



Linking Ecological Monitoring with Socioeconomic Monitoring Results: 1995-96 to 2000-01



Background. Results presented here are part of the Recreation and Tourism component of the Socioeconomic Research and Monitoring Program for the Florida Keys National Marine Sanctuary (FKNMS). The Socioeconomic Research and Monitoring Program was designed in a workshop held in Islamorada, Florida in January 1998, which was attended by 50 social scientists and community stakeholders. Baseline measurements for Recreation and Tourism were obtained in a 1995-96 study entitled "Linking the Economy and Environment of the Florida Keys/ Florida Bay." However, in our baseline year of 1995-96, the Sanctuary Preservation Areas (SPAs) and Ecological Reserves (ERs) or "no take zones" were not yet in existence. The information presented here was obtained from a multi-agency partnership project entitled "Socioeconomic Study of Reefs in Southeast Florida, 2000-2001." We were able to add several modules of questions to the 2000-01 surveys about use of the SPAs and ERs. From the broader survey, we were also able to produce comparative socioeconomic profiles of SPA & ER Users versus Non Users, comparative importance and satisfaction scores, and estimates of economic user value. Twenty-two of the SPAs and ERs (18 of which are open to nonconsumptive recreation activities) went into effect on July 1, 1997. The Tortugas Ecological Reserve went into effect on July 1, 2001. The Socioeconomic Study of Reefs in Southeast Florida was for the time period of June 2000 through May 2001. Therefore, the Tortugas Ecological Reserve was not part of the 2000-01 survey results. Results from Ecological Monitoring can be found in the 2001 Science Report for the FKNMS (see web site links below).

The purpose of a monitoring program for marine protected areas is to improve management of the system. Baseline and repeated measurements are taken to judge, over time, the effectiveness of carefully designed protected areas.

Measurements. We choose to focus on four main attributes

measured by the FKNMS Ecological Monitoring Program, with which we can integrate socioeconomic data from the 1995-96 and 2000-01 Reef Studies, to link ecological monitoring results with socioeconomic results to get the full picture of the performance of SPAs and ERs within the FKNMS. These attributes are 1) Diversity, 2) Abundance, 3) Amount of living coral, and 4) Water clarity (Clear Water-High Visibility). The main question we hope to answer is whether people perceive the changes in the ecosystem that scientists are observing, or are there great differences between perceptions and scientific observations?

Comparisons were made between socioeconomic and ecological monitoring from two perspectives. First, the trends across the entire FKNMS were evaluated. For the socioeconomic measures we looked at the differences in mean satisfaction scores between 1995-96 and 2000-01. This was done for all boating visitors and residents and for those more experienced versus less experienced visitor and resident boaters (more experienced users are those with five or more years of boating experience). The ecological measures are described in the full report (see link to web site below) and can be found in greater detail in the 2001 Science Report for the FKNMS. The results

Sanctuary Preservation Areas are marine zones that focus on the protection of shallow, heavily used reefs where conflicts occur between user groups, and where concentrated visitor activity leads to resource degradation. These areas are designed to enhance the reproductive capabilities of renewable resources, protect areas critical for sustaining and protecting important marine species, and reduce user conflicts in high-use areas. This is accomplished through the prohibition of consumptive activities within these areas. SPAs are chosen based on the status of important habitat, the ability of a particular area to sustain and protect the habitat, the level of visitor use, and the degree of conflict between consumptive and nonconsumptive users. The actual size and location of these zones have been determined by examination of user patterns, aerial photography, and ground-truthing of specific habitats.

Ecological Reserves are designed to encompass large, contiguous diverse habitats. They are intended to provide natural spawning, nursery, and permanent residence areas for the replenishment and genetic protection of marine life and to protect and preserve all habitats and species particularly those not protected by fishery management regulations. These reserves are intended to protect areas that represent the full range of diversity of resources and habitats found throughout the Sanctuary. The intent is to meet these objectives by limiting consumptive activities, while continuing to allow activities that are compatible with resource protection. This will provide the opportunity for these areas to evolve in a natural state, with a minimum of human influence. These zones will protect a limited number of areas that provide important habitat for sustaining natural resources such as fish and invertebrates.

Source: National Marine Sanctuary Program

of the trends in the overall FKNMS are summarized in Table 1. Second, SPAs and ERs were compared to open or reference areas. For socioeconomic measures, comparisons of mean satisfaction ratings of SPA & ER Users versus Non SPA &

Table 1: Reef User Perceptions vs. Ecological Observations: Overall FKNMS

	Socioeconomics (Satisfaction Scores)		Ecological
	Trends (95-96 vs. 00-01) ¹	Experienced vs. Less Experienced ²	
Diversity			
Visitors	Significant Decline	Significantly Lower	Increase
Residents	Significant Decline	Lower – Not Significant	
Abundance			
Visitors	Significant Decline	Significantly Lower	Targeted species (+)
Residents	Significant Decline	Lower – Not Significant	Non-targeted species (+/-) Spiny Lobsters (-)
Amount of Living Coral			
Visitors	Significant Decline	Significantly Lower	37% Decline in stony coral cover
Residents	Significant Decline	Lower – Not Significant	Increase in disease infections
Water Clarity			
Visitors	Lower – Not Significant	Lower – Not Significant	No trend
Residents	Significantly Lower	Significantly Lower	

1. Trends are based on comparison of mean scores for 1995-96 samples of visitors and residents versus 2000-01 samples of visitors and residents. T-test for differences in means with significance cut-off at 0.05 or 95 percent confidence level

2. Experienced users are those with five or more years of experience in FKNMS. Statistical test is a T-test on mean satisfaction scores of experienced vs. less experienced samples of users from the 2000-01 survey. Significance cut-off is at 0.05 or 95 percent confidence level.

Table 2. Reef User Perceptions vs. Ecological Observations: Comparison of SPAs & ERs to Open (Reference) Areas

Socioeconomics (Satisfaction Scores)		Ecological
2000-01 Comparison: SPA & ER Users vs. Non-SPA & ER Users ¹		
Diversity		
Visitors	Significantly Higher	Higher for SPAs and ERs
Residents	Lower – Not Significant	
Abundance		
Visitors	Significantly Higher	Mixed Results
Residents	Lower – Not Significant	(see write-up)
Amount of Living Coral		
Visitors	Significantly Higher	No difference
Residents	Lower – Not Significant	
Water Clarity		
Visitors	Higher – Not Significant	No difference
Residents	No Difference	

1. Comparison of mean scores using T-test. Significance cut-off level is 0.05 or the 95 percent confidence level.

ER Users were used. The results for these comparisons are summarized in Table 2.

Key Findings: Overall FKNMS 1995-96 to 2000-01

Water Clarity. Socioeconomic and ecological monitoring are in agreement for visitors, i.e. there has been no change in water clarity. However, residents perceive that water clarity has declined, and this is more prevalent among more experienced residents. This might be a possible job for education and outreach, if residents are misperceiving the actual water clarity conditions.

Diversity. There was disagreement between socioeconomic and ecological monitoring results. Users perceive a decline, while physical scientists say actual conditions are improving. This would appear to be a job for education and outreach to correct these misperceptions. Perhaps the ratings on diversity were influenced by the status of the amount of living coral on the reefs (see below).

Abundance. Here users perceive significant declines, while ecological monitoring produced mixed results. Here there are needs to both make greater investments in protecting and restoring resources and in education and outreach efforts.

Amount of Living Coral on Reefs. Here socioeconomic and ecological monitoring is in agreement. Physical scientists are observing significant declines in stony coral cover

and increases in diseases, and users perceive these declines. Here there is a clear need to identify the sources and solutions to the problems. Given the higher use and economic value of the natural versus artificial reefs in the FKNMS (see Johns et al, 2003), there is economic justification to make the investments to solve these problems before they translate into economic losses.

Key Findings: SPAs and ERs vs. Open (Reference) Areas

Water Clarity. Users don't perceive any changes in water clarity between SPAs & ERs and open (reference) areas. This is consistent with ecological monitoring that says there would be no expected differences.

Diversity. Overall, there was general agreement between the socioeconomic and ecological monitoring. SPAs and ERs are improving in diversity relative to open areas and visitors perceive the difference, while residents do not perceive the change.

Abundance. Both socioeconomic and ecological monitoring have mixed results. But overall, both socioeconomic and ecological monitoring support the notion that SPAs & ERs are providing the benefits from improved quality of the protected sites.

Amount of Living Coral on the Reefs. There is only a small difference between the results of the socioeconomic monitoring and

ecological monitoring results when comparing amount of living coral on reef in SPAs and ERs versus open (reference) areas. Visitors that use the SPAs and ERs have slightly higher mean satisfaction scores than non-users, whereas there is no difference between resident reef users.

For the two items for which managers had expectations for improvement (e.g. diversity and abundance), the SPAs and ERs appear to be generating benefits as expected. Visitors seem more apt to perceive these benefits than residents.

For Further Information:

For the full report containing the Comparison of Socioeconomic and Ecological Monitoring Results go to our web site:
<http://marineeconomics.noaa.gov/SocmonFK/rectour.html>

For the 2001 Science Report containing details of the Ecological Monitoring Results go to:
http://www.fknms.nos.noaa.gov/research_monitoring/welcome.html

For the full report on the Socioeconomic Study on Reefs in Southeast Florida, 2000-2001 go to:
<http://marineeconomics.noaa.gov/Reefs/02-01.pdf>

For fact sheets addressing the following topics:
-Comparative Socioeconomic Profiles of SPA & ER Users and Non Users
-SPA and ER Use
-Comparative Importance-Satisfaction Ratings of SPA & ER Users and Non Users
-Economic User Value of the SPAs and ERs
-Monroe County Reef Using Residents' Opinions on "No Take" Zones
Go to:
<http://marineeconomics.noaa.gov/SocmonFK/rectour.html>

Dr. Vernon R. (Bob) Leeworthy
Leader, Coastal and Ocean Resource Economics Program
NOAA/NOS/Special Projects – N/MB7
1305 East West Highway, SSMC4, 9th Fl.
Silver Spring, MD 20910
Telephone: (301) 713-3000 x 138
Fax: (301) 713-4384
E-mail: Bob.Leeworthy@noaa.gov