	252	22%	51%	48%	1%	100%
Miami-Dade	339	8%	32%	65%	3%	100%
Monroe	1,392	17%	16%	80%	4%	100%

*Note: Boating Modes are Charter, Party, Rental, and Private (Own or Friend's) Boat.*

The number of person-days spent in each saltwater boating activity-boat mode was estimated as the total person days reef-using boaters spent visiting the county in year 2000-2001 (from Table 2.2.1-10) times the proportion of visitor days that these visitors spent participating in each activity-boat mode. Then the number of person-days spent in each saltwater boating activity-boat mode was allocated to artificial and natural reefs based on either the proportion of days or the proportion of dives spent in that activity-boat mode on or near artificial versus natural reefs. Proportion of days was used for all activities except scuba diving and snorkeling where the proportion of dives was used to provide a more accurate indicator of reef use.

A summary of the total person-days that visitors spent participating in all activity-boat modes by type of reef is provided in Table 2.2.1-13. A summary of total person days visitors spent participating in each activity for each county is provided in Tables 2.2.1-14 through Tables 2.2.1-17. The total person-days visitors spent participating in all saltwater activities and boat modes by type of reef is provided in Tables 2.2.1-18 to 2.2.1-21 for each county.

**Table 2.2.1-13 (Visitors)**  
**Total Person-Days Visitors Spent on Artificial and Natural Reefs by County**  
**June 2000 to May 2001 (Millions)**

County	Number of Visitor Person Days on:		
	Artificial Reefs	Natural Reefs	All Reefs
Palm Beach	0.33	0.93	1.26
Broward	2.69	3.03	5.72
Miami-Dade	1.41	3.25	4.66
Monroe	0.48	1.60	2.08
All Counties	4.91	8.81	13.72

Visitors to the four counties spent about 14 million person-days on the reef systems of southeast Florida from June 2000 to May 2001. About 5 million of these days were spent on artificial reefs and about 9 million of these days were spent on natural reefs.



**Table 2.2.1-14 (Visitors)**  
**Number of Person-Days Spent Using Artificial and Natural Reefs**  
**By Recreation Activity – Palm Beach County**

Activity	Number of Person-Days		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	36,940	90,544	127,484
Scuba Diving	237,921	681,802	919,723
Fishing	55,252	158,329	213,580
Glass Bottom Boat Sightseeing	0	0	0
<b>Total</b>	<b>330,112</b>	<b>930,675</b>	<b>1,260,787</b>

**Table 2.2.1-15 (Visitors)**  
**Number of Person-Days Spent Using Artificial and Natural Reefs**  
**By Recreation Activity – Broward County**

Activity	Number of Person-Days		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	87,669	266,717	354,386
Scuba Diving	1,587,123	1,433,074	3,020,197
Fishing	1,003,641	1,289,745	2,293,386
Glass Bottom Boat Sightseeing	16,483	37,675	54,157
<b>Total</b>	<b>2,694,915</b>	<b>3,027,210</b>	<b>5,722,125</b>

**Table 2.2.1-16 (Visitors)**  
**Number of Person-Days Spent Using Artificial and Natural Reefs**  
**By Recreation Activity – Miami-Dade County**

Activity	Number of Person-Days		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	281,347	599,359	880,706
Scuba Diving	168,664	270,813	439,477
Fishing	959,302	2,363,723	3,323,024
Glass Bottom Boat Sightseeing	3,124	14,060	17,184
<b>Total</b>	<b>1,412,438</b>	<b>3,247,954</b>	<b>4,660,392</b>

**Table 2.2.1-17 (Visitors)**  
**Number of Person-Days Spent Using Artificial and Natural Reefs**  
**By Recreation Activity – Monroe County**

Activity	Number of Person-Days		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	121,778	641,218	762,996
Scuba Diving	75,632	282,336	357,967
Fishing	277,349	603,549	880,899
Glass Bottom Boat Sightseeing	3,636	71,363	75,000
<b>Total</b>	<b>478,395</b>	<b>1,598,467</b>	<b>2,076,862</b>

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**Table 2.2.1-18 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in Saltwater Boating Activities and Reef Use - June 2000 to May 2001**  
**Palm Beach County**

Activity	Boat Mode	Number of Person Days	Number of Person-Days on:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	34,171	6,276	27,895	0
	Rental	9,528	5,558	3,970	0
	Private	83,785	25,105	58,679	0
Scuba Diving	Charter/Party	795,460	179,124	607,859	8,477
	Rental	5,257	1,643	3,614	0
	Private	127,484	57,155	70,329	0
Fishing – Offshore / Trolling	Charter	39,428	5,399	18,221	15,808
	Party	73,270	10,032	33,861	29,377
	Rental	16,428	0	986	15,443
	Private	115,655	32,937	64,004	18,714
Fishing – Flats or Back Country	Charter/Party	329	0	0	329
	Rental	329	0	0	329
	Private	657	0	657	0
Fishing Bottom	Charter	18,071	2,474	8,351	7,245
	Party	32,200	4,409	14,881	12,910
	Rental	0	0	0	0
	Private	39,428	0	17,367	22,061
Viewing Nature and Wildlife	Glass Bottom Boat	0	0	0	0
	Back Country Excursion	986	0	0	986
	Rental	5,914	0	0	5,914
	Private	23,000	0	0	23,000
Personal Watercraft (jet skis, wave runners, etc.)	Rental	2,629	0	0	2,629
	Private	42,714	0	0	42,714
Sailing	Charter/Party	657	0	0	657
	Rental	1,314	0	0	1,314
	Private	34,171	0	0	34,171
Other Boating Activities	Charter/Party	4,929	0	0	4,929
	Rental	0	0	0	0
	Private	33,185	0	0	33,185
<b>Total Person-Days</b>		<b>1,540,978</b>	<b>330,112</b>	<b>930,675</b>	<b>280,190</b>

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**Table 2.2.1-19 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in Saltwater Boating Activities and Reef Use - June 2000 to May 2001**  
**Broward County**

Activity	Boat Mode	Number of Person Days	Number of Person-Days on:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	233,553	52,880	176,267	4,407
	Rental	0	0	0	0
	Private	125,239	34,789	90,450	0
Scuba Diving	Charter/Party	2,613,090	1,370,373	1,233,489	9,228
	Rental	176,011	88,006	88,006	0
	Private	240,323	128,745	111,579	0
Fishing – Offshore / Trolling	Charter	338,483	48,895	52,970	236,619
	Party	2,034,284	293,859	318,347	1,422,078
	Rental	0	0	0	0
	Private	1,133,919	471,151	637,970	24,797
Fishing – Flats or Back Country	Charter/Party	0	0	0	0
	Rental	0	0	0	0
	Private	88,006	29,335	44,298	0
Fishing Bottom	Charter	6,770	978	1,059	4,732
	Party	169,242	24,447	68,826	118,309
	Rental	0	0	0	0
	Private	301,250	134,976	166,274	0
Viewing Nature and Wildlife	Glass Bottom Boat	54,157	16,483	37,675	0
	Back Country Excursion	20,309	0	0	20,309
	Rental	10,154	0	0	10,154
	Private	74,466	0	0	74,466
Personal Watercraft (jet skis, wave runners, etc.)	Rental	13,539	0	0	13,539
	Private	176,011	0	0	176,011
Sailing	Charter/Party	0	0	0	0
	Rental	0	0	0	0
	Private	44,003	0	0	44,003
Other Boating Activities	Charter/Party	60,927	0	0	60,927
	Rental	3,385	0	0	3,385
	Private	10,154	0	0	10,154
<b>Total Person-Days</b>		<b>7,927,276</b>	<b>2,694,915</b>	<b>3,027,210</b>	<b>2,233,120</b>

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**Table 2.2.1-20 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in Saltwater Boating Activities and Reef Use - June 2000 to May 2001**  
**Miami-Dade County**

Activity	Boat Mode	Number of Person Days	Number of Person-Days on:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	144,205	51,231	79,692	13,282
	Rental	0	0	0	0
	Private	751,307	230,116	519,667	1,524
Scuba Diving	Charter/Party	142,763	25,318	102,677	14,769
	Rental	0	0	0	0
	Private	311,483	143,347	168,136	0
Fishing – Offshore / Trolling	Charter	288,410	93,657	114,974	79,778
	Party	501,833	162,964	200,056	138,814
	Rental	347,534	139,013	208,520	0
	Private	1,455,027	318,640	817,748	318,640
Fishing – Flats or Back Country	Charter/Party	1,442	0	0	1,442
	Rental	0	0	0	0
	Private	637,386	59,393	538,880	39,112
Fishing Bottom	Charter	18,747	6,088	7,473	5,186
	Party	233,612	75,862	93,129	64,620
	Rental	0	0	0	0
	Private	501,833	103,684	382,941	15,207
Viewing Nature and Wildlife	Glass Bottom Boat	18,747	3,124	14,060	1,562
	Back Country Excursion	0	0	0	0
	Rental	2,884	0	0	2,884
	Private	341,766	0	0	341,766
Personal Watercraft (jet skis, wave runners, etc.)	Rental	30,283	0	0	30,283
	Private	73,544	0	0	73,544
Sailing	Charter/Party	23,073	0	0	23,073
	Rental	7,210	0	0	7,210
	Private	235,054	0	0	235,054
Other Boating Activities	Charter/Party	46,146	0	0	46,146
	Rental	2,884	0	0	2,884
	Private	194,677	0	0	194,677
<b>Total Person-Days</b>		<b>6,311,847</b>	<b>1,412,438</b>	<b>3,247,954</b>	<b>1,651,455</b>

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**Table 2.2.1-21 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in Saltwater Boating Activities and Reef Use - June 2000 to May 2001**  
**Monroe County (Florida Keys)**

Activity	Boat Mode	Number of Person Days	Number of Person-Days on:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	269,479	13,413	250,701	5,365
	Rental	65,315	8,476	56,590	249
	Private	465,424	99,889	333,928	31,607
Scuba Diving	Charter/Party	119,816	17,678	99,738	2,401
	Rental	18,600	1,898	16,702	0
	Private	222,331	56,056	165,896	379
Fishing – Offshore / Trolling	Charter	93,863	4,779	41,190	47,894
	Party	110,300	5,616	48,403	56,281
	Rental	35,902	10,097	21,317	4,488
	Private	618,547	119,763	215,028	283,756
Fishing – Flats or Back Country	Charter/Party	18,167	0	0	18,167
	Rental	9,084	0	0	9,084
	Private	305,380	62,694	95,052	147,634
Fishing Bottom	Charter	21,195	1,079	9,301	10,815
	Party	24,223	1,233	10,630	12,360
	Rental	15,572	4,152	7,786	3,633
	Private	467,587	67,935	154,842	244,810
Viewing Nature and Wildlife	Glass Bottom Boat	80,454	3,636	71,363	5,455
	Back Country Excursion	15,572	0	0	15,572
	Rental	50,608	0	0	50,608
	Private	309,273	0	0	309,273
Personal Watercraft (jet skis, wave runners, etc.)	Rental	31,576	0	0	31,576
	Private	154,420	0	0	154,420
Sailing	Charter/Party	12,111	0	0	12,111
	Rental	3,028	0	0	3,028
	Private	18,167	0	0	18,167
Other Boating Activities	Charter/Party	17,735	0	0	17,735
	Rental	2,595	0	0	2,595
	Private	134,091	0	0	134,091
<b>Total Person-Days</b>		<b>3,710,416</b>	<b>478,395</b>	<b>1,598,467</b>	<b>1,633,554</b>

### 2.2.2 Economic Contribution – Visitors

The Visitor Boater Survey asked respondents how much money they and members of their party spent on their last day that they participated in fishing, scuba diving and snorkeling in the county. The respondent was also asked how many people spent or benefited from those expenditures. The respondent was asked only to provide the amount of money spent in the county of interview. From this information, a picture of the average itemized expenditures per person per fishing or diving day and by boating mode was estimated.

The average itemized per person expenditures by those who participated in the activity-boat mode are provided for each county in Tables 2.2.2-1 through 2.2.2-4. For example, Palm Beach County visitors who went scuba diving or snorkeling on charter or party boats spent, on average, \$138 per person per day. This expenditure was comprised of \$56 per day for the dive charter or party boat, \$21 per day for lodging and \$21 per day for food and beverages in restaurants and bars, among other items. As can be seen from Palm Beach County's daily expenditure table, visitors who fish via charter boats spent significantly more per person per day than visitors who dive or who fish via other boating modes. This also is the case for Miami-Dade and Monroe counties primarily due to the greater expense associated with renting a charter boat.

The lodging expenditure item includes lodging costs for hotels, motels and campgrounds or if the respondent paid by the day or by the week for the other accommodations. The \$21 per person per day for lodging may seem lower than the actual per person rate of a hotel or motel. Bear in mind that only a portion of visitors stay at a hotel or motel. Visitor accommodations also include campgrounds, family or friends, second homes and time shares. Also, as discussed previously, many visitors spend only one day in the county and therefore do not incur the cost of a room. The cost of the second home or time share is not included in the lodging cost because this is a monthly or up front cost that can, at best, only be partially due to the existence of the reefs.

The expenditures per person per day were multiplied by the number of person-days by boating mode and reef type to obtain an estimate of the total expenditures associated with reef related activities. The itemized total expenditures associated with reef use in 2000-2001 are provided in Tables 2.2.2-5 through 2.2.2-8 for each county. The expenditures associated with glass bottom boating days only included the fee per person per ride (\$20). The other expenditures associated with the entire day spent in the county were not included for glass bottom boat riders because these visitors are likely in the county for other reasons either not reef-related or included in the other reef-related recreational activities.

The reef-related visitor expenditures were then used to estimate the economic contribution of artificial and natural reefs to each of the counties. As discussed in the Introduction of the Report, 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 re-spent 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

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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.

**Table 2.2.2-1 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Palm Beach County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$96.00	\$24.41		\$56.26
Boat Rental				\$0.94	
Boat Fuel	\$58.84			\$38.40	
Air Refills				\$1.86	\$1.67
Tackle	\$28.21				
Bait	\$6.22				
Ice	\$1.96			\$1.56	\$0.06
Ramp Fees	\$4.80			\$15.12	\$0.01
Marina Fees	\$30.63			\$21.23	\$0.17
Lodging	\$7.36	\$28.68	\$17.84	\$1.72	\$20.60
Camping Fees	\$0.00	\$0.00	\$0.00	\$0.45	\$0.67
Food and Beverages - Stores	\$11.71	\$16.03	\$13.77	\$17.66	\$8.34
Food and Beverages - Restaurants/Bars	\$23.12	\$33.54	\$29.74	\$19.39	\$21.54
Auto Gas	\$3.85	\$30.70	\$2.89	\$3.36	\$8.24
Auto Rental	\$8.99	\$29.29	\$10.69	\$5.80	\$9.12
Equipment Rental	\$1.73	\$0.00	\$4.97	\$0.50	\$2.09
Shopping	\$7.99	\$28.88	\$11.20	\$9.39	\$9.68
Total	\$195.42	\$263.13	\$115.50	\$137.37	\$138.48
Number of Respondents	47	19	78	42	314
Number of Respondents and Party Members <sup>c</sup>	152	51	176	137	718

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity\_Mode, the expenditures for each item were summed over all the respondents who participated in the Activity\_Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.

**Table 2.2.2-2 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Broward County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$58.88	\$29.29		\$68.09
Boat Rental				\$0.86	
Boat Fuel	\$18.52			\$18.13	
Air Refills				\$1.00	\$1.91
Tackle	\$1.29				
Bait	\$4.80				
Ice	\$1.76			\$1.31	\$0.10
Ramp Fees	\$0.20			\$3.44	\$0.05
Marina Fees	\$0.98			\$2.91	\$0.00
Lodging	\$11.64	\$19.29	\$22.30	\$11.19	\$33.97
Camping Fees	\$0.16	\$0.00	\$0.00	\$0.00	\$0.78
Food and Beverages - Stores	\$13.96	\$17.57	\$11.54	\$14.66	\$10.40
Food and Beverages - Restaurants/Bars	\$17.11	\$45.89	\$50.65	\$14.93	\$36.54
Auto Gas	\$6.07	\$6.09	\$10.93	\$8.74	\$5.56
Auto Rental	\$3.16	\$13.81	\$12.57	\$0.00	\$12.78
Equipment Rental	\$0.00	\$0.00	\$1.92	\$0.00	\$2.24
Shopping	\$13.47	\$40.11	\$30.04	\$13.53	\$73.15
Total	\$93.12	\$201.65	\$169.24	\$90.70	\$245.56
Number of Respondents	43	53	27	19	127
Number of Respondents and Party Members <sup>c</sup>	136	147	54	58	306

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity\_Mode, the expenditures for each item were summed over all the respondents who participated in the Activity\_Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.



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**Table 2.2.2-3 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Miami-Dade County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$75.26	\$30.47		\$30.50
Boat Rental				\$6.80	
Boat Fuel	\$38.28			\$17.12	
Air Refills				\$6.38	\$2.04
Tackle	\$4.72				
Bait	\$2.53				
Ice	\$2.02			\$2.06	\$0.15
Ramp Fees	\$1.93			\$1.57	\$0.00
Marina Fees	\$1.25			\$6.71	\$2.84
Lodging	\$0.00	\$46.36	\$40.15	\$3.59	\$20.15
Camping Fees	\$0.52	\$0.11	\$0.11	\$0.75	\$0.19
Food and Beverages - Stores	\$21.22	\$16.41	\$13.98	\$16.83	\$6.87
Food and Beverages - Restaurants/Bars	\$14.54	\$33.96	\$40.34	\$10.79	\$22.23
Auto Gas	\$6.17	\$6.98	\$8.01	\$7.45	\$4.54
Auto Rental	\$8.25	\$15.72	\$22.16	\$1.47	\$14.79
Equipment Rental	\$1.13	\$0.00	\$2.18	\$1.65	\$1.56
Shopping	\$11.61	\$30.10	\$36.86	\$4.26	\$19.45
<b>Total</b>	<b>\$114.17</b>	<b>\$224.90</b>	<b>\$194.24</b>	<b>\$87.42</b>	<b>\$125.30</b>
Number of Respondents	89	71	69	47	76
Number of Respondents and Party Members <sup>c</sup>	289	228	186	147	291

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity\_Mode, the expenditures for each item were summed over all the respondents who participated in the Activity\_Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.

**Table 2.2.2-4 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Monroe County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$95.17	\$40.88		\$44.33
Boat Rental				\$8.03	
Boat Fuel	\$27.51			\$12.70	
Air Refills				\$1.46	\$1.66
Tackle	\$6.85				
Bait	\$5.71				
Ice	\$3.86			\$2.74	\$0.17
Ramp Fees	\$1.09			\$1.26	\$0.00
Marina Fees	\$6.34			\$3.48	\$2.06
Lodging	\$21.12	\$49.59	\$38.67	\$36.67	\$42.46
Camping Fees	\$10.76	\$11.57	\$2.96	\$11.43	\$4.92
Food and Beverages - Stores	\$21.31	\$17.51	\$13.08	\$18.82	\$11.75
Food and Beverages - Restaurants/Bars	\$22.21	\$58.88	\$32.56	\$22.50	\$30.68
Auto Gas	\$8.21	\$6.63	\$3.56	\$7.21	\$4.55
Auto Rental	\$2.83	\$14.80	\$4.49	\$4.47	\$8.52
Equipment Rental	\$2.08	\$1.18	\$0.63	\$0.44	\$2.69
Shopping	\$16.68	\$29.68	\$30.73	\$11.03	\$19.11
Total	\$156.57	\$284.99	\$167.57	\$142.23	\$172.89
Number of Respondents	368	126	171	342	544
Number of Respondents and Party Members <sup>c</sup>	1,468	394	484	1,463	1,888

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity\_Mode, the expenditures for each item were summed over all the respondents who participated in the Activity\_Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.2-5 (Visitors)**  
**Total Visitor Expenditures In Palm Beach County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	330,112	930,675	1,260,787
Charter / Party Boat Fee	\$11,539,154	\$39,509,116	\$51,048,270
Boat Rental	84,080	128,377	212,457
Boat Fuel	5,373,044	10,129,360	15,502,404
Air Refills	476,896	1,318,351	1,795,247
Tackle	929,222	2,341,949	3,271,170
Bait	204,837	516,259	721,096
Ice	215,386	414,936	630,322
Ramp Fees	1,512,441	2,470,091	3,982,532
Marina Fees	2,939,896	5,550,829	8,490,725
Lodging	4,699,409	15,575,573	20,274,983
Camping Fees	165,415	490,450	655,865
Food and Beverages - Stores	3,836,933	9,783,741	13,620,674
Food and Beverages - Restaurants/Bars	7,183,784	20,604,786	27,788,570
Auto Gas	2,238,482	6,974,355	9,212,837
Auto Rental	2,891,652	8,638,760	11,530,413
Equipment Rental	561,319	1,784,856	2,346,175
Shopping	3,287,962	9,415,881	12,703,843
Glass Bottom Boat Ride	0	0	0
<b>Total</b>	<b>\$48,139,911</b>	<b>\$135,647,670</b>	<b>\$183,787,582</b>

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.2-6 (Visitors)**  
**Total Visitor Expenditures In Broward County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	2,694,915	3,027,210	5,722,125
Charter / Party Boat Fee	\$109,166,167	\$110,508,817	\$219,674,984
Boat Rental	216,844	250,030	466,873
Boat Fuel	16,326,072	20,969,451	37,295,524
Air Refills	2,963,161	2,975,942	5,939,103
Tackle	817,690	1,091,875	1,909,565
Bait	3,051,152	4,074,253	7,125,405
Ice	1,593,185	2,017,408	3,610,593
Ramp Fees	1,060,145	1,235,500	2,295,644
Marina Fees	1,352,237	1,672,381	3,024,618
Lodging	66,625,405	70,694,385	137,319,791
Camping Fees	1,219,072	1,242,955	2,462,027
Food and Beverages - Stores	31,911,169	36,176,792	68,087,961
Food and Beverages - Restaurants/Bars	85,044,260	92,450,853	177,495,113
Auto Gas	17,753,895	20,087,351	37,841,245
Auto Rental	24,887,396	26,310,827	51,198,222
Equipment Rental	3,793,516	3,895,783	7,689,299
Shopping	127,637,167	132,276,824	259,913,991
Glass Bottom Boat Ride	329,653	753,493	1,083,146
<b>Total</b>	<b>\$495,748,186</b>	<b>\$528,684,919</b>	<b>\$1,024,433,105</b>

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.2-7 (Visitors)**  
**Total Visitor Expenditures In Miami-Dade County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	1,412,438	3,247,954	4,660,392
Charter / Party Boat Fee	\$17,118,148	\$23,710,254	\$40,828,402
Boat Rental	2,540,565	4,678,931	7,219,496
Boat Fuel	30,156,338	86,350,800	116,507,138
Air Refills	2,538,890	4,760,334	7,299,223
Tackle	2,932,339	9,202,805	12,135,144
Bait	1,570,737	4,929,575	6,500,312
Ice	2,035,146	5,381,221	7,416,367
Ramp Fees	1,782,445	4,834,576	6,617,021
Marina Fees	3,496,104	7,559,320	11,055,423
Lodging	17,096,751	23,592,903	40,689,654
Camping Fees	651,817	1,602,569	2,254,386
Food and Beverages - Stores	24,957,770	60,274,523	85,232,293
Food and Beverages - Restaurants/Bars	27,777,276	55,785,655	83,562,932
Auto Gas	9,568,144	21,174,183	30,742,328
Auto Rental	13,659,366	28,193,581	41,852,947
Equipment Rental	1,958,101	4,261,687	6,219,788
Shopping	22,089,926	43,581,942	65,671,868
Glass Bottom Boat Ride	62,489	281,199	343,688
<b>Total</b>	<b>\$181,992,354</b>	<b>\$390,156,057</b>	<b>\$572,148,411</b>

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.2-8 (Visitors)**  
**Total Visitor Expenditures In Monroe County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	478,395	1,598,467	2,076,862
Charter / Party Boat Fee	\$2,215,748	\$22,752,503	\$24,968,251
Boat Rental	1,335,356	4,601,477	5,936,833
Boat Fuel	9,391,142	20,866,226	30,257,368
Air Refills	294,492	1,417,735	1,712,226
Tackle	1,812,737	3,383,970	5,196,707
Bait	1,510,516	2,819,792	4,330,308
Ice	1,483,748	3,539,523	5,023,271
Ramp Fees	498,254	1,261,038	1,759,293
Marina Fees	2,321,536	5,850,565	8,172,101
Lodging	13,562,993	51,114,784	64,677,777
Camping Fees	4,989,991	14,348,964	19,338,955
Food and Beverages - Stores	9,326,234	27,085,778	36,412,012
Food and Beverages - Restaurants/Bars	11,142,883	39,515,821	50,658,705
Auto Gas	3,575,394	10,323,454	13,898,848
Auto Rental	1,875,831	7,959,339	9,835,170
Equipment Rental	718,651	2,319,993	3,038,643
Shopping	7,228,354	24,573,805	31,802,159
Glass Bottom Boat Ride	72,727	1,427,269	1,499,996
<b>Total</b>	<b>\$73,356,586</b>	<b>\$245,162,036</b>	<b>\$318,518,623</b>

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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The direct, indirect and induced increase in sales, total income, employment and indirect business taxes generated by the reef-related expenditures were estimated for Palm Beach, Broward and Miami-Dade counties using the IMPLAN Regional Input-Output Model. This model uses detailed data on the economies of these counties to estimate economic multipliers and to model the impact of reef-related expenditures on the economy.

For Monroe County, a different approach was used because of concern that the IMPLAN model does not adequately capture the unique economy of this county. Relative to other counties in the nation, this economy is very dependent on imports and heavily dependent on one industry, tourism. Therefore, the approach used in Leeworthy (1996) was used. This approach utilized several ratios on economic measures for Monroe County derived from data published by the U.S. Census (1997 Economic Census) and the Bureau of Economic Analysis. These ratios included (1) wage-to-sales ratio, (2) wages-to-employment ratio, (3) total income-to-wage and salaries ratio, and (4) proprietor's income-to-proprietor's employment ratio. These ratios were multiplied by the total visitor expenditures associated with reef-related activities to estimate total direct sales, direct income and direct employment due to these activities. The analysis then utilized sales (1.6), income (1.6) and employment (1.6) multipliers taken from a recent Monroe County economic study (Leeworthy, 1996) to estimate total (direct, indirect and induced) contributions to sales, income and employment from visitor expenditures associated with reef related activities. This method provides estimates of total direct, indirect and induced economic contributions for Monroe County and cannot provide a breakdown of direct versus indirect versus induced effects.

The economic contribution of the reefs to each of the counties is provided in Tables 2.2.2-9 through 2.2.2-12. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. Income is the money that stays in the county's economy. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures. The indirect business tax contribution is the sum of the additional excise taxes, property taxes, fees, licenses, and sales taxes collected due to the reef-related expenditures.

Each table represents the economic contribution to the county as visitors to that county spend money in the county to use the reefs. The economic contributions cannot be summed over the four counties to get the total contribution of the reefs to southeast Florida. Instead, the expenditures of visitor reef users to southeast Florida would have to be estimated wherein a visitor comes from outside the four county area. In this study, each county's visitors were evaluated on a county-by-county basis, so that a visitor in Palm Beach County could be a resident of Broward County. If the expenditures of all four counties reported in this study were added together and then input into the IMPLAN model to estimate the economic contribution to southeast Florida, the reported economic contribution of the reefs would be overestimated. This is because southeast Florida resident expenditures would be included in the multiplier effects.

2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.2-9 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Palm Beach County**  
**Economic Area is Palm Beach County**  
**June 2000 to May 2001 – In 2000 dollars**

Reef Type/Economic Contribution	Direct	Indirect	Induced	Total
<b>Artificial Reefs</b>				
Sales	\$48,139,911	\$13,615,865	\$19,410,419	\$81,166,195
Total Income	\$25,033,935	\$7,408,596	\$12,211,129	\$44,653,660
Employment	849	142	253	1,244
Indirect Business Taxes	\$4,087,804	\$754,643	\$1,210,601	\$6,053,048
<b>Natural Reefs</b>				
Sales	\$135,647,661	\$37,909,019	\$54,627,400	\$228,184,080
Total Income	\$72,055,317	\$20,844,992	\$34,328,471	\$127,228,780
Employment	2,439	401	712	3,552
Indirect Business Taxes	\$11,220,086	\$2,152,321	\$3,417,124	\$16,789,531
<b>Natural and Artificial Reefs</b>				
Sales	\$183,787,572	\$51,524,884	\$74,037,819	\$309,350,275
Total Income	\$97,089,252	\$28,253,588	\$46,539,600	\$171,882,440
Employment	3,288	543	965	4,796
Indirect Business Taxes	\$15,307,890	\$2,906,964	\$4,627,725	\$22,842,579

**Table 2.2.2-10 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Broward County**  
**Economic Area is Broward County**  
**June 2000 to May 2001 – In 2000 dollars**

Reef Type/Economic Contribution	Direct	Indirect	Induced	Total
<b>Artificial Reefs</b>				
Sales	\$493.3	\$136.67	\$241.11	\$871.08
Total Income	\$264.67	\$75.01	\$149.75	\$489.43
Employment	11,155	1,548	3,306	16,009
Indirect Business Taxes	\$46.87	\$7.87	\$15.11	\$69.85
<b>Natural Reefs</b>				
Sales	\$526.11	\$145.52	\$257.48	\$929.11
Total Income	\$282.27	\$79.75	\$159.93	\$521.95
Employment	11,814	1,645	3,530	16,989
Indirect Business Taxes	\$50.15	\$8.37	\$16.13	\$74.69
<b>Natural and Artificial Reefs</b>				
Sales	\$1,019.41	\$282.18	\$498.59	\$1,800.19
Total Income	\$546.97	\$154.76	\$309.67	\$1,011.37
Employment	22,969	3,193	6,837	32,999
Indirect Business Taxes	\$97.02	\$16.23	\$31.24	\$144.49



## 2.0 Socioeconomic Value of Reefs in Southeast Florida

**Table 2.2.2-11 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Miami-Dade County**  
**Economic Area is Miami-Dade County**  
**June 2000 to May 2001 – In 2000 dollars**

Reef Type/Economic Contribution	Direct	Indirect	Induced	Total
<b>Artificial Reefs</b>				
Sales	\$181,992,354	\$50,373,237	\$91,522,054	\$323,887,645
Total Income	\$98,068,036	\$26,955,522	\$56,811,301	\$181,834,859
Employment	3,532	520	1,214	5,266
Indirect Business Taxes	\$18,462,677	\$2,954,424	\$5,467,652	\$26,884,753
<b>Natural Reefs</b>				
Sales	\$390,156,057	\$106,631,671	\$200,284,701	\$697,072,429
Total Income	\$211,942,283	\$56,642,529	\$124,502,414	\$393,087,226
Employment	7,462	1,087	2,662	11,211
Indirect Business Taxes	\$41,647,111	\$6,178,534	\$11,923,603	\$59,749,248
<b>Natural and Artificial Reefs</b>				
Sales	\$572,148,411	\$157,004,908	\$291,806,755	\$1,020,960,074
Total Income	\$310,010,319	\$83,598,051	\$181,313,715	\$574,922,085
Employment	10,994	1,607	3,876	16,477
Indirect Business Taxes	\$60,109,788	\$9,132,958	\$17,391,255	\$86,634,001

**Table 2.2.2-12 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Monroe County**  
**Economic Area is Monroe County**  
**June 2000 to May 2001 – In 2000 dollars**

	Artificial Reefs	Natural Reefs	Total
Total Sales	\$82,159,376	\$274,581,481	\$356,740,857
Total Income	\$26,695,085	\$94,168,665	\$120,863,750
Total Employment	1,916	6,737	8,653

### 2.2.3 Use Value

Use value was defined in the introduction to this report. In this study, four types of use values were estimated: (1) the value of maintaining the natural reefs in their existing condition; (2) the value of maintaining the artificial reefs in their existing condition; (3) the value of maintaining both artificial and natural reefs in their existing condition; and (4) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value is measured in terms of per party per trip for existing natural and artificial reefs, and per party per year for new artificial reefs. For presentation, values were normalized to values per person-day of reef use so they can be compared with the results of other studies. Use value is also presented in aggregate for all users of the reef system.

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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The visitor reef-user values associated with maintaining the reefs in their existing conditions for each county is provided in Table 2.2.3-1. Use value per person day means the value per person day of artificial, natural or all reef use, as specified in the table. Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs.” Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition.

A logit model was used on all the visitor data pooled across all four counties and the two seasons (e.g., summer and winter). The logit model was used to test for differences by county, season, activity-boat mode, type of reef used (e.g., natural or artificial), and various user characteristics such as, household income, age of respondent, race/ethnicity, sex, boat ownership, years of boating experience in South Florida and whether the respondent was a member of a fishing or diving club.

Separate models were estimated for each of the four reef programs (e.g., natural reefs, existing artificial reefs, natural and artificial reefs combined, and new artificial reefs and maintenance). For all four reef programs, significant differences were found by county. On both a per party per trip and per person-trip basis, Miami-Dade County had the lowest values for all four reef programs. In order from lowest to highest values were Miami-Dade, Palm Beach, Broward and Monroe.

Significant differences were also found by activity-boat modes, but these differences were dependent on reef type and county. For natural reefs, there were no differences that could be identified for Miami-Dade County. For Palm Beach and Broward counties, scuba divers from charter/party boats had significantly higher values than users from all other activity-boat modes. For Monroe County, snorkelers from private/rental boats and scuba divers from charter/party boats had higher values than users of all other activity-boat modes.

For existing artificial reefs, there were no differences found by activity-boat modes for Miami-Dade, Palm Beach and Broward counties. For Monroe County, differences were found for snorkelers from private/rental boats and for those who bottom fished from private/rental boats. These latter user groups were, holding all other factors constant, willing to pay more than those who participated in other activity-boat modes.

For the combined natural and artificial reef program, there were no differences found among activity-boat modes in Miami-Dade County. For Palm Beach and Broward counties, scuba divers from charter/party boats were willing to pay more than those who participated in other activity-boat modes. For Monroe County, snorkelers from private/rental boats, scuba divers

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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from charter/party boats, and those who participated in bottom fishing from private/rental boats had higher willingness to pay than those who participated in other activity-boat modes.

For the new artificial reefs, there were no differences found among the different activity-boat modes in Miami-Dade County. For Palm Beach, Broward and Monroe counties, scuba divers from charter/party boats had a higher willingness to pay than those who participated in all other activity-boat modes.

Season was a significant factor in all estimated models. Summer season visitors had significantly lower willingness to pay than winter season visitors. This influenced our decision on how to calculate total annual value. We calculated separate total values for the summer and winter seasons and then added them together to get annual values.

Household income was a significant factor in all of the estimated logit models. The higher the household income levels, the higher the willingness to pay. Race/ethnicity was mixed. There were no significant differences for Hispanic visitors. Whites (95 percent of the visitors) had higher willingness to pay for natural reefs, existing artificial reefs and the combination of natural and artificial reefs, but being white was not significant for new artificial reefs.

Sex was only significant for existing artificial reefs. Males (74 percent of the sample reef users) had higher willingness to pay than female reef users. Boat ownership was significant for existing artificial reefs and for the combined natural and artificial reef programs. Boat owners had higher willingness to pay than non-boat owners, holding all other factors constant, for these two programs.

For all other factors tested, there were no significant differences in willingness-to-pay for any of the four programs. These factors included age, years of experience in South Florida boating and membership in a fishing or diving club.

The logit model was used to estimate the values per party per trip for each of the sampled users for each reef type program. For new artificial reefs, this required an additional calculation because the question asked for a yearly amount instead of an amount per trip. For new artificial reefs, we divided the per party per year estimate by the number of trips that the person made to South Florida on which they used artificial reefs over the past 12 months. We then estimated separate sample averages for each county, Season and Activity-boat mode for which there were significant differences. These values per party per trip were then divided by the average party size (number of people who benefited from or incurred the trip expenses) by county and activity-boat mode to get estimates of willingness to pay per person-trip.

To estimate annual user values, the values per person-trip were multiplied by the estimates of the number of person-trips by county, Season and Activity-boat mode. Although we present the more aggregated results here, the details are provided in the Technical Appendix to this report.

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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User value per person-day was derived by simply dividing the total annual user value by the relevant number of total annual person-days. Again, the value per person-day is a standardized measure that can be compared with results from other studies.

The results are consistent with the idea that natural reefs are more valuable than artificial reefs. Across all four counties, natural reefs were valued by visitors at \$16.85 per person-day versus \$14.26 per person-day for artificial reefs. Numbers of person-days of reef use were also higher for natural versus artificial reefs. This translates into an estimated \$148 million in annual use value for the natural reefs versus \$70 million for the artificial reefs.

Visitor reef users in Palm Beach County are willing to pay \$21 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor reef users are willing to pay \$6 million to protect the artificial reefs and \$26 million to protect the natural reefs.

Visitor reef users in Broward County are willing to pay \$113 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor reef users are willing to pay \$52 million to protect the artificial reefs and \$64 million to protect the natural reefs.

Visitor reef users in Miami-Dade County are willing to pay \$33 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor reef users are willing to pay \$6 million to protect the artificial reefs and \$23 million to protect the natural reefs.

Visitor reef users in Monroe County are willing to pay \$39 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor reef users are willing to pay \$6 million to protect the artificial reefs and \$36 million to protect the natural reefs.

The sum of the values for the individual reef programs can be different from the value for the combined programs. This is because some respondents are not willing to pay the sum of the individual program values to finance the combined programs. This is probably due to income constraints as higher bid values are provided to the respondents. So bear in mind that willingness to pay for the combined programs is a completely different scenario from willingness to pay for the individual programs.

The capitalized value of the reef user values is the present value of the annual values calculated at three percent discount rate. It represents the “stock” value analogous to land market values. The capitalized visitor reef user value for all southeast Florida reefs is \$6.9 billion. Bear in mind

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that this value only includes the value that visitor reef users place on the reefs and does not include the values that resident reef users and non-reef-users place on the reefs or the economic contribution of the reefs. The estimation of the value of reefs to non-reef users was not part of this study.

Reef users' willingness to pay to invest in and maintain "new" artificial reefs is provided in Table 2.2.3-2. The use value per person-day is the value per day or a portion of a day of artificial reef use. In Palm Beach County, reef users are willing to pay \$4 million annually for this program in Palm Beach county. Broward County reef users are willing to pay \$15 million per year while Miami-Dade County reef users are willing to pay \$3.6 million per year. Monroe County reef users are willing to pay \$1.7 million annually per year to fund this program in Monroe County.

**Table 2.2.3-1 (Visitors)  
Annual Use Value From June 2000 to May 2001 and Capitalized Value associated With Reef Use  
Visitor Reef-Users by County**

<b>Item</b>	<b>Palm Beach County</b>	<b>Broward County</b>	<b>Miami-Dade County</b>	<b>Monroe County</b>	<b>Total</b>
<b>All Reefs - Artificial and Natural</b>					
Number of Person-Days of Reef Use	1,260,787	5,722,125	4,660,392	2,076,862	<b>13,720,166</b>
Use Value Per Person-Day of Reef Use	\$16.68	\$19.92	\$7.01	\$17.19	<b>\$15.04</b>
Annual Use Value in Million Dollars	\$21.03	\$113.98	\$32.65	\$38.67	<b>\$206.34</b>
Capitalized Value @ 3 percent Discount Rate in Billion Dollars	\$0.7	\$3.8	\$1.1	\$1.3	<b>\$6.9</b>
<b>Artificial Reefs</b>					
Number of Person-Days of Artificial Reef Use	330,112	2,694,915	1,412,438	478,395	<b>4,915,860</b>
Use Value Per Person-Day	\$17.89	\$19.39	\$4.31	\$12.23	<b>\$14.26</b>
Annual Use Value in Million Dollars	\$5.91	\$52.26	\$6.08	\$5.85	<b>\$70.10</b>
Capitalized Value @ 3 percent Discount Rate in Billion Dollars	\$0.2	\$1.7	\$0.2	\$0.2	<b>\$2.3</b>
<b>Natural Reefs</b>					
Number of Person-Days of Natural Reef Use	930,675	3,027,210	3,247,954	1,598,467	<b>8,804,306</b>
Use Value Per Person-Day	\$27.85	\$21.04	\$7.09	\$22.35	<b>\$16.85</b>
Annual Use Value in Million Dollars	\$25.92	\$63.70	\$23.01	\$35.72	<b>\$148.35</b>
Capitalized Value @ 3 percent Discount Rate in Billion Dollars	\$0.8	\$2.1	\$0.8	\$1.2	<b>\$4.9</b>

**Table 2.2.3-2 (Visitors)**  
**Estimated Use Value of Investing in and Maintaining "New" Artificial Reefs**  
**Visitor Reef-Users by County**

<b>Item</b>	<b>Palm Beach County</b>	<b>Broward County</b>	<b>Miami-Dade County</b>	<b>Monroe County</b>	<b>Total</b>
Number of Person-Days of Artificial Reef Use	330,112	2,694,915	1,412,438	478,395	4,915,860
Use Value Per Person-Day for "New" Artificial Reefs	\$12.01	\$5.55	\$2.57	\$3.60	\$4.94
Annual Use Values for "New" Artificial Reefs in Million Dollars	\$4.00	\$14.94	\$3.63	\$1.72	\$24.26
Capitalized Value @ 3 percent Discount Rate in Million Dollars	\$132.15	\$498.15	\$120.89	\$57.48	\$808.67

*Note: Use value per person-day is use value per day or portion of a day of artificial reef use.*

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### 2.2.4 Demographic Information

The Visitor Boater Survey asked the respondent questions regarding his/her socioeconomic characteristics so that a picture of the typical reef user could be developed. The results for each county are summarized in Table 2.2.4-1.

**Table 2.2.4-1 (Visitors)  
Demographic Characteristics of Visitor Reef-Users in Southeast Florida, 2000**

Characteristic	Palm Beach County	Broward County	Miami-Dade County	Monroe County
Median Age of Respondent – Years	41	39	41	44
Sex of Respondent				
Male	79%	77%	75%	70%
Female	21%	23%	25%	30%
Race of Respondent				
White	94%	89%	83%	95%
Black	2%	7%	7%	2%
Other	4%	4%	10%	3%
Percent Hispanic / Latino	5%	13%	29%	8%
Median Household Income	\$87,500	\$87,500	\$55,000	\$87,500
Average Years Boating in Southeast Florida	9.2	6.7	6.7	7.4
Average Length of Own Boat Used in Saltwater Boating in Feet	25	27	26	22
Percent of Respondents Who Belong to Fishing and/or Diving Clubs	24%	12%	6%	11%

### 2.3 Total – Residents and Visitors

This section summarizes the user activities, economic contribution and use values associated with the artificial and natural reefs of southeast Florida for both residents and visitors. Demographic information of both resident and visitor reef users is also provided.

#### 2.3.1 User Activity

The numbers of person-days spent using the reefs in southeast Florida by county, reef type and population (residents and visitors) are summarized in Table 2.3.1-1. Visitors and residents spent 28 million person-days using artificial and natural reefs in southeast Florida during the 12-month period from June 2000 to May 2001. Residents spent 14.2 million person-days and visitors spent 13.7 million person-days. Reef users spent 10 million person-days using artificial reefs



## 2.0 Socioeconomic Value of Reefs in Southeast Florida

and 18 million person-days using natural reefs. A summary of reef use by type of activity is provided in Table 2.3.1-2.

**Table 2.3.1-1  
Number of Person-Days Spent on Artificial and Natural Reefs in Southeast Florida  
Residents and Visitors By County (in millions)**

Population	Palm Beach County			Broward County		
	Artificial Reefs	Natural Reefs	All Reefs	Artificial Reefs	Natural Reefs	All Reefs
Residents	1.08	1.90	2.98	1.28	2.44	3.72
Visitors	0.33	0.93	1.26	2.70	3.02	5.72
Total	1.41	2.83	4.24	3.98	5.46	9.44

Population	Miami-Dade County			Monroe County		
	Artificial Reefs	Natural Reefs	All Reefs	Artificial Reefs	Natural Reefs	All Reefs
Residents	1.54	2.97	4.51	0.99	2.04	3.03
Visitors	1.41	3.25	4.66	0.48	1.60	2.08
Total	2.95	6.22	9.17	1.47	3.64	5.11

Population	Southeast Florida		
	Artificial Reefs	Natural Reefs	All Reefs
Residents	4.89	9.35	14.24
Visitors	4.92	8.80	13.72
Total	9.81	18.15	27.96

**Table 2.3.1-2**  
**Number of Person-Days Spent Using Reefs in Southeast Florida By Recreational Activity**  
**Residents and Visitors By County (in millions)**

Population	Palm Beach County			Broward County		
	Residents	Visitors	Total	Residents	Visitors	Total
Snorkeling	0.62	0.13	0.74	0.73	0.35	1.09
Scuba Diving	0.81	0.92	1.73	0.83	3.02	3.85
Fishing	1.55	0.21	1.76	2.15	2.29	4.45
Glass Bottom Boats	-	0	0	-	0.05	0.05
Total	2.98	1.26	4.23	3.71	5.71	9.44

Population	Miami-Dade County			Monroe County		
	Residents	Visitors	Total	Residents	Visitors	Total
Snorkeling	1.23	0.88	2.11	0.99	0.76	1.75
Scuba Diving	0.70	0.44	1.14	0.48	0.36	0.83
Fishing	2.58	3.32	5.90	1.56	0.88	2.45
Glass Bottom Boats	-	0.02	0.02	-	0.08	0.08
Total	4.51	4.66	9.17	3.03	2.08	5.11

Population	Southeast Florida		
	Residents	Visitors	Total
Snorkeling	3.57	2.13	5.69
Scuba Diving	2.82	4.73	7.55
Fishing	7.85	6.71	14.56
Glass Bottom Boats	-	0.15	0.15
Total	14.24	13.72	27.95
<i>Note: Residents were not asked about their participation in glass bottom boat sightseeing.</i>			

Overall, fishing activity on the reefs appears to dominate when snorkeling and scuba diving are compared separately. When snorkeling and scuba diving are considered together as diving activities, diving and fishing contribute about equally to total reef use in southeast Florida.

### 2.3.2 Economic Contribution

The total economic contribution of the reefs to each county includes the contribution of reef expenditures to sales, income and employment. 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 visitor expenditures create multiplier effects wherein additional income and employment is created as the income earned by the reef-related industries is re-spent 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

## 2.0 Socioeconomic Value of Reefs in Southeast Florida

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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.

The economic contributions of the reefs to each of the counties are provided in Tables 2.3.2-1 through 2.3.2-9. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

The economic contributions cannot be summed over the four counties to get the total contribution of the reefs to southeast Florida. Instead, the expenditures of visitor reef users to southeast Florida would have to be estimated wherein a visitor comes from outside the four county area. In this study, each county's visitors were evaluated on a county-by-county basis, so that a visitor in Palm Beach County could be a resident of Broward County. If the expenditures of all four counties reported in this study were added together and then input into the economic input-output models to estimate the economic contribution to southeast Florida, the reported economic contribution of the reefs would be overestimated. This is because southeast Florida resident expenditures imbedded in the expenditures by visitors would be included in the multiplier effects.

Reef-related expenditures generated \$504 million in sales in Palm Beach County, \$2.1 billion in sales in Broward County, \$1.3 billion in sales in Miami-Dade County and \$490 million in sales in Monroe County during the 12-month period from June 2000 to May 2001 as summarized in Table 2.3.2-3. These sales resulted in \$194 million in income to Palm Beach County residents, \$1.05 billion in income to Broward County residents, \$614 million in income to Miami-Dade County residents and \$138 million in income to Monroe County residents during the same time period as summarized in Table 2.3.2-6. Reef-related expenditures provided 6,300 jobs in Palm Beach County, 35,500 jobs in Broward County, 18,600 jobs in Miami-Dade County and 10,000 jobs in Monroe County as summarized in Table 2.3.2-9. Artificial reef-related expenditures

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contributed about a third of the economic contribution and natural reef-related expenditures contributed about two-thirds of the economic contribution among the four counties.

Reef-related expenditures within each county are responsible for up to 7 percent of personal income and 16.5 percent of employment, depending on the county. The percent of reef-related income that is total personal income for each county is provided in Table 2.3.2-10. The percent of reef-related employment that is total county employment is also presented in this table. The income and employment data used to calculate the percentages are provided in Table 2.3.2-11. Personal income is income from all sources, including employee compensation, proprietor's income, other property income and government transfer payments.

**Table 2.3.2-1**  
**Economic Contribution of Artificial Reef-Related Expenditures to Each County**  
**Contribution to Sales**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct <sup>a</sup>				
Resident	\$67.00	\$90.90	\$95.20	\$44.30
Visitor	\$48.14	\$493.30	\$181.99	\$73.36
Total	\$115.14	\$584.20	\$277.19	\$117.66
Indirect <sup>b</sup>	\$13.62	\$136.67	\$50.37	\$8.80
Induced	\$19.41	\$241.11	\$91.52	
Total	\$148.17	\$961.98	\$419.09	\$126.46

<sup>a</sup> The direct contribution is the actual expenditures made in the county.

<sup>b</sup> For Monroe County, both the indirect and induced contribution are included under indirect.

**Table 2.3.2-2**  
**Economic Contribution of Natural Reef-Related Expenditures to Each County**  
**Contribution to Sales**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct <sup>a</sup>				
Resident	\$128.40	\$178.90	\$180.40	\$88.00
Visitor	\$135.65	\$526.11	\$390.16	\$245.16
Total	\$264.05	\$705.01	\$570.56	\$333.16
Indirect <sup>b</sup>	\$37.91	\$145.51	\$106.63	\$29.42
Induced	\$54.63	\$257.48	\$200.28	
Total	\$356.59	\$1,108.01	\$877.47	\$362.58

<sup>a</sup> The direct contribution is the actual expenditures made in the county.

<sup>b</sup> For Monroe County, both the indirect and induced contribution are included under indirect.

**Table 2.3.2-3**  
**Economic Contribution of All Reef-Related Expenditures to Each County**  
**Contribution to Sales**  
**June 2000 to May 2001 – In millions of 2000 dollars**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct <sup>a</sup>				
Resident	\$195.40	\$269.80	\$275.60	\$132.30
Visitor	\$183.79	\$1,019.41	\$572.15	\$318.52
Total	\$379.19	\$1,289.21	\$847.75	\$450.82
Indirect <sup>b</sup>	\$51.52	\$282.18	\$157.00	\$38.22
Induced	\$74.04	\$498.59	\$291.81	\$0
Total	\$504.75	\$2,069.98	\$1,296.56	\$489.04

<sup>a</sup> The direct contribution is the actual expenditures made in the county.

<sup>b</sup> For Monroe County, both the indirect and induced contribution are included under indirect.

**Table 2.3.2-4**  
**Economic Contribution of Artificial Reef-Related Expenditures to Each County**  
**Contribution to Total Income<sup>a</sup>**  
**June 2000 to May 2001 – In millions of 2000 dollars**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct				
Resident	\$7.70	\$12.50	\$13.40	\$5.80
Visitor <sup>b</sup>	\$25.00	\$264.67	\$98.00	\$26.70
Total	\$32.70	\$277.17	\$111.40	\$32.50
Indirect	\$7.40	\$75.01	\$27.00	
Induced	\$12.20	\$149.75	\$56.80	
Total	\$52.30	\$501.93	\$195.20	\$32.50

<sup>a</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits

<sup>b</sup> For Monroe County, the direct, indirect and induced contribution are included under direct.

**Table 2.3.2-5**  
**Economic Contribution of Natural Reef-Related Expenditures to Each County**  
**Contribution to Total Income<sup>a</sup>**  
**June 2000 to May 2001 – In millions of 2000 dollars**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct				
Resident	\$14.70	\$25.20	\$25.50	\$11.40
Visitor <sup>b</sup>	\$72.00	\$282.26	\$211.90	\$94.20
Total	\$86.70	\$307.46	\$237.40	\$105.60
Indirect	\$21.00	\$79.75	\$56.60	
Induced	\$34.00	\$159.93	\$124.50	
Total	\$141.70	\$547.14	\$418.50	\$105.60

<sup>a</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits

<sup>b</sup> For Monroe County, the direct, indirect and induced contribution are included under direct.

**Table 2.3.2-6**  
**Economic Contribution of All Reef-Related Expenditures to Each County**  
**Contribution to Total Income<sup>a</sup>**  
**June 2000 to May 2001 – In millions of 2000 dollars**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct				
Resident	\$22.40	\$37.70	\$38.90	\$17.20
Visitor <sup>b</sup>	\$97.00	\$546.97	\$309.90	\$120.90
Total	\$119.40	\$584.67	\$348.80	\$138.10
Indirect	\$28.40	\$154.76	\$83.60	\$0
Induced	\$46.20	\$309.67	\$181.30	\$0
Total	\$194.00	\$1,049.43	\$613.70	\$138.10

<sup>a</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits

<sup>b</sup> For Monroe County, the direct, indirect and induced contribution are included under direct.

**Table 2.3.2-7**  
**Economic Contribution of Artificial Reef-Related Expenditures to Each County**  
**Contribution to Employment<sup>a</sup>**  
**June 2000 to May 2001 – Number of Full-Time and Part-Time Jobs**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct				
Resident	512	812	724	403
Visitor <sup>b</sup>	849	11,155	3,532	1,916
Total	1,361	11,967	4,256	2,319
Indirect	142	1,548	520	
Induced	253	3,306	1,214	
Total	1,756	16,821	5,990	2,319

<sup>a</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits

<sup>b</sup> For Monroe County, the direct, indirect and induced contribution are included under direct.

**Table 2.3.2-8**  
**Economic Contribution of Natural Reef-Related Expenditures to Each County**  
**Contribution to Employment<sup>a</sup>**  
**June 2000 to May 2001 – Number of Full-Time and Part-Time Jobs**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct				
Resident	992	1,662	1,385	792
Visitor <sup>b</sup>	2,439	11,814	7,462	6,737
Total	3,431	13,476	8,847	7,529
Indirect	401	1,645	1,087	
Induced	712	3,530	2,662	
Total	4,544	18,651	12,596	7,529

<sup>a</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits

<sup>b</sup> For Monroe County, the direct, indirect and induced contribution are included under direct.

**Table 2.3.2-9**  
**Economic Contribution of All Reef-Related Expenditures to Each County**  
**Contribution to Employment<sup>a</sup>**  
**June 2000 to May 2001 – Number of Full-Time and Part-Time Jobs**

Round of Spending	County			
	Palm Beach	Broward	Miami-Dade	Monroe
Direct				
Resident	1,504	2,474	2,109	1,195
Visitor <sup>b</sup>	3,288	22,969	10,994	8,653
Total	4,792	25,443	13,103	9,848
Indirect	543	3,193	1,607	0
Induced	965	6,837	3,876	0
Total	6,300	35,473	18,586	9,848

<sup>a</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits

<sup>b</sup> For Monroe County, the direct, indirect and induced contribution are included under direct.

**Table 2.3.2-10**  
**Percent of County Income and Employment Tied to Reef Use**

County	Percent of Total Income That Is Reef-Related	Percent of Employment That Is Reef-Related
Palm Beach	0.6	0.8
Broward	3.0	4.0
Miami-Dade	1.2	2.7
Monroe	7.0	16.5

Source: Study results and U.S. Department of Commerce, Bureau of Economic Analysis

**Table 2.3.2-11**  
**Personal Income and Employment by County, 1999**

County	Personal Income Place of Residence (Billions \$)	Personal Income Place of Work (Billions \$)	Employment (Number) <sup>a</sup>
Palm Beach	43.978	21.357	615,482
Broward	45.208	25.432	818,928
Miami-Dade	53.811	41.518	1,234,196
Monroe	2.754	1.366	52,431

<sup>a</sup> Number of full and part-time jobs

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



### 2.3.3 Use Value

In this study, three types of use values were estimated: (1) the value of maintaining the natural reefs in their existing condition; (2) the value of maintaining the artificial reefs in their existing condition and (3) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The reef-user values associated with maintaining the reefs in their existing conditions for each county is provided in Table 2.3.3-1. Use value per person day means the value per person day of artificial, natural or all reef use, as specified in the table. Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs.” Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition.

Visitor and resident reef users in Palm Beach County are willing to pay \$31 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$9 million to protect the artificial reefs and \$42 million to protect the natural reefs.

Visitor and resident reef users in Broward County are willing to pay \$126 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$56 million to protect the artificial reefs and \$84 million to protect the natural reefs.

Visitor and resident reef users in Miami-Dade County are willing to pay \$47 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs. When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$10 million to protect the artificial reefs and \$47 million to protect the natural reefs.

Visitor and resident reef users in Monroe County are willing to pay \$50 million per year to maintain both the artificial reefs and the natural reefs in their current condition by maintaining water quality, limiting damage to reefs from anchoring, and preventing overuse of the reefs.

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When the projects to protect the artificial and natural reefs are considered separately, visitor and resident reef users are willing to pay \$9 million to protect the artificial reefs and \$55 million to protect the natural reefs.

The sum of the values for the individual reef programs can be different from the value for the combined programs. This is because some respondents are not willing to pay the sum of the values for the individual programs to finance the combined programs. This is primarily due to income constraints as higher bid values are provided to the respondents. So bear in mind that willingness to pay for the combined programs is a different scenario from willingness to pay for the individual programs.

The capitalized value of the reef user values is the present value of the annual values calculated at three percent discount rate. It represents the “stock” value analogous to land market values. The capitalized reef user value for all southeast Florida reefs is \$21.5 billion. Bear in mind that this value only includes the value that reef users place on the reefs and does not include the values that non-reef-users place on the reefs or the economic contribution of the reefs. ***From previous studies of resource valuation, the total value to non-reef users is likely to be much larger than the total value to reef users. The estimation of this value was not part of this study.***

Reef users’ willingness to pay to invest in and maintain “new” artificial reefs is provided in Table 2.3.3-2. The use value per person-day is the value per day or a portion of a day of artificial reef use. In Palm Beach County, reef users are willing to pay \$4.8 million annually for this program in Palm Beach county. Broward County reef users are willing to pay \$15.7 million per year while Miami-Dade County reef users are willing to pay \$4.1 million per year. Monroe County reef users are willing to pay \$2.1 million annually per year to fund this program in Monroe County.

**Table 2.3.3-1 (Residents and Visitors)**  
**Annual Use Value From June 2000 to May 2001 and Capitalized Value associated With Reef Use**  
**Southeast Florida**

<b>Item</b>	<b>Palm Beach County</b>	<b>Broward County</b>	<b>Miami-Dade County</b>	<b>Monroe County</b>	<b>Total</b>
<b>All Reefs - Artificial and Natural</b>					
Person-Days of Reef Use (in millions)	4.24	9.44	9.17	5.11	<b>27.96</b>
Use Value Per Person-Day	\$7.34	\$13.35	\$5.12	\$9.87	<b>\$9.10</b>
Annual Use Value in million dollars	\$31.30	\$126.02	\$46.95	\$50.44	<b>\$254.51</b>
Capitalized Value @ 3 percent Discount Rate in billion dollars	\$1.0	\$4.2	\$1.6	\$1.7	<b>\$8.5</b>
<b>Artificial Reefs</b>					
Person-Days of Reef Use (in millions)	1.4	3.97	2.95	1.47	<b>9.80</b>
Use Value Per Person-Day	\$6.47	\$14.07	\$3.50	\$6.36	<b>\$8.63</b>
Annual Use Value in million dollars	\$9.09	\$55.86	\$10.33	\$9.35	<b>\$84.63</b>
Capitalized Value @ 3 percent Discount Rate in billion dollars	\$0.3	\$1.9	\$0.3	\$0.3	<b>\$2.8</b>
<b>Natural Reefs</b>					
Person-Days of Reef Use (in millions)	2.83	5.47	6.21	3.64	<b>18.15</b>
Use Value Per Person-Day	\$14.86	\$15.16	\$7.54	\$16.34	<b>\$12.74</b>
Annual Use Value in million dollars	\$42.12	\$83.60	\$46.70	\$55.22	<b>\$227.65</b>
Capitalized Value @ 3 percent Discount Rate in billion dollars	\$1.4	\$2.8	\$1.6	\$1.8	<b>\$7.6</b>

<sup>a</sup> Use Value per Person per Day is the average among the counties.

Note: Use value per person day means per person day of artificial, natural or all reef use. Values for all reefs taken from statistical analysis of responses to Question 38 of Visitor Boater Survey: Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If you total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs. Values for artificial reefs taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition. Therefore, the sum of the values for the individual reef programs will be less than the value for both programs.

**Table 2.3.3-2 (Residents and Visitors)  
Estimated Use Value of Investing in and Maintaining "New" Artificial Reefs  
Southeast Florida**

<b>Item</b>	<b>Palm Beach County</b>	<b>Broward County</b>	<b>Miami-Dade County</b>	<b>Monroe County</b>	<b>Total</b>
Person-Days of Artificial Reef Use (in millions)	1.40	3.97	2.95	1.47	9.80
Use Value Per Person-Day for "New" Artificial Reefs	\$3.37	\$3.95	\$1.38	\$1.46	\$2.72
Annual Use Values for "New" Artificial Reefs in million dollars	\$4.78	\$15.70	\$4.07	\$2.14	\$26.69
Capitalized Value @ 3 percent Discount Rate in million dollars	\$158.0	\$523.5	\$135.4	\$71.5	\$888.4

<sup>a</sup> Use Value per Person per Day is the average among the counties.

Note: Use value per person-day is a day or portion of a day of artificial reef use.

### 2.3.4 Demographic Information

This section summarizes and compares the demographic characteristics of visitor and resident reef users. These characteristics were obtained from the resident boater survey and the visitor boater survey. They are summarized in Tables 2.3.4-1 and 2.3.4-2.

**Table 2.3.4-1**  
**Demographic Characteristics of Resident and Visitor Reef-Users in Southeast Florida, 2000**

<b>Median Age of Respondent</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
Palm Beach	48			41		
Broward	48			39		
Miami-Dade	46			41		
Monroe	54			44		
<b>Sex Of Respondent</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
	<b>Male</b>	<b>Female</b>		<b>Male</b>	<b>Female</b>	
Palm Beach	91%	9%		79%	21%	
Broward	92%	8%		77%	23%	
Miami-Dade	93%	7%		75%	25%	
Monroe	86%	14%		70%	30%	
<b>Race Of Respondent</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
Palm Beach	97%	0%	3%	94%	2%	4%
Broward	93%	2%	5%	89%	7%	4%
Miami-Dade	88%	1%	11%	83%	7%	10%
Monroe	94%	0.2%	5.8%	95%	2%	3%
<b>Percent Hispanic/Latino</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
Palm Beach	4%			5%		
Broward	5%			13%		
Miami-Dade	33%			29%		
Monroe	7%			8%		
<b>Median Household Income</b>	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
Palm Beach	\$71,695			\$87,500		
Broward	\$72,310			\$87,500		
Miami-Dade	\$69,722			\$55,000		
Monroe	\$56,393			\$87,500		

**Table 2.3.4-2**  
**Boater Profile of Resident and Visitor Reef-Users in Southeast Florida, 2000**  
**Average Years Boating in South Florida**

<b>County</b>	<b>Residents</b>	<b>Visitors</b>
Palm Beach	21	9.2
Broward	22	6.7
Miami-Dade	25	6.7
Monroe	22	7.4

**Average Length of Boat Used for Salt Water Activities in Feet**

<b>County</b>	<b>Residents</b>	<b>Visitors</b>
Palm Beach	25	25
Broward	25	27
Miami-Dade	23	26
Monroe	24	22

**Percentage of Respondents Who Belong to Fishing and/or Diving Clubs**

<b>County</b>	<b>Residents</b>	<b>Visitors</b>
Palm Beach	20%	24%
Broward	19%	12%
Miami-Dade	18%	6%
Monroe	15%	11%

# Chapter 3: Socioeconomic Value of Reefs in Palm Beach County

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This chapter describes the Socioeconomic Value of Artificial and Natural Reefs in Palm Beach County to residents and visitors. For both groups this chapter discusses the following topics.

- Volume of user activity on both artificial and natural reefs off Palm Beach County;
- Economic Contribution of artificial and natural reefs to the county's economy;
- Resident and visitor "use value" associated with recreating on artificial and natural reefs in Palm Beach County; and,
- Demographic and boater profile of reef users in Palm Beach County.

For residents, their opinions regarding the existence of "no-take" zones as a tool to protect existing artificial and natural reefs are provided.

## 3.1 Residents

This section presents the estimated socioeconomic values associated with resident boater use of the reefs off the coast of Palm Beach County. Resident boaters are those individuals who live within Palm Beach County and who use a boat that is owned by a resident of the county to visit the reef system. Resident boats used to visit the reef system are defined as those greater than 16 feet in length and registered with the Florida Department of Highway Safety and Motor Vehicles.

### 3.1.1 User Activity

There are two fundamental measures of user activity of natural resources such as the reef systems. First, user activity can be measured by the number of boating trips that individuals take to spend part or a full day visiting the reef system. The number of boating trips is usually called "party-days" since each boat carries one to numerous individuals depending for the most part on the size of the boat. Party-days are measured in this analysis because the party is the principal spending unit. When the average number of individuals in a party is multiplied by the number of party-days, the number of "person-days" is obtained. This second measure of boating activity is important because it determined how many people will be fishing and/or diving on a particular reef. Person-days are of particular significance when estimating the "use value" of the reef system. Both measures of user activity are discussed below.

To measure user activity associated with the reef system, the numbers of party-days and person-days spent on artificial and natural reefs off the coast of Palm Beach County were estimated. Most residents use their own boats to facilitate this recreational pursuit. The use of party boats and charter rentals by residents was not estimated. In 1999-2000, there were 56,924 registered pleasure boats in Palm Beach County according to the Florida Department of Highway Safety and Motor Vehicles (2001). These pleasure craft were divided into the following size classes:

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

<b>Boat Size Category (Length of Boat in Feet)</b>	<b>Number of Boats</b>	<b>Percentage of Total</b>	<b>Cumulative Percentage</b>
Less than 12 feet	10,900	19%	19%
12 feet to 15' 11"	9,529	17%	36%
16 feet to 25' 11"	28,257	50%	86%
26 feet to 39' 11"	6,612	12%	98%
40 feet to 64' 11"	1,488	2%	100%
65 feet to 109' 11"	129	0%	100%
Greater than 110 ft	9	0%	100%
<b>Total</b>	<b>56,924</b>	<b>100%</b>	

The registered pleasure craft in Palm Beach County is the global universe under consideration. However, two adjustments were made to derive the “target population” for this analysis. First, sampling was restricted to pleasure craft over 16 feet in length. This was due to expert opinion that indicated very few pleasure craft under 16 feet could reach the reef system. Thus, the target population was restricted to pleasure craft 16 feet and longer so that non-reef users would be avoided and to increase the sample size on that segment of the boating population with the highest propensity to use the reef system. Therefore, the target population was reduced to 56,924 registered boats to 36,495 registered boats. However, not everyone with a relatively large boat used an artificial and/or natural reef in the last twelve months. In fact, the survey results indicated that only 53.6 percent of these larger vessels used the Palm Beach County reef system in the last 12 months or 19,562 pleasure craft. Finally, about one-half of one percent of registered boats in the target population had a residence somewhere outside of Palm Beach County, which further reduced the target population of resident boats to 19,465 pleasure craft.

On average, the respondents to the mail survey indicated that over a 12-month period (1999-2000) they and their party used the reef system 40 days. While using the reef system, respondents indicated they were involved with three main recreational activities - fishing, snorkeling, and scuba diving. Based upon this information, it was estimated that during this 12-month period (i.e., 1999-2000), 778,532 “party-days” were spent on the reef system (40 party days times 19,465 pleasure craft).

In conducting the mail survey of resident boaters, reef-users were asked to distribute their 40 reef using party-days in two ways. First, they were asked to distribute their usage among three activities as follows: (1) Fishing, (2) Snorkeling and (3) Scuba Diving. Second, respondents were asked to distribute each of these recreational activities between artificial and natural reefs. Table 3.1.1-1 shows the final distribution of party-days and the derivation of person-days. With respect to party-days, the activity of fishing on artificial and natural reefs constituted 52 percent of all party-days followed by scuba diving (27 percent) and snorkeling (21 percent). For all the recreational activities on reefs, there was an obvious preference for natural reefs as 64 percent of the party-days were concentrated on natural reefs. The strongest intensity of natural reef use was found among the scuba divers where 72 percent of the party-days were spent at natural reefs.



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## 3.0 Socioeconomic Value of Reefs in Palm Beach County

Multiplying the average size of the party by the number of party-days spent on the reef, as summarized in Table 3.1.1-1, resulted in the number of person-days. However, one important adjustment was made to the average party size to account for nonresidents in calculating resident person-days. For this analysis, the number of nonresidents per party (approximately 20 percent) was subtracted out of the average party size. Thus, the number of person-days summarized in Table 3.1.1-1 was determined using the resident party size. The resident party size does not vary appreciably among the various reef-related recreational activities and averages about 3.82 residents per party. Because of this, the distribution of person-days among the activities is similar to the distribution of party-days. For example, saltwater fishing on reefs yielded 1.55 million person-days or 52 percent of all person-days and party-days enjoyed on the reef system off the coast of Palm Beach County during the 12-month period (1999-2000).

The total number of person-days spent on the reefs in Palm Beach County was estimated at about 3 million. While party-days gives a “boater dimension” to activity in and around the reef system, person days yield a “people dimension” to the use of the reef system. The former is especially useful in judging the adequacy of the boating infrastructure such as marinas and boat ramps while the latter is used in calculating recreational value of the reef system. The estimates of user activity will now be used to evaluate the economic contribution of resident reef-users to the Palm Beach County economy.

### 3.1.2 Economic Contribution

To fully understand the economic contribution of reef use in Palm Beach County, it is important to recognize what factors influence the demand for boating. This will help in understanding the nature of boating in this area and how it relates to the use of artificial and natural reefs. In a study by Bell and Leeworthy (1986), the authors found that the demand for boats in a particular area was influenced by boat prices, population and per capita income. Therefore, we would expect a higher demand for boats (i.e. number of registered pleasure craft) in counties with larger populations that are relatively affluent as measured by real per capita income.

The number of registered boats in any county is therefore critical in assessing the adequacy of the boating infrastructure such as boat ramps and artificial and natural reefs. This topic was recently addressed in the 2000 State Comprehensive Outdoor Recreational Plan (2001) issued by the Division of Recreation and Parks, Florida Department of Environmental Protection. However, this report did not assess the adequacy of the reef system in the various regions of Florida. This section will consider only the demand for boating in Palm Beach County, not the adequacy of the boating infrastructure. This will give the reader an overview of boating characteristics in Palm Beach County and valuable information necessary to assess the adequacy of the boating infrastructure. The overview includes a discussion of the county’s population, per capita income, industrial structure and its infrastructure related to saltwater boating. This will also give a background by which to assess the results of this study.

3.0 Socioeconomic Value of Reefs in Palm Beach County

**Table 3.1.1-1 (Residents)**  
**Estimated Resident User Activity As Measured by Party-Days and Person-Days on**  
**Artificial and Natural Reefs off Palm Beach County, Florida, 2000**

Activity/ Type Of Reef	Number and Distribution of Party-Days by Activity and Reef Type			Number and Distribution of Person-Days by Activity and Reef Type			
	Number of Party-Days	Percentage of Party-Days per Activity by Reef Type	Percentage of Total Party- Days per Activity	Resident Party-Size by Activity	Number of Resident Person- Days <sup>1</sup> by Activity by Reef Type	Percentage of Person-Days per Activity by Reef Type	Percentage of Total Person-Days per Activity
<b>Fishing</b>			52%	3.83			52%
Artificial	145,741	36%			558,188	36%	
Natural	259,095	64%			992,334	64%	
Subtotal	404,836	100%			1,550,522	100%	
<b>Snorkeling</b>			21%	3.77			21%
Artificial	76,841	47%			289,691	47%	
Natural	86,651	53%			326,674	53%	
Subtotal	163,492	100%			616,365	100%	
<b>Scuba Diving</b>			27%	3.86			27%
Artificial	58,857	28%			227,188	28%	
Natural	151,347	72%			584,199	72%	
Subtotal	210,204	100%			811,387	100%	
<b>All Activities</b>							
Artificial	281,439	36%			1,075,067		
Natural	497,093	64%			1,903,207		
<b>Total</b>	<b>778,532</b>	<b>100%</b>			<b>2,978,274</b>		

<sup>1</sup> Resident person-days is calculated by multiplying the number of party-days by the average resident party size.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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Palm Beach County is on the southeast coast of Florida bordering the Atlantic Ocean. West Palm Beach is the principal city within this county. In 1999, the resident population was estimated at 1,042,196 individuals; the third largest county in Florida as measured by population. Over the last ten years, the population in Palm Beach County has grown by 20.7 percent making it the thirty-ninth fastest growing county in Florida (out of 67 counties). The County's population is projected to increase by 29.5 percent by the year by 2015.<sup>1</sup> In-migration from Broward County to Palm Beach County, as in the past, will account for over 94 percent of this growth. Thus, this county's population growth will depend heavily on individuals moving into the county.

In 1998, Palm Beach County had a per capita income of \$40,044 placing it third among the 67 counties in the State of Florida. This per capita income was over 49 percent higher than the state average of \$26,845. The higher per capita income in Palm Beach County is largely due to three factors. First, the population receives nearly \$16,000 per capita in dividends, interest and rents. Thus, the holding of capital assets such as stocks, bonds and property largely accounts for the relative affluence of the residents of Palm Beach County. Second, income maintenance programs and retirement benefits exceed the state average and add to the per capita income received by residents of this county. Third, average earnings of those employed exceed the average earnings of workers in Florida by about 12 percent. Palm Beach County appears to be a bimodal population where one segment is characterized by wealthy retirees living off accumulated capital assets while the other segment of the population is employed in industries paying wages above the average when compared to the State of Florida. A relatively high per capita income is a favorable factor leading to the purchase of recreational durable goods such as large pleasure boats capable of reaching artificial and natural reefs in the Atlantic Ocean.

In 1998, there were 493,000 persons employed in Palm Beach County earning \$17.0 billion in wage and salaries. Over the last ten years, employment in this county grew by 20.7 percent, which corresponds exactly to the rate of growth in population as discussed above. Measured by earnings, the largest industries in 1998, were services (35.6 percent); finance, insurance and real estate (13.6 percent); and retail trade (10.2 percent). Of particular note, the county's economy includes a substantial number of persons employed in the tourist-related services such as lodging, amusement and recreation. Nearly 22,000 persons were employed in these industries in Palm Beach County in 1998. The attraction of tourists to the county provides part of the county's economic base as evidenced by boating visitors using artificial and natural reefs along the coasts as discussed later in this chapter.

The infrastructure supporting various coastal or saltwater forms of boating recreation in Palm Beach County include the following (FDEP, 2001)(Pybas, 1997):

1. Boat Ramps: 35 with a total of 46 boating lanes;
2. Marinas: 66 with 2,758 wet slips and moorings;

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<sup>1</sup> University of Florida, Bureau of Economic and Business Research.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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3. Other Facilities: 2,264 boat dry storage berths;
4. Artificial Reefs: 32 artificial reefs ranging from 0.7 to 3.4 nautical miles from shore.

Using the estimated number of person-days discussed above, the average resident person-days accommodated at each artificial reef was estimated to be 35,000 during the 12-month period (i.e. 1,075,067 person-days on artificial reefs divided by 32 artificial reefs). This amounts to nearly 95 individual reef-users per day. The number of person-days is obviously higher on weekends and lower during the week and does not include visitors, which will be discussed below. It is beyond the scope of this study to speculate on the carrying capacity of each reef or where congestion diminishes user or recreational value.

In 2000, there were 57,000 recreational boats (FDHSMV, 2001) registered in Palm Beach County or 1 boat for every 18 persons. In the State of Florida as a whole, there was 1 registered pleasure boat for every 13 residents. Despite the relatively large population and high per capita income in Palm Beach County and the artificial and natural reefs along its shore, the demand for recreational boating is somewhat less in the county than in the rest of Florida as measured by the ratio of registered boats to population. The county's demand factors combined with the saltwater coastal nature of this county would lead one to predict a much higher ratio of registered boats to people.

The explanation for this finding is usually found on the supply side where there is crowding or congestion at access points to the water (e.g., boat ramps) and access points to the recreational resources such as artificial and natural reefs offshore. This increases the cost of recreational boating and reduces the demand for pleasure boats. The results of this study will be useful to testing "working hypotheses" regarding demand and supply side issues.

Using a mail survey, 3,000 registered boaters in Palm Beach County were contacted at random using the survey instrument provided in Appendix A. The participants' addresses were obtained from a registered boater database compiled on tape by the Florida Department of Highway Safety and Motor Vehicles. Over six hundred registered boaters from Palm Beach County responded to the survey of which 54 percent (330 pleasure craft owners) used reefs in their county of residence in a 12-month period (1999-2000). Thus, the party-days and spending by boaters estimated in this section refers only to those residents who used artificial and/or natural reefs off the coast of Palm Beach County during the 12-month period from December 1999 to November 2000.

To estimate the economic contribution of reef-user spending on the Palm Beach County economy, the respondents were asked to estimate party spending during their last boating trip to visit the reef system. It was assumed that each boating trip would involve only one day since the residents are in their own county. The results of the survey allowed the average total spending per party by recreational activity for residents of Palm Beach County to be estimated as follows:

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

**Average Resident Spending per Party for Palm Beach County Reef-Users**

Activity	Estimated Spending per Party per Day	Percentage of Residents per Party	Estimated Spending per Resident Party per Day
(1)	(2)	(3)	(4) = (2) * (3)
Fishing	\$377.44	79%	\$298.18
Snorkeling	\$198.42	80%	\$158.74
Scuba Diving	\$273.40	85%	\$232.39

Resident fishers using the county’s reefs spent the most per day while resident snorkelers spent the least per day. Expenditures for fuel, tackle and bait made fishing a more expensive recreational activity than snorkeling. Detailed expenditures on particular items are discussed below and a more disaggregated analysis can be found in the Technical Appendix to this report. Please note that the total resident spending per party-day, as calculated in column 4, does not include spending by visitors. Approximately 15 to 21 percent of the typical party in Palm Beach County includes nonresidents. The simplifying assumption was made that these visitors would pay their fair share of the trip costs. Therefore, visitors are assumed to pay a fair proportion of the trip costs such as boat fuel, restaurants and bait, for example. The resident component probably pays for more than indicated above; however, it was conservatively assumed that costs were equally shared between residents and their guests.

To derive the economic contribution of a particular reef-related recreational activity, one must briefly return to Table 3.1.1-1 discussed above. This table shows the number of party-days and person-days associated with reef use over the past 12-months. For example, the recreational activity of fishing generated about 405,000 party-days on all reefs off Palm Beach County. According to the resident spending per party discussed above, fishers spent \$298 per trip. Thus, annual expenditures for reef-related fishing was estimated at \$120.7 million dollars per year in Palm Beach County (i.e. \$298.18 times 404,836). Based upon the distribution of party-days, about \$48.3 million was spent while using artificial reefs while the balance (\$72.4 million) was spent while using natural reefs by recreational fishers.

Table 3.1.2-1 shows the economic contribution of reef-related recreational pursuits off the Palm Beach County coast. Residents spent an estimated \$195.4 million during the twelve-month period from December 1999 to November 2000. About two-thirds of this amount was spent while using natural reefs (\$128.4 million) while the balance (\$67 million) was spent while using the artificial reefs. Nearly 62 percent of total spending or \$120.7 million was spent on reef-related recreational fishing while \$48.8 million (25 percent) was spent on reef-related scuba diving and \$25.9 million (13 percent) was spent on reef-related snorkeling.

It is important that we further clarify the economic contribution of resident boaters from Palm Beach County. The engine of economic growth for any region is found in its export industries such as tourism in Palm Beach County. This has a “multiplier” effect on the region as discussed in the section focused on “visitors”. As income from exports flows through the region, it creates

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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local income (e.g., money paid for haircuts by residents) and a demand for imports (e.g., TV sets since Palm Beach County does not have TV manufacturers).

The local income is spent on everything from marina services for boats to dining out at local restaurants. Thus, the spending by residents in conjunction with reef use represents the choice of residents to recreate locally as opposed to leaving the area to recreate somewhere else. The reef system keeps the “locals” in the county and enlarges the economy by \$195.4 million in local spending. However, in contrast to visitors entering the county, there is no multiplier effect from residents spending their income locally. Generally, the more money kept in the local economy enlarges the regional multiplier since there is less “leakage” through spending on imports or residents leaving the county for recreational pursuits in other areas such as Key West or Orlando. Just how much the regional multiplier is enlarged is beyond the scope of this study. However, it is safe to say that construction of artificial reefs has the potential of keeping more business in Palm Beach County. For ardent reef-users, the absence of reefs off the coast of Palm Beach County would certainly divert more residents to counties north and south of this area to the economic detriment of the county.

Reef-related local spending discussed above is, in itself, only a vehicle to create jobs and wages in the local community. To evaluate the industries that benefit from this reef-related spending, reef-users were asked to break their spending into 12 categories such as boat fuel, ice, tackle and marina fees. For each of the twelve categories, resident reef-related spending was matched to data published in the 1997 U.S. Census of Business. For example, spending on boat fuel was matched up with gasoline stations in Palm Beach County. It was found that each gasoline station employee “sells” \$312,757 per year out of which they are paid about \$15,000 or about 4.8 percent of their sales. The annual salary may seem low, but this figure represents the average salary of full and part time employees with a relatively low skill level. Thus, one job paying approximately \$15,000 per year is generated for every \$312,757 in gasoline purchased for reef-related recreation by residents.

This rather simple procedure was followed for each of the 12 spending categories. Each category varies greatly in labor intensity. The higher the sales-to-employment ratio, the less labor intensive the industry. For example, restaurants are relatively labor intensive while gasoline stations are highly automated and consequently need relatively few employees.

Table 3.1.2-1 shows the estimated wages and employment generated from resident spending on reef-related recreational activities in Palm Beach County. The \$195.4 million in annual resident reef-related spending generated about \$22.4 million in annual wages supporting 1,504 employees.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

**Table 3.1.2-1 (Residents)  
Reef-Related Expenditures, Wages and Employment Generated by Resident Boating  
Activities in Palm Beach County, Florida, 2000**

Type of Activity/ Type of Reef	Expenditures (Million \$)	Wages (Million \$)	Employment (Number of Full and Part-Time Jobs)
<b>Artificial Reef</b>			
Fishing	\$48.3	\$5.6	367
Snorkeling	\$3.6	\$0.4	31
Scuba Diving	\$15.1	\$1.7	114
Subtotal	\$67.0	\$7.7	512
Percentage Attributed to Artificial Reefs	34.29%	34.38%	34.04%
<b>Natural Reef</b>			
Fishing	\$72.4	\$8.4	550
Snorkeling	\$22.3	\$2.6	188
Scuba Diving	\$33.7	\$3.7	254
Subtotal	\$128.4	\$14.7	992
Percentage Attributable to Natural Reefs	65.71%	65.63%	65.96%
<b>Total All Reefs</b>			
Fishing	\$120.7	\$14.0	917
Snorkeling	\$25.9	\$3.0	219
Scuba Diving	\$48.8	\$5.4	368
<b>Total All Reefs/All Activities</b>	<b>\$195.4</b>	<b>\$22.4</b>	<b>1,504</b>

Source: Florida State University

It is also important to examine the industries that benefit from reef-related resident spending. Table 3.1.2-2 shows the 12 spending categories and, as expected, reef-related expenditures are concentrated on running and storing a boat, which is the case in Palm Beach County. Expenditures on boat oil and gas constituted 25 percent of all spending followed by marina slip rentals and dockage fees (18 percent). These two categories account for 43 percent of all reef-related spending. In addition, food and beverages from restaurants and stores were both 8 percent (a total of 16 percent) of total reef-related resident spending. In terms of dollar figures, resident reef-users spent over \$35 million during a 12-month period on items produced by the marina industry. According to the U.S. Census of Business (1997), the marina industry in Palm Beach County grossed about \$99 million in sales. Thus, resident reef-users may account for as much as one-third of these sales. Marina industry sales would also come from resident non-reef-users and visitors keeping their boats in local marinas.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

**Table 3.1.2-2 (Residents)**  
**Detailed Expenditure Pattern Supporting Employment and Wages by All Resident Reef-Users in Palm Beach County, Florida, 2000**

Expenditure Item	Expenditures (Million \$)	Percentage of Total Expenditures	Employment (Number of Full and Part-Time Jobs)	Percentage of Total Employment	Wages (Million \$)	Percentage of Total Wages
1. Boat gas and oil	\$49.61	25%	159	11%	\$2.37	10%
2. Marina slip rentals and dockage fees	\$35.01	18%	313	21%	\$5.98	27%
3. Food and beverages from restaurants/bars	\$16.06	8%	429	29%	\$4.41	20%
4. Food and beverages from stores	\$14.94	8%	109	7%	\$1.57	7%
5. Tackle	\$10.59	5%	76	5%	\$1.35	6%
6. Bait	\$9.16	5%	66	4%	\$1.17	5%
7. Gas for auto	\$9.01	5%	28	2%	\$0.42	2%
8. ICE	\$4.81	2%	16	1%	\$0.23	1%
9. Equipment rentals	\$4.68	2%	31	2%	\$0.66	3%
10. Boat ramp and parking fees	\$3.84	2%	34	2%	\$0.66	3%
11. Sundries (e.g. Sun screen, sea sickness pills, etc.)	\$5.41	3%	34	2%	\$0.51	2%
12. All other	\$32.39	17%	209	14%	\$3.12	14%
<b>Total</b>	<b>\$195.51</b>	<b>100%</b>	<b>1,504</b>	<b>100%</b>	<b>\$22.45</b>	<b>100%</b>



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## 3.0 Socioeconomic Value of Reefs in Palm Beach County

In terms of employment, reef-related resident spending created proportionately more employment in marinas and restaurants because, as discussed above, these industries are relatively labor intensive. Although ranked number one as a component of spending, gasoline stations are a capital-intensive industry not conducive to the creation of jobs. That is, spending on boat oil and gas accounted for one-fourth of all spending, but only one in ten jobs. As might be expected, wages follow employment. That is, the higher the percentage of spending on labor intensive industries, the higher the total wages generated. However, some industries employ highly skilled persons such as marinas where the wages paid are proportionately higher than employment as indicated in Table 3.1.2-2.

### 3.1.3 Use Value

Natural and artificial reefs contribute to the recreational experience of residents (i.e. fishing, snorkeling and scuba diving). Traveling to and enjoying a reef system involves economic costs including the cost of boat fuel, bait and tackle. This was discussed above. However, the market does not measure the total economic value of reef systems. There is no organized market in which to buy and sell the use of reefs because these resources are not owned by one individual but by society as a whole. Thus, the absence of private property rights creates a challenge in valuing natural and artificial reefs. Yet, the general public does pay for the deployment of artificial reefs and the protection of natural reefs. So, there must be some unmeasured value of providing the reef system to the general public. Since reef-users are attracted to reefs for recreational pursuits, we call this unmeasured value “use value”. For example, one could engage in scuba diving without the benefit of a natural or artificial reef. The addition of a reef presumably adds some “value” to the scuba diver’s recreational experience. More specifically, this analysis evaluates the incremental use value of having a reef system off the shore of Palm Beach County.

The contingent valuation (CV) method asks users about their willingness to pay for a reef system contingent on specified conditions (e.g., use of funds for various reef related improvements). This CV method has been employed in numerous studies to estimate use values from deep-sea fishing to deer hunting.<sup>2</sup> The reef-using respondents were asked a series of CV questions dealing with their willingness to pay for the reef program. The respondents were asked to consider the total cost for their last boating trip to the reefs including travel expenses, lodging, and all boating expenses. Then, the respondent was asked:

“If your total cost per trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the (kind of reef – artificial, natural or both) in their existing condition?”

Payment amounts (or cost increases) of \$10, \$50, \$100, \$200, and \$500 were inserted into the survey instrument (where the blank is in the question above). The payment amounts were rotated from respondent to respondent. Thus, some respondents received questions asking about

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<sup>2</sup> See Clawson and Knetch (1966).

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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a \$10 increase while others were asked about a \$50, \$100 or even \$500 increase in trip cost. The purpose of these questions was to establish the user value per day for artificial and natural reefs.

The above willingness to pay question was asked of each respondent in three forms: (1) natural reefs separately; (2) artificial reefs separately and (3) a combination of natural and artificial reefs. For the combined program, the randomly assigned cost increases presented in the previous paragraph were doubled. Because the primary spending unit is the “party”, the willingness to pay response referred to an increase in trip cost to the entire party.

To estimate values per party per trip (a day and a trip are equal for residents), the data were pooled for all four counties. A logit model was used to estimate the per party per trip values. The logit model tested for differences in use value by county, activity, household income, age of respondent, years of boating experience in South Florida, race/ethnicity, sex, length of boat owned, and whether a member of a fishing or diving club.

Separate models were estimated for each of the four reef programs (e.g., natural reefs, existing artificial reefs, both natural and artificial reefs and new artificial reefs). For the natural reefs, existing artificial reefs and the combined programs, the only significant differences found were for those with income greater than \$100,000. This group had a higher willingness to pay than other reef users. There were no other differences found. The logit model did not produce different per party per trip values by county, and because party sizes were not significantly different by county the estimated values per person-trip were also the same across counties for each of the reef valuation programs<sup>3</sup>. The estimated per party per trip (day) values were \$32.55 for the natural reefs, \$11.31 for the artificial reefs and \$12.94 for the combined program.

To estimate total annual use values for each county, the number of party-days was multiplied by the estimated values per party per day. The value per person-day was then estimated by dividing the total annual use value by the total number of person-days. This normalized value per person-day can be compared with results from other studies.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. For Palm Beach County residents, the average per person-day use value of the natural reefs was \$8.50 versus \$2.96 for artificial reefs. Total use is also higher for natural reefs versus artificial reefs. Palm Beach County residents’ natural reef use was over 1.9 million person-days versus about 1.1 million person-days for artificial reefs. This translated into an estimated total annual use value of \$16.2 million for natural reefs and \$3.2 million for artificial reefs. Capitalizing the annual use values using a three percent discount rate yields asset values of about \$539 million for the natural reefs and \$106 million for the artificial reefs. These results are summarized in Table 3.1.3-1.

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**Table 3.1.3-1 (Residents)  
Estimated Use Value of Artificial and Natural Reefs off the Coast of  
Palm Beach County, Florida, 2000**

Reef Type/Activity	Person-days (Millions)	Annual User Value (Millions \$)	User Value Per Person-day (\$)	Asset Value at 3% (Millions \$)
<b>Natural Reef Maintenance</b>	<b>1.903</b>	<b>\$16.18</b>	<b>\$8.50</b>	<b>\$539.3</b>
Snorkeling	0.327	\$2.82	\$8.63	\$94.0
Scuba Diving	0.584	\$4.93	\$8.43	\$164.2
Fishing	0.992	\$8.43	\$8.50	\$281.1
<b>Artificial Reef Maintenance</b>	<b>1.075</b>	<b>\$3.18</b>	<b>\$2.96</b>	<b>\$106.1</b>
Snorkeling	0.290	\$0.87	\$3.00	\$29.0
Scuba Diving	0.227	\$0.66	\$2.93	\$22.2
Fishing	0.558	\$1.65	\$2.95	\$54.9
<b>Natural &amp; Artificial Reef Maintenance</b>	<b>2.978</b>	<b>\$10.07</b>	<b>\$3.38</b>	<b>\$335.8</b>
Snorkeling	0.616	\$2.11	\$3.43	\$70.5
Scuba Diving	0.811	\$2.72	\$3.35	\$90.7
Fishing	1.550	\$5.24	\$3.38	\$174.6
<b>New Artificial Reefs</b>	<b>1.075</b>	<b>\$0.78</b>	<b>\$0.72</b>	<b>\$25.9</b>
Snorkeling	0.290	\$0.28	\$0.95	\$9.2
Scuba Diving	0.227	\$0.21	\$0.93	\$7.1
Fishing	0.558	\$0.29	\$0.52	\$9.6

Annual use value represents the annual flow of total use value (i.e, the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs. This includes investments for such things as deployment of new artificial reefs and enhancements of natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs would provide a conservative or lower bound estimate of the total natural and artificial reef values.

One can see the usefulness of measuring the economic benefits of natural reef systems to policy makers in justifying public budgets for such programs. If protected, the use value for natural

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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reefs will flow into perpetuity. Using a real discount rate of 3 percent, it is estimated that the capitalized use value of the natural reefs off Palm Beach County is \$539 million. Why is this important? Natural reef systems are not privately owned, but are common property resources. If a region or a nation were preparing a balance sheet showing its assets and liabilities, the asset value of the reef system would need to be included. This analysis provides an estimate of the capitalized value of the natural reef system to reef users. Bear in mind that this value only includes the value that reef users place on the reefs and does not include the values that non-reef-users place on the reefs or the economic contribution of the reefs. *The estimation of the value of the reefs to non-reef users was not part of this study.*

As discussed above, artificial reefs have a use value per person of less than that of natural reefs, as one would expect. However, preservation of the existing artificial reef system of Palm Beach County produces an annual use value of over \$3 million. Again, this is for the maintenance of these reefs. The capitalized value of the artificial reef system off Palm Beach County is estimated at \$106 million. If users were obstructed from getting to Palm Beach County's artificial reefs, an estimate of damages to the reef users would be either the annual use value lost if users are temporarily obstructed or the capitalized value if users were permanently cut-off from using the artificial reefs.

The resident survey included a question to solicit resident reef users' willingness-to-pay for new artificial reefs. The question is as follows:

“Local and state government agencies are being asked to evaluate how users of artificial reefs value new artificial reefs. Artificial reef programs cost money. Suppose that the government proposed that all users of the artificial reefs would pay for all newly constructed reefs. Fishermen and divers with their own boats would pay for a decal as part of their boat registration and/or, if they used a charter/party boat or a rental boat (pay operation), they would pay for the costs through higher fees charged by the pay operation. The money would go into a trust fund that could only be used for the construction and maintenance of artificial reefs in southeast Florida.”

14. Would you be willing to pay \$ \_\_\_\_\_ per year when you renew your boat registration and/or the amount in higher fees to a charter/party boat or rental boat operation to fund this program?

Payment amounts of \$5, \$10, \$20, \$30, \$50 and \$100 were assigned randomly. The survey results were statistically analyzed using the logit model.

The logit model used to estimate willingness to pay for a program that provides new artificial reefs found some statistically significant differences in use value as socioeconomic characteristics change. Resident artificial reef users in Palm Beach and Broward counties had higher willingness to pay than resident artificial reef users in Miami-Dade and Monroe counties. Snorkelers and scuba divers had higher use values than those who participated in fishing

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### 3.0 Socioeconomic Value of Reefs in Palm Beach County

activities. The only other statistically significant variable was household income. As household income levels increased so did willingness to pay for new artificial reefs. On a per party per day basis, the estimated values ranged from a high of \$3.60 for snorkelers and scuba divers who use artificial reefs to a low of \$1.98 for fishers who use artificial reefs.

As with the other three programs, the estimated per party per day values were multiplied by the total party-days spent on artificial reefs by artificial reefs users in the county to get total annual use value for the county. The total annual use values were then divided by the total annual person-days of artificial reef use in the county to get an estimate of the value per person-day. This “new artificial reef” value per person-day can be compared with results from other studies.

On a per person-day basis, the estimated values ranged from a low of 52 cents for those fishing to a high of 95 cents for those who participated in snorkeling off Palm Beach County. Across all activities, the average value for new artificial reefs was 72 cents per person-day.

In terms of total annual value among all artificial reef users, fishers have the highest willingness to pay for new artificial reefs. The total amount of artificial reef use more than compensates for the lower value per person-day associated with fishers. Across all activities, total annual user value is over \$777,000 with an asset value of \$25.9 million.

The relatively low marginal willingness to pay of \$0.72 per person-day for artificial reef expansion in comparison to artificial reef maintenance discussed above is somewhat expected. If present users do not feel that congestion on artificial reefs is a problem, they would be expected to value expansion lower than maintenance of the existing artificial reefs. However, their willingness to pay anything for expansion demonstrates some level of unhappiness with the existing number of artificial reefs off Palm Beach County. Perhaps, residents are competing with visitors for choice spots or just getting in the way of fishing and diving when arriving at an artificial reef.

#### **3.1.4 Role of “No-Take” Zones**

Both the economic contribution and the use value of the reef system are based upon the management or lack thereof of these resources. There have been controversies about the wisdom of deploying, for example, artificial reefs. Opponents argue that this encourages over fishing since artificial reefs tend to concentrate fish in a smaller number of places and they become easier targets for fishers. Others find that artificial reefs serve as added habitats and thereby increase the overall biomass available to fishers. The Bell et al., (1999) study of artificial reefs in northwest Florida found that most people fell into the latter group believing that the pie got larger with the deployment of more reefs. However, other studies such as Bohnsack et al., (1997) and Grossman et al., (1997) support the opponents opinions of additional artificial reef systems.

In this section, we examine the opinions of residents on “no take” zones in the Florida Keys and other counties in southeast Florida. A no-take zone is a designated area of the reef systems in which nothing is to be taken from this area, including fish and shellfish. To provide a net

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benefit, it is argued that “no-take” zones would actually increase the total pie available to users. Supporters of “no-take” zones point to the overuse of common property resources such as ocean fisheries by both recreational and commercial interests. In effect, “no-take” zones would vest the property right with the government. In theory, “no-take” zones would increase fish and coral populations to the carrying capacity of the specified area with benefits spilling over into areas used by recreational and even commercial users. Some question these alleged benefits and oppose the imposition of such zones. Therefore, as part of this study, we were asked to obtain the opinion of resident artificial and natural reef-users regarding “no-take” zones as management tools. In each of our four counties, reef-users were asked questions regarding “no-take” zones. The results for Palm Beach County are summarized in Table 3.1.4-1.

Under the National Marine Sanctuary Act, 23 areas or zones were created where the taking of anything including fish and shellfish has been prohibited since 1997 in the Florida Keys. It is reasonable to assume that residents of neighboring counties may have formed an opinion about this management tool. In addition, the “not in my backyard view” was also tested by asking respondents for their opinions on “no take” zones in Palm Beach County. Over 65 percent of the respondents in Palm Beach County are willing to have “no take” zones off the shore of their county. Respondents are also willing to extend this concept southward to Broward and Miami-Dade Counties with nearly 65 percent supporting this expansion according to the results shown in Table 3.1.4-1.

**Table 3.1.4-1 (Residents)  
Opinion of Palm Beach County Residents Regarding "No Take" Zones  
For Artificial and Natural Reefs, 2000**

Survey Question (1)	Percent of Respondents Answering "Yes" (2)	Percent of Respondents Answering "No" (3)	Percent of Respondents Answering "Don't Know" (4)	Sample Size (5)
Support existing "NO TAKE" Zones in the Florida Keys	75%	15%	10%	337
Support "NO TAKE" Zones on some reefs off shore of Palm Beach County	65%	23%	12%	335
Support "NO TAKE" Zones on some reefs off shore of Palm Beach, Broward and Miami-Dade Counties	65%	21%	14%	136
	<b>Average for All Responses</b>	<b>Median for all Responses</b>		
What Percent of natural reefs in Palm Beach County should be protected with "No Take" Zones	30%	20%		287

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## 3.0 Socioeconomic Value of Reefs in Palm Beach County

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Finally, respondents were asked for their opinion regarding the percent of the reef system that should be included in “no take” zones. Respondents, on average, would be willing to have “no take” zones cover about 30 percent of the natural reefs off the Palm Beach County coast. Because the average may be skewed by exceptionally large answers, we also looked at the median percent of natural reefs respondents felt might be managed by the use of “no-take” zones. The median, or the midpoint between the highest and lowest answer, was 20 percent of the natural reefs. Such results will provide the public with important information regarding resident opinions of “no take” zones in Palm Beach County.

### 3.1.5 Demographic Information

The mail survey administered to Palm Beach County residents included questions regarding demographic characteristics. The reason for collecting such information was to determine what segment of the population will gain by protecting natural and artificial reefs off the Palm Beach County coast. Respondents were asked to provide some background on both themselves and their boating experience. Thus, the survey was used to collect demographic information as well as develop a boater profile to better understand these people called resident “reef-users” in Palm Beach County. Table 3.1.5-1 presents the results from the mail survey combined with comparable information on the entire Palm Beach County population.

The owners of reef-using registered boats are slightly older than the general population of Palm Beach County. The median age of reef-users is 48 years compared to 45.5 years for the general population. Statistically speaking, there is no real difference between these two groups. However, boating appears to be a male dominated activity with about 91 percent of the respondents indicating they were male compared to the general population of which 48 percent is male. Of course, there is no way to control who fills out the survey instrument once it reaches the boat owner’s residence. However, the survey is directed at the person who owns the boat. With respect to race, white individuals dominate boat ownership with 97 percent of respondents indicating they were white. This is a higher percentage than the general population which is 79 percent white in Palm Beach County. Further, a lesser percentage of respondents characterized themselves as Hispanic/Latino (4 percent) than exists in the general population (12 percent).

Nearly 53 percent of respondents indicated they had a college degree or higher level of education compared to 16 percent of the general population in 1990.<sup>3</sup> The education level of the general population is probably much higher today than ten years ago, but may not reach the level of education reported by survey respondents. Since education and income are positively correlated, it is expected that income levels would also be higher for respondents than the general population which was indeed the case as demonstrated with the last demographic statistic in Table 3.1.5-1. The estimated median household income of respondents is about \$72,000 compared to about \$40,000 for the general population.

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<sup>3</sup> *The U.S. Census Bureau has not yet released the educational levels for counties as part of the 2000 Census.*

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Of course, the purchase of a relatively large pleasure craft is also correlated with higher income as found by Bell and Leeworthy (1987) and discussed earlier in this chapter. So, this finding is not unusual.

Using the information on user activity, an estimated minimum of 74,000 residents engaged in a reef-using recreational activity in 2000. This was obtained by multiplying the number of registered boats that are estimated to be involved in reef use (19,464) by the average resident party size of 3.8 individuals. Because the turnover rate of the party is unknown, the term “minimum” is used to qualify the finding. That is, the same residents may not go boating every party trip. There are 859,812 residents in Palm Beach County over 14 years of age (i.e. about that age at which they can become boaters). In addition, it was estimated earlier in this chapter that resident reef-users constitute approximately 8.6 percent of this boater population (73,963/859,812). However, this reef-using population will be higher if party turnover (i.e. different individuals per trip) is considered.

**Table 3.1.5-1 (Residents)  
Demographic Characteristics and Boater Profile of Reef-Users in  
Palm Beach County Florida, 2000**

<b>Demographic Characteristics of Respondents to Mail Survey</b>	<b>Reef-Users</b>	<b>Palm Beach County Population</b>
Median Age	48	46
Sex		
Male	91%	48%
Female	9%	52%
Race		
White	97%	79%
Black/African American	0%	14%
Hispanic/Latino	4%	12%
Other	3%	7%
Education		
Percentage that completed College Degree or More	53%	16%
Median Household Income	\$71,698	\$39,560
Boater Profile		
Average Years of Residence in Palm Beach County	23	N/A
Average Years of Boating in south Florida	21	N/A
Average Length of Boat Used for Saltwater Activities (ft)	25	N/A
Percentage of Respondents that belong to fishing and/or diving clubs	20%	N/A
Sample Size		336

<sup>1</sup> Latest year that educational level attained by county is available is for 1990 from the U.S. Census Bureau. Source: Florida State University and the U.S. Bureau of the Census (1990, 2000).



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## 3.0 Socioeconomic Value of Reefs in Palm Beach County

The information collected in this section of the survey provides an idea of the characteristics and the magnitude of the population which are served by artificial and natural reefs off the coast of Palm Beach County. This should be valuable information for policy makers at the local and state levels.

Finally, a boater profile for Palm Beach County was developed from the survey results as follows. The typical reef-using boater has lived in Palm Beach County for 23 years and boated for 21 years. As is true of many south Florida residents, boaters moved to this county from other areas, probably out of state. The reef-using boaters in the sample own a pleasure craft of 25 feet in length on average. The weighted average of registered boats 16 feet and over in Palm Beach County is also 25 feet so it appears that the sample is particularly reflective of the population based on average boat length. Nearly 20 percent of the respondents were members of fishing and/or diving clubs. This indicator gives some idea of the intensity and degree of interest in recreational fishing, snorkeling and scuba diving off the coast of Palm Beach County, Florida.

### 3.2 Visitors

The focus of this section is the socioeconomic value of the reefs associated with visitors to Palm Beach County. As defined in Chapter 1, Introduction, visitors to a county are defined as nonresidents of the county that they are visiting. For example, a person from Broward County visiting Palm Beach County is considered to be a visitor to Palm Beach County. Likewise, a person from New York visiting Palm Beach County is considered to be a visitor to Palm Beach County. This section provides the following values associated with visitors to Palm Beach County: reef user activity, economic contribution of the reefs, use value of the reefs and demographic information. Detailed explanations of the methods and data used to estimate these values for Palm Beach County are provided in Chapter 1: Introduction and Chapter 2: Socioeconomic Values of Reefs in Southeast Florida.

#### 3.2.1 User Activity

The activity of reef users is summarized in person-days of reef use. For visitors, the number of person-trips to use the reefs is also of interest. In order to measure person-days and person-trips associated with reef use, the total number of person-trips by all visitors to each county must be estimated. Total visitation includes visits to a county by non-residents of that county to participate in any activity be it recreation, business or family matters. The total number of person-trips by all visitors to the county was estimated using the Capacity Utilization Model. This model uses a variety of information obtained from the counties and the responses to the General Visitor Survey. The number of person-trips was then converted to the number of person-days spent by all visitors to Palm Beach County using information from the General Visitor Survey.

The number of person-trips taken by all visitors to Palm Beach County and the number of person-days these visitors spent in the county during the year 2000-2001, developed in Chapter 2.2.1, is summarized in Table 3.2.1-1.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

**Table 3.2.1-1 (Visitors)  
Number of Person-Trips and Person Days  
All Visitors to Palm Beach County  
June 2000 to May 2001**

Measure of Visitation	Summer – 00	Winter – 01	Total
Number of Person-Trips	1,938,327	2,313,013	4,251,340
Number of Person-Days	13,413,018	33,439,901	46,852,919

Visitors took 4.2 million person-trips to Palm Beach County from June 2000 to May 2001 and spent 47 million person-days in the county.

The number of person-trips by all visitors was used as the basis for estimating the number of person-days visitors spent using the artificial and natural reefs in each county. For each season, the number of boating person-trips is equal to the total number of person-trips by all visitors multiplied by the proportion of person-trips taken by visitors who participated in saltwater boating in the county in the past twelve months. This proportion was taken from the General Visitor Survey answer to Question 13 (Which activities and boating modes did you participate in over the past 12 months in this county?) for one boating activity per respondent divided by the total number of respondents.

To get the number of boating person-trips when the person used the reefs, the number of boating person-trips is multiplied by the proportion of boating person-trips when the respondent used the reefs. This proportion was obtained from the Visitor Boater Screening Tally sheets. These sheets indicated the proportion of boaters intercepted who used the reefs at least once in the past 12 months. The results for the summer, winter and the year are summarized in Tables 3.2.1-2.

**Table 3.2.1-2 (Visitors)  
Person-Trips of Visitors Who Boated  
And Visitors Who Used the Reefs in Palm Beach County Over the Past 12 Months**

Season	Total Person Trips to County - All Visitors	Proportion of Person Trips Taken By Visitors Who Boated <sup>a</sup>	Boating Person Trips	Proportion of Boating Person Trips When the Reef was Used for Recreation <sup>b</sup>	Boating Person Trips When the Reef was Used for Recreation
Summer - June 2000 to Nov. 2001	1,938,327	0.16	306,304	0.98	299,522
Winter - December 2000 to May 2001	2,313,013	0.14	330,430	0.98	323,115
Year Round - June 2000 to May 2001	4,251,340		636,734		622,637

<sup>a</sup> Saltwater Boating Only. From General Visitor Survey Answer to Question 13 (Which activities\_modes did you participate in over the past 12 months in this county) for one boating activity divided by total number of respondents.

<sup>b</sup> From the Visitor Boater Tally Sheets:  $= 1 - (Q6/(Q6+Q7+Q8+Q10))$

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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Of the 4,250,000 person-trips visitors took to Palm Beach County from June 2000 to May 2001, 16 percent of the trips involved saltwater boating activities in the summer and 14 percent involved saltwater boating activities in the winter. Of the resulting 637,000 boating person-trips by visitors to Palm Beach County, 98 percent of those trips involved recreational reef use. Thus, visitors who used the reefs for recreation in Palm Beach County made about 623,000 person-trips to the county from June 2000 to May 2001.

Next, the total number of person-days that visitor boaters who used the reefs spent visiting the county was estimated. This estimate is the total boating person trips when reefs were used times the average days per visit by boaters who used the reefs. The average days per visit by boaters who used the reefs was obtained from the responses to Question 10 of the Visitor Boater Survey (How many nights are you spending on this trip?) where a 1 was added to each answer to obtain number of days. The average number of days and the total person days reef users spent in Palm Beach county in 2000-2001 are provided in Table 3.2.1-3.

**Table 3.2.1-3 (Visitors)  
Average Number of Days Visiting Palm Beach County and Total Person  
Days in Palm Beach County by Visitor Boaters Who Used the Reefs  
June 2000 to May 2001**

<b>County</b>	<b>Average Days Visiting the County Per Trip</b>	<b>Total Person Days Spent Visiting the County</b>
Palm Beach	5.36	3,336,923

Reef-using boaters who visited Palm Beach County spent an average of 5.36 days in the county during their trip. As a result, these visitors spent 3.3 million person-days in Palm Beach County from June 2000 to May 2001.

To allocate the total person days spent visiting the county to actual days using the artificial and natural reefs, the daily participation rates of the different boating activities were calculated using the responses to Questions 12, 15, 16 and 17 of the Visitor Boater Survey. Participation rate is the proportion of total days that respondents spent in the county in the last 12 months when the respondent actually participated in a saltwater activity and boat mode. It represents the probability that a visitor boater who uses the reefs will participate in a particular saltwater boating activity and boating mode on any given day.

Question 12 asked the respondent to examine a list of saltwater boating activities and boat modes and read the number corresponding to the activity-boat mode that he/she or someone in his/her party participated in over the past 12 months. The saltwater activity-boat mode list is provided in Appendix B with the Visitor Boater Survey. Question 13 asked if the respondent participated in the activity and boating mode. Question 15 asked how many days in the past 12 months that the respondent participated in the activity-boat mode. From the responses to these questions, the proportions of total visiting days respondents actually spent participating in the activity-boat mode were obtained.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

To allocate the total number of days in an activity-boat mode to the use of artificial reefs versus natural reefs versus no reefs, the proportion of fishing days and the proportion of dives spent on each reef/no reef was calculated from the Visitor Boater Survey responses. Question 16 asked the respondent how many days he/she spent on the artificial reef and Question 17 asked the respondent how many days he/she spent on the natural reef. For scuba divers and snorkelers, Question 18 asked for the total number of dives and Questions 19 and 20 asked for the number of dives on artificial versus natural reefs. A dive is defined as exiting and reentering the boat and applies to both divers and snorkelers. From the responses to these questions, the proportions of fishing days spent on the artificial and natural reefs and the proportions of dives spent on the artificial and natural reefs were obtained. For fishing charter and party boats, the proportion of days spent on artificial versus natural versus no reefs was taken from the fishing-related responses to the charter/party boat operator survey for those operators who provide services in Palm Beach County.

The proportion of visitor days that visitor boaters who use the reefs participated in fishing and diving/snorkeling and the proportion of fishing days and scuba/snorkeling dives that visitor boaters spent on the artificial, natural and no reefs for Palm Beach County are presented in Table 3.2.1-4.

**Table 3.2.1-4 (Visitors)**  
**Saltwater Recreational Activities from All Boating Modes**  
**Percent of Visitor Person-Days That Reef-Using Boaters Participated in the**  
**Saltwater Recreation Activity and Percent of Fishing Days or Dives Spent on**  
**Artificial, Natural and No Reefs from Visitor Boater Survey**  
**Palm Beach County**

Activity	Total Respondents	Percent of All Visitor Days	Percent of Activity Days or Dives On:			
			Artificial Reefs	Natural Reefs	No Reefs	Sum of Percentages
Fishing <sup>a</sup>	490	10%	21%	45%	34%	100%
Scuba Diving/Snorkeling <sup>b</sup>	490	32%	25%	74%	1%	100%

<sup>a</sup> Percent of fishing days on each reef type is reported.  
<sup>b</sup> Percent of dives on each reef type is reported. A dive is a boat exit and re-entry.  
Note: Boating Modes are Charter, Party, Rental, and Private (Own or Friend's) Boat.

Visitor boaters who came to Palm Beach County to use the reefs spent 10 percent of their visiting days participating in saltwater fishing from either a charter, party, rental or private boat. Of these fishing days, 21 percent of days were spent fishing near artificial reefs, 45 percent of days were spent fishing near natural reefs and 34 percent of days were spent fishing near no reefs. Also, visitor boaters who came to the county to use the reefs spent 32 percent of their visiting days scuba diving or snorkeling. Of these diving/snorkeling days, 25 percent of dives were spent on artificial reefs, 74 percent of dives were spent on natural reefs, and 1 percent of dives were spent on no reefs.

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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These percentages are based on the visitor responses to the survey. The breakdown between artificial and natural reef use for charter boat and party boat fishing was taken from the responses to the charter boat survey. The breakdown between artificial and natural reef use for all other activities and boat modes were taken from the visitor responses to the survey.

The number of person-days spent in each saltwater boating activity-boat mode was estimated as the total person days reef-using boaters spent visiting the county in year 2000-2001 (from Table 3.2.1-3) times the proportion of person-days that these visitors spent participating in each activity-boat mode. Then the number of person-days spent in each saltwater boating activity-boat mode was allocated to artificial and natural reefs based on either the proportion of days or the proportion of dives spent in that activity-boat mode on or near artificial versus natural reefs. Proportion of days was used for all activities except scuba diving and snorkeling where the proportion of dives was used to provide a more accurate indicator of reef use.

A summary of the total person-days visitors spent participating in reef-related recreation by type of activity and by type of reef in Palm Beach County is provided in Table 3.2.1-5. The total person-days visitors spent participating in each saltwater activity and boat mode by type of reef is provided in Table 3.2.1-6.

Visitors to Palm Beach County spent about 1,260,000 person-days on the reef system from June 2000 to May 2001. About 330,000 of these days were spent on artificial reefs and about 931,000 of these days were spent on natural reefs.

**Table 3.2.1-5 (Visitors)  
Number of Visitor Person-Days Spent Using Artificial and Natural Reefs  
By Recreation Activity – Palm Beach County**

Activity	Number of Person-Days		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	37,000	91,000	127,000
Scuba Diving	238,000	682,000	920,000
Fishing	55,000	158,000	214,000
Glass Bottom Boat Sightseeing	0	0	0
<b>Total</b>	<b>330,000</b>	<b>931,000</b>	<b>1,261,000</b>

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**Table 3.2.1-6 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in Saltwater Boating Activities and Boating Modes and Type of Reef Used - June 2000 to May 2001**  
**Palm Beach County**

Activity	Boat Mode	Number of Person Days	Number of Person-Days On:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	34,171	6,276	27,895	0
	Rental	9,528	5,558	3,970	0
	Private	83,785	25,105	58,679	0
Scuba Diving	Charter/Party	795,460	179,124	607,859	8,477
	Rental	5,257	1,643	3,614	0
	Private	127,484	57,155	70,329	0
Fishing – Offshore / Trolling	Charter	39,428	5,399	18,221	15,808
	Party	73,270	10,032	33,861	29,377
	Rental	16,428	0	986	15,443
	Private	115,655	32,937	64,004	18,714
Fishing – Flats or Back Country	Charter/Party	329	0	0	329
	Rental	329	0	0	329
	Private	657	0	657	0
Fishing Bottom	Charter	18,071	2,474	8,351	7,245
	Party	32,200	4,409	14,881	12,910
	Rental	0	0	0	0
	Private	39,428	0	17,367	22,061
Viewing Nature and Wildlife	Glass Bottom Boat	0	0	0	0
	Back Country Excursion	986	0	0	986
	Rental	5,914	0	0	5,914
	Private	23,000	0	0	23,000
Personal Watercraft (jet skis, wave runners, etc.)	Rental	2,629	0	0	2,629
	Private	42,714	0	0	42,714
Sailing	Charter/Party	657	0	0	657
	Rental	1,314	0	0	1,314
	Private	34,171	0	0	34,171
Other Boating Activities	Charter/Party	4,929	0	0	4,929
	Rental	0	0	0	0
	Private	33,185	0	0	33,185
Total Person-Days		1,540,978	330,112	930,675	280,190

### 3.2.2 Economic Contribution – Visitors

The Visitor Boater Survey asked respondents how much money they and members of their party spent on their last day that they participated in fishing, scuba diving and snorkeling in the county. The respondent was also asked how many people spent or benefited from those expenditures. The respondent was asked only to provide the amount of money spent in Palm Beach County. From this information, a picture of the average itemized expenditures per person per fishing or diving day and by boating mode was estimated.

The average itemized per person expenditures by those who participated in each activity and boat mode in Palm Beach County are provided in Table 3.2.2-1. Palm Beach County reef-using visitors who went saltwater fishing on their own boat, a friend's boat or a rental boat spent, on average, \$195 per person per day on the day that they went fishing. This amount is comprised of \$59 for boat fuel, \$28 for tackle, \$31 for marina fees, \$7 for lodging, \$12 for food and beverages at stores and \$23 for food and beverages at restaurants and bars, among other items.

The average expenditure of persons who fished on charter boats was \$263 per person per day. About \$96 was the cost of the charter boat while \$29 was spent on lodging, \$34 was spent on food and beverages at restaurants and bars, \$31 was spent on automobile gasoline, \$29 was spent on auto rental, and \$29 was spent on shopping.

Persons who fished on party boats spent considerably less per day than other fishers. Average daily expenditures were \$116 per person which included \$24 for the party boat fee, \$18 for lodging, \$14 for food and beverages at stores, \$30 for food and beverages at restaurants, \$11 for auto rental and \$11 for shopping.

Palm Beach County reef-using visitors who went scuba diving or snorkeling on their own boat, a friend's boat or a rental boat spent, on average, \$137 per person per day on the day they went diving. This amount is comprised of \$38 for boat fuel, \$15 for ramp fees, \$21 for marina fees, \$18 for food and beverages at stores and \$19 for food and beverages at restaurants and bars.

Visitors who went diving on charter or party boats spent the same amount per day as those using a private or rental boat. They spent, on average, \$138 per person per day. This expenditure was comprised of \$56 per day for the dive charter or party boat, \$21 per day for lodging and \$22 per day for food and beverages in restaurants and bars, among other items.

The lodging expenditure item includes lodging costs for hotels, motels and campgrounds or if the respondent paid by the day or by the week. The \$21 per person per day for lodging by divers who use charter or party boats may seem lower than the actual per person rate of a hotel or motel. Bear in mind that only a portion of visitors stay at a hotel or motel. Visitor accommodations also include campgrounds, family or friends, second homes and time shares. Also, many visitors spend only one day in the county and therefore do not incur the cost of a room. The cost of the second home or time share is not included in the lodging cost because this is a monthly or up front cost that can, at best, only be partially due to the existence of the reefs.

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**Table 3.2.2-1 (Visitors)  
Amount of Money Spent in County Per Person During Most Recent Day  
Participating in Each Reef-Related Activity and Boating Mode  
Palm Beach County  
From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$96.00	\$24.41		\$56.26
Boat Rental				\$0.94	
Boat Fuel	\$58.84			\$38.40	
Air Refills				\$1.86	\$1.67
Tackle	\$28.21				
Bait	\$6.22				
Ice	\$1.96			\$1.56	\$0.06
Ramp Fees	\$4.80			\$15.12	\$0.01
Marina Fees	\$30.63			\$21.23	\$0.17
Lodging	\$7.36	\$28.68	\$17.84	\$1.72	\$20.60
Camping Fees	\$0.00	\$0.00	\$0.00	\$0.45	\$0.67
Food and Beverages - Stores	\$11.71	\$16.03	\$13.77	\$17.66	\$8.34
Food and Beverages - Restaurants/Bars	\$23.12	\$33.54	\$29.74	\$19.39	\$21.54
Auto Gas	\$3.85	\$30.70	\$2.89	\$3.36	\$8.24
Auto Rental	\$8.99	\$29.29	\$10.69	\$5.80	\$9.12
Equipment Rental	\$1.73	\$0.00	\$4.97	\$0.50	\$2.09
Shopping	\$7.99	\$28.88	\$11.20	\$9.39	\$9.68
Total	\$195.42	\$263.13	\$115.50	\$137.37	\$138.48
Number of Respondents	47	19	78	42	314
Number of Respondents and Party Members <sup>c</sup>	152	51	176	137	718

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity-Mode, the expenditures for each item were summed over all the respondents who participated in the Activity-Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.



### 3.0 Socioeconomic Value of Reefs in Palm Beach County

The expenditures per person per day were multiplied by the number of person-days by boating mode and reef type to obtain an estimate of the total expenditures associated with reef related activities in Palm Beach County. The itemized total expenditures associated with reef use in 2000-2001 are provided in Table 3.2.2-2. Visitors who used the reefs in Palm Beach County spent \$184 million on reef-related expenditures. Of this amount \$48 million was associated with artificial reef-related expenditures and \$136 million was associated with natural reef-related expenditures.

**Table 3.2.2-2 (Visitors)  
Total Visitor Expenditures In Palm Beach County Associated with Reef Use  
All Reef-Related Activities and Boating Modes  
June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	330,112	930,675	1,260,787
Charter / Party Boat Fee	\$11,539,154	\$39,509,116	\$51,048,270
Boat Rental	84,080	128,377	212,457
Boat Fuel	5,373,044	10,129,360	15,502,404
Air Refills	476,896	1,318,351	1,795,247
Tackle	929,222	2,341,949	3,271,170
Bait	204,837	516,259	721,096
Ice	215,386	414,936	630,322
Ramp Fees	1,512,441	2,470,091	3,982,532
Marina Fees	2,939,896	5,550,829	8,490,725
Lodging	4,699,409	15,575,573	20,274,983
Camping Fees	165,415	490,450	655,865
Food and Beverages - Stores	3,836,933	9,783,741	13,620,674
Food and Beverages - Restaurants/Bars	7,183,784	20,604,786	27,788,570
Auto Gas	2,238,482	6,974,355	9,212,837
Auto Rental	2,891,652	8,638,760	11,530,413
Equipment Rental	561,319	1,784,856	2,346,175
Shopping	3,287,962	9,415,881	12,703,843
Glass Bottom Boat Ride	0	0	0
<b>Total</b>	<b>\$48,139,911</b>	<b>\$135,647,670</b>	<b>\$183,787,582</b>

The reef-related visitor expenditures were then used to estimate the economic contribution of artificial and natural reefs to Palm Beach County. As discussed in the Introduction of the Report, 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

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

wherein additional income and employment is created as the income earned by the reef-related industries is re-spent 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.

The direct, indirect and induced increase in sales, total income, employment and indirect business taxes generated by the reef-related expenditures were estimated for Palm Beach County using the IMPLAN Regional Input-Output Model. This model uses detailed data on the economy of the county to estimate economic multipliers and to model the impact of reef-related expenditures on the economy.

The economic contribution of the reefs to Palm Beach County is provided in Table 3.2.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. Income is the money that stays in the county's economy. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures. The indirect business tax contribution is the sum of the additional excise taxes, property taxes, fees, licenses, and sales taxes collected due to the reef-related expenditures.

**Table 3.2.2-3 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Palm Beach County**  
**Economic Area is Palm Beach County**  
**June 2000 to May 2001 – In 2000 dollars**

Reef Type/Economic Contribution	Direct	Indirect	Induced	Total
<b>Artificial Reefs</b>				
Sales	\$48,139,911	\$13,615,865	\$19,410,419	\$81,166,195
Total Income	\$25,033,935	\$7,408,596	\$12,211,129	\$44,653,660
Employment	849	142	253	1,244
Indirect Business Taxes	\$4,087,804	\$754,643	\$1,210,601	\$6,053,048
<b>Natural Reefs</b>				
Sales	\$135,647,661	\$37,909,019	\$54,627,400	\$228,184,080
Total Income	\$72,055,317	\$20,844,992	\$34,328,471	\$127,228,780
Employment	2,439	401	712	3,552
Indirect Business Taxes	\$11,220,086	\$2,152,321	\$3,417,124	\$16,789,531
<b>Natural and Artificial Reefs</b>				
Sales	\$183,787,572	\$51,524,884	\$74,037,819	\$309,350,275
Total Income	\$97,089,252	\$28,253,588	\$46,539,600	\$171,882,440
Employment	3,288	543	965	4,796
Indirect Business Taxes	\$15,307,890	\$2,906,964	\$4,627,725	\$22,842,579

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## 3.0 Socioeconomic Value of Reefs in Palm Beach County

Reef-related expenditures by visitors to Palm Beach County during the period June 2000 to May 2001 resulted in \$309 million in sales to county businesses. These sales generated \$172 million in income and 4,800 jobs. About \$23 million in indirect business taxes were collected as a result. About 25 percent of these values were the result of artificial reef-related expenditures and 75 percent of these values were the result of natural reef-related expenditures.

### 3.2.3 Use Value

Use value was defined in the introduction to this report. In this study, four types of use values were estimated: (1) the value of maintaining the natural reefs in their existing condition; (2) the value of maintaining the artificial reefs in their existing condition; (3) the value of maintaining both artificial and natural reefs in their existing condition; and (4) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The visitor reef-user values associated with maintaining the reefs in their existing conditions for Palm Beach County is provided in Table 3.2.3-1. Use value per person day means the value per person day of artificial, natural or all reef use, as specified in the table. The respondent was asked to state yes, no or don't know to a specified payment to maintain the artificial reefs, the natural reefs and a combined program that would protect both types of reefs. The scenario provided to the respondent was as follows:

“Local and state government agencies are considering different approaches to maintaining the health and condition of the natural and artificial reefs in southeast Florida. One plan focuses on providing greater protection for natural reefs by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the artificial reefs by maintaining water quality, limiting damage to artificial reefs from anchoring and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both or none of these plans and if you would be willing to incur higher costs to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on you ability to participate in any boating activity or other recreation in southeast Florida.”

Then the respondent was asked a yes or no question regarding the natural reef plan, the artificial reef plan and both plans. For example, the question regarding both plans read: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together in a combined program. Consider once again your total trip cost for your last trip to use the reefs in southeast Florida including travel expenses, lodging, and all boating expenses. If

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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your total costs for this trip would have been \$\_\_\_\_\_ higher, would you be willing to pay this amount to maintain the artificial and natural reefs?”

The amounts (bid values) of \$20, \$100, \$200, \$1,000, and \$2,000 were rotated from respondent to respondent. For the individual programs (just natural or artificial reef protection), the amounts were one-half of the above amounts: \$10, \$50, \$100, \$500 and \$1,000.

Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey<sup>4</sup>: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs.” Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition.

Chapter 2.2.2 provides a general description of the procedures used to analyze the use value responses and the procedures used to estimate the user values presented here. For a more technical discussion, please see this report’s Technical Appendix which is a separate document. This report describes the methods used to derive the values presented here and provides alternative estimates using different estimation methods. Here we present the estimates of total annual use value, use value per person-day, and the asset value of the reefs derived using the logit model.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. For Palm Beach County visitors, the average per person-day value of the natural reefs was \$27.85 versus \$17.89 for artificial reefs. Total use is also higher for natural versus artificial reefs. Palm Beach County visitors’ natural reef use was almost 931 thousand person-days versus 330 thousand person-days for artificial reefs. This translated into an estimate of total annual use value of over \$25.9 million for natural reefs and \$5.9 million for artificial reefs. Capitalizing the annual use values, using a three percent discount rate, yields asset values of about \$864 million for the natural reefs and \$197 million for the artificial reefs.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs. This includes investments for such things as deployment of new artificial reefs and enhancements of natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of

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<sup>4</sup> For a complete description of the contingent valuation questions, please refer to the Visitor Boater Survey and the Blue Card (which is white in this report but labeled “Blue Card” in Appendix B).

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of use value lower than that derived by adding-up the values of the natural and artificial reef programs separately. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs would provide a conservative or lower bound estimate of the total natural and artificial reef values.

The capitalized value of the reef user values is the present value of the annual values calculated at three percent discount rate. It represents the “stock” value analogous to land market values. The capitalized visitor reef user value associated with Palm Beach County reefs, both artificial and natural, is \$701 million. Bear in mind that this value only includes the value that visitor reef users place on the reefs and does not include the values that resident reef users and non-reef-users place on the reefs or the economic contribution of the reefs. *The estimation of the value of reefs to non-reef users was not part of this study.*

**Table 3.2.3-1 (Visitors)**  
**Annual Value of Reefs To Reef Users and Capitalized Value**  
**Data Represents June 2000 to May 2001**  
**Visitor Reef-Users in Palm Beach County**

Item	All Reefs – Artificial and Natural	Artificial Reefs	Natural Reefs
Number of Person-Days of Reef Use	1,260,787	330,112	930,675
Use Value Per Person-Day (\$2000)	\$16.68	\$17.89	\$27.85
Annual Use Value - (\$2000)	\$21,032,312	\$5,906,311	\$25,919,931
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$701,077,067	\$196,877,033	\$863,997,700

Reef users’ willingness to pay to invest in and maintain “new” artificial reefs is provided in Table 3.2.3-2. The use value per person-day is the value per day or a portion of a day of artificial reef use. Reef users are willing to pay \$4 million annually for this program in Palm Beach County. Scuba divers have the highest value for new artificial reefs of all user types.

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**Table 3.2.3-2 (Visitors)**  
**Estimated Use Value of Investing in and Maintaining "New" Artificial Reefs in the County**  
**Visitor Reef-Users in Palm Beach County**

Item	Value
Number of Person-Days of Artificial Reef Use	330,112
Use Value Per Person-Day for "New" Artificial Reefs (\$2000)	\$12.01
Annual Use Values for "New" Artificial Reefs	\$3,964,467
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$132,148,900
<i>Note: Use value per person-day is the use value for a whole day or a portion of a day of artificial reef use.</i>	

The value of reefs by reef type and activity type for Palm Beach County is provided in Table 3.2.3-3.

**Table 3.2.3-3 (Visitors)**  
**Value of Reefs to Visitors to Palm Beach County, by Reef Type and Activity, 2000-2001**

Reef Type/Activity	Person-Days	Annual User Value (\$)	User Value Per Person-Day (\$)
<b>Natural Reefs</b>	<b>930,675</b>	<b>\$25,919,931</b>	<b>\$27.85</b>
Snorkeling	90,544	\$1,343,878	\$14.84
Scuba Diving	681,802	\$22,378,144	\$32.82
Fishing	158,329	\$2,197,909	\$13.88
<b>Artificial Reefs</b>	<b>330,112</b>	<b>\$5,906,311</b>	<b>\$17.89</b>
Snorkeling	36,940	\$362,444	\$9.81
Scuba Diving	237,921	\$4,812,227	\$20.23
Fishing	55,252	\$731,639	\$13.24
<b>Natural &amp; Artificial Reefs</b>	<b>1,260,787</b>	<b>\$21,032,312</b>	<b>\$16.68</b>
Snorkeling	127,484	\$963,029	\$7.55
Scuba Diving	919,723	\$18,396,328	\$20.00
Fishing	213,580	\$1,672,955	\$7.83
<b>New Artificial Reefs</b>	<b>330,112</b>	<b>\$3,964,467</b>	<b>\$12.01</b>
Snorkeling	36,940	\$155,683	\$4.21
Scuba Diving	237,921	\$3,494,556	\$14.69
Fishing	55,252	\$314,228	\$5.69

#### 3.2.4 Demographic Information

The Visitor Boater Survey asked the respondent questions regarding his/her socioeconomic characteristics so that a picture of the typical reef user could be developed. The results for Palm Beach County are summarized in Table 3.2.4-1.

**Table 3.2.4-1 (Visitors)  
Demographic Characteristics of Visitor Reef-Users in Palm Beach County, 2000**

<b>Characteristic</b>	<b>Value</b>
Median Age of Respondent – Years	41
Sex of Respondent	
Male	79%
Female	21%
Race of Respondent	
White	94%
Black	2%
Other	4%
Percent Hispanic / Latino	5%
Median Household Income	\$87,500
Average Years Boating in Southeast Florida	9.2
Average Length of Own Boat Used in Saltwater Boating in Feet	25
Percent of Respondents Who Belong to Fishing and/or Diving Clubs	24%

### **3.3 Total – Residents and Visitors**

This section summarizes the user activities, economic contribution and use values associated with the artificial and natural reefs for both residents and visitors of Palm Beach County. Demographic information of both resident and visitor reef users is also provided.

#### **3.3.1 User Activity**

The numbers of person-days spent using the reefs in Palm Beach County by reef type and population (residents and visitors) are summarized in Table 3.3.1-1. Visitors and residents spent 4.2 million person-days using artificial and natural reefs in Palm Beach County during the 12 month period from June 2000 to May 2001. Residents spent 3.0 million person-days and visitors spent 1.2 million person-days. Reef users spent 1.4 million person-days using artificial reefs and 2.8 million person-days using natural reefs. A summary of reef use by type of activity is provided in Table 3.3.1-2.

**Table 3.3.1-1  
Number of Person-Days Spent on Artificial and  
Natural Reefs in Palm Beach County  
Residents and Visitors  
In Millions**

<b>Population</b>	<b>Artificial Reefs</b>	<b>Natural Reefs</b>	<b>All Reefs</b>
Residents	1.08	1.90	2.98
Visitors	0.33	0.93	1.26
Total	1.41	2.83	4.24

**Table 3.3.1-2  
Number of Person-Days Spent Using Reefs in Palm Beach County  
By Recreational Activity  
Residents and Visitors  
In Millions**

<b>Activity</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Snorkeling	0.62	0.13	0.75
Scuba Diving	0.81	0.92	1.73
Fishing	1.55	0.21	1.76
Total	2.98	1.26	4.24

Diving is a bit more prevalent than fishing in Palm Beach County. Fishing comprises 1.8 million person-days while scuba diving and snorkeling comprise 1.7 million person-days and about 750,000 person-days, respectively. Resident reef-related recreation comprises 70 percent of total reef-related recreation by residents and visitors in Palm Beach County. Residents spend significantly more days fishing and more days snorkeling than do visitors.

### **3.3.2 Economic Contribution**

The total economic contribution of the reefs to Palm Beach County includes the contribution of reef expenditures to sales, income and employment. 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 visitor expenditures create multiplier effects wherein additional income and employment is created as the income earned by the reef-related industries is re-spent 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.



### 3.0 Socioeconomic Value of Reefs in Palm Beach County

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.

The economic contributions of the artificial, natural and all reefs to Palm Beach County are provided in Tables 3.3.2-1 through 3.3.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

All reef-related expenditures in Palm Beach County generated \$504 million in sales during the 12-month period from June 2000 to May 2001. These sales resulted in \$194 million in income to Palm Beach County residents and provided 6,300 jobs in Palm Beach County. Artificial reef-related expenditures accounted for 30 percent of the economic contribution of all reefs and natural reef-related expenditures accounted for 70 percent of the economic contribution.

**Table 3.3.2-1**  
**Economic Contribution of Artificial Reef-Related Expenditures**  
**to Palm Beach County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$67.00	\$7.70	512
Visitor	\$48.14	\$25.00	849
Total	\$115.14	\$32.70	1,361
Indirect	\$13.62	\$7.40	142
Induced	\$19.41	\$12.20	253
Total	\$148.17	\$52.30	1,756

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.

**Table 3.3.2-2**  
**Economic Contribution of Natural Reef-Related Expenditures**  
**to Palm Beach County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$128.40	\$14.70	992
Visitor	\$135.65	\$72.00	2,439
Total	\$264.05	\$86.70	3,431
Indirect	\$37.91	\$21.00	401
Induced	\$54.63	\$34.00	712
Total	\$356.59	\$141.70	4,544
<sup>a</sup> The direct contribution is the actual expenditures made in the county.			
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits			
<sup>c</sup> Employment includes the number of full-time and part-time jobs.			

**Table 3.3.2-3**  
**Economic Contribution of All Reef-Related Expenditures**  
**to Palm Beach County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$195.40	\$22.40	1,504
Visitor	\$183.79	\$97.00	3,288
Total	\$379.19	\$119.40	4,792
Indirect	\$51.52	\$28.40	543
Induced	\$74.04	\$46.20	965
Total	\$504.75	\$194.00	6,300
<sup>a</sup> The direct contribution is the actual expenditures made in the county.			
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits			
<sup>c</sup> Employment includes the number of full-time and part-time jobs.			

### 3.3.3 Use Value

In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to all reef users of maintaining both the artificial and natural reefs in their existing condition; and (4) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount

### 3.0 Socioeconomic Value of Reefs in Palm Beach County

of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The annual value Palm Beach County visitors and residents place on protecting the reefs in their existing condition and the associated capitalized value is presented in Table 3.3.3-1. The annual value visitor and resident reef-users place on investing in and maintaining “new” artificial reefs is presented in Table 3.3.3-2. These values were explained in Sections 3.1.3 and 3.2.3.

**Table 3.3.3-1**  
**Annual Use Value Associated with Protecting Reefs in their Existing Condition and**  
**Capitalized Value associated With Reef Use**  
**Data Represents June 2000 to May 2001**  
**Palm Beach County, Florida**

<b>Item</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
<b>All Reefs - Artificial and Natural</b>			
Number of Person-Days of Reef Use (millions)	2.98	1.26	<b>4.24</b>
Use Value Per Person-Day	\$3.38	\$16.68	<b>\$7.34</b>
Annual Use Value - (million dollars)	\$10.7	\$21.03	<b>\$31.10</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$335.8	\$701.08	<b>\$1,036.88</b>
<b>Artificial Reefs</b>			
Number of Person-Days of Artificial Reef Use (millions)	1.08	0.33	<b>1.41</b>
Use Value Per Person-Day	\$2.96	\$17.89	<b>\$6.47</b>
Annual Use Value - (million dollars)	\$3.18	\$5.91	<b>\$9.09</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$106.10	\$196.88	<b>\$302.98</b>
<b>Natural Reefs</b>			
Number of Person-Days of Reef Use (millions)	1.90	0.93	<b>2.83</b>
Use Value Per Person-Day	\$8.50	\$27.85	<b>\$14.86</b>
Annual Use Value - (million dollars)	\$16.18	\$25.92	<b>\$42.10</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$539.30	\$864.00	<b>\$1,403.30</b>

**Table 3.3.3-2  
Estimated Value to Reef Users From Investing in and  
Maintaining "New" Artificial Reefs  
Palm Beach County, Florida**

<b>Item</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Number of Person-Days of Artificial Reef Use (millions)	1.08	0.33	<b>1.41</b>
Use Value Per Person-Day for "New" Artificial Reefs	\$0.72	\$12.01	<b>\$3.37</b>
Annual Use Values for "New" Artificial Reefs (million dollars)	\$0.78	\$3.96	<b>\$4.74</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$25.90	\$132.10	<b>\$158.00</b>

**3.3.4 Demographic Information**

This section summarizes and compares the demographic characteristics of visitor and resident reef users. These characteristics were obtained from the resident boater survey and the visitor boater survey. They are summarized in Table 3.3.4-1. A comparison of the demographics indicate that resident and visitors are very similar in terms of age, race, income, and membership in fishing and/or diving clubs.

3.0 Socioeconomic Value of Reefs in Palm Beach County

**Table 3.3.4-1  
Demographic Characteristics of Resident and Visitor Reef-Users in  
Palm Beach County, 2000**

	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Age of Respondent</b>	48			41		
<b>Sex Of Respondent</b>	<b>Percent</b>			<b>Percent</b>		
Male	91%			79%		
Female	9%			21%		
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
<b>Race Of Respondent</b>	97%	0%	3%	94%	2%	4%
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
<b>Percent Hispanic/Latino</b>	4%			5%		
	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Household Income</b>	\$71,695			\$87,500		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Years Boating in South Florida</b>	21			9.2		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Length of Boat Used for Salt Water Activities in Feet</b>	25			25		
	<b>Residents</b>			<b>Visitors</b>		
<b>% of Respondents Who Belong to Fishing and/or Diving Clubs</b>	20%			24%		

# Chapter 4: Socioeconomic Values of Reefs in Broward County

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This chapter describes the Socioeconomic Value of Artificial and Natural Reefs in Broward County to residents and visitors. For both groups this chapter discusses the following topics.

- Volume of user activity on both artificial and natural reefs off Broward County;
- Economic Contribution of artificial and natural reefs to the county's economy;
- Resident and visitor "use value" associated with recreating on artificial and natural reefs in Broward County; and,
- Demographic and boater profile of reef users in Broward County.

For residents, their opinions regarding the existence of "no-take" zones as a tool to protect existing artificial and natural reefs are provided.

## 4.1 Residents

This section presents the estimated socioeconomic values associated with resident boater use of the reefs off the coast of Broward County. Resident boaters are those individuals who live within Broward County and who use a boat that is owned by a resident of the county to visit the reef system. Resident boats used to visit the reef system are defined as those greater than 16 feet in length and registered with the Florida Department of Highway Safety and Motor Vehicles.

### 4.1.1 User Activity

This chapter first considers the volume of resident user activity associated with the artificial and natural reefs off Broward County. User activity is expressed in terms of the number of boating days or "party-days" since each boat usually carries one or more individuals. Also, user activity will be analyzed in terms of the kinds of recreational activities (e.g., snorkeling) that parties take part in when they visit the reef system.

To measure party-days for any recreational resource, it is important to define what universe the research is intended to measure. In this study, we wish to measure the number of party-days spent on artificial and natural reefs in the Atlantic Ocean off the coast of Broward County. Most residents use their own boats to visit and use the reefs. The use of party boats and charter rentals by residents was not estimated.

In 1999-2000, there were 61,124 registered pleasure boats in Broward County according to the Florida Department of Highway Safety and Motor Vehicles (2001). These pleasure craft were divided into the following size classes:

## 4.0 Socioeconomic Value of Reefs in Broward County

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Boat Size Category (Length of Boat in Feet)	Number of Boats	Percentage of Total	Cumulative Percentage
Less than 12 feet	12,579	20.6%	20.6%
12 feet to 15'11"	8,917	14.5%	35.1%
16 feet to 25'11"	27,917	45.6%	80.7%
26 feet to 39'11"	9,413	15.4%	96.1%
40 feet to 64'11"	2,109	3.5%	99.6%
65 feet to 109'11"	173	0.3%	99.9%
Greater than 110 feet	16	0.1%	100.00%
<b>Total</b>	<b>61,124</b>	<b>100.00%</b>	

The largest boat size category of pleasure craft in Broward County is between 16 and nearly 26 feet in length (46 percent).

Three adjustments were made to reach the target population of resident boaters in Broward County who may visit the reef system. First, sampling was restricted to pleasure craft at least 16 feet in length. This was in response to expert opinion that very few pleasure craft under 16 feet could reach the reef system. Thus, the mail survey was targeted at pleasure craft at least 16 feet long so that non reef users could be avoided and to increase the sample size on that segment of the boating population with the highest propensity to use the reef system. This reduced the target boat population in Broward County to 39,628 pleasure craft.

In addition, not everyone with a relatively large boat would use an artificial and/or natural reef in the last twelve months. In fact, the results of the survey indicated that 61 percent of these larger vessels used the Broward County reef system in the last 12 months or 23,975 pleasure craft. Finally, we found that about one-half of one percent of registered boats in our target population had a residence somewhere outside Broward County. Thus, the target population was again reduced to 23,855 pleasure craft to reflect only resident boat owners who used the reefs in the past twelve months.

On average, respondents indicated that over a 12-month period (1999-2000) they used the reef system on 39 separate days while engaging in three main recreational activities including fishing, snorkeling and scuba diving. Remember, these boaters have the highest propensity to use the reef system compared to smaller vessels. Based upon this information, it was estimated that over this 12-month period, 930,319 “party- days” were spent on the reef system (39 party days times 23,855 pleasure craft) by Broward County residents.

In conducting the mail survey, we asked reef-users from Broward County to distribute their 39 party-days in two ways. First, they were asked to distribute their reef usage among three recreational activities as follows: (1) Fishing, (2) Snorkeling and (3) Scuba Diving. Second, respondents were asked to distribute each of these recreational activities between artificial and

## 4.0 Socioeconomic Value of Reefs in Broward County

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natural reefs. Table 4.1.1-1 shows the distribution of party-days by resident boaters in Broward County.

Broward county residents spent an estimated 55 percent of their party-days fishing on the artificial and natural reefs followed by scuba diving (26 percent) and snorkeling (19 percent). For all the recreational activities on reefs, 66 percent of the party-days were spent visiting natural reefs. The strongest intensity of natural reef use was for snorkeling where 78 percent of the respondents used the natural reef for this activity.

In the right-hand side of Table 4.1.1-1, user activity measured in "person-days" is provided. A "person-day" is equivalent to an individual traveling to use the reef system for part or all of one day. The number of person-days can be calculated by multiplying the average size of the party (i.e. number of individuals per party) by the number of party-days. However, one important adjustment to average party size was necessary to calculate residential person-days. Here the average party size was reduced by subtracting out those individuals that are considered to be visitors (i.e. non-residents of Broward County). About 20 percent of the average boating party is a nonresident. Thus, Table 4.1.1-1 utilizes the average resident party size to calculate resident person-days. The average resident party size does not vary appreciably among the various reef-related recreational activities and averages about 3.9 residents per party. Because of this, the distribution of person-days among the activities is similar to the distribution of party-days among the activities. For example, saltwater fishing on reefs garnered 2.2 million person-days or 58 percent of all person-days during the 12-month period (December 1999 to November 2000). The total number of person-days for residents using the reef system off Broward County over a 12-month period was estimated at 3.7 million.

While party-days gives a "boater dimension" to user activity in and around the reef system, person-days yield a "people dimension" to use of the reef system. The former is especially useful in judging the adequacy of the boating infrastructure such as marinas and boat ramps while the latter is used in calculating recreational use value which will be discussed below.



4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.1.1-1 (Residents)**  
**Estimated Resident User Activity As Measured by Party-Days and Person-Days on**  
**Artificial and Natural Reefs off Broward County, Florida, 2000**

Activity/ Type of Reef	Number and Distribution of Party-Days by Activity and Reef Type			Number and Distribution of Person-Days by Activity and Reef Type			
	Number of Party-Days	Percentage of Party-Days Per Activity by Reef Type	Percentage of Total Party-Days Per Activity	Resident Party-Size by Activity	Number of Resident Person-Days <sup>1</sup> by Activity by Reef Type	Percentage of Person-Days Per Activity by Reef Type	Percentage of Total Person-Days Per Activity
<b>Fishing</b>			55%	4.21			58%
Artificial	204,670	40%			861,661	40%	
Natural	307,005	60%			1,292,491	60%	
Subtotal	511,675	100%			2,154,152	100%	
<b>Snorkeling</b>			19%	4.14			20%
Artificial	38,887	22%			160,992	22%	
Natural	137,873	78%			570,794	78%	
Subtotal	176,760	100%			731,786	100%	
<b>Scuba Diving</b>			26%	3.44			22%
Artificial	74,985	31%			257,948	31%	
Natural	166,899	69%			574,133	69%	
Subtotal	241,884	100%			832,081	100%	
<b>All Activities</b>				4.00			
Artificial	318,542	34%			1,280,601	34%	
Natural	611,777	66%			2,437,418	66%	
<b>Total</b>	930,319	100%	100%		3,718,019	100%	100%

<sup>1</sup> Resident person-days is calculated by multiplying the number of party-days by the average resident party size.

### 4.1.2 Economic Contribution

To fully understand the economic contribution of reefs to Broward County it is first important to recognize what factors influence the demand for boating in this area. This will help in understanding the nature of boating in the county and how it relates to the use of artificial and natural reefs. In a study by Bell and Leeworthy (1986), the authors found that the demand for boats by individuals was related to boat prices, population and per capita income. Therefore, we would expect a higher number of registered pleasure craft in counties that are large as measured by population and are relatively affluent as measured by real per capita income.

The number of registered boats in any county is critical in assessing the adequacy of the boating infrastructure such as boat ramps and, of course, artificial and natural reefs. This topic has recently been addressed in the 2000 State Comprehensive Outdoor Recreational Plan (2001) issued by the Division of Recreation and Parks, Florida Department of Environmental Protection. However, this report did not include an assessment of the reef system in various regions of Florida.

This section considers the demand for boating in Broward County, not the adequacy of the boating infrastructure. This will give the reader an overview of boating characteristics in Broward County and valuable information necessary to assess the adequacy of the boating infrastructure. The overview includes a discussion of the county's population, per capita income, industrial structure and its infrastructure related to saltwater boating. This will also give a background by which to assess the results of this study.

Broward County is on the southeast coast of Florida bordering the Atlantic Ocean with Fort Lauderdale as its largest city. In 1999, the county was Florida's second largest with 1.49 million residents. Over the last ten years, population in this county grew by 18.7 percent making it the 48<sup>th</sup> fastest growing county in Florida (out of 67 counties). Broward County has 1,233 persons per square mile as compared to 284 for Florida as a whole, making it the second most densely populated county in the State. This county's population has a median age of 39.8 years which is comparable to the general population of Florida which has a median age of 39 years.

The University of Florida, Bureau of Economic Research projects the county's population to reach 1.8 million by 2015 or a 26 percent increase. In-migration to Broward County, as in the past, will account for over 84 percent of this growth. Thus, this county's population growth will depend heavily on individuals moving into the county. The size of Broward County's population coupled with its projected future growth makes this county a potentially large market for resident recreational boating along its coasts.

In 1998, Broward County had a per capita income of \$28,546 placing it eleventh among the 67 counties in the State of Florida. However, this per capita income was only 6.3 percent above the state average of \$26,845. The higher per capita income in Broward County is largely due to higher earnings per job in the local economy combined with a higher work participation rate.<sup>1</sup>

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<sup>1</sup> *The workforce participation rate in Broward County is 85.1 percent compared to 78.5 percent for the general population of Florida.*

## 4.0 Socioeconomic Value of Reefs in Broward County

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In 1998, there were 675,558 persons employed in Broward County earning \$19.92 billion in wages and salaries. Over the last ten years, employment grew by 17.7 percent which corresponds to the rate of growth in population as discussed above. Measured by employment earnings, the largest industries in 1998 were services (33.4 percent); state and local government (12.8 percent); and retail trade (12.6 percent). Of particular note, this county provides a lot of tourist-related services such as lodging, amusement and recreation. Nearly 20,000 workers were involved in these industries in Broward County in 1998. The attraction of tourists provides part of the economic base for this county.

In 2000, there were 61,124 recreational boats (FDHSMV, 2001) registered in Broward County or 1 boat for every 25 people. For the State of Florida, there is 1 registered pleasure boat for every 14 residents. The infrastructure supporting various coastal or saltwater forms of boating recreation in Broward County include the following (FDEP, 2000)(Pybas, 1997):

1. Boat Ramps: 47 with a total of 56 boating lanes;
2. Marinas: 126 with 3,467 wet slips and moorings;
3. Other Facilities: 2,804 boat dry storage;
4. Artificial Reefs: 104 artificial reefs ranging from 0.5 to 2.5 nautical miles from shore.

Despite the relatively large population and high per capita income in Broward County, the demand for recreational boating is less than the demand for boating throughout Florida as measured by the ratio of registered boats per person. These demand factors combined with the saltwater coastal nature of this county would lead one to predict a much higher ratio of registered boats per person. The explanation for this finding is usually found on the supply side where there is crowding or congestion at the access points (e.g., boat ramps) to the water and access points to the recreational resources such as artificial and natural reefs once off shore. This increases the cost of recreational boating and reduces the demand for pleasure boats. This is just a “working hypothesis” of potential supply side problems. Other factors may also be affecting recreational boat ownership in Broward County.

Using a mail survey, 3,000 registered boaters in Broward County were contacted at random using the survey instrument provided in Appendix A. Boat owner addresses were obtained from a registered boater database compiled by the Florida Department of Highway Safety and Motor Vehicles. A total of 616 registered boaters responded to the mail survey and 53.6 percent indicated that they used their pleasure crafts to visit the reefs offshore of Broward County during the past twelve months (December 1999 to November 2000). The results of the survey were used to estimate a total of 1.28 million person-days spent by residents of Broward County on artificial reefs in a 12-month period. This amounts to an average of 17,305 person-days per year for each reef or 47 persons per day. This, of course, does not include visitors from outside Broward County, which are discussed in the next section of this chapter.

## 4.0 Socioeconomic Value of Reefs in Broward County

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To estimate the economic contribution of resident spending associated with reef use in the Broward County economy, we asked the respondents to estimate their party's spending during their last reef-related boating activity. It was assumed that each boating trip would involve one day since the residents are in their county of residence. Residential expenditures per party were distributed by type of recreation activity and the results are presented in Table 4.1.2-1.

**Table 4.1.2-1 (Residents)  
Average Resident Spending per Party by Broward County Reef-Users**

Activity	Estimated Spending per Party per Day	Percentage of Residents per Party	Estimated Spending per Resident Party per Day
(1)	(2)	(3)	(4) = (2) * (3)
Fishing	\$330.41	79%	\$261.02
Snorkeling	\$375.18	79%	\$296.39
Scuba Diving	\$407.85	85%	\$346.67

Scuba divers spent the most amount of money and fishers spent the least amount of money per day. Expenditures for marina fees, equipment rentals and restaurants made the former activity a more expensive recreational activity than the latter. Detailed expenditures on particular items will be discussed below while additional information and analysis is provided in the Technical Appendix to this report.

Note that an adjustment was made to the size of the boating party in order to calculate estimated expenditures by residents as summarized above. About 15 to 21 percent of the typical party includes individuals who were apparently guests of the Broward County residents. We made the simplifying assumption that these visitors would pay their fair share of the trip cost. For instance, visitors would pay a proportion of the trip costs such as boat fuel, restaurants and bait. We believe that residents probably pay for a larger share of total party costs than used in this study. However, we shall be conservative and assume an equal sharing of cost between residents and their visitors.

To derive the economic impact of a particular reef-related recreational activity, one must briefly return to Table 4.1.1-1. This table shows the number of residential party-days and person-days associated with reef use over a 12-month period off the coast of Broward County. For example, recreational fishers spent 511,675 resident party-days on all reefs off Broward County. According to our resident spending per party discussed above, fishers spent \$261.02 per trip. Thus, annual expenditures for reef-related fishing was estimated at \$133.6 million dollars (\$261.02 times 511,675).

Based upon the distribution of party-days per reef type, about \$53.4 million was spent while using an artificial reef while the balance or \$80.2 million was spent in conjunction with the use of natural reefs by recreational fishers. There did not appear to be much difference between

## 4.0 Socioeconomic Value of Reefs in Broward County

party spending by fishers who used either type of reef. This held for the other two recreational activities as well.

Table 4.1.2-2 presents the economic contribution of all reef-related recreational pursuits off the Broward County coast. Residents spent an estimated \$269.8 million during the 12-month period December 1999 through November 2000. About two-thirds of this amount was spent while using natural reefs (\$178.9 million) while the balance (\$90.9 million) was spent in conjunction with the use of artificial reefs. Nearly 50 percent of total spending or \$133.5 million was spent on reef-related recreational fishing while \$83.9 million (31 percent) was spent on reef-related scuba diving and \$52.4 million (19 percent) was spent on reef-related snorkeling.

**Table 4.1.2-2 (Residents)  
Reef-Related Expenditures, Wages and Employment Generated by  
Resident Boating Activities in Broward County, Florida, 2000**

Type of Activity/ Type of Reef	Expenditures (Million \$)	Wages (Million \$)	Employment (Number of Full and Part-Time Jobs)
<b>Artificial Reef</b>			
Fishing	\$53.4	\$6.8	438
Snorkeling	\$11.5	\$1.9	132
Scuba Diving	\$26.0	\$3.8	242
Subtotal	\$90.9	\$12.5	812
Percentage Attributed to Artificial Reefs	34%	33%	33%
<b>Natural Reef</b>			
Fishing	\$80.1	\$10.1	656
Snorkeling	\$40.9	\$6.7	467
Scuba Diving	\$57.9	\$8.4	539
Subtotal	\$178.9	\$25.2	1,662
Percentage Attributable to Natural Reefs	66%	67%	67%
<b>Total All Reefs</b>			
Fishing	\$133.5	\$16.9	1,094
Snorkeling	\$52.4	\$8.6	599
Scuba Diving	\$83.9	\$12.2	781
<b>Total All Reefs/All Activities</b>	<b>\$269.8</b>	<b>\$37.7</b>	<b>2,474</b>

It is important that we clarify the economic contribution of resident boaters from Broward County. The engine of economic growth for any region such as Broward County is found in its export industries such as tourism in Broward County. As export income flows through the region, it creates local income (e.g., money paid for haircuts by residents) and a demand for imports (e.g., TV sets since Broward County does not have such a manufacturer). The local income is spent on everything from marina services to dining out at a local restaurant to grocery purchases to rent or mortgage payments. Thus, residents use local income to pay for goods and

## 4.0 Socioeconomic Value of Reefs in Broward County

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services in conjunction with reef use. This spending represents the choice between recreating locally and leaving the area to recreate elsewhere.

The reef system keeps the “locals” in the county and enlarges the economy by about \$269.8 million in local spending. In contrast to visitors entering the county, there is no multiplier effect. Generally, the more money kept in the local economy, the larger is the regional multiplier because there is less “leakage” through the purchase of imports, including residents leaving the area for recreational pursuits in places such as Key West or Orlando. Just how much the regional multiplier is enlarged from resident use of the reef system is beyond the scope of this study. However, it is safe to say that protection and maintenance of the reef system has the potential to keep more business in Broward County. For ardent reef-users, the absence of reefs off the coast of Broward County would certainly divert more of these residents to reef systems in counties north and south of this area to the economic detriment of Broward county.

Reef-related local spending discussed above is, in itself, only a vehicle to create jobs and wages in the local community. To evaluate which industries benefit from residential reef use, reef-users were asked to break their expenditures into 12 categories for items such as boat fuel, ice, tackle and marina fees. For each of the twelve categories, resident expenditures were matched to total county expenditures published in the 1997 U.S. Census of Business (1997). For example, spending on boat fuel was matched up with total expenditures at gasoline stations in Broward County. It was found that each gasoline station employee “sells” \$331,382 per year out of which the employee is paid about \$15,244 or about 4.6 percent of sales. The annual salary may seem low, but this figure is for full and part time employees with a relatively low skill level. Thus, every \$331,382 in gasoline purchased for reef-related recreation by local users, generates one job paying about \$15,244 per year.

This rather simple procedure was followed for each of the 12 expenditure categories that vary greatly in labor intensity. The higher the sales-to-employment ratio, the less labor intensive the activity. For example, restaurants are relatively labor intensive (i.e., cooks and servers) while gasoline stations discussed are highly automated and consequently need relatively few employees per \$100,000 dollars in sales.

Table 4.1.2-2 shows the estimated wages and employment generated by resident spending on reef-related recreational activities in Broward County. The \$269.8 million in annual spending generated about \$37.7 million dollars in annual wages supporting 2,474 jobs.

It is also important to look at what industries benefit from reef-related resident spending. Table 4.1.2-3 presents the 12 spending categories of resident boaters. We would expect that expenditures would be concentrated on running and storing a boat and the results support this assumption. Expenditures on boat oil and gas constituted 25 percent of all spending followed by spending on marina slip rentals and dockage fees (18 percent) and food and beverages from restaurants (13 percent) and stores (8 percent). In terms of dollar figures, resident reef-users spent over \$47 million annually on the marina industry. According to the U.S. Census of Business (1997), the marina industry in Broward County grossed about \$99 million in sales.

## 4.0 Socioeconomic Value of Reefs in Broward County

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Thus, resident reef-users may account for about one-half of these sales. Marina industry sales would also come from resident non-reef users and visitors keeping their boats in local marinas. The role of visitors will be discussed in the next section.

In terms of employment, reef-related resident spending created proportionately more employment in marinas and restaurants than the other industries since, as discussed above, these industries are relatively labor intensive. Although gasoline stations ranked number one as a component of spending, this industry is capital-intensive and provides relatively lower employment per \$100,000 in sales. Spending on boat oil and gas accounted for one-fourth of all spending, but only one in ten jobs. As might be expected, wages follow employment. That is, the higher the percentage of spending on labor intensive industries, the higher the total wages generated. However, some industries employ highly skilled persons such as marinas where the wages paid are proportionately higher than employment as indicated in Table 4.1.2-3.

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**Table 4.1.2-3 (Residents)**  
**Detailed Expenditure Pattern Supporting Employment and Wages by**  
**All Resident Reef-Users in Broward County, Florida, 2000**

<b>Expenditure Item</b>	<b>Expenditures (Million \$)</b>	<b>Percentage of Total Expenditures</b>	<b>Employment (Number of Full and Part-Time Jobs)</b>	<b>Percentage of Total Employment</b>	<b>Wages (Million \$)</b>	<b>Percentage of Total Wages</b>
1. Boat gas and oil	\$67.28	25%	203	8%	\$3.06	8%
2. Marina slip rentals and dockage fees	\$47.17	17%	477	19%	\$11.49	31%
3. Food and beverages from restaurants/bars	\$35.99	13%	951	39%	\$9.39	25%
4. Food and beverages from stores	\$22.47	8%	172	7%	\$2.41	6%
5. Tackle	\$24.68	9%	165	7%	\$3.04	8%
6. Bait	\$12.35	5%	83	3%	\$1.52	4%
7. Gas for auto	\$10.47	4%	32	1%	\$0.48	1%
8. Ice	\$6.11	2%	19	1%	\$0.28	1%
9. Equipment rentals	\$6.78	3%	69	3%	\$1.70	4%
10. Boat ramp and parking fees	\$4.61	2%	51	2%	\$1.12	3%
11. Sundries (e.g. Sun screen, sea sickness pills, etc.)	\$6.56	3%	84	3%	\$0.64	2%
12. All other	\$25.31	9%	170	7%	\$2.46	7%
<b>Total</b>	<b>\$269.78</b>	<b>100%</b>	<b>2,476</b>	<b>100%</b>	<b>\$37.59</b>	<b>100%</b>



### 4.1.3 Use Value

Natural and artificial reefs contribute to the recreational experience of residents (i.e. fishing, snorkeling and scuba diving). Traveling to and enjoying a reef system involves economic costs including the cost of boat fuel, bait and tackle. This was discussed above. However, the market does not measure the total economic value of reef systems. There is no organized market in which to buy and sell the use of reefs because these resources are not owned by one individual but by society as a whole. Thus, the absence of private property rights creates a challenge in valuing natural and artificial reefs.

Yet, the general public does pay for the deployment of artificial reefs and the protection of natural reefs. So, there must be some unmeasured value of providing the reef system to the general public. Because reef-users are attracted to the reefs for recreation, we call this unmeasured value “use value”. For example, one could engage in scuba diving without the benefit of a natural or artificial reef. The addition of a reef presumably adds some “value” to the scuba diver’s recreational experience. This section examines the incremental use value of having a reef system off the coast of Broward County.

The contingent valuation (CV) method asks users about their willingness to pay for a reef system contingent on specified conditions (e.g., use of funds for various reef related improvements). This CV method has been employed in numerous studies of use value from deep-sea fishing to deer hunting.<sup>2</sup> The reef-using respondents were asked a series of CV questions dealing with their willingness to pay for the reef program. The respondents were asked to consider the total cost for their last boating trip to the reefs including travel expenses, lodging, and all boating expenses. Then, the respondent was asked

“If your total cost per trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the (kind of reef – artificial or natural or both) in their existing condition.”

Payment amounts or cost increases (\$10, \$50, \$100, \$200 and \$500) were inserted in the blank space and the amounts were rotated from respondent to respondent. Thus, some respondents received questions asking about a \$10 increase while others were asked about a \$50, \$100 or even \$500 increase in trip cost. The purpose of these questions was to establish the user value per day for artificial and natural reefs.

The above willingness to pay question was asked of each respondent in three forms: (1) natural reefs separately; (2) artificial reefs separately and (3) a combination of natural and artificial reefs. Because the primary spending unit is the “party”, the willingness to pay response to an increase in trip cost was considered to be the willingness to pay of the entire party.

To estimate values per party per trip (a day and a trip are equal for residents), the data were pooled for all counties. A logit model was used to estimate the values per-party-per-trip. The

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<sup>2</sup> See Clawson and Knetch (1966).

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logit model tested for differences by county, activity, household income, age of respondent, years of boating experience in South Florida, race/ethnicity, sex, length of boat owned, and whether the respondent is a member of a fishing or diving club.

Separate models were estimated for each of the four reef programs (e.g., natural reefs, existing artificial reefs, natural & artificial reefs combined and new artificial reefs). For the natural reef, existing artificial reefs and the combined programs, the only significant differences found were for those with income greater than \$100,000. This group had a higher willingness to pay than other reef users. There were no other differences found. The logit model did not produce different per party per trip values by county, and because party sizes were not significantly different by county the estimated values per person-trip were also the same across counties for each of the reef valuation programs. The estimated per party per trip (day) values were \$32.55 for the natural reefs, \$11.31 for the artificial reefs and \$12.94 for the combined program.

To estimate total annual use values for each county, we multiplied the number of party-days times the estimated values per party per day. We then estimated the value per person-day by dividing the total annual use value by the total number of person-days. This normalized value per person-day can be compared with results from other studies.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. For Broward County residents, the average per person-day value of the natural reefs was \$8.17 versus \$2.81 for artificial reefs. Total use is also higher for natural versus artificial reefs. Broward County residents' natural reef use was about 2.4 million person-days versus about 1.3 million person-days for artificial reefs. This translated into an estimate of total annual use value of about \$19.9 million for natural reefs and \$3.6 million for artificial reefs. Capitalizing the annual use values, using a three percent interest rate, yields asset values of about \$663.8 million for the natural reefs and \$120.1 million for the artificial reefs. All of these results are summarized in Table 4.1.3-1.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs including investments for deploying new artificial reefs and enhancing of natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined

## 4.0 Socioeconomic Value of Reefs in Broward County

programs. The value of the combined programs or \$12 million per year would provide a conservative or lower bound estimate of the total natural and artificial reef values.

**Table 4.1.3-1 (Residents)  
Estimated Use Value of Artificial and Natural Reefs off the Coast of  
Broward County, Florida, 2000**

<b>Reef Type/Activity</b>	<b>Person-days (millions)</b>	<b>Annual User Value (Millions \$)</b>	<b>User Value Per Person-day (\$)</b>	<b>Asset Value at 3% (Millions \$)</b>
<b>Natural Reefs</b>	<b>2.437</b>	<b>\$19.91</b>	<b>\$8.17</b>	<b>\$663.8</b>
Snorkeling	0.571	\$4.49	\$7.86	\$149.6
Scuba Diving	0.574	\$5.43	\$9.46	\$181.1
Fishing	1.292	\$9.99	\$7.73	\$333.1
<b>Artificial Reefs</b>	<b>1.281</b>	<b>\$3.60</b>	<b>\$2.81</b>	<b>\$120.1</b>
Snorkeling	0.161	\$0.44	\$2.73	\$14.7
Scuba Diving	0.258	\$0.85	\$3.29	\$28.3
Fishing	0.862	\$2.31	\$2.69	\$77.2
<b>Natural &amp; Artificial Reefs</b>	<b>3.718</b>	<b>\$12.04</b>	<b>\$3.24</b>	<b>\$401.3</b>
Snorkeling	0.732	\$2.29	\$3.13	\$76.2
Scuba Diving	0.832	\$3.13	\$3.76	\$104.3
Fishing	2.154	\$6.62	\$3.07	\$220.7
<b>New Artificial Reefs</b>	<b>1.281</b>	<b>\$0.76</b>	<b>\$0.60</b>	<b>\$25.4</b>
Snorkeling	0.161	\$0.14	\$0.87	\$4.7
Scuba Diving	0.258	\$0.27	\$1.05	\$9.0
Fishing	0.862	\$0.35	\$0.41	\$11.7

Measuring the economic benefits of natural reef systems to policy makers is useful in justifying public budgets for such programs. If protected, the use value for natural reefs will flow into perpetuity. Using a real discount rate of 3 percent, it is estimated that the capitalized value of the natural reefs off Broward County is \$663.8 million. Why is this important? Natural reef systems are not privately owned, but are common property resources. If a region or a nation were preparing a balance sheet showing its assets and liabilities, the asset value of the reef system would need to be included. This analysis provides an estimate of the capitalized value (or asset value) of the natural reef system to reef users. Bear in mind that this value only includes the value that reef users place on the reefs and does not include the values that non-reef-users place on the reefs or the economic contribution of the reefs. *The estimation of the value of the reefs to non-reef users was not part of this study.*

In addition, asset value comes into play when there is an environmental disaster that damages the reefs such as an oil or hazardous waste spill. If the polluter destroyed for the foreseeable future

## 4.0 Socioeconomic Value of Reefs in Broward County

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20 percent of the natural reef system off Broward County, then the government could ask for \$133 million (i.e., 0.20 times \$663.8 million) in compensatory damage. An example of this problem is in the Florida Keys, where ships that destroy natural reefs are required to pay the loss of use value as a result of legal proceedings. Numbers provided here are quite real and useful especially in the case of environmental damage assessment.

As discussed above, artificial reefs had a use value per person less than that of natural reefs as one would expect. However, preservation of the existing artificial reef system of Broward County produces an annual use value of about \$3.6 million. Again, this is for the maintenance of these reefs. The capitalized value of the artificial reef system off Broward County is estimated to be \$120.1 million. If users were obstructed from getting to Broward County's artificial reefs, an estimate of damages to the reef users would be either the annual use value lost if users are temporarily obstructed or the capitalized value if users were permanently cut-off from using the artificial reefs.

The logit model estimated for the new artificial reef program found statistically significant differences in willingness-to-pay depending on county, activity and income. Those from Palm Beach and Broward counties had higher willingness to pay than those from Miami-Dade and Monroe counties. Snorkelers and scuba divers had higher values than those who participated in fishing activities. The only other statistically significant variable was household income. As household income levels increased so did willingness-to-pay for new artificial reefs. On a per party per day basis, the estimated values ranged from a high of \$3.60 for snorkelers and scuba divers from Broward County to a low of \$1.72 for those who participated in fishing activities off Broward County.

As with the other three programs, the estimated per party per day values were multiplied by the total party-days spent on artificial reefs by artificial reefs users in the county to get total annual use value for the county. The total annual use values were then divided by the total annual person-days of artificial reef use in the county to get an estimate of the value per person-day. Again, this normalized value per person-day can be compared with results from other studies.

On a per person-day basis, the estimated values ranged from a low of \$0.41 for those fishing to a high of \$1.05 for those that participated in scuba diving off Broward County. Across all activities, the average was 60 cents per person-day.

In terms of total annual use value, fishing is the highest valued use for new artificial reefs. The total person-days of artificial reef use while fishing more than compensates for the lower value per person-day. Across all activities, total annual user value associated with a new artificial reef program is almost \$762 thousand with an asset value of \$25.4 million.

The relatively low marginal willingness to pay of \$0.60 per person-day for artificial reef expansion in comparison to artificial reef maintenance discussed above is somewhat expected. If present users do not feel that congestion on artificial reefs is a problem, they would be expected to value expansion lower than maintenance of the existing artificial reefs. However, their

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willingness to pay anything for expansion demonstrates some level of unhappiness with the existing number of artificial reefs off Broward County. Perhaps, residents are competing with visitors for choice spots or just getting in the way of fishing and diving when arriving at an artificial reef.

### 4.1.4 Role of “No-Take” Zones

Both the economic contribution and the use value of the reef system are based upon the management or lack thereof of these resources. There have been controversies about the wisdom of deploying, for example, artificial reefs. Opponents argue that this encourages over fishing since artificial reefs tend to concentrate fish in a smaller number of places and they become easier targets for fishers. Others find that artificial reefs serve as added habitats and thereby increase the overall biomass available to fishers. The Bell et al., study (1999) of artificial reefs in northwest Florida found that most people fell into the latter group believing that the pie got larger with the deployment of more reefs. However, other studies such as Bolnsack et al., (1997) and Grossman et al., (1997) report results that support opinions of opponents regarding additional artificial reef systems.

In this section, we examine “no take” zones in the Florida Keys and other counties in southeast Florida. “No-take” zones are defined as areas where reef-users can visit but nothing can be removed from an artificial or natural reef area. The existing reef system is coming under increased pressure to yield stable catch rates for fishing and a pristine environment for snorkeling and scuba diving. Also, the reefs play a vital role in the entire oceanic ecosystem by providing habitat and protection for young fish and other creatures. To provide a net benefit, it is argued that “no-take” zones would actually increase recreational benefits even though takings would be banned in certain areas.

Supporters of “no-take” zones point to the overuse of common property resources such as ocean fishing both by recreational and commercial interests. In effect, “no-take” zones would vest the property right with the government. Although the carrying capacity of a reef system is not evaluated in this study, the concept has widespread validity. This concept has been examined by many natural resource economists with the finding that congestion and declining yields of fish create a decline in use value per day.<sup>3</sup> Bell (1992) found that tourists visiting Florida would go elsewhere if fishery catch rates declined to a certain point from the existing level. No one knows exactly where and to what degree “no-take” zones must be employed to increase the net benefit available to recreational interests. Like the deployment of artificial reefs, “no-take” zones have become a controversial issue. Therefore, as part of this study, respondents were asked their opinions regarding the use of “no-take” zones as a management tool for artificial and natural reefs in southeast Florida.

In each of our four counties, resident reef-users were asked questions regarding “no-take” zones. The results for Broward County are summarized in Table 4.1.4-1. In 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones (13.37 square miles) in which the taking of

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<sup>3</sup> See Green (1984) and Bell (1992).

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anything including fish and shellfish is prohibited. It is reasonable to believe that residents of Broward County may have formed an opinion about this management effort and indeed, about three quarters of the Broward County respondents supported this experimental management effort. However, the “not in my backyard view” also had to be tested so respondents were asked for their opinions regarding “no take” zones in Broward County. About 63 percent of the respondents were willing to have “no take” zones off the shore of their county. Respondents were also willing to extend this concept southward to Miami-Dade County and northward through Palm Beach County with about 64 percent supporting this expansion according to the results shown in Table 4.1.4-1.

Finally, respondents were asked for their opinion regarding the percent of the reef system that should be included in “no take” zones. Respondents, on average, would be willing to have “no take” zones cover about 35 percent of the natural reefs off Broward County. Because the average may be skewed by exceptionally high answers, we also looked at the median percent of natural reefs respondents felt might be managed by the use of “no-take” zones. The median, or the midpoint between the highest and lowest answer, was 25 percent of the natural reef system. Such results provide the public with important information regarding resident opinions of “no take” zones in Broward County.

**Table 4.1.4-1 (Residents)  
Opinion of Broward County Residents on  
"No Take" Zones for Artificial and Natural Reefs, 2000**

Survey Question (1)	Percentage of Respondents Answering "Yes" (2)	Percentage of Respondents Answering "No" (3)	Percentage of Respondents Answering "Don't Know" (4)	Sample Size (5)
Support existing "NO TAKE" Zones in the Florida Keys	75%	18%	7%	369
Support "NO TAKE" Zones on some reefs off shore of Broward County	63%	27%	10%	369
Support "NO TAKE" Zones on some reefs off shore of Palm Beach, Broward and Miami-Dade Counties	64%	24%	12%	369
	<b>Average for All Response</b>	<b>Median of All Responses</b>		
What Percent of Natural Reefs in Broward County Should be Protected with "NO TAKE" Zones	35%	25%		369

Given the short experience of the Keys “no-take” zones, it is quite remarkable that present reef users would be willing to establish “no-take” zones in their county. Combined with the results from the Florida Keys (Monroe County) resident survey, these statistics indicate a willingness to

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support management efforts in the direction of “no-take” zones. Such results are important to public officials in charge of managing the natural reef system off Broward County.

### 4.1.5 Demographic Information

The mail survey administered to Broward County residents included questions regarding demographic characteristics. The reason for collecting such information was to determine what segment of the population will gain by protecting and maintaining artificial and natural reefs and/or designating “no-take” zones as discussed in the very last section. Respondents were asked to provide some background on both themselves and their boating experiences. Thus, the survey was used to collect demographic information as well develop a boater profile to better understand these people called “reef-users” in Broward County. Table 4.1.5-1 presents the results from the mail survey combined with comparable information on the entire Broward County population.

**Table 4.1.5-1 (Residents)  
Demographic Characteristics and Boater Profile of  
Reef-Users in Broward County Florida, 2000**

<b>Demographic Characteristics of Respondents to Mail Survey</b>	<b>Reef Users</b>	<b>Broward County Population</b>
<b>Median Age</b>	48	39.8
<b>Sex</b>		
Male	92%	48%
Female	8%	52%
<b>Race</b>		
White	93%	71%
Black/African American	2%	21%
Hispanic/Latino	5%	15%
Other	5%	9%
<b>Education</b>		
Percentage that completed College Degree or More	50%	13%
<b>Median Household Income</b>	\$72,310	\$37,431
<b>Boater Profile</b>		
Average Years of Residence in Broward County	26	N/A
Average Years of Boating in South Florida	22	N/A
Average Length of Boat Used for Saltwater Activities (ft)	25	N/A
Percentage of Respondents that belong to fishing and/or diving clubs	18%	N/A
<b>Sample Size</b>		<b>374</b>
<small><sup>1</sup> Latest year that educational level attained by county is available is for 1990 from the U.S. Census Bureau.</small>		
<small>Source: Florida State University and the U.S. Bureau of the Census (1990, 2000).</small>		

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The owners of reef-using registered boats are slightly older than the general population of Broward County. The median age of reef-users is 48 years compared to 39.8 years for the general population. Statistically speaking, there is a real age difference between these two groups. Further, reef-related boating appears to be a male dominated activity as about 92 percent of the respondents indicated they were male compared to 48 percent in the general population. Of course, we have no way to control who fills out the survey instrument once it reaches the boat owner's residence. The survey is directed at the person to whom it is registered.

With respect to race, white individuals in Broward County dominate boat ownership. About 93 percent of the respondents characterized themselves as white compared to 71 percent in the general population of Broward County. Further, a lesser percentage characterized themselves as Hispanic/Latino (5 percent) as compared to the general population (15 percent).

Nearly 50 percent of the respondents indicated they had at least a college degree compared to 13 percent for the general population in 1990.<sup>4</sup> The education level of the general population is probably much higher today than ten years ago, but may not reach the levels reported by the respondents.

Since education and income are positively correlated, it is expected that the median household income reported by reef-users would be higher than the general population. This is indeed the case as confirmed by the last demographic statistic in Table 4.1.5-1 where respondents reported a median household income of \$72,310 compared to \$37,431 for the general population. Of course, the purchase of a relatively large pleasure craft is also associated with higher income as found by Bell and Leeworthy (1986) and discussed earlier in this chapter. So, this finding is not unusual.

Using the information gathered from the first section of this Chapter on user activity, we can estimate that a minimum of 93,035 residents engaged in at least one reef-using recreational activity during the period December 1999 to November 2000. This was obtained by multiplying the number of registered boats that are estimated to be involved in reef use (23,855) by the average number of residents per party (3.9 individuals). The reason we say minimum is that the turnover rate of the party is unknown. That is, the same residents may not go on every boat outing. There are over 1.2 million residents in Broward County that are over 14 years of age (i.e. about that age at which they could become boaters). The boating population that uses the reef system constitutes a minimum of 7.7 percent of the county's population (93,035/1.2 million). The boating population that uses the reef system would probably be higher if the party turnover rate (i.e. different individuals on each boat outing) were considered. The information presented here provides some insight on what segments of the Broward County population are being served by artificial and natural reefs off its coast. This should be valuable information for policy makers at the local and state levels.

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<sup>4</sup> *The U.S. Census Bureau has not yet released the educational levels for counties as part of the 2000 Census.*



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## 4.0 Socioeconomic Value of Reefs in Broward County

Finally, a boater profile for Broward County was developed from the survey results as follows. The typical reef-using boater has lived in Broward County for 26 years and boated for 22 years. The reef-using boaters in our sample own a pleasure craft of 25 feet in length on average. The weighted average of registered boats 16 feet and over in Broward County is also 25 feet so it appears that our sample is particularly reflective of the population based on average boat length. About 18 percent of the respondents were members of fishing and/or diving clubs. This indicator gives some idea of the intensity and degree of interest in recreational fishing, snorkeling and scuba diving off Broward County, Florida.

### 4.2 Visitors

The focus of this section is the socioeconomic value of the reefs associated with visitors to Broward County. As presented in Chapter 1, Introduction, visitors to a county are defined as nonresidents of the county that they are visiting. For example, a person from Miami-Dade County visiting Broward County is considered to be a visitor to Broward County. Likewise, a person from New York visiting Broward County is considered to be a visitor to Broward County.

This section provides the following values regarding visitors to Broward County: reef user activity, economic contribution of the reefs, use value of the reefs and demographic information. Detailed explanations of the methods and data used to estimate these values for Broward County are provided in Chapter 1: Introduction and Chapter 2: Socioeconomic Values of Reefs in Southeast Florida.

#### 4.2.1 User Activity

The activity of reef users is summarized in person-days of reef use. For visitors, the number of person-trips to use the reefs is also of interest. In order to measure person-days and person-trips associated with reef use, the total number of person-trips by all visitors to Broward County must be estimated. Total visitation includes visits to Broward County by non-residents of Broward County to participate in any activity be it recreation, business or family matters. The total number of person trips by all visitors to the county was estimated using the Capacity Utilization Model as described in Chapter 2. This model uses a variety of information obtained from the counties and the responses to the General Visitor Survey. The number of person-trips was then converted to the number of person-days spent by all visitors to Broward County using information from the General Visitor Survey.

The number of person-trips taken by all visitors to Broward County and the number of person-days these visitors spent in the county during the year 2000-2001, developed in Chapter 2, are summarized in Table 4.2.1-1.

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**Table 4.2.1-1 (Visitors)**  
**Number of Person-Trips and Person-Days**  
**All Visitors to Broward County**  
**June 2000 to May 2001 – in millions**

Measure of Visitation	Summer 2000	Winter 2001	Total
Number of Person-Trips	3.31	6.09	9.40
Number of Person-Days	25.94	58.69	84.63

*Note: Summer 2000 is from June 2000 to November 2000. Winter 2001 is from December 2000 to May 2001.*

Visitors took 9.4 million person-trips to Broward County from June 2000 to May 2001 and spent 85 million person-days in the county.

The number of person-trips by all visitors was used as the basis for estimating the number of person-days visitors spent using the artificial and natural reefs in each county. For each season, the number of boating person-trips is equal to the total number of person-trips by all visitors times the proportion of person-trips taken by visitors who participated in saltwater boating in the county in the past twelve months. This proportion was taken from the General Visitor Survey answer to Question 13 (Which activities and boating modes did you participate in over the past 12 months in this county?). The proportion is equal to the number of respondents who participated in at least one boating activity divided by the total number of respondents to the General Visitor Survey.

To get the number of boating person-trips when the person used the reefs, the number of boating person-trips is multiplied by the proportion of boating person-trips when the respondent used the reefs. This proportion was obtained from the Visitor Boater Screening Tally sheets. These sheets indicated the proportion of boaters intercepted who used the reefs at least once in the past 12 months. The results for the summer, winter and the year are summarized in Table 4.2.1-2.

**Table 4.2.1-2 (Visitors)**  
**Person-Trips of Visitors Who Boated**  
**And Visitors Who Used the Reefs in Broward County Over the Past 12 Months**

Season	Total Person Trips to County - All Visitors	Proportion of Person Trips Taken By Visitors Who Boated <sup>a</sup>	Boating Person Trips	Proportion of Boating Person Trips When the Reef was Used for Recreation <sup>b</sup>	Boating Person Trips When the Reef was Used for Recreation
Summer - June 2000 to Nov. 2001	3,314,292	0.20	668,204	0.99	663,312
Winter – December 2000 to May 2001	6,088,714	0.19	1,145,612	0.99	1,137,225
Year Round - June 2000 to May 2001	9,403,006		1,813,816		1,800,537

<sup>a</sup> *Saltwater Boating Only. From General Visitor Survey Answer to Question 13 (Which activities-modes did you participate in over the past 12 months in this county). The proportion is equal to the number of respondents who participated in at least one boating activity divided by total number of respondents to the General Visitor Survey.*

<sup>b</sup> *From the Visitor Boater Tally Sheets: = 1 - (Q6/(Q6+Q7+Q8+Q10))*

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Of the 9.4 million person-trips visitors took to Broward County from June 2000 to May 2001, 20 percent of these trips involved saltwater boating activities in the summer and 19 percent involved saltwater boating activities in the winter. Of the resulting 1,813,816 boating person-trips by visitors to Broward County, 99 percent of those trips involved recreational reef use. Thus, visitors who used the reefs for recreation in Broward County made about 1.8 million person-trips to the county from June 2000 to May 2001.

Next, the total number of person-days that visitor boaters who used the reefs spent visiting the county was estimated. This estimate is the total boating person-trips when reefs were used times the average days per visit by boaters who use the reefs. The average days per visit by boaters who used the reefs was obtained from Question 10 of the Visitor Boater Survey (How many nights are you spending on this trip?) where each response was increased by one unit to convert nights to days. The average number of days and the total person-days reef users spent in Broward County in 2000-2001 are provided in Table 4.2.1-3.

**Table 4.2.1-3 (Visitors)  
Average Number of Days Visiting Broward County  
And Total Person-Days in Broward County  
By Visitor Boaters Who Used the Reefs  
June 2000 to May 2001**

<b>County</b>	<b>Average Days Visiting the County Per Trip</b>	<b>Total Person Days Spent Visiting the County</b>
Broward	8.47	15,252,053

Reef-using boaters who visited Broward County spent an average of 8.47 days in the county during their trip. As a result, these visitors spent 15.2 million person-days in Broward County from June 2000 to May 2001.

To allocate the total person-days spent visiting the county to actual days using the artificial and natural reefs, the daily participation rates of the different boating activities were calculated using the responses to Questions 12, 15, 16 and 17 of the Visitor Boater Survey. Participation rate is the proportion of total days that respondents spent in the county in the last 12 months when the respondent actually participated in a saltwater activity and boat mode. It represents the probability that a visitor boater who uses the reefs will participate in a particular saltwater boating activity and boating mode on any given day.

Question 12 asked the respondent to examine a list of saltwater boating activities and boat modes and read the number corresponding to the activity-boat mode that he/she or someone in his/her party participated in over the past 12 months. The saltwater activity-boat mode list is provided in Appendix B with the Visitor Boater Survey. Question 13 asked if the respondent participated in the activity and boating mode. Question 15 asked how many days in the past 12 months that the respondent participated in the activity-boat mode. From the responses to these questions, the

## 4.0 Socioeconomic Value of Reefs in Broward County

proportions of total visiting days respondents actually spent participating in the activity-boat mode were obtained.

To allocate the total number of days in an activity-boat mode to the use of artificial reefs versus natural reefs versus no reefs, the proportion of fishing days and the proportion of dives spent on each reef/no reef was calculated from the Visitor Boater Survey responses. Question 16 asked the respondent how many days he/she spent on the artificial reef and Question 17 asked the respondent how many days he/she spent on the natural reef. For scuba divers and snorkelers, Question 18 asked for the total number of dives and Questions 19 and 20 asked for the number of dives on artificial versus natural reefs. A dive is defined as exiting and reentering the boat and applies to both divers and snorkelers. From the responses to these questions, the proportions of fishing days spent on artificial, natural and no reefs and the proportions of dives spent on artificial, natural and no reefs were obtained. For fishing charter and fishing party boats, the proportion of days spent on artificial versus natural versus no reefs was taken from the fishing-related responses to the charter/party boat operator survey for Broward County.

The proportion of visitor days that visitor boaters who use the reefs participated in fishing and diving/snorkeling and the proportion of fishing days and scuba/snorkeling dives that visitor boaters spent on the artificial, natural and no reefs for Broward County are presented in Table 4.2.1-4.

**Table 4.2.1-4 (Visitors)  
Percent of Visitor Person-Days That Reef-Using Boaters  
Participated in the Saltwater Recreation Activity  
And Percent of Fishing Days or Dives Spent on Artificial, Natural and No Reefs  
From Visitor Boater Survey  
Broward County**

Activity	Total Respondents	Percent of All Visitor Days	Percent of Activity Days or Dives On:			
			Artificial Reefs	Natural Reefs	No Reefs	Sum of Percentages
Fishing <sup>a</sup>	252	27%	47%	52%	1%	100%
Scuba Diving/ Snorkeling <sup>b</sup>	252	22%	51%	48%	1%	100%
<sup>a</sup> Percent of fishing days on each reef type is reported. <sup>b</sup> Percent of dives on each reef type is reported. A dive is a boat exit and re-entry. Note: Boating Modes are Charter, Party, Rental, and Private (Own or Friend's) Boat.						

Visitor boaters who came to Broward County to use the reefs spent 27 percent of their visiting days participating in saltwater fishing from either a charter, party, rental or private boat. Of these fishing days, 47 percent of days were spent fishing near artificial reefs, 52 percent of days were spent fishing near natural reefs and 1 percent of days were spent fishing near no reefs. Also, visitor boaters who came to the county to use the reefs spent 22 percent of their visiting days scuba diving or snorkeling. Of these diving/snorkeling days, 51 percent of dives were spent

## 4.0 Socioeconomic Value of Reefs in Broward County

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on artificial reefs, 48 percent of dives were spent on natural reefs, and 1 percent of dives were spent on no reefs.

The number of person-days spent in each saltwater boating activity-boat mode was estimated as the total person days reef-using boaters spent visiting the county in year 2000-2001 (from Table 4.2.1-3) times the proportion visitor days that these visitors spent participating in each activity-boat mode. Then the number of person-days spent in each saltwater boating activity-boat mode was allocated to artificial and natural reefs based on either the proportion of days or the proportion of dives spent in that activity-boat mode on or near artificial versus natural reefs. Proportion of days was used for all activities except scuba diving and snorkeling where the proportion of dives was used to provide a more accurate indicator of reef use.

A summary of the total person-days visitors spent participating in reef-related recreation by type of activity and by type of reef in Broward County is provided in Table 4.2.1-5. The total person-days visitors spent participating in each saltwater activity and boat mode by type of reef is provided in Table 4.2.1-6.

Visitors to Broward County spent about 5.7 million person-days on the reef system from June 2000 to May 2001. About 2.7 million of these days were spent on artificial reefs and about 3.0 million of these days were spent on natural reefs.

**Table 4.2.1-5 (Visitors)  
Number of Person-Days Spent Using Artificial and Natural Reefs  
By Recreation Activity – Broward County**

Activity	Number of Person-Days – in millions		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	0.09	0.27	0.35
Scuba Diving	1.59	1.43	3.02
Fishing	1.00	1.29	2.29
Glass Bottom Boat Sightseeing	0.02	0.04	0.05
<b>Total</b>	<b>2.70</b>	<b>3.03</b>	<b>5.71</b>

### 4.2.2 Economic Contribution – Visitors

The Visitor Boater Survey asked respondents how much money they and members of their party spent on the last day that they participated in fishing, scuba diving and snorkeling in the county. The respondent was also asked how many people spent or benefited from those expenditures. The respondent was asked only to provide the amount of money spent in the county of interview. From this information, a picture of the average itemized expenditures per person per fishing or diving day and by boating mode was estimated.

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**Table 4.2.1-6 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in**  
**Saltwater Boating Activities and Reef Use - June 2000 to May 2001**  
**Broward County**

Activity	Boat Mode	Number of Person Days	Number of Person-Days On:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	233,553	52,880	176,267	4,407
	Rental	0	0	0	0
	Private	125,239	34,789	90,450	0
Scuba Diving	Charter/Party	2,613,090	1,370,373	1,233,489	9,228
	Rental	176,011	88,006	88,006	0
	Private	240,323	128,745	111,579	0
Fishing – Offshore / Trolling	Charter	338,483	48,895	52,970	236,619
	Party	2,034,284	293,859	318,347	1,422,078
	Rental	0	0	0	0
	Private	1,133,919	471,151	637,970	24,797
Fishing – Flats or Back Country	Charter/Party	0	0	0	0
	Rental	0	0	0	0
	Private	88,006	29,335	44,298	0
Fishing Bottom	Charter	6,770	978	1,059	4,732
	Party	169,242	24,447	68,826	118,309
	Rental	0	0	0	0
	Private	301,250	134,976	166,274	0
Viewing Nature and Wildlife	Glass Bottom Boat	54,157	16,483	37,675	0
	Back Country Excursion	20,309	0	0	20,309
	Rental	10,154	0	0	10,154
	Private	74,466	0	0	74,466
Personal Watercraft (jet skis, wave runners, etc.)	Rental	13,539	0	0	13,539
	Private	176,011	0	0	176,011
Sailing	Charter/Party	0	0	0	0
	Rental	0	0	0	0
	Private	44,003	0	0	44,003
Other Boating Activities	Charter/Party	60,927	0	0	60,927
	Rental	3,385	0	0	3,385
	Private	10,154	0	0	10,154
<b>Total Person-Days</b>		<b>7,927,276</b>	<b>2,694,915</b>	<b>3,027,210</b>	<b>2,233,120</b>

## 4.0 Socioeconomic Value of Reefs in Broward County

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The average itemized per person expenditures by those who participated in each activity and boat mode in Broward County are provided in Table 4.2.2-1. Broward County reef-using visitors who went saltwater fishing on their own boat, a friend's boat or a rental boat spent, on average, \$93 per person per day on the day that they went fishing. This amount is comprised of \$18 for boat fuel, \$12 for lodging, \$14 for food and beverages at stores and \$17 for food and beverages at restaurants and bars and \$13 for shopping, among other items.

The average expenditure of persons who fished on charter boats was \$202 per person per day. About \$59 was the cost of the charter boat while \$19 was spent on lodging, \$18 was spent on food and beverages at stores, \$46 was spent on food and beverages at restaurants and bars, \$14 was spent on auto rental, and \$40 was spent on shopping.

Persons who fished on party boats spent, on average, \$169 per person on the day they went fishing which included \$29 for the party boat fee, \$22 for lodging, \$12 for food and beverages at stores, \$51 for food and beverages at restaurants and bars, \$13 for auto rental and \$30 for shopping.

Broward County reef-using visitors who went scuba diving or snorkeling on their own boat, a friend's boat or a rental boat spent, on average, \$91 per person per day on the day they went diving. This amount is comprised of \$18 for boat fuel, \$11 for lodging, \$15 for food and beverages at stores and \$15 for food and beverages at restaurants and bars.

Visitors who went diving on charter or party boats spent, on average, \$246 per person per day. This expenditure was comprised of \$68 per day for the dive charter or party boat, \$34 per day for lodging and \$10 per day for food and beverages at stores, \$37 per day for food and beverages in restaurants and bars and \$73 for shopping, among other items.

The lodging expenditure item includes lodging costs for hotels, motels and campgrounds or if the respondent paid by the day or by the week for the other accommodations. The \$33 per person per day for lodging may seem lower than the actual per person rate of a hotel or motel. Bear in mind that only a portion of visitors stay at a hotel or motel. Visitor accommodations also include campgrounds, family or friends, second homes and time shares. Also, as discussed previously, many visitors spend only one day in the county and therefore do not incur the cost of a room. The cost of the second home or time share is not included in the lodging cost because this is a monthly or up front cost that can, at best, only be partially due to the existence of the reefs.

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**Table 4.2.2-1 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Broward County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$58.88	\$29.29		\$68.09
Boat Rental				\$0.86	
Boat Fuel	\$18.52			\$18.13	
Air Refills				\$1.00	\$1.91
Tackle	\$1.29				
Bait	\$4.80				
Ice	\$1.76			\$1.31	\$0.10
Ramp Fees	\$0.20			\$3.44	\$0.05
Marina Fees	\$0.98			\$2.91	\$0.00
Lodging	\$11.64	\$19.29	\$22.30	\$11.19	\$33.97
Camping Fees	\$0.16	\$0.00	\$0.00	\$0.00	\$0.78
Food and Beverages - Stores	\$13.96	\$17.57	\$11.54	\$14.66	\$10.40
Food and Beverages - Restaurants/Bars	\$17.11	\$45.89	\$50.65	\$14.93	\$36.54
Auto Gas	\$6.07	\$6.09	\$10.93	\$8.74	\$5.56
Auto Rental	\$3.16	\$13.81	\$12.57	\$0.00	\$12.78
Equipment Rental	\$0.00	\$0.00	\$1.92	\$0.00	\$2.24
Shopping	\$13.47	\$40.11	\$30.04	\$13.53	\$73.15
Total	\$93.12	\$201.65	\$169.24	\$90.70	\$245.56
Number of Respondents	43	53	27	19	127
Number of Respondents and Party Members <sup>c</sup>	136	147	54	58	306

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity-Mode, the expenditures for each item were summed over all the respondents who participated in the Activity-Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.



## 4.0 Socioeconomic Value of Reefs in Broward County

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The expenditures per person per day were multiplied by the number of person-days by boating mode and reef type to obtain an estimate of the total expenditures associated with reef related activities. The itemized total expenditures associated with reef use in Broward County in 2000-2001 are provided in Table 4.2.2-2. The expenditures associated with glass bottom boating days only included the fee per person per ride (\$20). The other expenditures associated with the entire day spent in the county were not included for glass bottom boat riders because these visitors are likely in the county for other reasons either not reef-related or included in the other reef-related recreational activities.

Visitors who used the reefs in Broward County spent \$1,024,000,000 (\$1 billion) on reef-related expenditures. Of this amount \$496 million was associated with artificial reef-related expenditures and \$529 million was associated with natural reef-related expenditures.

The reef-related visitor expenditures were then used to estimate the economic contribution of artificial and natural reefs to each of the counties. As discussed in the Introduction of the Report, 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 re-spent 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.

#### 4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.2.2-2 (Visitors)**  
**Total Visitor Expenditures In Broward County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	2,694,915	3,027,210	5,722,125
Charter / Party Boat Fee	\$109,166,167	\$110,508,817	\$219,674,984
Boat Rental	216,844	250,030	466,873
Boat Fuel	16,326,072	20,969,451	37,295,524
Air Refills	2,963,161	2,975,942	5,939,103
Tackle	817,690	1,091,875	1,909,565
Bait	3,051,152	4,074,253	7,125,405
Ice	1,593,185	2,017,408	3,610,593
Ramp Fees	1,060,145	1,235,500	2,295,644
Marina Fees	1,352,237	1,672,381	3,024,618
Lodging	66,625,405	70,694,385	137,319,791
Camping Fees	1,219,072	1,242,955	2,462,027
Food and Beverages - Stores	31,911,169	36,176,792	68,087,961
Food and Beverages - Restaurants/Bars	85,044,260	92,450,853	177,495,113
Auto Gas	17,753,895	20,087,351	37,841,245
Auto Rental	24,887,396	26,310,827	51,198,222
Equipment Rental	3,793,516	3,895,783	7,689,299
Shopping	127,637,167	132,276,824	259,913,991
Glass Bottom Boat Ride	329,653	753,493	1,083,146
<b>Total</b>	<b>\$495,748,186</b>	<b>\$528,684,919</b>	<b>\$1,024,433,105</b>

The direct, indirect and induced increase in sales, total income, employment and indirect business taxes generated by the reef-related expenditures were estimated for Broward County using the IMPLAN Regional Input-Output Model. This model uses detailed data on the economies of this county to estimate economic multipliers and to model the impact of reef-related expenditures on the economy.

The economic contribution of the reefs to Broward County is provided in Table 4.2.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. Income is the money that stays in the county's economy. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures. The indirect business tax contribution is the sum of the additional excise taxes, property taxes, fees, licenses, and sales taxes collected due to the reef-related expenditures.

## 4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.2.2-3**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Broward County**  
**Economic Area is Broward County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

<b>Reef Type/Economic Contribution</b>	<b>Direct</b>	<b>Indirect</b>	<b>Induced</b>	<b>Total</b>
<b>Artificial Reefs</b>				
Sales	\$493.3	\$136.67	\$241.11	\$871.08
Total Income	\$264.67	\$75.01	\$149.75	\$489.43
Employment (full and part-time jobs)	11,155	1,548	3,306	16,009
Indirect Business Taxes	\$46.87	\$7.87	\$15.11	\$69.85
<b>Natural Reefs</b>				
Sales	\$526.11	\$145.52	\$257.48	\$929.11
Total Income	\$282.27	\$79.75	\$159.93	\$521.95
Employment (full and part-time jobs)	11,814	1,645	3,530	16,989
Indirect Business Taxes	\$50.15	\$8.37	\$16.13	\$74.69
<b>Natural and Artificial Reefs</b>				
Sales	\$1,019.41	\$282.18	\$498.59	\$1,800.19
Total Income	\$546.97	\$154.76	\$309.67	\$1,011.37
Employment (full and part-time jobs)	22,969	3,193	6,837	32,999
Indirect Business Taxes	\$97.02	\$16.23	\$31.24	\$144.49

Reef-related expenditures by visitors to Broward County (direct sales in Table 4.2.2-3) during the period June 2000 to May 2001 resulted in \$1.8 billion in sales to county businesses. These sales generated \$1 billion in income and 33,000 jobs. About \$144 million in indirect business taxes were collected as a result. About 48 percent of these values were the result of artificial reef-related expenditures and 52 percent of these values were the result of natural reef-related expenditures.

### 4.2.3 Use Value

Use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value was discussed in the introduction to this report. In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to all reef users of maintaining the artificial and natural reefs; and (4) the value of adding and maintaining additional artificial reefs. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The visitor reef-user values associated with maintaining the reefs in their existing conditions for Broward County is provided in Table 4.2.3-1. Use value per person day means the value per person day of artificial, natural or all reef use, as specified in the table. The respondent was asked to state *yes*, *no* or *don't know* to a specified payment to maintain the artificial reefs, the natural reefs and a combined program that would protect both types of reefs. The scenario provided to the respondent was as follows.

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“Local and state government agencies are considering different approaches to maintaining the health and condition of the *natural* and *artificial* reefs in southeast Florida. One plan focuses on providing greater protection for *natural* reefs by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the *artificial* reefs by maintaining water quality, limiting damage to artificial reefs from anchoring and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both or none of these plans and if you would be willing to incur higher costs to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on your ability to participate in any boating activity or other recreation in southeast Florida.”

Then the respondent was asked a yes or no question regarding the natural reef plan, the artificial reef plan and both plans. For example, the question regarding both plans read: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together in a combined program. Consider once again your total trip cost for your last trip to use the reefs in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you be willing to pay this amount to maintain the artificial and natural reefs?”

The amounts (bid values) of \$20, \$100, \$200, \$1,000, and \$2,000 were rotated from respondent to respondent. For the individual programs (just natural or artificial reef protection), the amounts were one-half of the above amounts: \$10, \$50, \$100, \$500 and \$1,000.

Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey<sup>5</sup>: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs.” Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition.

Chapter 2.2.2 provides a general description of the procedures used to analyze the data and to estimate the user values presented here. For a more technical discussion, please see the Technical Appendix to this report. The Technical Appendix is a separate document that

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<sup>5</sup> For a complete description of the contingent valuation questions, please refer to the Visitor Boater Survey and the Blue Card (which is a white page in this report but labeled “Blue Card”) in Appendix B.

## 4.0 Socioeconomic Value of Reefs in Broward County

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describes the methods used to derive the values presented here and also provides alternative estimates using different estimation methods. In this final report, the estimates of total annual use value, use value per person-day, and the asset value of the reefs are those that were derived using the logit model.

The estimated use values by type of activity are presented in Table 4.2.3-2 and are consistent with the idea that natural reefs are preferred to artificial reefs although, for Broward County, the difference is not vary large. For Broward County visitors, the average per person-day value of the natural reefs was \$21.04 versus \$19.39 for artificial reefs. Total use is also higher for natural versus artificial reefs. Broward County visitors' natural reef use was over 3 million person-days versus about 2.7 million person-days for artificial reefs. This translated into an estimate of total annual use value of about \$63.7 million for natural reefs and \$52.3 million for artificial reefs. Capitalizing the annual use values, using a three percent interest rate, yields asset values of about \$2.1 billion for the natural reefs and \$1.7 billion for the artificial reefs. When both artificial and natural reef maintenance programs are considered, total use value is \$114 million per year for an asset value of \$3.8 billion.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs. Investments include deploying new artificial reefs and enhancing natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. However, for Broward County residents, this difference was not significant. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs would provide a conservative or lower bound estimate of the total natural and artificial reef values.

The capitalized value of the reef user values is the present value of the annual values calculated at three percent discount rate. It represents the "stock" value analogous to land market values. The capitalized visitor reef user value for associated with Broward County reefs, both artificial and natural is \$3.8 billion. Bear in mind that this value only includes the value that visitor reef users place on the reefs and does not include the values that resident reef users and non-reef-users place on the reefs or the economic contribution of the reefs. *The estimation of this value was not part of this study.*

## 4.0 Socioeconomic Value of Reefs in Broward County

Reef users' willingness to pay to invest in and maintain "new" artificial reefs is provided in Table 4.2.3-3. The use value per person-day is the value per day or a portion of a day of artificial reef use. In Broward County, reef users are willing to pay \$15 million annually for this program. Scuba divers have the highest value associated with the new artificial reef program.

**Table 4.2.3-1 (Visitors)**  
**Annual Value of Reefs To Reef Users and Capitalized Value**  
**Data Represents June 2000 to May 2001**  
**Visitor Reef-Users in Broward County**

Item	All Reefs - Artificial and Natural	Artificial Reefs	Natural Reefs
Number of Person-Days of Reef Use	5,722,126	2,694,916	3,027,210
Use Value Per Person-Day (\$2000)	\$19.92	\$19.39	\$21.04
Annual Use Value - (\$2000)	\$113,982,216	\$52,259,828	\$63,699,452
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$3,799,407,200	\$1,741,994,267	\$2,123,315,067

**Table 4.2.3-2 (Visitors)**  
**Value of Reefs to Visitors to Broward County, by Reef Type and Activity, 2000-2001**

Reef Type/Activity	Person-Days	Annual User Value (\$)	User Value Per Person-Day (\$)
<b>Natural Reefs</b>	<b>3,027,210</b>	<b>\$63,699,452</b>	<b>\$21.04</b>
Snorkeling	266,717	\$2,475,446	\$9.28
Scuba Diving	1,433,074	\$31,359,551	\$21.88
Fishing	1,289,745	\$29,369,538	\$22.77
Glass Bottom Boat	37,675	\$494,917	\$13.14
<b>Artificial Reefs</b>	<b>2,694,916</b>	<b>\$52,259,828</b>	<b>\$19.39</b>
Snorkeling	87,669	\$791,396	\$9.03
Scuba Diving	1,587,123	\$23,469,635	\$14.79
Fishing	1,003,641	\$27,777,415	\$27.68
Glass Bottom Boat	16,483	\$221,382	\$13.43
<b>Natural &amp; Artificial Reefs</b>	<b>5,722,126</b>	<b>\$113,982,216</b>	<b>\$19.92</b>
Snorkeling	354,386	\$2,900,266	\$8.18
Scuba Diving	3,020,197	\$59,584,003	\$19.73
Fishing	2,293,386	\$50,857,974	\$22.18
Glass Bottom Boat	54,157	\$639,973	\$11.82
<b>New Artificial Reefs</b>	<b>2,694,916</b>	<b>\$14,944,495</b>	<b>\$5.55</b>
Snorkeling	87,669	\$190,895	\$2.18
Scuba Diving	1,587,123	\$7,934,751	\$5.00
Fishing	1,003,641	\$6,764,935	\$6.74
Glass Bottom Boat	16,483	\$53,916	\$3.27

## 4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.2.3-3 (Visitors)  
Estimated Use Value of Investing in and Maintaining  
"New" Artificial Reefs in the County  
Visitor Reef-Users in Broward County**

Item	Value
Number of Person-Days of Artificial Reef Use	2,694,915
Use Value Per Person-Day for "New" Artificial Reefs (\$2000)	\$5.55
Annual Use Values for "New" Artificial Reefs	\$14,944,495
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$498,149,833
<i>Note: Use value per person-day is use value per whole day or portion of a day of artificial reef use.</i>	

### 4.2.4 Demographic Information

The Visitor Boater Survey asked the respondent questions regarding his/her socioeconomic characteristics so that a picture of the typical reef user could be developed. The results for Broward County are summarized in Table 4.2.4-1.

**Table 4.2.4-1 (Visitors)  
Demographic Characteristics of Visitor Reef-Users in Broward County, 2000**

Characteristic	Broward County
Median Age of Respondent – Years	39
Sex of Respondent	
Male	77%
Female	23%
Race of Respondent	
White	89%
Black	7%
Other	4%
Percent Hispanic / Latino	13%
Median Household Income	\$87,500
Average Years Boating in Southeast Florida	6.7
Average Length of Own Boat Used in Saltwater Boating in Feet	27
Percent of Respondents Who Belong to Fishing and/or Diving Clubs	12%

**4.3 Total – Residents and Visitors**

This section summarizes the user activities, economic contribution and use values associated with the artificial and natural reefs for both residents and visitors of Broward County. Demographic information of both resident and visitor reef users is also provided.

**4.3.1 User Activity**

The numbers of person-days spent using the reefs in Broward County by reef type and population (residents and visitors) are summarized in Table 4.3.1-1. Visitors and residents spent about 9.4 million person-days using artificial and natural reefs in Broward County during the 12 month period from June 2000 to May 2001. Residents spent 3.7 million person-days and visitors spent 5.7 million person-days. Reef users spent 3.9 million person-days using artificial reefs and 5.5 million person-days using natural reefs. A summary of reef use by type of activity is provided in Table 4.3.1-2.

**Table 4.3.1-1  
Number of Person-Days Spent on Artificial and Natural Reefs  
in Broward County  
Residents and Visitors – in millions**

<b>Population</b>	<b>Artificial Reefs</b>	<b>Natural Reefs</b>	<b>All Reefs</b>
Residents	1.28	2.44	3.72
Visitors	2.70	3.02	5.72
<b>Total</b>	<b>3.98</b>	<b>5.46</b>	<b>9.44</b>

**Table 4.3.1-2  
Number of Person-Days Spent Using Reefs in Broward County by  
Recreational Activity  
Residents and Visitors – in millions**

<b>Activity</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Snorkeling	0.73	0.35	1.09
Scuba Diving	0.83	3.02	3.85
Fishing	2.15	2.29	4.45
Glass Bottom Boats	-	0.05	0.05
<b>Total</b>	<b>3.71</b>	<b>5.71</b>	<b>9.44</b>

*Note: Residents were not asked about their participation in glass bottom boat sightseeing.*

The popularity of reef-related diving is about equal to the popularity of reef-related fishing. Fishing comprised 4.4 million person-days while scuba diving and snorkeling comprised 3.3 million person-days and 1.1 person-days, respectively. Visitor reef-related recreation comprises 65 percent of total reef-related recreation by residents and visitors in Broward County. Visitors spent significantly more days scuba diving than did residents.



### 4.3.2 Economic Contribution

The total economic contribution of the reefs to Broward County includes the contribution of reef expenditures to sales, income and employment. 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 visitor expenditures create multiplier effects wherein additional income and employment is created as the income earned by the reef-related industries is re-spent 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.

The economic contributions of the artificial, natural and all reefs to Broward County are provided in Tables 4.3.2-1 through 4.3.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

As presented in Table 4.3.2-3, reef-related expenditures in Broward County generated \$2.1 billion in sales during the 12-month period from June 2000 to May 2001. These sales resulted in \$1.1 billion in income to Broward County residents and provided 35,500 jobs in Broward County. Artificial reef-related expenditures accounted for 48 percent of the economic contribution of all reefs and natural reef-related expenditures accounted for 52 percent of the economic contribution.

4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.3.2-1**  
**Economic Contribution of Artificial Reef-Related Expenditures to**  
**Broward County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$90.90	\$12.50	812
Visitor	\$493.30	\$264.67	11,155
Total	\$584.20	\$277.17	11,967
Indirect	\$136.67	\$75.01	1,548
Induced	\$241.11	\$149.75	3,306
Total	\$961.98	\$501.93	16,821

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.

**Table 4.3.2-2**  
**Economic Contribution of Natural Reef-Related Expenditures to**  
**Broward County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$178.90	\$25.20	1,662
Visitor	\$526.11	\$282.26	11,814
Total	\$705.01	\$307.46	13,476
Indirect	\$145.51	\$79.75	1,645
Induced	\$257.48	\$159.93	3,530
Total	\$1,108.00	\$547.11	18,651

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.

**Table 4.3.2-3**  
**Economic Contribution of All Reef-Related Expenditures to Broward**  
**County**  
**June 2000 to May 2001 – In Millions of 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$269.80	\$37.70	2,474
Visitor	\$1,019.41	\$546.97	22,969
Total	\$1,289.21	\$584.67	25,443
Indirect	\$282.18	\$154.76	3,193
Induced	\$498.59	\$309.67	6,837
Total	\$2,069.98	\$1,049.43	35,473

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.

### 4.3.3 Use Value

In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to all reef users of maintaining both the artificial and natural reefs and (4) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The annual value Broward County visitors and residents place on protecting the reefs in their existing condition and the associated capitalized value is presented in Table 4.3.3-1. The annual value visitor and resident reef-users place on investing in and maintaining “new” artificial reefs is presented in Table 4.3.3-2. These values were explained in Sections 4.1.3 and 4.2.3.

## 4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.3.3-1**  
**Annual Use Value Associated with Protecting Reefs in their Existing Condition and**  
**Capitalized Value Associated With Reef Use**  
**Data Represents June 2000 to May 2001**  
**Broward County, Florida**

<b>Item</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
<b>All Reefs - Artificial and Natural</b>			
Number of Person-Days of Reef Use (millions)	3.72	5.72	<b>9.44</b>
Use Value Per Person-Day	\$3.24	\$19.92	<b>\$13.35</b>
Annual Use Value - (million dollars)	\$12.04	\$113.98	<b>\$126.02</b>
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.40	\$3.80	<b>\$4.20</b>
<b>Artificial Reefs</b>			
Number of Person-Days of Reef Use (millions)	1.28	2.69	<b>3.97</b>
Use Value Per Person-Day	\$2.81	\$19.39	<b>\$14.07</b>
Annual Use Value - (million dollars)	\$3.60	\$52.26	<b>\$55.86</b>
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.12	\$1.74	<b>\$1.86</b>
<b>Natural Reefs</b>			
Number of Person-Days of Reef Use (millions)	2.44	3.03	<b>5.47</b>
Use Value Per Person-Day	\$8.17	\$21.04	<b>\$15.16</b>
Annual Use Value - (million dollars)	\$19.91	\$63.70	<b>\$82.61</b>
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.66	\$2.12	<b>\$2.78</b>

**Table 4.3.3-2**  
**Estimated Value to Reef Users From Investing in and**  
**Maintaining "New" Artificial Reefs**  
**Broward County, Florida**

<b>Item</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Number of Person-Days of Artificial Reef Use (millions)	1.28	2.69	<b>3.97</b>
Use Value Per Person-Day for "New" Artificial Reefs	\$0.60	\$5.55	<b>\$3.95</b>
Annual Use Values for "New" Artificial Reefs (million dollars)	\$0.76	\$14.94	<b>\$15.70</b>
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$25.40	\$498.15	<b>\$523.55</b>

### 4.3.4 Demographic Information

This section summarizes and compares the demographic characteristics of visitor and resident reef users. These characteristics were obtained from the resident boater survey and the visitor boater survey. They are summarized in Tables 4.3.4-1. A comparison of the demographics indicate that resident and visitors are very similar in terms of age, race, income, and membership in fishing and/or diving clubs.

4.0 Socioeconomic Value of Reefs in Broward County

**Table 4.3.4-1  
Demographic Characteristics of Resident and Visitor Reef-Users in  
Broward County, 2000**

	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Age of Respondent</b>	48			39		
<b>Sex Of Respondent</b>	<b>Percent</b>			<b>Percent</b>		
Male	92%			77%		
Female	8%			23%		
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
<b>Race Of Respondent</b>	93%	2%	5%	89%	7%	4%
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
<b>Percent Hispanic/Latino</b>	5%			13%		
	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Household Income</b>	\$72,310			\$87,500		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Years Boating in South Florida</b>	22			6.7		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Length of Boat Used for Salt Water Activities in Feet</b>	25			27		
	<b>Residents</b>			<b>Visitors</b>		
<b>% of Respondents Who Belong to Fishing and/or Diving Clubs</b>	19%			12%		

# Chapter 5: Socioeconomic Value of Reefs in Miami-Dade County

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This chapter describes the Socioeconomic Value of Artificial and Natural Reefs in Miami-Dade County to residents and visitors. For both groups this chapter discusses the following topics.

- Volume of user activity on both artificial and natural reefs off Miami-Dade County;
- Economic Contribution of artificial and natural reefs to the county's economy;
- Resident and visitor "use value" associated with recreating on artificial and natural reefs in Miami-Dade County; and,
- Demographic and boater profile of reef users in Miami-Dade County.

For residents, their opinions regarding the existence of "no-take" zones as a tool to protect existing artificial and natural reefs are provided.

## 5.1 Residents

The focus of this section is on the socioeconomic values of the reefs off the Coast of Miami-Dade County to resident boaters. Resident boaters are those individuals who live within Miami-Dade County and use a boat that is owned by a resident of the county to visit the reef system. Resident boats used to visit the reef system are defined as those greater than 16 feet in length and are registered with the Florida Department of Highway Safety and Motor Vehicles.

### 5.1.1 User Activity

This chapter first considers the volume of resident user activity associated with the artificial and natural reefs off Miami-Dade County. User activity is expressed in terms of the number of boating days or "party-days" since each boat carries one or more individuals. Also, user activity is analyzed in terms of the kinds of recreational activities (e.g., snorkeling) that parties participate in when they visit the reef system.

To measure party-days for any recreational resource, it is important to define what universe the research is intended to measure. In this study, we wish to measure the number of party-days spent on artificial and natural reefs in the Atlantic Ocean off the Coast of Miami-Dade County. For most residents, their own boats are used to facilitate this recreational process. The use of party boats or charter rentals by residents was not estimated in this study.

In 1999-2000, there were 67,936 registered pleasure boats in Miami-Dade County according to the Florida Department of Highway Safety and Motor Vehicles (2001). These pleasure craft were divided into the following size classes:

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

Boat Size Category (Length of Boat in Feet)	Number of Boats	Percentage of Total	Cumulative Percentage
Less than 12 feet	14,041	20.67%	20.67%
12 feet to 15'11"	8,859	13.04%	33.71%
16 feet to 25'11"	34,912	51.39%	85.10%
26 feet to 39'11"	8,431	12.41%	97.51%
40 feet to 64'11"	1,591	2.34%	99.85%
65 feet to 109'11"	97	0.14%	99.99%
Greater than 110 feet	5	0.01%	100.00%
<b>Total</b>	<b>67,936</b>	<b>100.00%</b>	

The largest boat size category of pleasure craft in Miami-Dade County is between 16 and nearly 26 feet in length (51 percent).

Three adjustments were made to reach the target population of registered boats for Miami-Dade County that may visit the reef system. First, sampling was restricted to pleasure craft over 16 feet in length. This was in response to expert opinion that very few pleasure craft less than 16 feet could reach the reef system. Thus, the mail survey was targeted at pleasure craft over 16 feet long so that nonusers could be avoided and to increase the sample size on that segment of the boating population with the highest propensity to use the reef system. This reduced the target boat population in Miami-Dade County to 45,036 pleasure craft.

In addition, not everyone with a relatively large boat would use an artificial and/or natural reef in the last twelve months. In fact, the results of the survey indicated that 68.5 percent of these larger vessels used the Miami-Dade County reef system in the last 12 months or 30,850 pleasure craft. Finally, it was determined that about one-half a percent of registered boats in the target population had a residence somewhere outside Miami-Dade County. Thus, the target population was again reduced to 30,695 pleasure craft to reflect only resident boat owners likely to use the reefs via their own boat.

On average, respondents indicated that over a 12-month period (1999-2000) they used the reef system on 36 separate days while engaging in three main recreational activities: fishing, snorkeling and scuba diving. Remember, these boaters have the highest propensity to use the reef system compared to smaller vessels. Based upon this information, it was estimated that over this 12-month period, Miami-Dade County residents spent 1,105,005 “party- days” on the reef system (i.e., 36 party-days times 30,695 pleasure craft).

In conducting the mail survey, reef-users from Miami-Dade County were asked to distribute their 36 party-days in two ways. First, they were asked to distribute their reef usage among three recreational activities as follows: (1) Fishing, (2) Snorkeling and (3) Scuba Diving. Second, respondents were asked to distribute each of these recreational activities between artificial and

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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natural reefs. Table 5.1.1-1 shows the distribution of party-days for resident boaters in Miami-Dade County.

Miami-Dade County residents spent an estimated 54 percent of their party-days fishing on the artificial and natural reefs followed by snorkeling (26 percent) and scuba diving (20 percent). For all the recreational activities on reefs, there was a slight preference for natural reefs with 66 percent of the party-days spent visiting natural reefs. Snorkelers had the highest propensity to use the natural reefs with 72 percent of the respondents using the natural reef for this activity.

On the right hand side of Table 5.1.1-1, user activity, measured in "person-days" is estimated. A "person-day" is equivalent to an individual traveling to use the reef system for part or all of one day. While party-days gives a "boater dimension" to an activity in and around the reef system, person-days yields a "people dimension" to the use of the reef system. The former is especially useful in judging the adequacy of the boating infrastructure such as marinas and boat ramps while the latter is used in calculating recreational value which is done on a person-day basis.

The number of person-days was calculated by multiplying by the average size of the party (i.e. number of individuals per party) by the number of party-days. However, one important adjustment to average party size was necessary to calculate residential person-days. Therefore, the average party size was reduced by subtracting individuals who were considered to be visitors (i.e. non-residents of Miami-Dade County). About 17 percent of the average party was identified as nonresidents. Thus, Table 5.1.1-1 utilizes the average resident party size to calculate person-days, which makes this adjustment. The average residential party size does not vary appreciably among the various reef-related recreational activities and averages about 3.92 residents per party. Because of this, the distribution of person-days per activity is similar to the distribution of party-days discussed above. For example, saltwater fishing on reefs garnered 2.6 million person-days or 57 percent of all person-days during the 12-month period (1999-2000). The total number of person-days for residents using the reef system off Miami-Dade County over a 12-month period was estimated at 4.5 million.

Now, we turn to the economic contribution of resident reef users to the Miami-Dade County economy.



5.0 Socioeconomic Value of Reefs in Miami-Dade County

**Table 5.1.1-1 (Residents)**  
**Estimated Resident User Activity as Measured by Party-Days and Person-Days on**  
**Artificial and Natural Reefs off Miami-Dade County, Florida, 2000**

Activity/ Type Of Reef	Number and Distribution of Party-Days by Activity and Reef Type			Number and Distribution of Person-Days by Activity and Reef Type			
	Number of Party-Days	Percentage of Party-Days Per Activity by Reef Type	Percentage of Total Party-Days Per Activity	Resident Party-Size by Activity	Number of Resident Person-Days <sup>1</sup> by Activity by Reef Type	Percentage of Person-Days Per Activity by Reef Type	Percentage of Total Person-Days Per Activity
<b>Fishing</b>			54%	4.32			57%
Artificial	226,747	38%			979,547	38%	
Natural	369,956	62%			1,598,210	62%	
Subtotal	596,703	100%			2,577,757	100%	
<b>Snorkeling</b>			26%	4.28			27%
Artificial	80,445	28%			344,305	28%	
Natural	206,857	72%			885,348	72%	
Subtotal	287,302	100%			1,229,653	100%	
<b>Scuba Diving</b>			20%	3.16			16%
Artificial	68,510	31%			216,492	31%	
Natural	152,491	69%			481,872	69%	
Subtotal	221,001	100%			698,363	100%	
<b>All Activities</b>							
Artificial	375,702	34%			1,540,343		
Natural	729,304	66%			2,965,430		
<b>Total</b>	<b>1,105,006</b>	<b>100%</b>	<b>100%</b>		<b>4,505,773</b>		<b>100%</b>

<sup>1</sup> Resident person-days were calculated by multiplying the number of party-days by the average resident party size.

### 5.1.2 Economic Contribution

To fully understand the economic contribution of reefs to Miami-Dade County it is first important to recognize what factors influence the demand for boating in this area. This will help in understanding the nature of boating in the county and how it relates to the use of artificial and natural reefs. In a study by Bell and Leeworthy (1986), the authors found that the demand for boats by individuals was related to boat prices, population and per capita income. Therefore, it is expected that there would be a higher number of registered pleasure craft in counties that are large as measured by population and are relatively affluent as measured by real per capita income.

The number of registered boats in any county is critical in assessing the adequacy of the boating infrastructure such as boat ramps and, of course, artificial and natural reefs. This topic has recently been addressed in the 2000 State Comprehensive Outdoor Recreational Plan (2001) issued by the Division of Recreation and Parks, Florida Department of Environmental Protection. However, this report did not include an assessment of the reef system in various regions of Florida. This chapter considers the demand for boating in Miami-Dade County, not the infrastructure available. This will give the reader an overview of Miami-Dade County and valuable information necessary to assess the adequacy of the boating infrastructure. The overview includes the size and nature of the county's population, per capita income, industrial structure, and the infrastructure related to saltwater boating. This will provide a background by which to assess the results of this study.

Miami-Dade County is on the southeast coast of Florida bordering the Atlantic Ocean with Miami as its largest city. In 1999, the county had the largest in population in Florida with 2.13 million residents. Over the last ten years, population in this county grew by 9 percent making it the 66<sup>th</sup> fastest growing county in Florida (out of 67 counties). Miami-Dade County has 1,094 persons per square mile as compared to 284 for Florida as a whole, making it the fourth most densely populated county in the State. This county's population has a median age of 35.9 years, which is comparable to the general population of Florida, which has a median age of 39 years.

The University of Florida, Bureau of Economic and Business Research projects the county's population to reach 2.50 million by 2015 or an 18 percent increase from 1999. In-migration to Miami-Dade County, will account for about one-third of this growth. Thus, this county's population growth will depend heavily on net birth rates. The absolute size of Miami-Dade County's population coupled with its projected future growth makes this county a potentially large market for resident recreational boating along its coasts.

In 1998, Miami-Dade County had a per capita income of \$23,919 placing it 21st among the 67 counties in the State of Florida. However, this per capita income was only 11 percent below the state average of \$26,845. Although the average earnings from employment are about nine percent above the state average, Miami-Dade County residents have a very low flow of income from dividends, interests and rents. The net effect of these two factors is therefore a lowering of per capita income below the state average. This could indicate reduced demand for reef-related recreational boating.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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In 1998, there were 1,041,257 persons employed generating \$31.72 billion in wage and salaries in Miami-Dade County. Over the last ten years, employment grew by 11.7 percent, which corresponds to the rate of growth in population as discussed above. Measured by earnings of persons, the largest industries in 1998, were services (32.7 percent); state and local government (12.7 percent); and finance, insurance and real estate (11 percent). Of particular note, this county provides tourist-related services such as lodging, amusement and recreation. More than 35,000 workers were involved in these industries in Miami-Dade County in 1998. The attraction of tourists provides part of the economic base for this county.

In 2000, there were 68,082 recreational boats (FDHSMV, 2001) registered in Miami-Dade County or 1 boat for every 32 people. For the State of Florida, there is one registered pleasure boat for every 14 residents. The infrastructure supporting various coastal or saltwater forms of boating recreation in Miami-Dade County includes the following (FDEP, 2000)(Pybas, 1997):

1. Boat Ramps: 57 with a total of 119 boating lanes;
2. Marinas: 97 with 6,166 wet slips and moorings;
3. Other Facilities: 3,082 boat dry storage;
4. Artificial Reefs: 105 artificial reefs ranging from .1 to 6.5 nautical miles from shore.

Despite the relatively large population in Miami-Dade County, the demand for recreational boating is less than the demand for boating throughout Florida as measured by the ratio of registered boats per person. The lower per capita income in this county would be a factor in lessening the demand for recreational boats. Additionally, the high population density, probably as in many of the Southeastern Florida counties, contributes to crowding and congestion, which impinges on the carrying capacity of both man-made facilities (e.g., artificial reefs; boat ramps) and natural resources. This increases the cost of recreational boating and reduces the demand for pleasure boats. This “working hypothesis” of a supply side problem could be one of several factors that may affect the demand for registered boats in Miami-Dade County.

Using a mail survey, 3,000 registered boaters in Miami-Dade County were contacted at random using the survey instrument provided in Appendix A. Boat owner addresses were obtained from a registered boater database compiled by the Florida Department of Highway Safety and Motor Vehicles. A total of 552 registered boaters responded to the mail survey. From the responses to the mail survey, 68.5 percent (378) indicated that they used their pleasure crafts to visit the reefs offshore of Miami-Dade County during a 12-month period (December 1999 through November 2000). The results of the survey were used to estimate a total of 1.28 million person-days spent by residents of Miami-Dade County on artificial reefs in a 12-month period. This amounts to an average of 17,305 person-days per year for each reef or 47 persons per day. This, of course, does not include visitors from outside Miami-Dade County, which are discussed in the next section of this chapter.

To estimate the economic contribution of resident spending associated with reef use in the Miami-Dade County economy, the respondents were asked to estimate party spending during

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their last boating activity. It was assumed that each boating trip would last one day because the residents are in their county of residence. Residential expenditures per party were distributed according to the categories of recreational activity as follows for Miami-Dade County residents:

<b>Average Resident Spending Per Party for Miami-Dade County Reef-Users</b>			
<b>Activity</b>	<b>Estimated Spending per Party per Day</b>	<b>Percentage of Residents per Party</b>	<b>Estimated Spending per Resident Party per Day</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4) = (2) * (3)</b>
Fishing	\$245.50	80%	\$276.40
Snorkeling	\$250.08	82%	\$205.07
Scuba Diving	\$268.88	87%	\$233.93

Note that an adjustment was made to the size of the boating party in order to calculate estimated expenditures by residents as summarized above. About 13 to 20 percent of the typical party included individuals that were apparently guests of the Miami-Dade County residents. We made the simplifying assumption that these visitors would pay their fair share of the trip cost. Such visitors may contribute to boat fuel, restaurants and bait for example. We feel that the resident component probably pays for more than indicated above; however, we shall be very conservative and assume an equal sharing. Thus, resident spending is certainly not overstated and that is what we mean by being conservative in terms of the economic contribution.

Recreational fishing on reefs was most expensive and snorkeling the least expensive. Expenditures for marina fees, equipment rentals and restaurants made the former activity a more expensive recreational activity than the latter. Detailed expenditures on particular items will be discussed below while additional information and analysis is provided in the Technical Appendix to this report which is a separate document.

To derive the economic impact of a particular reef-related recreational activity, one must briefly return to Table 5.1.1-1. This table shows the number of resident party-days and person-days associated with reef use over a 12-month period off the Coast of Miami-Dade County. For example, recreational fishing generated 596,703 resident party-days to all reefs off Miami-Dade County. According to our resident spending per party discussed above, resident fishers spent \$276.40 per trip. Thus, annual expenditures for reef-related fishing was estimated at \$164.9 million dollars (\$276.40 times 596,703).

Based upon the distribution of party-days per reef type, about \$62.7 million was spent while using artificial reefs while the balance, or \$102.2 million, was spent in conjunction with the use of natural reefs by recreational fishers. There did not appear to be much difference between party spending by fishers who used either type of reef. This held for the other two recreational activities as well.

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Table 5.1.2-1 shows the economic contribution of all reef-related recreational pursuits off the Miami-Dade County coast. Residents spent an estimated \$275.6 million during a 12-month period (1999-2000). About two-thirds of this was spent while using natural reefs (\$180.4 million) while the balance (\$95.2 million) was spent in conjunction with an artificial reef system. Nearly 60 percent of total spending or \$165 million was spent on reef-related recreational fishing while \$58.9 million (21 percent) was spent on reef-related snorkeling and \$51.7 million (19 percent) was spent on reef-related scuba diving.

**Table 5.1.2-1 (Residents)  
Reef-Related Expenditures, Wages and Employment Generated by  
Resident Boating Activities in Miami-Dade County, Florida, 2000**

Type of Activity/ Type of Reef	Expenditures (Million \$)	Wages (Million \$)	Employment (Number of Full and Part-Time Jobs)
<b>Artificial Reef</b>			
Fishing	\$62.70	\$8.50	460
Snorkeling	\$16.50	\$2.50	133
Scuba Diving	\$16.00	\$2.40	131
Subtotal	\$95.20	\$13.40	724
Percentage Attributed to Artificial Reefs	35%	35%	34%
<b>Natural Reef</b>			
Fishing	\$102.30	\$13.90	751
Snorkeling	\$42.40	\$6.40	342
Scuba Diving	\$35.70	\$5.20	292
Subtotal	\$180.40	\$25.50	1,385
Percentage Attributable to Natural Reefs	65%	65%	66%
<b>Total All Reefs</b>			
Fishing	\$165.00	\$22.40	1,211
Snorkeling	\$58.90	\$8.90	475
Scuba Diving	\$51.70	\$7.60	423
Total All Reefs/All Activities	\$275.60	\$38.90	2,109

It is important to clarify the economic contribution of resident boaters from Miami-Dade County. The engine of economic growth for any region is found in its export industries such as tourism in Miami-Dade County. As export income flows through the region, it creates local income (e.g., money paid for haircuts by residents) and a demand for imports (e.g., TV sets since Miami-Dade County does not have such a manufacturer). The local income is spent on everything from marina services to dining out at a local restaurant to buying groceries to pay the mortgage or rent.

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## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

Spending by residents in conjunction with reef use is local income, which represents the choice of recreating locally as opposed to leaving the area to recreate elsewhere.

The reef system keeps the “locals” in the county and enlarges the economy by \$275.6 million in local spending. In contrast to visitors entering the county, there is no multiplier effect. Generally, money kept in the local economy enlarges the regional multiplier since there is less “leakage” through the purchase of imports or residents leaving the area for recreational pursuits in places such as Key West or Orlando. Just how much the regional multiplier is enlarged from resident use of the reef system is beyond the scope of this study. However, it is safe to say that protection and maintenance of the reef system has the potential to keep more business in Miami-Dade County. For ardent reef-users, the absence of reefs off the of Miami-Dade County coast would certainly divert more of these residents to counties north and south of this area to the economic detriment of Miami-Dade County.

Reef-related local spending discussed above is, in itself, only a vehicle to create jobs and wages in the local community. To evaluate which industries benefit from residential reef use, reef-users were asked to break their expenditures into 12 categories for items such as boat fuel, ice, tackle, and marina fees. For each of the twelve categories, resident expenditures were matched to total sales as published in the 1997 U.S. Census of Business (1997). For example, spending on boat fuel was matched up with sales at gasoline stations in Miami-Dade County. It was found that each gasoline station employee “sells” \$325,761 per year out of which they are paid about \$14,648 or about 4.5 percent. The annual salary may seem low, but this figure is for full and part time employees with a relatively low skill level. Thus, every \$325,761 in gasoline purchased for reef-related recreation by local users, generates one job paying about \$14,648 per year.

This rather simple procedure was followed for each of the 12 expenditure categories, which vary greatly in labor intensity. The higher the sales-to-employment ratio, the less labor intensive the activity. For example, restaurants are relatively labor intensive (i.e., need cooks and servers) while gasoline stations are highly automated and consequently need relatively fewer employees.

Table 5.1.2-1 shows the estimated wages and employment generated by resident spending on reef-related recreational activities in Miami-Dade County. The \$275.6 million in annual spending generated about \$38.9 million dollars in annual wages supporting 2,109 employees.

It is also important to look at what industries benefit from reef-related resident spending. Table 5.1.2-2 shows the 12 spending categories of resident boaters.

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**Table 5.1.2-2 (Residents)**  
**Detailed Expenditure Pattern Supporting Employment and Wages by All Resident Reef-Users in**  
**Miami-Dade County, Florida, 2000**

<b>Expenditure Item</b>	<b>Expenditures (Million \$)</b>	<b>Percentage of Total Expenditures</b>	<b>Employment (Number of Full and Part-Time Jobs)</b>	<b>Percentage of Total Employment</b>	<b>Wages (Million \$)</b>	<b>Percentage of Total Wages</b>
1. Boat gas and oil	\$67.18	24%	207	10%	\$3.02	8%
2. Marina slip rentals and dockage fees	\$52.84	19%	576	27%	\$13.74	35%
3. Food and beverages from restaurants/bars	\$16.60	6%	402	19%	\$4.43	11%
4. Food and beverages from stores	\$26.15	10%	198	9%	\$2.66	7%
5. Tackle	\$16.21	6%	89	4%	\$1.82	5%
6. Bait	\$19.30	7%	106	5%	\$2.17	5%
7. Gas for auto	\$15.96	6%	49	2%	\$0.72	2%
8. Ice	\$7.36	3%	23	1%	\$0.33	1%
9. Equipment rentals	\$6.74	3%	86	4%	\$2.13	5%
10. Boat ramp and parking fees	\$20.27	7%	221	11%	\$5.27	14%
11. Sundries (e.g. Sun screen, sea sickness pills, etc.)	\$6.59	2%	38	2%	\$0.64	2%
12. All other	\$20.34	7%	118	6%	\$1.98	5%
<b>Total</b>	<b>\$275.54</b>	<b>100%</b>	<b>2,113</b>	<b>100%</b>	<b>\$38.91</b>	<b>100%</b>

Source: Florida State University

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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We would expect that expenditures would be concentrated on running and storing a boat and the results support this assumption. Expenditures on boat oil and gas constituted 24 percent of all spending followed by spending on marina slip rentals and dockage fees (19 percent) and food and beverages from restaurants (6 percent) and stores (10 percent). In terms of dollar figures, resident reef-users spent about \$53 million annually on the goods and services provided by the marina industry. According to the U.S. Census of Business (1997), the marina industry in Miami-Dade County grossed about \$76 million in sales. Thus, resident reef-users may account for as much as 70 percent of these sales. Marina industry sales would also come from resident non-reef users and visitors keeping their boats in local marinas. The role of visitors will be discussed in the next section.

In terms of employment, reef-related resident spending created proportionately more employment in marinas and restaurants since, as discussed above, these industries are relatively labor intensive. Although ranked number one as a component of spending, gasoline stations provide a capital-intensive industry not conducive to the creation of jobs. That is, spending on boat oil and gas accounted for one-fourth of all spending, but only one in ten jobs. As might be expected, wages follow employment. That is, the higher the percentage of spending on labor intensive industries, the higher the total wages generated. However, some industries employ highly skilled persons such as marinas where the wages paid are proportionately higher than employment as indicated in Table 5.1.2-2.

### 5.1.3 Use Value

Natural and artificial reefs contribute to the recreational experience of residents (i.e. fishing, snorkeling and scuba diving). Traveling to and enjoying a reef system involves economic costs including the cost of boat fuel, bait and tackle. This was discussed above. However, the market does not measure the total economic value of reef systems. There is no organized market in which to buy and sell the use of reefs because these resources are not owned by one individual but by society as a whole. Thus, the absence of private property rights creates a challenge in valuing natural and artificial reefs.

Yet, the general public does pay for the deployment of artificial reefs and the protection of natural reefs. So, there must be some unmeasured value of providing the reef system to the general public. Because reef-users are attracted to the reefs for recreation, we call this unmeasured value “use value”. For example, one could engage in scuba diving without the benefit of a natural or artificial reef. The addition of a reef presumably adds some “value” to the scuba diver’s recreational experience. This section examines the incremental use value of having a reef system off the coast of Miami-Dade County.

The contingent valuation (CV) method asks users about their willingness to pay for a reef system contingent on specified conditions (e.g., use of funds for various reef related improvements). This CV method has been employed in numerous studies of use value from deep-sea fishing to deer hunting.<sup>1</sup> The reef-using respondents were asked a series of CV questions dealing with their

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<sup>1</sup> See Clawson and Knetch (1966).



## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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willingness to pay for certain types of reef programs. The respondents were asked to consider the total cost for their last boating trip to the reefs including travel expenses, lodging, and all boating expenses. Then, the respondents were asked:

“If your total cost per trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the (kind of reef – artificial, natural or both) in their existing condition.”

Payment amounts or cost increases (\$10, \$50, \$100, \$200 and \$500) were inserted in the blank space and the amounts were rotated from respondent to respondent. Thus, some respondents received questions asking about a \$10 increase while others were asked about a \$50, \$100 or even \$500 increase in trip cost. The purpose of these questions was to establish the user value per day for artificial and natural reefs.

The above willingness to pay question was asked in three forms to each respondent: (1) natural reefs separately; (2) artificial reefs separately and (3) a combination of natural and artificial reefs. For the combined program, the rotated cost increase was doubled. Because the primary spending unit is the “party”, the willingness to pay response to an increase in trip cost was considered to be the willingness to pay of the entire party.

To estimate user values per party per trip (a day and a trip are equal for residents), the data for all counties were pooled. A logit model was used to estimate the per party per trip user values. The logit model tested for differences by county, activity, household income, age of respondent, years of boating experience in South Florida, race/ethnicity, sex, length of boat owned, and whether a member of a fishing or diving club.

Separate models were estimated for each of the four reef programs (e.g., natural reefs, existing artificial reefs, natural & artificial reefs combined and new artificial reefs). For the natural reefs, the existing artificial reefs and the combined programs, the only significant willingness-to-pay differences found were for those persons with income greater than \$100,000. This group had a higher willingness to pay than the other reef users. There were no other differences found. The logit model did not produce different per party per trip values by county, and because party sizes were not significantly different by county, the estimated values per person-trip were also the same across counties for each of the reef valuation programs. The estimated per party per trip (day) values were \$32.55 for the natural reefs, \$11.31 for the artificial reefs and \$12.94 for the combined program.

To estimate total annual use values for each county, we multiplied the number of party-days times the estimated use values per party per day. We then estimate the value per person-day by dividing the total annual use value by the total number of person-days. This normalized value per person-day can be compared with results from other studies.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. For Miami-Dade County residents, the average per person-day value of the natural reefs was \$8.01

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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versus \$2.76 for artificial reefs. Total use is also higher for natural versus artificial reefs. Miami-Dade County residents' natural reef use was over 2.9 million person-days versus about 1.5 million person-days for artificial reefs. This translated into an estimate of total annual use value of over \$23.74 million for natural reefs and \$4.25 million for artificial reefs. Capitalizing the annual use values, using a three percent interest rate, yields asset values of over \$791 million for the natural reefs and almost \$142 million for the artificial reefs. All of these results are summarized in Table 5.1.3-1.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs such as deploying of new artificial reefs and enhancing natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs would provide a conservative or lower bound estimate of the total natural and artificial reef values.

Measuring the economic benefits of natural reef systems to policy makers is useful to justify public budgets for natural reef programs. If protected, the use value for natural reefs will flow into perpetuity. Using a real discount rate of 3 percent, the capitalized value of the natural reefs off the Miami-Dade coast was estimated at \$791 million. Why is this important? Natural reef systems are not privately owned, but are common property resources. If a region or a nation is preparing a balance sheet showing its assets and liabilities, the asset value of the natural reef system would need to be included. This analysis provides an estimate of the capitalized value of the natural reef system to reef users, which is an asset to the residents of Miami-Dade County. Bear in mind that this value only includes the value that reef users place on the reefs and does not include the values that non-reef-users place on the reefs or the economic contribution of the reefs. *The estimation of the value of the reefs to non-reef users was not part of this study.*

In addition, asset value comes into play when there is an environmental disaster such as an oil or hazardous waste spill. If the polluter destroyed for the foreseeable future 20 percent of the natural reef system off the Miami-Dade coastline, then the government could ask for \$158.2 million (i.e., 0.20 times \$791 million) in compensatory damage. An example of this problem is in the Florida Keys, where ships that destroy natural reefs are required to pay the loss of use value as a result of legal proceedings. Numbers provided here are quite real and useful especially in the case of environmental damage assessment.

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**Table 5.1.3-1 (Residents)**  
**Estimated Use Value of Artificial and Natural Reefs off the Coast of**  
**Miami-Dade County, Florida, 2000**

<b>Reef Type/Activity</b>	<b>Person-days (millions)</b>	<b>Annual User Value (Millions \$)</b>	<b>User Value Per Person-day (\$)</b>	<b>Asset Value at 3% (Millions \$)</b>
<b>Natural Reefs</b>	<b>2.965</b>	<b>\$23.74</b>	<b>\$8.01</b>	<b>\$791.3</b>
Snorkeling	0.885	\$6.73	\$7.61	\$224.4
Scuba Diving	0.482	\$4.96	\$10.30	\$165.5
Fishing	1.598	\$12.04	\$7.53	\$401.4
<b>Artificial Reefs</b>	<b>1.540</b>	<b>\$4.25</b>	<b>\$2.76</b>	<b>\$141.6</b>
Snorkeling	0.344	\$0.91	\$2.64	\$30.3
Scuba Diving	0.216	\$0.77	\$3.58	\$25.8
Fishing	0.980	\$2.56	\$2.62	\$85.5
<b>Natural &amp; Artificial Reefs</b>	<b>4.506</b>	<b>\$14.30</b>	<b>\$3.17</b>	<b>\$476.6</b>
Snorkeling	1.230	\$3.72	\$3.02	\$123.9
Scuba Diving	0.698	\$2.86	\$4.09	\$95.3
Fishing	2.578	\$7.72	\$3.00	\$257.4
<b>New Artificial Reefs</b>	<b>1.540</b>	<b>\$0.44</b>	<b>\$0.28</b>	<b>\$14.5</b>
Snorkeling	0.344	\$0.16	\$0.46	\$5.3
Scuba Diving	0.216	\$0.13	\$0.62	\$4.5
Fishing	0.980	\$0.14	\$0.15	\$4.8

As discussed above, artificial reefs have a use value per person less than that of natural reefs, as one would expect. However, preservation of the existing artificial reef system of the Miami-Dade County coastline produces an annual use value of over \$4.25 million. Again, this is for the maintenance of these reefs. The capitalized value of the artificial reef system off the Miami-Dade County coastline is estimated as \$141.6 million. If users were obstructed from getting to Miami-Dade County's artificial reefs, an estimate of damages to the reef users would be either the annual use value lost if users are temporarily obstructed or the capitalized value if users were permanently cut-off from using the artificial reefs.

The logit model estimated for the new artificial reef program found some statistically significant differences in willingness-to-pay depending on county, activity and income. Those from Palm Beach and Broward counties had higher willingness to pay than those from Miami-Dade and Monroe counties. Snorkelers and scuba divers had higher values than those who participated in fishing activities. The only other statistically significant variable was household income. As household income levels increased so did willingness-to-pay for new artificial reefs. On a per party per day basis, the estimated values ranged from a high of \$1.97 for snorkelers and scuba

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divers from Miami-Dade County to a low of \$0.63 for those who participated in fishing activities off Miami-Dade County.

As with the other three programs, the estimated per party per day values were multiplied by the total party-days spent on artificial reefs by artificial reefs users in the county to get total annual use value for the county. The total annual use values were then divided by the total annual person-days of artificial reef use in the county to get an estimate of the value per person-day. Again, this normalized value per person-day can be compared with results from other studies.

On a per person-day basis, the estimated values ranged from a low of \$0.15 for those fishing to a high of \$0.62 for those that participated in scuba diving off Miami-Dade County. Across all activities, the average was 28 cents per person-day.

In terms of total annual use value, fishers have the highest value for new artificial reefs. Even though total snorkeling person-days was much lower than the number of person-days of fishing, snorkeling's relatively higher value per person-day results in higher total annual use value for snorkeling than for fishing. Across all activities, total annual user value is about \$440 thousand with an asset value of \$14.5 million.

The relatively low marginal willingness to pay of \$0.28 per person-day for artificial reef expansion in comparison to artificial reef maintenance discussed above is somewhat expected. If present users do not feel that congestion on artificial reefs is a problem, they would be expected to value expansion lower than maintenance of the existing artificial reefs. However, their willingness to pay anything for expansion demonstrates some level of unhappiness with the existing number of artificial reefs off the Miami-Dade County coastline. Perhaps, residents are competing with visitors for choice spots or just getting in the way of fishing and diving when arriving at an artificial reef.

### 5.1.4 Role of "No-Take" Zones

Both the economic contribution and the use value of the reef system are based upon the management of these resources or lack thereof. For example, there have been controversies about the wisdom of deploying artificial reefs. Opponents argue that this encourages over fishing since artificial reefs tend to concentrate fish in a smaller number of places and they become easier targets for fishers. Others find that artificial reefs serve as added habitats and thereby increase the overall biomass available to fishers. The study of artificial reefs in northwest Florida (Bell, et al., 1999) found that most people fell into the latter group believing that the pie got larger with the deployment of more reefs. However, other studies such as Bohnsack et al., (1997) and Grossman et al., (1997) report results that support opinions of opponents regarding additional artificial reef systems.

In this section, we examine "no take" zones in the Florida Keys and other counties in southeast Florida. "No-take" zones are defined as areas where reef-users can visit but nothing can be removed from an artificial or natural reef area. The existing reef system is coming under increased pressure to yield stable catch rates for fishing and a pristine environment for snorkeling

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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and scuba diving. Also, the reefs play a vital role in the entire oceanic ecosystem by providing habitat and protection for young fish and other creatures. To provide a net benefit, it is argued that “no-take” zones would actually increase recreational benefits even though takings would be banned in certain areas.

Supporters of “no-take” zones point to the overuse of common property resources such as ocean fishing both by recreational and commercial interests. In effect, “no-take” zones would vest the property right with the government. Although the carrying capacity of a reef system is not evaluated in this study, the concept has widespread validity. This concept has been examined by many natural resource economists with the finding that congestion and declining yields of fish created a decline of use value per day.<sup>2</sup> Bell (1992) found that tourists visiting Florida would go elsewhere if fishery catch rates declined to a certain point from the existing level. No one knows exactly where and to what degree “no-take” zones must be employed to increase the net benefit available to recreational interests. Like the deployment of artificial reefs, “no-take” zones have become a controversial issue. Therefore, as part of this study, respondents were asked for their opinion of using “no-take” zones as a management tool for artificial and natural reefs in southeast Florida.

In each of the four counties, reef-users were asked questions regarding “no-take” zones. The results for Miami-Dade County are summarized in Table 5.1.4-1. In 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones (13.37 square miles) in which the taking of anything including fish and shellfish is prohibited. It is reasonable to believe that residents of Miami-Dade County may have formed an opinion about this management effort and indeed, about three-quarters of the Miami-Dade County respondents supported this experimental management effort in the Keys. The “not in my backyard view” was tested so respondents were asked for their opinions on “no take” zones in Miami-Dade County. About 60 percent of the respondents were willing to have “no take” zones off the shore of their county. Respondents were also willing to extend this concept northward through Broward and Palm Beach Counties with nearly 64 percent supporting this expansion according to the results shown in Table 5.1.4-1.

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<sup>2</sup> See Green (1984) and Bell (1992).

**Table 5.1.4-1 (Residents)**  
**Opinion of Miami-Dade County Residents on "No Take" Zones for Artificial and Natural Reefs, 2000**

<b>Survey Question</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>	<b>Sample Size</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
Support "NO TAKE" Zones in for some reefs in the Florida Keys	74%	19%	7%	374
Support "NO TAKE" Zones on some reefs off shore of Miami-Dade County	61%	28%	11%	374
Support "NO TAKE" Zones on some reefs off shore of Palm Beach and, Broward Counties Plus the Keys	64%	24%	12%	374
	<b>Average for All Response</b>	<b>Median of All Responses</b>		
What Percent of Natural Reefs in Palm Beach County Should be Protected with "NO TAKE" Zones	30%	20%		374

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## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

Finally, respondents were asked for their opinion regarding the percent of the reef system that should be included in “no take” zones. Targeting only natural reefs, respondents indicated, on average, they would be willing to extend this management tool to almost 30 percent of the natural reefs off the Miami-Dade County shore. Since the average may be skewed by exceptionally high answers, the median percent of natural reefs respondents felt might be managed by the use of “no-take” zones was also reviewed. The median, or the midpoint between the highest and lowest answer was 20 percent.

Given the short experience of the Keys “no-take” zones, it was remarkable that present reef-users would be willing to establish “no take” zones in their county. Combined with the results from the Florida Keys, these statistics indicate a willingness to support management efforts in the direction of “no-take” zones. Such results are important to public officials in charge of managing the natural reef system off the Miami-Dade County coast.

### 5.1.5 Demographic Information

The mail survey administered to Miami-Dade residents included questions regarding demographic characteristics. The reason for collecting such information was to determine what segment of the population would gain from protecting and maintaining artificial and natural reefs and/or designating “no-take” zones as discussed in the previous section. Respondents were asked to provide some background on both themselves and their boating experiences. Thus, the survey was used to collect demographic information as well develop a boater profile to better understand these people called “reef-users” in Miami-Dade County. Table 5.1.5-1 presents the results from the mail survey combined with comparable information on the entire Miami-Dade County population.

The owners of reef-using registered boats were significantly older than the general population of Miami-Dade. The median age of reef-users is 46 years compared to 35.9 years for the general population. Statistically speaking, there is real age difference between these two groups. Further, boating appears to be a male-dominated activity as over 93 percent of the respondents indicated they were male compared to 48 percent in the general population. Of course, there is no foolproof way to control who completes the survey instrument once it reaches the boat owner’s residence. However, the survey is directed at the person to whom the boat was registered.

With respect to race, white individuals in Miami-Dade County dominate boat ownership. About 88 percent of the respondents characterized themselves as white compared to 70 percent in the general population of Miami-Dade County.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

**Table 5.1.5-1 (Residents)  
Demographic Characteristics and Boater Profile of  
Reef-Users in Miami-Dade County Florida, 2000**

<b>Demographic Characteristics of Respondents to Mail Survey</b>	<b>Reef-Users</b>	<b>Miami-Dade County Population</b>
<b>Median Age</b>	46	35.9
<b>Sex</b>		
Male	93%	48%
Female	7%	52%
<b>Race</b>		
White	88%	70%
Black/African American	1%	20%
Hispanic/Latino	32%	57%
Other	11%	10%
<b>Education</b> <sup>1</sup>		
Percentage that completed College Degree or More	57%	12%
<b>Median Household Income</b>	\$69,722	\$36,846
<b>Boater Profile</b>		
Average Years of Residence in Miami-Dade County	33	N/A
Average Years of Boating in South Florida	25	N/A
Average Length of Boat Used for Saltwater Activities (ft)	23	N/A
Percentage of Respondents that belong to fishing and/or diving clubs	19%	N/A
<b>Sample Size</b>		<b>390</b>

<sup>1</sup> Latest year that educational level attained by county is available is for 1990 from the U.S. Census Bureau.  
Source: Florida State University and the U.S. Bureau of the Census (1990, 2000).

Further, a lesser percentage characterized themselves as Hispanic/Latino (32.3 percent) as compared to the general population (57.3 percent).

Nearly 57 percent of the respondents indicated that they had at least a college degree compared to 12 percent for the general population in 1990.<sup>3</sup> The education level of the general population is probably much higher today than ten years ago, but may not reach the levels reported by the respondents.

<sup>3</sup> The U.S. Census has not yet released the educational levels for counties as part of the 2000 Census.



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## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

Since education and income are positively correlated, it is expected that the median household income reported by reef-users would be higher than the general population. This is indeed the case as confirmed by the last demographic statistic in Table 5.1.5-1 where respondents reported a median household income of nearly \$69,722 compared to \$36,846 for the general population. Of course, the purchase of a relatively large pleasure craft is also associated with higher income as found by Bell and Leeworthy (1986) and was discussed earlier in this chapter. So, this finding is not unusual.

Using the information gathered from the first section on user activity, it is estimated that a minimum of 120,325 residents engaged in reef-using recreational activity in a 12-month period (1999-2000) in Miami-Dade County. This number was obtained by multiplying the number of registered boats that were estimated to be involved in reef use (30,695) by the average number of residents per party (3.92 individuals). Because the turnover rate of the party is unknown, the term “minimum” is used. That is because the same residents may not go on every boat outing. There are about 1.7 million residents in Miami-Dade County who are over 14 years of age (i.e. about that age at which they could become boaters). The boating population that uses the reef system constitutes a minimum of 7.24 percent of the county’s population (120,325/1,660,955). The boating population that uses the reef system would probably be higher if the party turnover rate (i.e. different individuals on each boat outing) were considered. The information presented here provides some insight on the segments of the Miami-Dade County population that are being served by artificial and natural reefs off its coast. This should be valuable information for policy makers at the local and state levels.

Finally, a boater profile for Miami-Dade was developed from the survey results. The typical reef-using boater has lived in Miami-Dade for 33 years and boated for 25 years. The reef-using boaters in our sample own a pleasure craft of 23 feet in length, on average. The weighted average of registered boats 16 feet and over in Miami-Dade County is about 25 feet so it appears that the sample is particularly reflective of the population based on average boat length. About 19 percent of the respondents were members of fishing and/or diving clubs. This indicator provides some idea of the intensity and degree of interest in recreational fishing, snorkeling and scuba diving off the coast of Miami-Dade County, Florida.

### 5.2 Visitors

The focus of this section is the socioeconomic value of the reefs associated with visitors to Miami-Dade County. As defined in Chapter 1, Introduction, visitors to a county are defined as nonresidents of the county that they are visiting. For example, a person from Broward County visiting Miami-Dade County is considered to be a visitor to Miami-Dade County. Likewise, a person from New York visiting Miami-Dade County is considered to be a visitor to Miami-Dade County.

This section provides the following values regarding visitors to Miami-Dade County: reef user activity, economic contribution of the reefs, use value of the reefs and demographic information. Detailed explanations of the methods and data used to estimate these values for Miami-Dade

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

County are provided in Chapter 1: Introduction and Chapter 2: Socioeconomic Values of Reefs in Southeast Florida.

### 5.2.1 User Activity

The activity of reef users is summarized in person-days of reef use. For visitors, the number of person-trips to use the reefs is also of interest. In order to measure person-days and person-trips associated with reef use, the total number of person-trips by all visitors to Miami-Dade County must be estimated. Total visitation includes visits to Miami-Dade County by non-residents of Miami-Dade County to participate in any activity be it recreation, business or family matters. The total number of person-trips by all visitors to the county was estimated using the Capacity Utilization Model. This model uses a variety of information obtained from the counties and the responses to the General Visitor Survey. The number of person-trips was then converted to the number of person-days spent by all visitors to Miami-Dade County using information from the General Visitor Survey.

The number of person-trips taken by all visitors to Miami-Dade County and the number of person-days these visitors spent in the county during the year 2000-2001 was developed in Chapter 2 and is summarized in Table 5.2.1-1.

**Table 5.2.1-1 (Visitors)  
Number of Person-Trips and Person-Days  
All Visitors to Miami-Dade County  
June 2000 to May 2001 – in millions**

<b>Measure of Visitation</b>	<b>Summer – 00</b>	<b>Winter – 01</b>	<b>Total</b>
Number of Person-Trips	6.57	6.04	12.61
Number of Person-Days	44.19	56.43	100.62
<i>Note: Summer 2000 is from June 2000 to November 2000. Winter 2001 is from December 2000 to May 2001.</i>			

Visitors took 12.6 million person-trips to Miami-Dade County from June 2000 to May 2001 and spent 101 million person-days in the county.

The number of person-trips by all visitors was used as the basis for estimating the number of person-days visitors spent using the artificial and natural reefs in each county. For each season, the number of boating person-trips is equal to the total number of person-trips by all visitors times the proportion of person-trips taken by visitors who participated in saltwater boating in the county in the past twelve months. This proportion was taken from the General Visitor Survey answer to Question 13 (Which activities and boating modes did you participate in over the past 12 months in this county?). The proportion is equal to the number of respondents who participated in at least one boating activity divided by the total number of respondents to the General Visitor Survey.

To estimate the number of boating person-trips when the person used the reefs, the number of boating person-trips was multiplied by the proportion of boating person-trips when the

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

respondent used the reefs. This proportion was obtained from the Visitor Boater Screening Tally sheets. These sheets indicated the proportion of boaters intercepted who used the reefs at least once in the past 12 months. The results for the summer, winter and the year are summarized in Tables 5.2.1-2.

**Table 5.2.1-2 (Visitors)  
Person-Trips of Visitors Who Boated  
And Visitors Who Used the Reefs in Miami-Dade County Over the Past 12 Months**

Season	Total Person-Trips to County - All Visitors	Proportion of Person-Trips Taken By Visitors Who Boated <sup>a</sup>	Boating Person-Trips	Proportion of Boating Person-Trips When the Reef was Used for Recreation <sup>b</sup>	Boating Person-Trips When the Reef was Used for Recreation
Summer - June 2000 to Nov. 2001	6,574,428	0.28	1,843,418	0.91	1,682,421
Winter – December 2000 to May 2001	6,039,217	0.13	768,919	0.91	701,764
Year Round - June 2000 to May 2001	12,613,645		2,612,337		2,384,185

<sup>a</sup> *Saltwater Boating Only. From General Visitor Survey Answer to Question 13 (Which activities\_modes did you participate in over the past 12 months in this county). The proportion is equal to the number of respondents who participated in at least one boating activity divided by total number of respondents to the General Visitor Survey.*

<sup>b</sup> *From the Visitor Boater Tally Sheets: = 1 - (Q6/(Q6+Q7+Q8+Q10))*

Of the 12.6 million person-trips visitors took to Miami-Dade County from June 2000 to May 2001, 28 percent of the trips involved saltwater boating activities in the summer and 13 percent involved saltwater boating activities in the winter. Of the resulting 2.6 million boating person-trips by visitors to Miami-Dade County, 91 percent of those trips involved recreational reef use. Thus, visitors who used the reefs for recreation in Miami-Dade County made about 2.4 million person-trips to the county from June 2000 to May 2001.

Next, the total number of person-days that visitor boaters who used the reefs spent visiting the county was estimated. This estimate is the total boating person-trips when reefs were used times the average days per visit by boaters who use the reefs. The average days per visit by boaters who used the reefs was obtained from Question 10 of the Visitor Boater Survey (How many nights are you spending on this trip?) where each response was increased by one unit to convert nights to days. The average number of days and the total person days reef users spent in Miami-Dade County in 2000-2001 are provided in Table 5.2.1-3.

**Table 5.2.1-3 (Visitors)  
Average Number of Days Visiting Miami-Dade County  
And Total Person-Days in Miami-Dade County  
By Visitor Boaters Who Used the Reefs  
June 2000 to May 2001**

<b>County</b>	<b>Average Days Visiting the County Per Trip</b>	<b>Total Person Days Spent Visiting the County</b>
Miami-Dade	7.58	18,068,870

Reef-using boaters who visited Miami-Dade County spent an average of 7.58 days in the county during their trip. As a result, these visitors spent 18.1 million person-days in Miami-Dade County from June 2000 to May 2001.

To allocate the total person days spent visiting the county to actual days using the artificial and natural reefs, the daily participation rates of the different boating activities were calculated using the responses to Questions 12, 15, 16 and 17 of the Visitor Boater Survey. Participation rate is the proportion of total days that respondents spent in the county in the last 12 months when the respondent actually participated in a saltwater activity and boat mode. It represents the probability that a visitor boater who uses the reefs will participate in a particular saltwater boating activity and boating mode on any given day.

Question 12 asked the respondent to examine a list of saltwater boating activities and boat modes and read the number corresponding to the activity-boat mode that he/she or someone in his/her party participated in over the past 12 months. The saltwater activity-boat mode list is provided in Appendix B with the Visitor Boater Survey. Question 13 asked if the respondent participated in the activity and boating mode. Question 15 asked how many days in the past 12 months that the respondent participated in the activity-boat mode. From the responses to these questions, the proportions of total visiting days respondents actually spent participating in the activity\_boat mode were obtained.

To allocate the total number of days in an activity-boat mode to the use of artificial reefs versus natural reefs versus no reefs, the proportion of fishing days and the proportion of dives spent on each reef/no reef was calculated from the Visitor Boater Survey responses. Question 16 asked the respondent how many days he/she spent on the artificial reef and Question 17 asked the respondent how many days he/she spent on the natural reef. For scuba divers and snorkelers, Question 18 asked for the total number of dives and Questions 19 and 20 asked for the number of dives on artificial versus natural reefs. A dive is defined as exiting and reentering the boat and applies to both divers and snorkelers. From the responses to these questions, the proportions of fishing days spent on the artificial and natural reefs and the proportions of dives spent on the artificial and natural reefs were obtained. For fishing charter and fishing party boats, the proportions of days spent on artificial versus natural versus no reefs were taken from the fishing-related responses to the charter/party boat operator survey those operators who provide services in Miami-Dade County.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

The proportion of visitor days that visitor boaters who use the reefs participated in fishing and diving/snorkeling and the proportion of fishing days and scuba/snorkeling dives that visitor boaters spent on the artificial, natural and no reefs for Miami-Dade County are presented in Table 5.2.1-4.

**Table 5.2.1-4 (Visitors)  
Percent of Visitor Person-Days That Reef-Using Boaters  
Participated in the Saltwater Recreation Activity  
And Percent of Fishing Days or Dives Spent on Artificial, Natural and No Reefs  
From Visitor Boater Survey  
Miami-Dade County**

Activity	Total Respondents	Percent of All Visitor Days	Percent of Activity Days or Dives On:			
			Artificial Reefs	Natural Reefs	No Reefs	Sum of Percentages
Fishing <sup>a</sup>	339	22%	24%	61%	15%	100%
Scuba Diving/Snorkeling <sup>b</sup>	339	8%	32%	65%	3%	100%

<sup>a</sup> Percent of fishing days on each reef type is reported.  
<sup>b</sup> Percent of dives on each reef type is reported. A dive is a boat exit and re-entry.  
 Note: Boating Modes are Charter, Party, Rental, and Private (Own or Friend's) Boat.

Visitor boaters who came to Miami-Dade County to use the reefs spent 22 percent of their visiting days participating in saltwater fishing from either a charter, party, rental or private boat. Of these fishing days, 24 percent of days were spent fishing near artificial reefs, 61 percent of days were spent fishing near natural reefs and 15 percent of days were spent fishing near no reefs. Also, visitor boaters who came to the county to use the reefs spent 8 percent of their visiting days scuba diving or snorkeling. Of these diving/snorkeling days, 32 percent of dives were spent on artificial reefs, 65 percent of dives were spent on natural reefs, and 3 percent of dives were spent on no reefs.

The number of person-days spent in each saltwater boating activity\_boat mode was estimated as the total person-days reef-using boaters spent visiting the county in year 2000-2001 (from Table 5.2.1-3) times the proportion visitor days that these visitors spent participating in each activity\_boat mode. Then the number of person-days spent in each saltwater boating activity\_boat mode was allocated to artificial and natural reefs based on either the proportion of days or the proportion of dives spent in that activity\_boat mode on or near artificial versus natural reefs. Proportion of days was used for all activities except scuba diving and snorkeling where the proportion of dives was used to provide a more accurate indicator of reef use.

A summary of the total person-days visitors spent participating in reef-related recreation by type of activity and by type of reef in Miami-Dade County is provided in Table 5.2.1-5. The total person-days visitors spent participating in each saltwater activity and boat mode by type of reef is provided in Table 5.2.1-6.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

Visitors to Miami-Dade County spent about 4.7 million person-days on the reef system from June 2000 to May 2001. About 1.4 million of these days were spent on artificial reefs and about 3.2 million of these days were spent on natural reefs.

**Table 5.2.1-5 (Visitors)  
Number of Person-Days Spent Using Artificial and Natural Reefs  
By Recreation Activity – Miami-Dade County**

Activity	Number of Person-Days in millions		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	0.28	0.60	0.88
Scuba Diving	0.17	0.27	0.44
Fishing	0.96	2.36	3.32
Glass Bottom Boat Sightseeing	0.003	0.014	0.017
<b>Total</b>	<b>1.413</b>	<b>3.244</b>	<b>4.66</b>

### 5.2.2 Economic Contribution – Visitors

The Visitor Boater Survey asked respondents how much money they and members of their party spent on their last day that they participated in fishing, scuba diving and snorkeling in the county. The respondent was also asked how many people spent or benefited from those expenditures. The respondent was asked only to provide the amount of money spent in the county of interview. From this information, a picture of the average itemized expenditures per person per fishing or diving day and by boating mode was estimated.

The average itemized per person expenditures by those who participated in each activity and boat mode in Miami-Dade County are provided in Table 5.2.2-1. Miami-Dade County reef-using visitors who went saltwater fishing on their own boat, a friend's boat or a rental boat spent, on average, \$114 per person per day on the day that they went fishing. This amount is comprised of \$38 for boat fuel, \$21 for food and beverages at stores and \$15 for food and beverages at restaurants and bars and \$8 for auto rental, among other items.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

**Table 5.2.1-6 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in Saltwater Boating Activities**  
**and Reef Use - June 2000 to May 2001**  
**Miami-Dade County**

Activity	Boat Mode	Number of Person Days	Number of Person-Days On:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	144,205	51,231	79,692	13,282
	Rental	0	0	0	0
	Private	751,307	230,116	519,667	1,524
Scuba Diving	Charter/Party	142,763	25,318	102,677	14,769
	Rental	0	0	0	0
	Private	311,483	143,347	168,136	0
Fishing – Offshore / Trolling	Charter	288,410	93,657	114,974	79,778
	Party	501,833	162,964	200,056	138,814
	Rental	347,534	139,013	208,520	0
	Private	1,455,027	318,640	817,748	318,640
Fishing – Flats or Back Country	Charter/Party	1,442	0	0	1,442
	Rental	0	0	0	0
	Private	637,386	59,393	538,880	39,112
Fishing Bottom	Charter	18,747	6,088	7,473	5,186
	Party	233,612	75,862	93,129	64,620
	Rental	0	0	0	0
	Private	501,833	103,684	382,941	15,207
Viewing Nature and Wildlife	Glass Bottom Boat	18,747	3,124	14,060	1,562
	Back Country Excursion	0	0	0	0
	Rental	2,884	0	0	2,884
	Private	341,766	0	0	341,766
Personal Watercraft (jet skis, wave runners, etc.)	Rental	30,283	0	0	30,283
	Private	73,544	0	0	73,544
Sailing	Charter/Party	23,073	0	0	23,073
	Rental	7,210	0	0	7,210
	Private	235,054	0	0	235,054
Other Boating Activities	Charter/Party	46,146	0	0	46,146
	Rental	2,884	0	0	2,884
	Private	194,677	0	0	194,677
<b>Total Person-Days</b>		<b>6,311,847</b>	<b>1,412,438</b>	<b>3,247,954</b>	<b>1,651,455</b>

5.0 Socioeconomic Value of Reefs in Miami-Dade County

**Table 5.2.2-1 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Miami-Dade County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$75.26	\$30.47		\$30.50
Boat Rental				\$6.80	
Boat Fuel	\$38.28			\$17.12	
Air Refills				\$6.38	\$2.04
Tackle	\$4.72				
Bait	\$2.53				
Ice	\$2.02			\$2.06	\$0.15
Ramp Fees	\$1.93			\$1.57	\$0.00
Marina Fees	\$1.25			\$6.71	\$2.84
Lodging	\$0.00	\$46.36	\$40.15	\$3.59	\$20.15
Camping Fees	\$0.52	\$0.11	\$0.11	\$0.75	\$0.19
Food and Beverages - Stores	\$21.22	\$16.41	\$13.98	\$16.83	\$6.87
Food and Beverages - Restaurants/Bars	\$14.54	\$33.96	\$40.34	\$10.79	\$22.23
Auto Gas	\$6.17	\$6.98	\$8.01	\$7.45	\$4.54
Auto Rental	\$8.25	\$15.72	\$22.16	\$1.47	\$14.79
Equipment Rental	\$1.13	\$0.00	\$2.18	\$1.65	\$1.56
Shopping	\$11.61	\$30.10	\$36.86	\$4.26	\$19.45
Total	\$114.17	\$224.90	\$194.24	\$87.42	\$125.30
Number of Respondents	89	71	69	47	76
Number of Respondents and Party Members <sup>c</sup>	289	228	186	147	291

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity\_Mode, the expenditures for each item were summed over all the respondents who participated in the Activity\_Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.



## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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The average expenditure of persons who fished on charter boats was \$225 per person per day. About \$75 was the cost of the charter boat while \$46 was spent on lodging, \$16 was spent on food and beverages at stores, \$34 was spent on food and beverages at restaurants and bars, \$16 was spent on auto rental, and \$30 was spent on shopping.

Persons who fished on party boats spent, on average, \$194 per person on the day they went fishing which included \$30 for the party boat fee, \$40 for lodging, \$14 for food and beverages at stores, \$40 for food and beverages at restaurants and bars, \$22 for auto rental and \$37 for shopping.

Miami-Dade County reef-using visitors who went scuba diving or snorkeling on their own boat, a friend's boat or a rental boat spent, on average, \$87 per person per day on the day they went diving. This amount is comprised of \$17 for boat fuel, \$4 for lodging, \$17 for food and beverages at stores and \$11 for food and beverages at restaurants and bars.

Visitors who went diving on charter or party boats spent, on average, \$125 per person per day. This expenditure was comprised of \$31 per day for the dive charter or party boat, \$20 per day for lodging and \$7 per day for food and beverages at stores, \$22 per day for food and beverages in restaurants and bars; \$15 for auto rental; and \$19 for shopping, among other items.

The lodging expenditure item includes lodging costs for hotels, motels and campgrounds or if the respondent paid by the day or by the week for the other accommodations. The \$20 per person per day for lodging may seem lower than the actual per person rate of a hotel or motel. Bear in mind that only a portion of visitors stay at a hotel or motel. Visitor accommodations also include campgrounds, family or friends, second homes and time shares. Also, as discussed previously, many visitors spend only one day in the county and therefore do not incur the cost of a room. The cost of the second home or time share is not included in the lodging cost because this is a monthly or up front cost that can, at best, only be partially due to the existence of the reefs.

The expenditures per person per day were multiplied by the number of person-days by boating mode and reef type to obtain an estimate of the total expenditures associated with reef related activities. The itemized total expenditures associated with reef use in Miami-Dade County in 2000-2001 are provided in Table 5.2.2-2. The expenditures associated with glass bottom boating days only included the fee per person per ride (\$20). The other expenditures associated with the entire day spent in the county were not included for glass bottom boat riders because these visitors are likely in the county for other reasons either not reef-related or included in the other reef-related recreational activities.

Visitors who used the reefs in Miami-Dade County spent \$572 million on reef-related expenditures. Of this amount \$182 million was associated with artificial reef-related expenditures and \$390 million was associated with natural reef-related expenditures.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

**Table 5.2.2-2 (Visitors)**  
**Total Visitor Expenditures In Miami-Dade County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	1,412,438	3,247,954	4,660,392
Charter / Party Boat Fee	\$17,118,148	\$23,710,254	\$40,828,402
Boat Rental	2,540,565	4,678,931	7,219,496
Boat Fuel	30,156,338	86,350,800	116,507,138
Air Refills	2,538,890	4,760,334	7,299,223
Tackle	2,932,339	9,202,805	12,135,144
Bait	1,570,737	4,929,575	6,500,312
Ice	2,035,146	5,381,221	7,416,367
Ramp Fees	1,782,445	4,834,576	6,617,021
Marina Fees	3,496,104	7,559,320	11,055,423
Lodging	17,096,751	23,592,903	40,689,654
Camping Fees	651,817	1,602,569	2,254,386
Food and Beverages - Stores	24,957,770	60,274,523	85,232,293
Food and Beverages - Restaurants/Bars	27,777,276	55,785,655	83,562,932
Auto Gas	9,568,144	21,174,183	30,742,328
Auto Rental	13,659,366	28,193,581	41,852,947
Equipment Rental	1,958,101	4,261,687	6,219,788
Shopping	22,089,926	43,581,942	65,671,868
Glass Bottom Boat Ride	62,489	281,199	343,688
<b>Total</b>	<b>\$181,992,354</b>	<b>\$390,156,057</b>	<b>\$572,148,411</b>

The reef-related visitor expenditures were then used to estimate the economic contribution of artificial and natural reefs to each of the counties. As discussed in the Introduction of the Report, 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 re-spent 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.

The direct, indirect and induced increase in sales, total income, employment and indirect business taxes generated by the reef-related expenditures were estimated for Miami-Dade

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

County using the IMPLAN Regional Input-Output Model. This model uses detailed data on the economies of this county to estimate economic multipliers and to model the impact of reef-related expenditures on the economy.

The economic contribution of the reefs to Miami-Dade County is provided in Table 5.2.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. Income is the money that stays in the county's economy. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures. The indirect business tax contribution is the sum of the additional excise taxes, property taxes, fees, licenses, and sales taxes collected due to the reef-related expenditures.

**Table 5.2.2-3 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Miami-Dade County**  
**Economic Area is Miami-Dade County**  
**June 2000 to May 2001 – In 2000 dollars**

Reef Type/Economic Contribution	Direct	Indirect	Induced	Total
<b>Artificial Reefs</b>				
Sales	\$181,992,354	\$50,373,237	\$91,522,054	\$323,887,645
Total Income	\$98,068,036	\$26,955,522	\$56,811,301	\$181,834,859
Employment	3,532	520	1,214	5,266
Indirect Business Taxes	\$18,462,677	\$2,954,424	\$5,467,652	\$26,884,753
<b>Natural Reefs</b>				
Sales	\$390,156,057	\$106,631,671	\$200,284,701	\$697,072,429
Total Income	\$211,942,283	\$56,642,529	\$124,502,414	\$393,087,226
Employment	7,462	1,087	2,662	11,211
Indirect Business Taxes	\$41,647,111	\$6,178,534	\$11,923,603	\$59,749,248
<b>Natural and Artificial Reefs</b>				
Sales	\$572,148,411	\$157,004,908	\$291,806,755	\$1,020,960,074
Total Income	\$310,010,319	\$83,598,051	\$181,313,715	\$574,922,085
Employment	10,994	1,607	3,876	16,477
Indirect Business Taxes	\$60,109,788	\$9,132,958	\$17,391,255	\$86,634,001

Reef-related expenditures by visitors to Miami-Dade County during the period June 2000 to May 2001 resulted in \$1.0 billion in sales to county businesses. These sales generated \$575 million in income and 17,000 jobs. About \$87 million in indirect business taxes were collected as a result. About 32 percent of these values were the result of artificial reef-related expenditures and 68 percent of these values were the result of natural reef-related expenditures.

### 5.2.3 Use Value

Use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to all reef users of maintaining both the artificial and natural reefs in their existing condition; and (4) the value of adding and maintaining additional artificial reefs. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The visitor reef-user values associated with maintaining the reefs in their existing conditions for each county is provided in Table 5.2.3-1. Use value per person day means the value per person day of artificial, natural or all reef use, as specified in the table. The respondent was asked to state yes, no or don't know to a specified payment to maintain the artificial reefs, the natural reefs and a combined program that would protect both types of reefs. The scenario provided to the respondent was as follows.

“Local and state government agencies are considering different approaches to maintaining the health and condition of the natural and artificial reefs in southeast Florida. One plan focuses on providing greater protection for natural reefs by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the artificial reefs by maintaining water quality, limiting damage to artificial reefs from anchoring and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both or none of these plans and if you would be willing to incur higher costs to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on your ability to participate in any boating activity or other recreation in southeast Florida.”

Then the respondent was asked a yes or no question regarding the natural reef plan, the artificial reef plan and both plans. For example, the question regarding both plans read: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together in a combined program. Consider once again your total trip cost for your last trip to use the reefs in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you be willing to pay this amount to maintain the artificial and natural reefs?”

The amounts (bid values) of \$20, \$100, \$200, \$1,000, and \$2,000 were rotated from respondent to respondent. For the individual programs (just natural or artificial reef protection), the amounts were one-half of the above amounts: \$10, \$50, \$100, \$500 and \$1,000.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

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Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey<sup>4</sup>: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs.” Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition.

Chapter 2.2.2 provides a general description of the procedures used to analyze the data and the procedures used to estimate the user values presented here. For a more technical discussion, please see the Technical Appendix to this document which is a separate report. The Technical Appendix describes the methods used to derive the values presented here and provides alternative estimates using different methods. Here we present only the estimates of total annual use value, use value per person-day, and the asset value of the reefs derived using the logit model.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. For Miami-Dade County visitors, the average per person-day value of the natural reefs was \$7.09 versus \$4.31 for artificial reefs. Total use is also higher for natural versus artificial reefs. Miami-Dade County visitors’ natural reef use was over 3.2 million person-days versus 1.4 million person-days for artificial reefs. This translated into an estimate of total annual use value of over \$23 million for natural reefs and \$6 million for artificial reefs. Capitalizing the annual use values, using a three percent discount rate, yields asset values of \$767 million for the natural reefs and \$203 million for the artificial reefs.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs including investments to deploy new artificial reefs and enhance natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value slightly higher than that derived by adding-up the values of the natural and artificial reef programs separately. This result is quite different that what was obtained for other counties, where the result of the combined programs yielded estimates lower than that derived by adding-up the separate programs.

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<sup>4</sup> For a complete description of the contingent valuation questions, please refer to the Visitor Boater Survey and the Blue Card (which is white in this report but labeled “Blue Card” in Appendix B).

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

The capitalized value of the reef user values is the present value of the annual values calculated at three percent discount rate. It represents the “stock” value analogous to land market values. The capitalized visitor reef user value for associated with Miami-Dade County reefs, both artificial and natural, is \$1.1 billion. Bear in mind that this value only includes the value that visitor reef users place on the reefs and does not include the values that resident reef users and non-reef-users place on the reefs or the economic contribution of the reefs. *The estimation of the value of the reefs to non-reef users was not part of this study.*

**Table 5.2.3-1 (Visitors)**  
**Annual Value of Reefs To Reef Users and Capitalized Value**  
**Data Represents June 2000 to May 2001**  
**Visitor Reef-Users in Miami-Dade County**

Item	All Reefs – Artificial and Natural	Artificial Reefs	Natural Reefs
Number of Person-Days of Reef Use	4,660,392	1,412,438	3,247,954
Use Value Per Person-Day (\$2000)	\$7.01	\$4.31	\$7.09
Annual Use Value - (\$2000)	\$32,651,524	\$6,083,896	\$23,014,615
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$1,088,384,133	\$202,796,533	\$767,153,833

Reef users’ willingness to pay to invest in and maintain “new” artificial reefs is provided in Table 5.2.3-2. The use value per person-day is the value per day or a portion of a day of artificial reef use. In Miami-Dade County, reef users are willing to pay \$3.6 million annually for this program. Recreational fishers have the highest value associated with the new artificial reef program.

**Table 5.2.3-2 (Visitors)**  
**Estimated Use Value of Investing in and Maintaining**  
**"New" Artificial Reefs in the County**  
**Visitor Reef-Users in Miami-Dade County**

Item	Value
Number of Person-Days of Artificial Reef Use	1,412,438
Use Value Per Person-Day for "New" Artificial Reefs (\$2000)	\$2.57
Annual Use Values for "New" Artificial Reefs	\$3,626,829
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$120,894,300
<i>Note: Use value per person-day is a day or portion of a day of artificial reef use.</i>	

The values of reefs by reef type and activity type for Miami-Dade County are provided in Table 5.2.3-3.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

**Table 5.2.3-3 (Visitors)**  
**Value of Reefs to Visitors to Miami-Dade County, by Reef Type and Activity, 2000-2001**

Reef Type/Activity	Person-Days	Annual User Value (\$)	User Value Per Person-Day (\$)
<b>Natural Reefs</b>	<b>3,247,954</b>	<b>\$23,014,615</b>	<b>\$7.09</b>
Snorkeling	599,359	\$4,347,142	\$7.25
Scuba Diving	270,813	\$2,656,749	\$9.81
Fishing	2,363,723	\$15,912,165	\$6.73
Glass Bottom Boat	14,060	\$98,559	\$7.01
<b>Artificial Reefs</b>	<b>1,412,438</b>	<b>\$6,083,896</b>	<b>\$4.31</b>
Snorkeling	2,812,347	\$1,020,984	\$3.63
Scuba Diving	168,664	\$736,686	\$4.37
Fishing	959,302	\$4,312,230	\$4.50
Glass Bottom Boat	3,124	\$13,996	\$4.48
<b>Natural &amp; Artificial Reefs</b>	<b>4,660,392</b>	<b>\$32,651,524</b>	<b>\$7.01</b>
Snorkeling	880,706	\$5,966,114	\$6.77
Scuba Diving	439,477	\$3,823,197	\$8.70
Fishing	3,323,024	\$22,741,322	\$6.84
Glass Bottom Boat	17,184	\$120,891	\$7.03
<b>New Artificial Reefs</b>	<b>1,412,438</b>	<b>\$3,626,829</b>	<b>\$2.57</b>
Snorkeling	281,347	\$608,645	\$2.16
Scuba Diving	168,664	\$439,165	\$2.60
Fishing	959,302	\$2,570,675	\$2.68
Glass Bottom Boat	3,124	\$8,343	\$2.67

### 5.2.4 Demographic Information

The Visitor Boater Survey asked the respondent questions regarding his/her socioeconomic characteristics so that a picture of the typical reef user could be developed. The results for Miami-Dade County are summarized in Table 5.2.4-1.

**Table 5.2.4-1  
Demographic Characteristics of Visitor Reef-Users in Miami-Dade County, 2000**

<b>Characteristic</b>	<b>Value</b>
Median Age of Respondent – Years	41
Sex of Respondent	
Male	75%
Female	25%
Race of Respondent	
White	83%
Black	7%
Other	10%
Percent Hispanic / Latino	29%
Median Household Income	\$55,000
Average Years Boating in Southeast Florida	6.7
Average Length of Own Boat Used in Saltwater Boating in Feet	26
Percent of Respondents Who Belong to Fishing and/or Diving Clubs	6%

### 5.3 Total – Residents and Visitors

This section summarizes the user activities, economic contribution and use values associated with the artificial and natural reefs for both residents and visitors of Miami-Dade County. Demographic information of both resident and visitor reef users is also provided.

#### 5.3.1 User Activity

The numbers of person-days spent using the reefs in Miami County by reef type and population (residents and visitors) are summarized in Table 5.3.1-1. Visitors and residents spent 9.2 million person-days using artificial and natural reefs in Miami-Dade County during the 12-month period from June 2000 to May 2001. Residents spent 4.5 million person-days and visitors spent 4.7 million person-days. Reef users spent 2.9 million person-days using artificial reefs and 6.2 million person-days using natural reefs. A summary of reef use by type of activity is provided in Table 5.3.1-2.

**Table 5.3.1-1  
Number of Person-Days Spent on Artificial and  
Natural Reefs in Miami-Dade County  
Residents and Visitors – in millions**

<b>Population</b>	<b>Artificial Reefs</b>	<b>Natural Reefs</b>	<b>All Reefs</b>
Residents	1.54	2.97	4.51
Visitors	1.41	3.25	4.66
Total	2.95	6.22	9.17



**Table 5.3.1-2  
Number of Person-Days Spent Using Reefs in Miami-Dade County  
By Recreational Activity  
Residents and Visitors**

<b>Activity</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Snorkeling	1.23	0.88	2.11
Scuba Diving	0.70	0.44	1.14
Fishing	2.58	3.32	5.90
Glass Bottom Boat	-	0.017	0.017
<b>Total</b>	<b>4.51</b>	<b>4.66</b>	<b>9.17</b>
<i>Note: Residents were not asked about their use of glass bottom boats.</i>			

Reef fishing is a bit more popular than reef diving in Miami-Dade County. Snorkeling was more popular than scuba diving. Fishing comprised 5.9 million person-days while scuba diving and snorkeling comprised 1.1 million person-days and 2.1 person-days, respectively. Visitor reef-related recreation comprises about half of total reef-related recreation by residents and visitors in Miami-Dade County. Visitors spent more days fishing than did residents but residents spent more time diving than visitors.

### **5.3.2 Economic Contribution**

The total economic contribution of the reefs to Miami-Dade County includes the contribution of reef expenditures to sales, income and employment. 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 visitor expenditures create multiplier effects wherein additional income and employment is created as the income earned by the reef-related industries is re-spent 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.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

To provide a conservative estimate of the economic contribution of resident use of the reef system, the multiplier effects were not included.

The economic contributions of the artificial, natural and all reefs to Miami-Dade County are provided in Tables 5.3.2-1 through 5.3.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

Reef-related expenditures in Miami-Dade County generated \$1.3 billion in sales during the 12-month period from June 2000 to May 2001. These sales resulted in \$614 million in income to Miami-Dade County residents and provided 18,600 jobs in Miami-Dade County. Artificial reef-related expenditures accounted for 32 percent of the economic contribution of all reefs and natural reef-related expenditures accounted for 68 percent of the economic contribution.

**Table 5.3.2-1  
Economic Contribution of Artificial Reef-Related Expenditures  
to Miami-Dade County  
June 2000 to May 2001 – In 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$95,200,000	\$13,400,000	724
Visitor	\$181,992,354	\$98,000,000	3,532
Total	\$277,192,354	\$111,400,000	4,256
Indirect	\$50,373,237	\$27,000,000	520
Induced	\$91,522,054	\$56,800,000	1,214
Total	\$419,087,645	\$195,200,000	5,990

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.

**Table 5.3.2-2  
Economic Contribution of Natural Reef-Related Expenditures  
to Miami-Dade County  
June 2000 to May 2001 – In 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$180,400,000	\$25,500,000	1,385
Visitor	\$390,156,057	\$211,900,000	7,462
Total	\$570,556,057	\$237,400,000	8,847
Indirect	\$106,631,671	\$56,600,000	1,087
Induced	\$200,284,701	\$124,500,000	2,662
Total	\$877,472,429	\$418,500,000	12,596
<sup>a</sup> The direct contribution is the actual expenditures made in the county.			
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits			
<sup>c</sup> Employment includes the number of full-time and part-time jobs.			

**Table 5.3.2-3  
Economic Contribution of All Reef-Related Expenditures  
to Miami-Dade County  
June 2000 to May 2001 – In 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$275,600,000	\$38,900,000	2,109
Visitor	\$572,148,411	\$309,900,000	10,994
Total	\$847,748,411	\$348,800,000	13,103
Indirect	\$157,004,908	\$83,600,000	1,607
Induced	\$291,806,755	\$181,300,000	3,876
Total	\$1,296,560,074	\$613,700,000	18,586
<sup>a</sup> The direct contribution is the actual expenditures made in the county.			
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits			
<sup>c</sup> Employment includes the number of full-time and part-time jobs.			

### 5.3.3 Use Value

Use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to all reef users of maintaining both the artificial and natural reef system; and (4) the value of adding and maintaining additional artificial reefs.

## 5.0 Socioeconomic Value of Reefs in Miami-Dade County

Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The annual value Miami-Dade County visitors and residents place on protecting the reefs in their existing condition and the associated capitalized value is presented in Table 5.3.3-1. The annual value visitor and resident reef-users place on investing in and maintaining “new” artificial reefs is presented in Table 5.3.3-2. These values were explained in Sections 5.1.3 and 5.2.3.

**Table 5.3.3-1**  
**Annual Use Value Associated with Protecting Reefs in their Existing Condition and Capitalized Value associated With Reef Use**  
**Data Represents June 2000 to May 2001**  
**Miami-Dade County, Florida**

Item	Residents	Visitors	Total
<b>All Reefs - Artificial and Natural</b>			
Number of Person-Days of Reef Use (millions)	4.51	4.66	<b>9.17</b>
Use Value Per Person-Day	\$3.17	\$7.01	<b>\$5.12</b>
Annual Use Value - (million dollars)	\$14.30	\$32.65	<b>\$46.95</b>
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.48	\$1.09	<b>\$1.57</b>
<b>Artificial Reefs</b>			
Number of Person-Days of Reef Use (millions)	1.54	1.41	<b>2.95</b>
Use Value Per Person-Day	\$2.76	\$4.31	<b>\$3.50</b>
Annual Use Value - (million dollars)	\$4.25	\$6.08	<b>\$10.33</b>
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.14	\$0.20	<b>\$0.34</b>
<b>Natural Reefs</b>			
Number of Person-Days of Reef Use (millions)	2.97	3.25	<b>6.21</b>
Use Value Per Person-Day	\$8.01	\$7.09	<b>\$7.54</b>
Annual Use Value - (million dollars)	\$23.74	\$23.01	<b>\$46.85</b>
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.79	\$0.77	<b>\$1.56</b>

**Table 5.3.3-2**  
**Estimated Value to Reef Users From Investing in and Maintaining "New" Artificial Reefs**  
**Miami-Dade County, Florida**

Item	Residents	Visitors	Total
Number of Person-Days of Artificial Reef Use (millions)	1.54	1.41	<b>2.95</b>
Use Value Per Person-Day for "New" Artificial Reefs	\$0.28	\$2.57	<b>\$1.38</b>
Annual Use Values for "New" Artificial Reefs (million dollars)	\$0.44	\$3.63	<b>\$4.07</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$14.5	\$120.89	<b>\$135.4</b>

**5.3.4 Demographic Information**

This section summarizes and compares the demographic characteristics of visitor and resident reef users. These characteristics were obtained from the resident boater survey and the visitor boater survey. They are summarized in Tables 5.3.4-1. A comparison of the demographics indicate that resident and visitors are very similar in terms of age, race, income, and membership in fishing and/or diving clubs.

**Table 5.3.4-1  
Demographic Characteristics of Resident and Visitor Reef-Users  
In Miami-Dade County, 2000**

	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Age of Respondent</b>	46			41		
<b>Sex Of Respondent</b>	<b>Percent</b>			<b>Percent</b>		
Male	93%			75%		
Female	7%			25%		
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
<b>Race Of Respondent</b>	88%	1%	11%	83%	7%	10%
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
<b>Percent Hispanic/Latino</b>	33%			29%		
	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Household Income</b>	\$69,722			\$55,000		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Years Boating in South Florida</b>	25			6.7		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Length of Boat Used for Salt Water Activities in Feet</b>	23			26		
	<b>Residents</b>			<b>Visitors</b>		
<b>% of Respondents Who Belong to Fishing and/or Diving Clubs</b>	18%			6%		

# Chapter 6: Socioeconomic Values of Reefs in Monroe County

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This chapter describes the Socioeconomic Value of Artificial and Natural Reefs in Monroe County to residents and visitors. Monroe County includes the Florida Keys. For both groups this chapter discusses the following topics.

- Volume of user activity on both artificial and natural reefs off Monroe County;
- Economic Contribution of artificial and natural reefs to the county's economy;
- Resident and visitor "use value" associated with recreating on artificial and natural reefs in Monroe County; and,
- Demographic and boater profile of reef users in Monroe County.

For residents, their opinions regarding the existence of "no-take" zones as a tool to protect existing artificial and natural reefs are provided.

## 6.1 Residents

The focus of this section is on the socioeconomic values of the reefs off the Coast of Monroe County (The Florida Keys) to resident boaters. Resident boaters are those individuals who live within Monroe County and use a boat that is owned by a resident of the county to visit the reef system. Resident boats used to visit the reef system are defined as those greater than 16 feet in length and are registered with the Florida Department of Highway Safety and Motor Vehicles.

### 6.1.1 User Activity

This chapter first considers the volume of resident user activity associated with the artificial and natural reefs off Monroe County. User activity is expressed in terms of the number of boating days or "party-days" since each boat carries one or more individuals. User activity was analyzed in terms of the kinds of recreational activities (e.g., snorkeling, scuba diving, fishing) that parties participate in when they visit the reef system.

To measure party-days for any recreational resource, it is important to define the universe that the research is intended to measure. In this study, we wish to measure the number of party-days spent on artificial and natural reefs in the Atlantic Ocean or Gulf of Mexico off the coast of Monroe County, Florida. For most residents, their own boats are used to facilitate this recreational process. The use of party boats or charter rentals by residents was not considered during this study.

In 1999-2000, there were 26,564 registered pleasure boats in Monroe County according to the Florida Department of Highway Safety and Motor Vehicles (2001). These pleasure craft were divided into the following size classes:

## 6.0 Socioeconomic Value of Reefs in Monroe County

<b>Boat Size Category (Length of Boat in Feet)</b>	<b>Number of Boats</b>	<b>Percentage of Total</b>	<b>Cumulative Percentage</b>
Less than 12 feet	3,715	14%	14%
12 feet to 15'11"	3,552	13%	27%
16 feet to 25'11"	15,027	57%	84%
26 feet to 39'11"	3,644	13%	97%
40 feet to 64'11"	598	2%	99%
65 feet to 109'11"	28	1%	100%
Greater than 110 feet	0	0%	100%
<b>Total</b>	<b>26,564</b>	<b>100%</b>	

The largest boat size category of pleasure craft in Monroe County is between 16 and nearly 26 feet in length (57 percent).

Three adjustments were made to reach the target population of boats registered in Monroe County whose owners may visit the reef system. First, sampling was restricted to pleasure craft over 16 feet in length. This was in response to expert opinion that very few pleasure craft less than 16 feet could reach the reef system. Thus, the mail survey was targeted at pleasure craft over 16 feet long so that nonusers could be avoided and to increase the sample size on that segment of the boating population with the highest propensity to use the reef system. This reduced the target boat population in Monroe County to 19,297 pleasure craft.

Additionally, not everyone with a relatively large boat would use an artificial and/or natural reef in the last twelve months. In fact, the results of the survey indicated that only 75.4 percent of these larger vessels used the Monroe County reef system in the last 12 months or 13,062 pleasure craft. Finally, it was determined that about one-half of one percent of the owners of registered boats in the target population had a residence somewhere outside Monroe County. Thus, the target population was again reduced to 12,996 pleasure craft to reflect only resident boat owners.

On average, respondents indicated that over a 12-month period (1999-2000) they used the reef system on 70 separate days while engaging in three main recreational activities: fishing, snorkeling and scuba diving. Remember, these boaters have the highest propensity to use the reef system compared to smaller vessels. Based upon this information, it was estimated that over this 12-month period, Monroe County residents spent 909,900 “party-days” on the reef system (70 party days times 12,996 pleasure craft).

In conducting the mail survey, resident reef-users from Monroe County were asked to distribute their 70 party-days in two ways. First, they were asked to distribute their reef usage among three recreational activities as follows: (1) Fishing, (2) Snorkeling and (3) Scuba Diving. Second, respondents were asked to distribute each of these recreational activities between artificial and

## 6.0 Socioeconomic Value of Reefs in Monroe County

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natural reefs. Table 6.1.1-1 presents the distribution of party-days for resident boaters in Monroe County.

Monroe County residents spent an estimated 52 percent of their party-days fishing on the artificial and natural reefs followed by snorkeling (28 percent) and scuba diving (20 percent). For all the recreational activities on reefs, there was an obvious preference for natural reefs with 66 percent of the party-days spent visiting natural reefs. The strongest intensity of natural reef use was for snorkeling where 75 percent of the respondents used the natural reef for this activity.

User activity, measured in "person-days" is presented in the right hand side of Table 6.1.1-1. A "person-day" is equivalent to an individual using the reef system for part or all of one day. The number of person-days was calculated by multiplying by the average size of the party (i.e. number of individuals per party) by the number of party-days. However, one important adjustment to average party size was necessary to calculate residential person-days. The average party size was reduced by subtracting the individuals who were considered as visitors (i.e., non-residents of Monroe County). About 32 percent of the average party was identified as nonresidents.

Thus, Table 6.1.1-1 utilizes the average resident party size to calculate resident person-days. The average residential party size does not vary appreciably among the various reef-related recreational activities and averages about 3.27 residents per party. Because of this, the distribution of person-days per activity is similar to the distribution of party-days discussed above. For example, saltwater fishing on reefs garnered 1.57 million person-days or 52 percent of all person-days during the 12-month period (December 1999 to November 2000). The total number of person-days residents used the reef system off Monroe County over a 12-month period was estimated at 3.03 million.

While party-days gives a "boater dimension" to user activity in and around the reef system, person-days yield a "people dimension" to use of the reef system. The former is especially useful in judging the adequacy of the boating infrastructure such as marinas and boat ramps while the latter is used in calculating recreational use value, which is discussed below.



**Table 6.1.1-1 (Residents)**  
**Estimated Resident User Activity as Measured by Party-Days and Person-Days on**  
**Artificial and Natural Reefs off Monroe County, Florida, 2000**

Activity/ Type of Reef	Number and Distribution of Party-Days by Activity and Reef Type			Number and Distribution of Person-Days by Activity and Reef Type			
	Number of Party-Days	Percentage of Party-Days Per Activity by Reef Type	Percentage of Total Party-Days Per Activity	Resident Party-Size by Activity	Number of Resident Person-Days <sup>2</sup> by Activity by Reef Type	Percentage of Person-Days Per Activity by Reef Type	Percentage of Total Person-Days Per Activity
<b>Fishing</b>			52%	4.32			52%
Artificial	141,916	30%			469,742	30%	
Natural	331,138	70%			1,096,067	70%	
Subtotal	473,054	100%			1,565,809	100%	
<b>Snorkeling</b>			28%	4.28			33%
Artificial	63,860	25%			248,415	25%	
Natural	191,041	75%			743,150	75%	
Subtotal	254,901	100%			991,565	100%	
<b>Scuba Diving</b>			20%	3.16			16%
Artificial	103,708	57%			271,715	57%	
Natural	78,236	43%			204,978	43%	
Subtotal	181,944	100%			476,693	100%	
<b>All Activities</b>							
Artificial	309,484	34%			989,872	33%	
Natural	600,415	66%			2,044,195	67%	
<b>Total</b>	909,899	100%			3,034,067	100%	

<sup>1</sup> Resident person-days were calculated by multiplying the number of party-days by the average resident party size.

### 6.1.2 Economic Contribution

To fully understand the economic contribution of reefs to Monroe County it is first important to recognize what factors influence the demand for boating in this area. This will help to understand the nature of boating in the county and how it relates to the use of artificial and natural reefs. In a study by Bell and Leeworthy (1986), the authors found that the demand for boats by individuals was related to boat prices, population and per capita income. Therefore, it is expected that there would be a higher number of registered pleasure craft in counties that are large as measured by population and are relatively affluent as measured by real per capita income.

The number of registered boats in any county is critical in assessing the adequacy of the boating infrastructure such as boat ramps and, of course, artificial and natural reefs. This topic has recently been addressed in the 2000 State Comprehensive Outdoor Recreational Plan (2001) issued by the Division of Recreation and Parks, Florida Department of Environmental Protection. However, this report did not include an assessment of the reef system in various regions of Florida. This chapter considers the demand for boating in Monroe County, not the infrastructure available. This information will provide the reader with an overview of Monroe County and valuable information necessary to assess the adequacy of the boating infrastructure. The overview includes the size and nature of the county's population, per capita income, industrial structure, and the infrastructure related to saltwater boating. This will provide a background by which to assess the results of this study.

Monroe County is on the southeast coast of Florida bordering both the Atlantic Ocean and the Gulf of Mexico. Key West is the principal city in this county. In 1999, the county ranked 34<sup>th</sup> in the state in terms of population, with 79,941 residents<sup>1</sup>. Over the last ten years, population in this county has grown by 23.5 percent making it the 45<sup>th</sup> fastest growing county in Florida (out of 67 counties). Monroe County has 87 persons per square mile as compared to 284 for Florida as a whole, making it the 39<sup>th</sup> most densely populated county in the State. This county's population has a median age of 41 years, which is comparable to the general population of Florida, which has a median age of 39 years.

The University of Florida, Bureau of Economic and Business Research projects the county's population to reach 102,100 by 2015 or a 28 percent increase. In-migration to Monroe County, will account for about 80 percent of this growth. Thus, this county's population growth will depend heavily on individuals moving into the county, and more specifically into the Florida Keys.

In 1998, Monroe County had a per capita income of \$32,501 placing it seventh among the 67 counties in the State of Florida. This per capita income was 21 percent above the state average of \$26,845. Monroe County residents received nearly \$13,000 per capita in dividends, interest and rents. Thus, the holding of capital assets such as stocks, bonds and property largely accounts for the relative affluence of the residents. However, average earnings of those employed in

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<sup>1</sup> U.S. Department of Commerce, Bureau of the Census, July 1, 1999.

## 6.0 Socioeconomic Value of Reefs in Monroe County

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Monroe County fall short of the average wage for the State by almost 16 percent. Monroe County appears to have a bimodal population where wealthy individuals live off accumulated capital assets while the other segments of the population are employed in industries paying wages below the state average. The net effect of these factors is a high per capita income above the state average. This could generate a large demand for reef-related recreational boating.

In 1998, there were 41,190 persons employed in Monroe County generating \$1.029 billion in wage and salaries. Over the last ten years, employment grew by 12.2 percent, which corresponds to the growth rate of the population as discussed above. Measured by employee earnings, the largest industries in 1998 were services (34 percent), retail trade (17.8 percent), and state and local government (13.9 percent). Of particular note, this county provides a significant amount of tourist-related services such as lodging, amusement and recreation. About 6,800 workers were involved in these industries in Monroe County in 1998. Tourism provides part of the economic base for this county.

In 2000, there were 26,638 recreational boats (FDHSMV, 2001) registered in Monroe County or 1 boat for every 4 people. For the State of Florida, there is 1 registered pleasure boat for every 14 residents. The infrastructure supporting various coastal or saltwater forms of boating recreation in Monroe County include the following (FDEP, 2000)(Pybas, 1997):

1. Boat Ramps: 143 with a total of 181 boating lanes;
2. Marinas: 144 with 4,873 wet slips and moorings;
3. Other Facilities: 4,452 boat dry storage;
4. Artificial Reefs: 48 artificial reefs ranging from 2.3 to 19.5 nautical miles from shore.

The relatively high per capita income in Monroe County coupled with the vast water resources makes the demand for recreational boating the highest in the State of Florida as measured by the ratio of registered boats to people. However, the high population density, probably as in many of the southeastern Florida counties, may contribute to crowding and congestion, which impinges on the carrying capacity of both man-made facilities (e.g., artificial reefs; boat ramps) and natural resources. This increases the cost of recreational boating and reduces the demand for pleasure boats. This “working hypothesis” of a supply side problem could be one of several factors that may affect the demand for registered boats in Monroe County.

Using a mail survey, 3,500 registered boaters in Monroe County were contacted at random using the survey instrument provided in Appendix A. Boat owner addresses were obtained from a registered boater database compiled by the Florida Department of Highway Safety and Motor Vehicles. A total of 790 registered boaters responded to the mail survey and 75.4 percent (596) indicated that they used their pleasure crafts to visit the reefs offshore of Monroe County during a 12-month period (1999-2000).

## 6.0 Socioeconomic Value of Reefs in Monroe County

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To estimate the economic contribution to Monroe County of resident spending associated with reef use, the respondents were asked to estimate party spending during their last boating activity. It was assumed that each boating trip would involve one day since the residents are in their county of residence. Residential expenditures per party were distributed according to the categories of recreational activity as follows.

<b>Average Resident Spending Per Party for Monroe County Reef-Users</b>			
<b>Activity</b>	<b>Estimated Spending Per Party Per Day</b>	<b>Percentage of Residents Per Party</b>	<b>Estimated Spending per Resident Party Per Day</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4) = (2) * (3)</b>
Fishing	\$249.74	68%	\$169.82
Snorkeling	\$181.86	64%	\$116.39
Scuba Diving	\$171.23	72%	\$123.29

Recreational fishing on reefs was most expensive (\$250 per party per day) and scuba diving was the least expensive (\$171 per party per day). Expenditures for marina fees, equipment rentals and restaurants made the former activity a more expensive recreational activity than the latter. Detailed expenditures on particular items are discussed below.

Note that an adjustment was made to the size of the boating party in order to calculate estimated expenditures by residents as summarized above. About 28 to 36 percent of the typical party included individuals who were apparently guests of the Monroe County residents. A simplifying assumption was made that these visitors would pay their fair share of the trip cost. For example, visitors would pay a proportion of the trip costs such as the costs of boat fuel, restaurants and bait. In reality, residents might pay less than their proportionate share. However, it shall be assumed that an equal sharing of cost between residents and their visitors existed to obtain a conservative estimate of resident spending.

To derive the economic impact of a particular reef-related recreational activity, one must briefly return to Table 6.1.1-1. This table shows the number of residential party-days and person-days associated with reef use over a 12-month period off the Coast of Monroe County. For example, recreational fishing generated 473,054 resident party-days to all reefs off Monroe County. According to resident spending per party discussed above, fishers spent \$169.82 per trip. Thus, annual expenditures for reef-related fishing was estimated to be \$80.3 million dollars (\$169.82 times 473,054).

Based upon the distribution of party-days per reef type, about \$24.1 million was spent while using artificial reefs while the balance or \$56.2 million was spent in conjunction with use of natural reefs by recreational fishers. There did not appear to be much difference between per party spending by fishers who used either type of reef. This held for the other two recreational activities as well.

## 6.0 Socioeconomic Value of Reefs in Monroe County

Table 6.1.2-1 presents the economic contribution of all reef-related recreation off the Monroe County coast. Residents spent an estimated \$132.3 million during a 12-month period (December 1999 through November 2000). About two-thirds of this was spent while using natural reefs (\$88 million) while the balance (\$44.3 million) was spent in conjunction with use of the artificial reef system. About 61 percent of total spending or \$80.3 million was due to reef-related recreational fishing while \$29.6 million (22 percent) was due to reef-related snorkeling and \$22.4 million (17 percent) was due to reef-related scuba diving.

It is important to clarify the economic contribution of resident boaters in Monroe County. The engine of economic growth for any region is found in its export industries such as tourism in Monroe County. As export income flows through the region, it creates local income (e.g., money paid for haircuts by residents) and a demand for imports (e.g., TV sets since Monroe County does not have such a manufacturer). The local income is spent on everything from marina services to dining out at a local restaurant to groceries to mortgages or rents. Thus, the spending by residents in conjunction with reef use represents the choice of recreating locally as opposed to leaving the area to recreate elsewhere.

**Table 6.1.2-1 (Residents)  
Reef-Related Expenditures, Wages and Employment Generated by  
Resident Boating Activities in Monroe County, Florida, 2000**

Type of Activity/ Type of Reef	Expenditures (Million \$)	Wages (Million \$)	Employment (Number of Full and Part-Time Jobs)
<b>Artificial Reef</b>			
Fishing	\$24.10	\$3.10	208
Snorkeling	\$7.40	\$1.00	71
Scuba Diving	\$12.80	\$1.70	125
Subtotal	\$44.30	\$5.80	404
Percentage Attributed to Artificial Reefs	33%	34%	34%
<b>Natural Reef</b>			
Fishing	\$56.20	\$7.10	485
Snorkeling	\$22.20	\$3.00	213
Scuba Diving	\$9.60	\$1.30	94
Subtotal	\$88.00	\$11.40	792
Percentage Attributable to Natural Reefs	67%	66%	66%
<b>Total All Reefs</b>			
Fishing	\$80.30	\$10.20	693
Snorkeling	\$29.60	\$4.00	284
Scuba Diving	\$22.40	\$3.00	219
<b>Total All Reefs/All Activities</b>	<b>\$132.30</b>	<b>\$17.20</b>	<b>1,196</b>

## 6.0 Socioeconomic Value of Reefs in Monroe County

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The reef system keeps the “locals” in the county and enlarges the economy by \$132.3 million in local spending. In contrast to visitors entering the county, there is no multiplier effect. Generally, the more money kept in the local economy the larger will be the regional multiplier because there would be less “leakage” through the purchase of imports or residents leaving the area for recreational pursuits in places such as Fort Lauderdale or Orlando. Just how much the regional multiplier is enlarged from resident use of the reef system is beyond the scope of this study. However, it is safe to say that protection and maintenance of reef system has the potential to keep more business in Monroe County. For ardent reef-users, the absence of reefs off the Monroe County coast would certainly divert these residents elsewhere for recreation to the economic detriment of Monroe County.

Reef-related local spending, discussed above, is in itself, only a vehicle to create jobs and wages in the local community. To evaluate which industries benefit from resident reef use, reef-users were asked to break their expenditures into 12 categories such as boat fuel, ice, tackle, and marina fees. For each of the twelve categories, resident expenditures were matched to total sales as published in the 1997 U.S. Census of Business (1997). For example, spending on boat fuel was matched up with sales at gasoline stations in Monroe County. It was found that each gasoline station employee “sells” \$227,300 per year out of which they are paid about \$15,939 or about 7 percent. The annual salary may seem low, but this figure is for full and part time employees with a relatively low skill level. Thus, every \$227,300 in gasoline purchased for reef-related recreation by local users, generates one job paying about \$15,939 per year.

This rather simple procedure was followed for each of the 12 expenditure categories, which vary greatly in labor intensity. The higher the sales-to-employment ratio, the less labor intensive the activity. For example, restaurants are relatively labor intensive (i.e., need cooks and servers) while gasoline stations are highly automated and need fewer employees per \$100,000 in sales.

Table 6.1.2-1 shows the estimated wages and employment generated by resident spending on reef-related recreational activities in Monroe County. The \$132.3 million in annual spending generated about \$17.2 million dollars in annual wages supporting 1,195 employees or \$14,393 per employee. As discussed above, this annual wage reflects part and full-time employees in low wage service and retail industries where boaters using the reef system would concentrate their spending. The reef-related spending by residents is 2.9 percent of total county employment of 41,190.

It is also important to identify the industries that benefit from reef-related resident spending. Table 6.1.2-2 shows the 12 spending categories of resident boaters. One would expect that expenditures would be concentrated on running and storing a boat and the results support this expectation. Expenditures for boat oil and gas constituted 27 percent of all spending followed by food and beverages from restaurants (13 percent) and stores (12 percent) and spending on marina slip rentals and dockage fees (8 percent). In terms of dollar figures, resident reef-users spent about \$11 million annually on goods and services provided by the marina industry. According to the U.S. Census of Business (1997), the marina industry in Monroe County grossed about \$35 million in sales. Thus, resident reef-users may account for as much as 50 percent of these sales.

**Table 6.1.2-2 (Residents)  
Detailed Expenditure Pattern Supporting Employment and Wages by  
All Resident Reef-Users in Monroe County, Florida, 2000**

Expenditure Item	Expenditures (Million \$)	Percentage of Total Expenditures	Employment (Number of Full and Part-Time Jobs)	Percentage of Total Employment	Wages (Million \$)	Percentage of Total Wages
1. Boat gas and oil	\$36.29	27%	160	13%	\$2.55	15%
2. Marina slip rentals and dockage fees	\$10.72	8%	88	7%	\$1.82	11%
3. Food and beverages from restaurants/bars	\$17.24	13%	410	34%	\$4.65	27%
4. Food and beverages from stores	\$15.25	12%	97	8%	\$1.43	8%
5. Tackle	\$10.63	8%	88	7%	\$1.61	9%
6. Bait	\$7.97	6%	67	6%	\$1.22	7%
7. Gas for auto	\$4.83	4%	21	2%	\$0.34	2%
8. ICE	\$5.48	4%	24	2%	\$0.38	2%
9. Equipment rentals	\$4.39	3%	81	7%	\$1.02	6%
10. Boat ramp and parking fees	\$2.04	1%	17	2%	\$0.35	2%
11. Sundries (e.g. Sun screen, sea sickness pills, etc.)	\$4.36	4%	35	3%	\$0.45	3%
12. All other	\$13.10	10%	107	9%	\$1.36	8%
<b>Total</b>	<b>\$132.30</b>	<b>100%</b>	<b>1,195</b>	<b>100%</b>	<b>\$17.18</b>	<b>100%</b>

*Source: Florida State University*

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## 6.0 Socioeconomic Value of Reefs in Monroe County

Resident non-reef users and visitors who keep their boats in local marinas would also generate sales to the marina industry. The role of visitors is discussed in the next section.

In terms of employment, reef-related resident spending created proportionately more employment in marinas and restaurants since, as discussed above, these industries are relatively labor intensive. Although ranked number one as a component of spending, gasoline stations are a capital-intensive industry. That is, spending on boat oil and gas accounted for one-fourth of all spending, but only one in eight jobs. As might be expected, wages follow employment. That is, the higher the percentage of spending on labor intensive industries, the higher the total wages generated. However, some industries employ highly skilled persons such as marinas where the wages paid are proportionately higher than employment as indicated in Table 6.1.2-2.

### 6.1.3 Use Value

Natural and artificial reefs contribute to the recreational experience of residents (i.e. fishing, snorkeling and scuba diving). Traveling to and enjoying a reef system involves economic costs including the cost of boat fuel, bait and tackle. This was discussed above. However, the market does not measure the total economic value of reef systems. There is no organized market in which to buy and sell the use of reefs because these resources are not owned by one individual but by society as a whole. Thus, the absence of private property rights creates a challenge in valuing natural and artificial reefs.

Yet, the general public does pay for the deployment of artificial reefs and the protection of natural reefs. So, there must be some unmeasured value of providing the reef system to the general public. Because reef-users are attracted to the reefs for recreation, we call this unmeasured value “use value”. For example, one could engage in scuba diving without the benefit of a natural or artificial reef. The addition of a reef presumably adds some “value” to the scuba diver’s recreational experience. This section examines the incremental use value of having a reef system off the coast of Monroe County.

The contingent valuation (CV) method asks users about their willingness-to-pay for a reef system contingent on specified conditions (e.g., use of funds for various reef related improvements). The CV method has been employed in numerous studies of use value from deep-sea fishing to deer hunting.<sup>2</sup> The reef-using respondents were asked a series of CV questions dealing with their willingness to pay for a specific type of reef program. The respondents were asked to consider the total cost for their last boating trip to the reefs including travel expenses, lodging, and all boating expenses. Then, the respondents were asked:

“If your total cost per trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the (kind of reef – artificial, natural or both artificial and natural) in their existing condition.”

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<sup>2</sup> See Clawson and Knetch (1966).



## 6.0 Socioeconomic Value of Reefs in Monroe County

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Payment amounts or cost increases (\$10, \$50, \$100, \$200 and \$500) were inserted in the blank space and the amounts were rotated from respondent to respondent. Thus, some respondents received questions asking about a \$10 increase while others were asked about a \$50, \$100 or even \$500 increase in trip cost. The purpose of these questions was to establish the user value per day for artificial and natural reefs.

The above willingness to pay question was asked in three forms to each respondent: (1) natural reefs separately; (2) artificial reefs separately and (3) a combination of natural and artificial reefs. For the combined program, the rotated cost increase was doubled. Because the primary spending unit is the “party”, the willingness to pay response was interpreted as an increase in trip cost to the entire party.

To estimate use values per party per trip (a day and a trip are equal for residents), the data for all counties were pooled. A logit model was used to estimate use values per party per trip. The logit model tested for differences in willingness-to-pay by county, activity, household income, age of respondent, years of boating experience in South Florida, race/ethnicity, sex, length of boat owned, and whether a member of a fishing or diving club.

Separate models were estimated for each of the four reef programs (e.g., natural reefs, existing artificial reefs, natural & artificial reefs combined, and new artificial reefs). For the natural reef, existing artificial reefs and the combined programs, the only significant differences in willingness-to-pay found were for reef users with income greater than \$100,000. This group had a higher willingness-to-pay than other reef users. There were no other differences found. The logit model did not produce different use values per party per trip among counties. Because party sizes were not significantly different among the counties, the estimated use values per person-trip were also the same across counties for each of the reef valuation programs. The estimated use values per party per trip (day) were \$32.55 for the natural reefs, \$11.31 for the artificial reefs and \$12.94 for the combined program.

To estimate total annual use values for each county, the number of party-days was multiplied by the estimated values per party per day. The use value per person-day was then estimated by dividing the total annual use value by the total number of person-days. This normalized value per person-day can be compared with results from other studies.

The results are consistent with the idea that natural reefs are preferred to artificial reefs. For Monroe County residents, the average use value per person-day of the natural reef use was \$9.56 versus \$3.54 for artificial reefs. Total use is also higher for natural versus artificial reefs. Monroe County residents’ natural reef use was over 2.0 million person-days versus about 0.99 million person-days for artificial reefs. This translated into an estimate of total annual use value of about \$23.74 million for natural reefs and \$3.5 million for artificial reefs. Capitalizing the annual use values, using a three percent discount rate, yields asset values of about \$651 million for the natural reefs and about \$117 million for the artificial reefs. These results are summarized in Table 6.1.3-1.

6.0 Socioeconomic Value of Reefs in Monroe County

**Table 6.1.3-1 (Residents)**  
**Estimated Use Value of Artificial and Natural Reefs off the Coast of**  
**Monroe County, Florida, 2000**

<b>Reef Type/Activity</b>	<b>Person-days (millions)</b>	<b>Annual User Value (Millions \$)</b>	<b>User Value Per Person-day (\$)</b>	<b>Asset Value at 3% (Millions \$)</b>
<b>Natural Reefs</b>	<b>2.044</b>	<b>\$23.74</b>	<b>\$9.56</b>	<b>\$651.5</b>
Snorkeling	0.743	\$6.73	\$8.37	\$207.3
Scuba Diving	0.205	\$4.96	\$12.42	\$84.9
Fishing	1.096	\$12.04	\$9.83	\$359.3
<b>Artificial Reefs</b>	<b>0.990</b>	<b>\$3.50</b>	<b>\$3.54</b>	<b>\$116.7</b>
Snorkeling	0.248	\$0.72	\$2.91	\$24.1
Scuba Diving	0.272	\$1.17	\$4.32	\$39.1
Fishing	0.470	\$1.61	\$3.42	\$53.5
<b>Natural &amp; Artificial Reefs</b>	<b>3.034</b>	<b>\$11.77</b>	<b>\$3.88</b>	<b>\$392.5</b>
Snorkeling	0.992	\$3.30	\$3.33	\$110.0
Scuba Diving	0.477	\$2.35	\$4.94	\$78.5
Fishing	1.566	\$6.12	\$3.91	\$204.0
<b>New Artificial Reefs</b>	<b>0.990</b>	<b>\$0.42</b>	<b>\$0.42</b>	<b>\$14.0</b>
Snorkeling	0.248	\$0.13	\$0.51	\$4.2
Scuba Diving	0.272	\$0.20	\$0.75	\$6.8
Fishing	0.470	\$0.09	\$0.19	\$3.0

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs including investments to deploy new artificial reefs and enhance natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs would provide a conservative or lower bound estimate of the total natural and artificial reef values.

## 6.0 Socioeconomic Value of Reefs in Monroe County

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One can see the usefulness of measuring the economic benefits of natural reef systems to policy makers in justifying public budgets for such programs. If protected, the use value for natural reefs will flow into perpetuity. Using a real discount rate of 3 percent, the capitalized value of the natural reefs off the Monroe County coast was estimated at \$651 million. Why is this important? Natural reef systems are not privately owned, but are common property resources. If a region or a nation were preparing a balance sheet showing its assets and liabilities, the asset value of the natural reef system would need to be included. This analysis provides an estimate of the capitalized value of the natural reef system, which is an asset to the residents of Monroe County. Bear in mind that this value only includes the value that reef users place on the reefs and does not include the values that non-reef-users place on the reefs or the economic contribution of the reefs. The estimation of the value of the reefs to non-reef users was not part of this study.

In addition, asset value comes into play when there is an environmental disaster such as an oil or hazardous waste spill. If the polluter destroyed for the foreseeable future 20 percent of the natural reef system off the Monroe County coastline, then the government could ask for up to \$130.2 million (i.e., 0.20 times \$651 million) in compensatory damage. An example of this problem is in the Florida Keys, where ships that destroy natural reefs are required to pay the loss of use value as a result of legal proceedings. The values provided here are quite real and useful especially in the case of environmental damage assessment.

As discussed above, the use value per person-day of artificial reef use is lower than the use value per person-day of natural reef use, as one would expect. However, preservation of the existing artificial reef system off the Monroe County coastline provides an annual use value of about \$3.5 million. Again, this is for the maintenance of these reefs. The capitalized value of the artificial reef system off the Monroe County coastline is estimated as \$117 million. If users were obstructed from getting to Monroe County's artificial reefs, an estimate of damages to the reef users would be either the annual use value lost if users are temporarily obstructed or the capitalized value if users were permanently cut-off from using the artificial reefs.

The logit model estimated for the new artificial reef program found some statistically significant differences in willingness-to-pay. Artificial reef users in Palm Beach and Broward counties had higher willingness-to-pay than those from Miami-Dade and Monroe counties. Snorkelers and scuba divers on artificial reefs had higher values than those who participated in fishing activities on artificial reefs. The only other statistically significant variable was household income. As household income levels increased so did willingness-to-pay for new artificial reefs. On a per party per day basis, the estimated values ranged from a high of \$1.97 for snorkelers and scuba divers using artificial reefs in Monroe County to a low of \$0.63 for those who participated in fishing activities on artificial reefs in Monroe County.

As with the other three programs, the estimated values per party per day were multiplied by the total party-days spent on artificial reefs by artificial reefs users in the county to get total annual use value for the county. The total annual use values were then divided by the total annual

## 6.0 Socioeconomic Value of Reefs in Monroe County

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person-days of artificial reef use in the county to get an estimate of the value per person-day. Again, this normalized value per person-day can be compared with results from other studies.

On a per person-day basis, the estimated values ranged from a low of \$0.19 for those fishing to a high of \$0.75 for those who participated in scuba diving off Monroe County. Across all activities, the average was 42 cents per person-day.

In terms of total annual use value, scuba divers have the highest value for new artificial reefs. Even though there were more fishing person-days than scuba diving person-days, the value per person-day was much higher for scuba diving than for fishing. Across all activities, the total annual user value of new artificial reefs is about \$420 thousand with an asset value of \$14 million.

The relatively low marginal willingness to pay of \$0.42 per person-day for artificial reef expansion in comparison to artificial reef maintenance discussed above is somewhat expected. If present users do not feel that congestion on artificial reefs is a problem, they would be expected to value expansion lower than maintenance of the existing artificial reefs. However, their willingness to pay anything for expansion demonstrates some level of unhappiness with the existing number of artificial reefs off the Monroe County coastline. Perhaps, residents are competing with visitors for choice spots or just getting in the way of fishing and diving when arriving at an artificial reef.

### 6.1.4 Role of “No-Take” Zones

Both the economic contribution and the use value of the reef system are based upon the management or lack thereof of these resources. There have been controversies about the wisdom of deploying, for example, artificial reefs. Opponents argue that this encourages over fishing since artificial reefs tend to concentrate fish in a smaller number of places and they become easier targets for fishers. Others find that artificial reefs serve as added habitats and thereby increase the overall biomass available to fishers. The study of artificial reefs in northwest Florida (Bell, et al., 1999) found that most people fell into the latter group believing that the pie got larger with the deployment of more reefs. However, other studies such as Bolnsack et al., (1997) and Grossman et al., (1997) report results that support opinions of opponents regarding additional artificial reef systems.

In this section, “no take” zones in the Florida Keys and other counties in southeast Florida are examined. “No-take” zones are defined as areas where reef-users can visit but nothing can be removed from an artificial or natural reef area. The existing reef system is coming under increased pressure to yield stable catch rates for fishing and a pristine environment for snorkeling and scuba diving. Also, the reefs play a vital role in the entire oceanic ecosystem by providing habitat and protection for young fish and other creatures. To provide a net benefit, it is argued that “no-take” zones would actually increase recreational benefits even though takings would be banned in certain areas.

## 6.0 Socioeconomic Value of Reefs in Monroe County

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Supporters of “no-take” zones point to the overuse of common property resources such as ocean fishing both by recreational and commercial interests. In effect, “no-take” zones would vest the property right with the government. Although the carrying capacity of a reef system is not evaluated in this study, the concept has widespread validity. This concept has been examined by many natural resource economists with the finding that congestion and declining yields of fish created a decline of use value per day.<sup>3</sup> Bell (1992) found that tourists visiting Florida would go elsewhere if fishery catch-rates declined to a certain point from the existing level. No one knows exactly where and to what degree “no-take” zones must be employed to increase the net benefit available to recreational interests. Like the deployment of artificial reefs, “no-take” zones have become a controversial issue. Therefore, as part of this study, respondents were asked for their opinion of using “no-take” zones as a management tool for artificial and natural reefs in southeast Florida.

In each of our four counties, reef-users were asked questions regarding “no-take” zones. The results for Monroe County are summarized in Table 6.1.4-1. In 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones (13.37 square miles) in which the taking of anything including fish and shellfish is prohibited. It is reasonable to believe that residents of Monroe County may have formed an opinion about this management effort and indeed, about 78 percent of the Monroe County respondents supported this experimental management effort. Because Monroe County (Florida Keys) already has a system of “no take” zones in effect, respondents were asked if they would support additional “no take” zones in their county. About 57 percent of the respondents were willing to support additional “no take” zones in Monroe County. Only 44 percent of respondents were willing to extend this concept northward through Miami-Dade, Broward and Palm Beach counties – 17 percent of the respondents did not know.

Finally, respondents were asked for their opinion regarding the percent of the reef system that should be included in “no take” zones. Targeting only natural reefs, respondents indicated, on average, they would be willing to extend this management tool to almost 32 percent of the natural reefs off the Monroe County coast. Since the average may be skewed by exceptionally large answers, the median percent of natural reefs respondents felt might be managed by the use of “no-take” zones was also reviewed. The median, or the midpoint between the highest and lowest answer, was 20 percent.

Given the short experience of the Keys “no-take” zones, it was remarkable that present reef-users would be willing to reduce their present natural reef recreational areas from 20 to 32 percent in an effort to improve the net recreational benefits. These statistics indicate a willingness to support management efforts in the direction of “no-take” zones. Such results are important to public officials responsible for managing the natural reef system off the Monroe County coast.

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<sup>3</sup> See Green (1984) and Bell (1992).

**Table 6.1.4-1 (Residents)**  
**Opinion of Monroe County Residents on "No Take" Zones for Artificial and Natural Reefs, 2000**

<b>Survey Question</b>	<b>Percentage of Respondents Answering "Yes"</b>	<b>Percentage of Respondents Answering "No"</b>	<b>Percentage of Respondents Answering "Don't Know"</b>	<b>Sample Size</b>
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
Support "NO TAKE" Zones in for some reefs in the Florida Keys	78%	18%	4%	609
Support "NO TAKE" Zones on some reefs off shore of Monroe County	57%	21%	22%	609
Support "NO TAKE" Zones on some reefs off shore of Palm Beach, Broward and Miami-Dade Counties	44%	39%	17%	609
	<b>Average for All Response</b>	<b>Median of All Responses</b>		
What Percent of Natural Reefs in Monroe County Should be Protected with "NO TAKE" Zones	32%	20%		609

## 6.0 Socioeconomic Value of Reefs in Monroe County

### 6.1.5 Demographic Information

The mail survey administered to Monroe County residents included questions regarding demographic characteristics. The reason for collecting such information was to determine what segment of the population would gain from protecting and maintaining artificial and natural reefs and/or designating “no-take” zones as discussed in the previous section. Respondents were asked to provide some background on both themselves and their boating experiences. Thus, the survey was used to collect demographic information and to develop a boater profile to better understand these people called “reef-users” in Monroe County. Table 6.1.5-1 presents the results from the mail survey combined with comparable information on the entire Monroe County population.

**Table 6.1.5-1  
Demographic Characteristics and Boater Profile of Reef-Users in  
Monroe County Florida, 2000**

Demographic Characteristics of Respondents to Mail Survey	Reef Users	Monroe County Population
<b>Median Age</b>	54	41
<b>Sex</b>		
Male	86%	51%
Female	14%	49%
<b>Race</b>		
White	94%	91%
Black/African American	1%	5%
Hispanic/Latino	7%	16%
Other	6%	5%
<b>Education <sup>1</sup></b>		
Percentage that completed College Degree or More	57%	16%
<b>Median Household Income</b>	\$56,393	\$31,922
<b>Boater Profile</b>		
Average Years of Residence in Broward County	16	N/A
Average Years of Boating in South Florida	22	N/A
Average Length of Boat Used for Saltwater Activities (ft)	24	N/A
Percentage of Respondents that belong to fishing and/or diving clubs	15%	N/A
<b>Sample Size</b>		<b>604</b>
<i>1 Latest year that educational level attained by county is available is for 1990 from the U.S. Census Bureau. Source: Florida State University and the U.S. Bureau of the Census (1990, 2000).</i>		

The owners of reef-using registered boats were significantly older than the general population of Monroe County. The median age of reef-users is 54 years compared to 41 years for the general population. Statistically speaking, there is real age difference between these two groups. Further, boating appears to be a male-dominated activity as over 86 percent of the respondents

## 6.0 Socioeconomic Value of Reefs in Monroe County

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indicated they were male compared to about 51 percent in the general population. Of course, there is no foolproof way to control who completes the survey instrument once it reaches a boat owner's residence. However, the survey is directed at the person to whom the boat was registered.

With respect to race, about 94 percent of the respondents characterized themselves as white compared to 91 percent in the general population of Monroe County.

Further, a lesser percentage characterized themselves as Hispanic/Latino (7 percent) as compared to the general population (16 percent).

Nearly 57 percent of the respondents indicated that they had at least a college degree compared to about 16 percent for the general population in 1990.<sup>4</sup> The education level of the general population is probably much higher today than ten years ago, but may not reach the levels reported by the respondents.

Since education and income are positively correlated, it is expected that the median household income reported by reef-users would be higher than the general population. This is indeed the case as confirmed by the last demographic statistic in Table 6.1.5-1 where respondents reported a median household income of nearly \$56,393 compared to \$31,922 for the general population. Of course, the purchase of a relatively large pleasure craft is also associated with higher income as found by Bell and Leeworthy (1986) and was discussed earlier in this chapter. So, this finding is not unusual.

Using the information gathered from the first section on user activity, it is estimated that a minimum of 42,497 residents engaged in reef-using recreational activities during the 12-month period from December 1999 to November 2000 in Monroe County. This number was obtained by multiplying the number of registered boats that were estimated to be involved in reef use (12,996) by the average number of residents per party (3.27 individuals). Because the turnover rate of the party is unknown, the term "minimum" is used because the same residents may not go on every boat outing. There are about 73,367 residents in Monroe County who are over 14 years of age (i.e. about that age at which they could become boaters). The boating population that uses the reef system constitutes a minimum of 17.7 percent of the county's population (12,996/73,367). The boating population that uses the reef system would probably be higher if the party turnover rate (i.e. different individuals on each boat outing) were considered. The information presented here provides some insight on what segments of the Monroe County population that are being served by artificial and natural reefs off its coast. This should be valuable information for policy makers at the local and state levels.

Finally, a boater profile for Monroe County was developed from the survey results as follows. The typical reef-using boater has lived in Monroe County for 16 years and boated for 22 years. The reef-using boaters in the sample own a pleasure craft of 24 feet in length, on average. The

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<sup>4</sup> *The U.S. Census Bureau has not yet released educational levels for counties as part of the 2000 Census.*



weighted average of registered boats 16 feet and over in Monroe County is about 25 feet so it appears that the sample is particularly reflective of the population based on average boat length. About 15 percent of the respondents were members of fishing and/or diving clubs. This indicator gives some idea of the intensity and degree of interest in recreational fishing, snorkeling and scuba diving off the coast of Monroe County, Florida.

**6.2 Visitors**

The focus of this section is the socioeconomic value of the reefs associated with visitors to Monroe County. Tourism and reef use in Monroe County takes place in the Florida Keys. As defined in Chapter 1, Introduction, visitors to a county are defined as nonresidents of the county that they are visiting. For example, a person from Broward County visiting the Florida Keys is considered to be a visitor to Monroe County. Likewise, a person from New York visiting the Florida Keys is considered to be a visitor to Monroe County.

This section provides the following values regarding visitors to Monroe County: reef user activity, economic contribution of the reefs, use value of the reefs and demographic information. Detailed explanations of the methods and data used to estimated these values for Monroe County are provided in Chapter 1: Introduction and Chapter 2: Socioeconomic Values of Reefs in Southeast Florida.

**6.2.1 User Activity**

The activity of reef users is summarized in person-days of reef use. For visitors, the number of person-trips to use the reefs is also of interest. In order to measure person-days and person-trips associated with reef use, the total number of person-trips by all visitors to Monroe County must be estimated. Total visitation includes visits to Monroe County by non-residents of Monroe County to participate in any activity be it recreation, business or family matters. The total number of person-trips by all visitors to the county was estimated using the Capacity Utilization Model. This model uses a variety of information obtained from the counties and the responses to the General Visitor Survey. The number of person-trips was then converted to the number of person-days spent by all visitors to Monroe County using information from the General Visitor Survey.

The number of person-trips taken by all visitors to Monroe County and the number of person-days these visitors spent in the county during the year 2000-2001, developed in Chapter 2, is summarized in Table 6.2.1-1.

**Table 6.2.1-1 (Visitors)  
Number of Person-Trips and Person-Days  
All Visitors to Monroe County<sup>a</sup> June 2000 to May 2001 – in millions**

<b>Measure of Visitation</b>	<b>Summer – 00</b>	<b>Winter – 01</b>	<b>Total</b>
Number of Person-Trips	1.51	1.60	3.11
Number of Person-Days	5.54	6.59	12.13

<sup>a</sup> Includes cruise ship passengers who disembark at Key West for day trip.

Note: Summer 2000 is from June 2000 to November 2000. Winter 2001 is from December 2000 to May 2001.

## 6.0 Socioeconomic Value of Reefs in Monroe County

Visitors took 3.1 million person-trips to Monroe County from June 2000 to May 2001 and spent 12.1 million person-days in the county.

The number of person-trips by all visitors was used as the basis for estimating the number of person-days visitors spent using the artificial and natural reefs in each county. For each season, the number of boating person-trips is equal to the total number of person-trips by all visitors times the proportion of person-trips taken by visitors who participated in saltwater boating in the county in the past twelve months. This proportion was taken from the General Visitor Survey answer to Question 13 (Which activities and boating modes did you participate in over the past 12 months in this county?). The proportion is equal to the number of respondents who participated in at least one boating activity divided by the total number of respondents to the General Visitor Survey.

To get the number of boating person-trips when the person used the reefs, the number of boating person-trips is multiplied by the proportion of boating person-trips when the respondent used the reefs. This proportion was obtained from the Visitor Boater Screening Tally sheets. These sheets indicated the proportion of boaters intercepted who used the reefs at least once in the past 12 months. The results for the summer, winter and the year are summarized in Tables 6.2.1-2.

**Table 6.2.1-2 (Visitors)  
Person-Trips of Visitors Who Boated  
And Visitors Who Used the Reefs in Monroe County Over the Past 12 Months**

Season	Total Person Trips to County - All Visitors	Proportion of Person Trips Taken By Visitors Who Boated <sup>a</sup>	Boating Person Trips	Proportion of Boating Person Trips When the Reef was Used for Recreation <sup>b</sup>	Boating Person Trips When the Reef was Used for Recreation
Summer - June 2000 to Nov. 2001	1,513,099	0.33	502,031	0.90	450,077
Winter – December 2000 to May 2001	1,596,298	0.26	413,226	0.90	370,462
Year Round - June 2000 to May 2001	3,109,397		915,257		820,539

<sup>a</sup> Saltwater Boating Only. From General Visitor Survey answer to Question 13 (Which activities\_modes did you participate in over the past 12 months in this county). The proportion is equal to the number of respondents who participated in at least one boating activity divided by the total number of respondents to the General Visitor Survey.

<sup>b</sup> From the Visitor Boater Tally Sheets:  $= 1 - (Q6/(Q6+Q7+Q8+Q10))$

Of the 3.1 million person-trips visitors took to Monroe County from June 2000 to May 2001, 33 percent of the trips involved saltwater boating activities in the summer and 26 percent involved saltwater boating activities in the winter. Of the resulting 915,000 boating person-trips by visitors to Monroe County, 90 percent of those trips involved recreational reef use. Thus,

## 6.0 Socioeconomic Value of Reefs in Monroe County

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visitors who used the reefs for recreation in Monroe County made about 821,000 person-trips to the county from June 2000 to May 2001.

Next, the total number of person-days that visitor boaters who used the reefs spent visiting the county was estimated. This estimate is the total boating person-trips when reefs were used times the average days per visit by boaters who used the reefs. The average days per visit by boaters who used the reefs was obtained from Question 10 of the Visitor Boater Survey (How many nights are you spending on this trip?) where a 1 was added to each of the responses to convert number of nights to number of days. The average number of days and the total person-days reef users spent in Monroe County in 2000-2001 are provided in Table 6.2.1-3.

**Table 6.2.1-3 (Visitors)  
Average Number of Days Visiting Monroe County  
And Total Person Days in Monroe County  
By Visitor Boaters Who Used the Reefs  
June 2000 to May 2001**

<b>County</b>	<b>Average Days Visiting the County Per Trip</b>	<b>Total Person Days Spent Visiting the County</b>
Monroe	8.39	6,887,497

Reef-using boaters who visited Monroe County spent an average of 8.39 days in the county during their trip. As a result, these visitors spent 6.9 million person-days in Monroe County from June 2000 to May 2001.

To allocate the total person-days spent visiting the county to actual days using the artificial and natural reefs, the daily participation rates of the different boating activities were calculated using the responses to Questions 12, 15, 16 and 17 of the Visitor Boater Survey. Participation rate is the proportion of total days that respondents spent in the county in the last 12 months when the respondent actually participated in a saltwater activity and boat mode. It represents the probability that a visitor boater who uses the reefs will participate in a particular saltwater boating activity and boating mode on any given day.

Question 12 asked the respondent to examine a list of saltwater boating activities and boat modes and read the number corresponding to the activity-boat mode that he/she or someone in his/her party participated in over the past 12 months. The saltwater activity-boat mode list is provided in Appendix B with the Visitor Boater Survey. Question 13 asked if the respondent participated in the activity and boating mode. Question 15 asked how many days in the past 12 months that the respondent participated in the activity-boat mode. From the responses to these questions, the proportions of total visiting days respondents actually spent participating in the activity-boat mode were obtained.

To allocate the total number of days in an activity-boat mode to the use of artificial reefs versus natural reefs versus no reefs, the proportion of fishing days and the proportion of dives spent on

## 6.0 Socioeconomic Value of Reefs in Monroe County

each reef/no reef was calculated from the Visitor Boater Survey responses. Question 16 asked the respondent how many days he/she spent on the artificial reef and Question 17 asked the respondent how many days he/she spent on the natural reef. For scuba divers and snorkelers, Question 18 asked for the total number of dives and Questions 19 and 20 asked for the number of dives on artificial versus natural reefs. A dive is defined as exiting and reentering the boat and applies to both divers and snorkelers. From the responses to these questions, the proportions of fishing days spent on the artificial and natural reefs and the proportions of dives spent on the artificial and natural reefs were obtained.

The proportion of visitor days that visitor boaters who use the reefs participated in fishing and diving/snorkeling and the proportion of fishing days and scuba/snorkeling dives that visitor boaters spent on the artificial, natural and no reefs for Monroe County are presented in Table 6.2.1-4.

**Table 6.2.1-4 (Visitors)**  
**Saltwater Recreational Activities from All Boating Modes**  
**Percent of Visitor Person-Days That Reef-Using Boaters**  
**Participated in the Saltwater Recreation Activity**  
**And Percent of Fishing Days or Dives Spent on Artificial, Natural and No Reefs**  
**From Visitor Boater Survey**  
**Monroe County**

Activity	Total Respondents	Percent of All Visitor Days	Percent of Activity Days or Dives On:			
			Artificial Reefs	Natural Reefs	No Reefs	Sum of Percentages
Fishing <sup>a</sup>	1,392	26%	20%	40%	40%	100%
Scuba Diving/Snorkeling <sup>b</sup>	1,392	17%	16%	80%	4%	100%

<sup>a</sup> Percent of fishing days on each reef type is reported.  
<sup>b</sup> Percent of dives on each reef type is reported. A dive is a boat exit and re-entry.  
Note: Boating Modes are Charter, Party, Rental, and Private (Own or Friend's) Boat.

Visitor boaters who came to Monroe County to use the reefs spent 26 percent of their visiting days participating in saltwater fishing from either a charter, party, rental or private boat. Of these fishing days, 20 percent of days were spent fishing near artificial reefs, 40 percent of days were spent fishing near natural reefs and 40 percent of days were spent fishing near no reefs. Also, visitor boaters who came to the county to use the reefs spent 17 percent of their visiting days scuba diving or snorkeling. Of these diving/snorkeling days, 16 percent of dives were spent on artificial reefs, 80 percent of dives were spent on natural reefs, and 4 percent of dives were spent on no reefs.

The number of person-days spent in each saltwater boating activity-boat mode was estimated as the total person-days reef-using boaters spent visiting the county in year 2000-2001 (from Table 6.2.1-3) times the proportion visitor days that these visitors spent participating in each activity-

## 6.0 Socioeconomic Value of Reefs in Monroe County

boat mode. Then the number of person-days spent in each saltwater boating activity-boat mode was allocated to artificial and natural reefs based on either the proportion of days or the proportion of dives spent in that activity-boat mode on or near artificial versus natural reefs. Proportion of days was used for all activities except scuba diving and snorkeling where the proportion of dives was used to provide a more accurate indicator of reef use.

A summary of the total person-days visitors spent participating in reef-related recreation by type of activity and by type of reef in Monroe County is provided in Table 6.2.1-5. The total person-days visitors spent participating in each saltwater activity and boat mode by type of reef is provided in Table 6.2.1-6.

Visitors to Monroe County spent about 2.1 million person-days on the reef system from June 2000 to May 2001. About 478 thousand of these days were spent on artificial reefs and about 1.6 million of these days were spent on natural reefs.

**Table 6.2.1-5 (Visitors)  
Number of Person-Days Spent Using Artificial and Natural Reefs  
By Recreation Activity – Monroe County**

Activity	Number of Person-Days		
	Artificial Reefs	Natural Reefs	All Reefs
Snorkeling	121,778	641,218	762,996
Scuba Diving	75,632	282,336	357,967
Fishing	277,349	603,549	880,899
Glass Bottom Boat Sightseeing	3,636	71,363	75,000
<b>Total</b>	<b>478,395</b>	<b>1,598,467</b>	<b>2,076,862</b>

### 6.2.2 Economic Contribution – Visitors

The Visitor Boater Survey asked respondents how much money they and members of their party spent on their last day that they participated in fishing, scuba diving and snorkeling in the county. The respondent was also asked how many people spent or benefited from those expenditures. The respondent was asked only to provide the amount of money spent in the county of interview. From this information, a picture of the average itemized expenditures per person per fishing or diving day and by boating mode was estimated.

The average itemized per person expenditures by those who participated in each activity and boat mode in Monroe County are provided in Table 6.2.2-1. Monroe County reef-using visitors who went saltwater fishing on their own boat, a friend's boat or a rental boat spent, on average, \$157 per person per day on the day that they went fishing. This amount is comprised of \$28 for boat fuel, \$21 for lodging, \$11 in camping fees, \$21 for food and beverages at stores and \$22 for food and beverages at restaurants and bars and \$17 for shopping, among other items.

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**Table 6.2.1-6 (Visitors)**  
**Number of Person-Days Visitors Spent Participating in**  
**Saltwater Boating Activities and Reef Use - June 2000 to May 2001**  
**Monroe County (Florida Keys)**

Activity	Boat Mode	Number of Person Days	Number of Person-Days On:		
			Artificial Reefs	Natural Reefs	No Reefs
Snorkeling	Charter/Party	269,479	13,413	250,701	5,365
	Rental	65,315	8,476	56,590	249
	Private	465,424	99,889	333,928	31,607
Scuba Diving	Charter/Party	119,816	17,678	99,738	2,401
	Rental	18,600	1,898	16,702	0
	Private	222,331	56,056	165,896	379
Fishing – Offshore / Trolling	Charter	93,863	4,779	41,190	47,894
	Party	110,300	5,616	48,403	56,281
	Rental	35,902	10,097	21,317	4,488
	Private	618,547	119,763	215,028	283,756
Fishing – Flats or Back Country	Charter/Party	18,167	0	0	18,167
	Rental	9,084	0	0	9,084
	Private	305,380	62,694	95,052	147,634
Fishing Bottom	Charter	21,195	1,079	9,301	10,815
	Party	24,223	1,233	10,630	12,360
	Rental	15,572	4,152	7,786	3,633
	Private	467,587	67,935	154,842	244,810
Viewing Nature and Wildlife	Glass Bottom Boat	80,454	3,636	71,363	5,455
	Back Country Excursion	15,572	0	0	15,572
	Rental	50,608	0	0	50,608
	Private	309,273	0	0	309,273
Personal Watercraft (jet skis, wave runners, etc.)	Rental	31,576	0	0	31,576
	Private	154,420	0	0	154,420
Sailing	Charter/Party	12,111	0	0	12,111
	Rental	3,028	0	0	3,028
	Private	18,167	0	0	18,167
Other Boating Activities	Charter/Party	17,735	0	0	17,735
	Rental	2,595	0	0	2,595
	Private	134,091	0	0	134,091
<b>Total Person-Days</b>		<b>3,710,416</b>	<b>478,394</b>	<b>1,598,467</b>	<b>1,633,554</b>

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**Table 6.2.2-1 (Visitors)**  
**Amount of Money Spent in County Per Person During Most Recent Day**  
**Participating in Each Reef-Related Activity and Boating Mode**  
**Monroe County**  
**From Visitor Boater Survey Responses – 2000 Dollars**

Item	Amount Spent Per Person-Day <sup>a</sup>				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat <sup>b</sup>	Charter Boat	Party Boat	Own, Friend's or Rental Boat	Charter or Party Boat
Charter / Party Boat Fee		\$95.17	\$40.88		\$44.33
Boat Rental				\$8.03	
Boat Fuel	\$27.51			\$12.70	
Air Refills				\$1.46	\$1.66
Tackle	\$6.85				
Bait	\$5.71				
Ice	\$3.86			\$2.74	\$0.17
Ramp Fees	\$1.09			\$1.26	\$0.00
Marina Fees	\$6.34			\$3.48	\$2.06
Lodging	\$21.12	\$49.59	\$38.67	\$36.67	\$42.46
Camping Fees	\$10.76	\$11.57	\$2.96	\$11.43	\$4.92
Food and Beverages - Stores	\$21.31	\$17.51	\$13.08	\$18.82	\$11.75
Food and Beverages - Restaurants/Bars	\$22.21	\$58.88	\$32.56	\$22.50	\$30.68
Auto Gas	\$8.21	\$6.63	\$3.56	\$7.21	\$4.55
Auto Rental	\$2.83	\$14.80	\$4.49	\$4.47	\$8.52
Equipment Rental	\$2.08	\$1.18	\$0.63	\$0.44	\$2.69
Shopping	\$16.68	\$29.68	\$30.73	\$11.03	\$19.11
<b>Total</b>	<b>\$156.57</b>	<b>\$284.99</b>	<b>\$167.57</b>	<b>\$142.23</b>	<b>\$172.89</b>
Number of Respondents	368	126	171	342	544
Number of Respondents and Party Members <sup>c</sup>	1,468	394	484	1,463	1,888

<sup>a</sup> Expenditures per person per day were estimated from the responses to the Visitor Boater Survey. For each Activity\_Mode, the expenditures for each item were summed over all the respondents who participated in the Activity\_Mode. This sum was divided by the total number of respondents and party members who spent or benefited from the expenditures.

<sup>b</sup> Boat rental is included under Equipment Rental.

<sup>c</sup> The number of persons used to calculate the average expenditure per person for a specific item will be up to two percent lower than the number of respondents and party members due to the incidents of "don't knows" for a specific item. "Don't know" answers and the associated number of persons in the party were excluded from the calculation of expenditures per person for a specific expenditure item.

## 6.0 Socioeconomic Value of Reefs in Monroe County

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The average expenditure of persons who fished on charter boats was \$285 per person per day. About \$95 was the cost of the charter boat while \$50 was spent on lodging, \$12 was spent in camping fees, \$18 was spent on food and beverages at stores, \$59 was spent on food and beverages at restaurants and bars, \$15 was spent on auto rental, and \$30 was spent on shopping.

Persons who fished on party boats spent, on average, \$168 per person on the day they went fishing which included \$41 for the party boat fee, \$39 for lodging, \$13 for food and beverages at stores, \$33 for food and beverages at restaurants and bars, and \$31 for shopping.

Monroe County reef-using visitors who went scuba diving or snorkeling on their own boat, a friend's boat or a rental boat spent, on average, \$142 per person per day on the day they went diving. This amount is comprised of \$13 for boat fuel, \$37 for lodging, \$11 for camping fees, \$19 for food and beverages at stores and \$23 for food and beverages at restaurants and bars.

Visitors who went diving on charter or party boats spent, on average, \$173 per person per day. This expenditure was comprised of \$44 per day for the dive charter or party boat, \$42 per day for lodging, \$5 per day for camping fees, \$12 per day for food and beverages at stores, \$31 per day for food and beverages in restaurants and bars and \$19 for shopping, among other items.

The expenditures per person per day were multiplied by the number of person-days by boating mode and reef type to obtain an estimate of the total expenditures associated with reef related activities. The itemized total expenditures associated with reef use in Monroe County in 2000-2001 are provided in Table 6.2.2-2. The expenditures associated with glass bottom boating days only included the fee per person per ride (\$20). The other expenditures associated with the entire day spent in the county were not included for glass bottom boat riders because these visitors are likely in the county for other reasons either not reef-related or included in the other reef-related recreational activities.

Visitors who used the reefs in Monroe County spent \$319 million on reef-related expenditures. Of this amount \$73 million was associated with artificial reef-related expenditures and \$245 million was associated with natural reef-related expenditures.

The reef-related visitor expenditures were then used to estimate the economic contribution of artificial and natural reefs to each of the counties. As discussed in the Introduction of the Report, 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 re-spent 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.



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**Table 6.2.2-2 (Visitors)**  
**Total Visitor Expenditures In Monroe County Associated with Reef Use**  
**All Reef-Related Activities and Boating Modes**  
**June 2000 to May 2001 – In 2000 dollars**

<b>Item</b>	<b>Artificial Reef</b>	<b>Natural Reef</b>	<b>Total</b>
Total Number of Person Days	478,395	1,598,467	2,076,862
Charter / Party Boat Fee	\$2,215,748	\$22,752,503	\$24,968,251
Boat Rental	1,335,356	4,601,477	5,936,833
Boat Fuel	9,391,142	20,866,226	30,257,368
Air Refills	294,492	1,417,735	1,712,226
Tackle	1,812,737	3,383,970	5,196,707
Bait	1,510,516	2,819,792	4,330,308
Ice	1,483,748	3,539,523	5,023,271
Ramp Fees	498,254	1,261,038	1,759,293
Marina Fees	2,321,536	5,850,565	8,172,101
Lodging	13,562,993	51,114,784	64,677,777
Camping Fees	4,989,991	14,348,964	19,338,955
Food and Beverages - Stores	9,326,234	27,085,778	36,412,012
Food and Beverages - Restaurants/Bars	11,142,883	39,515,821	50,658,705
Auto Gas	3,575,394	10,323,454	13,898,848
Auto Rental	1,875,831	7,959,339	9,835,170
Equipment Rental	718,651	2,319,993	3,038,643
Shopping	7,228,354	24,573,805	31,802,159
Glass Bottom Boat Ride	72,727	1,427,269	1,499,996
<b>Total</b>	<b>\$73,356,586</b>	<b>\$245,162,036</b>	<b>\$318,518,623</b>

While the IMPLAN Regional Input-Output Model was used to estimate economic contribution associated with the reef-related expenditures, for Monroe County, a different approach was used. This was due to concern that the IMPLAN model does not adequately capture the unique economy of this county. Relative to other counties in the nation, this economy is very dependent on imports and heavily dependent on one industry, tourism. Therefore, the approach used in Leeworthy (1996) was used. This approach utilized several ratios on economic measures for Monroe County derived from data published by the U.S. Census (1997 Economic Census) and the Bureau of Economic Analysis. The analysis then utilized sales, income, and employment multipliers taken from a recent Monroe County economic study (Leeworthy, 1996) to estimate total (direct, indirect and induced) contributions to sales, income and employment from visitor expenditures associated with reef related activities. This method provides estimates of total direct, indirect and induced economic contributions for Monroe County and cannot provide a breakdown of direct versus indirect versus induced effects.

## 6.0 Socioeconomic Value of Reefs in Monroe County

The economic contribution of the reefs to Monroe County is provided in Table 6.2.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. Income is the money that stays in the county's economy. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

**Table 6.2.2-3 (Visitors)**  
**Economic Contribution of Reef-Related Expenditures by Visitors to Monroe County**  
**Economic Area is Monroe County**  
**June 2000 to May 2001 – In 2000 dollars**

	<b>Artificial Reefs</b>	<b>Natural Reefs</b>	<b>Total</b>
Total Sales	\$82,159,376	\$274,581,481	\$356,740,857
Total Income	\$26,695,085	\$94,168,665	\$120,863,750
Total Employment	1,916	6,737	8,653

Reef-related expenditures by visitors to Monroe County during the period June 2000 to May 2001 resulted in \$357 million in sales to county businesses. These sales generated \$121 million in income and 8,700 jobs. About 22 percent of these values were the result of artificial reef-related expenditures and 78 percent of these values were the result of natural reef-related expenditures.

### 6.2.3 Use Value

Use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. In this study, four types of use values were estimated: (1) the value to natural reef users of maintaining the natural reefs in their existing condition; (2) the value to artificial reef users of maintaining the artificial reefs in their existing condition; (3) the value to all reef users of maintaining artificial and natural reefs in their existing condition; and (4) the value to artificial reef users of adding and maintaining additional artificial reefs. Use value is presented in terms of per person per day of reef use and in aggregate for all users of the reef system.

The visitor reef-user values associated with maintaining the reefs in their existing conditions is provided in Table 6.2.3-1. Use value per person day means the value per person day of artificial, natural or all reef use, as specified in the table. The respondent was asked to state yes, no or don't know to a specified payment to maintain the artificial reefs, the natural reefs and a combined program that would protect both types of reefs. The scenario provided to the respondent was as follows.

“Local and state government agencies are considering different approaches to maintaining the health and condition of the natural and artificial reefs in southeast

## 6.0 Socioeconomic Value of Reefs in Monroe County

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Florida. One plan focuses on providing greater protection for natural reefs by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the artificial reefs by maintaining water quality, limiting damage to artificial reefs from anchoring and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both or none of these plans and if you would be willing to incur higher costs to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on you ability to participate in any boating activity or other recreation in southeast Florida.”

Then the respondent was asked a yes or no question regarding the natural reef plan, the artificial reef plan and both plans. For example, the question regarding both plans read: “Suppose that both of the above plans to maintain the natural and artificial reefs in southeast Florida were put together in a combined program. Consider once again your total trip cost for your last trip to use the reefs in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you be willing to pay this amount to maintain the artificial and natural reefs?”

The amounts (bid values) of \$20, \$100, \$200, \$1,000, and \$2,000 were rotated from respondent to respondent. For the individual programs (just natural or artificial reef protection), the amounts were one-half of the above amounts: \$10, \$50, \$100, \$500 and \$1,000.

**Table 6.2.3-1 (Visitors)  
Annual Value of Reefs To Reef Users and Capitalized Value  
Data Represents June 2000 to May 2001  
Visitor Reef-Users in Monroe County**

<b>Item</b>	<b>All Reefs – Artificial and Natural</b>	<b>Artificial Reefs</b>	<b>Natural Reefs</b>
Number of Person-Days of Reef Use	2,076,862	478,395	1,598,467
Use Value Per Person-Day (\$2000)	\$17.19	\$12.23	\$22.35
Annual Use Value - (\$2000)	\$38,673,282	\$5,851,199	\$35,719,677
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$1,289,109,400	\$195,039,967	\$1,190,655,900

Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey<sup>5</sup>: “Suppose that both of the above plans to maintain the natural and artificial reefs

<sup>5</sup> For a complete description of the contingent valuation questions, please refer to the Visitor Boater Survey and the Blue Card (which is white in this report but labeled “Blue Card” in Appendix B.

## 6.0 Socioeconomic Value of Reefs in Monroe County

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in southeast Florida were put together into a combined program...If your total costs for this trip would have been \$\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs.” Values for artificial reefs were taken from statistical analysis of responses to Question 36 pertaining only to a program to maintain the existing artificial reefs in their current condition. Values for natural reefs were taken from statistical analysis of responses to Question 34 pertaining only to a program to maintain the natural reefs in their current condition.

Chapter 2.2.2 provides a general description of the procedures used to analyze the data and the procedures used to estimate the user values presented here. For a more technical discussion, please see the Technical Appendix to this document which is a separate report. The Technical Appendix describes the methods used to derive the values presented here and provides alternative estimates using different methods. Here we present only the estimates of total annual use value, use value per person-day, and the asset value of the reefs derived using the logit model.

The estimated use values are consistent with the idea that natural reefs are preferred to artificial reefs. For Monroe County visitors, the average use value per person-day of natural reef use was \$22.35 versus \$12.23 for artificial reef use. Total use is also higher for natural versus artificial reefs. Monroe County visitors’ natural reef use was almost 1.6 million person-days versus 478 thousand person-days for artificial reefs. This translated into an estimate of total annual use value of \$35.7 million for natural reefs and \$5.9 million for artificial reefs. Capitalizing the annual use values, using a three percent interest rate, yields asset values of about \$1.2 billion for the natural reefs and \$195 million for the artificial reefs.

Annual use value represents the annual flow of total use value (i.e., the recreational benefits) to the reef-using public. From a public policy point of view, government spends money on the protection and management of the valuable resources of the natural and artificial reefs including investments to deploy new artificial reefs and enhance natural reefs. In addition, government entities incur variable costs each year to support marine patrol, biologists, planners and even contracts with economists to help carry out the mission of protecting the existing reef system. These costs can be compared with the annual flow of total use value of the reef to determine if this is indeed a wise investment.

The question combining the natural and artificial reef programs yielded estimates of value lower than that derived by adding-up the values of the natural and artificial reef programs separately. However, for Broward County residents this difference was not significant. This result is consistent with past research. Some respondents are not willing to pay the sum of the values of the individual programs to finance the combined programs. This is largely due to the income constraints as higher bid values are provided to the respondents under the combined programs. The value of the combined programs provide a conservative or lower bound estimate of the total natural and artificial reef values.

## 6.0 Socioeconomic Value of Reefs in Monroe County

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The capitalized value of reef use value is the present value of the annual values calculated at three percent discount rate. It represents the “stock” value analogous to land market values. The capitalized visitor reef user value associated with Monroe County reefs, both artificial and natural, is \$1.3 billion. Bear in mind that this value only includes the value that visitor reef users place on the reefs and does not include the values that resident reef users and non-reef-users place on the reefs or the economic contribution of the reefs. The estimation of the value of reefs to non-reef users was not part of this study.

Reef users’ willingness to pay to invest in and maintain “new” artificial reefs is provided in Table 6.2.3-2. The use value per person-day is the value per day or a portion of a day of artificial reef use. In Monroe County, reef users are willing to pay \$1.7 million annually for this program in Monroe County.

**Table 6.2.3-2 (Visitors)  
Estimated Use Value of Investing in and Maintaining  
"New" Artificial Reefs in the County  
Visitor Reef-Users in Monroe County**

Item	Value
Number of Person-Days of Artificial Reef Use	478,395
Use Value Per Person-Day for "New" Artificial Reefs (\$2000)	\$3.60
Annual Use Values for "New" Artificial Reefs	\$1,724,324
Capitalized Value @ 3 percent Discount Rate (\$2000)	\$57,477,467
<i>Note: Use value per person-day is the use value per whole day or portion of a day of artificial reef use.</i>	

The value of reefs by reef type and activity type for Monroe County is provided in Table 6.2.3-3.

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**Table 6.2.3-3 (Visitors)**  
**Value of Reefs to Visitors to Monroe County, by Reef Type and Activity, 2000-2001**

<b>Reef Type/Activity</b>	<b>Person-Days</b>	<b>Annual User Value (\$)</b>	<b>User Value Per Person-Day (\$)</b>
<b>Natural Reefs</b>	<b>1,598,467</b>	<b>\$35,719,677</b>	<b>\$22.35</b>
Snorkeling	641,218	\$17,428,710	\$27.18
Scuba Diving	282,336	\$5,854,637	\$20.74
Fishing	603,549	\$10,479,512	\$17.36
Glass Bottom Boats	71,363	\$1,956,818	\$27.42
<b>Artificial Reefs</b>	<b>478,395</b>	<b>\$5,851,199</b>	<b>\$12.23</b>
Snorkeling	121,778	\$1,755,307	\$14.41
Scuba Diving	75,632	\$751,366	\$9.93
Fishing	277,349	\$3,290,720	\$11.86
Glass Bottom Boats	3,636	\$53,807	\$14.80
<b>Natural &amp; Artificial Reefs</b>	<b>2,076,862</b>	<b>\$38,673,282</b>	<b>\$18.62</b>
Snorkeling	762,996	\$15,397,007	\$20.18
Scuba Diving	357,967	\$6,445,422	\$18.01
Fishing	880,899	\$15,141,356	\$17.19
Glass Bottom Boats	75,000	\$1,689,496	\$22.53
<b>New Artificial Reefs</b>	<b>478,395</b>	<b>\$1,724,324</b>	<b>\$3.60</b>
Snorkeling	121,778	\$356,746	\$2.93
Scuba Diving	75,632	\$425,167	\$5.62
Fishing	277,349	\$923,763	\$3.33
Glass Bottom Boats	3,636	\$18,648	\$5.13

**6.2.4 Demographic Information**

The Visitor Boater Survey asked the respondent questions regarding his/her socioeconomic characteristics so that a picture of the typical reef user could be developed. The results for Monroe County are summarized in Table 6.2.4-1.

**Table 6.2.4-1 (Visitors)  
Demographic Characteristics of Visitor Reef-Users in Monroe County, 2000**

<b>Characteristic</b>	<b>Value</b>
Median Age of Respondent – Years	44
Sex of Respondent	
Male	70%
Female	30%
Race of Respondent	
White	95%
Black	2%
Other	3%
Percent Hispanic / Latino	8%
Median Household Income	\$87,500
Average Years Boating in Southeast Florida	7.4
Average Length of Own Boat Used in Saltwater Boating in Feet	22
Percent of Respondents Who Belong to Fishing and/or Diving Clubs	11%

### **6.3 Total – Residents and Visitors**

This section summarizes the user activities, economic contribution and use values associated with the artificial and natural reefs for both residents and visitors of Monroe County. Demographic information of both resident and visitor reef users is also provided.

#### **6.3.1 User Activity**

The numbers of person-days spent using the reefs in Monroe County by reef type and population (residents and visitors) are summarized in Table 6.3.1-1. Visitors and residents spent 5.1 million person-days using artificial and natural reefs in Monroe County during the 12-month period from June 2000 to May 2001. Residents spent 3.0 million person-days and visitors spent 2.1 million person-days. Reef users spent 1.5 million person-days using artificial reefs and 3.6 million person-days using natural reefs. A summary of reef use by type of activity is provided in Table 6.3.1-2.

**Table 6.3.1-1  
Number of Person-Days Spent on Artificial and  
Natural Reefs in Monroe County  
Residents and Visitors – in millions**

<b>Population</b>	<b>Artificial Reefs</b>	<b>Natural Reefs</b>	<b>All Reefs</b>
Residents	0.99	2.04	3.03
Visitors	0.48	1.60	2.08
Total	1.47	3.64	5.11

**Table 6.3.1-2  
Number of Person-Days Spent Using Reefs in Monroe County  
By Recreational Activity  
Residents and Visitors – in millions**

<b>Activity</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Snorkeling	0.99	0.76	1.75
Scuba Diving	1.57	0.36	1.93
Fishing	0.48	0.88	1.36
Glass Bottom Boat	-	0.075	0.075
Total	3.04	2.08	5.11

*Note: Residents were not asked about their use of glass-bottom boats.*

Reef diving and reef fishing are equally common in Monroe County. Snorkeling is more common than scuba diving. Fishing comprises 1.36 million person-days while scuba diving and snorkeling comprise 1.93 million person-days and 1.75 million person-days, respectively. Resident reef-related recreation comprises 60 percent of total reef-related recreation by residents and visitors in Monroe County. Residents spend significantly more days scuba diving than do visitors.

### **6.3.2 Economic Contribution**

The total economic contribution of the reefs to Monroe County includes the contribution of reef expenditures to sales, income and employment. 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 visitor expenditures create multiplier effects wherein additional income and employment is created as the income earned by the reef-related industries is re-spent 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.



## 6.0 Socioeconomic Value of Reefs in Monroe County

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.

The economic contributions of the artificial, natural and all reefs to Monroe County are provided in Tables 6.3.2-1 through 6.3.2-3. The sales contribution is defined as the value of the additional output produced in the county due to the reef-related expenditures. The total income contribution is defined as the sum of employee compensation, proprietor's income, interest, rents, and profits generated as a result of the reef-related expenditures. The employment contribution is the number of full-time and part-time jobs created due to the reef-related expenditures.

Reef-related expenditures in Monroe County generated \$489 million in sales during the 12-month period from June 2000 to May 2001. These sales resulted in \$138 million in income to Monroe County residents and provided 9,800 jobs in Monroe County. Artificial reef-related expenditures accounted for 24 percent of the economic contribution of all reefs and natural reef-related expenditures accounted for 76 percent of the economic contribution.

**Table 6.3.2-1  
Economic Contribution of Artificial Reef-Related Expenditures  
to Monroe County  
June 2000 to May 2001 – In 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$44,300,000	\$5,800,000	403
Visitor <sup>d</sup>	\$73,356,586	\$26,700,000	1,916
Total	\$117,656,586	\$32,500,000	2,319
Indirect <sup>d</sup>	\$8,802,790		
Induced			
Total	\$126,459,376	\$32,500,000	2,319

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.  
<sup>d</sup> For sales, both the indirect and induced contribution are included under indirect. For income and employment, the direct, indirect and induced contributions are included under direct.

**Table 6.3.2-2  
Economic Contribution of Natural Reef-Related Expenditures  
to Monroe County  
June 2000 to May 2001 – In 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$88,000,000	\$11,400,000	792
Visitor <sup>d</sup>	\$245,162,036	\$94,200,000	6,737
Total	\$333,162,036	\$105,600,000	7,529
Indirect <sup>d</sup>	\$29,419,445		
Induced			
Total	\$362,581,481	\$105,600,000	7,529

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs.  
<sup>d</sup> For sales, both the indirect and induced contribution are included under indirect. For income and employment, the direct, indirect and induced contributions are included under direct.

**Table 6.3.2-3  
Economic Contribution of All Reef-Related Expenditures  
to Monroe County  
June 2000 to May 2001 – In 2000 dollars**

Round of Spending	Contribution to:		
	Sales	Income <sup>b</sup>	Employment <sup>c</sup>
Direct <sup>a</sup>			
Resident	\$132,300,000	\$17,200,000	1,195
Visitor <sup>d</sup>	\$318,518,622	\$120,900,000	8,653
Total	\$450,818,622	\$138,100,000	9,848
Indirect <sup>d</sup>	\$38,222,235	\$0	0
Induced		\$0	0
Total	\$489,040,857	\$138,100,000	9,848

<sup>a</sup> The direct contribution is the actual expenditures made in the county.  
<sup>b</sup> Total income includes employee compensation, proprietor's income, interest, rents and profits  
<sup>c</sup> Employment includes the number of full-time and part-time jobs  
<sup>d</sup> For sales, both the indirect and induced contribution are included under indirect. For income and employment, the direct, indirect and induced contributions are included under direct.

**6.3.3 Use Value**

In this study, three types of use values were estimated: (1) the value of maintaining the natural reefs in their existing condition; (2) the value of maintaining the artificial reefs in their existing condition and (3) the value of adding and maintaining additional artificial reefs. In general, use value is the maximum amount of money that reef users are willing to pay to maintain the reefs in their existing condition and to add more artificial reefs to the system. Use value is measured in terms of per person per day of reef use and in aggregate for all users of the reef system.

The annual value Monroe County visitors and residents place on protecting the reefs in their existing condition and the associated capitalized value is presented in Table 6.3.3-1. The annual value visitor and resident reef-users place on investing in and maintaining “new” artificial reefs is presented in Table 6.3.3-2. These values were explained in Sections 6.1.3 and 6.2.3.

**Table 6.3.3-1  
Annual Use Value Associated with Protecting Reefs in their Existing Condition and  
Capitalized Value associated With Reef Use  
Data Represents June 2000 to May 2001  
Monroe County, Florida**

<b>Item</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
<b>All Reefs - Artificial and Natural</b>			
Number of Person-Days of Reef Use (millions)	3.03	2.08	<b>5.11</b>
Use Value Per Person-Day	\$3.88	\$17.19	<b>\$9.87</b>
Annual Use Value - (million dollars)	\$11.77	\$38.67	<b>\$50.44</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$390	\$1,289	<b>\$1,679</b>
<b>Artificial Reefs</b>			
Number of Person-Days of Reef Use (millions)	0.99	0.48	<b>1.47</b>
Use Value Per Person-Day	\$3.54	\$12.23	<b>\$6.36</b>
Annual Use Value - (million dollars)	\$3.50	\$5.85	<b>\$9.35</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$116.7	\$195.0	<b>\$311.7</b>
<b>Natural Reefs</b>			
Number of Person-Days of Reef Use (millions)	2.04	1.60	<b>3.64</b>
Use Value Per Person-Day	\$9.56	\$22.35	<b>\$16.34</b>
Annual Use Value - (million dollars)	\$23.74	\$35.72	<b>\$59.46</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$651	\$1,191	<b>\$1,842</b>

**Table 6.3.3-2  
Estimated Value to Reef Users From Investing in and  
Maintaining "New" Artificial Reefs  
Monroe County, Florida**

<b>Item</b>	<b>Residents</b>	<b>Visitors</b>	<b>Total</b>
Number of Person-Days of Artificial Reef Use (millions)	0.99	0.48	<b>1.47</b>
Use Value Per Person-Day for "New" Artificial Reefs	\$0.42	\$3.60	<b>\$1.46</b>
Annual Use Values for "New" Artificial Reefs (million dollars)	\$0.42	\$1.72	<b>\$2.14</b>
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$14.0	\$57.5	<b>\$71.5</b>

**6.3.4 Demographic Information**

This section summarizes and compares the demographic characteristics of visitor and resident reef users. These characteristics were obtained from the resident boater survey and the visitor boater survey. They are summarized in Tables 6.3.4-1. A comparison of the demographics indicate that resident and visitors are very similar in terms of age, race, income, and membership in fishing and/or diving clubs.

6.0 Socioeconomic Value of Reefs in Monroe County

**Table 6.3.4-1  
Demographic Characteristics of Resident and Visitor Reef-Users in  
Monroe County, 2000**

	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Age of Respondent</b>	54			44		
<b>Sex Of Respondent</b>	<b>Percent</b>			<b>Percent</b>		
Male	86%			14%		
Female	70%			30%		
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
	<b>White</b>	<b>Black</b>	<b>Other</b>	<b>White</b>	<b>Black</b>	<b>Other</b>
<b>Race Of Respondent</b>	94%	.02%	5.8%	95%	2%	3%
	<b>% of Resident Reef-Users</b>			<b>% of Visitor Reef-Users</b>		
<b>Percent Hispanic/Latino</b>	7%			8%		
	<b>Resident Reef-Users</b>			<b>Visitor Reef-Users</b>		
<b>Median Household Income</b>	\$56,393			\$87,500		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Years Boating in South Florida</b>	22			7.4		
	<b>Residents</b>			<b>Visitors</b>		
<b>Average Length of Boat Used for Salt Water Activities in Feet</b>	24			22		
	<b>Residents</b>			<b>Visitors</b>		
<b>% of Respondents Who Belong to Fishing and/or Diving Clubs</b>	15%			11%		

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Fall, 2000

Dear Florida Boat Owner,

Please find enclosed a boater's survey to be completed. You have been randomly selected from a list of Florida boat owners to participate in this study. Please place the completed survey in the enclosed postage-paid business reply envelope and return it at your earliest convenience.

This study is very important to evaluate the socio-economic impact of artificial and natural reefs in your county. Your completing and returning this survey is vital to this study. Please be reminded that your responses are strictly confidential and will be combined with over 25,000 other responses. Upon completion of the survey, all mailing lists will be destroyed.

This project is called the Socioeconomic Study of Reefs in Southeast Florida being sponsored by the counties of Palm Beach, Broward, Miami-Dade and Monroe; the Florida Fish and Wildlife Conservation Commission; and the National Oceanic and Atmospheric Administration. This study will determine, in a comprehensive manner, the net economic value of the natural and artificial reef resources of southeast Florida to the users of these reefs and the local economies. This study is expected to demonstrate the importance of additional funding at the federal, State and local levels to protect our resources while promoting reef use.

Your help is vital to this study and should you have any questions or concerns, please feel free to contact me.

Thank you very much for your participation

Dr. Mark A. Bonn Ph.D.  
Professor  
Florida State University  
850-644-8244



**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1**

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OMB Approval #0648-0410 Expires: 7/31/03  
SURVEY ID# : \_\_\_\_\_

**SECTION 1: Screening**

1. Over the past 12 months, how many days have you used your boat for saltwater activities in your county of residence? \_\_\_\_\_ (days)
  2. While saltwater boating in your county of residence over the past 12 months, did you use the artificial or natural reefs for any recreational activities such as fishing, diving or snorkeling?  
  
YES \_\_\_\_\_ (If yes, please continue with the survey.)  
NO \_\_\_\_\_ (If no, please return this uncompleted survey. It is very important that you return this survey.)
- 

**SECTION 2: Activity Profile and Use of Reefs**

3. Of the days spent saltwater **boating** in your county of residence over the past 12 months, how many of these days were spent:  
  
Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_
  4. Of the days spent **saltwater fishing** in your county of residence over the past 12 months, how many of these days were spent fishing on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  5. If you spent a portion of your saltwater fishing days on both artificial and natural reefs, what **percent** of your time do you usually spend on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  6. Of the days you spent **snorkeling** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  7. Of the days you spent **scuba diving** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
- 

**SECTION 3: Expenditures**

8. How many other people living in your county of residence went with you on your last trip to go:  
  
Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_
9. How many other people who are **not** residents of your county went with you on your last trip to go:  
  
Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1**

10. On your most recent saltwater fishing day, snorkeling day, and scuba diving day in your county of residence, would you please indicate your best estimate of how much money you and your party spent in your county of residence?

**Expenditures in your county of residence on most recent day**

Expense Item	Fishing	Snorkeling	Scuba Diving
Boat Oil and Gas	\$	\$	\$
Bait	\$	\$	\$
Tackle	\$	\$	\$
Ice	\$	\$	\$
Food & Beverages from stores	\$	\$	\$
Food & Beverages from Restaurants/Bars	\$	\$	\$
Gas for Auto	\$	\$	\$
Boat ramp fees & parking fees	\$	\$	\$
Marina slip rental & dockage fees	\$	\$	\$
Equipment rentals	\$	\$	\$
Sundries (sun screen, sickness pills, etc.)	\$	\$	\$
Any other items not mentioned above	\$	\$	\$
Number of people who spent or benefited from these expenditures			

**SECTION 4: Value of Reefs**

Local and state government agencies are considering different approaches to maintaining the health and condition of natural and artificial reefs in Southeast Florida. One plan focuses on providing greater protection for *natural reefs* by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the *artificial reefs* by maintaining water quality, limiting damage to artificial reefs from anchoring, and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in Southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both, or none of these plans and if you would be willing to incur higher cost to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on your ability to participate in any boating activity or other recreation in Southeast Florida.

11. Southeast Florida includes Palm Beach, Broward, Miami-Dade and Monroe Counties. The Florida Keys are in Monroe County. Over the past 12 months, how many boating trips have you made in southeast Florida to use the:  
 Natural reefs? \_\_\_\_\_ (# of trips).                      Artificial reefs? \_\_\_\_\_ (# of trips).
12. Suppose there was a plan to maintain the health and condition of *natural reefs* in southeast Florida. First, consider your total costs for your last boating trip in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the *natural reefs* in their existing condition?

\_\_\_ YES                      \_\_\_ NO

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1**

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If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than natural reefs are worth to me.
  - B. I really don't know how much natural reefs are worth to me.
  - C. There are no problems with water quality or the natural reefs.
  - D. There is not enough information to form a decision.
  - E. I don't understand or like the question.
  - F. I already pay too much to government.
  - G. Government waste should be reduced to pay for water quality protection and management of the natural reefs.
  - H. Other (please explain): \_\_\_\_\_
- 

13. Now suppose there was a plan to maintain the health and condition of **artificial reefs** in southeast Florida and that this was the only plan you were asked to consider. Think about your total costs for your last boating trip in southeast Florida again including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the **artificial reefs** in their existing condition?

\_\_\_ YES      \_\_\_ NO

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than artificial reefs are worth to me.
  - B. I don't really know how much artificial reefs are worth to me.
  - C. There are no problems with water quality or the artificial reefs.
  - D. There is not enough information to form a decision.
  - E. I don't understand or like the question.
  - F. I already pay too much to government.
  - G. Government waste should be reduced to pay for water quality protection and management of the artificial reefs.
  - H. Other (please explain): \_\_\_\_\_
- 

14. Finally, suppose that both of these plans to maintain the existing condition of **natural and artificial reefs** in southeast Florida were put together into a combined program. Consider once again your total costs for your last boating trip in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the **natural and artificial reefs** in their existing condition?

\_\_\_ YES      \_\_\_ NO

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than reefs are worth to me.
- B. I don't really know how much reefs are worth to me.
- C. There are no problems with water quality or the reefs.
- D. There is not enough information to form a decision.
- E. I don't understand or like the question.
- F. I already pay too much to government.
- G. Government waste should be reduced to pay for water quality protection and management of the reefs.
- H. Other (please explain): \_\_\_\_\_

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1**

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**SECTION 5: No Take Area Opinions**

In July 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones in which the taking of anything is prohibited. The total area of this no take zone is 13.37 square miles. A no take zone is a designated area of the reef system in which nothing is to be taken from this area including fish and shellfish.

15. Do you support the currently designated "NO TAKE" zones in the Florida Keys?  
\_\_\_\_ YES      \_\_\_\_ NO      \_\_\_\_ Don't Know      \_\_\_\_ Refused
16. Would you support the creation of "NO TAKE" zones on some of the reefs in Palm Beach, Broward, and Dade counties?  
\_\_\_\_ YES      \_\_\_\_ NO      \_\_\_\_ Don't Know      \_\_\_\_ Refused
17. Would you support the creation of "NO TAKE" zones on some of the reefs in your county of residence?  
\_\_\_\_ YES      \_\_\_\_ NO      \_\_\_\_ Don't Know      \_\_\_\_ Refused
18. What percentage of the coral or natural reefs in your county do you think would be a reasonable proportion to protect by giving them NO TAKE designation? \_\_\_\_\_(%)

**SECTION 6: Demographics**

19. How long have you been boating in south Florida? \_\_\_\_\_ (# years)
20. What is the length of your boat that you use for your saltwater activities? \_\_\_\_\_ (feet)
21. Are you a member of fishing or diving club? \_\_\_\_ YES \_\_\_\_ NO
22. In what year were you born? 19 \_\_\_\_
23. What is your zip code? \_\_\_\_\_ (five digits)
24. How long have you lived in this county? \_\_\_\_\_ (# years)
25. Are you: Male? \_\_\_\_ Female? \_\_\_\_
26. Are you Hispanic, Latino, or have Spanish origin? \_\_\_\_ YES \_\_\_\_ NO
27. Please circle the letter that best describes you?
- |                                     |  |
|-------------------------------------|--|
| a. White                            | e. Native Hawaiian or Other Pacific Islander |
| b. Black or African American        | f. Other (please notify) _____               |
| c. American Indian or Alaska Native |  |
| d. Asian                            |  |
27. Please circle the letter of your highest education level?
- |                         |                                      |
|-------------------------|--------------------------------------|
| a. Completed grades 1-9 | d. Some college or vocational school |
| b. Some high school     | e. College graduate                  |
| c. High School graduate | f. Graduate or professional degree   |
28. Please circle the letter that corresponds to your estimated household income before taxes?
- |                          |                          |                            |
|--------------------------|--------------------------|----------------------------|
| (a) less than \$5,000    | (f) \$30,000 to 34,999   | (k) \$75,000 to \$99,999   |
| (b) \$5,000 to \$9,999   | (g) \$35,000 to \$39,999 | (l) \$100,000 to \$149,000 |
| (c) \$10,000 to \$14,999 | (h) \$40,000 to \$49,999 | (m) \$150,000 or more      |
| (d) \$15,000 to \$24,999 | (i) \$50,000 to \$59,000 |                            |
| (e) \$25,000 to \$29,999 | (j) \$60,000 to \$74,999 |                            |

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 2**

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OMB Approval #0648-0410 Expires: 7/31/03  
SURVEY ID# : \_\_\_\_\_

**SECTION 1: Screening**

1. Over the past 12 months, how many days have you used your boat for saltwater activities in your county of residence?  
\_\_\_\_\_ (days)
  
  2. While saltwater boating in your county of residence over the past 12 months, did you use the artificial or natural reefs for any recreational activities such as fishing, diving or snorkeling?  
  
YES \_\_\_\_\_ (If yes, please continue with the survey.)  
NO \_\_\_\_\_ (If no, please return this uncompleted survey. It is very important that you return this survey.)
- 

**SECTION 2: Activity Profile and Use of Reefs**

3. Of the days spent saltwater **boating** in your county of residence over the past 12 months, how many of these days were spent:  
  
Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_
  
  4. Of the days spent **saltwater fishing** in your county of residence over the past 12 months, how many of these days were spent fishing on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  5. If you spent a portion of your saltwater fishing days on both artificial and natural reefs, what **percent** of your time do you usually spend on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  6. Of the days you spent **snorkeling** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  7. Of the days you spent **scuba diving** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
-

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 2**

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**SECTION 3: Expenditures**

8. How many other people living in your county of residence went with you on your last trip to go:

Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

9. How many other people who are **not** residents of your county went with you on your last trip to go:

Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

10. On your most recent saltwater fishing day, snorkeling day, and scuba diving day in your county of residence, would you please indicate your best estimate of how much money you and your party spent in your county of residence?

**Expenditures in your county of residence on most recent day**

Expense Item	Fishing	Snorkeling	Scuba Diving
Boat Oil and Gas	\$	\$	\$
Bait	\$	\$	\$
Tackle	\$	\$	\$
Ice	\$	\$	\$
Food & Beverages from stores	\$	\$	\$
Food & Beverages from Restaurants/Bars	\$	\$	\$
Gas for Auto	\$	\$	\$
Boat ramp fees & parking fees	\$	\$	\$
Marina slip rental & dockage fees	\$	\$	\$
Equipment rentals	\$	\$	\$
Sundries (sun screen, sickness pills, etc.)	\$	\$	\$
Any other items not mentioned above	\$	\$	\$
Number of people who spent or benefited from these expenditures			

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 2**

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**SECTION 4: Value of Reefs**

11. Southeast Florida includes Palm Beach, Broward, Dade and Monroe Counties. The Florida Keys are in Monroe County. Over the past 12 months, how many boating trips have you made in southeast Florida to use the:

Natural reefs? \_\_\_\_\_ (# of trips).

Artificial reefs? \_\_\_\_\_ (# of trips).

Local and state government agencies are being asked to evaluate how users of artificial reefs value new artificial reefs. Artificial reef programs cost money. Suppose that the government proposed that all users of the artificial reefs would pay for all newly constructed reefs. Fishermen and divers with their own boats would pay for a decal as part of their boat registration and/or, if they used a charter/party boat or a rental boat (pay operation), they would pay for the costs through higher fees charged by the pay operation. The money would go into a trust fund that could only be used for the construction and maintenance of artificial reefs in southeast Florida.

12. Would you be willing to pay \$ \_\_\_\_\_ per year when you renew your boat registration and/or the amount in higher fees to a charter/party boat or rental boat operation to fund this program?

\_\_\_ YES      \_\_\_ NO

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than new artificial reefs are worth to me.
  - B. I really don't know how much new artificial reefs are worth to me.
  - C. There are enough artificial reefs already.
  - D. There is not enough information to form a decision.
  - E. I don't understand or like the question.
  - F. The government should fund the artificial reef program out of general revenue and not a specific tax or fee.
  - G. I already pay too much to the government.
  - H. Government waste should be reduced to fund the artificial reef program.
  - I. Other (please explain): \_\_\_\_\_
- 

**SECTION 5: No Take Area Opinions**

In July 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones in which the taking of anything is prohibited. The total area of this no take zone is 13.37 square miles. A no take zone is a designated area of the reef system in which nothing is to be taken from this area including fish and shellfish.

13. Do you support the currently designated "NO TAKE" zones in the Florida Keys?

\_\_\_ YES      \_\_\_ NO      \_\_\_ Don't Know      \_\_\_ Refused

14. Would you support the creation of "NO TAKE" zones on some of the reefs in your county of residence?

\_\_\_ YES      \_\_\_ NO      \_\_\_ Don't Know      \_\_\_ Refused

15. What percentage of the coral or natural reefs in your county do you think would be a reasonable proportion to protect by giving them NO TAKE designation? \_\_\_\_\_(%)

**Socioeconomic Study of Reefs in Southeast Florida  
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**SECTION 6: Demographics**

16. How long have you been boating in south Florida? \_\_\_\_\_ (# years)
17. What is the length of your boat that you use for your saltwater activities? \_\_\_\_\_ (feet)
18. Are you a member of fishing or diving club? \_\_\_\_ YES \_\_\_\_ NO
19. In what year were you born? 19 \_\_\_\_\_
20. What is your zip code? \_\_\_\_\_ (five digits)
21. How long have you lived in this county? \_\_\_\_\_ (# years)
22. Are you: Male? \_\_\_\_ Female? \_\_\_\_
23. Are you Hispanic, Latino, or have Spanish origin? \_\_\_\_ YES \_\_\_\_ NO
24. Please circle the letter that best describes you?
- |                                     |  |
|-------------------------------------|--|
| a. White                            | e. Native Hawaiian or Other Pacific Islander |
| b. Black or African American        | f. Other (please                             |
| c. American Indian or Alaska Native | notify) _____                                |
| d. Asian                            |  |
25. Please circle the letter of your highest education level?
- |                         |                                      |
|-------------------------|--------------------------------------|
| a. Completed grades 1-9 | d. Some college or vocational school |
| b. Some high school     | e. College graduate                  |
| c. High School graduate | f. Graduate or professional degree   |
26. Please circle the letter that corresponds to your estimated household income before taxes?
- |                          |                          |                            |
|--------------------------|--------------------------|----------------------------|
| (a) less than \$5,000    | (f) \$30,000 to 34,999   | (k) \$75,000 to \$99,999   |
| (b) \$5,000 to \$9,999   | (g) \$35,000 to \$39,999 | (l) \$100,000 to \$149,000 |
| (c) \$10,000 to \$14,999 | (h) \$40,000 to \$49,999 | (m) \$150,000 or more      |
| (d) \$15,000 to \$24,999 | (i) \$50,000 to \$59,000 |                            |
| (e) \$25,000 to \$29,999 | (j) \$60,000 to \$74,999 |                            |



**Socioeconomic Study of Reefs in Southeast Florida  
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OMB Approval #0648-0410 Expires: 7/31/03  
SURVEY ID# : \_\_\_\_\_

**SECTION 1: Screening**

1. Over the past 12 months, how many days have you used your boat for saltwater activities in your county of residence? \_\_\_\_\_ (days)
  
  2. While saltwater boating in your county of residence over the past 12 months, did you use the artificial or natural reefs for any recreational activities such as fishing, diving or snorkeling?  
  
YES \_\_\_\_\_ (If yes, please continue with the survey.)  
NO \_\_\_\_\_ (If no, please return this uncompleted survey. It is very important that you return this survey.)
- 

**SECTION 2: Activity Profile and Use of Reefs**

3. Of the days spent saltwater **boating** in your county of residence over the past 12 months, how many of these days were spent:  
  
Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_
  
  4. Of the days spent **saltwater fishing** in your county of residence over the past 12 months, how many of these days were spent fishing on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  5. If you spent a portion of your saltwater fishing days on both artificial and natural reefs, what **percent** of your time do you usually spend on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  6. Of the days you spent **snorkeling** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  7. How many of these dives were done in the Sanctuary Preservation Areas or Ecological Reserves in the Florida Keys National Marine Sanctuary? These areas are marked with yellow buoys.  
  
\_\_\_\_\_ (number of dives)
  
  8. Of the days you spent **scuba diving** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  
  9. How many of these dives were done in the Sanctuary Preservation Areas or Ecological Reserves in the Florida Keys National Marine Sanctuary? These areas are marked with yellow buoys.  
  
\_\_\_\_\_ (number of dives)
-

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1 – Monroe County**

**SECTION 3: Expenditures**

10. How many other people living in your county of residence went with you on your last trip to go:

Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

11. How many other people who are **not** residents of your county went with you on your last trip to go:

Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

12. On your most recent saltwater fishing day, snorkeling day, and scuba diving day in your county of residence, would you please indicate your best estimate of how much money you and your party spent in your county of residence?

**Expenditures in your county of residence on most recent day**

Expense Item	Fishing	Snorkeling	Scuba Diving
Boat Oil and Gas	\$	\$	\$
Bait	\$	\$	\$
Tackle	\$	\$	\$
Ice	\$	\$	\$
Food & Beverages from stores	\$	\$	\$
Food & Beverages from Restaurants/Bars	\$	\$	\$
Gas for Auto	\$	\$	\$
Boat ramp fees & parking fees	\$	\$	\$
Marina slip rental & dockage fees	\$	\$	\$
Equipment rentals	\$	\$	\$
Sundries (sun screen, sickness pills, etc.)	\$	\$	\$
Any other items not mentioned above	\$	\$	\$
Number of people who spent or benefited from these expenditures			

**SECTION 4: Value of Reefs**

Local and state government agencies are considering different approaches to maintaining the health and condition of natural and artificial reefs in Southeast Florida. One plan focuses on providing greater protection for *natural reefs* by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the *artificial reefs* by maintaining water quality, limiting damage to artificial reefs from anchoring, and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in Southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both, or none of these plans and if you would be willing to incur higher cost to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on your ability to participate in any boating activity or other recreation in Southeast Florida.

13. Southeast Florida includes Palm Beach, Broward, Miami-Dade and Monroe Counties. The Florida Keys are in Monroe County. Over the past 12 months, how many boating trips have you made in southeast Florida to use the:  
 Natural reefs? \_\_\_\_\_ (# of trips). Artificial reefs? \_\_\_\_\_ (# of trips).

**Socioeconomic Study of Reefs in Southeast Florida**  
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14. Suppose there was a plan to maintain the health and condition of *natural reefs* in southeast Florida. First, consider your total costs for your last boating trip in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the *natural reefs* in their existing condition?

\_\_\_ YES            \_\_\_ NO

---

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than natural reefs are worth to me.
- B. I really don't know how much natural reefs are worth to me.
- C. There are no problems with water quality or the natural reefs.
- D. There is not enough information to form a decision.
- E. I don't understand or like the question.
- F. I already pay too much to government.
- G. Government waste should be reduced to pay for water quality protection and management of the natural reefs.
- H. Other (please explain): \_\_\_\_\_

- 
15. Now suppose there was a plan to maintain the health and condition of *artificial reefs* in southeast Florida and that this was the only plan you were asked to consider. Think about your total costs for your last boating trip in southeast Florida again including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the *artificial reefs* in their existing condition?

\_\_\_ YES            \_\_\_ NO

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than artificial reefs are worth to me.
- B. I don't really know how much artificial reefs are worth to me.
- C. There are no problems with water quality or the artificial reefs.
- D. There is not enough information to form a decision.
- E. I don't understand or like the question.
- F. I already pay too much to government.
- G. Government waste should be reduced to pay for water quality protection and management of the artificial reefs.
- H. Other (please explain): \_\_\_\_\_

- 
16. Finally, suppose that both of these plans to maintain the existing condition of *natural and artificial reefs* in southeast Florida were put together into a combined program. Consider once again your total costs for your last boating trip in southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the *natural and artificial reefs* in their existing condition?

\_\_\_ YES            \_\_\_ NO

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than reefs are worth to me.
- B. I don't really know how much reefs are worth to me.
- C. There are no problems with water quality or the reefs.
- D. There is not enough information to form a decision.
- E. I don't understand or like the question.
- F. I already pay too much to government.
- G. Government waste should be reduced to pay for water quality protection and management of the reefs.
- H. Other (please explain): \_\_\_\_\_

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1 – Monroe County**

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**SECTION 5: No Take Area Opinions**

In July 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones in which the taking of anything is prohibited. The total area of this no take zone is 13.37 square miles. A no take zone is a designated area of the reef system in which nothing is to be taken from this area including fish and shellfish.

17. Do you support the currently designated “NO TAKE” zones in the Florida Keys?  
\_\_\_ YES      \_\_\_ NO      \_\_\_ Don’t Know      \_\_\_ Refused
18. Would you support the creation of additional “NO TAKE” zones on some of the reefs in your county of residence?  
\_\_\_ YES      \_\_\_ NO      \_\_\_ Don’t Know      \_\_\_ Refused
19. Would you support the creation of “NO TAKE” zones on some of the reefs in Palm Beach, Broward, and Dade counties?  
\_\_\_ YES      \_\_\_ NO      \_\_\_ Don’t Know      \_\_\_ Refused
20. What percentage of the coral or natural reefs in your county do you think would be a reasonable proportion to protect by giving them NO TAKE designation? \_\_\_\_\_(%)

**SECTION 6: Demographics**

21. How long have you been boating in south Florida? \_\_\_\_\_ (# years)
22. What is the length of your boat that you use for your saltwater activities? \_\_\_\_\_ (feet)
23. Are you a member of fishing or diving club? \_\_\_ YES \_\_\_ NO
24. In what year were you born? 19 \_\_\_\_
25. What is your zip code? \_\_\_\_\_ (five digits)
26. How long have you lived in this county? \_\_\_\_\_ (# years)
27. Are you: Male? \_\_\_ Female? \_\_\_
28. Are you Hispanic, Latino, or have Spanish origin? \_\_\_ YES \_\_\_ NO
29. Please circle the letter that best describes you?
- |                                     |  |
|-------------------------------------|--|
| a. White                            | e. Native Hawaiian or Other Pacific Islander |
| b. Black or African American        | f. Other (please                             |
| c. American Indian or Alaska Native | notify)_____                                 |
| d. Asian                            |  |
30. Please circle the letter of your highest education level?
- |                         |                                      |
|-------------------------|--------------------------------------|
| a. Completed grades 1-9 | d. Some college or vocational school |
| b. Some high school     | e. College graduate                  |
| c. High School graduate | f. Graduate or professional degree   |
31. Please circle the letter that corresponds to your estimated household income before taxes?
- |                          |                          |                            |
|--------------------------|--------------------------|----------------------------|
| (a) less than \$5,000    | (f) \$30,000 to 34,999   | (k) \$75,000 to \$99,999   |
| (b) \$5,000 to \$9,999   | (g) \$35,000 to \$39,999 | (l) \$100,000 to \$149,000 |
| (c) \$10,000 to \$14,999 | (h) \$40,000 to \$49,999 | (m) \$150,000 or more      |
| (d) \$15,000 to \$24,999 | (i) \$50,000 to \$59,000 |                            |
| (e) \$25,000 to \$29,999 | (j) \$60,000 to \$74,999 |                            |

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**SECTION 7: Importance**

32. Please read each statement and rate the importance of each item as it contributes to an ideal recreation setting for the activities you did in the Florida Keys/Florida Bay Area. If an item does not apply, indicate by circling **n/a (not applicable)**. Likewise, if you don't know, circle **dk (don't know)**.

**1=Not Important, 2=Somewhat Important, 3=Important, 4=Very Important, 5=Extremely Important (circle response)**

a. Clear water (high visibility)	n/a	dk	1	2	3	4	5
b. Amount of living coral on the reefs	n/a	dk	1	2	3	4	5
c. Public transportation	n/a	dk	1	2	3	4	5
d. Parking	n/a	dk	1	2	3	4	5
e. Many different kinds of fish and sea life to view	n/a	dk	1	2	3	4	5
f. Many different kinds of fish and sea life to catch	n/a	dk	1	2	3	4	5
g. Large numbers of fish	n/a	dk	1	2	3	4	5
h. Opportunity to view large wildlife: (manatees, whales, dolphins, sea turtles)	n/a	dk	1	2	3	4	5
i. Uncrowded conditions	n/a	dk	1	2	3	4	5
j. Maps, brochures, and other tourist info	n/a	dk	1	2	3	4	5
k. Boat ramps/launching facilities	n/a	dk	1	2	3	4	5
l. Marina facilities	n/a	dk	1	2	3	4	5
m. Directional signs, street signs, mile markers	n/a	dk	1	2	3	4	5
n. Condition of roads and streets	n/a	dk	1	2	3	4	5
o. Cleanliness of streets and sidewalks	n/a	dk	1	2	3	4	5
p. Condition of bike paths, sidewalks, walking paths	n/a	dk	1	2	3	4	5
q. Shoreline access	n/a	dk	1	2	3	4	5
r. Designated swimming/beach areas	n/a	dk	1	2	3	4	5
s. Quality of beaches	n/a	dk	1	2	3	4	5
t. Service and friendliness of people	n/a	dk	1	2	3	4	5
u. Historic preservation (landmarks, houses, etc)	n/a	dk	1	2	3	4	5
v. Availability of public restrooms	n/a	dk	1	2	3	4	5
w. Value for the price	n/a	dk	1	2	3	4	5
x. Parks and specially protected areas	n/a	dk	1	2	3	4	5
y. Mooring buoys near coral reefs	n/a	dk	1	2	3	4	5

**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 1 – Monroe County**

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**SECTION 8: Satisfaction**

33. In the above section, you indicated the importance of a list of items to your recreation experiences. Now please read each of the items on this list and rate how satisfied you were with each at the places you did your activities in the Florida Keys/Florida Bay Area. If the item does not apply, indicate by circling **n/a (not applicable)**. Likewise, if you don't know, circle **dk (don't know)**.

**1=Not Satisfied, 2=Somewhat Satisfied, 3=Satisfied, 4=Very Satisfied, 5=Extremely Satisfied  
(circle response)**

a. Clear water (high visibility)	n/a	dk	1	2	3	4	5
b. Amount of living coral on the reefs	n/a	dk	1	2	3	4	5
c. Public transportation	n/a	dk	1	2	3	4	5
d. Parking	n/a	dk	1	2	3	4	5
e. Many different kinds of fish and sea life to view	n/a	dk	1	2	3	4	5
f. Many different kinds of fish and sea life to catch	n/a	dk	1	2	3	4	5
g. Large numbers of fish	n/a	dk	1	2	3	4	5
h. Opportunity to view large wildlife: (manatees, whales, dolphins, sea turtles)	n/a	dk	1	2	3	4	5
i. Uncrowded conditions	n/a	dk	1	2	3	4	5
j. Maps, brochures, and other tourist information	n/a	dk	1	2	3	4	5
k. Boat ramps/launching facilities	n/a	dk	1	2	3	4	5
l. Marina facilities	n/a	dk	1	2	3	4	5
m. Directional signs, street signs, mile markers	n/a	dk	1	2	3	4	5
n. Condition of roads and streets	n/a	dk	1	2	3	4	5
o. Cleanliness of streets and sidewalks	n/a	dk	1	2	3	4	5
p. Condition of bike paths, sidewalks, walking paths	n/a	dk	1	2	3	4	5
q. Shoreline access	n/a	dk	1	2	3	4	5
r. Designated swimming/beach areas	n/a	dk	1	2	3	4	5
s. Quality of beaches	n/a	dk	1	2	3	4	5
t. Service and friendliness of people	n/a	dk	1	2	3	4	5
u. Historic preservation (landmarks, houses, etc.)	n/a	dk	1	2	3	4	5
v. Availability of public restrooms	n/a	dk	1	2	3	4	5
w. Value for the price	n/a	dk	1	2	3	4	5
x. Parks and specially protected areas	n/a	dk	1	2	3	4	5
y. Mooring buoys near coral reefs	n/a	dk	1	2	3	4	5

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OMB Approval #0648-0410 Expires: 7/31/03  
SURVEY ID# : \_\_\_\_\_

**SECTION 1: Screening**

1. Over the past 12 months, how many days have you used your boat for saltwater activities in your county of residence? \_\_\_\_\_ (days)
  2. While saltwater boating in your county of residence over the past 12 months, did you use the artificial or natural reefs for any recreational activities such as fishing, diving or snorkeling?  
  
YES \_\_\_\_\_ (If yes, please continue with the survey.)  
NO \_\_\_\_\_ (If no, please return this uncompleted survey. It is very important that you return this survey.)
- 

**SECTION 2: Activity Profile and Use of Reefs**

3. Of the days spent saltwater **boating** in your county of residence over the past 12 months, how many of these days were spent:  
  
Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_
  4. Of the days spent **saltwater fishing** in your county of residence over the past 12 months, how many of these days were spent fishing on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  5. If you spent a portion of your saltwater fishing days on both artificial and natural reefs, what **percent** of your time do you usually spend on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  6. Of the days you spent **snorkeling** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  7. How many of these dives were done in the Sanctuary Preservation Areas or Ecological Reserves in the Florida Keys National Marine Sanctuary? These areas are marked with yellow buoys.  
  
\_\_\_\_\_ (number of dives)
  8. Of the days you spent **scuba diving** in your county of residence over the past 12 months, how many different dives were done on:  
  
Artificial reefs? \_\_\_\_\_ Natural reefs? \_\_\_\_\_
  9. How many of these dives were done in the Sanctuary Preservation Areas or Ecological Reserves in the Florida Keys National Marine Sanctuary? These areas are marked with yellow buoys.  
  
\_\_\_\_\_ (number of dives)
-

**Socioeconomic Study of Reefs in Southeast Florida  
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**SECTION 3: Expenditures**

10. How many other people living in your county of residence went with you on your last trip to go:

Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

11. How many other people who are **not** residents of your county went with you on your last trip to go:

Saltwater fishing? \_\_\_\_\_ Snorkeling? \_\_\_\_\_ Scuba diving? \_\_\_\_\_

12. On your most recent saltwater fishing day, snorkeling day, and scuba diving day in your county of residence, would you please indicate your best estimate of how much money you and your party spent in your county of residence?

**Expenditures in your county of residence on most recent day**

Expense Item	Fishing	Snorkeling	Scuba Diving
Boat Oil and Gas	\$	\$	\$
Bait	\$	\$	\$
Tackle	\$	\$	\$
Ice	\$	\$	\$
Food & Beverages from stores	\$	\$	\$
Food & Beverages from Restaurants/Bars	\$	\$	\$
Gas for Auto	\$	\$	\$
Boat ramp fees & parking fees	\$	\$	\$
Marina slip rental & dockage fees	\$	\$	\$
Equipment rentals	\$	\$	\$
Sundries (sun screen, sickness pills, etc.)	\$	\$	\$
Any other items not mentioned above	\$	\$	\$
Number of people who spent or benefited from these expenditures			



**Socioeconomic Study of Reefs in Southeast Florida  
Resident Boater Survey 2 – Monroe County**

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**SECTION 4: Value of Reefs**

13. Southeast Florida includes Palm Beach, Broward, Miami-Dade and Monroe Counties. The Florida Keys are in Monroe County. Over the past 12 months, how many boating trips have you made in southeast Florida to use the:

Natural reefs? \_\_\_\_\_ (# of trips).

Artificial reefs? \_\_\_\_\_ (# of trips).

Local and state government agencies are being asked to evaluate how users of artificial reefs value new artificial reefs. Artificial reef programs cost money. Suppose that the government proposed that all users of the artificial reefs would pay for all newly constructed reefs. Fishermen and divers with their own boats would pay for a decal as part of their boat registration and/or, if they used a charter/party boat or a rental boat (pay operation), they would pay for the costs through higher fees charged by the pay operation. The money would go into a trust fund that could only be used for the construction and maintenance of artificial reefs in southeast Florida.

14. Would you be willing to pay \$ \_\_\_\_\_ per year when you renew your boat registration and/or the amount in higher fees to a charter/party boat or rental boat operation to fund this program?

\_\_\_ YES      \_\_\_ NO

If you answered NO to the above question or you don't know or you refuse to answer the question, please circle the **one** letter that best explains your reason for saying no or don't know; or refusing to answer?

- A. A contribution of that amount is more than new artificial reefs are worth to me.
- B. I really don't know how much new artificial reefs are worth to me.
- C. There are enough artificial reefs already.
- D. There is not enough information to form a decision.
- E. I don't understand or like the question.
- F. The government should fund the artificial reef program out of general revenue and not a specific tax or fee.
- G. I already pay too much to the government.
- H. Government waste should be reduced to fund the artificial reef program.
- I. Other (please explain): \_\_\_\_\_

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**SECTION 5: No Take Area Opinions**

In July 1997, the Florida Keys National Marine Sanctuary created 23 areas or zones in which the taking of anything is prohibited. The total area of this no take zone is 13.37 square miles. A no take zone is a designated area of the reef system in which nothing is to be taken from this area including fish and shellfish.

15. Do you support the currently designated "NO TAKE" zones in the Florida Keys?

\_\_\_ YES      \_\_\_ NO      \_\_\_ Don't Know      \_\_\_ Refused

16. Would you support the creation of additional "NO TAKE" zones on some of the reefs in your county of residence?

\_\_\_ YES      \_\_\_ NO      \_\_\_ Don't Know      \_\_\_ Refused

17. Would you support the creation of "NO TAKE" zones on some of the reefs in Palm Beach, Broward, and Dade counties?

\_\_\_ YES      \_\_\_ NO      \_\_\_ Don't Know      \_\_\_ Refused

18. What percentage of the coral or natural reefs in your county do you think would be a reasonable proportion to protect by giving them NO TAKE designation? \_\_\_\_\_(%)

**Socioeconomic Study of Reefs in Southeast Florida  
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**SECTION 6: Demographics**

19. How long have you been boating in south Florida? \_\_\_\_\_ (# years)
20. What is the length of your boat that you use for your saltwater activities? \_\_\_\_\_ (feet)
21. Are you a member of fishing or diving club? \_\_\_\_ YES \_\_\_\_ NO
22. In what year were you born? 19 \_\_\_\_\_
23. What is your zip code? \_\_\_\_\_ (five digits)
24. How long have you lived in this county? \_\_\_\_\_ (# years)
25. Are you: Male? \_\_\_\_ Female? \_\_\_\_
26. Are you Hispanic, Latino, or have Spanish origin? \_\_\_\_ YES \_\_\_\_ NO
27. Please circle the letter that best describes you?
- |                                     |  |
|-------------------------------------|--|
| a. White                            | e. Native Hawaiian or Other Pacific Islander |
| b. Black or African American        | f. Other (please                             |
| c. American Indian or Alaska Native | notify) _____                                |
| d. Asian                            |  |
28. Please circle the letter of your highest education level?
- |                         |                                      |
|-------------------------|--------------------------------------|
| a. Completed grades 1-9 | d. Some college or vocational school |
| b. Some high school     | e. College graduate                  |
| c. High School graduate | f. Graduate or professional degree   |
29. Please circle the letter that corresponds to your estimated household income before taxes?
- |                          |                          |                            |
|--------------------------|--------------------------|----------------------------|
| (a) less than \$5,000    | (f) \$30,000 to 34,999   | (k) \$75,000 to \$99,999   |
| (b) \$5,000 to \$9,999   | (g) \$35,000 to \$39,999 | (l) \$100,000 to \$149,000 |
| (c) \$10,000 to \$14,999 | (h) \$40,000 to \$49,999 | (m) \$150,000 or more      |
| (d) \$15,000 to \$24,999 | (i) \$50,000 to \$59,000 |                            |
| (e) \$25,000 to \$29,999 | (j) \$60,000 to \$74,999 |                            |

**Socioeconomic Study of Reefs in Southeast Florida  
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**SECTION 7: Importance**

30. Please read each statement and rate the importance of each item as it contributes to an ideal recreation setting for the activities you did in the Florida Keys/Florida Bay Area. If an item does not apply, indicate by circling **n/a (not applicable)**. Likewise, if you don't know, circle **dk (don't know)**.

**1=Not Important, 2=Somewhat Important, 3=Important, 4=Very Important, 5=Extremely Important (circle response)**

a. Clear water (high visibility)	n/a	dk	1	2	3	4	5
b. Amount of living coral on the reefs	n/a	dk	1	2	3	4	5
c. Public transportation	n/a	dk	1	2	3	4	5
d. Parking	n/a	dk	1	2	3	4	5
e. Many different kinds of fish and sea life to view	n/a	dk	1	2	3	4	5
f. Many different kinds of fish and sea life to catch	n/a	dk	1	2	3	4	5
g. Large numbers of fish	n/a	dk	1	2	3	4	5
h. Opportunity to view large wildlife: (manatees, whales, dolphins, sea turtles)	n/a	dk	1	2	3	4	5
i. Uncrowded conditions	n/a	dk	1	2	3	4	5
j. Maps, brochures, and other tourist info	n/a	dk	1	2	3	4	5
k. Boat ramps/launching facilities	n/a	dk	1	2	3	4	5
l. Marina facilities	n/a	dk	1	2	3	4	5
m. Directional signs, street signs, mile markers	n/a	dk	1	2	3	4	5
n. Condition of roads and streets	n/a	dk	1	2	3	4	5
o. Cleanliness of streets and sidewalks	n/a	dk	1	2	3	4	5
p. Condition of bike paths, sidewalks, walking paths	n/a	dk	1	2	3	4	5
q. Shoreline access	n/a	dk	1	2	3	4	5
r. Designated swimming/beach areas	n/a	dk	1	2	3	4	5
s. Quality of beaches	n/a	dk	1	2	3	4	5
t. Service and friendliness of people	n/a	dk	1	2	3	4	5
u. Historic preservation (landmarks, houses, etc)	n/a	dk	1	2	3	4	5
v. Availability of public restrooms	n/a	dk	1	2	3	4	5
w. Value for the price	n/a	dk	1	2	3	4	5
x. Parks and specially protected areas	n/a	dk	1	2	3	4	5
y. Mooring buoys near coral reefs	n/a	dk	1	2	3	4	5

**Socioeconomic Study of Reefs in Southeast Florida  
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**SECTION 8: Satisfaction**

31. In the above section, you indicated the importance of a list of items to your recreation experiences. Now please read each of the items on this list and rate how satisfied you were with each at the places you did your activities in the Florida Keys/Florida Bay Area. If the item does not apply, indicate by circling **n/a (not applicable)**. Likewise, if you don't know, circle **dk (don't know)**.

**1=Not Satisfied, 2=Somewhat Satisfied, 3=Satisfied, 4=Very Satisfied, 5=Extremely Satisfied  
(circle response)**

a. Clear water (high visibility)	n/a	dk	1	2	3	4	5
b. Amount of living coral on the reefs	n/a	dk	1	2	3	4	5
c. Public transportation	n/a	dk	1	2	3	4	5
d. Parking	n/a	dk	1	2	3	4	5
e. Many different kinds of fish and sea life to view	n/a	dk	1	2	3	4	5
f. Many different kinds of fish and sea life to catch	n/a	dk	1	2	3	4	5
g. Large numbers of fish	n/a	dk	1	2	3	4	5
h. Opportunity to view large wildlife: (manatees, whales, dolphins, sea turtles)	n/a	dk	1	2	3	4	5
i. Uncrowded conditions	n/a	dk	1	2	3	4	5
j. Maps, brochures, and other tourist information	n/a	dk	1	2	3	4	5
k. Boat ramps/launching facilities	n/a	dk	1	2	3	4	5
l. Marina facilities	n/a	dk	1	2	3	4	5
m. Directional signs, street signs, mile markers	n/a	dk	1	2	3	4	5
n. Condition of roads and streets	n/a	dk	1	2	3	4	5
o. Cleanliness of streets and sidewalks	n/a	dk	1	2	3	4	5
p. Condition of bike paths, sidewalks, walking paths	n/a	dk	1	2	3	4	5
q. Shoreline access	n/a	dk	1	2	3	4	5
r. Designated swimming/beach areas	n/a	dk	1	2	3	4	5
s. Quality of beaches	n/a	dk	1	2	3	4	5
t. Service and friendliness of people	n/a	dk	1	2	3	4	5
u. Historic preservation (landmarks, houses, etc.)	n/a	dk	1	2	3	4	5
v. Availability of public restrooms	n/a	dk	1	2	3	4	5
w. Value for the price	n/a	dk	1	2	3	4	5
x. Parks and specially protected areas	n/a	dk	1	2	3	4	5
y. Mooring buoys near coral reefs	n/a	dk	1	2	3	4	5

**BOATING VISITORS SURVEY  
SCREENER/TALLY SHEET**

Interviewer: \_\_\_\_\_

Interview Location (circle county): Palm Beach Broward Dade Monroe

Site Location: \_\_\_\_\_

1. Are you a permanent resident of (county of interview) ?

\_\_\_ YES Thank you. We are only interviewing nonresidents of (county of interview). ( place tic mark in column 4)

\_\_\_ NO Hand respondent WHITE CARD (Activities List).

2. Over the past 12 months, did you do any of the activities on the list in (County of interview) ? (place tic mark in column 5)

\_\_\_ NO Thank you. We are only interviewing those that did boating activities.

\_\_\_ YES 3. Did you do any boating activities on the artificial or natural reefs in the (County of interview) ?

\_\_\_ NO Thank you. We are only interviewing reef users. (place tic mark in column 6)

\_\_\_ YES 4. Are you ending your visit to (county of interview) today ?

NOTE: If person is a scuba diver and is flying or is leaving before noon the next day, Proceed with interview.

\_\_\_ NO Thank you. We are only interviewing people at the end of their visit. (place tic mark in column 7)

\_\_\_ YES 5. Will you participate in a 5-20 minute (average 15 minute interview about your visit to (county of interview) ?

\_\_\_ NO Thank you. (place tic mark in column 8)

If language Barrier, place tic mark in column 9.

\_\_\_ YES Go to Questionnaire. (place tic mark in column 10)

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
Site	Date	Time Period	Permanent Resident	Non Boating	Non Reef User	Non Exit Visitor	Refusal	Language Barrier	Interviewed

**Boating Visitors Survey - Keys**

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- Screening Criteria:
- 1) NOT a resident of county of interview.
  - 2) Engaged in saltwater boating activities in county of interview in the past 12 months.
  - 3) Meets Exit Condition

Survey number: \_\_\_\_\_

Date/time of interview:

\_\_\_\_\_

Month      Day      Time

County of Interview (circle): Palm Beach Broward Dade Monroe

Interview Site: \_\_\_\_\_

**HAND RESPONDENT YELLOW CARD AND ASK THEM TO READ PRIVACY ACT STATEMENT**

1. a) How many people are with you on your visit to (county of interview)(do not count the respondent)?

\_\_\_\_\_ # people

1. b) How many of these people are not permanent residents of (county of interview)

\_\_\_\_\_

\_\_\_\_\_ # people

2. How many of these people are 16 or older (do not include respondent)?

\_\_\_\_\_ # people

3. Where is your primary residence?

\_\_\_\_\_

City or nearest city      County      State      Zip Code

Country: \_\_\_\_\_

- USA
- Canada
- Mexico
- Central/South America
- Austalia/Oceania
- Japan
- Other Far East
- United Kingdom
- Other Europe
- Middle East
- Africa
- Other

4. a) On this trip, is (county of interview) the only destination?

YES Go to Q5.       NO Go to Q4b.

4. b) Is (county of interview) your primary destination for this trip?

YES Go to Q5.       NO Go to Q4c.

Boating Visitors Survey - Keys

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4. c) Where did you last visit before coming to (county of interview)?

\_\_\_\_\_  
City or nearest city                      County                      State                      Zip Code

5. Look at Section 1 of the Yellow Card. How did you and those in your group who are not residents of (county of interview) get to (county of interview)? Please give the letters of all that apply. (Circle all that apply)

- |   |                                   |   |                     |
|---|-----------------------------------|---|---------------------|
| A | Automobile - private              | H | Air - Marathon      |
| B | Automobile - rental               | I | Air - Key West      |
| C | Air - Miami                       | J | Air - other Florida |
| D | Air - Ft Lauderdale/<br>Hollywood |   | Specify _____       |
| E | Air - West Palm Beach             | K | Cruise ship         |
| F | Air - Tampa                       | L | Own boat            |
| G | Air - Orlando                     | M | Other               |
|   |                                   |   | Specify _____       |

6. a) On this trip to (county of interview), when did you first arrive

\_\_\_\_\_  
Month                      Day                      Time

6. b) When do you plan to leave?

\_\_\_\_\_  
Month                      Day                      Time

7. Including this trip, how many times have you visited (county of interview) in the last 12 months, that is since (date last year)?

\_\_\_\_\_  
# times

8. Including this trip, how many days have you spent in (county of interview) in the last 12 months?

\_\_\_\_\_  
# days

9. How many overnight trips have you made to (county of interview) in the last 12 months?

\_\_\_\_\_  
# overnight trips

10. How many nights are you spending in (county of interview) on this trip?

\_\_\_\_\_  
# nights

If Question 10 is zero, then go to Q12.



**Boating Visitors Survey - Keys**

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11. Please refer to the Yellow Card in Section 2 and tell me the number corresponding to where you stayed on this trip to (county of interview)? (circle)

- |   |   |
|---|---|
| 1 = Hotel/Motel/Guest House/<br>Bed & Breakfast | 4 = Condominium, or second home (own),<br>excluding time shares |
| 2 = Home of family/friends                      | 5 = Vacation Rental   |
| 3 = Campground                                  | 6 = Time Share  |

I would now like to ask you about some of the activities in which you or someone in your group who is not a permanent resident of (county of interview), participated while on your visits to (county of interview).

**HAND RESPONDENT WHITE CARD WITH ACTIVITIES LIST**

- Q12. In which of these activities did you or someone in your group participate during the last 12 months in (county of interview)? Please read me the number corresponding to each activity on the card.
- Q13. As I read you each activity in which you said you or someone in your group participated, please tell me which activity you participated in during the past 12 months in (county of interview).  
*If person by themselves, skip to Q15.*
- Q14. As I read each activity, please tell me how many others in your group who are not permanent residents of (county of interview) participated in the activity in (county of interview) during the last 12 months.
- Q15. As I read each activity, would you tell me how many days you participated in the activity in (county of interview) over the past 12 months?
- Q16. How many of the days of (activity) were on artificial reefs?
- Q17. How many of the days of (activity) were on natural reefs?  
*If no DIVING OR SNORKELING activities, skip to Q21.*
- Don't ask Q18-Q20 for special snorkeling or scuba diving (activities 300-305).*
- Q18. Over the past 12 months, in the (county of interview), how many dives did you make (read activity - snorkeling or scuba diving; a dive is a water entry and exit.)?
- Q19. How many of these dives were on artificial reefs (for each snorkeling and scuba diving activity)?
- Q20. How many of these dives were on natural reefs (for each snorkeling and scuba diving activity)?

Q12 Activity	Q13 Resp	Q14 # Others	Q15 Respondent # of days	Q16 # of days artificial reef	Q17 # of days natural reef	Q18 Respondent # of dives	Q19 Resp # dives artificial reef	Q20 Resp # dives natural reef
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____

**For the Florida Keys Only - Divers and Glass-bottom Boat Riders Only.  
For Others Skip to Question 24.**

The map of the Florida Keys show the Sanctuary preservation Areas and Ecological Reserves currently in place. These areas are marked by yellow buoys. These areas only allow non-consumptive activities such as snorkeling, scuba diving and viewing. No one is allowed to take anything from these areas.

Q 21. Over the past 12 months, did you participate in any of your activities in any of these areas?

YES

NO (Go to Q24)

Could you please refer to the White Card and tell me which activities which you participated in, in these special areas?

**For Snorkeling and Scuba Diving**

Q22. How many dives did you make in these areas for snorkeling and Scuba Diving? \_\_\_\_\_  
# dives

Q23. a) How many boat rides did you make to these areas? \_\_\_\_\_  
# boat rides

Q23. b) On average, how many of these areas did you visit on each boat ride?

<u>Activity</u>	<u>Q22/Q23a Dives/Rides</u>	<u>Q23b Areas Visited</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**Q24.** Please refer to section 3 on your Yellow Card and tell me which reason best describes your primary purpose of your trip to (county of interview). Please read the letter from the Yellow Card.

- A Recreation or vacation
- B Visit family or friends
- C Business trip
- D Business and pleasure
- E Other (specify) \_\_\_\_\_

**Boating Visitors Survey - Keys**

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**Ask Q25 if they participated in fishing from own boat or a friend's boat (activities 403, 406 or 410).**

Q25. On the most recent saltwater fishing day using your own or a friend's boat, approximately how much money did your party spend on the following items in (county of interview):

**Ask Q26 if they participated in fishing from a rental boat (activities 402, 405, or 409).**

Q26. On the most recent saltwater fishing day using a rental boat, approximately how much did your party spend on the following items in (county of interview):

	Q25 Own/Friend's Boat	Q26 Rental Boat
Boat fuel	\$ _____	\$ _____
Tackle	\$ _____	\$ _____
Bait	\$ _____	\$ _____
Ice	\$ _____	\$ _____
Ramp fees	\$ _____	\$ _____
Marine fees	\$ _____	\$ _____
Lodging	\$ _____	\$ _____
Camping fees	\$ _____	\$ _____
Food and beverages - stores	\$ _____	\$ _____
Food and beverages - restaurants/bars	\$ _____	\$ _____
Auto gas	\$ _____	\$ _____
Auto rental	\$ _____	\$ _____
Equipment rental	\$ _____	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____	\$ _____
Number of People in party who spent or benefited from this money (overall)	# _____	# _____

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**Ask Q27 if they participated in fishing from a charter boat (activities 400, 404 charter, or 407).**

Q27. On the most recent saltwater fishing day using a charter boat, approximately how much did your party spend on the following items in (county of interview):

**Ask Q28 if they participated in fishing from a party boat (activities 401, 404 party, or 408).**

Q28. On the most recent saltwater fishing day using a party boat (charge per person), approximately how much did your party spend on the following items in (county of interview):

	Q27 Charter <u>Boat</u>	Q28 Party <u>Boat</u>
Charter fee	\$ _____	\$ _____
Lodging	\$ _____	\$ _____
Camping fees	\$ _____	\$ _____
Food and beverages - stores	\$ _____	\$ _____
Food and beverages - restaurants/bars	\$ _____	\$ _____
Auto gas	\$ _____	\$ _____
Auto rental	\$ _____	\$ _____
Equipment rentals	\$ _____	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____	\$ _____
Number of people in party who spent or benefited from this money (overall) #	# _____	# _____

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**Ask Q29 if they participated in snorkeling or scuba diving from their own or a friends boat (activities 102 or 202).**

Q29. On the most recent saltwater snorkeling or scuba diving day using your own or a friends boat, approximately how much did your party spend on the following items in (county of interview):

**Ask Q30 if they participated in snorkeling or scuba diving from a rental boat (activities 101,201)**

Q30. On the most recent saltwater snorkeling or scuba diving day using a rental boat, approximately how much did your party spend on the following items in (county of interview):

	Q29 Own/Friend's Boat	Q30 Rental Boat
Boat rental	\$ <u>XXXXXXXXXX</u>	\$ _____
Boat fuel	\$ _____	\$ _____
Air refills	\$ _____	\$ _____
Ice	\$ _____	\$ _____
Ramp fees	\$ _____	\$ _____
Marina fees	\$ _____	\$ _____
Other equipment rentals	\$ _____	\$ _____
Lodging	\$ _____	\$ _____
Camping fees	\$ _____	\$ _____
Food and Beverages - Stores	\$ _____	\$ _____
Food and Beverages - restaurants/bars	\$ _____	\$ _____
Auto gas	\$ _____	\$ _____
Auto rental	\$ _____	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____	\$ _____
Number of people in party who spent or benefited from this money (overall)	# _____	# _____

**Ask Q31 if they participated in snorkeling or scuba diving from a charter/party boat (activities 100,200)**

Q31. On the most recent saltwater snorkeling or scuba diving day using a charter/party boat, approximately how much did your party spend on the following items in (county of interview):

	Q31 Charter/Party Boat
Charter/party boat fee	\$ _____
Equipment rental	\$ _____
Air refills	\$ _____
Ice	\$ _____
Ramp fees	\$ _____
Marina fees	\$ _____
Lodging	\$ _____
Camping fees	\$ _____
Food and Beverages - Stores	\$ _____
Food and Beverages - restaurants/bars	\$ _____
Auto gas	\$ _____
Auto rental	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____
Number of people in party who spent or benefited from this money	# _____

Now I would like to ask you a few questions about how you value both the artificial and natural reefs in Southeast Florida.

**CONTINGENT VALUATION QUESTIONS**

Q32. Over the past 12 months, how many trips have you made to Southeast Florida on which you used the natural reefs? \_\_\_\_\_ (# trips)

Q33. Over the past 12 months, how many trips have you made to Southeast Florida on which you used the artificial reefs? \_\_\_\_\_ (# trips)

**Hand respondent BLUE CARD.**

Could you take a minute and read the information in Section 1 on the BLUE CARD about the plans.

Now I would like to ask you only about a plan to maintain the health and condition of the natural reefs in Southeast Florida.

34. First, consider your total trip costs for your last trip to use the natural reefs of Southeast Florida, including travel expenses, hotel and campsites fees, food and drink, and all other expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the natural reefs ?

Please keep in mind that the added costs would have been used to make sure the water quality and health of the natural reefs would have been maintained in their current condition. Also, keep in mind that instead of using the natural reefs in Southeast Florida, you could have used the artificial reefs, gone to places other than Southeast Florida or spent this money on other things.

YES (Go to Question 36)     Don't Know (Go to Question 35)  
 NO (Go to Question 35)     Refused (Go to Question 35)

35. Please refer to Section 2 on the BLUE CARD and indicate the letter that best describes your reason for saying no, don't know or refusing. Write-in any other reason.

(circle): A B C D E F G H \_\_\_\_\_

Now we would like to evaluate the artificial reef plan.

36. Considering your total trip costs for your last trip to use the artificial reefs in Southeast Florida, including travel expenses, hotel and campsites fees, food and drink, and all other expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay that amount to maintain the artificial reefs ?

Please keep in mind that the added costs would have been used to make sure the water quality and health of the fish and sea life on the artificial reefs would have been maintained in their current condition. Also, keep in mind that instead of using the artificial reefs of Southeast Florida, you could have used the natural reefs, gone to places other than Southeast Florida or spent this money on other things.

YES (Go to Question 38)     Don't Know (Go to Question 37)  
 NO (Go to Question 37)     Refused (Go to Question 37)

37. Please refer to Section 3 on the BLUE CARD and indicate the letter that best describes your reason for saying no, don't know or refusing.

(circle): A B C D E F G H \_\_\_\_\_

38. Suppose that both of the above plans to maintain the natural and artificial reefs in Southeast Florida were put together in a combined program. Consider once again your total trip costs for your last trip to use the reefs in Southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs ?

\_\_\_ YES (Go to Question 40)    \_\_\_ Don't Know (Go to Question 39)  
\_\_\_ NO (Go to Question 39)    \_\_\_ Refused (Go to Question 39)

39. Please refer to Section 4 on the BLUE CARD and indicate the letter that best describes your reason for saying no, don't know or refusing.

(circle): A B C D E F G H \_\_\_\_\_

Could you take a minute and read Section 5 of the blue Card on the **Artificial Reef Program for New Reefs.**

40. Would you be willing to pay \$ \_\_\_\_ per year when you renew your boat registration and/or that amount in higher fees to charter/party boat or rental boat operations to fund this program ? The amount paid would go to fund new artificial reefs in Southeast Florida.

Please keep in mind that this amount would be in addition to the costs above for maintaining the current artificial reefs and protecting the water quality. Also, keep in mind that instead of using the artificial reefs in Southeast Florida, you could have used the natural reefs, gone to places other than Southeast Florida or spent this money on other things.

\_\_\_ YES (Go to Question 42)    \_\_\_ Don't Know (Got to Question 41)  
\_\_\_ NO (Go to Question 41)    \_\_\_ Refused (Go to Question 41)

41. Please refer to Section 6 on the BLUE CARD and read me the letter that best describes your reason for saying no, don't know or refusing.

(circle): A B C D E F G H \_\_\_\_\_

Q42. How long have you been boating in South Florida? \_\_\_\_\_  
# years

Q43. a) Do you own your own boat?

YES Go to Q43b                       NO Go to Q44



Boating Visitors Survey - Keys

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Q43. b) What is the length of your boat? \_\_\_\_\_ feet.

Q43. c) Where is it registered?

\_\_\_\_\_      \_\_\_\_\_  
County                      State

Q44. Are you a member of a fishing or diving club?

YES                                       NO

Q45. In what year were you born? 19 \_\_\_\_ \_\_\_\_

Q46. Sex:       Male                                       Female                      (Observed, not asked)

Q47. Are you Hispanic, Latino or of Spanish origin?

YES                                       NO

Q48. Please refer to section 4 of the Yellow Card and tell me which category best describes you?  
Please read the letter of the category.

Circle	A	White	D	Native Hawaiian or Pacific Islander
	B	Black or African American	E	Asian
	C	American Indian or Alaska Native	F	Other (specify) _____

Q49. Please refer to section 5 of the Yellow Card and tell me which income category best describes your annual household income last year, before taxes. Please give me the letter on the card that corresponds to the category.

(a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n) (o)  
 Refused  
 Don't know

Q50. a) During this trip to (county of interview), were you giving up any income earning activities?

YES                                       NO



Q55. b) How much income, before taxes, do you estimate you lost during this trip to (county of interview)? \$ \_\_\_\_\_

**IF NOT MONROE COUNTY,**

This concludes your interview. Thank you for your time.

**FOR MONROE COUNTY ONLY**

We have a short questionnaire on items we would like you to rate.

Please take this questionnaire and after you complete it return it to us by mail. Postage is prepaid

Accept questionnaire

Refuse

Interviewer: Code on-site survey identification number on questionnaire

Please get their telephone number for purposes of follow-up.

\_\_\_\_\_ Telephone number.  Refused

**YELLOW CARD**

**PRIVACY ACT STATEMENT**

Your participation is voluntary. Notwithstanding any other provision of the law, no person is required to respond to nor shall any person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act, unless the collection of information displays a currently valid OMB Control Number.

Since each interviewed person will represent many others not interviewed, your cooperation is extremely important. This study is being conducted by Hazen & Sawyer and the Florida State University for the State of Florida, Palm Beach, Broward, Miami-Dade and Monroe Counties and the National Oceanic and Atmospheric Administration. Uses of the information include evaluation of present recreation uses and planning for future recreation visitation. At the end of the study any materials identifying you, such as name, address or telephone number will be destroyed. All other information is available for distribution.

**Section 1. Modes of Transportation**

- |   |                                    |   |                     |
|---|------------------------------------|---|---------------------|
| A | Automobile – private               | H | Air – Marathon      |
| B | Automobile – rental                | I | Air – Key West      |
| C | Air – Miami                        | J | Air – other Florida |
| D | Air – Ft. Lauderdale/<br>Hollywood |   | Specify_____        |
| E | Air – West Palm Beach              | K | Cruise ship         |
| F | Air – Tampa                        | L | Own boat            |
| G | Air – Orlando                      | M | Other               |
|   |                                    |   | Specify_____        |

**Section 2. Overnight Accommodations**

- |   |  |
|---|--|
| 1 = Hotel/motel/Guest House/<br>Bed & Breakfast | 4 = Condominium or second home (own),<br>excluding time shares |
| 2 = Home of family/friends                      | 5 = Vacation rental  |
| 3 = Campground                                  | 6 = Time Share   |

**Section 3. Primary Purpose of Trip**

- |                             |                           |
|-----------------------------|---------------------------|
| A = Recreation or Vacation  | D = Business and Pleasure |
| B = Visit family or friends | E = Other (Specify)       |
| C = Business trip           |                           |

**Section 4. Race/Ethnicity**

- A. White
- B. Black or African American
- C. American Indian or Alaska Native
- D. Asian
- E. Native Hawaiian or Other Pacific Islander
- F. Other

----OVER-----

## YELLOW CARD

### Section 4. Annual Household Income before Taxes

*Please give only the letter of your income category.*

A	Less than \$5,000	I	\$40,000 to \$44,999
B	\$5,000 to \$9,999	J	\$45,000 to \$49,999
C	\$10,000 to \$14,999	K	\$50,000 to \$59,999
D	\$15,000 to \$19,999	L	\$60,000 to \$74,999
E	\$20,000 to \$24,999	M	\$75,000 to \$99,999
F	\$25,000 to \$29,999	N	\$100,000 to \$149,999
G	\$30,000 to \$34,999	O	\$150,000 or more
H	\$35,000 to \$39,999		

## WHITE CARD

### ACTIVITIES LIST

Number

#### Activities by Boat in Saltwater

---

##### **Snorkeling**

- 100 Snorkeling from charter/party boat (pay operation)
- 101 Snorkeling from Rental boat
- 102 Snorkeling from private boat (own boat/friend's boat)

##### **Scuba Diving**

- 200 Scuba diving from charter/party boat (pay operation)
- 201 Scuba diving from rental boat
- 202 Scuba diving from private boat (own boat/friend's boat)

##### **Special Activities while Snorkeling or Scuba Diving**

- 300 Diving for lobsters
- 301 Underwater photography
- 302 Wreck diving
- 303 Spear fishing
- 304 Collecting tropical fish or shellfish
- 305 Current/drift diving

##### **Fishing - Offshore/Trolling**

- 400 Fishing from charter boat (pay operation six persons or less) - offshore
- 401 Fishing from party or head boat (charge per person) - off shore
- 402 Fishing from rental boat - offshore
- 403 Fishing from private boat (own boat/friend's boat) - offshore

##### **Fishing - Flats or Back Country**

- 404 Fishing from Charter/party boat (pay operation) - flats or back country
- 405 Fishing from rental boat - flats or back country
- 406 Fishing from private boat (own boat/friend's boat) - flats or back country

##### **Fishing - Bottom**

- 407 Bottom fishing from charter boat (pay operation six persons or less)
- 408 Bottom fishing from party or head boat (charge per person)
- 409 Bottom fishing from rental boat
- 410 Bottom fishing from private boat (own boat/friend's boat)

##### **Viewing Nature and Wildlife**

- 500 Glass bottom boat rides (pay operation)
- 501 Back country boating excursions (pay operation/guided service/NOT FISHING)
- 502 Viewing nature and wildlife from rental boat
- 503 Viewing nature and wildlife from private boat (own boat/friend's boat)

##### **Personal Watercraft (jet skis, wave runners, etc.)**

- 600 Personal watercraft - rental
- 601 Personal watercraft - private (own boat/friend's boat)

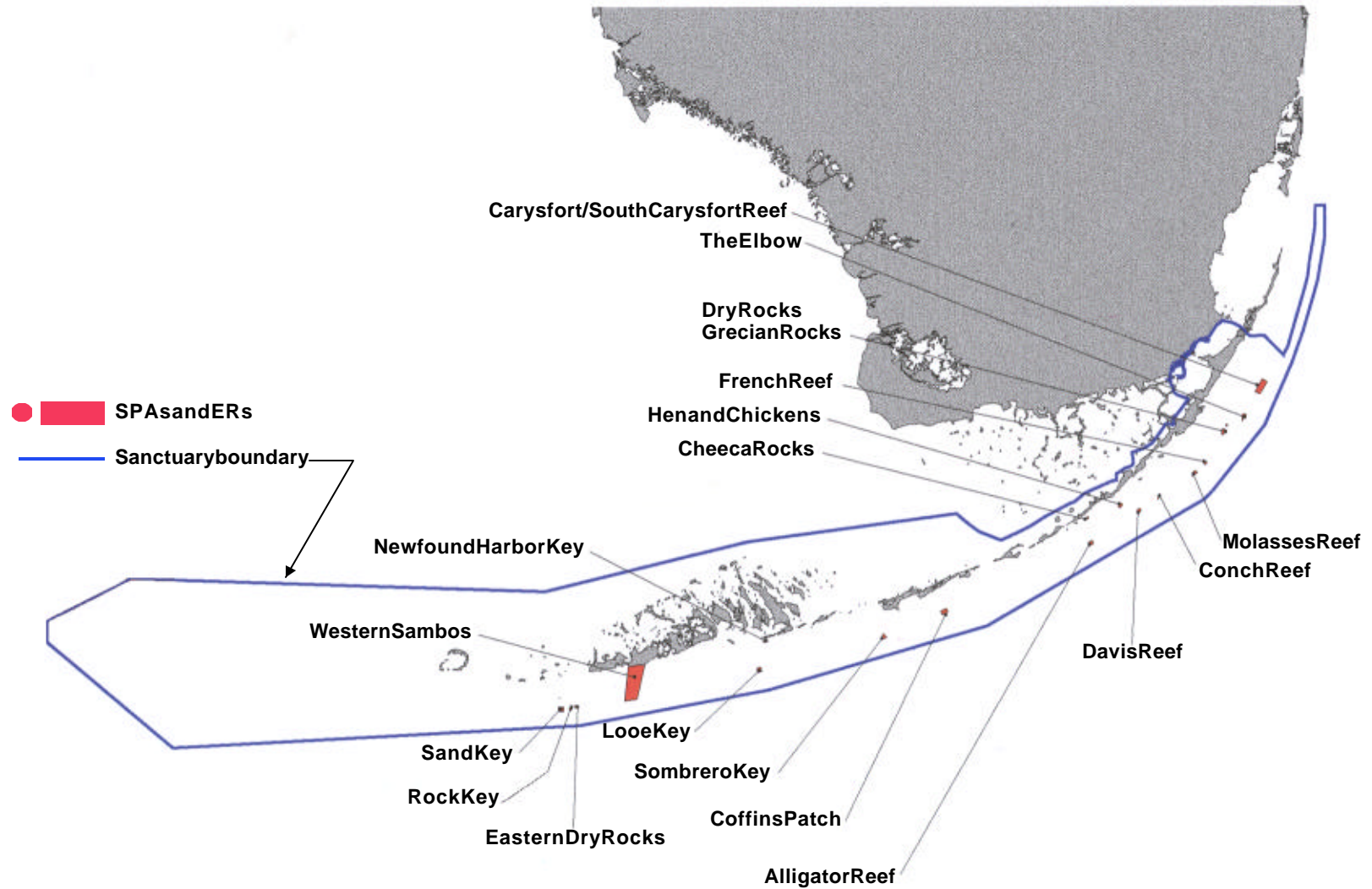
##### **Sailing**

- 700 Sailing charter/party boat (pay operation)
- 701 Sailing rental boat
- 702 Sailing private boat (own boat/friend's boat)

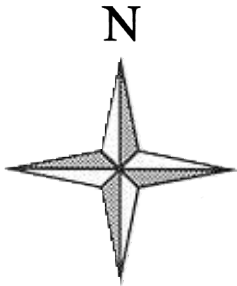
##### **Other Activities NOT MENTIONED ABOVE** (parasailing, hang gliding, sunset cruises, water-skiing)

- 800 Other activities from charter/party (pay operation)
- 801 Other activities from rental boat
- 802 Other activities from private boat (own boat/friend's boat)

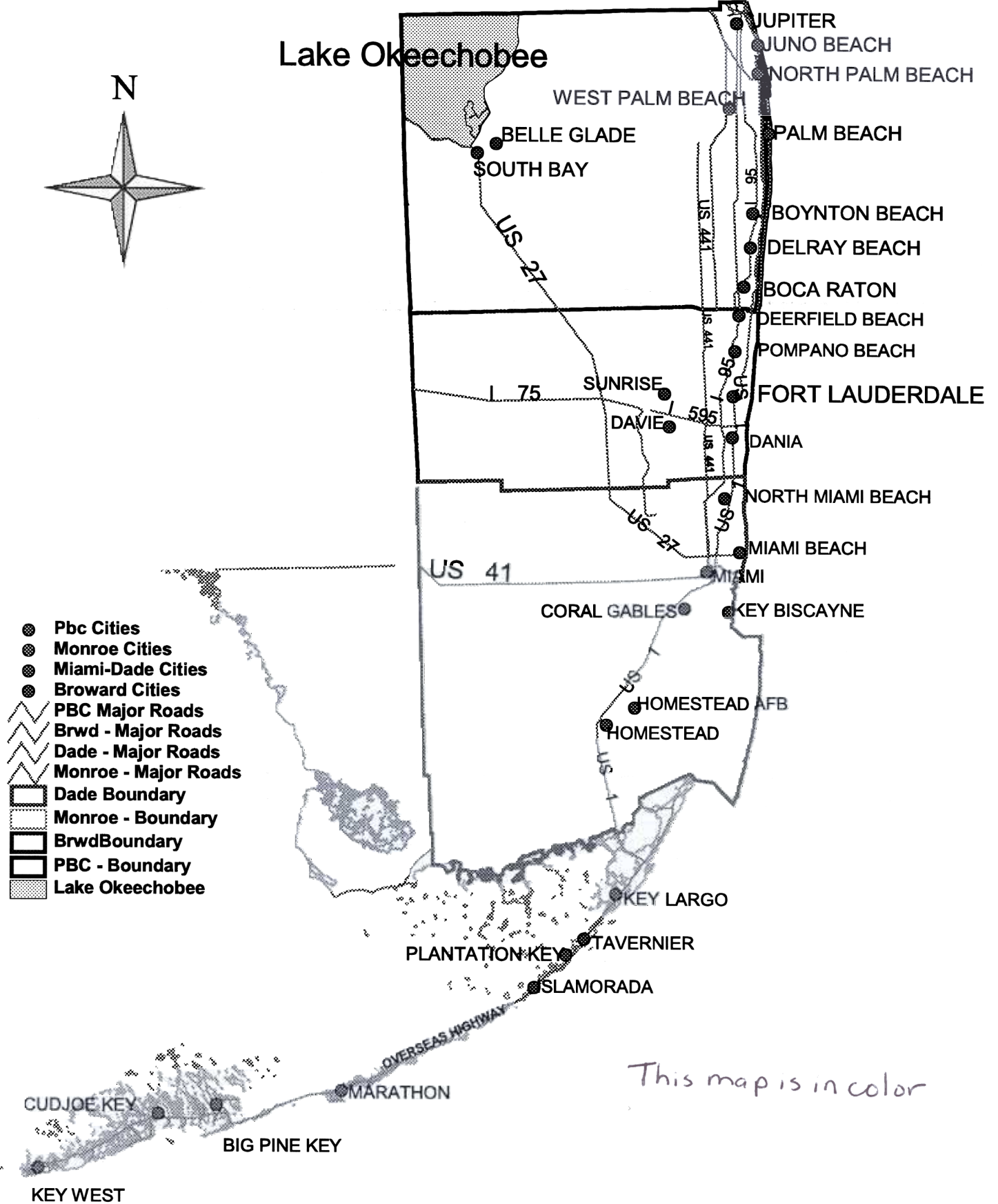
# Florida Keys National Marine Sanctuary Sanctuary Preservation Areas and Ecological Reserves



# Southeast Florida - Cities and Counties



Lake Okeechobee



*This map is in color*

**SECTION 1. REEF PLANS**

Local and state government agencies are considering different approaches to maintaining the health and condition of natural and artificial reefs in Southeast Florida. One plan focuses on providing greater protection for *natural reefs* by maintaining water quality, limiting damage to natural reefs from anchoring, and preventing overuse of the natural reefs. A second plan focuses on protecting the *artificial reefs* by maintaining water quality, limiting damage to artificial reefs from anchoring, and preventing overuse of the artificial reefs.

Both of these plans will involve increased costs to local businesses that will ultimately be passed on to both residents and visitors in Southeast Florida. We are doing this survey because local government agencies want to know whether you support one, both, or none of these plans and if you would be willing to incur higher costs to pay for these plans. Please keep in mind that whether you support these plans or not would not have any effect on your ability to participate in any boating activity or other recreation in Southeast Florida.

**SECTION 2. REASONS FOR SAYING NO, DON'T KNOW OR REFUSAL**

**Please give the letter corresponding to the answer that best describes your reason.**

- A** A contribution of that amount is more than natural reefs are worth to me.
- B** I don't really know how much an natural reefs are worth to me.
- C** There are no problems with water quality or the natural reefs.
- D** Not enough information to form a decision.
- E** I don't understand or like the question.
- F** Already pay too much to the government.
- G** Government waste should be reduced to pay for water quality protection and management of the natural reefs.
- H** Other Reason (Please Specify)\_\_\_\_\_

**SECTION 3. REASONS FOR SAYING NO, DON'T KNOW OR REFUSAL**

**Please read the letter of the answer that best describes your reason.**

- A** A contribution of that amount is more than the artificial reefs are worth to me.
- B** I don't really know how much artificial reefs are worth to me.
- C** Water quality is not a problem and artificial reefs don't need any management.
- D** Not enough information to form a decision.
- E** I don't understand or like the question.
- F** Already pay too much to the government.
- G** Government waste should be reduced to fund water quality protection and management of the artificial reefs.
- H** Other Reason (Please Specify)\_\_\_\_\_



**SECTION 4. REASONS FOR SAYING NO, DON'T KNOW OR REFUSAL**

**Please read the letter of the answer that best describes your reason.**

- A A contribution of that amount is more than the reefs are worth to me.
- B I don't really know how much reefs are worth to me.
- C Water quality is not a problem and the reefs don't need any management.
- D Not enough information to form a decision.
- E I don't understand or like the question.
- F Already pay too much to the government.
- G Government waste should be reduced to fund water quality protection and management of the reefs.
- H Other Reason (Please Specify)\_\_\_\_\_

**SECTION 5. ARTIFICIAL REEF PROGRAM - NEW REEFS**

Artificial reef programs cost money. Suppose that the government proposed that all newly constructed reefs would be paid for by all users of the artificial reefs. Fishermen and divers with their own boats would pay for a decal as part of their boat registration and/or, if they used a charter/party boat (pay operation) or a rental boat, they would pay for the costs through higher fees charged by the pay operation.

**How would the money be used ?**

The money would go into a trust fund that could only be used for the construction and maintenance of artificial reefs in Southeast Florida.

**SECTION 6. REASONS FOR SAYING NO, DON'T KNOW OR REFUSAL**

- A A contribution of that amount is more than a new artificial reef is worth to me.
- B I don't really know how much an artificial reef is worth to me.
- C There are enough artificial reefs already.
- D Not enough information to form a decision.
- E I don't understand or like the question.
- F The government should fund the artificial reef program out of general revenue and not a specific tax or fee.
- G Already pay too much to the government.
- H Government waste should be reduced to fund the artificial reef program.
- I Other Reason (Please Specify)\_\_\_\_\_

**Boating Visitors Survey - Not Keys**

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- Screening Criteria:
- 1) NOT a resident of county of interview.
  - 2) Engaged in saltwater boating activities in county of interview in the past 12 months.
  - 3) Meets Exit Condition

Survey number: \_\_\_\_\_

Date/time of interview:

\_\_\_\_\_

Month      Day      Time

County of Interview (circle): Palm Beach Broward Dade Monroe

Interview Site: \_\_\_\_\_

**HAND RESPONDENT YELLOW CARD AND ASK THEM TO READ PRIVACY ACT STATEMENT**

1. a) How many people are with you on your visit to (county of interview)(do not count the respondent)?

\_\_\_\_\_ # people

1. b) How many of these people are not permanent residents of (county of interview)

\_\_\_\_\_

\_\_\_\_\_ # people

2. How many of these people are 16 or older (do not include respondent)?

\_\_\_\_\_ # people

3. Where is your primary residence?

\_\_\_\_\_

City or nearest city      County      State      Zip Code

Country: \_\_\_\_\_

- USA
- Canada
- Mexico
- Central/South America
- Austalia/Oceania
- Japan
- Other Far East
- United Kingdom
- Other Europe
- Middle East
- Africa
- Other

4. a) On this trip, is (county of interview) the only destination?

YES Go to Q5.       NO Go to Q4b.

4. b) Is (county of interview) your primary destination for this trip?

YES Go to Q5.       NO Go to Q4c.

**Boating Visitors Survey - Not Keys**

OMB Approval #:0648-0410  
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4. c) Where did you last visit before coming to (county of interview)?

_____	_____	_____	_____
City or nearest city	County	State	Zip Code

5. Look at Section 1 of the Yellow Card. How did you and those in your group who are not residents of (county of interview) get to (county of interview)? Please give the letters of all that apply. (*Circle all that apply*)

- |   |                                   |   |                     |
|---|-----------------------------------|---|---------------------|
| A | Automobile - private              | H | Air - Marathon      |
| B | Automobile - rental               | I | Air - Key West      |
| C | Air - Miami                       | J | Air - other Florida |
| D | Air - Ft Lauderdale/<br>Hollywood |   | Specify _____       |
| E | Air - West Palm Beach             | K | Cruise ship         |
| F | Air - Tampa                       | L | Own boat            |
| G | Air - Orlando                     | M | Other               |
|   |                                   |   | Specify _____       |

6. a) On this trip to (county of interview), when did you first arrive

_____	_____	_____
Month	Day	Time

6. b) When do you plan to leave?

_____	_____	_____
Month	Day	Time

7. Including this trip, how many times have you visited (county of interview) in the last 12 months, that is since (date last year)?

\_\_\_\_\_ # times

8. Including this trip, how many days have you spent in (county of interview) in the last 12 months?

\_\_\_\_\_ # days

9. How many overnight trips have you made to (county of interview) in the last 12 months?

\_\_\_\_\_ # overnight trips

10. How many nights are you spending in (county of interview) on this trip?

\_\_\_\_\_ # nights

*If Question 10 is zero, then go to Q12.*

**Boating Visitors Survey - Not Keys**

OMB Approval #:0648-0410  
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11. Please refer to the Yellow Card in Section 2 and tell me the number corresponding to where you stayed on this trip to (county of interview)? (circle)

- |   |   |
|---|---|
| 1 = Hotel/Motel/Guest House/<br>Bed & Breakfast | 4 = Condominium, or second home (own),<br>excluding time shares |
| 2 = Home of family/friends                      | 5 = Vacation Rental   |
| 3 = Campground                                  | 6 = Time Share  |

I would now like to ask you about some of the activities in which you or someone in your group who is not a permanent resident of (county of interview), participated while on your visits to (county of interview).

**HAND RESPONDENT WHITE CARD WITH ACTIVITIES LIST**

- Q12. In which of these activities did you or someone in your group participate during the last 12 months in (county of interview)? Please read me the number corresponding to each activity on the card.
- Q13. As I read you each activity in which you said you or someone in your group participated, please tell me which activity you participated in during the past 12 months in (county of interview).  
*If person by themselves, skip to Q15.*
- Q14. As I read each activity, please tell me how many others in your group who are not permanent residents of (county of interview) participated in the activity in (county of interview) during the last 12 months.
- Q15. As I read each activity, would you tell me how many days you participated in the activity in (county of interview) over the past 12 months?
- Q16. How many of the days of (activity) were on artificial reefs?
- Q17. How many of the days of (activity) were on natural reefs?  
*If no DIVING OR SNORKELING activities, skip to Q21.*
- Don't ask Q18-Q20 for special snorkeling or scuba diving (activities 300-305).*
- Q18. Over the past 12 months, in the (county of interview), how many dives did you make (read activity - snorkeling or scuba diving; a dive is a water entry and exit.)?
- Q19. How many of these dives were on artificial reefs (for each snorkeling and scuba diving activity)?
- Q20. How many of these dives were on natural reefs (for each snorkeling and scuba diving activity)?

Q12 Activity	Q13 Resp	Q14 # Others	Q15 Respondent # of days	Q16 # of days artificial reef	Q17 # of days natural reef	Q18 Respondent # of dives	Q19 Resp # dives artificial reef	Q20 Resp # dives natural reef
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____
_____	O	_____	_____	_____	_____	_____	_____	_____

**Boating Visitors Survey - Not Keys**

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**Q24.** Please refer to section 3 on your Yellow Card and tell me which reason best describes your primary purpose of your trip to (county of interview). Please read the letter from the Yellow Card.

- A Recreation or vacation
- B Visit family or friends
- C Business trip
- D Business and pleasure
- E Other (specify) \_\_\_\_\_

**Ask Q25 if they participated in fishing from own boat or a friend's boat (activities 403, 406 or 410).**

**Q25.** On the most recent saltwater fishing day using your own or a friend's boat, approximately how much money did your party spend on the following items in (county of interview):

**Ask Q26 if they participated in fishing from a rental boat (activities 402, 405, or 409).**

**Q26.** On the most recent saltwater fishing day using a rental boat, approximately how much did your party spend on the following items in (county of interview):

	<u>Expenditures on Most Recent Saltwater Fishing Day</u> (only in county of interview)	
	Q25 Own/Friend's <u>Boat</u>	Q26 Rental <u>Boat</u>
Boat fuel	\$ _____	\$ _____
Tackle	\$ _____	\$ _____
Bait	\$ _____	\$ _____
Ice	\$ _____	\$ _____
Ramp fees	\$ _____	\$ _____
Marine fees	\$ _____	\$ _____
Lodging	\$ _____	\$ _____
Camping fees	\$ _____	\$ _____
Food and beverages - stores	\$ _____	\$ _____
Food and beverages - restaurants/bars	\$ _____	\$ _____
Auto gas	\$ _____	\$ _____
Auto rental	\$ _____	\$ _____
Equipment rental	\$ _____	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____	\$ _____
Number of People in party who spent or benefited from this money (overall)	# _____	# _____

**Boating Visitors Survey - Not Keys**

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**Ask Q27 if they participated in fishing from a charter boat (activities 400, 404 charter, or 407).**

Q27. On the most recent saltwater fishing day using a charter boat, approximately how much did your party spend on the following items in (county of interview):

**Ask Q28 if they participated in fishing from a party boat (activities 401, 404 party, or 408).**

Q28. On the most recent saltwater fishing day using a party boat (charge per person), approximately how much did your party spend on the following items in (county of interview):

	Q27 Charter <u>Boat</u>	Q28 Party <u>Boat</u>
Charter fee	\$ _____	\$ _____
Lodging	\$ _____	\$ _____
Camping fees	\$ _____	\$ _____
Food and beverages - stores	\$ _____	\$ _____
Food and beverages - restaurants/bars	\$ _____	\$ _____
Auto gas	\$ _____	\$ _____
Auto rental	\$ _____	\$ _____
Equipment rentals	\$ _____	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____	\$ _____
Number of people in party who spent or benefited from this money (overall)	# _____	# _____

**Boating Visitors Survey - Not Keys**

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**Ask Q29 if they participated in snorkeling or scuba diving from their own  
or a friends boat (activities 102 or 202).**

Q29. On the most recent saltwater snorkeling or scuba diving day using your own or a friends boat, approximately how much did your party spend on the following items in (county of interview):

**Ask Q30 if they participated in snorkeling or scuba diving from a rental boat (activities 101,201)**

Q30. On the most recent saltwater snorkeling or scuba diving day using a rental boat, approximately how much did your party spend on the following items in (county of interview):

	Q29 Own/Friend's Boat	Q30 Rental Boat
Boat rental	\$ <u>XXXXXXXXXX</u>	\$ _____
Boat fuel	\$ _____	\$ _____
Air refills	\$ _____	\$ _____
Ice	\$ _____	\$ _____
Ramp fees	\$ _____	\$ _____
Marina fees	\$ _____	\$ _____
Other equipment rentals	\$ _____	\$ _____
Lodging	\$ _____	\$ _____
Camping fees	\$ _____	\$ _____
Food and Beverages - Stores	\$ _____	\$ _____
Food and Beverages - restaurants/bars	\$ _____	\$ _____
Auto gas	\$ _____	\$ _____
Auto rental	\$ _____	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____	\$ _____
Number of people in party who spent or benefited from this money (overall)	# _____	# _____

**Ask Q31 if they participated in snorkeling or scuba diving from a charter/party boat (activities 100,200)**

Q31. On the most recent saltwater snorkeling or scuba diving day using a charter/party boat, approximately how much did your party spend on the following items in (county of interview):

	Q31 Charter/Party <u>Boat</u>
Charter/party boat fee	\$ _____
Equipment rental	\$ _____
Air refills	\$ _____
Ice	\$ _____
Ramp fees	\$ _____
Marina fees	\$ _____
Lodging	\$ _____
Camping fees	\$ _____
Food and Beverages - Stores	\$ _____
Food and Beverages - restaurants/bars	\$ _____
Auto gas	\$ _____
Auto rental	\$ _____
Shopping (clothing, gifts, souvenirs)	\$ _____
Number of people in party who spent or benefited from this money	# _____

Now I would like to ask you a few questions about how you value both the artificial and natural reefs in Southeast Florida.

**CONTINGENT VALUATION QUESTIONS**

Q32. Over the past 12 months, how many trips have you made to Southeast Florida on which you used the natural reefs? \_\_\_\_\_ (# trips)

Q33. Over the past 12 months, how many trips have you made to Southeast Florida on which you used the artificial reefs? \_\_\_\_\_ (# trips)



**Hand respondent BLUE CARD.**

Could you take a minute and read the information in Section 1 on the BLUE CARD about the plans.

Now I would like to ask you only about a plan to maintain the health and condition of the natural reefs in Southeast Florida.

34. First, consider your total trip costs for your last trip to use the natural reefs of Southeast Florida, including travel expenses, hotel and campsites fees, food and drink, and all other expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay this amount to maintain the natural reefs ?

Please keep in mind that the added costs would have been used to make sure the water quality and health of the natural reefs would have been maintained in their current condition. Also, keep in mind that instead of using the natural reefs in Southeast Florida, you could have used the artificial reefs, gone to places other than Southeast Florida or spent this money on other things.

- YES (Go to Question 36)     Don't Know (Go to Question 35)
- NO (Go to Question 35)     Refused (Go to Question 35)

35. Please refer to Section 2 on the BLUE CARD and indicate the letter that best describes your reason for saying no, don't know or refusing. Write-in any other reason.

(circle): A B C D E F G H \_\_\_\_\_

Now we would like to evaluate the artificial reef plan.

36. Considering your total trip costs for your last trip to use the artificial reefs in Southeast Florida, including travel expenses, hotel and campsites fees, food and drink, and all other expenses. If your total costs for this trip would have been \$\_\_\_\_\_ higher, would you have been willing to pay that amount to maintain the artificial reefs ?

Please keep in mind that the added costs would have been used to make sure the water quality and health of the fish and sea life on the artificial reefs would have been maintained in their current condition. Also, keep in mind that instead of using the artificial reefs of Southeast Florida, you could have used the natural reefs, gone to places other than Southeast Florida or spent this money on other things.

- YES (Go to Question 38)     Don't Know (Go to Question 37)
- NO (Go to Question 37)     Refused (Go to Question 37)

37. Please refer to Section 3 on the BLUE CARD and indicate the letter that best describes your reason for saying no, don't know or refusing.

(circle): A B C D E F G H \_\_\_\_\_

38. Suppose that both of the above plans to maintain the natural and artificial reefs in Southeast Florida were put together in a combined program. Consider once again your total trip costs for your last trip to use the reefs in Southeast Florida including travel expenses, lodging, and all boating expenses. If your total costs for this trip would have been \$ \_\_\_\_ higher, would you have been willing to pay this amount to maintain the artificial and natural reefs ?

\_\_\_ YES (Go to Question 40)    \_\_\_ Don't Know (Go to Question 39)  
\_\_\_ NO (Go to Question 39)    \_\_\_ Refused (Go to Question 39)

39. Please refer to Section 4 on the BLUE CARD and indicate the letter that best describes your reason for saying no, don't know or refusing.

(circle): A B C D E F G H \_\_\_\_\_

Could you take a minute and read Section 5 of the blue Card on the **Artificial Reef Program for New Reefs.**

40. Would you be willing to pay \$ \_\_\_\_ per year when you renew your boat registration and/or that amount in higher fees to charter/party boat or rental boat operations to fund this program ? The amount paid would go to fund new artificial reefs in Southeast Florida.

Please keep in mind that this amount would be in addition to the costs above for maintaining the current artificial reefs and protecting the water quality. Also, keep in mind that instead of using the artificial reefs in Southeast Florida, you could have used the natural reefs, gone to places other than Southeast Florida or spent this money on other things.

\_\_\_ YES (Go to Question 42)    \_\_\_ Don't Know (Got to Question 41)  
\_\_\_ NO (Go to Question 41)    \_\_\_ Refused (Go to Question 41)

41. Please refer to Section 6 on the BLUE CARD and read me the letter that best describes your reason for saying no, don't know or refusing.

(circle): A B C D E F G H \_\_\_\_\_

Q42. How long have you been boating in South Florida? \_\_\_\_\_  
# years

Q43. a) Do you own your own boat?

YES Go to Q43b                       NO Go to Q44

**Boating Visitors Survey - Not Keys**

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Q43. b) What is the length of your boat? \_\_\_\_\_ feet.

Q43. c) Where is it registered?

\_\_\_\_\_      \_\_\_\_\_  
County                      State

Q44. Are you a member of a fishing or diving club?

YES                                       NO

Q45. In what year were you born? 19 \_\_\_\_ \_\_\_\_

Q46. Sex:       Male                                       Female                      (Observed, not asked)

Q47. Are you Hispanic, Latino or of Spanish origin?

YES                                       NO

Q48. Please refer to section 4 of the Yellow Card and tell me which category best describes you?  
Please read the letter of the category.

Circle	A	White	D	Native Hawaiian or Pacific Islander
	B	Black or African American	E	Asian
	C	American Indian or Alaska Native	F	Other (specify) _____

Q49. Please refer to section 5 of the Yellow Card and tell me which income category best describes your annual household income last year, before taxes. Please give me the letter on the card that corresponds to the category.

(a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n) (o)  
 Refused  
 Don't know

Q50. a) During this trip to (county of interview), were you giving up any income earning activities?

YES

NO



Q55. b) How much income, before taxes, do you estimate you lost during this trip to (county of interview)? \$\_\_\_\_\_

This concludes your interview. Thank you for your time.



**General Visitors Survey**

OMB Approval #:0648-0410  
Expiration Date 7/31/2003

Screening Criteria: 1) NOT a resident of county of interview.  
2) Meets exit condition

Onsite survey number: \_\_\_\_\_

Date/time of interview:

County of Interview: \_\_\_\_\_

\_\_\_\_\_  
Month Day Time

1. a) How many people are here with you on your visit to (county of interview) (do not include \_\_\_\_\_  
# people

1. b) How many of these people are not permanent residents of (county of interview) \_\_\_\_\_  
# people

2. How many of these people are 16 or older (do not include respondent)? \_\_\_\_\_  
# people

3. Where is your primary residence?

\_\_\_\_\_  
City or nearest city County State Zipcode

Country: \_\_\_\_\_

- USA
- Canada
- Mexico
- Central/South America
- Austalia/Oceania
- Japan
- Other Far East
- United Kingdom
- Other Europe
- Middle East
- Africa
- Other

4. a) On this trip to (county of interview), when did you first arrive? \_\_\_\_\_  
Month Day Time

b) On this trip to (county of interview), when do you plan to leave? \_\_\_\_\_  
Month Day Time

5. Including this trip, how many times have you visited (county of interview) in the last 12 months - that is, since (date last year)? \_\_\_\_\_  
# times

General Visitors Survey

OMB Approval #:0648-0410  
Expiration Date:7/31/2003

6. Including this trip, how many days have you spent in (county of interview) in the last 12 months?

\_\_\_\_\_ # days

7. How many overnight trips have you made to (county of interview) in the last 12 months?

\_\_\_\_\_ # overnight trips

8. On this trip, how many nights will you have spent in (county of interview)?

\_\_\_\_\_ # nights

9. Look at Section 1 of the Green Card. How did you and those in your group who are not permanent residents of (county of interview) get to (county of interview)? Please give the letters of all that apply. (Circle all that apply)

- |   |                                   |   |                     |
|---|-----------------------------------|---|---------------------|
| A | Automobile - private              | H | Air - Marathon      |
| B | Automobile - rental               | I | Air - Key West      |
| C | Air - Miami                       | J | Air - other Florida |
| D | Air - Ft Lauderdale/<br>Hollywood |   | Specify _____       |
| E | Air - West Palm Beach             | K | Cruise ship         |
| F | Air - Tampa                       | L | Own boat            |
| G | Air - Orlando                     | M | Other               |
|   |                                   |   | Specify _____       |

10. Where are you staying or did you stay on this trip to (county of interview)? Please read me the number from Section two of the Green Card.

- |   |   |
|---|---|
| 1 = Hotel/Motel/Guest House/<br>Bed & Breakfast | 4 = Condominium, or second home (own),<br>excluding time shares |
| 2 = Home of family/friends                      | 5 = Vacation Rental   |
| 3 = Campground                                  | 6 = Time Share  |

Please refer to the White Card with the Activities List.

11. Over the last 12 months, did you or someone in your current group who is not a resident of (county of interview) engage in any kind of saltwater boating when visiting (county of interview)?

- YES Go to Q12.                       NO Go to Q15.

**HAND RESPONDENT WHITE CARD WITH  
ACTIVITIES LIST**

I would now like to ask you about some of the activities in which you, or someone in your group, participated in while on your visits to (county of interview).

- Q12. In which of these activities did you or someone in your group participate during the last 12 months?
- Q13. As I read each activity in which you said you or someone in your group participated, could you tell me which activity YOU participated in during the past 12 months? *If the person is alone, skip to Q15.*
- Q14. Now as I read each activity would you tell me how many others in your group who are not residents of (county of interview) participated in the activity in (county of interview) during the past 12 months?

Last 12 months					
Activity			Resp	#	Others
___	___	___	○	___	___
___	___	___	○	___	___
___	___	___	○	___	___
___	___	___	○	___	___
___	___	___	○	___	___
___	___	___	○	___	___
___	___	___	○	___	___

- Q15. Please refer to Section 3 on your green card and tell me which reason best describes your primary purpose of your trip to (county of interview). Please read the letter from the green card.
- A Recreation or vacation
  - B Visit family or friends
  - C Business trip
  - D Business and pleasure
  - E Other (specific) \_\_\_\_\_



**General Visitors Survey**

OMB Approval #:0648-0410

Expiration Date:7/31/2003

Now I would like to ask you about your trip expenses. Please provide your best estimate of the total for each category for your party for this trip. Include only the amounts spent in this county.

- Q16 \_\_\_\_\_ Lodging accommodations
- Q17 \_\_\_\_\_ Food & beverage at restaurants/bars
- Q18 \_\_\_\_\_ Food & beverage at grocery/convenient stores
- Q19 \_\_\_\_\_ Sport activities including charter/party/guide fees, boat ramp/marine fees, tackle and bait fees
- Q20 \_\_\_\_\_ Admission to events and attractions
- Q21 \_\_\_\_\_ Evening entertainment
- Q22 \_\_\_\_\_ Rental car, taxi, bus fares
- Q23 \_\_\_\_\_ Shopping (clothing, gifts, souvenirs)
- Q24 \_\_\_\_\_ All other
- Q25 How many people in your party spent or benefited from these expenditure? \_\_\_\_\_  
# of People

Finally, for statistical purposes, we need to know a few things about you.

- Q26. In what year were you born? 19 \_\_\_\_ \_\_\_\_
- Q27. Sex: Male \_\_\_\_\_ Female \_\_\_\_\_ (Observed, not asked)
- Q28. Are you Hispanic, Latino or of Spanish origin?  
 YES  NO

Q29. Please refer to Section 4 of the green card and tell me which category best describes you.

- A White
- B Black or African American
- C American Indian or Alaska Native
- D Native Hawaiian or other Pacific Islander
- E Asian
- F Other

Q30. Please refer to section 5 of the green card and tell me which income category best describes your annual household income last year before taxes. Please give me the letter on the card corresponding to the amount that is the closest to your annual household income.

a  b  c  d  e  f  g  h  i  j  k  l  m  n  o

Refused

Don't know

That's it. Thank you very much for participating in this survey. I hope you enjoyed your stay.

## GREEN CARD

### PRIVACY ACT STATEMENT

Your participation is voluntary. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless the collection of information displays a currently valid OMB Control Number.

Since each interviewed person will represent many others not interviewed, your cooperation is extremely important. This study is being conducted by Hazen & Sawyer and the Florida State University for the State of Florida, Palm Beach, Broward, Miami-Dade and Monroe Counties and the National Oceanic and Atmospheric Administration. Uses of the information include evaluation of present recreation uses and planning for future recreation visitation. At the end of the study any materials identifying you such as name, address or telephone number will be destroyed. All other information will be available for distribution. The interview should take 5 to 15 minutes with an average of 10 minutes.

### Section 1. Modes of Transportation

- |  |                         |
|--|-------------------------|
| A = Automobile – private               | H = Air – Marathon      |
| B = Automobile – rental                | I = Air – Key West      |
| C = Air – Miami                        | J = Air – Other Florida |
| D = Air – Ft. Lauderdale/<br>Hollywood | Specify _____           |
| E = Air – West Palm Beach              | K = Cruise Ship         |
| F = Air – Tampa                        | L = Own boat            |
| G = Air – Orlando                      | M = Other               |
|  | Specify _____           |

### Section 2. Overnight Accommodations

- |   |  |
|---|--|
| 1 = Hotel/Motel/Guest House/<br>Bed & Breakfast | 4 = Condominium or Second Home (own),<br>excluding time shares |
| 2 = Home of family/friends                      | 5 = Vacation Rental  |
| 3 = Campground                                  | 6 = Time Share   |

### Section 3. Primary Purpose of Trip

- |                             |                           |
|-----------------------------|---------------------------|
| A = Recreation or Vacation  | D = Business and Pleasure |
| B = Visit family or friends | E = Other (Specific)      |
| C = Business trip           |                           |

### Section 4. Race/Ethnicity

- A. White
- B. Black or African American
- C. American Indian or Alaska Native
- D. Asian
- E. Native Hawaiian or Other Pacific Islander
- F. Other

---OVER---

**GREEN CARD**

**Section 5. Annual Household Income before Taxes**

*Please give only the letter of your income category.*

- |   |                      |   |                        |
|---|----------------------|---|------------------------|
| A | Less than \$5,000    | I | \$40,000 to \$44,999   |
| B | \$5,000 to \$9,999   | J | \$45,000 to \$49,999   |
| C | \$10,000 to \$14,999 | K | \$50,000 to \$59,999   |
| D | \$15,000 to \$19,999 | L | \$60,000 to \$74,999   |
| E | \$20,000 to \$24,999 | M | \$75,000 to \$99,999   |
| F | \$25,000 to \$29,999 | N | \$100,000 to \$149,999 |
| G | \$30,000 to \$34,999 | O | \$150,000 or more      |
| H | \$35,000 to \$39,999 |   |                        |

**Appendix Table C-1**  
**Visitor Boater Survey Site Count**  
**Number of Surveys Completed at Each Site - By County**

Site Code	MONROE County Sites	Number of Surveys
3	Blank	15
50	American Outdoors	1
51	Annie's Beach	12
52	Atlantic Shores Motel	1
53	Bahia Honda Beach & State Park	48
54	Banana Bay Resort - Marathon	66
55	Banana Bay Resort - Key West	29
56	Cabana Bay Resort	2
57	Calusa Beach, Campground & Resort	48
58	Boyd's Campground/Captain John's Greyhound - Boat Harbor	11
59	Charter Boat Row - Key West	7
60	Cobra Marina	3
61	Crane Hammock Museum	3
62	Crain Point Museum	3
63	Curry Hammock State Park	12
64	Curry Mansion	9
65	Denny's	1
66	Estes Motors/Estes Marine	2
67	Exxon at MM 101	1
68	Exxon at Rock Harbor	1
69	Fairfield Inn - Key West	42
70	Fiesta Key - Campground & KOA Site	98
71	Fort Zachary Taylor Park	43
72	Galleon Marina/Reef Raiders	18
73	Garden Cove Marina	2
74	Glass Bottom Boats	1
75	Hampton Inn - Key West	39
76	Harry Harris State Park	16
77	Hemmingway House	6
78	Holiday Inn - Key Largo	9
79	Holiday Isle/Holiday Inn Dock	3
80	Italian Marina	1
81	John Pennekamp State Park	144
82	Key Largo Harbor	1
83	Key West Airport	75
84	Key West Bight	5

**Appendix Table C-1**  
**Visitor Boater Survey Site Count**  
**Number of Surveys Completed at Each Site - By County**

Site Code	MONROE County Sites	Number of Surveys
85	City of Key West Boat Harbor - Marina, Charter Row, Garrison Bight & Captain John's Greyhound	82
86	Key West Diving Society - Stock Island	7
87	Knights Key - Campground	59
88	KOA Campground	1
89	Land's End Village Boat Harbor & Marina - Key West	17
90	Largo Harbor	2
91	Largo Lodge	2
92	Little Duck Key & LDK Beach	4
93	Long Key State Park & Campground	69
94	Marriott Key Largo	1
95	Matecumbe Beach	4
96	Miami Sub Parking Lot	1
97	Monroe	1
98	Ocean Divers	2
99	Parmer's [Palmer's] Resort Marina	58
100	Quay Restaurant	4
101	Ramp on the street	4
102	Roadside Park	1
103	Rock Harbor Marina	4
104	Rowell's Marina	6
105	Shell Gas Station	2
106	Sombero Beach	99
107	Southernmost South Beach - Key West	6
108	Southernmost Point; Hotel/Motel	6
109	Sugar Loaf Key/KOA & Campground	12
110	Sunshine Key Campground/RV Park & Resort	41
111	Tavernier Creek Marina	6
112	Veteran's Park/Veteran's Park Rest Area	8
113	Weston Resort	1
114	Whale Harbor Marina	3
131	Almost There (Stock Island) Charters	1
132	Amber Jack Pier / Garrison Bight City Marina	6
133	Atlanta Dive Center	43
134	Big Pine Key Fish Camp/Big Pine Fishing Camp	8
135	Camp Hammael	1

**Appendix Table C-1**  
**Visitor Boater Survey Site Count**  
**Number of Surveys Completed at Each Site - By County**

<b>Site Code</b>	<b>MONROE County Sites</b>	<b>Number of Surveys</b>
136	Captain Hook	1
138	Dive Key West	1
140	Dolphin Research/Dolphin Research Court	6
141	Dolphin Resort	6
142	Lions Liar	4
143	Marathon Airport Marathon	1
144	Marathon Lady	1
145	Mel Fisker Museum	1
146	Sheraton	2
147	South Beach Motel	1
148	Theater of the Seas	5
149	Turtle Kraals	13
150	Wild Bird Center	2
<b>Total</b>		<b>1394</b>

**Appendix Table C-1 (Continued)**  
**Visitor Boater Survey Site Count**  
**Number of Surveys Completed at Each Site - By County**

<b>Site Code</b>	<b>MIAMI-DADE County Sites</b>	<b>Number of Surveys</b>
3	Blank	7
5	City of Boca Boat	4
10	Lake Park Marina	2
19	Bayside Marina	21
20	Bayside Marketplace	1
22	Crandon Park Marina	27
23	Dinner Key Marina	2
24	Haulover Beach	6
25	Haulover Marina	154
26	Marriott Biscayne Bay Hotel	6
27	Matheson Hammock Marina	3
28	Miami International Airport	4
29	Miami Seaquarium	3
30	Monty's/Monte's Marina	2
31	Pelican Harbor Marina	23
32	Sealine Marina	1
123	Biscayne National Park	58
124	Haulover Dock	19
125	Homestead Bayfront	7
152	Black Point Marina	1
153	Island View Park	2
<b>Total</b>		<b>353</b>



**Appendix Table C-1 (Continued)**  
**Visitor Boater Survey Site Count**  
**Number of Surveys Completed at Each Site - By County**

<b>Site Code</b>	<b>BROWARD County Sites</b>	<b>Number of Surveys</b>
3	Blank	7
33	15th Street Boatramp	10
35	Broward/Broward Marina	18
36	CB Smith Park	3
37	Cove Marina	6
38	Fort Lauderdale International Airport	9
39	Hillsboro Inlet Marina	26
40	Holiday Inn	3
41	Holiday Inn Lauderdale-by-the-Sea	1
42	Hugh Taylor Birch State Park	1
43	Las Olas Riverfront	5
44	Marina	4
45	Ocean Walk - Hollywood Beach	1
46	Pro Dive	70
47	Sand Harbor Hotel and Marina	41
48	Seafair	64
49	Blank	5
126	Helen's Drift Fishing	21
127	IFGA	1
128	John Lloyd	3
129	Jungle Queen	1
130	Lady go Diver	1
154	Dry Martini	3
<b>Total</b>		<b>304</b>

**Appendix Table C-1 (Continued)**  
**Visitor Boater Survey Site Count**  
**Number of Surveys Completed at Each Site - By County**

Site Code	PALM BEACH County Sites	Number of Surveys
1	Jim Abernathy's/Jim Abernathy's Scuba Adventures (Multiple Locations)	100
2	Blue Heron Drifffishing	5
3	Blank	7
5	City of Boca Boat	2
6	Frenchman's Marina	3
7	Hilton	1
9	Jupiter Seasport marina	3
10	Lake Park Marina	2
11	New Port Cove Marine Center - Abernathy's	4
12	North Palm Beach Marina	6
13	Palm Beach Airport	37
14	Phil Foster Park	19
15	Riviera Beach Marina	147
16	Sailfish Marina	36
17	Sportsmans Marina - Lantana	2
18	Two Georges Marina - Boynton Beach	3
115	B-Love	7
116	Boynton Beach Boat Club	3
117	Dive Shop II	1
118	Logger Head	2
119	Seamist Marina	78
120	Splashdown	4
121	Sportsman Park - B-Love	7
122	Starfish Enterprise	2
151	Blue Heron/Blue Heron Marina	38
156	Rampage Dive Center	9
<b>Total</b>		<b>528</b>

**SOUTHEAST FLORIDA  
CHARTER/PARTY BOAT SURVEY  
ARTIFICIAL AND NATURAL REEF USE**

We are conducting a study of the economic value of both artificial and natural reef use in the saltwater areas off the counties of Palm Beach, Broward, Miami-Dade and Monroe Counties.

The study is being funded through a partnership with the State of Florida's Fish and Wildlife Conservation Commission, the four counties and the National Oceanic and Atmospheric Administration (NOAA).

Separate surveys of residents and non-residents of each county are being conducted. However, for those people who use charter/party/guide boat services, we have found that they do not know whether they have fished (and sometimes whether they had dived) on artificial or natural reefs.

As an experienced captain or guide that takes people out for fishing, diving or glass-bottom rides, we would like your assistance in more accurately estimating the proportion of use on artificial and natural reefs.

The attached information sheet explains the authorities to collect this information, how the information will be used, a statement of burden (estimate of how much time it will take you to complete the survey), who to contact if you have any questions about the information collection, and your participation and protections of the confidentiality of your information.

**SECTION 1: KIND AND USE OF VESSEL/BOAT**

1. How many vessels/boats do you own or operate to take out paying passengers?

\_\_\_\_\_   
# boats

2. What is the length of each boat and how many passengers is each boat licensed to carry ?

	Length	Number of Passengers
Boat 1	_____	_____
Boat 2	_____	_____
Boat 3	_____	_____
Boat 4	_____	_____

3. How would you classify your activity? Check the category that best describes your operation. Charter = 6 or less passengers Party = more than six passengers

- |  |  |
|--|--|
| <input type="checkbox"/> Charter – Fish Only   | <input type="checkbox"/> Party – Fish Only     |
| <input type="checkbox"/> Charter – Dive Only   | <input type="checkbox"/> Party – Dive Only     |
| <input type="checkbox"/> Charter – Fish & Dive | <input type="checkbox"/> Party – Fish & Dive   |
| <input type="checkbox"/> Glass-bottom boat     | <input type="checkbox"/> Other (specify) _____ |

4. From what ports/cities and counties do you launch your boat (s)? If more than three, give the top three.

Port/City	County
1. _____	_____
2. _____	_____
3. _____	_____

5. What percentage of your business is from residents of the county in which you mainly operate ? \_\_\_\_\_ (%) Please provide your best estimate.

**SECTION 2: ARTIFICIAL AND NATURAL REEF USE**

Here we need your best estimates of passenger-days, dives, and the proportion of your passenger days and dives that were spent on artificial reefs versus natural reefs versus no reefs for the latest year. Below we ask for the information by activity type (e.g., fishing, snorkeling, scuba diving, or glass-bottom boat rides) and by county (e.g., Palm Beach, Broward, Miami-Dade, and Monroe).

For fishing and glass bottom boats, we need your best estimate of the number of **passenger-days**. A passenger-day is defined as one passenger for any part of a day (half day or whole day). For snorkeling and scuba diving, we need to know both passenger-days and the number of dives.

For all activities, we need to know the percent of time spent on artificial reefs versus natural reefs versus not on reefs. The sum of the three percentages should sum to 100%.

**6. Fishing Passenger-Days**

\_\_\_ check here if you did NOT operate your business for Recreational Fishing in any of the four counties and go to question 7. Snorkeling Passenger-Days.

COUNTY	Check if none	Total Passenger-Days	Percent of Passenger-Days			
			On Artificial Reefs	On Natural Reefs	Not on Reefs	Total
<b>Palm Beach</b>	_____	_____	_____	_____	_____	<b>100%</b>
<b>Broward</b>	_____	_____	_____	_____	_____	<b>100%</b>
<b>Miami-Dade</b>	_____	_____	_____	_____	_____	<b>100%</b>
<b>Monroe</b>	_____	_____	_____	_____	_____	<b>100%</b>

**7. Snorkeling Passenger-Days**

\_\_ check here if you did NOT operate your business for Snorkeling in any of the four counties and go to question 9. Scuba Diving Passenger-Days.

COUNTY	Check if none	Total Passenger-Days	Percent of Passenger-Days			
			On Artificial Reefs	On Natural Reefs	Not on Reefs	Total
Palm Beach	_____	_____	_____	_____	_____	100%
Broward	_____	_____	_____	_____	_____	100%
Miami-Dade	_____	_____	_____	_____	_____	100%
Monroe	_____	_____	_____	_____	_____	100%

**8. Snorkeling Dives**

\_\_ check here if you did NOT operate your business for Snorkeling in any of the four counties and go to question 9. Scuba Diving Passenger-Days.

COUNTY	Check if none	Total Passenger-Days	Percent of Dives			
			On Artificial Reefs	On Natural Reefs	Not on Reefs	Total
Palm Beach	_____	_____	_____	_____	_____	100%
Broward	_____	_____	_____	_____	_____	100%
Miami-Dade	_____	_____	_____	_____	_____	100%
Monroe	_____	_____	_____	_____	_____	100%

**9. Scuba Diving Passenger-Days**

\_\_ check here if you did NOT operate your business for Scuba Diving in any of the four counties and go to question 11. Glass-Bottom Boat Rides.

COUNTY	Check if none	Total Passenger-Days	Percent of Passenger-Days			
			On Artificial Reefs	On Natural Reefs	Not on Reefs	Total
Palm Beach	_____	_____	_____	_____	_____	100%
Broward	_____	_____	_____	_____	_____	100%
Miami-Dade	_____	_____	_____	_____	_____	100%
Monroe	_____	_____	_____	_____	_____	100%

**10. Scuba Diving – Dives**

\_\_ check here if you did NOT operate your business for Scuba Diving in any of the four counties and go to question 11. Glass-Bottom Boat Rides.

COUNTY	Check if none	Total Passenger-Days	Percent of Dives			
			On Artificial Reefs	On Natural Reefs	Not on Reefs	Total
Palm Beach	_____	_____	_____	_____	_____	100%
Broward	_____	_____	_____	_____	_____	100%
Miami-Dade	_____	_____	_____	_____	_____	100%
Monroe	_____	_____	_____	_____	_____	100%

**11. Glass-bottom Boat Rides - Passenger-Days**

\_\_ check here if you did NOT operate your business for Glass-Bottom Boat Rides in any of the four counties and go to Section 3.

COUNTY	Check if none	Total Passenger-Days	Percent of Passenger-Days			
			On Artificial Reefs	On Natural Reefs	Not on Reefs	Total
Palm Beach	_____	_____	_____	_____	_____	100%
Broward	_____	_____	_____	_____	_____	100%
Miami-Dade	_____	_____	_____	_____	_____	100%
Monroe	_____	_____	_____	_____	_____	100%

**SECTION 3: FOR Monroe County/Florida Keys ONLY**

In July 1997, the Florida Keys National Marine Sanctuary established 18 Sanctuary Preservation Areas (SPAs) and one Ecological Reserve (Sambos Ecological Reserve, Western Sambos or ER). These areas are available for non-consumptive activities (e.g., snorkeling, scuba diving and glass-bottom boat rides). Generally, these are “no take areas”, except there are a couple of exceptions for bait fishing by permit.

Here, please tell us the amount of use that you gave above that occurs on the SPAs and the Sambos Ecological Reserve. A map is enclosed that shows the SPAs and the Sambos Ecological Reserve and the four regions of the Florida Keys.

**12. Snorkeling – SPAs and ER**

\_\_\_ check here if no Snorkeling took place in the SPAs and the ER and go to question 13.

REGION	Check if none	Total Passenger-Days	Total Passenger-Dives
Upper Keys	___	_____	_____
Middle Keys	___	_____	_____
Lower Keys	___	_____	_____
Key West	___	_____	_____

**13. Scuba Diving – SPAs and ER**

\_\_\_ check here if no Scuba Diving took place in the SPAs and the ER and go to question 14.

REGION	Check if none	Total Passenger-Days	Total Passenger-Dives
Upper Keys	___	_____	_____
Middle Keys	___	_____	_____
Lower Keys	___	_____	_____
Key West	___	_____	_____

**14. Glass-bottom Boat Rides – SPAs and ER**

\_\_\_ check here if no Glass-bottom Boat Rides took place in the SPAs and the ER and go to Section 4.

REGION	Check if none	Total Passenger-Days	Total Passenger-Dives
Upper Keys	___	_____	_____
Middle Keys	___	_____	_____
Lower Keys	___	_____	_____
Key West	___	_____	_____

**SECTION 4: IMPORTANCE AND SATISFACTION OF REEFS**

For the following questions, would you please use the following 1-5 rating scales:

IMPORTANCE	Not at all Important 1	Not Very Important 2	Somewhat Important 3	Important 4	Very Important 5
------------	------------------------------	----------------------------	----------------------------	----------------	------------------------

SATISFACTION	Not at all Satisfied 1	Not Very Satisfied 2	Somewhat Satisfied 3	Satisfied 4	Very Satisfied 5
--------------	------------------------------	----------------------------	----------------------------	----------------	------------------------

- 15. How important are the counties' artificial reef programs to your business?  
\_\_\_\_\_ (Rating 1-5)
- 16. How satisfied are you with the counties' artificial reef program?  
\_\_\_\_\_ (Rating 1-5)
- 17. How important are the natural reefs off South Florida to your business?  
\_\_\_\_\_ (Rating 1-5)
- 18. How satisfied are you with the natural reefs off South Florida?  
\_\_\_\_\_ (Rating 1-5)
- 19. How important are the Sanctuary Preservation Areas and the Ecological Reserve in the Florida Keys to your business? \_\_\_\_\_ (Rating 1-5)
- 20. How satisfied are you with the Sanctuary Preservation Areas and the Ecological Reserve in the Florida Keys? \_\_\_\_\_ (Rating 1-5)

**THANK YOU VERY MUCH FOR YOUR PARTICIPATION**

**Please place your completed forms in the self-addressed envelope and mail.**

**If you have lost your self-addressed envelope, please mail to:**

**Grace Johns  
Hazen and Sawyer  
4000 Hollywood Boulevard, Ste. 750 N  
Hollywood, Florida 33021**

**If you have any questions, please call Grace Johns at (954) 987-0066 or (954) 462-2709 or (305) 625-4101.**



# Florida Keys National Marine Sanctuary Sanctuary Preservation Areas and Ecological Reserves

