

Chapter 5: Socioeconomic Value of Reefs in Miami-Dade County

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%
Total	67,936	100.00%	

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

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 ¹ by Activity by Reef Type	Percentage of Person-Days Per Activity by Reef Type	Percentage of Total Person-Days Per Activity
Fishing			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%	
Snorkeling			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%	
Scuba Diving			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%	
All Activities							
Artificial	375,702	34%			1,540,343		
Natural	729,304	66%			2,965,430		
Total	1,105,006	100%	100%		4,505,773		100%

¹ 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 66th 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

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

5.0 Socioeconomic Value of Reefs in Miami-Dade County

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:

Average Resident Spending Per Party for Miami-Dade 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	\$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.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

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)
Artificial Reef			
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%
Natural Reef			
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%
Total All Reefs			
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.

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.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

Table 5.1.2-2 (Residents)
Detailed Expenditure Pattern Supporting Employment and Wages by All Resident Reef-Users in
Miami-Dade 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	\$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%
Total	\$275.54	100%	2,113	100%	\$38.91	100%

Source: Florida State University

5.0 Socioeconomic Value of Reefs in Miami-Dade County

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.¹ The reef-using respondents were asked a series of CV questions dealing with their

¹ See Clawson and Knetch (1966).

5.0 Socioeconomic Value of Reefs in Miami-Dade County

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

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.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

Table 5.1.3-1 (Residents)
Estimated Use Value of Artificial and Natural Reefs off the Coast of
Miami-Dade County, Florida, 2000

Reef Type/Activity	Person-days (millions)	Annual User Value (Millions \$)	User Value Per Person-day (\$)	Asset Value at 3% (Millions \$)
Natural Reefs	2.965	\$23.74	\$8.01	\$791.3
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
Artificial Reefs	1.540	\$4.25	\$2.76	\$141.6
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
Natural & Artificial Reefs	4.506	\$14.30	\$3.17	\$476.6
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
New Artificial Reefs	1.540	\$0.44	\$0.28	\$14.5
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

5.0 Socioeconomic Value of Reefs in Miami-Dade County

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

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.² 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.

² 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

Survey Question	Percentage of Respondents Answering "Yes"	Percentage of Respondents Answering "No"	Percentage of Respondents Answering "Don't Know"	Sample Size
(1)	(2)	(3)	(4)	(5)
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
	Average for All Response	Median of All Responses		
What Percent of Natural Reefs in Palm Beach County Should be Protected with "NO TAKE" Zones	30%	20%		374

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**

Demographic Characteristics of Respondents to Mail Survey	Reef-Users	Miami-Dade County Population
Median Age	46	35.9
Sex		
Male	93%	48%
Female	7%	52%
Race		
White	88%	70%
Black/African American	1%	20%
Hispanic/Latino	32%	57%
Other	11%	10%
Education¹		
Percentage that completed College Degree or More	57%	12%
Median Household Income	\$69,722	\$36,846
Boater Profile		
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
Sample Size		390

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).

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 1990.³ 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.

³ The U.S. Census has not yet released the educational levels for counties as part of the 2000 Census.

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**

Measure of Visitation	Summer – 00	Winter – 01	Total
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 ^a	Boating Person-Trips	Proportion of Boating Person-Trips When the Reef was Used for Recreation ^b	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

^a *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.*

^b *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**

County	Average Days Visiting the County Per Trip	Total Person Days Spent Visiting the County
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 ^a	339	22%	24%	61%	15%	100%
Scuba Diving/Snorkeling ^b	339	8%	32%	65%	3%	100%

^a Percent of fishing days on each reef type is reported.
^b 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
Total	1.413	3.244	4.66

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
Total Person-Days		6,311,847	1,412,438	3,247,954	1,651,455

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 ^a				
	Fishing On:			Scuba Diving or Snorkeling On:	
	Own, Friend's or Rental Boat ^b	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 ^c	289	228	186	147	291

^a 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.

^b Boat rental is included under Equipment Rental.

^c 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

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

Item	Artificial Reef	Natural Reef	Total
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
Total	\$181,992,354	\$390,156,057	\$572,148,411

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
Artificial Reefs				
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
Natural Reefs				
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
Natural and Artificial Reefs				
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

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 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.

5.0 Socioeconomic Value of Reefs in Miami-Dade County

Values for all reefs were taken from statistical analysis of responses to Question 38 of Visitor Boater Survey⁴: “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.

⁴ 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 (\$)
Natural Reefs	3,247,954	\$23,014,615	\$7.09
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
Artificial Reefs	1,412,438	\$6,083,896	\$4.31
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
Natural & Artificial Reefs	4,660,392	\$32,651,524	\$7.01
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
New Artificial Reefs	1,412,438	\$3,626,829	\$2.57
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**

Characteristic	Value
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**

Population	Artificial Reefs	Natural Reefs	All Reefs
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**

Activity	Residents	Visitors	Total
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
Total	4.51	4.66	9.17
<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 ^b	Employment ^c
Direct ^a			
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

^a The direct contribution is the actual expenditures made in the county.
^b Total income includes employee compensation, proprietor's income, interest, rents and profits
^c 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 ^b	Employment ^c
Direct ^a			
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
^a The direct contribution is the actual expenditures made in the county.			
^b Total income includes employee compensation, proprietor's income, interest, rents and profits			
^c 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 ^b	Employment ^c
Direct ^a			
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
^a The direct contribution is the actual expenditures made in the county.			
^b Total income includes employee compensation, proprietor's income, interest, rents and profits			
^c 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
All Reefs - Artificial and Natural			
Number of Person-Days of Reef Use (millions)	4.51	4.66	9.17
Use Value Per Person-Day	\$3.17	\$7.01	\$5.12
Annual Use Value - (million dollars)	\$14.30	\$32.65	\$46.95
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.48	\$1.09	\$1.57
Artificial Reefs			
Number of Person-Days of Reef Use (millions)	1.54	1.41	2.95
Use Value Per Person-Day	\$2.76	\$4.31	\$3.50
Annual Use Value - (million dollars)	\$4.25	\$6.08	\$10.33
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.14	\$0.20	\$0.34
Natural Reefs			
Number of Person-Days of Reef Use (millions)	2.97	3.25	6.21
Use Value Per Person-Day	\$8.01	\$7.09	\$7.54
Annual Use Value - (million dollars)	\$23.74	\$23.01	\$46.85
Capitalized Value @ 3 percent Discount Rate (billion dollars)	\$0.79	\$0.77	\$1.56

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	2.95
Use Value Per Person-Day for "New" Artificial Reefs	\$0.28	\$2.57	\$1.38
Annual Use Values for "New" Artificial Reefs (million dollars)	\$0.44	\$3.63	\$4.07
Capitalized Value @ 3 percent Discount Rate (million dollars)	\$14.5	\$120.89	\$135.4

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**

	Resident Reef-Users			Visitor Reef-Users		
Median Age of Respondent	46			41		
Sex Of Respondent	Percent			Percent		
Male	93%			75%		
Female	7%			25%		
	% of Resident Reef-Users			% of Visitor Reef-Users		
	White	Black	Other	White	Black	Other
Race Of Respondent	88%	1%	11%	83%	7%	10%
	% of Resident Reef-Users			% of Visitor Reef-Users		
Percent Hispanic/Latino	33%			29%		
	Resident Reef-Users			Visitor Reef-Users		
Median Household Income	\$69,722			\$55,000		
	Residents			Visitors		
Average Years Boating in South Florida	25			6.7		
	Residents			Visitors		
Average Length of Boat Used for Salt Water Activities in Feet	23			26		
	Residents			Visitors		
% of Respondents Who Belong to Fishing and/or Diving Clubs	18%			6%		