

# HDMCE ANALYSIS SERIES

## 2008-1-003



Human Dimensions of Marine and Coastal Ecosystems Program  
Department of Natural Resources Conservation  
University of Massachusetts Amherst  
Amherst, MA 01003

David K. Loomis, Ph.D.  
Laura E. Anderson, Ph.D.  
Christopher Hawkins  
Shona K. Paterson



## **Understanding Coral Reef Use: SCUBA Diving in the Florida Keys by Residents and Non- Residents During 2006-2007**

Submitted to:  
The Florida Reef Resilience Program  
The Nature Conservancy, Florida Keys Program

## Diving in the Florida Keys



This project was funded by The Nature Conservancy on behalf of the Florida Reef Resilience Program. Program partners include The Nature Conservancy, National Oceanic and Atmospheric Administration, Great Barrier Reef Marine Park Authority, Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, World Wildlife Fund, Mote Marine Laboratory, Florida International University, University of Miami, University of South Florida, University of Massachusetts Amherst, Nova Southeastern University, Broward County and Miami-Dade County.

This report is the third of three descriptive documents produced by the Human Dimensions of Marine and Coastal Ecosystems Program focused on coral reef use in the Florida Keys. Additional titles in this analysis series include:

- Understanding Coral Reef Use: Recreational Fishing in the Florida Keys by Resident and Non-Residents During 2006-2007
- Understanding Coral Reef Use: Snorkeling in the Florida Keys by Resident and Non-Residents During 2006-2007

Further reports focusing on specific social theories and data subsets will also be produced.

Report date: December 1<sup>st</sup> 2008

# Human Dimensions of Marine and Coastal Ecosystems

## Table of Contents

Glossary of Key Terms .....	vi
Coral Reef Resilience: the Ecological and Human Dimensions.....	vii
Management Summary .....	ix
Introduction.....	1
Purpose of Project .....	2
Theoretical and Conceptual Research Topics.....	3
Methods.....	7
Resident Divers .....	13
Resident Divers' Profile.....	13
Dive Practices and Motivations .....	16
Resident Divers' Use of Information Sources .....	16
Acceptability of Presence of Other Resource Users .....	16
Behavioral Norms .....	19
Satisfaction.....	20
Coral Reef Characteristics and User Impacts .....	23
Non-Resident Divers.....	24
Non-Resident Divers' Profile .....	24
Diving Practices and Motivations.....	27
Non-Resident Divers' Use of Information Sources.....	28
Acceptability of Presence of Other Resource Users.....	29
Behavioral Norms .....	32
Satisfaction.....	33
Coral Reef Characteristics and User Impacts .....	36
RESIDENT SCUBA DIVING SURVEY RESULTS .....	38
NON-RESIDENT SCUBA DIVING SURVEY DATA.....	66
APPENDIX A: Survey Instrument .....	107
Literature Cited .....	123

# Diving in the Florida Keys

## List of Figures

Figure A. Sand Key, Florida.....	xv
Figure 1. The integration of human dimensions research for coral reef management decision-making.....	1
Figure 2. Conceptual model of natural resource management systems (adapted from Kennedy and Thomas 1995).....	2
Figure 3. Components of recreation specialization (adapted from McIntyre and Pigram 1992) ...	5
Figure 4. Locations of Coral Reef Subregions and Zones Included in this Study.....	9
Figure 5. Snorkelers in the Florida Keys .....	10
Figure 6. Resident Divers in the Upper Keys by Specialization Level .....	14
Figure 7. Resident Divers in the Middle and Lower Keys by Specialization Level.....	15
Figure 8. Norm curve for the number of divers seen by resident divers .....	17
Figure 9. Norm curve for the number of snorkelers seen by resident divers.....	18
Figure 10. Norm curve for the number of boats seen by resident divers.....	18
Figure 11. Normative curves for coral reef conditions for resident divers .....	21
Figure 12. Underwater Resources in the Florida Keys .....	23
Figure 13. Resource Users at Eastern Dry Rocks, Key West .....	23
Figure 14. Non-Resident Anglers in the Upper Keys by Specialization Level .....	25
Figure 15. Non-Resident Snorkelers in the Middle and Lower Keys by Specialization Level ...	26
Figure 16. Norm curve for the number of divers seen by non-resident divers .....	30
Figure 17. Norm curve for the number of snorkelers seen by non-resident divers .....	30
Figure 18. Norm curve for the number of boats seen by non-resident divers .....	31
Figure 19. Grand Canyon, Sand Key .....	33
Figure 20. Normative curves for coral reef conditions for non-resident divers.....	34
Figure 21. Diving in the Florida Keys .....	36

## List of Boxes

Box 1. Specialization Propositions .....	5
Box 2. Sub-regions of the Florida Keys.....	8
Box 3. Zones of the Florida Keys .....	10
Box 4. Norms and Management Implications .....	19
Box 5. Proposition 2-Side Bets.....	28
Box 6. Proposition 7-Mediated Interaction.....	28

## Human Dimensions of Marine and Coastal Ecosystems

### List of Tables

Table 1. Status of resident and non-resident mail survey response rate.....	12
Table 2. Breakdown of number of responses by activity.....	12
Table 3. Resident divers distributed according to specialization level.....	14
Table 4. Resident divers' expected and accomplished experience levels, discrepancies between these levels, and resident diver satisfactions.....	22
Table 5. Non-resident divers distributed according to specialization level.....	25
Table 6. Differences in years of experience, annual frequency of participation and value of equipment according to specialization levels for non-resident divers.....	27
Table 7. Mean differences in media use according to specialization level.....	29
Table 8. Non-resident divers' expected and accomplished experience levels, discrepancies between these levels, and resident diver satisfactions.....	35
Table 9. Mean differences for the ratings of the quality of coral reefs by non-resident divers....	37

### Glossary of Key Terms

---

**Attitudes.** A psychological tendency that is expressed by evaluating a particular entity (aka an attitude object) with some degree of favor or disfavor.

**Attributions.** The perceived cause, not necessarily the true cause, of some event or situation.

**Crowding (perceived).** Crowding is typically perceived as a negative phenomenon in which the presence of too many people negatively affects a user's experience. However, perceptions of crowding may vary depending upon experience, motivations, expectations and visitor behavior.

**Mediated interaction.** The use of sources of information, such as newspapers, radio, Internet, television and printed material.

**Norms.** The evaluation of personal or group conduct. Includes both the conduct that is occurring (a descriptive norm) and the conduct that ought to be occurring (an injunctive norm). Social norms consist of rules of conduct and models of behavior prescribed by a society. They are rooted in the customs, traditions and value systems that gradually develop in society to incorporate a sense of what is right in a given situation.

**Recreation specialization.** A theory that postulates that outdoor recreation participants (e.g. anglers, SCUBA divers, boaters) can be placed on a continuum from general interest and low involvement to specialized interest and high involvement. Each level of specialization involves distinctive behaviors, skills, and directions. These include equipment preference, type of experiences sought, desired setting for the activity, attitudes toward resource management, preferred social context, and even vacation patterns.

**Satisfaction.** Defined in various ways, including consumer's fulfillment response, a pleasurable level of consumption-related fulfillment, and a broad evaluation of an experience or service that is influenced by perceptions of experience quality, service quality, price, and other factors. Satisfaction is sometimes understood as the difference between what is expected and what is actually experienced.

### Coral Reef Resilience: the Ecological and Human Dimensions

---

Coral reefs are among the most productive and biologically diverse natural systems on Earth, providing habitat for approximately twenty-five percent of all marine life, and nearly one-third of all fish. Coral reefs are dynamic, rapidly changing ecosystems that experience a variety of stresses which can affect many different aspects of coral existence such as grow rates, recruitment and, ultimately, survival. However, coral species react very differently to the variety of stressors they are exposed to. “Resilient” is one way of describing those reefs and corals that have withstood, or recovered from, natural disturbances, like hurricanes, or chronic human-caused impacts, like water pollution. Obviously not all reefs are resilient, and in the worst cases the living coral reef may be replaced by a different and less desirable natural community.

*Resilience: the ability of systems to absorb disturbances, to resist phase shifts, and to regenerate and reorganize in order to maintain key functions and processes in a time span relevant to resource use and management*

However, coral reefs are more than just ecological hotspots. It is estimated that 500 million people around the world rely on coral reefs for food and income (UNEP 2007). Coral reefs also supply physical protection from storm damage and coastal erosion that no amount of modern engineering can provide. Therefore, it becomes imperative for resource managers to determine, and mitigate if possible, sources of conflict between the needs of the coral reefs and those of the users that depend upon them. Mitigation often takes the form of regulations and use restrictions, but the development of effective management strategies is reliant on understanding both the biophysical and the human dimensions of these coral reef ecosystems.

*Human dimensions of coral reef management: an area of investigation which attempts to describe, predict, understand and affect human thought and action toward coral reefs and their associated environments.*

## Diving in the Florida Keys

The values and priorities of society as expressed by our social, political, and economic systems drive coral reef management; therefore, the way in which different reefs are managed in different ways for various purposes is a reflection of what society wants from those reefs. Coral reef ecosystems are a global asset worth nearly \$800 billion, and provide nearly \$30 billion in goods and services worldwide each year (UNEP 2007). Coral reefs provide a variety of important regional and national social services including tourism, recreation, fisheries, trade, and aesthetic and cultural value. Many of these benefits are nonmarket benefits and so are not captured by traditional economic tools based on market transactions. Understanding the people that benefit from these services provided by coral reefs, and how those users may respond to the biophysical changes in the ecosystem over time, can help guide management strategies and regulations.

Because resource managers are directed by institutional mandates that have both ecological and human components, there is a need for an integrated coral reef research approach. Management alternatives need to be flexible, and must be adaptable, depending on how ecologically resilient a reef is, and how that reef is being used. Consequently, it is important to determine how people will respond and adapt to both real and perceived changes resulting from a variety of reef conditions and management strategies. In some cases the social ramifications of a management strategy may outweigh any ecological benefit, making that one strategy unviable. Conversely the opposite may be true if the ecological benefit negatively impacts the socially accepted condition. The costs and benefits of each management strategy must be considered within the matrix of the existing dual mandate of protecting the resource while allowing human access and activities. By establishing parameters such as a) what attributes people value in coral reef ecosystems, b) use patterns, and c) identifying how people respond to changes in coral reefs over time, we can answer the fundamental question - *Is management responsive to what people want and need from coral reef ecosystems?*

*Human dimensions of reef resilience: the scientific investigation of the linkages between reef resilience, the management strategies employed to improve the health of coral reefs, and individuals and groups who depend on and enjoy coral reef environments.*

### Management Summary

---

In 2006, the Florida Reef Resilience Program (FRRP) complemented its existing biophysical research efforts targeting resilience factors on reefs in the Florida Keys with a social research component. This component was designed to address the FRRP question: **what do people want and need from coral reefs?** The population of interest for this study was recreating residents and visitors using the coral reefs of the Florida Keys from June, 2006 through July, 2007.

The focus of this study is a representative understanding of the non-economic interactions that SCUBA divers, snorkelers, and recreational anglers have with coral reef environments and each other. This requires a diverse set of disciplines, including sociology and social psychology, and the collection and presentation of data in a fashion that represents those individuals and groups that use or simply appreciate the resource. The collection of such data has been conducted by practitioners grounded in the theory and methods of, in this instance, quantitative social science research.

### Purpose of Project

Many of the direct and indirect benefits that coral reefs confer to surrounding communities are well documented. However, such benefits are most often researched and reported in terms of market and non-market economic calculi. While such calculi can be very useful to policy-makers determining how to prioritize state and national spending on coastal resource management projects, they are of lesser utility when coastal and coral reef managers seek to determine how stakeholder groups' interactions with coral reef environments and each other affect their preferences for how these same environments are managed. This is because people do not always make decisions based on logical economic considerations. It was the purpose of this project to understand these interactions, which are perceived through the prisms of individual and collective values, norms of behavior, levels of specialization (a measure of how central a coral reef-associated activity is to a person's life), resource conflict, and attitudes. In this way, public management preferences for, and perceptions of, coral reefs are more completely taken into account when developing the strategies that are central to FRRP activities.

## **Diving in the Florida Keys**

### **Project Methods**

A sample of snorkelers and SCUBA divers was identified through in-person intercepts, which were designed to collect names and addresses for the mail questionnaire. Since it was assumed that sampling for only snorkelers and only SCUBA divers would present challenges, the sampling design was such that the two groups were combined and then later segregated via the design of the survey instrument. Intercepts began in June, 2006 and took place during approximately one week of each month during a 13-month period. Intercepts, conducted by graduate and undergraduate students of the University, were conducted both on the water and on land throughout the Florida Keys, with a focus on collecting names and addresses from three distinct areas: designated terrestrially as the lower, middle, and upper Keys (Figure 4). In each area, users in the nearshore, mid-channel, and reef margin/forereef zones were surveyed. On-water intercepts targeted private boat owners or visitors who had rented a boat for the day and snorkeled or SCUBA dived on or around coral reefs. These reefs were, defined by FRRP, as oceanside of the keys island chain from shore to 30m of water. On-land intercepts included divers who dived on or around coral reefs, again defined by FRRP. The approach used in this study ensured that private boats coming from canal-side docks, rental boat, divers trailering boats, and individual divers from charter boats all had the potential to be included in the sample.

### **An Overview of Research Findings**

#### ***Residents' Profile***

Of all the resident SCUBA divers surveyed, respondents were predominately male, were an average age of 45 and identified themselves as white. Seventy percent of respondents reported a household income of \$45,000 or greater.

Analysis suggests that resident SCUBA divers are highly specialized, averaging over 18 years of diving experience and spending an average of 56 days a year diving on or around coral reefs in the Florida Keys. Seventy percent of respondents would need up to \$2,000 to replace their equipment.

## Human Dimensions of Marine and Coastal Ecosystems

Residents indicated that they are most likely to dive from for-hire or private boats, highlighting a reliance on commercial ventures, either in terms of direct access or boat maintenance, and suggesting that resident diver activity may be an important component of the local economy.

The majority of residents sampled dive with friends and family with only a small percentage choosing to dive alone. When compared to the last five years, use levels have remained '*about the same*' and the opportunity to dive on or around coral reefs was determined to be moderately to very important.

Residents listed talking to other divers and dive shops/companies as the most important sources for current information about diving in the Florida Keys. The least important source was listed as the television. Many residents make at least some use of a variety of other listed media sources, including government publications, which suggests that any communication strategy employed to target this user group should be a varied, multi-media approach.

### *Non-Residents' Profile*

Of all the non-resident SCUBA divers surveyed, respondents were predominately male, were an average age of 43 and identified themselves as white. Eighty-three percent of respondents reported a household income of \$45,000 or greater.

Analysis suggests that there is a large variation in the specialization levels of non-resident SCUBA divers visiting the Florida Keys. Non-residents averaged just less than 8.5 years of diving experience and spent an average of nine days a year diving on or around coral reefs in the Florida Keys. Seventy percent of respondents would need up to \$2,000 to replace their equipment.

Non-residents indicated that they are most likely to dive from for-hire dive boats, highlighting a reliance on commercial ventures for direct access, and suggesting that non-resident diver activity may be an important component of the local economy.

## Diving in the Florida Keys

The majority of non-residents sampled dive with friends and family with only a small percentage choosing to dive alone. When compared to the last five years, use levels have remained ‘*about the same*’ and the opportunity to dive on or around coral reefs was determined to be moderately to very important.

Non-residents listed talking to other divers and dive shops/companies as the most important sources for current information about diving in the Florida Keys. The least important source was listed as the radio. The results show that with the exception of the two sources listed above, non-resident divers make little use of most information sources. This highlights a potential difficulty in communicating with this section of the visiting population, an important subgroup for regulation and conservation messages.

### Acceptability of the presence of other resource users

To determine acceptable levels of use patterns, respondents were asked to describe the number of other SCUBA divers, snorkelers and boats they considered acceptable to see at any one moment during their time at any dive site. The responses were then compared to the number of each that resident and non-resident respondents recalled actually seeing.

#### *Acceptable range of the number of different user group participants*

	<b>Divers</b>	<b>Snorkelers</b>	<b>Boats</b>
Residents	0-10	0-14	0-15
Non-residents	0-11	0-8	0-7

#### *Number of different user groups actually seen by respondents*

	<b>Divers</b>	<b>Snorkelers</b>	<b>Boats</b>
Residents	6.3	9.1	6.1
Non-residents	4.4	14.0	6.8

## Human Dimensions of Marine and Coastal Ecosystems

Levels of satisfaction could also be inferred from perceptions of crowding and use level of the resource. In general, residents experienced only a small perceived level of crowding. Thirty percent of respondents felt “*not crowded at all*” during their most recent trip whereas only 4% felt “*extremely crowded.*” This suggests that resident divers are generally satisfied with the level of user density and perhaps interaction that they experienced.

With respect to unacceptable use density, non-residents seemed to perceive fairly little crowding. Twenty-four percent of respondents felt “*not crowded at all*” during their most recent trip whereas only 1% felt “*extremely crowded.*” This suggests that non-resident divers are also generally satisfied with the level of user density that they experienced

### Behavioral Norms

To determine if behavioral norms for the appreciation of coral reef ecosystems were strongly held by both resident and non-resident divers, respondents were asked to consider a list of items and describe the levels of obligation and embarrassment attached to each item. The items that elicited the strongest responses are shown below.

#### *Behavioral Norms*

	<b>Strong obligation to never do</b>	<b>Strong obligation to always do</b>	<b>Most embarrassed to be seen doing</b>
Residents	<ul style="list-style-type: none"> <li>• Breaking off pieces of coral</li> <li>• Taking pieces of dead coral</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain buoyancy control</li> <li>• Tell others not to touch coral</li> <li>• Operate boats at least 100’ from a dive flag</li> </ul>	<ul style="list-style-type: none"> <li>• Knowingly anchoring a boat on coral</li> <li>• Breaking off pieces of live coral</li> </ul>
Non-residents	<ul style="list-style-type: none"> <li>• Breaking off pieces of coral</li> <li>• Taking pieces of dead coral</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain buoyancy control</li> <li>• Tell others not to touch coral</li> <li>• Tell others not to anchor on coral</li> </ul>	<ul style="list-style-type: none"> <li>• Knowingly anchoring a boat on coral</li> <li>• Breaking off pieces of live coral</li> </ul>

## Diving in the Florida Keys

### Experience Attributes

The satisfaction that individuals derive from various aspects of their trip can be understood by learning about 1) what were the respondents' expectations, 2) to what extent were respondents able to accomplish their expectations and 3) how satisfied were respondents with regard to each item.

The ten items measured were:

- |  |  |
|--|--|
| 1. To see a healthy reef                 | 6. To see large fish                         |
| 2. To experience easy snorkel conditions | 7. To see unique underwater formations       |
| 3. To see marine life                    | 8. To see live coral                         |
| 4. To see undamaged reef sites           | 9. To experience natural surroundings        |
| 5. To relax                              | 10. To experience good underwater visibility |

The items most highly rated in terms of the three components are displayed below along with the lowest rated.

#### *Residents*

	Expected	Accomplished	Satisfaction
Most Highly Rated	<ul style="list-style-type: none"> <li>• To relax</li> <li>• To experience natural surroundings</li> <li>• To see marine life</li> </ul>	<ul style="list-style-type: none"> <li>• To relax</li> <li>• To experience natural surroundings</li> <li>• To see marine life</li> </ul>	<ul style="list-style-type: none"> <li>• Relaxing</li> <li>• Experiencing natural surroundings</li> <li>• Seeing marine life</li> </ul>
Least Highly Rated	<ul style="list-style-type: none"> <li>• To see undamaged reef sites</li> <li>• To see unique formations</li> </ul>	<ul style="list-style-type: none"> <li>• To see undamaged reef sites</li> </ul>	<ul style="list-style-type: none"> <li>• Seeing undamaged reef sites</li> <li>• Seeing a healthy reef</li> </ul>

#### *Non-Residents*

	Expected	Accomplished	Satisfaction
Most Highly Rated	<ul style="list-style-type: none"> <li>• To experience natural surroundings</li> <li>• To relax</li> <li>• To see live coral</li> </ul>	<ul style="list-style-type: none"> <li>• To experience natural surroundings</li> <li>• To relax</li> <li>• To see marine life</li> </ul>	<ul style="list-style-type: none"> <li>• Relaxing</li> <li>• Experiencing natural surroundings</li> <li>• Seeing marine life</li> </ul>
Least Highly Rated	<ul style="list-style-type: none"> <li>• To see undamaged reef sites</li> <li>• To see unique formations</li> </ul>	<ul style="list-style-type: none"> <li>• To see undamaged reef sites</li> </ul>	<ul style="list-style-type: none"> <li>• Seeing undamaged reef sites</li> <li>• Seeing large fish</li> </ul>

## Human Dimensions of Marine and Coastal Ecosystems

### Coral Reef Characteristics and User Impacts

To determine resource conditions that would be perceived as acceptable by resource users, respondents were asked to rate levels of certain parameters synonymous with coral reef health. Resource condition was assessed using four proxy measures, easily identifiable by the vast majority of divers, and frequently monitored by resource management agencies.

*Range of coral reef parameters respondents considered acceptable*

	<b>Coral Bleaching</b>	<b>Algal Cover</b>	<b>Visibility</b>	<b>Fish Cohorts</b>
Residents	0-15%	0-18%	Not less than 25 feet	Many fish, many types
Non-residents	0-20%	0-25%	Not less than 25 feet	Few fish, many types

#### ***Residents***

Coral reefs are sensitive, dynamic environments that are constantly in flux. Threats to these systems fall into two categories: natural and anthropogenic. Resident divers appear to rate commercial fishing operations as the biggest threat to coral reefs, with 75% of respondents “*strongly disagreeing*” to “*disagreeing*” that coral reefs in the Florida Keys are able to easily recover from any impacts from commercial fishing without any long-term damage. Resident divers saw diving/snorkeling as less of a threat to coral reefs in the Keys, though on average they did respond that coral reefs would not be able to easily recover from any impacts caused during these activities.

When asked to evaluate the positive or negative impact of a variety of environmental and human activities, respondents felt that *global climate change* and *hurricanes* were both having a “*slightly negative*” to “*moderately negative*” impact. This suggests that resident divers may feel that natural processes rather than direct human impacts are more responsible for negative reef conditions. Resident divers rate the current ecological health of the coral reefs in the Florida Keys as ‘*fair*’ to ‘*good*’ but that the state of the reef is “*declining somewhat*.”

## Diving in the Florida Keys

### *Non-Residents*

Non-resident divers appear to rate commercial fishing operations as the biggest threat to coral reefs with 76% of respondents “*strongly disagreeing*” to “*disagreeing*” that coral reefs in the Florida Keys are able to easily recover from any impacts from commercial fishing without any long-term damage. Non-resident divers saw diving/snorkeling as less of a threat to coral reefs in the Keys, though on average they did respond that coral reefs would not be able to easily recover from any impacts caused during these activities.

When asked to evaluate the positive or negative impact of a variety of environmental and human activities, respondents felt that *hurricanes* and *commercial fishing* were both having a “*slightly negative*” to “*moderately negative*” impact. This suggests that respondents feel that both naturally occurring and human-induced threats play a role in the ecological health of the coral reefs of the Florida Keys. Non-resident divers feel that the current ecological health of the coral reefs in the Florida Keys is ‘*fair*’ to ‘*good*’ but that the state of the reef is ‘*declining somewhat.*’



Figure A. Sand Key, Florida.

Source: [www.reefreliefarchive.org](http://www.reefreliefarchive.org)

## Understanding Coral Reef Use: SCUBA Diving in the Florida Keys by Residents and Non-Residents During 2006-2007

### Introduction

---

The Florida Reef Resilience Program (FRRP) is a collaborative program between non-governmental organizations, state and federal agencies, academic institutions, and the people whose livelihoods and recreational pursuits depend upon healthy coral reefs. It brings these groups together to achieve a common goal of improving the collective understanding of the mechanisms of coral reef resilience by exploring the biological, environmental, and social aspects of reef health and by asking a fundamental question of society, “What is it that people want and need from coral reefs?” Ultimately the Florida Reef Resilience Program seeks to develop strategies to improve the health of Florida’s reefs and enhance the sustainability of reef-dependent commercial enterprises and recreational activities (FRRP, 2008).

The question of what people want and need from coral reefs is a social question. The answers to this question are likely to reflect the commercial and recreational goals and preferences for resource condition that society has for coral reef environments. These goals and preferences, along with biological and ecological considerations, should be the basis of coral reef management decision-making (Figure 1).

As such, this project is part of a broader interdisciplinary resilience research effort. The strength of such an approach is that it typically yields a much more complex and holistic picture of what Krueger et al. (1986) call the natural resource management environment, defined as the case-relevant ecological, political, economic, and socio-

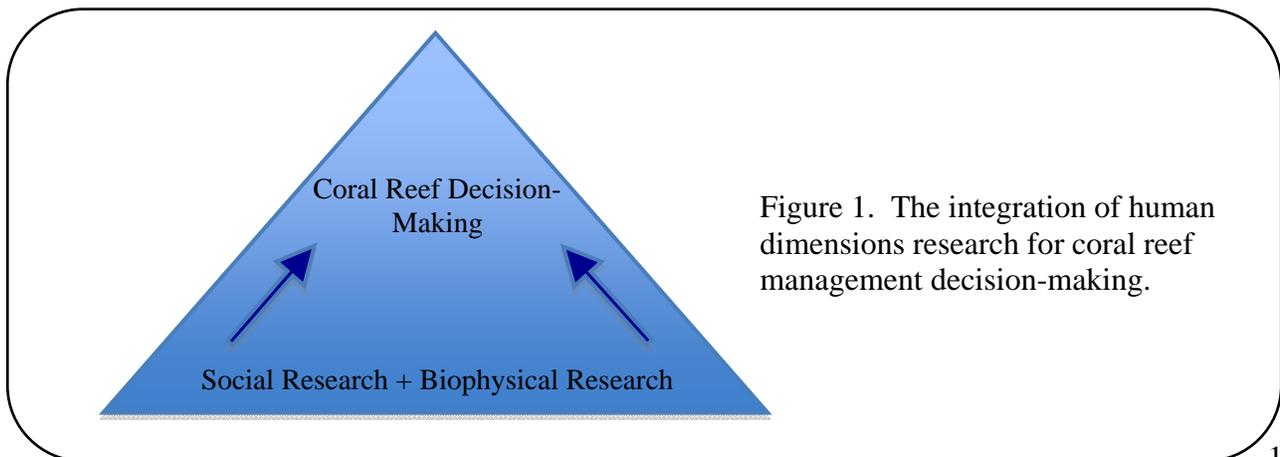


Figure 1. The integration of human dimensions research for coral reef management decision-making.

## Diving in the Florida Keys

cultural domains. This in turn is more responsive to the myriad social issues that drive coral reef management and preservation.

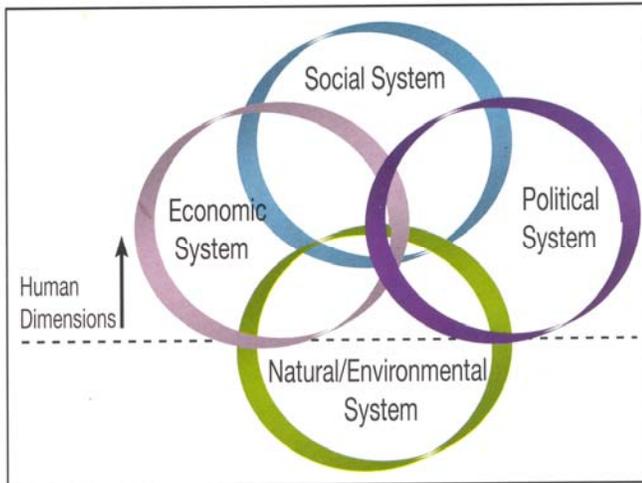


Figure 2. Conceptual model of natural resource management systems (adapted from Kennedy and Thomas 1995)

The focus of the current study is on developing a representative understanding of the non-economic interactions that coral reef users have with coral reef environments. This requires a diverse set of disciplines, including sociology and social psychology, and the collection and presentation of data in a fashion that represents those individuals and groups that use or simply appreciate the resource. The collection of such data should be conducted by practitioners grounded in the theory and methods of, in this instance, quantitative social science research.

In 2006, the Florida Reef Resilience Program (FRRP) complemented its existing biophysical research efforts targeting resilience factors on reefs in the Florida Keys with a social research component. This component was designed to elicit information about those recreating residents and visitors using the coral reefs of the Florida Keys. The University of Massachusetts Amherst's Human Dimensions of Marine and Coastal Ecosystems Program entered into an agreement with the Florida Keys Program of The Nature Conservancy in May, 2006 to conduct survey-based research to obtain and report this information. This report is the third of three such documents and should be used in conjunction with the angler survey and the SCUBA diver survey (HDME Analysis Series 2008-1-001 and 2008-1-002).

### Purpose of Project

---

Many of the direct and indirect benefits that coral reefs confer to surrounding communities are well documented (e.g., Spurgeon, 1992; Cesar & van Beukering, 2004; Leeworthy, et al., 1996). However, such benefits are most often researched and reported in terms of market and non-market economic calculi. While such calculi are very useful to policy-makers determining how to

## Human Dimensions of Marine and Coastal Ecosystems

prioritize state and national spending on coastal resource management projects, they are of lesser utility when coastal and coral reef managers seek to determine how stakeholder groups' interactions with coral reef environments and each other affect their preferences for how these same environments are managed. This is because people do not always make decisions based on logical economic considerations. It was the purpose of this project to understand these interactions, which are perceived through the prisms of individual and collective values, norms of behavior, levels of specialization (a measure of how central a coral reef-associated activity is to a person's life), resource conflict, and attitudes. In this way, public management preferences for, and perceptions of, coral reefs are more completely taken into account when developing the strategies that are central to FRRP activities.

### Theoretical and Conceptual Research Topics

---

The following provides information about the main themes comprising the foci of this report. This section is included as a brief introduction tool for those unfamiliar with the literature about these common human dimensions conceptual frameworks.

Extensive literature exists for each theory. In summary, using such frameworks and the literature developed therein allows social science researchers to develop ways to understand groups of SCUBA divers, how they think about coral reefs, perceive their environment and each other, and to what extent they are satisfied with their recreational experiences and opportunities.

**Attitudes.** Eagly & Chaiken (1993) define an attitude as “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (p. 1). This definition has been supported by various investigators (e.g., Ajzen & Fishbein, 2000; Ajzen, 2001). In Eagly & Chaiken's definition, *psychological tendency* is internal to the individual and *evaluating* refers to all kinds of evaluative response: overt, covert, cognitive, affective, or behavioral. The study of attitudes has been used in a variety of natural resource management situations, such as restoring wildlife (Brooks et al., 1999; Enck & Brown, 2002), and wildlife management activities (Bright & Barro, 2000; Teel et al., 2002; Lee & Miller, 2003; Koval & Mertig, 2004). However, McCleery et al. (2006) contend that many of the authors of natural resource management studies that utilize the attitude construct either do not

## Diving in the Florida Keys

understand or have failed to properly communicate attitudes and their social psychological frameworks, especially when examining attitude-behavior linkages.

**Norms.** A norm is a rule or standard about how individuals ought to behave in social situations. Violations of norms have consequences ranging from benign to severe. In an attempt to understand how individuals' actions are influenced by others, normative theory and methods, originally developed in the disciplines of sociology and social psychology, have become an important construct in natural resource management research. Common themes in normative natural resource management research are crowding and conflict, understanding preferential experiences, and user satisfaction (Shelby et al., 1992). Several kinds of norms have been identified. Cialdini et al. (1990) described two primary norm types: descriptive and injunctive. Descriptive norms refer to what most people are doing while injunctive norms refer to what people should be doing. Norms have also been shown to operate at two distinct levels, personal and social. Personal norms are a reflection of an individual's expectations, whereas social norms are standards shared by members of a group (Schwartz, 1977; Vaske et al., 1986).

To avoid social sanctions, what ought to be done is what is usually done, so descriptive and injunctive norms can be confused. However, since they arise from distinct motivations and are conceptually different, it is important to keep them separate (Cialdini et al., 1990; Reno et al., 1993).

**Specialization.** Specialization theory, first proposed by Bryan (1977), postulates that outdoor recreation participants (e.g., anglers, SCUBA divers, boaters) can be placed on a continuum from general interest and low involvement to expert interest and high involvement in a leisure social world. Each level of specialization involves a change in distinctive behaviors, skills, and directions. These include equipment preference, type of experiences sought (goals), desired setting for the activity, attitudes toward resource management, preferred social context, and even vacation patterns. The concept of recreation specialization is important because it allows researchers to analyze subgroups of populations, rather than aggregate the attitudes and preferences of novice, medium, and advanced participants. Various authors followed Bryan in researching recreation specialization (Graefe, 1980; Wellman et al., 1980; Kaufman, 1984; Donnelly et al., 1986).

## Human Dimensions of Marine and Coastal Ecosystems

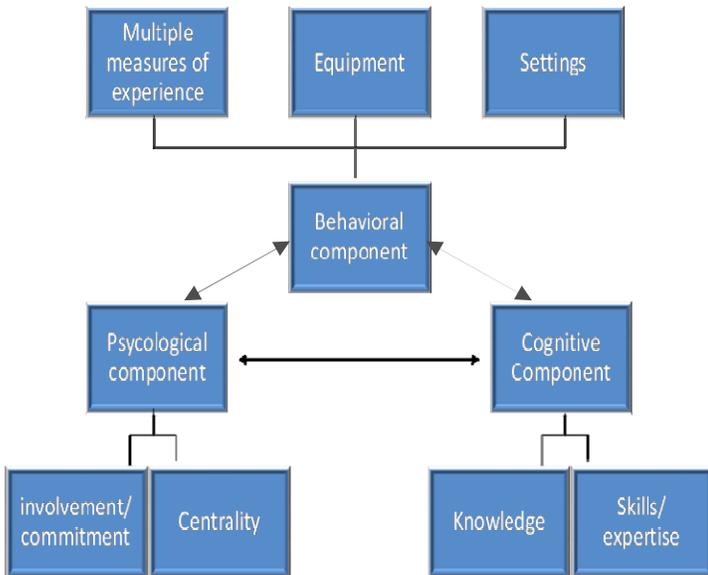


Figure 3. Components of recreation specialization (adapted from McIntyre and Pigram 1992)

However, Ditton et al. (1992) advanced specialization theory considerably by recognizing that Bryan's (1977) definition of specialization was also an explanation, and as such, a tautology. To give a theoretical foundation to specialization, these authors reconceptualized recreation specialization in terms of social sub-worlds (Shibutani, 1955; Unruh, 1979), which has been defined as an "internally recognizable constellation of actors, organizations, events, and practices which has coalesced into a perceived sphere of interest and involvement for participants" (Unruh, 1979). Eight testable propositions were defined by Ditton et al. (Box 1) to link specialization to these social sub-worlds and Bryan's work. In more recent research, Salz et al. (2001) developed and validated a

multivariable specialization index based on a social world view of recreation specialization and used this index to test recreation specialization theory by re-examining one of the propositions tested by Ditton et al. (1992). This study will utilize this specialization index to segment SCUBA divers in order to better understand the perceptions and experiences of survey respondents.

### Box 1. Specialization Propositions

1. Persons participating in a given recreation activity are likely to become more specialized in that activity over time
2. As level of specialization in a give recreation activity increases, the value of side bets will likely increase
3. As level of specialization in a given recreation activity increases, the centrality of that activity in a person's life will likely increase
4. As levels of specialization in a given recreation activity increase, acceptance and support for the rules, norms and procedures associated with the activity will likely increase
5. As level of specialization in a given recreation activity increases, the importance attached to equipment and the skillful use of that equipment will likely increase
6. As level of specialization in a given recreation activity increases, dependency on a specific resource will likely increase
7. As level of specialization in a given recreation activity increases, level of mediated interaction relative to that activity will likely increase
8. As level of specialization in a given recreation activity increases, the importance of activity-specific elements of the experience will decrease relative to non activity-specific elements of the experience

## Diving in the Florida Keys

**Satisfaction.** To adequately deliver recreation opportunities to the public, resource managers often want to understand how well a person's actual experience fits her expectations (see above) for that experience. For example, was the dive site as good as it was claimed to be? Were the fish all keepers? For several decades, natural resource managers and researchers have focused on understanding quality in recreational activities. One way to determine the quality of a recreational experience is through the concept of *satisfaction*, which can be defined in various ways (e.g. consumer's fulfillment response, a pleasurable level of consumption-related fulfillment, a broad evaluation of a product or service that is influenced by perceptions of service quality, product quality, price, and other factors).

Though recreation satisfaction has been examined from many different perspectives, measuring the satisfaction of recreating visitors is a complicated task. For example, while it is logical to assume that the number of users (both perceived and actual user density) will correlate highly with satisfaction, research has shown this not to be the case. A good satisfaction study will take into account seasonal and weekend/weekday effects, specialization levels, and environmental conditions.

**Expectations.** Expectancy/discrepancy theory suggests that satisfaction is a measure of how close a person's desired experiential outcome is to that person's perceived reality when or after the activity takes place (Vroom 1964, Porter & Lawler 1968). When visitor perceptions of reality meet or exceed their expectations, they tend to be more satisfied (Manning 1999). Thus, simply asking a SCUBA diver or snorkeler how satisfied they were with their experience means little unless it is understood in the context of his expectations and other factors.

**Attributions.** Attribution theory seeks to understand how people explain things. In fact, the term "attribution" could be replaced by the term "explanation" when discussing attributions. Attribution theory assumes that individuals attempt to figure out why they and other people do the things they do, or what is responsible for those things. There are three stages to attributing or explaining a behavior: (1) you perceive or observe the behavior, (2) you must think that the behavior was intentional, and (3) then you must determine if you think the other person was forced to perform the behavior (in which case the cause is external and attributed to the situation) or not (in which case the cause is internal and is attributed to the other person).

## Human Dimensions of Marine and Coastal Ecosystems

When we attempt to explain why something has happened, we have two options for explaining it. The first option is to say that something outside of ourselves caused it to happen. This is called an external attribution. The second option is to say that the cause was internal that it was one's own fault or responsibility. This is an internal attribution.

### Methods

---

Collecting information about people using natural resources like coral reefs can be time consuming, difficult, and costly, since often there are no lists of names and addresses of residents and tourists engaged in, for example, SCUBA diving in Monroe County at any one time. The percentage of the population actively engaged in SCUBA diving as a sport is also comparatively small compared to other recreational activities. Therefore, a method of intercepting a representative sample of such people while they are participating in diving activities must be employed. The methodology used in this study was designed with sample size and representativeness in mind. It was based on intercepting snorkelers in many different locations on the land and on the water to collect individuals' names, addresses, and phone numbers so as to be able to later send them a mail survey.

### Sampling

The sampling goal of this study was representativeness. This means that the data obtained for this study were intended to come from a representative sample of those using the coral reefs of the Florida Keys during sampling periods. A sample of snorkelers and SCUBA divers was identified through in-person intercepts, which were designed to collect names and addresses for the mail questionnaire. Since it was assumed that sampling for only snorkelers and only SCUBA divers would present challenges, the sampling design was such that the two groups were combined and then later segregated via the design of the survey instrument.

Intercepts began in June, 2006 and took place during approximately one week of each month during a 13-month period. Intercepts, conducted by graduate and undergraduate students of the University, were conducted both on the water and on land throughout the Florida Keys, with a focus on collecting names and addresses from nine distinct areas: designated as the lower, middle, and upper Keys nearshore, mid-channel, and reef margin/forereef zones (Figure 4). On-water intercepts, conducted via rental or Mote Marine Laboratory boat, targeted private boat owners or visitors who had rented a boat for

## Diving in the Florida Keys

the day and snorkeled or SCUBA dived on or around coral reefs. These reefs were defined by FRRP as oceanside of the keys island chain from shore to 30m of water. This method was used because it was the best approach for intercepting residents and tourists. While obtaining a list of Florida residents by county may be possible, “cold”

### Box 2. Sub-regions of the Florida Keys

#### *Upper Keys*

The Upper Keys sub-region extends from just south of Biscayne National Park down to Lower Matecumbe Key. The islands of the Upper Keys are closely joined together, forming a nearly continuous chain. This limits tidal water exchange between the Atlantic Ocean side of the islands and the Florida Bay side. The Gulf Stream also frequently loops in close to this sub-region. The combination of these factors usually results in very good visibility.

#### *Middle Keys*

The Middle Keys sub-region travels southwest from the Upper Keys sub-region encompassing the area from the south end of Lower Matecumbe Key to Bahia Honda Key. The Middle Keys are widely separated, allowing major tidal flow from Florida Bay and the Gulf of Mexico to the Atlantic Ocean.

#### *Lower Keys*

The Lower Keys sub-region extends west from Bahia Honda Key out past Key West but stopping shy of the Marquesas Keys. This area has many more and much wider keys with the island orientation changing to a northwest to south east direction. These wide land expanses result in shallow bays between keys, slowing tidal water flow. There are, however, a few deep water passes that allow more tidal flow.

mailing surveys to individuals and asking for information about their most recent trip to a coral reef area has the potential to suffer from high amounts of recall bias. This is because an individual receiving a survey in the mail may have not been snorkeling or SCUBA diving in many weeks or even months.

Instead, individuals were intercepted on the water in day-long boat “patrols” in the inshore, mid-channel, and reef margin/forereef zones. On-land intercepts included divers who dived on or around coral reefs, again defined by FRRP as oceanside of the Keys island chain from shore to 30m of water, on a hired charter boat. The approach used in this study ensured that private boats coming from canal-side docks, rental boat, divers trailering boats, and individual divers from charter boats all had the potential to be included in the sample.

#### *Sampling Places*

Selecting shore locations at which to sample involved creating a census of diving and snorkeling businesses in the Florida Keys. Following that, all of these operations were contacted and made aware of the project. With only four exceptions, all agreed to allow access to their customers.

# Human Dimensions of Marine and Coastal Ecosystems

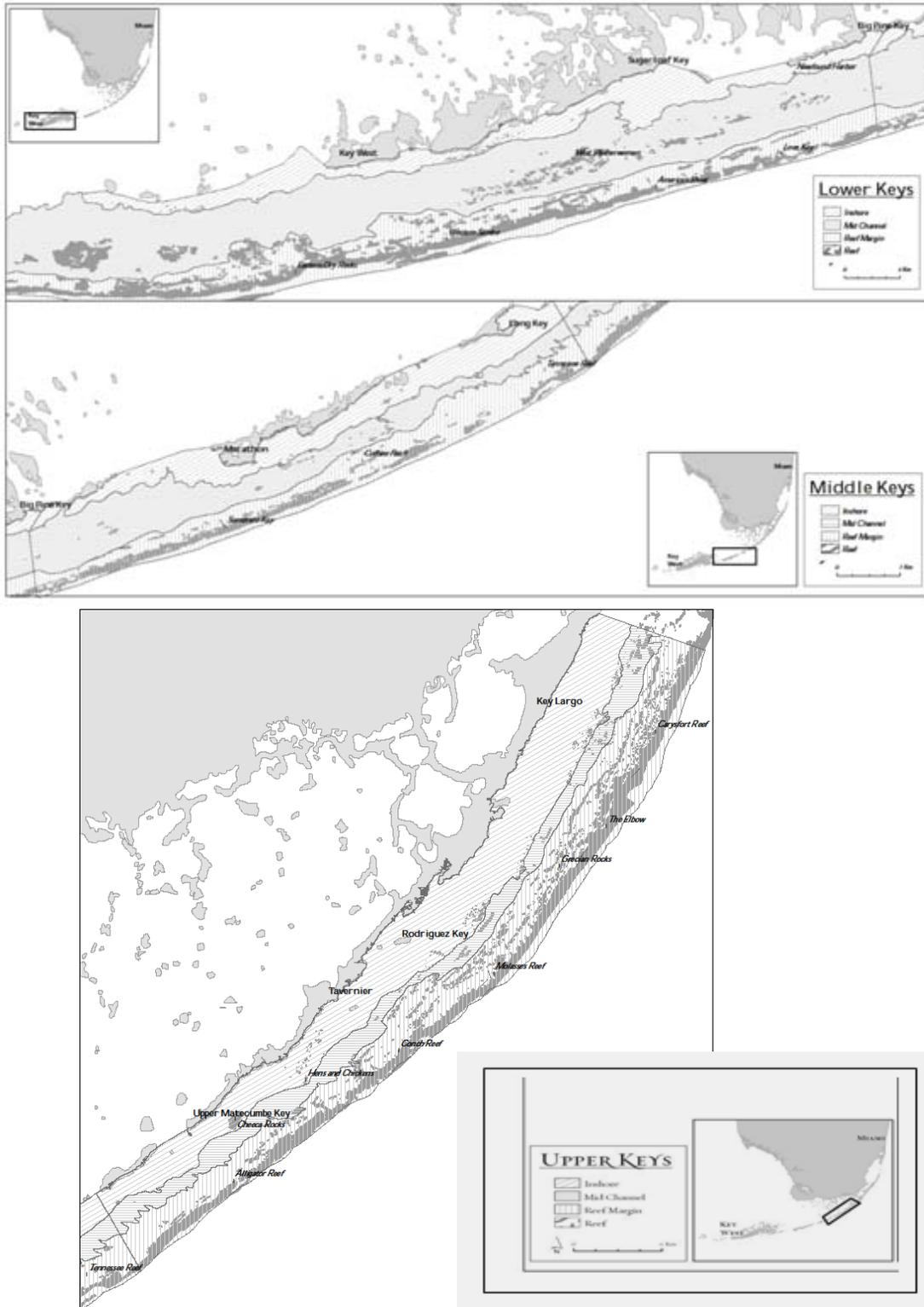


Figure 4. Locations of Coral Reef Subregions and Zones Included in this Study.

## Diving in the Florida Keys

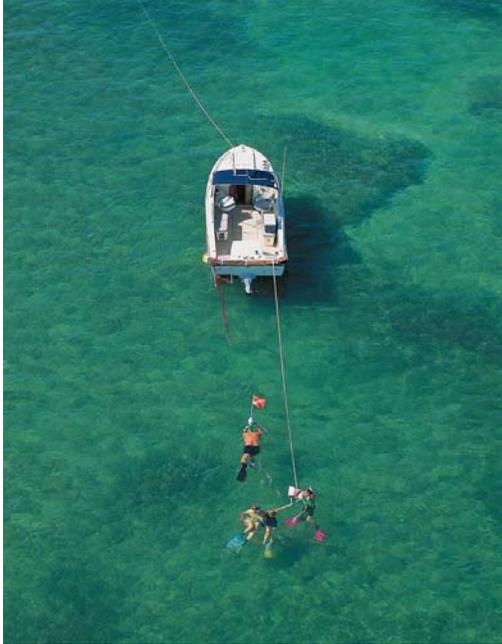


Figure 5. Snorkelers in the Florida Keys

Source: [www.visitusa.com](http://www.visitusa.com)

### *Zones*

Collecting information by zones, which had been previously determined by FRRP, was important because it mirrored how biophysical data collection was being collected. As such, there is the possibility of being able to integrate some of the social and biophysical findings to gain a more focused picture of reef use and perceptions, impacts, and health. In addition to intercepting people by zone type, the survey instrument (by way of an accompanying map) asked people to indicate the zone in which they believed they had been snorkeling in.

### *Sample Size*

The larger FRRP project was designed for the collection of 300 SCUBA diver/snorkeler

names per month. With this target in mind, it was expected that a sample of approximately 3,600 snorkelers and SCUBA divers would be available after the sampling. This number was based on obtaining enough respondents for between-group analyses (e.g., specialization level). Reaching this target would be dependent on a number of factors, including weather, the number of snorkelers and divers available to sample, and cooperation rates.

### **Box 3. Zones of the Florida Keys**

#### ***Inshore***

This zone encompasses a large area that extends from the shoreline to approximately the 5.5m bathymetric contour. Both hard bottom and discontinuous patch reefs occur within the Inshore zone, and they are generally protected from the high-energy waves commonly experienced in the outer reef tract.

#### ***Mid-Channel***

This zone encompasses the area referred to as Hawk's Channel, extending from the edge of the Inshore zone to the edge of the reef terrace. Depth varies from 8.5-13.7m. Hawk's Channel in the Lower Keys is typically deeper than its extent in the Middle and Upper Keys.

#### ***Forereef /Reef Margin***

For the purposes of the Human Dimensions study, the zones called Offshore Patch Reef and Forereef were combined. This results in a zone covering any reef found seaward of Hawk's Channel out to the 30m depth contour of the reef slope. The Offshore Patch Reef zone contributes shallow spur and groove reef along with its characteristic patch reefs. The Forereef zone consists of the reef flat and intermediate forereef, also made up of spur and groove formations.

## Human Dimensions of Marine and Coastal Ecosystems

### *Survey Design*

The survey instrument for this study was developed cooperatively with members of FRRP (predominately TNC staff) over a four-month period, a process that yielded a 16-page mail questionnaire. Questions were designed to cover a variety of human dimensions concepts related to snorkel and dive norms, motivations, expectations, accomplishments, and satisfaction, as well as equipment expenditures, levels of media interaction, attitudes towards coral reef use, and evaluations of biological conditions. Items were also included to collect basic demographic data, including respondent gender, age, race, ethnicity, income, and place of residence.

One major difference between the design of the SCUBA diver/snorkeler survey and the angler survey was the incorporation of a method of differentiating between SCUBA divers and snorkelers for analysis. This was done by asking respondents which of the two activity groups they considered they belonged to, which of the two they did on their last visit to a reef in the Florida Keys, and by skip patterns in the questions.

The questionnaire items were reviewed by graduate students, an academic committee at the University of Massachusetts, a senior

research associate at the University of Miami, a research programs coordinator at Florida Atlantic University, and employees of The Nature Conservancy and the National Oceanic and Atmospheric Administration for wording, relevance, and appropriateness. In addition, several SCUBA divers were asked to complete the draft questionnaire and comment on how long they spent completing the survey, whether any questions were confusing, and any other aspects of the survey that could be better presented. Based on these comments, the length of the survey was reduced, and some modifications to question wording were made.

### *Survey Implementation*

To maximize response rates for the survey, materials were sent out using the Dillman (1978) Total Design Method. Following each intercept wave, a term used in this case to describe the 13 periods of name and address collection in the field, all potential study participants were sent a packet of survey materials that included a cover letter thanking them for their participation and ensuring their confidentiality, a questionnaire, a business reply envelope, and a map of the Florida Keys. One week after mailing the initial packet, all potential respondents were sent a post-card that thanked them for completing

## Diving in the Florida Keys

the survey if they had already completed and returned it, or reminded them of the importance of their participation and asking that they complete and return the survey. Three weeks after the initial mailing, potential respondents who had not returned a questionnaire were sent a second packet of survey materials. For this mailing, the packets of materials were the same as in the first mailing, except that the cover letter was revised slightly to further emphasize the importance of their participation. Six weeks after the initial mailing, all potential respondents who had not returned a survey

were sent a third packet of materials, with a cover letter that further emphasized the importance of their participation. All letters and post-cards were hand-addressed, hand-signed, and posted with a stamp. This "personalizing" of survey materials and sending multiple copies of the survey to potential respondents was used to help maximize the response rate. Tables 1 and 2 demonstrate the response rates for both resident and non-resident divers and snorkelers, as well as the breakdown per activity.

Table 1. Status of resident and non-resident mail survey response rate.

	<u>N</u>	<u>%</u>
Initial sample	2,867	---
Non-deliverable	114	---
Effective sample	2,753	---
Total non-returned surveys	1,158	42.1%
Total returned surveys	1,595	57.9%

Table 2. Breakdown of number of responses by activity

	<u>N</u>	<u>%</u>
SCUBA		
Resident	61	3.8%
Non Resident	938	58.8%
Snorkel		
Resident	38	2.4%
Non-Resident	558	35.0%
Total	1,595	100.0%

### Resident Divers

---

#### Resident Divers' Profile

As a starting point for developing a detailed picture of the resident diver population in the Florida Keys, a series of personal history-based questions were asked. Of all resident divers surveyed, just over 30% were between 23 and 35 years of age (Q41) with the majority being over 40 ( $\bar{x}$ = 45.16 years). The respondents were predominately male (69%), and none of the sample self-identified as Hispanic/Spanish/Latino (Q42 and 45). Virtually all respondents (98.2%) listed their race as white (Q46).

Sixteen percent of those surveyed reported their household income as between \$75,000 - \$99,999, with 70% of respondents reporting a household income of greater than \$45,000 (Q44), the recorded average household income for Florida in 2006 (BEBR, University of Florida).

Further analysis indicates that 70% of respondents would need up to \$2,000 to replace their equipment ( $\bar{x}$ =\$2,656). Additionally, they had an average of over 18 years of diving experience (Q5) and over 50% of respondents had spent more than 35 days over the last 12 months diving on or around coral reefs in the Keys ( $\bar{x}$ =56.00 days). This

suggests that a highly specialized group of divers are residents of the Florida Keys.

#### Specialization

Specialization can be categorized as behavior from the general to the particular, and is often reflected in the quality of equipment used and skill level possessed as well as by activity setting preferences. Utilizing the specialization index developed and validated by Salz et al. (2001) that incorporates the four social world dimensions, Table 3 shows how respondents were distributed into three levels of specialization. Initially four levels were used as the theory suggests but there were no resident divers in the least specialized category, and only two in the moderate level, so these categories were combined. The distribution highlights the degree to which resident divers were categorized into only the two highest levels. This infers both a dedication to, and investment in, the sport of diving. Due to this distribution, no further analyses were conducted according to specialization for resident divers.

Figures 6 and 7 provide a breakdown of the percentage of divers per specialization level per sub-region of the Keys, highlighting the differences in each area. These percentages

## Diving in the Florida Keys

demonstrate that a higher percentage of less specialized diving residents are found in the Lower Keys. Based on the specialization proposition 4 described by Ditton et al. (1992), this would suggest that management

regulations, more readily accepted by highly specialized individuals, may require greater levels of enforcement in the Lower Keys than both the other sub-regions.

Table 3. Resident divers distributed according to specialization level.

Specialization Level					
Least		Moderate		High	
n	%	n	%	n	%
2	3.39	22	37.29	35	59.32

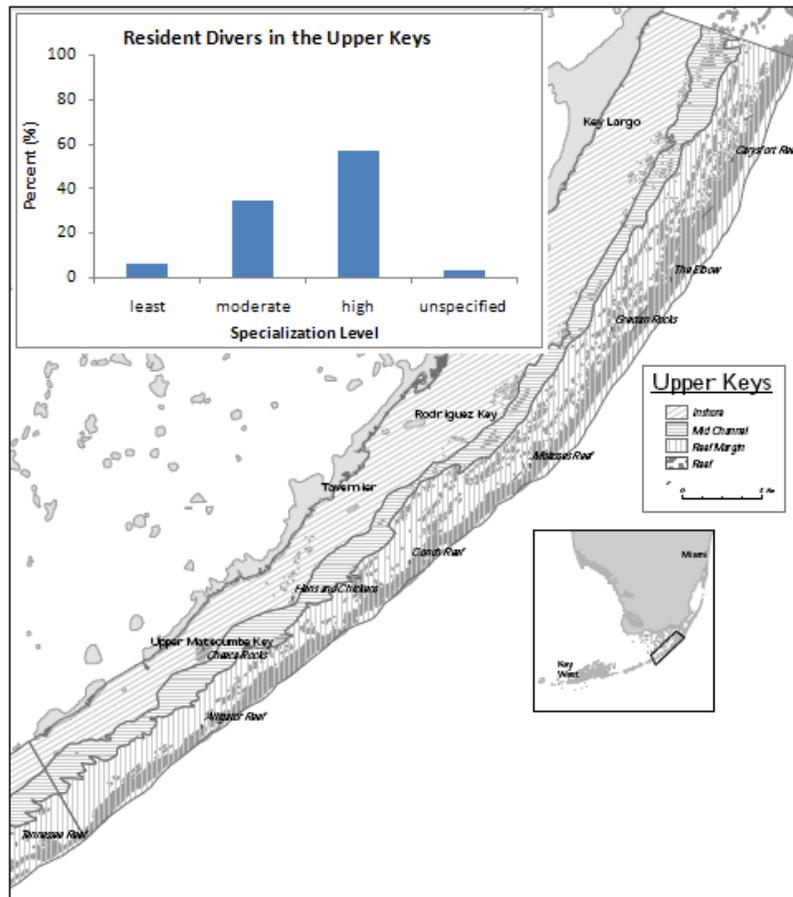


Figure 6. Resident Divers in the Upper Keys by Specialization Level

## Human Dimensions of Marine and Coastal Ecosystems

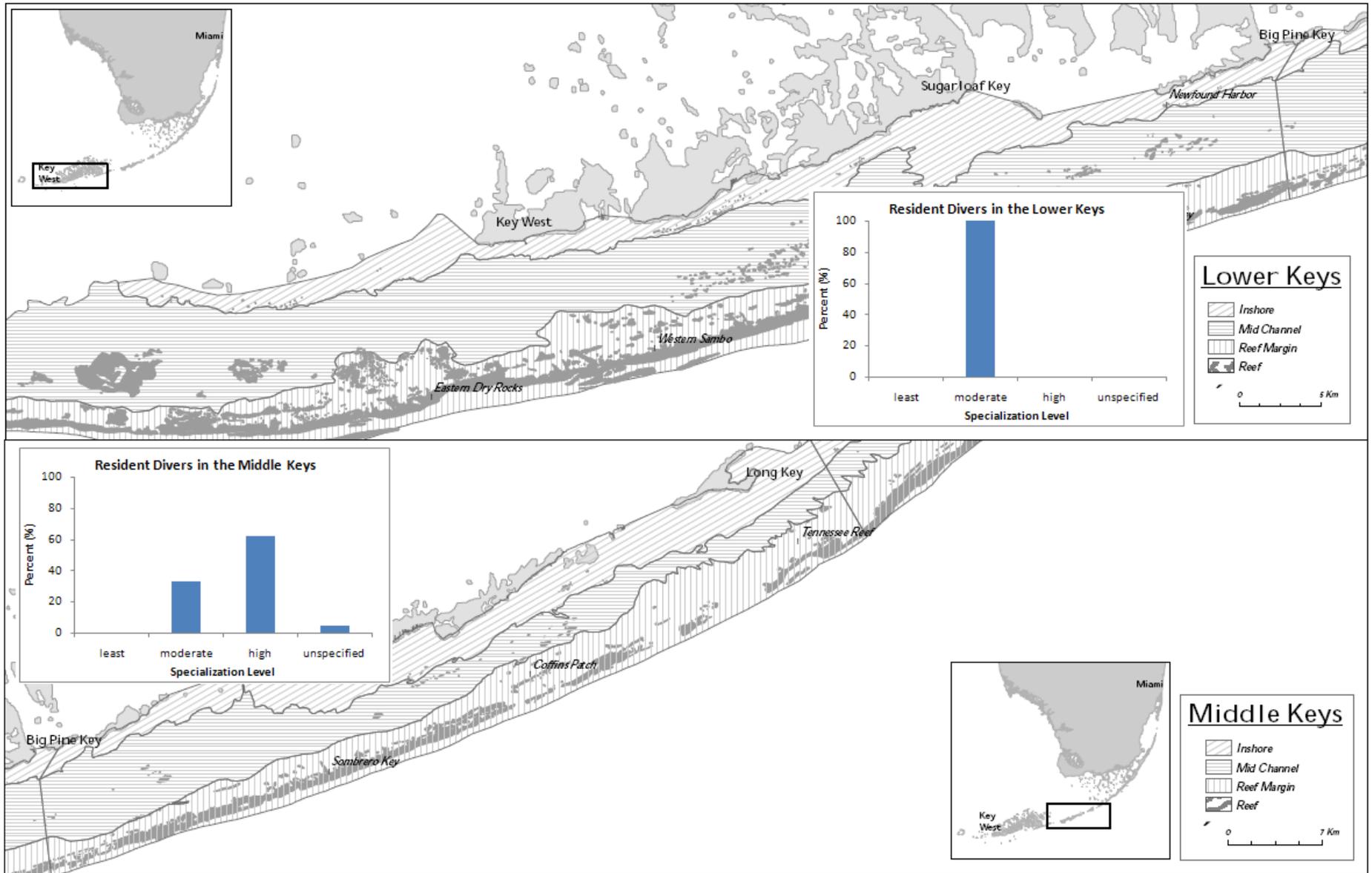


Figure 7. Resident Divers in the Middle and Lower Keys by Specialization Level

## Diving in the Florida Keys

### Dive Practices and Motivations

There are many different modes of access to the resource available to all resident divers (Q7). Responses indicated that residents were most likely to dive from for-hire boats ( $\bar{x}$  = 28.5 days over a 12 month period). This category suggests an important reliance on commercial ventures and, therefore, resident diver activity and dive boat operations are an important component of the local economy. Private boats ( $\bar{x}$ =25.7 days) also represents a major mode of access for residents. The majority of residents dive with friends (38.0%) or friends and family (34.5%) with only a relatively small percentage (15.52%) choosing to dive alone (Q4).

During the 12 months prior to the survey many divers spent ‘*about the same*’ number of days diving on or around coral reefs in the Florida Keys (Q8) when compared to previous years (37.7%). The opportunity to dive on coral reefs as opposed to other snorkel locations, such as wrecks, sand flats, or seagrass beds, was considered to be between ‘*moderately important*’ and ‘*very important*’ for 61.7% of respondents ( $\bar{x}$ = 3.52) (Q9).

### Resident Divers’ Use of Information Sources

There are several potential sources of information available to resident divers in the

Florida Keys (Q10). The source used most often, with 81% of respondents making “*some*” to “*a lot of use*” was that of ‘*talking to other divers*’ ( $\bar{x}$ = 4.24), and 59% gave the same responses for ‘*dive shops/companies*’ ( $\bar{x}$ =3.68). The least common source of information used was ‘*television*’ with over 58% making “*no use*” of this resource. Many residents made ‘*some use*’ of a variety of other listed media sources, suggesting that communicating with resident divers is possible but that a varied and multi-media approach will likely be required. However, it is also evident that residents do not actively seek out information from many sources, with the exception being other divers. This suggests that generalized communication with resident divers may be problematic.

### Acceptability of Presence of Other Resource Users

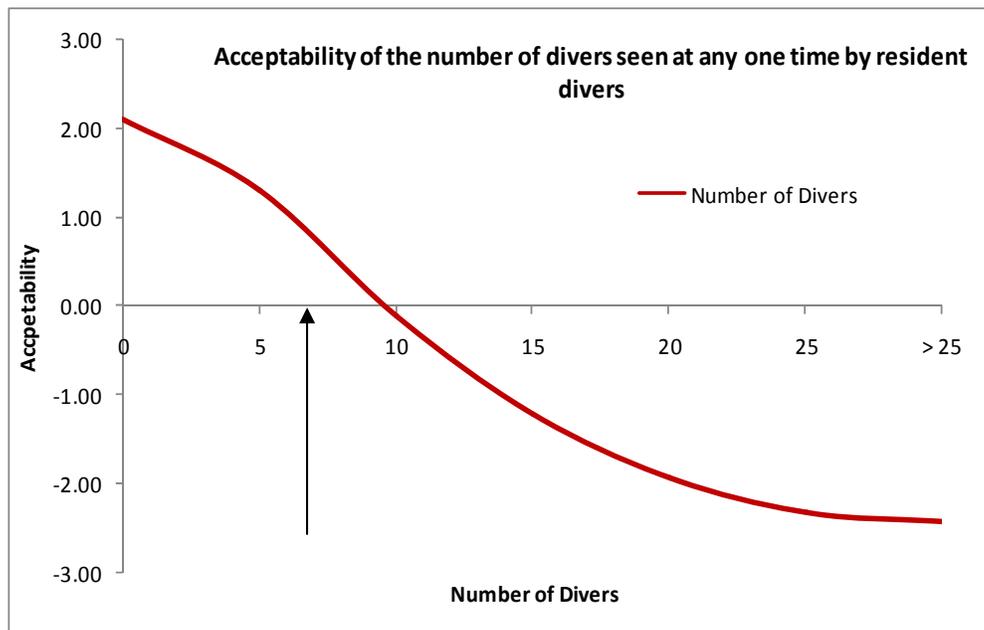
Normative theory was used to investigate divers’ views on acceptable levels of use and diver behavior. Respondents were asked to describe the number of SCUBA divers, snorkelers and boats they considered to be acceptable to see at any one moment during their time at the dive site (Q17, 18, 19). In order to determine the critical information on when acceptable becomes unacceptable, a norm curve was created. Distributed around

## Human Dimensions of Marine and Coastal Ecosystems

the mean of 4, but graphically represented as positive (acceptable), neutral (critical point) and negative (unacceptable) on a 7-point scale, Figures 8, 9 and 10 show the norm distribution highlighting the decreasing level of acceptability as the number of users seen in each category increases. The critical piece of information on each curve is where it crosses the neutral point on the acceptability scale (anything above 0 is acceptable, and anything below 0 is unacceptable). In this case it crosses at approximately 9 SCUBA divers, 14 snorkelers and 8 boats. Thus, more than 14 snorkelers or 9 SCUBA divers would be unacceptable, as would more than 8 boats.

These do not represent a cumulative total of all user groups, and therefore, each norm curve should be considered individually as acceptable or not.

Expectations for seeing other users at any one moment while diving, which is different from what is considered to be acceptable, varied across the sample (Q25, 26). Eighty-six percent of resident divers expected to see 10 or fewer other SCUBA divers ( $\bar{x}=5.71$ ), 83% expected to see 10 or fewer snorkelers ( $\bar{x}=7.02$ ), and 86% expected to see 10 or fewer boats ( $\bar{x}=5.02$ ).

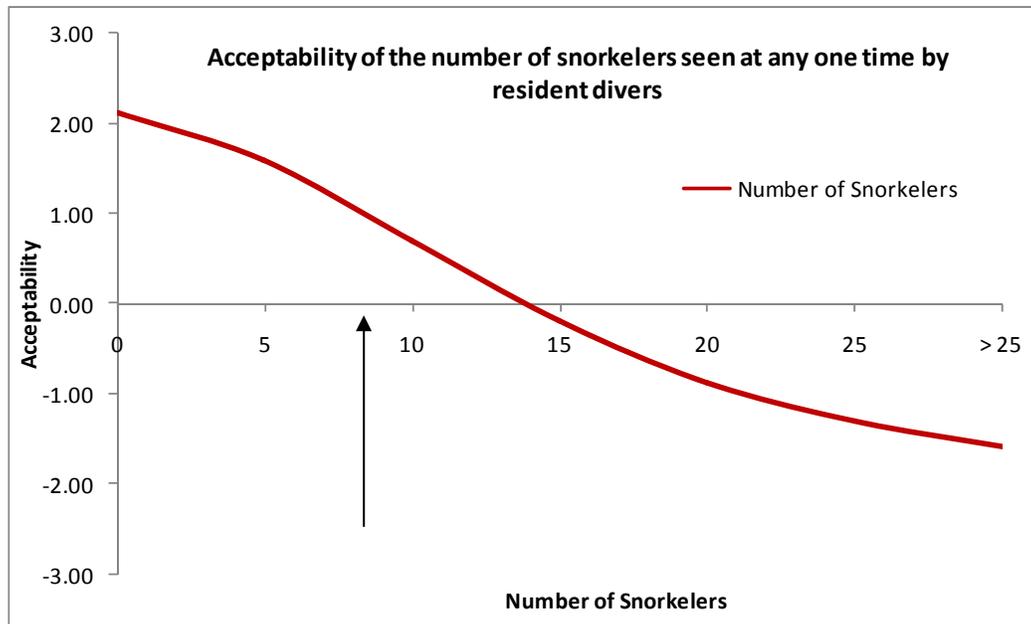


*Arrow denotes actual number seen by resident divers*

Figure 8. Norm curve for the number of divers seen by resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3).

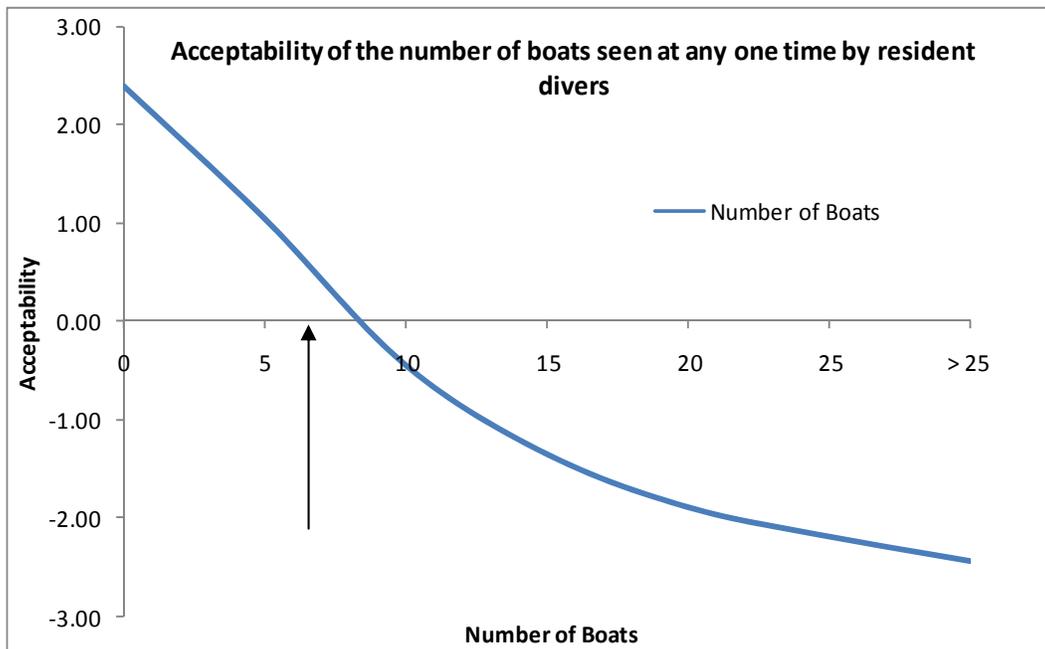
## Diving in the Florida Keys



*Arrow denotes actual number seen by resident divers*

Figure 9. Norm curve for the number of snorkelers seen by resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3).



*Arrow denotes actual number seen by resident divers*

Figure 10. Norm curve for the number of boats seen by resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3).

## Human Dimensions of Marine and Coastal Ecosystems

It appears that these expectations were well founded since 82% reported seeing 10 or fewer SCUBA divers ( $\bar{x}$ =6.28), 78% reported actually seeing 10 or fewer snorkelers ( $\bar{x}$ =9.12), and 78% reported seeing 10 or fewer boats ( $\bar{x}$ =6.06) (Q33, 34). This suggests that resident divers are very knowledgeable about the current use levels in the Florida Keys, either through previous experience, awareness messaging through different media sources or from communication with others.

Crowding is a subjective negative evaluation of use level that occurs when the individual perceives an interference with their own activities. In general, residents experienced only a small perceived level of crowding (Q29). Thirty percent of all respondents felt “not crowded at all” during their most recent

trip ( $\bar{x}$ =3.06) on a scale of 1-9, with 9 being the most crowded, whereas only 4% felt extremely crowded. This suggests that resident divers are generally satisfied with the level of use patterns that currently exist. It also suggests that small adjustments in management decisions to allow higher levels of use in some areas may have big effects when it comes to levels of satisfaction with the experience in general.

### Behavioral Norms

The two items that respondents felt divers had “a strong obligation to never do” were to ‘break off pieces of live coral’ ( $\bar{x}$ = 1.39) and to ‘take pieces of dead coral’ ( $\bar{x}$ =1.41) (Q21). Respondents also felt that all divers had a “strong obligation” to ‘maintain buoyancy control’ ( $\bar{x}$ =6.92), to ‘tell others not to touch coral’ ( $\bar{x}$ =6.79) and to ‘operate boats at least 100’ from a dive flag’ ( $\bar{x}$ =6.50). These results demonstrate a recognition of the value of coral as a resource to society and a willingness to protect it even if that means remonstrating with others. It also suggests a responsibility to ensure the safety of other users.

This was also indicated when respondents were asked to describe their embarrassment levels if seen engaging in certain activities, whether intentionally or accidentally (Q22).

### **Box 4. Norms and Management Implications**

Normative theory suggests that current use levels do not exceed acceptable levels at this time. Users are not feeling excessively crowded while engaging in their recreational activity of choice. This means that management alternatives that increase usage may not be seen as negative.

Management options may include:

1. The addition of extra mooring buoys at popular dives sites
2. An increase in the number of dive operator concessions

## Diving in the Florida Keys

The two items respondents felt they would be most embarrassed to be seen doing were '*knowingly anchoring a boat on coral*' ( $\bar{x}=4.75$ ) and '*breaking off pieces of live coral*' ( $\bar{x}=4.70$ ). The results suggest that behavioral norms for the appreciation and protection of coral reef ecosystems were strongly held by divers who are residents of the Florida Keys.

### Reef Condition

Normative theory and methods can be applied as a basis for formulating indicators and standards of what should be acceptable in terms of coral reef conditions. In Question 20, respondents were asked for an acceptability rating, on a 1-7 point scale, for four important coral reef conditions. In order to determine the critical information on when acceptable becomes unacceptable, norm curves were created for the parameters of coral bleaching, algal cover, visibility and fish abundance and diversity. Distributed around the mean of 4, but graphically represented as a positive (acceptable), neutral (critical point) or negative (unacceptable), on a 7-point scale, Figure 11 shows the norm distribution highlighting the decreasing level of acceptability as the quality of the four conditions decreases. The critical piece of information on the curve is where it crosses

the neutral point on the acceptability scale (anything above 0 is acceptable, and anything below 0 is unacceptable). In this case the norm curves show that these points are approximately 15% bleached, 18% algal cover and 25 feet of visibility. These do not represent a cumulative total of all coral reef characteristics, and therefore, each norm should be considered individually as being acceptable or not. Fish abundance and distribution is harder to quantify but the curve shows that both species of fish and abundance are important to resident divers, with an emphasis placed on variation of species.

Mean responses to Questions 30 and 31 indicated that divers would be likely to return to the reef area that they had dived during their last visit ( $\bar{x}=4.67$ ). The results also show that respondents would recommend that a friend dive on that same reef ( $\bar{x}=4.35$ ).

### Satisfaction

The satisfaction that individuals derive from various aspects of their trip can be better understood by learning about their pre-trip expectations, determining from them what then actually occurred, and then asking how satisfied they were with the experience (Table 4). To this end the same set of ten items was asked in three separate ways on the survey instrument; 1) what were their expectations 2)

### Human Dimensions of Marine and Coastal Ecosystems

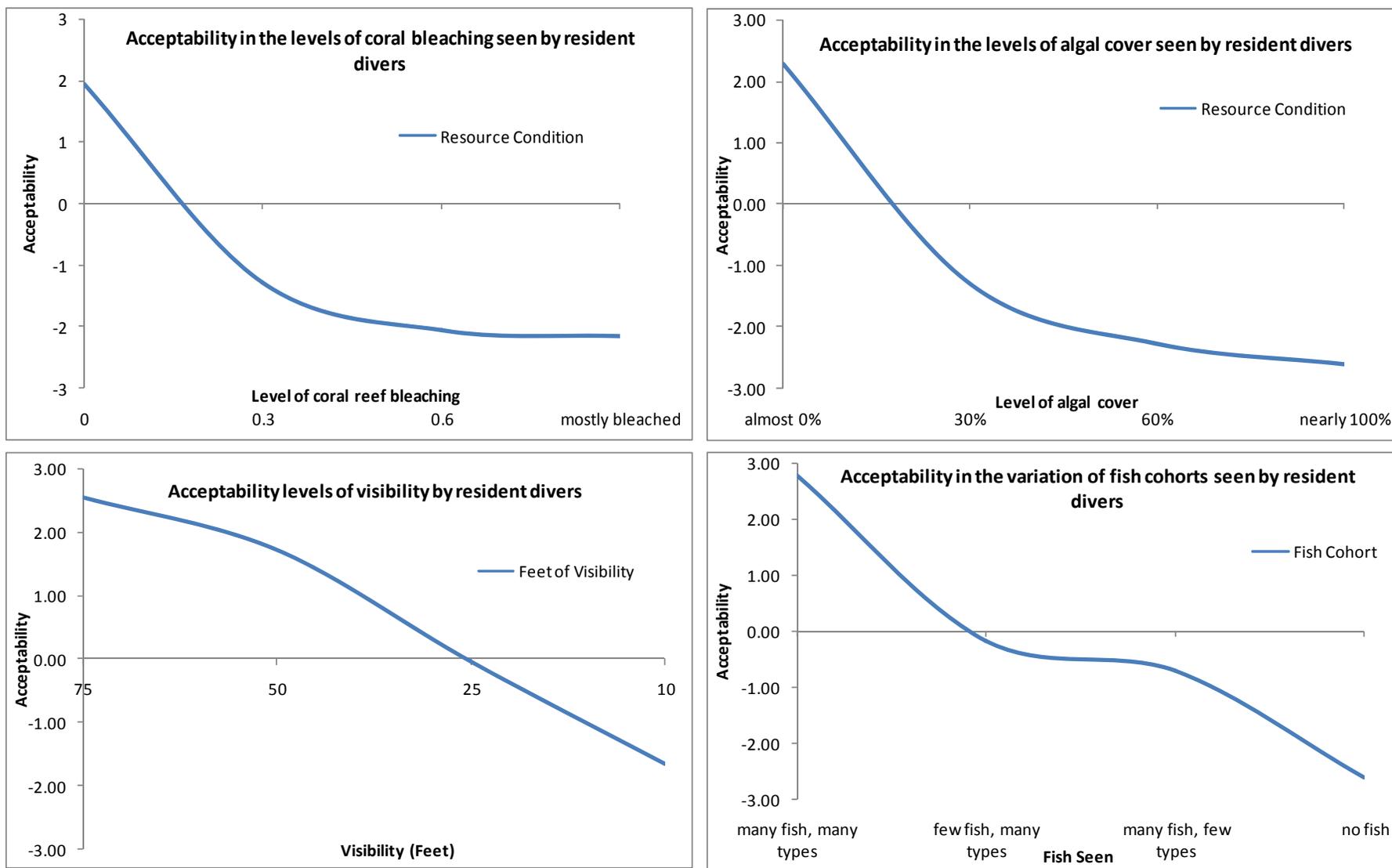


Figure 11. Normative curves for coral reef conditions for resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (7) to extremely unacceptable (1).

## Diving in the Florida Keys

to what extent were they able to accomplish these things, and 3) how satisfied were they with regard to each item. The three items with the highest expectations were ‘to relax’ ( $\bar{x}$ =4.42), ‘to experience natural surroundings’ ( $\bar{x}$ =4.33) and ‘to see marine life’ ( $\bar{x}$ =4.05) (Q11). A measure of the quality of experience can be tied to the ability to accomplish important components normally expected with an activity (Q24). The three items with the highest level of accomplishment were ‘to relax’ ( $\bar{x}$ =4.62), ‘to experience natural surroundings’ ( $\bar{x}$ =4.50) and ‘to see marine life’ ( $\bar{x}$ =4.46). The item

that was accomplished the least was ‘to see undamaged reef sites’ ( $\bar{x}$ =2.96). Using the same series of items, respondents were asked to rate how satisfied they were with each item during their last trip to the Florida Keys using a 1-5 scale. All items received a rating of “moderately satisfied” or better with ‘relaxing’ ( $\bar{x}$ =4.49), ‘experiencing natural surroundings’ ( $\bar{x}$ = 4.29) and ‘seeing marine life’ ( $\bar{x}$ =4.00) returning the greatest satisfaction ratings (Q32). The two items that returned the lowest levels of satisfaction were ‘seeing undamaged reef sites’ ( $\bar{x}$ =2.94) and ‘seeing a healthy reef’ ( $\bar{x}$ =3.06).

Table 4. Resident divers’ expected and accomplished experience levels, discrepancies between these levels, and resident diver satisfactions.

Item	Expected mean	Accomplished mean	Discrepancy mean	Satisfaction mean
Seeing a healthy reef	3.362	3.308	-0.054	3.059 <sup>1</sup>
Easy snorkeling conditions	3.772	4.135	<b>0.363</b>	3.960
Experiencing good underwater visibility	3.596	3.538	-0.058	3.549
Undamaged reef sites	2.862	2.962	<b>0.100</b>	2.941
Seeing marine life	4.052	4.462	<b>0.410</b>	4.000
Seeing large fish	3.667	3.596	-0.071	3.412
Seeing unique formations	3.281	3.442	<b>0.161</b>	3.294
Seeing live coral	4.000	3.942	-0.058	3.392
Experiencing natural surroundings	4.333	4.500	<b>0.167</b>	4.294
Relaxing	4.421	4.615	<b>0.194</b>	4.490

\**Bold denotes exceeded expectations*

<sup>1</sup>1=not at all satisfied, 2=slightly satisfied, 3=moderately satisfied, 4=very satisfied, 5=extremely satisfied

## Human Dimensions of Marine and Coastal Ecosystems

### Coral Reef Characteristics and User Impacts

A range of coral reef characteristics were considered by resident divers in order to determine the perceived quality of the coral reefs in the Florida Keys. Of the ten characteristics listed, all but one (amount of coral disease) were considered to be above “average” in quality (Q28) with ‘different kinds of fish’ ( $\bar{x}$ =5.26) and ‘number of fish’ ( $\bar{x}$ =5.16) ranking the highest.



Figure 12. Underwater Resources in the Florida Keys

Source: [www.reefreliefarchive.org](http://www.reefreliefarchive.org)

Resident divers see commercial fishing operations as the biggest threat to coral reefs with 75% of respondents “strongly disagreeing” to “disagreeing” that coral reefs in the Florida Keys are able to easily recover from any impacts from commercial fishing without any long-term damage ( $\bar{x}$ =1.92). Diving/snorkeling was also seen as a threat to coral reefs in the Keys, as respondents felt

that coral reefs would not be able to easily recover from any impacts caused during these activities ( $\bar{x}$ = 2.27) (Q38).

When asked to determine whether a variety of environmental and human activities were having a positive or negative impact on the ecological health of coral reefs in the Florida Keys, respondents felt that on a scale of 1-7, global climate change ( $\bar{x}$ =2.23) and hurricanes ( $\bar{x}$ =2.58) were both having a “slightly negative” to “moderately negative” impact (Q35). Resident divers feel that the current ecological health of the coral reefs in the Florida Keys (Q36, 37) is ‘fair’ to ‘good’ ( $\bar{x}$ =2.20) but that the state of the reef is ‘declining somewhat’ ( $\bar{x}$ = 2.05).

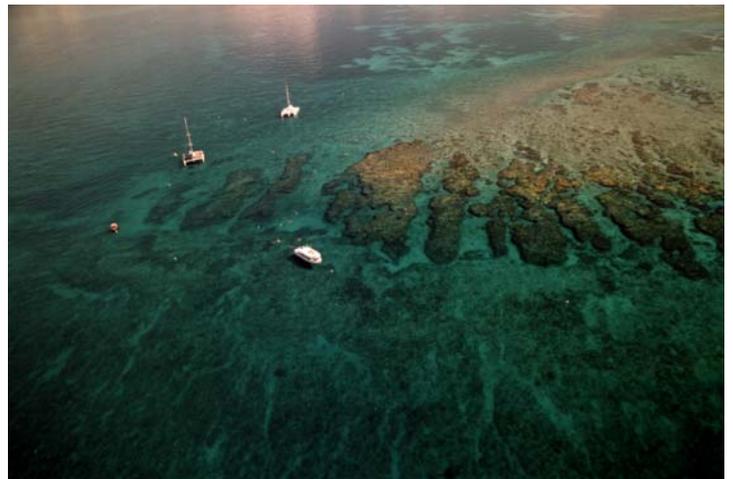


Figure 13. Resource Users at Eastern Dry Rocks, Key West

Source: [www.reefreliefarchive.org](http://www.reefreliefarchive.org)

## Diving in the Florida Keys

### Non-Resident Divers

---

#### Non-Resident Divers' Profile

As a starting point for developing a detailed picture of non-resident divers in the Florida Keys, a series of personal history-based questions were asked through the survey instrument. Of all non-resident divers surveyed, 28% were between 15 and 35 years of age (Q41) with the majority being over 40 ( $\bar{x}$ =43.0 years). The respondents were predominately male (73%), and only 3% of the sample self-identified as Hispanic/Spanish/Latino (Q42, 45). Virtually all respondents (97.9%) listed their race as white (Q46).

Twenty-five percent of those surveyed reported their household income as \$150,000 or more, with 87% of respondents reporting a household income of greater than \$45,000 (Q44). Further analysis indicates that just under 70% of respondents would need up to \$2,000 to replace their equipment ( $\bar{x}$ =\$1,955.42). Additionally, they had an average of over 8.4 years of diving experience (Q5) but over 50% of respondents had spent 4 or fewer days over the last 12 months diving on or around coral reefs in the Keys ( $\bar{x}$ =8.9 days). This suggests that a large variation in the specialization levels of

divers visiting the Florida Keys exists, including a number of new or less specialized individuals.

#### Specialization

Specialization can be defined as behavior from the general to the particular and is often reflected by the quality of equipment used and skill level possessed as well as by activity setting preferences. Utilizing the specialization index developed and validated by Salz et al. (2001) that incorporates the four social world dimensions of orientation, experiences, relationships and commitment, non-resident diver respondents were distributed into levels of specialization based on Questions 13-16. Table 5 displays this distribution into four groups.

Figures 14 and 15 provide a breakdown of the percentage of snorkelers per specialization level per sub-region of the Keys, highlighting the differences in each area. These percentages demonstrate that a higher percentage of less specialized diving non-residents are found in the Lower Keys. Based on specialization proposition 4 described by Ditton et al. (1992), this would suggest that management regulations, more readily

## Human Dimensions of Marine and Coastal Ecosystems

accepted by highly specialized individuals, may require greater levels of enforcement in

the Lower Keys than both the other sub-regions.

Table 5. Non-resident divers distributed according to specialization level.

<u>Specialization Level</u>							
Least		Moderate		High		Very High	
<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>
30	3.13	217	24.80	378	43.20	250	28.57

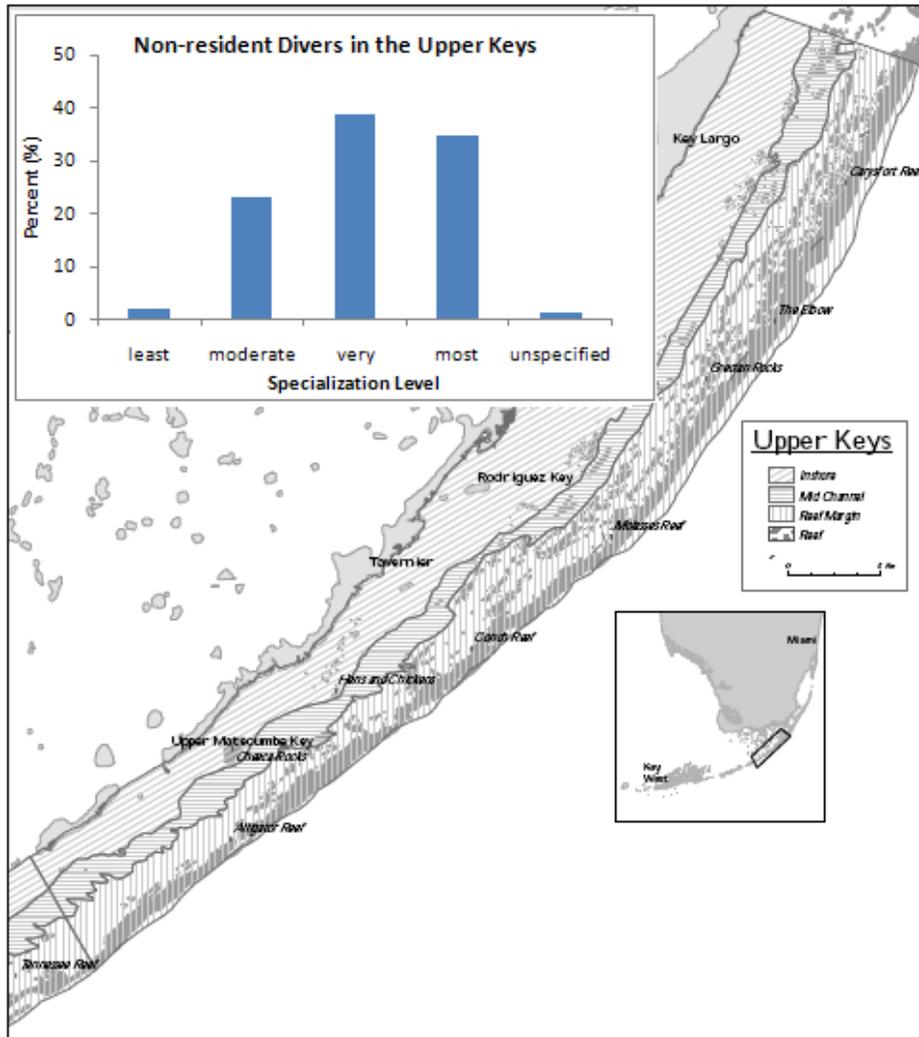


Figure 14. Non-Resident Anglers in the Upper Keys by Specialization Level

## Diving in the Florida Keys

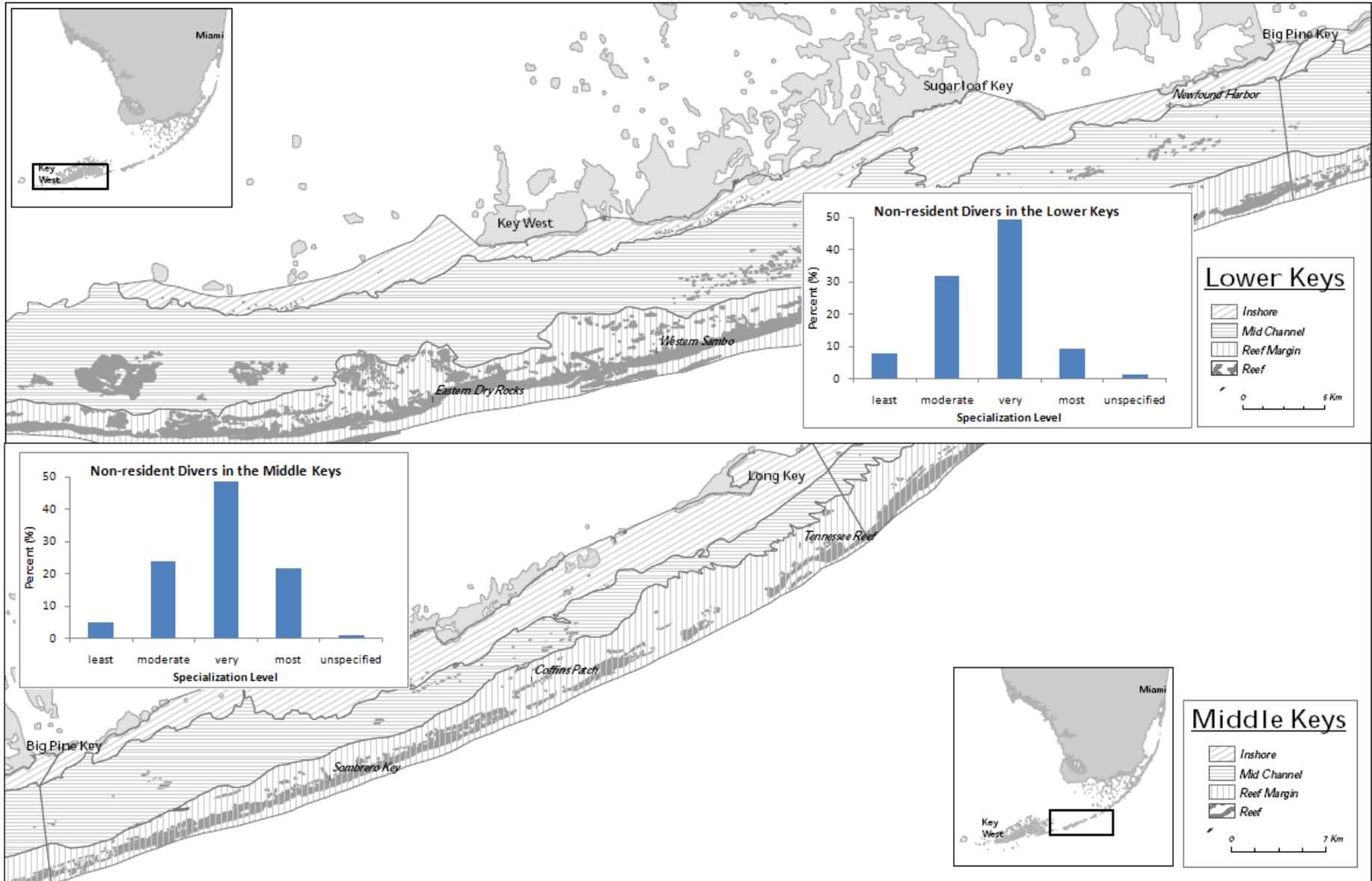


Figure 15. Non-Resident Snorkelers in the Middle and Lower Keys by Specialization Level

## Human Dimensions of Marine and Coastal Ecosystems

### Diving Practices and Motivations

There are many different modes of access to the resource available to all non-resident divers (Q7). Responses indicated that non-residents were most likely to dive from for-hire boats ( $\bar{x}$ =6.49 days over a 12 month period). This category suggests an important reliance on commercial ventures and, therefore, an important component of the local economy. Rented boats ( $\bar{x}$ =0.42 days) or private boats ( $\bar{x}$ =1.59), are less frequently used, and don't represent an important mode of access for non-residents. The majority of non-residents dive with friends (39.1%) or friends and family (27.68%) with about one in ten (10.51%) choosing to dive alone (Q4).

During the 12 months prior to the survey many divers spent '*about the same*' number of days diving on or around coral reefs in the

Florida Keys (Q8) when compared to previous years (31.15%) and 32.28% spent a greater amount of time than before diving in the Keys. These data were analyzed according to specialization level to show the variation across the continuum (Table 6) showing that as specialization increases, the commitment to the sport of diving, in terms of time spent and financial investment, also increases. The analyses indicate statistically significant differences across the continuum, with the greatest differences seen as specialization level increases. The opportunity to dive on coral reefs as opposed to other dive locations, such as wrecks, sand flats, or seagrass beds, was considered to be between '*moderately important*' and '*very important*' for 58.33% of respondents ( $\bar{x}$ = 3.40) (Q9).

Table 6. Differences in years of experience, annual frequency of participation and value of equipment according to specialization levels for non-resident divers

	<u>Specialization Level</u>				<u>F-Ratio</u>	<u>p-value</u>
	<u>Least</u>	<u>Moderate</u>	<u>Very</u>	<u>Most</u>		
No of years diving	<u>1.50</u>	<u>4.57</u>	<u>7.72</u>	<u>13.60</u>	57.669	0.000
No of days in 12 months	<u>2.39</u>	<u>3.19</u>	<u>6.81</u>	<u>18.00</u>	44.766	0.000
Equipment value (\$)	<u>775</u>	<u>1156</u>	<u>1822</u>	<u>2920</u>	47.153	0.000

Means underscores by same line are not significantly different (0.05) using Tukey's test.

### Box 5. Proposition 2-Side Bets

Specialization theory states that as specialization level increases so will the value of side bets. Side bets include the financial and temporal costs of participation. They denote the investment of something of value in the activity.

The results displayed in Table 6 demonstrate significant differences in the investment levels of more highly specialized divers when compared to less specialized divers.

The results clearly support proposition 2 of specialization theory showing that more specialized individuals have a greater financial and emotional investment in diving as a recreational activity.

### Non-Resident Divers' Use of Information Sources

There are several potential sources of information available to non-resident divers in the Florida Keys (Q10). The most used source, with 74% of respondents making “*some*” to “*a lot of use*” was that of ‘*talking to other divers*’ ( $\bar{x}$ =3.99), followed by 59% who gave the same responses for ‘*dive shops/companies*’ ( $\bar{x}$ =3.92). The least common source of information used was the ‘*radio*’ with over 77% making “*no use*” of this resource. The results show that, with the exception of ‘*talking to other snorkelers/diver*’ and ‘*dive shops/companies*,’ non-resident divers made little use of most information sources. This highlights a

potential difficulty in communicating with the non-resident dive population visiting the Keys, a group which represents an important target subgroup for regulation and conservation messages. The responses were further analyzed to determine if specialization level was related to use of information sources. Consistent with what the theory predicts, the results show that where significant differences exist, those individuals at the lower end of the specialization spectrum are much less likely to seek out information on diving from recognized sources than those having a higher specialization level (Table 7).

### Box 6. Proposition 7-Mediated Interaction

Specialization theory states that as specialization level increases so will the level of mediated interaction. Those individuals with the greatest level of investment in an activity will seek out information.

This proposition was tested in Question 10 of the survey instrument. The results displayed in Table 7 show significant differences between levels of specialization and mediated interaction, especially when looking at the most popular sources of information such as *talking to other divers* and *dive magazines*.

The results support proposition 7, providing further evidence to suggest that more specialized users seek information from more varied sources more frequently. Less specialized users are more difficult for managers to communicate with.

## Human Dimensions of Marine and Coastal Ecosystems

### Acceptability of Presence of Other Resource Users

Normative theory was used to investigate divers' views on acceptable levels of use and diver behavior. Respondents were asked to describe the number of SCUBA divers, snorkelers and boats they considered to be acceptable to see at any one moment during their time at the dive site (Q 17, 18, 19). In order to determine the critical information on when acceptable becomes unacceptable a norm curve was created. Distributed around

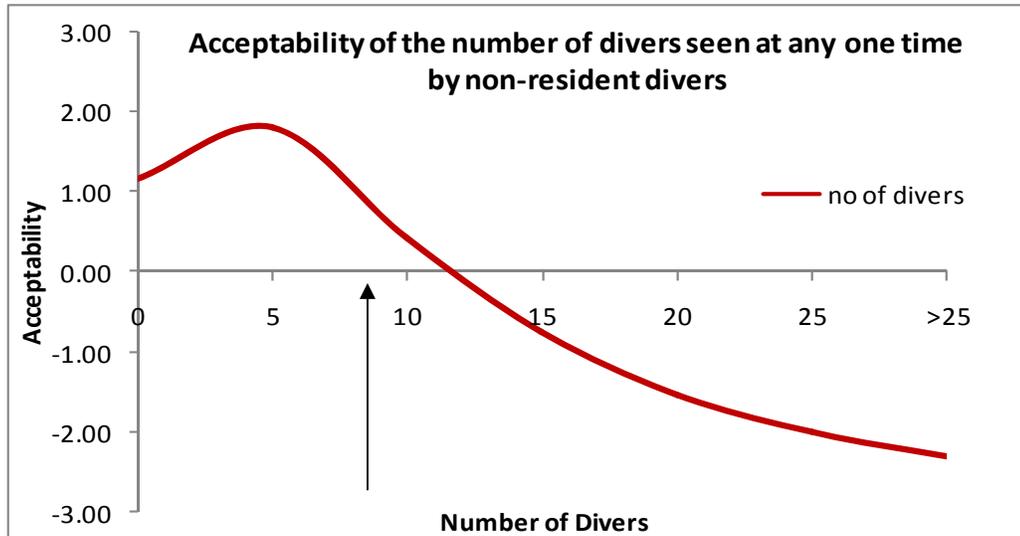
the mean of 4, but graphically represented as positive (acceptable), neutral (critical point) and negative (unacceptable) on a 7-point scale, Figures 16, 17 and 18 show the norm distribution highlighting the decreasing level of acceptability as the number of users in each category seen increases. The critical piece of information on each curve is where it crosses the neutral point on the acceptability scale (anything above 0 is acceptable, and anything below 0 is unacceptable).

Table 7. Mean differences in media use according to specialization level

	<u>Specialization Level</u>				<u>F-Ratio</u>	<u>p-value</u>
	<u>Least</u>	<u>Moderate</u>	<u>Very</u>	<u>Most</u>		
Talking with other divers.....	<u>3.57</u> <sup>1</sup>	4.00	<u>3.93</u>	<u>4.15</u>	3.617	0.013
Diving/snorkeling magazines .....	<u>2.23</u>	<u>2.92</u>	<u>3.35</u>	<u>3.44</u>	14.364	0.000
Govt. agency publications.....	<u>1.37</u>	1.71	<u>2.02</u>	<u>2.18</u>	10.477	0.000
Conservation organizations' publications	<u>1.57</u>	1.91	<u>2.05</u>	<u>2.47</u>	13.862	0.000
Newspapers .....	<u>1.50</u>	1.56	1.73	<u>1.70</u>	2.057	0.104
Dive shops/companies .....	<u>3.73</u>	3.91	3.90	<u>3.99</u>	0.628	0.597
Club meetings .....	<u>1.30</u>	1.52	<u>1.69</u>	<u>2.03</u>	9.051	0.000
Television.....	<u>1.23</u>	<u>1.65</u>	<u>1.82</u>	<u>1.76</u>	3.438	0.016
Radio.....	<u>1.10</u>	1.32	<u>1.37</u>	<u>1.43</u>	2.120	0.096

<sup>1</sup>1= No use, 2= Almost no use, 3= A little use, 4= Some use, 5= A lot of use.  
Means underscores by same line are not significantly different (0.05) using Tukey's test.

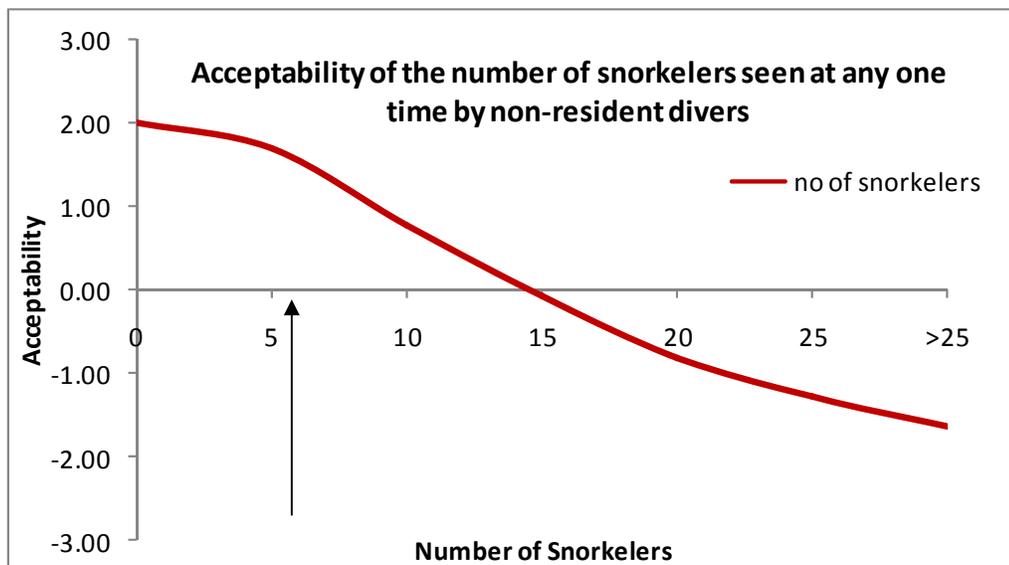
## Diving in the Florida Keys



*Arrow denotes actual number seen by resident divers*

Figure 16. Norm curve for the number of divers seen by non-resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3)

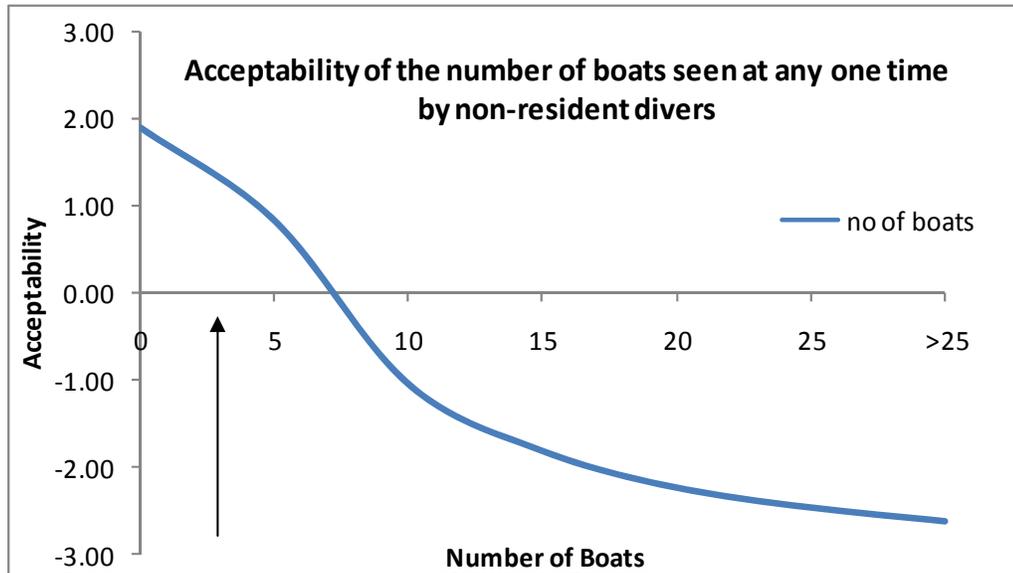


*Arrow denotes actual number seen by resident divers*

Figure 17. Norm curve for the number of snorkelers seen by non-resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3).

## Human Dimensions of Marine and Coastal Ecosystems



Arrow denotes actual number seen by resident divers

Figure 18. Norm curve for the number of boats seen by non-resident divers

Variables measured on a 7-point scale ranging from extremely acceptable (3) to extremely unacceptable (-3).

In this case it crosses at approximately 12 SCUBA divers, 14 snorkelers and 8 boats. Therefore, more than 8 boats would begin to become unacceptable, as would 12 SCUBA divers or 14 snorkelers. These do not represent a cumulative total of all user groups, and therefore, each norm curve should be considered individually as acceptable or not.

Expectations for seeing other users at any one moment while diving, which is different from what is considered to be acceptable, varied across the sample (Q 25, 26). Eighty-seven percent of non-resident divers expected to see 10 or fewer snorkelers ( $\bar{x}=5.44$ ), 77%

expected to see 10 or fewer other SCUBA divers ( $\bar{x}=8.98$ ) and 97% expected to see 10 or fewer boats ( $\bar{x}=3.54$ ). It appears that these expectations were not quite accurate for seeing other snorkelers, since only 60% reported actually seeing 10 or fewer snorkelers ( $\bar{x}=14.00$ ). Their other expectations, however, were well founded with 94% reported seeing 10 or fewer SCUBA divers ( $\bar{x}=4.44$ ) and 82% reported seeing 10 or fewer boats ( $\bar{x}=6.80$ ) (Q33, 34). This suggests that non-resident divers are knowledgeable about the current use levels in the Florida Keys either through previous experience, awareness messaging through

## Diving in the Florida Keys

different media sources or from communication with others.

Crowding can be defined as a subjective negative evaluation of use level that occurs when the individual perceives an interference with their own activities. In general, non-residents experienced fairly little perceived crowding (Q29). Twenty-four percent of all respondents felt “*not crowded at all*” during their most recent trip ( $\bar{x}=3.17$ ) on a scale of 1-9, with 9 being the most crowded, whereas only 1% felt extremely crowded. This suggests that non-resident divers are generally satisfied with the level of use patterns that currently exist. It also suggests that adjustments in management decisions to allow higher levels of use in some areas may have some effect when it comes to levels of perceived crowding.

### Behavioral Norms

The two items that respondents felt divers had “*a strong obligation to never do*” were to ‘*break off pieces of live coral*’ ( $\bar{x}=1.39$ ) and to ‘*take pieces of dead coral*’ ( $\bar{x}=1.88$ ) (Q21). Respondents also felt that all divers had a “*strong obligation*” to ‘*maintain buoyancy control*’ ( $\bar{x}=6.78$ ), to ‘*tell others not to touch coral*’ ( $\bar{x}=6.48$ ) and to ‘*tell others not to anchor boats on coral*’ ( $\bar{x}=6.24$ ). These results demonstrate a recognition of the value

of coral as a resource to society and a willingness to protect it even if that means remonstrating with others.

This was also reflected when respondents were asked to describe their embarrassment levels if seen engaging in certain activities, whether intentionally or accidentally (Q22). The two items respondents felt they would be most embarrassed to be seen doing were ‘*knowingly anchoring a boat on coral*’ ( $\bar{x}=4.83$ ) and ‘*breaking off pieces of live coral*’ ( $\bar{x}=4.83$ ). The results show that behavioral norms for the appreciation of coral reef ecosystems were strongly held by divers who are visitors to the Florida Keys.

### Reef Condition

Normative theory and methods can be applied as a basis for formulating indicators and standards of what should be acceptable in terms of coral reef conditions. In Question 20, respondents were asked for an acceptability rating, on a 1-7 point scale, for four important coral reef conditions. In order to determine the critical information on when acceptable becomes unacceptable, norm curves were created for the parameters of coral bleaching, algal cover, visibility and fish distribution.

## Human Dimensions of Marine and Coastal Ecosystems

Distributed around the mean of 4, but graphically represented as positive (acceptable), neutral (critical point) and negative (unacceptable), Figure 20 shows the norm distribution highlighting the decreasing level of acceptability as the quality of the characteristic decreases. The critical piece of information on the curve is where it crosses the neutral point on the acceptability scale (anything above 0 is acceptable, and anything below 0 is unacceptable). In this case the norm curves show these points are approximately 20% bleached, 25% algal cover and 25 feet of visibility. These do not represent a cumulative total of all coral reef characteristics, and therefore, each norm should be considered individually as being acceptable or not. Fish distribution is harder to quantify but the curve shows that both species of fish and abundance are important to non-resident divers, with an emphasis placed on fish abundance and diversity of species.

Mean responses to Questions 30 and 31 indicated that divers would be likely to return to the reef area that they had dived during their last visit ( $\bar{x}=4.10$ ). The results also show that respondents would recommend that a friend dive on that same reef ( $\bar{x}=4.23$ ).



Figure 19. Grand Canyon, Sand Key

Source: [www.reefreliefarchive.org](http://www.reefreliefarchive.org)

### Satisfaction

The satisfaction that individuals derive from various aspects of their trip can be better understood by learning about their pre-trip expectations, determining from them what then actually occurred, and then asking how satisfied they were with the experience (Table 8). To this end the same set of ten items was asked in three separate ways on the survey instrument; 1) what were their expectations 2) to what extent were they able to accomplish

## Diving in the Florida Keys

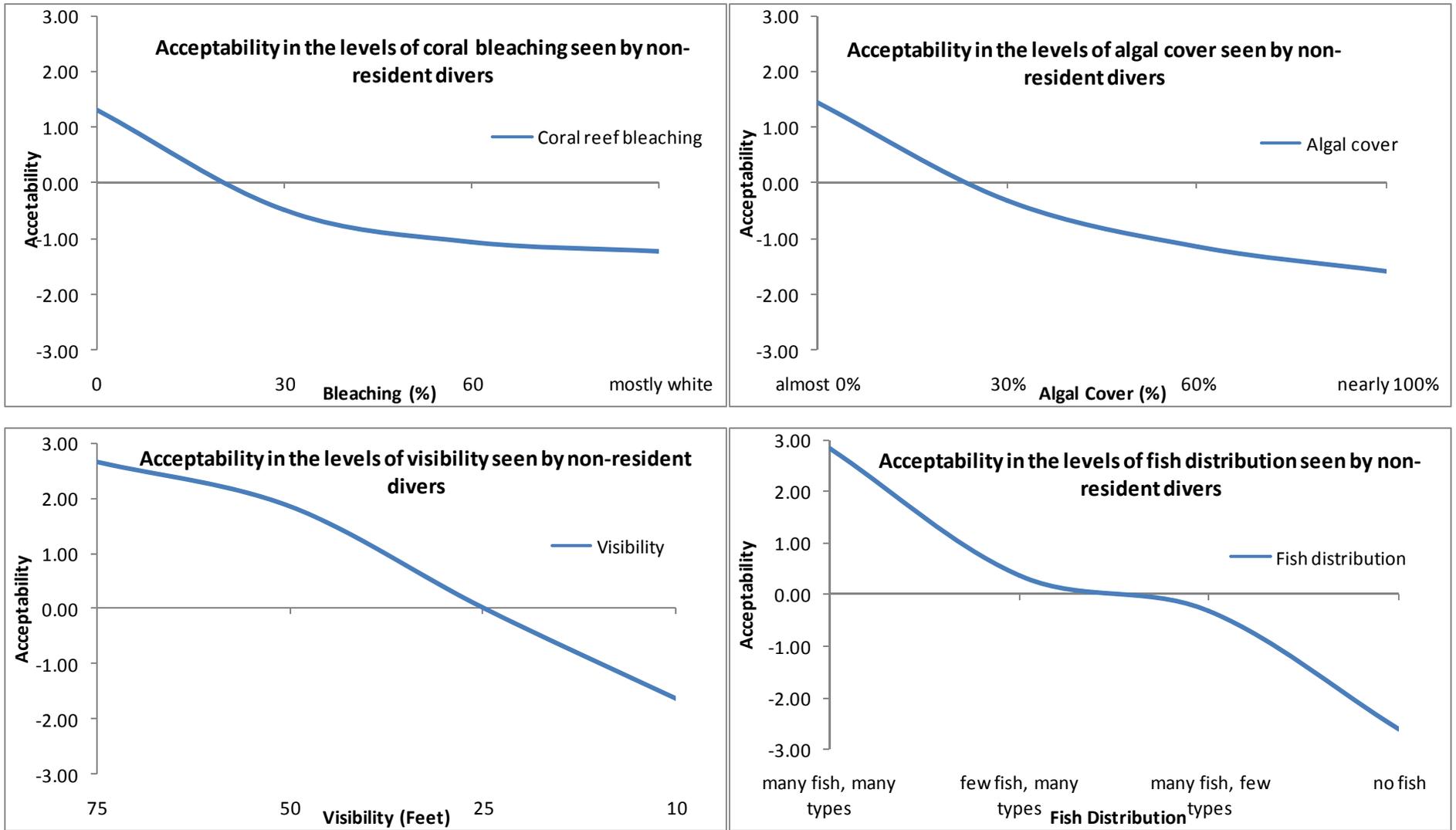


Figure 20. Normative curves for coral reef conditions for non-resident divers  
 Variables measured on a 7-point scale ranging from extremely acceptable (7) to extremely unacceptable (1).

## Human Dimensions of Marine and Coastal Ecosystems

these things, and 3) how satisfied were they with regard to each item. The three items with the highest expectations were ‘to experience natural surroundings’ ( $\bar{x}$ =4.41), ‘to relax’ ( $\bar{x}$ =4.32) and ‘to see live coral’ ( $\bar{x}$ =4.28) (Q11). A measure of the quality of the experience can be tied to the ability to accomplish important components normally expected with an activity (Q24). The three items with the highest level of accomplishment were ‘to experience natural surroundings’ ( $\bar{x}$ =4.37), ‘to relax’ ( $\bar{x}$ = 4.28) and ‘to see marine life’ ( $\bar{x}$ =4.27). The item that was accomplished the least was ‘to see

*undamaged reef sites’* ( $\bar{x}$ =3.50). Using the same series of items, respondents were asked to rate, on a 5-point scale, how satisfied they were with each item during their last trip to the Florida Keys. All items received a rating of “moderately satisfied” or better with ‘relaxing’ ( $\bar{x}$ =4.15), ‘experiencing natural surroundings’ ( $\bar{x}$ =4.03) and ‘seeing marine life’ ( $\bar{x}$ =3.77) having the highest satisfaction ratings (Q32). The two items that returned the lowest levels of satisfaction were ‘seeing undamaged reef sites’ ( $\bar{x}$ =3.39) and ‘seeing large fish’ ( $\bar{x}$ =3.36).

Table 8. Non-resident divers’ expected and accomplished experience levels, discrepancies between these levels, and resident diver satisfactions.

Item	Expected mean	Accomplished mean	Discrepancy mean	Satisfaction mean
Seeing a healthy reef	4.048	3.890	-0.158	3.493 <sup>1</sup>
Easy snorkeling conditions	3.746	3.855	<b>0.109</b>	3.670
Experiencing good underwater visibility	3.893	3.719	-0.174	3.496
Undamaged reef sites	3.657	3.499	-0.158	3.394
Seeing marine life	4.165	4.272	<b>0.107</b>	3.771
Seeing large fish	3.760	3.600	-0.160	3.362
Seeing unique formations	3.628	3.626	-0.002	3.453
Seeing live coral	4.280	4.127	-0.153	3.619
Experiencing natural surroundings	4.413	4.374	-0.039	4.025
Relaxing	4.323	4.280	-0.043	4.152

\***Bold denotes exceeded expectations**

<sup>1</sup>1=not at all satisfied, 2=slightly satisfied, 3=moderately satisfied, 4=very satisfied, 5=extremely satisfied

## Diving in the Florida Keys

### Coral Reef Characteristics and User Impacts

A range of coral reef characteristics were considered by non-resident divers in order to determine the perceived quality of the coral reefs in the Florida Keys. Of the ten characteristics listed, all but one (amount of coral disease) were considered to be above “average” in quality (Q 28) with ‘number of fish’ ( $\bar{x}$ =5.04) and ‘different kinds of fish’ ( $\bar{x}$ =5.00) ranking the highest.



Figure 21. Diving in the Florida Keys

Source: [www.destination360.com](http://www.destination360.com)

In order to determine if divers differed according to level of specialization with regards to the condition of the resource characteristics, an analysis of variance was conducted (Table 9). As the results show, all the coral reef characteristics listed were considered to be above average irrespective

of specialization levels across the non-resident dive sample. Non-resident divers see commercial fishing operations as the biggest threat to coral reefs with 76% of respondents “strongly disagreeing” to “disagreeing” that coral reefs in the Florida Keys are able to easily recover from any impacts from commercial fishing without any long-term damage ( $\bar{x}$ = 2.00). Diving/snorkeling was also seen as a threat to coral reefs in the Keys as respondents felt that coral reefs would not be able to easily recover from any impacts caused during these activities ( $\bar{x}$ =2.70) (Q38).

When asked to determine whether a variety of environmental and human activities were having a positive or negative impact on the ecological health of coral reefs in the Florida Keys, respondents indicated that, on a scale of 1-7, hurricanes ( $\bar{x}$ =2.51) and commercial fishing ( $\bar{x}$ =2.78) were both having a “slightly negative” to “moderately negative” impact (Q35). This suggests that respondents feel that both naturally occurring and human-induced threats play a role in the ecological health of the coral reefs of the Florida Keys. Non-resident divers feel that the current ecological health of the coral reefs in the Florida Keys (Q36, 37) is ‘fair’ to ‘good’ ( $\bar{x}$ =2.89) but that the state of the reef is ‘declining somewhat’ ( $\bar{x}$ = 2.53).

## Human Dimensions of Marine and Coastal Ecosystems

Table 9. Mean differences for the ratings of the quality of coral reefs by non-resident divers

	<u>Specialization Level</u>				<u>F-Ratio</u>	<u>p-value</u>
	<u>Least</u>	<u>Moderate</u>	<u>Very</u>	<u>Most</u>		
Amount of algae.....	<u>4.68<sup>1</sup></u>	<u>4.64</u>	<u>4.55</u>	<u>4.43</u>	1.362	0.253
Underwater visibility .....	<u>4.90</u>	<u>4.83</u>	<u>4.62</u>	<u>4.82</u>	1.654	0.175
Color of the coral .....	<u>4.83</u>	<u>4.48</u>	<u>4.59</u>	<u>4.54</u>	0.807	0.490
Number of fish.....	<u>5.39</u>	<u>4.97</u>	<u>5.09</u>	<u>4.99</u>	1.333	0.262
Different kinds of fish.....	<u>5.39</u>	<u>4.94</u>	<u>5.02</u>	<u>4.96</u>	1.222	0.301
Size of fish .....	<u>5.07</u>	<u>4.74</u>	<u>4.80</u>	<u>4.71</u>	0.849	0.467
Amount of coral disease.....	<u>4.40</u>	<u>4.19</u>	<u>4.05</u>	<u>4.06</u>	1.309	0.270
Amount of live coral .....	<u>4.89</u>	<u>4.65</u>	<u>4.72</u>	<u>4.62</u>	0.586	0.624
Size of corals.....	<u>4.93</u>	<u>4.59</u>	<u>4.72</u>	<u>4.57</u>	1.241	0.294
Different kinds of corals .....	<u>4.75</u>	<u>4.52</u>	<u>4.75</u>	<u>4.71</u>	1.528	0.206

<sup>1</sup>1= Extremely poor condition, 2= Very poor condition, 3= Poor condition, 4= Average condition, 5= Good condition 6= Very good condition, 7= Extremely good condition.

Means underscores by same line are not significantly different (0.05) using Tukey's test.

**Diving in the Florida Keys**

**RESIDENT SCUBA DIVING SURVEY RESULTS**

**R1. Consider the time you spend snorkeling and scuba diving in general, regardless of location. Between the two, what percentage of time do you spend snorkeling and what percentage of time do you spend scuba diving?**

---

	<u>Percent</u>
Snorkeling .....	49.6
Scuba diving.....	50.4

---

**R2. If you are a scuba diver, what level of certification do you presently hold?**

---

	<u>Yes</u>	<u>Percent</u>	<u>No</u>	<u>Percent</u>
None, I'm not a scuba diver .....	61	100.0	0	0.0
Enrolled in scuba diving course .....	61	100.0	0	0.0
Open water .....	21	34.4	40	65.6
Advanced.....	23	37.7	38	62.3
Dive master .....	12	19.7	49	80.3
Instructor .....	17	27.9	44	72.1
Other.....				

---

## Human Dimensions of Marine and Coastal Ecosystems

### R4. With whom do you scuba dive most often?

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
By myself .....	9	9	15.5	15.5
With friends.....	22	31	37.9	53.4
With family .....	7	38	12.1	65.5
With family and friends .....	20	58	34.5	100.0

---

### R5. How many total years have you been scuba diving on coral reefs?

---

<i>Years</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
1-5 .....	9	9	14.8	14.8
6-10 .....	10	19	16.4	31.2
11-15 .....	11	30	18.1	49.3
16-20 .....	19	40	16.5	65.8
21-30 .....	13	53	21.3	87.1
31-60 .....	8	61	12.9	100.0

Arithmetic Mean: 18.33 Years

---

**Diving in the Florida Keys**

**R6. During the past 12 months, approximately how many days did you go scuba diving on coral reefs in the Florida Keys?**

---

<i>Days</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0-10 .....	11	11	18.0	18.0
11-40 .....	26	37	42.7	60.7
41-100 .....	18	55	29.5	90.2
101-300 .....	6	61	9.8	100.0

Arithmetic Mean: 56.00 Days

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R7. During the past 12 months, how many days did you go scuba diving on a coral reef in the Florida Keys on a private boat (owned and captained by yourself or a friend), on a rented boat (captained by yourself or a friend), or on a hired boat (owned and captained by a dive company)?**

<i>Number of days on a private boat</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0-5 .....	21	21	34.4	34.4
6-20 .....	17	38	27.9	62.3
21-40 .....	26	50	19.7	82.0
41-150 .....	11	61	18.0	100.0

Arithmetic Mean: 25.66 Days

<i>Number of days on a rented boat</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	50	50	86.2	86.2
1-3 .....	4	54	6.9	93.1
6-25 .....	4	58	6.9	100.0

Arithmetic Mean: 0.97 Days

<i>Number of days on a for-hire boat</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	21	21	35.6	35.6
1-5 .....	13	34	22.0	57.6
6-30 .....	13	47	22.0	79.6
31-238 .....	12	59	20.4	100.0

Arithmetic Mean: 28.49 Days

**Diving in the Florida Keys**

**R8. Would you say the number of days you went scuba diving on coral reefs in the Florida Keys this past year was less, about the same, or more than in the previous five years?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Less .....	16	16	26.2	26.2
About the same.....	23	39	37.7	63.9
More .....	22	61	36.1	100.0
I've only gone once.....	0	0	0.0	100.0

---

**R9. How important is it to you to scuba dive on coral reefs as opposed to other locations (such as wrecks, sand flats, and seagrass beds)?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Not at all important .....	1	1	1.7	1.7
Somewhat important .....	10	11	16.6	18.3
Moderately important.....	18	29	30.0	48.3
Very important .....	19	48	31.7	80.0
Extremely important.....	12	60	20.0	100.0

Arithmetic Mean: 3.52

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R10. To what extent do you make use of the following for current information about scuba diving in the Florida Keys?**

---

	<u>No use</u>		<u>Almost no use</u>		<u>A little use</u>		<u>Some use</u>		<u>A lot of use</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Talking with other snorkelers/divers..	1	1.7	1	1.7	9	15.5	19	32.8	28	48.3	4.24
Diving/snorkeling magazines.....	9	15.8	20	35.1	15	26.3	10	17.5	3	5.3	2.61
Government agency publications.....	18	31.6	18	31.6	10	17.5	9	15.8	2	3.5	2.28
Conservation organization publications .....	14	24.6	16	28.1	14	24.6	8	14.0	5	8.8	2.54
Newspaper.....	18	32.1	16	28.6	15	26.8	7	12.5	0	0.0	2.20
Dive shops/companies.....	2	3.4	8	13.6	14	23.7	18	30.5	17	28.8	3.68
Club meetings.....	34	60.7	9	16.1	7	12.5	2	3.6	4	7.1	1.80
Television.....	33	57.9	13	22.8	9	15.8	2	3.5	0	0.0	1.65
Radio .....	30	51.7	13	22.4	10	17.2	22	3.4	3	5.2	1.88

---

**Diving in the Florida Keys**

**R11. To what extent did you expect to be able to do each of the following on your most recent trip to a reef in the Florida Keys?**

---

	<u>Did not expect</u>		<u>Small expectation</u>		<u>Moderate expectation</u>		<u>Large expectation</u>		<u>Very large expectation</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
To see a healthy reef .....	6	10.3	7	12.1	16	27.6	18	31.0	11	19.0	3.36
To experience easy snorkeling/scuba conditions .....	0	0.0	3	5.3	21	36.8	19	33.3	14	24.6	3.77
To experience good underwater conditions .....	1	1.8	2	3.5	23	40.4	24	42.1	7	12.3	3.60
To see undamaged reef sites .....	12	20.7	9	15.5	17	29.3	15	25.9	5	8.6	2.86
To see marine life (other than fish) ....	1	1.7	2	3.4	10	17.2	25	43.1	20	34.5	4.05
To see large fish .....	0	0.0	7	12.3	15	26.3	25	43.9	10	17.5	3.67
To see unique underwater formations	5	8.8	8	14.0	20	35.1	14	24.6	10	17.5	3.28
To see live coral .....	1	1.8	5	8.8	9	15.8	20	35.1	22	38.6	4.00
To experience natural surroundings ...	0	0.0	2	3.5	6	10.5	20	35.1	29	50.9	4.33
To relax .....	0	0.0	2	3.5	6	10.5	15	26.3	34	59.6	4.42

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R12. During a typical trip to a coral reef in the Florida Keys, what is the maximum number of:**

---

*SCUBA divers you find acceptable to see at any one moment during your time in the water*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	1	1	1.7	1.7
1-5 .....	33	34	56.9	58.6
6-10 .....	18	52	31.0	89.7
11-25 .....	5	57	8.6	98.2
26-100 .....	1	58	1.7	100.0

Arithmetic Mean: 6.76

*Snorkelers you find acceptable to see at any one moment during your time in the water*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	4	4	7.5	7.5
1-5 .....	14	16	26.4	30.2
6-10 .....	17	33	32.1	62.3
11-25 .....	13	46	24.5	86.8
26-100 .....	7	53	13.2	100.0

Arithmetic Mean: 15.04

*Boats you find acceptable to see at any one moment during your time at a snorkel/dive site*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	2	2	3.5	3.5
1-5 .....	38	40	65.5	69.0
6-10 .....	13	53	24.5	91.4
11-100 .....	5	58	8.6	100.0

Arithmetic Mean: 5.19

---

**Diving in the Florida Keys**

**R17. During a typical scuba dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of divers at any one moment during your time in the water?**

---

	<u>Extremely unacceptable</u>		<u>Very unacceptable</u>		<u>Somewhat unacceptable</u>		<u>Not sure</u>		<u>Somewhat acceptable</u>		<u>Very acceptable</u>		<u>Extremely acceptable</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Zero scuba divers .....	2	3.4	3	5.1	3	5.1	1	1.7	2	3.4	7	11.9	41	69.5	6.10
5 scuba divers .....	3	5.1	0	0.0	6	10.2	1	1.7	16	27.1	23	39.0	10	16.9	5.31
10 scuba divers .....	8	13.8	9	15.5	9	15.5	4	6.9	13	22.4	14	24.1	1	1.7	3.88
15 scuba divers .....	20	35.1	10	17.5	8	14.0	4	7.0	12	21.1	3	5.3	0	0.0	2.77
20 scuba divers .....	30	50.0	15	25.0	6	10.0	4	6.7	1	1.7	4	6.7	0	0.0	2.05
25 scuba divers .....	41	69.5	10	16.9	2	3.4	2	3.4	1	1.7	3	5.1	0	0.0	1.66
More than 25 scuba divers .....	46	76.7	7	11.7	2	3.3	1	1.7	0	0.0	4	6.7	0	0.0	1.57

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R18. During a typical scuba dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of snorkelers at any one moment during your time in the water?**

---

	Extremely unacceptable		Very unacceptable		Somewhat unacceptable		Not sure		Somewhat acceptable		Very acceptable		Extremely acceptable		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Zero scuba divers .....	4	7.0	0	0.0	2	3.5	2	3.5	4	7.0	4	7.0	41	71.9	6.12
5 scuba divers .....	4	6.9	1	1.7	2	3.4	2	3.4	9	15.5	21	36.2	19	32.8	5.59
10 scuba divers .....	8	14.3	2	3.6	4	7.1	6	10.7	10	17.9	17	30.4	9	16.1	4.70
15 scuba divers .....	12	21.1	7	12.3	8	14.0	3	5.3	13	22.8	8	14.0	6	10.5	3.81
20 scuba divers .....	18	32.1	13	23.2	4	7.1	3	5.4	7	12.5	5	8.9	6	10.7	3.13
25 scuba divers .....	28	48.3	8	13.8	5	8.6	3	5.2	5	8.6	3	5.2	6	10.3	2.69
More than 25 snorkelers .....	36	61.0	5	8.5	3	5.1	3	5.1	2	3.4	5	8.5	5	8.5	2.41

---

**Diving in the Florida Keys**

**R19. During a typical scuba dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of boats at any one moment during your time at a dive site?**

---

	Extremely unacceptable		Very unacceptable		Somewhat unacceptable		Not sure		Somewhat acceptable		Very acceptable		Extremely acceptable		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Zero scuba divers .....	1	1.7	1	1.7	3	5.0	3	5.0	1	1.7	3	5.0	48	80.0	6.38
5 scuba divers .....	3	5.0	3	5.0	6	10.0	2	3.3	20	33.3	15	25.0	11	18.3	5.03
10 scuba divers .....	16	27.1	6	10.2	8	13.6	5	8.5	11	18.6	9	15.3	4	6.8	3.54
15 scuba divers .....	26	44.8	10	17.2	5	8.6	4	6.9	4	6.9	7	12.1	2	3.4	2.64
20 scuba divers .....	33	54.1	11	18.0	7	11.5	2	3.3	4	6.6	4	6.6	0	0.0	2.10
25 scuba divers .....	38	63.3	10	16.7	5	8.3	1	3.3	3	5.0	2	3.3	0	0.0	1.80
More than 25 boats .....	46	76.7	6	10.0	2	3.3	3	5.0	1	1.7	2	3.3	0	0.0	1.55

---

### Human Dimensions of Marine and Coastal Ecosystems

**R20. During a typical scuba dive on a coral reef in the Florida Keys, how acceptable or unacceptable do you consider each of the following resource conditions to be?**

	Extremely unacceptable		Very unacceptable		Somewhat unacceptable		Not sure		Somewhat acceptable		Very acceptable		Extremely acceptable		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Coral reefs that are mostly white .....	40	70.2	6	10.5	1	1.8	6	10.5	1	1.8	0	0.0	3	5.3	1.84
Coral reefs that are 60% white .....	29	50.9	15	26.3	4	7.0	6	10.5	3	5.3	0	0.0	0	0.0	1.93
Coral reefs that are 30% white .....	12	21.8	17	30.9	10	18.2	10	18.2	3	5.5	3	5.5	0	0.0	2.71
Reefs with no white coral present .....	5	8.6	1	1.7	0	0.0	5	8.6	2	3.4	7	12.1	38	65.5	5.95
Nearly 100% algal cover	45	78.9	6	10.5	3	5.3	2	3.5	1	1.8	0	0.0	0	0.0	1.39
60% algal cover .....	30	52.6	20	35.1	2	3.5	3	5.3	2	3.5	0	0.0	0	0.0	1.72
30% algal cover .....	18	32.1	10	17.9	13	23.2	4	7.1	8	14.3	3	5.4	0	0.0	2.70
Almost no algae present	1	1.8	0	0.0	2	3.5	2	3.5	4	7.0	13	22.8	35	61.4	6.28
Visibility of about 10 ft	20	35.1	16	28.1	14	24.6	1	1.8	1	1.8	4	7.0	1	1.8	2.35
Visibility of about 25 ft	3	5.1	7	11.9	18	30.5	4	3.8	18	30.5	6	10.2	3	5.1	3.97
Visibility of about 50 ft	2	3.4	0	0.0	0	0.0	1	1.7	20	33.9	20	33.9	16	27.1	5.73
Visibility of about 75 ft	2	3.4	0	0.0	0	0.0	0	0.0	1	1.7	12	20.3	44	74.6	6.56
Seeing no fish at the reef site .....	50	86.2	3	5.2	2	3.4	0	0.0	1	1.7	1	1.7	1	1.7	1.38
Seeing many fish, but of few kinds .....	8	13.8	16	27.6	12	20.7	2	3.4	15	25.9	4	6.9	1	1.7	3.28
Seeing many fish, but of many kinds .....	5	8.5	14	23.7	5	8.5	6	10.2	23	39.0	3	5.1	3	5.1	3.83
Seeing many fish, of many kinds .....	0	0.0	1	1.7	0	0.0	1	1.7	0	0.0	5	8.5	52	88.1	6.78

**Diving in the Florida Keys**

**R21. Please indicate the extent to which you believe all snorkelers/scuba divers have an obligation either to do or not to do each of the following at a coral reef.**

	Strong obligation <u>to never do</u>		Moderate obligation <u>to not do</u>		Slight obligation <u>to not do</u>		No obligation <u>either way</u>		Slight obligation <u>to do</u>		Moderate obligation <u>to do</u>		Strong obligation to <u>always do</u>		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Maintain buoyancy															
control .....	0	0.0	0	0.0	0	0.0	0	0.0	1	1.7	3	5.0	56	93.3	6.92
Tell others not to touch															
corals .....	0	0.0	0	0.0	0	0.0	0	0.0	3	4.9	7	11.5	51	83.6	6.79
Operate boats in shallow															
reef areas .....	38	62.3	8	13.1	3	4.9	2	3.3	1	1.6	4	6.6	5	8.2	2.21
Feed fish .....	15	24.6	16	26.2	10	16.4	11	18.0	4	6.6	3	4.9	2	3.3	2.84
Swim close to marine															
mammals .....	13	21.3	14	23.0	9	14.8	15	24.6	6	9.8	3	4.9	1	1.6	3.00
Touch marine															
mammals .....	34	55.7	9	14.8	8	13.1	5	8.2	2	3.3	1	1.6	2	3.3	2.07
Pick up garbage from															
the sea floor .....	0	0.0	0	0.0	2	3.3	2	3.3	6	10.0	8	13.3	42	70.0	6.43
Operate boats at least 100															
feet from a dive flag ...	4	6.7	0	0.0	0	0.0	0	0.0	2	3.3	2	3.3	52	86.7	6.50
Take pieces of dead															
coral .....	48	82.4	4	6.8	1	1.7	6	10.2	0	0.0	0	0.0	0	0.0	1.41
Break off pieces of live															
coral .....	55	93.2	0	0.0	0	0.0	0	0.0	0	0.0	1	1.7	3	5.1	1.39
Leave shells in original															
locations on a reef .....	5	8.3	2	3.3	0	0.0	4	6.7	3	5.0	5	8.3	41	68.3	5.95
Tell others not to anchor															
boats on coral .....	5	8.3	1	1.7	1	1.7	0	0.0	0	0.0	7	11.7	46	76.7	6.23

## Human Dimensions of Marine and Coastal Ecosystems

**R22. Imagine that you did the following at a coral reef and others saw you. How embarrassed would you feel?**

---

	<u>Not at all embarrassed</u>		<u>Slightly embarrassed</u>		<u>Moderately embarrassed</u>		<u>Very embarrassed</u>		<u>Extremely embarrassed</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
	Lost buoyancy control.....	6	10.2	9	15.3	11	18.6	9	15.3	24	
Touched corals with your hands .....	2	3.4	7	11.9	4	6.8	19	32.2	27	45.8	4.05
Operated a boat in a shallow reef area .....	7	11.9	7	11.9	8	13.6	10	16.9	27	45.8	3.73
Feed fish.....	19	32.8	6	10.3	13	22.4	12	20.7	8	13.8	2.72
Swam close to marine mammals.....	24	41.4	11	19.0	14	24.1	5	8.6	4	6.9	2.21
Touched marine mammals .....	13	22.4	12	20.7	8	13.8	8	13.8	17	29.3	3.07
Left garbage on the sea floor .....	3	5.1	1	1.7	1	1.7	3	5.1	54	86.4	4.66
Operated a boat too close to a dive flag.....	2	3.4	3	5.1	2	3.4	11	18.6	41	69.5	4.46
Took pieces of dead coral .....	8	13.6	3	5.1	5	8.5	13	22.0	30	50.8	3.92
Broke off pieces of live coral.....	3	5.1	1	1.7	0	0.0	3	5.1	52	88.1	4.70
Removed shells from a reef.....	6	10.2	7	11.9	4	6.8	7	11.9	35	59.3	3.98
Knowingly anchored a boat on coral .	2	3.4	1	1.7	1	1.7	2	3.4	53	89.8	4.75

---

**R23. On your most recent trip to a coral reef in the Florida Keys, did you spend more time snorkeling or scuba diving?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Snorkeling .....	9	9	14.8	14.8
Scuba diving.....	52	61	85.2	100.0

---

## Diving in the Florida Keys

**The following responses to Questions #24 through #34 include only those respondents what indicated that on their most recent trip to a coral reef in the Florida Keys they spent more time scuba diving than they did snorkeling.**

**R24. To what extent were you able to accomplish each of the following during your most recent scuba dive on a coral reef in the Florida Keys?**

---

	<u>Completely unable to accomplish</u>		<u>Slightly able to accomplish</u>		<u>Moderately able to accomplish</u>		<u>Mostly able to accomplish</u>		<u>Completely able to accomplish</u>		Mean
	n	%	n	%	n	%	n	%	n	%	
To see a healthy reef .....	8	15.4	7	13.5	10	19.2	15	28.8	12	23.1	3.31
To experience easy snorkel/scuba conditions .....	0	0.0	3	5.8	7	13.5	22	42.3	20	38.5	4.14
To experience good underwater visibility.....	2	3.8	9	17.3	13	25.0	15	28.8	13	25.0	3.54
To see undamaged reef sites .....	11	21.2	10	19.2	9	17.3	14	26.9	8	15.4	2.96
To see marine life.....	1	1.9	0	0.0	6	11.5	12	23.1	33	63.5	4.46
To see large fish .....	3	5.8	7	13.5	12	23.1	16	30.8	14	26.9	3.60
To see unique underwater formations	6	11.5	9	17.3	6	11.5	18	34.6	13	25.0	3.44
To see live coral .....	3	8.8	5	9.6	6	11.5	16	30.8	22	42.3	3.94
To experience natural surroundings...	1	1.9	1	1.9	2	3.8	15	28.8	33	63.5	4.50
To relax .....	0	0.0	2	3.8	3	5.8	8	15.8	39	75.0	4.62

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R25. On your most recent trip to a coral reef in the Florida Keys, about how many other snorkelers and scuba divers did you expect to see at any one moment while you were actually scuba diving in the water?**

<i>Number of snorkelers</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	14	14	33.3	33.3
1-5 .....	14	28	33.3	66.6
6-15 .....	9	37	21.5	88.1
16-50 .....	5	42	11.9	100.0

Arithmetic Mean: 7.02 snorkelers

<i>Number of scuba divers</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	7	7	15.9	15.9
1-5 .....	20	27	45.4	61.3
6-10 .....	11	38	25.0	86.3
11-30 .....	6	44	13.7	100.0

Arithmetic Mean: 5.71 SCUBA divers

**Diving in the Florida Keys**

**R26. On your most recent trip to a coral reef in the Florida Keys, about how many other boats did you expect to see at any one moment during your time at a dive site?**

---

<i>Boats</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	5	5	11.4	11.4
1-5 .....	26	31	59.1	70.5
6-20 .....	13	44	29.5	100.0

Arithmetic Mean: 5.02 boats

---

**R28. Below is a list of coral reef characteristics that you may notice while scuba diving. Consider your most recent scuba diving experience at a coral reef in the Florida Keys and rate the condition of the reef for each of the following items.**

---

	Extremely poor condition		Very poor condition		Poor condition		Average condition		Good condition		Very good condition		Extremely good condition		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
	Amount of algae.....	1	2.0	5	10.0	8	16.0	22	44.0	10	20.0	2	4.0	2	
Underwater visibility....	0	0.0	2	3.9	9	17.6	12	23.5	12	23.5	9	17.6	7	13.7	4.75
Color of the coral .....	1	2.0	4	8.0	15	30.0	11	22.0	9	18.0	6	12.0	4	8.0	4.14
Number of fish .....	0	0.0	2	3.9	5	9.8	8	15.7	14	27.5	12	23.5	10	19.6	5.16
Different kinds of fish ..	0	0.0	2	3.9	2	3.9	9	17.6	13	25.5	18	35.3	7	13.7	5.26
Size of fish.....	0	0.0	4	8.0	4	8.0	10	20.0	13	26.0	13	26.0	6	12.0	4.90
Amount of coral disease	3	6.1	6	12.2	13	26.5	20	40.8	3	6.1	4	8.2	0	0.0	3.53
Amount of live coral ....	4	7.8	3	5.9	11	21.6	13	25.5	4	7.8	12	23.5	4	7.8	4.22
Size of corals .....	2	3.9	4	7.8	9	17.6	17	33.3	8	15.7	8	15.7	3	5.9	4.20
Different kinds of coral	3	5.9	3	5.9	4	7.8	17	33.3	13	25.5	7	13.7	4	7.8	4.39

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R29. Please indicate below how crowded you felt on-site during your most recent trip to a coral reef in the Florida Keys.**

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Not at all crowded .....	15	15	30.0	30.0
.....	8	23	16.0	46.0
.....	10	33	20.0	66.0
.....	5	38	10.0	76.0
Neutral.....	5	43	10.0	86.0
.....	4	47	8.0	94.0
.....	1	48	2.0	96.0
.....	2	50	4.0	100.0
Extremely crowded .....	0	50	0.0	100.0

Arithmetic Mean: 3.06

**R30. If asked by a friend whether he/she should snorkel or dive on the coral reef you visited on your most recent trip to the Florida Keys, what advice would you give?**

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Strongly advice against .....	0	0	0.0	0.0
Advise against .....	2	2	3.8	3.8
Not sure .....	2	4	3.8	7.6
Recommended.....	24	28	46.2	53.8
Strongly recommend .....	24	52	46.2	100.0

Arithmetic Mean: 4.35

Diving in the Florida Keys

R31. If you were to snorkel or dive in the Florida Keys again, would you return to the coral reef you visited on your most recent trip?

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Definitely not .....	0	0	0.0	0.0
Probably not .....	3	3	5.9	5.9
Not sure .....	0	3	0.0	5.9
Maybe.....	7	10	13.7	19.6
Definitely.....	41	51	80.4	100.0

Arithmetic Mean: 4.69

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R32. How satisfied were you with each of the following during your most recent scuba dive on a coral reef in the Florida Keys?**

---

	<u>Not at all satisfied</u>		<u>Slightly satisfied</u>		<u>Moderately satisfied</u>		<u>Very satisfied</u>		<u>Extremely satisfied</u>		Mean
	n	%	n	%	n	%	n	%	n	%	
Seeing a healthy reef .....	10	19.6	4	7.8	17	33.3	13	25.5	7	13.7	3.06
Experiencing easy snorkeling/scuba diving conditions .....	1	2.0	4	8.0	6	12.0	24	48.0	15	30.0	3.96
Experiencing good underwater visibility.....	2	3.9	9	17.6	11	21.6	17	33.3	12	23.5	3.55
Seeing undamaged reef sites .....	8	15.7	12	23.5	12	23.5	13	25.5	6	11.8	2.94
Seeing marine life .....	0	0.0	4	7.8	7	13.7	25	49.0	15	29.4	4.00
Seeing large fish.....	6	11.8	5	9.8	12	23.5	18	35.3	10	19.6	3.41
Seeing unique underwater formations	5	9.8	10	19.6	10	19.6	17	33.3	9	17.6	3.29
Seeing live coral.....	4	7.8	8	15.7	13	25.5	16	31.4	10	19.6	3.39
Experiencing natural surroundings ....	0	0.0	2	3.9	4	7.8	22	43.1	23	45.1	4.29
Relaxing .....	0	0.0	2	3.9	3	5.9	14	27.5	32	62.7	4.49

---

**Diving in the Florida Keys**

**R33. On your most recent visit to a coral reef in the Florida Keys, about how many other snorkelers and scuba divers do you remember seeing at any one moment when you were actually snorkeling in the water?**

<i>Number of snorkelers</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	21	21	42.0	42.0
1-5 .....	16	37	32.0	74.0
6-30 .....	9	46	18.0	92.0
31-100 .....	4	50	8.0	100.0

Arithmetic Mean: 9.12 snorkelers

<i>Number of scuba divers</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	7	7	14.0	14.0
1-5 .....	26	33	52.0	66.0
6-10 .....	8	41	16.0	82.0
11-30 .....	9	50	18.0	100.0

Arithmetic Mean: 6.28 SCUBA divers

**Human Dimensions of Marine and Coastal Ecosystems**

**R34. On your most recent visit to a coral reef in the Florida Keys, about how many other boats do you remember actually seeing at any one moment during your time at a dive site?**

---

<i>Number of Boats</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	10	10	19.6	19.6
1-5 .....	23	33	45.7	64.7
6-10 .....	7	40	13.7	78.4
11-25 .....	11	51	21.6	100.0

Arithmetic Mean: 6.06 boats

---

**Responses to the remaining questions are for all resident SCUBA divers.**

**R35. Overall, do you feel the following are having a positive or negative impact on the ecological health of coral reefs in the Florida Keys?**

---

	Extremely negative impact		Moderately negative impact		Slightly negative impact		No positive or negative impact		Slightly positive impact		Moderately positive impact		Extremely positive impact		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Water quality .....	19	32.2	14	23.7	7	11.9	8	13.6	1	1.7	6	10.2	4	6.8	2.86
Scuba diving.....	2	3.3	6	10.0	24	40.0	14	23.3	3	5.0	6	10.0	5	8.3	3.80
Commercial fishing ....	13	22.4	9	15.5	14	24.1	16	27.6	3	5.2	1	1.7	2	3.4	2.97
Hurricanes .....	15	25.0	16	26.7	18	30.0	7	11.7	0	0.0	2	3.3	2	3.3	2.58
Snorkeling .....	4	6.7	6	10.0	13	21.7	24	40.0	4	6.7	3	5.0	6	10.0	3.85
Recreational fishing .....	6	10.0	17	28.3	20	33.3	13	21.7	2	3.3	1	1.7	1	1.7	2.92
Global climate change	26	43.3	10	16.7	10	16.7	12	20.0	2	3.3	0	0.0	0	0.0	2.23

---

**Diving in the Florida Keys**

**R36. Overall, how would you rate the current ecological health of the coral reefs in the Florida Keys?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Poor .....	18	18	30.0	30.0
Fair .....	18	36	30.0	60.0
Good.....	19	55	31.7	91.7
Very good.....	4	59	6.6	98.3
Excellent.....	1	60	1.7	100.0

Arithmetic Mean: 2.20

---

**R37. Do you feel that the ecological health of the coral reefs in the Florida Keys is improving, declining, or staying the same?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Declining substantially.....	21	21	35.6	35.6
Declining somewhat.....	22	43	37.2	72.8
Staying the same .....	8	51	13.6	86.4
Improving somewhat.....	8	59	13.6	100.0
Improving substantially.....	0	59	0.0	100.0

Arithmetic Mean: 2.05

---

**Human Dimensions of Marine and Coastal Ecosystems**

**R38. Please indicate the extent to which you agree or disagree with the following statements.**

	<u>Strongly disagree</u>		<u>Disagree</u>		<u>Neutral</u>		<u>Agree</u>		<u>Strongly agree</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Coral reefs in the Florida Keys are able to easily recover from any impacts due to <u>snorkeling/diving</u> without any long-term damage.....	19	31.2	20	33.3	8	13.3	12	20.0	1	1.7	2.27
Coral reefs in the Florida Keys are able to easily recover from any impacts due to <u>commercial fishing</u> without any long-term damage.....	25	41.7	20	33.3	10	16.7	5	8.3	0	0.0	1.92
Coral reefs in the Florida Keys are generally in a healthy condition ....	13	21.7	21	35.0	14	23.3	11	18.3	1	1.7	2.43
<u>Snorkelers/divers</u> cause some damage to reefs in the Florida Keys, which has long-lasting effects on reef health.....	0	0.0	9	15.0	7	11.7	33	55.0	11	18.3	3.77
<u>Recreational anglers</u> cause some damage to reefs in the Florida Keys, which has long-lasting effects on reef health.....	2	3.3	4	6.7	11	18.3	26	43.3	17	28.3	3.87
The Florida Keys reefs where I typically snorkel or dive are in a health condition.....	9	15.3	15	25.4	14	23.7	19	32.2	2	3.4	2.83

**Diving in the Florida Keys**

**R39. If you had to replace the scuba equipment that you currently own with similar equipment, how much would it cost to replace?  
Please indicate the amount for your primary activity, as you indicated in question #3. (Only include equipment that is directly used during snorkeling, exclude supplemental items like boats, trailers, etc.).**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
300-1,000 .....	12	12	20.3	20.3
1,001-2,000 .....	29	41	49.2	69.5
2,001-3,500 .....	11	52	18.7	88.2
3,501-30,000 .....	7	59	11.8	100.0

Arithmetic Mean: \$2,655.93

---

**R41. What is your age?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
23-30 .....	10	10	16.4	16.4
31-40 .....	12	22	19.7	36.1
41-50 .....	18	40	29.5	65.6
51-60 .....	14	54	22.9	88.5
61-75 .....	7	61	11.5	100.0

Arithmetic Mean: 45.16 years

---

## Human Dimensions of Marine and Coastal Ecosystems

### R42. Are you:

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Male.....	42	42	68.9	68.9
Female.....	19	61	31.1	100.0

---

### R43. What is your marital status?

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Single.....	25	25	41.7	41.7
Married .....	28	53	46.7	88.4
Divorced .....	4	57	6.7	95.1
Separated .....	1	58	1.6	96.7
Widowed .....	2	60	3.3	100.0

---

**Diving in the Florida Keys**

**R44. Which of the following categories best describes your annual household income?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Under \$5,000.....	0	0	0.0	0.0
\$5,000 to \$9,999.....	0	0	0.0	0.0
\$10,000 to \$14,999.....	1	1	1.8	1.8
\$15,000 to \$19,999.....	2	3	3.5	5.3
\$20,000 to \$24,999.....	5	8	8.8	14.1
\$25,000 to \$29,999.....	1	9	1.8	15.9
\$30,000 to \$34,999.....	4	13	7.0	22.9
\$35,000 to \$39,000.....	2	15	3.5	26.4
\$40,000 to \$44,999.....	2	17	3.5	29.9
\$45,000 to \$50,000.....	4	21	7.0	36.9
\$51,000 to \$59,999.....	5	26	8.8	45.7
\$60,000 to \$74,999.....	8	34	14.0	59.7
\$75,000 to \$99,999.....	9	43	15.8	75.5
\$100,000 to \$149,999.....	6	49	10.5	86.0
\$150,000 or More.....	8	57	14.0	100.0

---

**R45. Would you classify yourself as Spanish/Hispanic/Latino?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Yes.....	0	0	0.0	0.0
No.....	58	58	100.0	100.0

---

## Human Dimensions of Marine and Coastal Ecosystems

### R46. Which racial category best describes you?

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
American Indian or native Alaskan.....	0	0	0.0	0.0
Asian .....	0	0	0.0	0.0
Black or African American .....	1	1	1.7	1.7
Native Hawaiian or other pacific islander.....	0	1	0.0	1.7
White .....	57	58	98.3	100.0

---

**Diving in the Florida Keys**

**NON-RESIDENT SCUBA DIVING SURVEY DATA**

**NR1. Consider the time you spend snorkeling and SCUBA diving in general, regardless of location. Between the two, what percentage of time do you spend snorkeling and what percentage of time do you spend SCUBA diving?**

---

	<u>Percent</u>
Snorkeling .....	44.6
SCUBA Diving .....	55.4

---

**NR2. If you are a SCUBA diver, what level of certification do you presently hold?**

---

	<u>Yes Count</u>	<u>Yes Percent</u>	<u>No Count</u>	<u>No Percent</u>
None – I am not a SCUBA diver .....	4	0.5	884	99.5
Enrolled in SCUBA diving course .....	12	1.6	874	98.4
Open Water .....	490	55.2	398	44.8
Advanced.....	370	41.7	517	58.3
Dive Master .....	61	6.9	826	93.1
Instructor .....	66	7.4	822	92.6

---

Human Dimensions of Marine and Coastal Ecosystems

**NR3. In general, do you identify yourself as more of a snorkeler or more of a SCUBA diver?**

---

	Count	Cum Count	Percent	Cum Pct
SCUBA Diver .....	892	892	100.0	100.0

---

**In the following questions, we are interested in learning about the respondents' primary activity. The responses to Questions #4 through #22 are based on the respondents answer to Question #3 above. Thus, the following responses to Questions #4 through #22 are for SCUBA divers only.**

**NR4. With whom do you SCUBA dive most often?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
By myself .....	93	93	10.5	10.5
With friends.....	346	439	39.1	49.6
With family .....	201	640	22.7	72.3
With family and friends .....	245	885	27.7	100.0

---

**Diving in the Florida Keys**

**NR5. How many total years have you been SCUBA diving on coral reefs?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	22	22	2.5	2.5
1-5 .....	470	492	53.0	55.5
6-10 .....	162	654	18.2	73.7
11-15 .....	80	734	9.1	82.8
16-20 .....	60	794	6.7	89.5
21-30 .....	69	863	7.8	97.3
31-49 .....	24	887	2.7	100.0

Arithmetic Mean: 8.4 years

---

**NR6. During the past 12 months, approximately how many days did you go SCUBA diving on coral reefs in the Florida Keys?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0-2 .....	255	255	28.7	28.7
3-4 .....	208	463	23.4	52.1
5-10 .....	260	723	29.2	81.3
11-34 .....	130	853	14.7	96.0
35-200 .....	36	889	4.0	100.0

Arithmetic Mean: 8.9 Days

---

## Human Dimensions of Marine and Coastal Ecosystems

**NR7. During the past 12 months, how many days did you go SCUBA diving on a coral reef in the Florida Keys on a private boat (owned or captained by yourself or a friend), on a rental boat (captained by yourself or a friend), or on a hired boat (owned and captained by a dive company)?**

---

*Number of Days on a Private Boat*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	740	740	83.1	83.1
1-3 .....	49	789	5.6	88.7
4-10 .....	61	860	6.8	95.5
12-20 .....	23	873	2.6	98.1
21-86 .....	17	890	1.9	100.0

Arithmetic Mean: 1.59 Days

*Number of Days on a Rented Boat*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	822	822	92.4	92.4
1-5 .....	48	870	5.4	97.8
6-10 .....	14	884	1.5	99.3
14-60 .....	6	890	0.7	100.0

Arithmetic Mean: 0.42 Days

*Number of Days on a Hired boat*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	141	141	15.9	15.9
1-2 .....	251	29.	28.3	44.2
3-6 .....	286	678	32.2	76.4
7-20 .....	160	838	18.1	94.5
21-180 .....	49	887	5.5	100.0

Arithmetic Mean: 6.49 Days

---

## Diving in the Florida Keys

**NR8. Would you say the number of days you went SCUBA diving on coral reefs in the Florida Keys this past year was less, about the same, or more than previous five years?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Less .....	109	109	12.3	12.3
About the same.....	276	385	31.2	43.5
More .....	286	671	32.3	75.7
I've only gone once.....	215	886	24.3	100.0

---

**NR9. How important is it to you to SCUBA dive on coral reefs as opposed to other locations (such as wrecks, sand flats and seagrass beds)?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Not at all important .....	63	63	7.1	7.1
Somewhat important .....	147	210	16.6	23.6
Moderately important.....	213	423	24.0	47.6
Very important .....	305	728	34.3	82.0
Extremely important.....	160	888	18.0	100.0

Arithmetic Mean: 3.40

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR10. To what extent do you make use of the following for current information about SCUBA diving in the Florida Keys?**

---

	<u>No use</u>		<u>Almost no use</u>		<u>A little use</u>		<u>Some use</u>		<u>A lot of use</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Talking with other snorkelers/ divers.....	49	5.5	45	5.1	138	15.6	286	32.3	368	41.5	3.99
Diving/snorkeling magazines.....	117	13.3	124	14.1	220	25.1	267	30.4	149	17.0	3.24
Government agency publications...	403	46.0	220	25.1	155	17.7	78	9.0	20	2.3	1.96
Conservation organization publications .....	353	40.4	208	23.8	187	21.4	108	12.4	17	2.0	2.12
Newspapers .....	508	58.8	203	23.5	100	11.6	40	4.6	13	1.5	1.67
Dive shops/companies.....	45	5.1	55	6.3	149	17.0	303	34.6	323	36.9	3.92
Club meetings.....	575	66.3	101	11.6	81	9.3	69	8.0	41	4.7	1.73
Television.....	527	60.1	150	17.1	119	13.6	64	7.3	17	1.9	1.74
Radio .....	670	76.7	127	14.5	52	6.0	15	1.7	10	1.1	1.36

---

**Diving in the Florida Keys**

**NR11. To what extent did you expect to be able to do each of the following on your most recent trip to a reef in the Florida Keys?**

---

	<u>Did not expect</u>		<u>Small expectation</u>		<u>Moderate expectation</u>		<u>Large expectation</u>		<u>Very large large expectation</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
To see a healthy reef .....	13	1.5	26	2.9	176	19.8	364	40.9	310	34.9	4.05
To experience SCUBA diving conditions .....	10	1.1	34	3.9	303	34.1	367	41.3	175	19.7	3.75
To experience good underwater conditions .....	6	1.0	15	1.7	240	27.0	434	48.9	193	21.7	3.89
To see undamaged reef sites .....	31	3.5	77	8.7	238	26.8	362	40.8	180	20.3	3.66
To see marine life (other than fish) ....	4	0.5	33	3.7	138	15.6	347	39.3	362	41.0	4.17
To see large fish .....	12	1.4	77	8.7	243	27.3	337	37.9	220	24.7	3.76
To see unique underwater formations	20	2.3	111	12.5	237	26.8	327	36.9	190	21.5	3.63
To see live coral .....	3	0.3	16	1.8	112	12.7	352	39.9	400	45.3	4.28
To experience natural surroundings ...	1	0.1	10	1.1	79	8.9	329	37.1	469	52.8	4.41
To relax .....	16	1.8	30	3.4	102	11.5	244	27.4	497	55.9	4.32

---

## Human Dimensions of Marine and Coastal Ecosystems

**NR12. During a typical trip to a coral reef in the Florida Keys, what is the maximum number of:**

*SCUBA divers you find acceptable to see at any one moment during your time in the water*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	9	9	1.0	1.0
1-5 .....	316	325	36.6	37.6
6-10 .....	389	714	44.9	82.5
11-25 .....	135	849	15.7	98.2
26-100 .....	16	865	1.8	100.0

Arithmetic Mean: 8.49 SCUBA divers

*Snorkelers you find acceptable to see at any one moment during your time in the water*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	92	92	12.9	12.9
1-5 .....	194	286	27.1	40.0
6-10 .....	244	530	34.1	74.1
11-25 .....	164	694	23.0	97.1
26-100 .....	21	715	2.9	100.0

Arithmetic Mean: 9.23 snorkelers

*Boats you find acceptable to see at any one moment during your time at a snorkel/dive site*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	11	11	1.3	1.3
1-5 .....	741	752	87.6	88.9
6-10 .....	83	824	8.5	97.4
11-100 .....	22	846	2.6	100.0

Arithmetic Mean: 3.68 boats

**Diving in the Florida Keys**

**NR17. During a typical SCUBA dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of divers at any one moment during you time in the water?**

---

	<u>Extremely Unacceptable</u>		<u>Very Unacceptable</u>		<u>Somewhat Unacceptable</u>		<u>Not Sure</u>		<u>Somewhat Acceptable</u>		<u>Very Acceptable</u>		<u>Extremely Acceptable</u>		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Zero SCUBA divers	155	17.9	36	4.2	28	3.2	52	6.0	46	5.3	130	15.0	420	48.4	5.16
5 SCUBA divers.....	8	1.0	16	1.8	26	3.0	23	2.6	190	21.6	373	42.4	244	27.7	5.80
10 SCUBA divers.....	70	8.1	60	6.9	152	17.6	65	7.5	278	32.1	165	19.1	76	8.8	4.41
15 SCUBA divers.....	185	21.5	143	16.6	177	20.6	107	12.4	156	18.1	61	7.1	31	3.6	3.25
20 SCUBA divers.....	315	36.2	190	21.8	188	21.6	65	7.5	66	7.6	24	2.8	22	2.5	2.47
25 SCUBA divers.....	451	51.5	203	23.2	112	12.8	50	5.7	29	3.3	15	1.7	16	1.8	1.99
More than 25 SCUBA divers.....	594	67.7	132	15.0	64	7.3	44	5.0	16	1.8	11	1.3	17	1.9	1.70

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR18. During a typical SCUBA dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of snorkelers at any one moment during your time in the water?**

---

	<u>Extremely Unacceptable</u>		<u>Very Unacceptable</u>		<u>Somewhat Unacceptable</u>		<u>Not Sure</u>		<u>Somewhat Acceptable</u>		<u>Very Acceptable</u>		<u>Extremely Acceptable</u>		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Zero snorkelers .....	41	5.0	15	1.8	13	1.6	76	9.3	42	5.1	125	15.3	506	61.9	6.01
5 snorkelers .....	26	3.1	13	1.6	29	3.5	54	6.5	143	17.3	296	35.8	265	32.1	5.69
10 snorkelers .....	84	10.3	28	3.4	87	10.7	80	9.9	197	24.3	181	22.3	155	19.1	4.78
15 snorkelers .....	151	18.5	75	9.2	116	14.2	112	13.7	157	19.3	118	14.5	86	10.6	3.92
20 snorkelers .....	232	28.3	122	14.9	139	16.9	94	11.4	112	13.6	61	7.4	61	7.4	3.19
25 SCUBA divers.....	317	38.5	153	18.6	100	12.1	99	12.0	68	8.3	37	4.5	20	6.1	2.71
More than 25 snorkelers .....	433	52.4	104	12.6	81	9.8	88	10.7	45	5.8	21	2.5	51	6.1	2.37

---

**Diving in the Florida Keys**

**NR19. During a typical SCUBA dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of boats at any one moment during your time at a dive site?**

---

	<u>Extremely Unacceptable</u>		<u>Very Unacceptable</u>		<u>Somewhat Unacceptable</u>		<u>Not Sure</u>		<u>Somewhat Acceptable</u>		<u>Very Acceptable</u>		<u>Extremely Acceptable</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Zero boats .....	90	10.4	8	0.9	16	1.8	48	5.5	9	4.5	100	11.5	565	65.2	5.89
5 boats .....	37	4.2	50	5.7	122	14.0	46	5.3	294	33.6	219	25.1	106	12.1	4.82
10 boats .....	250	29.3	151	17.7	175	20.5	57	6.7	140	16.4	53	6.2	27	3.2	2.95
15 boats .....	402	47.1	176	20.6	123	14.4	65	7.6	56	6.6	21	2.5	10	1.2	2.18
20 boats .....	524	60.4	174	20.0	88	10.1	45	5.2	19	2.2	10	1.2	8	1.0	1.76
25 boats .....	608	70.0	160	18.4	47	5.4	27	3.1	14	1.6	7	0.8	6	0.7	1.53
More than 25 boats...	697	79.9	105	12.0	26	3.0	25	2.9	8	1.0	4	0.5	7	0.8	1.37

---

### Human Dimensions of Marine and Coastal Ecosystems

**NR20. During a typical SCUBA dive on a coral reef in the Florida Keys, how acceptable or unacceptable do you consider each of the following resource conditions to be?**

	<u>Extremely Unacceptable</u>		<u>Very Unacceptable</u>		<u>Somewhat Unacceptable</u>		<u>Not Sure</u>		<u>Somewhat Acceptable</u>		<u>Very Acceptable</u>		<u>Extremely Acceptable</u>		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Coral reefs that are mostly white .....	348	41.3	140	16.6	42	5.0	157	18.6	48	5.7	41	4.9	67	7.9	2.77
Coral reefs that are 60% white .....	230	27.4	181	21.5	89	10.6	184	21.9	79	9.4	57	6.8	20	2.4	2.94
Coral reefs that are 30% white.....	99	11.9	116	13.9	180	21.6	220	26.3	164	19.6	44	5.3	12	1.4	3.50
Reefs with no white coral present .....	51	6.1	40	4.8	36	4.3	180	21.5	58	6.9	121	14.4	352	42.0	5.30
Nearly 100% algal cover.....	385	46.4	113	13.6	66	8.0	197	23.8	28	3.4	22	2.7	18	2.2	2.41
60% algal cover.....	195	23.6	189	22.9	117	14.2	235	28.5	60	7.3	23	2.8	7	1.0	2.85
30% algal cover.....	78	9.5	85	10.3	177	21.5	250	30.4	168	20.4	51	6.2	14	1.7	3.67
Almost no algae present .....	36	4.3	20	2.4	21	2.5	209	25.2	63	7.6	140	16.9	339	40.9	5.44
Visibility of about 10 feet.....	302	34.4	243	27.7	196	22.3	29	3.3	81	9.2	15	1.7	12	1.4	2.36
Visibility of about 25 feet.....	49	5.6	111	12.7	240	27.4	46	5.2	284	32.4	112	12.8	35	4.0	4.01
Visibility of about 50 feet.....	7	0.8	8	0.9	25	2.8	22	2.5	205	23.2	366	41.5	249	28.2	5.84
Visibility of about 75 feet.....	3	0.3	4	0.5	8	0.9	8	0.9	21	2.4	177	20.1	661	74.9	6.65

**Diving in the Florida Keys**

**NR20 CONT. During a typical SCUBA dive on a coral reef in the Florida Keys, how acceptable or unacceptable do you consider each of the following resource conditions to be?**

---

.....															
Seeing no fish at the reef site .....	667	75.5	141	16.0	50	5.7	13	1.5	9	1.0	1	0.1	2	0.2	1.38
Seeing many fish, but of a few kinds .....	54	6.1	121	13.7	300	34.1	73	8.3	258	29.3	59	6.7	16	1.8	3.68
Seeing few fish, but of many kinds .....	22	2.5	73	8.3	184	20.8	91	10.3	347	39.3	134	15.2	32	3.6	4.36
Seeing many fish, of many kinds .....	1	0.1	1	0.1	1	0.1	6	0.7	9	1.0	101	11.4	765	86.5	6.83

---

## Human Dimensions of Marine and Coastal Ecosystems

**NR21. Please indicate the extent to which you believe all SCUBA divers have an obligation to do or to not do each of the following at a coral reef.**

	Strong obligation to never do		Moderate obligation to not do		Sight obligation to not do		No obligation either way		Slight obligation to do		Moderate obligation to do		Strong obligation to always do		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Maintain buoyancy control .....	5	0.6	5	0.6	1	0.1	3	0.3	11	1.2	104	11.7	758	85.5	6.78
Tell others not to touch corals .....	16	1.8	4	0.5	0	0.0	20	2.3	64	7.2	159	17.9	625	70.4	6.48
Operate boats in shallow reef areas .....	460	52.4	196	22.3	64	7.3	70	8.0	24	2.7	29	3.3	35	4.0	2.12
Feed fish .....	337	38.3	179	20.3	121	13.7	187	21.2	27	3.1	17	1.9	13	1.5	2.42
Swim close to marine mammals .....	155	17.5	186	21.0	170	19.2	268	30.3	55	6.2	36	4.1	15	1.7	3.06
Touch marine mammals .....	457	51.8	175	19.8	92	10.4	96	10.9	26	2.9	16	1.8	21	2.4	2.08
Pick up garbage from the sea floor .....	20	2.3	9	1.0	15	1.7	42	4.8	116	13.2	221	25.1	459	52.0	6.09
Operate boats at least 100 feet from a dive flag .....	100	11.4	17	1.9	11	1.3	26	3.0	15	1.7	71	8.1	637	72.6	5.97
Take pieces of dead coral .....	502	57.3	180	20.5	58	6.6	99	11.3	17	1.9	11	1.3	9	1.0	1.88
Break off pieces of live coral .....	814	92.1	10	1.1	3	0.3	2	0.2	0	0.0	3	0.3	51	5.8	1.39
Leave shells in original locations on a reef ....	67	7.6	42	4.8	28	3.8	64	7.3	45	5.1	109	12.4	527	59.8	5.74
Tell others not to anchor boats on coral .....	51	5.8	12	1.4	6	0.7	27	3.0	42	4.8	119	13.5	626	70.9	6.24

**Diving in the Florida Keys**

**NR22. Imagine that you did the following at a coral reef and others saw you. How embarrassed would you feel?**

---

	<u>Not at all embarrassed</u>		<u>Somewhat embarrassed</u>		<u>Moderately embarrassed</u>		<u>Very embarrassed</u>		<u>Extremely embarrassed</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Lost buoyancy control.....	60	6.8	160	18.1	275	31.1	222	25.1	168	9.0	3.14
Touched corals with your hands .....	27	3.1	119	13.5	181	20.6	272	30.9	281	31.9	3.75
Operated a boat in a shallow reef area.....	29	3.3	88	10.1	119	13.6	278	31.8	260	41.2	3.98
Fed fish.....	180	20.6	159	18.2	190	21.8	161	18.4	183	21.0	3.01
Swam close to marine mammals.....	339	38.7	161	18.4	171	19.5	119	13.6	87	9.9	2.38
Touched marine mammals .....	152	17.4	175	20.4	133	15.2	153	17.5	258	29.5	3.21
Left garbage on the sea floor.....	13	1.5	7	0.8	29	3.3	74	8.4	753	86.0	4.77
Operated a boat to close to a dive flag.....	110	1.1	10	1.1	58	6.6	166	19.0	630	17.1	4.60
Took pieces of dead coral .....	69	7.8	106	12.0	167	19.0	185	21.0	353	40.1	3.74
Broke off pieces of live coral .....	15	1.7	6	0.7	14	1.6	44	5.0	801	91.0	4.83
Removed shells from a reef.....	57	6.5	80	9.1	124	14.1	155	17.7	461	52.6	4.01
Knowingly anchored a boat on coral.....	11	1.3	3	0.3	17	1.9	60	6.8	787	89.6	4.83

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR23. On your most recent trip to a coral reef in the Florida Keys, did you spend more time snorkeling or SCUBA diving?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Snorkeling .....	64	64	7.2	7.2
SCUBA diving .....	823	887	92.8	100.0

---

**Responses to Questions #24 through #34 are based on the answers to Question #23 above. The following responses to Questions #24 through #34 are for those respondents who went SCUBA diving on their most recent trip to a coral reef in the Florida Keys.**

**Diving in the Florida Keys**

**NR24. To what extent were you able to accomplish each of the following during your most recent SCUBA dive on a coral reef in the Florida Keys?**

---

	<u>Completely unable to accomplish</u>		<u>Somewhat accomplish</u>		<u>Moderately accomplish</u>		<u>Mostly accomplish</u>		<u>Completely able to accomplish</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
To see a healthy reef .....	22	2.7	80	9.8	149	18.2	282	34.5	285	34.8	3.89
To experience easy snorkel/SCUBA conditions .....	38	4.6	75	9.1	142	17.3	279	34.0	287	35.0	3.86
To experience good underwater visibility.....	31	3.8	77	9.4	207	25.3	280	34.2	224	27.4	3.71
To see undamaged reef sites .....	52	6.4	116	14.2	203	24.8	66	32.5	181	22.1	3.50
To see marine life.....	6	0.7	34	4.1	99	12.1	274	33.4	408	49.7	4.27
To see large fish .....	51	6.2	116	14.2	191	23.4	211	25.8	249	30.4	3.60
To see unique underwater formations	32	3.4	105	12.8	218	26.7	245	30.0	218	26.7	3.63
To see live coral .....	9	1.1	49	6.0	124	15.1	285	34.8	353	43.0	4.13
To experience natural surroundings...	9	1.1	22	2.7	77	9.4	258	31.4	455	55.4	4.37
To relax .....	21	2.6	54	6.6	73	8.9	199	24.2	474	57.7	4.28

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR25. On your most recent trip to a coral reef in the Florida Keys, about how many other snorkelers and SCUBA divers did you expect to see at any one moment while you were actually SCUBA diving in the water?**

*Number of Snorkelers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Did not know what to expect .....	315	315	100.0	100.0
0.....	153	153	39.5	39.5
1-3 .....	46	199	11.9	51.4
4-10 .....	137	336	35.4	86.8
11-80 .....	51	387	13.2	100.0

Arithmetic Mean: 5.44 snorkelers

*Number of SCUBA divers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Did not know what to expect .....	268	268	100.0	100.0
0.....	11	11	2.0	2.0
1-5 .....	169	180	31.1	33.1
6-10 .....	239	419	43.9	77.0
11-60 .....	305	544	23.0	100.0

Arithmetic Mean: 6.88 SCUBA divers

**Diving in the Florida Keys**

**NR26. On your most recent trip to a coral reef in the Florida Keys, about how many other boats did you expect to see at any one moment during your time at the dive site?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Did not know what to expect .....	243	243	100.0	100.0
0.....	12	12	2.1	2.1
1-2 .....	253	265	44.2	46.3
3-5 .....	245	510	42.9	89.2
6-10 .....	49	559	8.5	97.7
11-50 .....	13	572	2.7	100.0

Arithmetic Mean: 3.54 boats

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR28. Below is a list of coral reef characteristics that you may notice while SCUBA diving. Consider your most recent SCUBA diving experience at a coral reef in the Florida Keys and rate the condition of the reef for each of the following items.**

---

	Extremely poor condition		Very poor condition		Poor condition		Average condition		Good condition		Very good condition		Extremely good condition		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
	Amount of algae.....	5	0.7	18	2.4	67	8.9	340	45.1	172	22.8	101	13.4	51	
Underwater visibility..	13	1.6	30	3.7	113	13.9	196	24.2	189	23.3	192	23.7	78	9.6	4.73
Color of the coral .....	13	1.6	26	3.3	102	12.8	240	30.0	238	29.8	140	14.5	41	5.1	4.56
Number of fish .....	6	0.7	13	1.6	63	7.8	186	22.9	238	29.3	206	25.4	100	12.3	5.04
Different kinds of fish ..	7	0.9	13	1.6	61	7.5	197	247.3	230	28.4	218	26.9	85	10.5	5.00
Size of fish.....	11	1.4	16	2.0	87	10.8	226	28.1	224	27.9	180	22.4	60	7.5	4.76
Amount of coral															
disease .....	12	1.6	28	3.8	152	20.9	343	47.1	101	13.9	71	9.7	22	3.0	4.09
Amount of live coral ..	12	1.5	27	3.4	97	12.3	223	28.3	199	25.2	173	21.9	58	7.4	4.67
Size of corals .....	11	1.4	27	3.4	89	11.2	250	31.4	199	25.0	168	21.1	52	6.5	4.65
Different kinds of															
coral.....	10	1.3	25	3.2	84	10.6	245	30.9	202	25.5	174	21.9	53	6.7	4.69

---

**Diving in the Florida Keys**

**NR29. Please indicate below how crowded you felt on-site during your most recent trip to a coral reef in the Florida Keys.**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
1 (Not at all crowded) .....	199	199	24.4	24.4
2.....	150	349	18.4	42.9
3.....	151	500	18.6	61.4
4.....	117	617	14.4	75.8
5.....	89	706	10.9	86.7
6.....	59	765	7.2	94.0
7.....	34	799	4.2	98.2
8.....	9	808	1.1	99.3
9 (Extremely crowded).....	6	814	0.7	100.0

Arithmetic Mean: 3.17

---

**NR30. If asked by a friend whether he/she should dive on the coral reef you visited on your most recent trip to the Florida Keys, what advice would you give?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Strongly advise against .....	15	15	1.9	1.9
Advise against .....	33	48	4.1	5.9
Not sure .....	56	104	6.9	12.8
Recommend.....	355	459	43.8	58.7
Strongly recommend .....	351	810	43.3	100.0

Arithmetic Mean: 4.23

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR31. If you were to dive in the Florida Keys again, would you return to the coral reef you visited on your most recent trip?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Definitely not .....	26	26	3.2	3.2
Probably not .....	106	132	13.1	16.3
Not sure .....	30	162	3.7	20.0
Maybe.....	249	411	30.7	50.6
Definitely.....	401	812	49.4	100.0

Arithmetic Mean: 4.10

---

**Diving in the Florida Keys**

**NR32. How satisfied were you with each of the following during your most recent SCUBA dive on a coral reef in the Florida Keys?**

---

	<u>Not at all satisfied</u>		<u>Slightly satisfied</u>		<u>Moderately satisfied</u>		<u>Very satisfied</u>		<u>Extremely satisfied</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Seeing a healthy reef .....	43	5.3	87	10.8	236	29.3	310	38.5	130	16.1	3.49
Experiencing easy SCUBA diving conditions .....	44	5.5	75	9.3	161	20.0	349	43.3	177	22.0	3.67
Experiencing good underwater visibility .....	48	5.9	94	11.6	212	26.2	317	39.2	137	17.0	3.50
Seeing undamaged reef sites .....	46	5.7	99	12.3	252	31.4	303	37.8	102	12.7	3.39
Seeing marine life .....	12	1.5	61	7.6	197	24.4	368	45.5	170	21.0	3.77
Seeing large fish .....	47	5.8	136	16.8	235	29.0	259	32.0	132	16.3	3.36
Seeing unique underwater formations .....	27	3.4	104	12.9	274	34.0	279	34.6	122	15.1	3.45
Seeing live coral .....	21	2.6	83	10.3	222	27.6	353	41.6	144	17.9	3.62
Experiencing natural surroundings ..	16	2.0	31	3.8	144	17.8	343	42.5	274	33.9	4.03
Relaxing .....	16	2.0	52	6.4	109	13.5	249	30.7	384	47.4	4.15

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR33. On your most recent visit to a coral reef in the Florida Keys, about how many other snorkelers and SCUBA divers do you remember seeing at any one moment when you were actually SCUBA diving in the water?**

---

*Number of Snorkelers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	335	335	50.4	50.4
1-2 .....	77	412	11.6	62.0
3-6 .....	119	531	17.9	79.9
7-20 .....	115	646	17.2	97.1
21-70 .....	19	665	2.8	100.0

Arithmetic Mean: 4.21 snorkelers

*Number of SCUBA Divers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	18	18	2.2	2.2
1-3 .....	133	151	16.6	18.8
4-6 .....	310	461	38.7	57.5
7-15 .....	268	729	33.4	90.9
16-60 .....	73	802	9.1	100.0

Arithmetic Mean: 7.87 SCUBA divers

---

**Diving in the Florida Keys**

**NR34. On your most recent visit to a coral reef in the Florida Keys, about how many other boats do you remember actually seeing at any one moment during your time at a dive site?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	54	54	6.7	6.7
1-2 .....	284	338	35.3	42.0
3-5 .....	331	669	41.1	83.1
6-10 .....	100	769	12.4	95.5
11-60 .....	36	805	4.5	100.0

Arithmetic Mean: 3.93 boats

---

**Responses to Questions #24 through #34 are based on the answers to Question #23. The following responses to Questions #24 through #34 are for those respondents who went snorkeling on their most recent trip to a coral reef in the Florida Keys.**

**Human Dimensions of Marine and Coastal Ecosystems**

**NR24. To what extent were you able to accomplish each of the following during your most recent snorkel on a coral reef in the Florida Keys?**

---

	Completely unable to accomplish		Somewhat accomplish		Moderately accomplish		Mostly accomplish		Completely able to accomplish		Mean
	n	%	n	%	n	%	n	%	n	%	
To see a healthy reef .....	5	7.8	12	18.8	9	14.1	19	29.7	19	29.7	3.55
To experience easy snorkel/SCUBA conditions .....	3	4.7	9	14.1	11	17.2	16	25.0	25	39.1	3.80
To experience good underwater visibility.....	1	1.6	13	20.3	15	23.4	18	28.1	17	26.6	3.58
To see undamaged reef sites .....	9	14.1	9	14.1	11	17.2	24	37.5	11	17.2	3.30
To see marine life.....	1	1.6	4	6.3	8	12.5	22	34.4	29	45.3	4.16
To see large fish .....	4	6.3	13	20.3	9	14.1	17	26.6	21	32.8	6.59
To see unique underwater formations	7	10.9	13	20.3	13	20.3	15	23.4	16	25.0	3.31
To see live coral .....	2	3.2	8	12.7	7	11.1	20	31.7	26	41.3	3.95
To experience natural surroundings...	0	0.0	4	6.3	5	7.8	27	42.2	28	43.8	4.23
To relax .....	2	3.1	1	1.6	9	14.1	18	28.1	34	53.1	4.27

---

**Diving in the Florida Keys**

**NR25. On your most recent trip to a coral reef in the Florida Keys, about how many other snorkelers and SCUBA divers did you expect to see at any one moment while you were actually snorkeling in the water?**

*Number of Snorkelers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Did not know what to expect .....	18	18	100.0	100.0
0.....	2	2	4.8	4.8
1-5 .....	9	11	21.4	26.2
6-10 .....	14	25	33.3	59.5
11-20 .....	12	37	28.6	88.1
21-50 .....	5	42	11.9	100.0

Arithmetic Mean: 12.6 snorkelers

*Number of SCUBA divers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Did not know what to expect .....	17	17	100.0	100.0
0.....	5	5	13.9	13.9
1-2 .....	6	11	16.7	30.6
3-5 .....	9	20	25.0	55.6
6-10 .....	12	32	33.3	88.9
11-25 .....	4	36	11.1	100.0

Arithmetic Mean: 6.30 SCUBA divers

**Human Dimensions of Marine and Coastal Ecosystems**

**NR26. On your most recent trip to a coral reef in the Florida Keys, about how many other boats did you expect to see at any one moment during your time at the dive site?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Did not know what to expect .....	20	20	100.0	100.0
0.....	2	2	4.5	4.5
1-3 .....	14	16	32.1	36.4
4-6 .....	15	31	34.1	70.5
7-10 .....	10	41	22.7	93.2
11-20 .....	3	44	6.8	100.0

Arithmetic Mean: 5.6 boats

---

**Diving in the Florida Keys**

**NR28. Below is a list of coral reef characteristics that you may notice while snorkeling. Consider your most recent snorkeling experience at a coral reef in the Florida Keys and rate the condition of the reef for each of the following items.**

---

	Extremely poor condition		Very poor condition		Poor condition		Average condition		Good condition		Very good condition		Extremely good condition		Mean
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
	Amount of algae.....	2	3.3	0	0.0	5	8.2	30	49.2	13	21.3	7	11.5	4	
Underwater visibility....	1	1.6	4	6.3	11	17.2	12	18.8	11	17.2	18	28.1	7	10.9	4.72
Color of the coral .....	2	3.1	2	3.1	12	18.8	13	20.3	20	31.3	11	17.2	4	6.3	4.50
Number of fish .....	1	1.6	2	3.2	7	11.1	12	19.0	14	22.2	17	27.0	10	15.9	5.02
Different kinds of fish ..	1	1.6	1	1.6	9	14.1	14	21.9	13	20.3	18	28.1	8	12.5	4.92
Size of fish.....	1	1.6	2	3.2	7	11.1	18	28.6	16	25.4	10	15.9	9	14.3	4.78
Amount of coral															
disease .....	1	1.9	3	5.6	9	16.7	28	51.9	7	13.0	5	9.3	1	1.9	4.04
Amount of live coral ....	2	3.2	3	4.8	7	11.3	13	21.0	18	29.0	14	22.6	5	8.1	4.68
Size of corals .....	2	3.2	3	4.8	9	14.3	13	20.6	17	27.0	11	17.5	8	12.7	4.68
Different kinds of															
coral.....	4	6.3	1	1.6	9	14.3	18	28.6	12	19.0	12	19.0	7	11.0	4.54

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR29. Please indicate below how crowded you felt on-site during your most recent trip to a coral reef in the Florida Keys.**

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
1 (Not at all crowded) .....	10	10	15.6	15.6
2.....	7	17	10.9	26.6
3.....	6	23	9.4	35.9
4.....	10	33	15.6	51.6
5.....	12	45	18.8	70.3
6.....	11	56	17.2	87.5
7.....	2	58	3.1	90.6
8.....	2	60	3.1	93.8
9 (Extremely crowded).....	4	64	6.3	100.0

Arithmetic Mean: 4.28

**NR30. If asked by a friend whether he/she should snorkel on the coral reef you visited on your most recent trip to the Florida Keys, what advice would you give?**

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Strongly advise against .....	2	2	3.1	3.1
Advise against .....	4	6	6.3	9.4
Not sure .....	7	13	10.9	20.3
Recommend.....	27	40	42.2	62.5
Strongly recommend .....	24	64	37.5	100.0

Arithmetic Mean: 4.05

### Diving in the Florida Keys

**NR31. If you were to snorkel in the Florida Keys again, would you return to the coral reef you visited on your most recent trip?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Definitely not .....	4	4	6.3	6.3
Probably not .....	16	20	25.0	31.3
Not sure .....	1	21	1.6	32.8
Maybe.....	14	35	21.9	54.7
Definitely.....	29	64	45.3	100.0

Arithmetic Mean: 3.75

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR32. How satisfied were you with each of the following during your most recent snorkel on a coral reef in the Florida Keys?**

---

	<u>Not at all satisfied</u>		<u>Slightly satisfied</u>		<u>Moderately satisfied</u>		<u>Very satisfied</u>		<u>Extremely satisfied</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Seeing a healthy reef .....	7	10.9	8	12.5	17	26.6	19	19.7	13	20.3	3.36
Experiencing easy snorkeling/SCUBA diving conditions .....	6	9.4	7	10.9	18	28.1	18	28.1	15	23.4	3.45
Experiencing good underwater visibility.....	5	7.8	12	18.8	13	20.3	21	32.8	13	20.3	3.39
Seeing undamaged reef sites .....	8	12.5	10	15.6	17	26.6	21	32.8	8	12.5	3.17
Seeing marine life .....	3	4.7	8	12.5	13	20.3	28	43.8	12	18.8	3.59
Seeing large fish.....	7	10.9	8	12.5	22	34.4	14	21.9	13	20.3	3.28
Seeing unique underwater formations .....	6	9.4	11	17.2	17	26.6	18	28.1	12	18.8	3.30
Seeing live coral.....	7	10.9	8	12.5	13	20.3	25	39.1	11	17.2	3.39
Experiencing natural surroundings ....	1	1.6	4	6.3	15	23.4	26	40.6	18	28.1	3.88
Relaxing .....	2	3.1	4	6.3	10	15.6	23	35.9	25	39.1	4.02

---

**Diving in the Florida Keys**

**NR33. On your most recent visit to a coral reef in the Florida Keys, about how many other snorkelers and SCUBA divers do you remember seeing at any one moment when you were actually snorkeling in the water?**

---

*Number of Snorkelers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	5	5	7.9	7.9
1-5 .....	15	20	23.8	31.7
6-10 .....	18	38	28.6	60.3
11-20 .....	10	48	15.9	76.2
21-50 .....	15	63	23.8	100.0

Arithmetic Mean: 14.00 snorkelers

*Number of SCUBA Divers*

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	12	12	22.2	22.2
1-2 .....	12	24	22.2	44.4
3-5 .....	14	38	26.0	70.4
6-10 .....	13	51	24.0	94.4
11-25 .....	3	54	5.6	100.0

Arithmetic Mean: 4.44 SCUBA divers

---

**Human Dimensions of Marine and Coastal Ecosystems**

**NR34. On your most recent visit to a coral reef in the Florida Keys, about how many other boats do you remember actually seeing at any one moment during your time at a dive site?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
0.....	5	5	7.8	7.8
1-2 .....	16	21	25.0	32.8
3-5 .....	14	35	21.9	54.7
6-10 .....	32	53	28.1	82.8
11-30 .....	11	64	17.2	100.0

Arithmetic Mean: 6.80 boats

---

**Responses to the following questions represent all non-resident SCUBA divers.**

**Diving in the Florida Keys**

**NR35. Overall, do you feel the following are having a positive or negative impact on the ecological health of coral reefs in the Florida Keys?**

---

	<u>Extremely negative impact</u>		<u>Moderately negative impact</u>		<u>Slightly negative impact</u>		<u>No positive or negative impact</u>		<u>Slightly positive impact</u>		<u>Moderately positive impact</u>		<u>Extremely positive impact</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Water quality .....	50	5.9	112	13.3	150	17.8	215	25.4	59	7.0	137	16.2	122	14.4	4.24
SCUBA diving .....	11	1.2	58	6.7	260	30.2	279	32.4	84	9.8	107	12.4	62	7.2	4.09
Commercial fishing ..	133	15.8	234	27.8	255	30.3	172	20.5	23	2.7	12	1.4	12	1.4	2.77
Hurricanes .....	209	24.8	258	30.6	193	22.9	147	17.4	11	1.3	15	1.8	11	1.3	2.51
Snorkeling .....	20	2.4	57	6.7	165	19.5	432	51.0	52	6.1	77	9.1	44	5.2	4.00
Recreational fishing ...	44	5.2	123	14.6	279	33.0	328	38.8	33	3.9	23	2.7	15	1.8	3.37
Global climate change	159	19.1	211	25.3	167	20.0	259	31.1	11	1.3	15	1.8	11	1.3	2.81

---

**NR36. Overall, how would you rate the current ecological health of the coral reefs in the Florida Keys?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Poor .....	52	52	6.0	6.0
Fair .....	244	296	28.2	34.3
Good .....	336	632	38.9	73.1
Very good .....	208	840	24.1	97.2
Excellent .....	24	864	2.8	100.0

Arithmetic Mean: 2.89

---

Human Dimensions of Marine and Coastal Ecosystems

NR37. Do you feel that the ecological health of the coral reefs in the Florida Keys is improving, declining, or staying the same?

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Declining substantially.....	71	71	8.7	8.7
Declining somewhat.....	372	443	45.5	54.2
Staying the same .....	250	693	30.6	84.7
Improving somewhat.....	117	810	14.3	99.0
Improving substantially.....	8	818	1.0	100.0

Arithmetic Mean: 2.53

---

**Diving in the Florida Keys**

**NR38. Please indicate the extent to which you agree or disagree with the following statements.**

	<u>Strongly disagree</u>		<u>Disagree</u>		<u>Neutral</u>		<u>Agree</u>		<u>Strongly agree</u>		<u>Mean</u>
	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	<u>n</u>	<u>%</u>	
Coral reefs in the Florida Keys are able to easily recover from any impacts due to diving without any long-term damage.....	133	15.3	289	33.2	198	22.8	210	24.1	40	4.6	2.70
Coral reefs in the Florida Keys are able to easily recover from any impacts due to commercial fishing without any long-term damage....	250	28.9	409	47.3	162	18.8	39	4.5	4	0.5	2.00
Coral reefs in the Florida Keys are generally in healthy condition.....	36	4.2	190	22.0	255	29.5	352	40.7	31	3.6	3.18
Snorkelers/divers cause some damage to reefs in the Florida Keys, which has long-lasting effects on reef health.....	28	3.2	175	20.2	211	24.3	397	44.6	67	7.7	3.33
Recreational anglers cause some damage to reefs in the Florida Keys, which has long-lasting effects on reef health.....	21	2.4	117	13.6	273	31.6	376	43.6	76	8.8	3.43
The Florida Keys reefs where I typically snorkel or dive are in a healthy condition .....	25	2.9	140	16.2	244	28.2	413	47.8	42	4.9	3.36

## Human Dimensions of Marine and Coastal Ecosystems

**NR39. If you had to replace the SCUBA diving equipment that you currently own with similar equipment, how much would it cost to replace? Please indicate the amount of your primary activity, as you indicated in question #3 on page 2.**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
\$0-249 .....	54	54	6.4	6.4
\$250-499 .....	57	111	6.7	13.1
\$500-999 .....	91	202	10.7	23.8
\$1,000-1,999 .....	265	467	31.1	54.9
\$2,000-2,999 .....	214	681	25.2	80.1
\$3,000-4,999 .....	123	804	14.5	94.6
\$5,000-20,000 .....	46	850	5.4	100.0

Arithmetic Mean: \$1,955.42

---

**Diving in the Florida Keys**

**NR41. What is your age?**

---

<i>Years</i>	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
15-25 .....	87	87	9.8	9.8
26-30 .....	71	158	8.1	17.9
31-35 .....	93	251	10.5	28.4
36-40 .....	92	343	10.4	38.8
41-45 .....	126	469	14.2	53.0
46-50 .....	153	622	17.3	70.3
51-55 .....	136	758	15.4	85.7
56-60 .....	89	847	10.0	95.7
61-76 .....	38	885	4.3	100.0

Arithmetic Mean: 43 years

---

**NR42. Are you:**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Male.....	652	652	73.3	73.3
Female .....	237	889	26.7	100.0

---

## Human Dimensions of Marine and Coastal Ecosystems

### NR43. What is your marital status?

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Single.....	240	240	27.1	27.1
Married.....	544	784	61.7	88.6
Divorced.....	90	847	10.2	98.8
Separated.....	4	878	0.5	99.2
Widowed.....	7	885	0.8	100.0

### NR44. Which of the following categories best describes your annual household income?

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Under \$5,000.....	14	14	1.6	1.6
\$5,000-9,999.....	8	22	0.9	2.6
\$10,000-14,999.....	5	27	0.6	3.2
\$15,000-19,999.....	5	32	0.6	3.8
\$20,000-24,999.....	13	45	1.5	5.3
\$25,000-29,999.....	14	59	1.6	6.9
\$30,000-34,999.....	16	75	1.9	8.8
\$35,000-39,999.....	19	94	2.2	11.1
\$40,000-44,999.....	19	113	2.2	13.3
\$45,000-49,999.....	28	141	3.3	16.6
\$50,000-59,999.....	58	199	6.8	23.4
\$60,000-74,999.....	95	294	11.2	34.6
\$75,000-99,999.....	155	449	18.3	52.9
\$100,000-149,999.....	187	636	22.0	74.9
\$150,000 or more.....	213	849	25.1	100.0

**Diving in the Florida Keys**

**NR45. Would you classify yourself as Spanish/Latino/Hispanic?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
Yes.....	29	29	3.3	3.3
No.....	851	880	96.7	100.0

---

**NR46. Which racial category best describes you?**

---

	<u>Count</u>	<u>Cum Count</u>	<u>Percent</u>	<u>Cum Pct</u>
American Indian or Native Alaskan.....	6	6	0.7	0.7
Asian .....	8	14	0.9	1.6
Black or African American .....	2	16	0.2	1.9
Native Hawaiian or other Pacific Islander .....	2	18	0.2	2.1
White .....	838	856	98.9	100.0

---

**APPENDIX A  
SURVEY INSTRUMENT**

**Understanding Coral Reef Use:  
Diving and Snorkeling in the  
Florida Keys**



**Human Dimensions of Marine and Coastal Ecosystems  
Holdsworth Natural Resources Center  
University of Massachusetts Amherst  
Amherst, MA 01003-9285**

## Diving in the Florida Keys

In the following questions, please tell us about your snorkeling and SCUBA diving activity and experience. The information you provide will remain strictly confidential and your name will never be identified with your answers.

1. Consider the time you spend snorkeling and SCUBA diving in general, regardless of location. Between the two, what percentage of time do you spend snorkeling and what percentage of time do you spend SCUBA diving? (The percentages of time for snorkeling and for SCUBA diving combined should equal 100%).

a. Percent of time snorkeling \_\_\_\_\_ %

b. Percent of time SCUBA diving \_\_\_\_\_ %

Total = 100%

2. If you are a SCUBA diver, what level of certification do you presently hold? (Please circle all that apply).

- 1 None - I am not a SCUBA diver
- 2 Enrolled in SCUBA diving course
- 3 Open Water
- 4 Advanced
- 5 Dive Master
- 6 Instructor
- 7 Other (please list) \_\_\_\_\_

We understand that you may be both a snorkeler and a SCUBA diver, but in the following section we are interested in learning about your primary activity. Please answer questions #4 through #22 based on your response to QUESTION #3 below.

3. In general, do you identify yourself as more of a snorkeler or more of a SCUBA diver? (Please circle only one response, and answer questions #4 through #22 based on your response to this question).

- 1 Snorkeler
- 2 SCUBA diver

## Human Dimensions of Marine and Coastal Ecosystems

4. With whom do you snorkel/SCUBA dive most often? Again answer questions #4 through #22 based on your response to question #3. (Please circle only one answer).

- 1 By myself
- 2 With friends
- 3 With family
- 4 With family and friends

5. How many total years have you been snorkeling/SCUBA diving on coral reefs? (In adding up the total number of years, please exclude years that you did not go snorkeling/SCUBA diving).

\_\_\_\_\_ Total years snorkeling/SCUBA diving

6. During the past 12 months, approximately how many days did you go snorkeling/SCUBA diving on coral reefs in the Florida Keys?

\_\_\_\_\_ Days snorkeling/SCUBA diving

7. During the past 12 months, how many days did you go snorkeling/SCUBA diving on a coral reef in the Florida Keys on a private boat (owned and captained by yourself or a friend), on a rented boat (captained by yourself or a friend), or on a hired boat (owned and captained by a dive company)?

\_\_\_\_\_ Number of days to a reef on a private boat

\_\_\_\_\_ Number of days to a reef on a rented boat

\_\_\_\_\_ Number of days to a reef on a for-hire boat

8. Would you say the number of days you went snorkeling/SCUBA diving on coral reefs in the Florida Keys this past year was less, about the same, or more than in the previous five years?

- 1 Less
- 2 About the same
- 3 More
- 4 I've only gone once

## Diving in the Florida Keys

9. How important is it to you to snorkel/SCUBA dive on coral reefs as opposed to other locations (such as wrecks, sand flats, and seagrass beds)?

- 1 Not at all important
- 2 Somewhat important
- 3 Moderately important
- 4 Very important
- 5 Extremely important

10. To what extent do you make use of the following for current information about snorkeling/SCUBA diving in the Florida Keys?

	No use	Almost no use	A little use	Some use	A lot of use
a. Talking with other snorkelers/divers .....	1	2	3	4	5
b. Diving/snorkeling magazines .....	1	2	3	4	5
c. Government agency publications .....	1	2	3	4	5
d. Conservation organization publications .....	1	2	3	4	5
e. Newspapers .....	1	2	3	4	5
f. Dive shops/companies .....	1	2	3	4	5
g. Club meetings .....	1	2	3	4	5
h. Television .....	1	2	3	4	5
i. Radio .....	1	2	3	4	5

11. To what extent did you expect to be able to do each of the following on your most recent trip to a reef in the Florida Keys?

	Did not expect	Small expectation	Moderate expectation	Large expectation	Very large expectation
a. To see a healthy reef .....	1	2	3	4	5
b. To experience easy snorkeling/SCUBA diving conditions .....	1	2	3	4	5
c. To experience good underwater conditions .....	1	2	3	4	5
d. To see undamaged reef sites .....	1	2	3	4	5
e. To see marine life (other than fish) .....	1	2	3	4	5
f. To see large fish .....	1	2	3	4	5
g. To see unique underwater formations .....	1	2	3	4	5
h. To see live coral .....	1	2	3	4	5
i. To experience natural surroundings .....	1	2	3	4	5
j. To relax .....	1	2	3	4	5

## Human Dimensions of Marine and Coastal Ecosystems

12. During a typical trip to a coral reef in the Florida Keys, what is the maximum number of:

- a. SCUBA divers you find acceptable to see at any one moment during your time in the water? \_\_\_\_\_
- b. snorkelers you find acceptable to see at any one moment during your time in the water? \_\_\_\_\_
- c. boats you find acceptable to see at any one moment during your time at a snorkel/dive site? \_\_\_\_\_

The next several questions ask you to indicate how important snorkeling/SCUBA diving is as a part of your life, regardless of location. For each question below, read the four choices and circle the one answer that best fits you for that question. Again, please answer the following questions based on your primary activity (i.e., the response you gave to QUESTION #3 on page 2).

13. When I participate in the sport of snorkeling/SCUBA diving I feel like:

- 1 a beginner. I don't really feel like I am part of the snorkeling/SCUBA diving scene.
- 2 an occasional or irregular participant. Sometimes it is fun, entertaining or rewarding to go snorkeling/SCUBA diving.
- 3 a habitual and regular participant in the sport of snorkeling/SCUBA diving.
- 4 an insider to the sport. Snorkeling/SCUBA diving is an important part of who I am.

14. During a snorkeling/SCUBA diving experience I can best be described as:

- 1 having very little understanding of the sport. I am often unsure of how to do certain things when I go snorkeling/SCUBA diving.
- 2 having some understanding of the sport, but I am still in the process of learning more about the sport. I am becoming familiar and comfortable with the activity.
- 3 being comfortable with the sport. I have a good understanding of what I can do while snorkeling/SCUBA diving, and how to do it.
- 4 a knowledgeable expert in the sport. I encourage, teach, and enhance opportunities for others who are interested in snorkeling/SCUBA diving.

## Diving in the Florida Keys

### 15. My relationships with others who snorkel/SCUBA dive are:

- 1 not established. I really don't know any other people who snorkel/SCUBA dive.
- 2 very limited. I know some other snorkelers/SCUBA divers by sight and sometimes talk with them, but I don't know their names.
- 3 one of familiarity. I know the names of others who snorkel/SCUBA dive, and often speak with them.
- 4 close. I have personal and close relationships with other snorkelers/SCUBA divers. These friendships often revolve around the sport.

### 16. My commitment to snorkeling/SCUBA diving is:

- 1 very slight. I have very little connection to the sport. I may or may not continue to participate in the sport in the future.
- 2 moderate. I will continue to go snorkeling/SCUBA diving as long as it is entertaining and provides the benefits I want.
- 3 fairly strong. I have a sense of being a member of the sport, and it is likely that I will continue to snorkel/SCUBA dive for a long time.
- 4 very strong. I am totally committed to snorkeling/SCUBA diving. I encourage others to participate in the sport and seek to ensure the activity continues into the future.

The next several questions ask you to rate how acceptable you find various snorkeling/SCUBA diving situations to be. For each of the following questions, please circle one number for each of the items listed. Again, please answer the following items based on the response you gave to QUESTION #3 on page 2.

## Human Dimensions of Marine and Coastal Ecosystems

17. During a typical snorkel/SCUBA dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of divers at any one moment during your time in the water? (Please circle one number for each of the following items).

	<i>Extremely unacceptable</i>	<i>Very unacceptable</i>	<i>Somewhat unacceptable</i>	<i>Not sure</i>	<i>Somewhat acceptable</i>	<i>Very acceptable</i>	<i>Extremely acceptable</i>
a. Zero SCUBA divers .....	1	2	3	4	5	6	7
b. 5 SCUBA divers .....	1	2	3	4	5	6	7
c. 10 SCUBA divers .....	1	2	3	4	5	6	7
d. 15 SCUBA divers .....	1	2	3	4	5	6	7
e. 20 SCUBA divers .....	1	2	3	4	5	6	7
f. 25 SCUBA divers .....	1	2	3	4	5	6	7
g. More than 25 SCUBA divers .....	1	2	3	4	5	6	7

18. During a typical snorkel/SCUBA dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of snorkelers at any one moment during your time in the water?

	<i>Extremely unacceptable</i>	<i>Very unacceptable</i>	<i>Somewhat unacceptable</i>	<i>Not sure</i>	<i>Somewhat acceptable</i>	<i>Very acceptable</i>	<i>Extremely acceptable</i>
a. Zero snorkelers .....	1	2	3	4	5	6	7
b. 5 snorkelers .....	1	2	3	4	5	6	7
c. 10 snorkelers .....	1	2	3	4	5	6	7
d. 15 snorkelers .....	1	2	3	4	5	6	7
e. 20 snorkelers .....	1	2	3	4	5	6	7
f. 25 snorkelers .....	1	2	3	4	5	6	7
g. More than 25 snorkelers .....	1	2	3	4	5	6	7

## Diving in the Florida Keys

**19. During a typical snorkel/SCUBA dive on a coral reef in the Florida Keys, how acceptable is it for you to see the following number of boats at any one moment during your time at a dive site?**

	Extremely unacceptable	Very unacceptable	Somewhat unacceptable	Not sure	Somewhat acceptable	Very acceptable	Extremely acceptable
a. Zero boats .....	1	2	3	4	5	6	7
b. 5 boats .....	1	2	3	4	5	6	7
c. 10 boats .....	1	2	3	4	5	6	7
d. 15 boats .....	1	2	3	4	5	6	7
e. 20 boats .....	1	2	3	4	5	6	7
f. 25 boats .....	1	2	3	4	5	6	7
g. More than 25 boats .....	1	2	3	4	5	6	7

**20. During a typical snorkel/SCUBA dive on a coral reef in the Florida Keys, how acceptable or unacceptable do you consider each of the following resource conditions to be?**

	Extremely unacceptable	Very unacceptable	Somewhat unacceptable	Not sure	Somewhat acceptable	Very acceptable	Extremely acceptable
a. Coral reefs that are mostly white ....	1	2	3	4	5	6	7
b. Coral reefs that are 60% white .....	1	2	3	4	5	6	7
c. Coral reefs that are 30% white .....	1	2	3	4	5	6	7
d. Reefs with no white coral present...	1	2	3	4	5	6	7
e. Nearly 100% algal cover .....	1	2	3	4	5	6	7
f. 60% algal cover .....	1	2	3	4	5	6	7
g. 30% algal cover .....	1	2	3	4	5	6	7
h. Almost no algae present .....	1	2	3	4	5	6	7
i. Visibility of about 10 feet .....	1	2	3	4	5	6	7
j. Visibility of about 25 feet .....	1	2	3	4	5	6	7
k. Visibility of about 50 feet .....	1	2	3	4	5	6	7
l. Visibility of about 75 feet .....	1	2	3	4	5	6	7
m. Seeing no fish at the reef site .....	1	2	3	4	5	6	7
n. Seeing many fish, but of few kinds .	1	2	3	4	5	6	7
o. Seeing few fish, but of many kinds .	1	2	3	4	5	6	7
p. Seeing many fish, of many kinds .....	1	2	3	4	5	6	7

## Human Dimensions of Marine and Coastal Ecosystems

**21. Please indicate the extent to which you believe all snorkelers/SCUBA divers have an obligation either to do or to not do each of the following at a coral reef.**

	Strong obligation to never do	Moderate obligation to not do	Slight obligation to not do	No obligation either way	Slight obligation to do	Moderate obligation to do	Strong obligation to always do
a. Maintain buoyancy control .....	1	2	3	4	5	6	7
b. Tell others not to touch corals .....	1	2	3	4	5	6	7
c. Operate boats in shallow reef areas ..	1	2	3	4	5	6	7
d. Feed fish .....	1	2	3	4	5	6	7
e. Swim close to marine mammals .....	1	2	3	4	5	6	7
f. Touch marine mammals .....	1	2	3	4	5	6	7
g. Pick up garbage from the sea floor ....	1	2	3	4	5	6	7
h. Operate boats at least 100 feet from a dive flag .....	1	2	3	4	5	6	7
i. Take pieces of dead coral .....	1	2	3	4	5	6	7
j. Break off pieces of live coral .....	1	2	3	4	5	6	7
k. Leave shells in original locations on a reef .....	1	2	3	4	5	6	7
l. Tell others not to anchor boats on coral .....	1	2	3	4	5	6	7

**22. Imagine that you did the following at a coral reef and others saw you. How embarrassed would you feel?**

	Not at all embarrassed	Somewhat embarrassed	Moderately embarrassed	Very embarrassed	Extremely embarrassed
a. Lost buoyancy control .....	1	2	3	4	5
b. Touched corals with your hands .....	1	2	3	4	5
c. Operated a boat in a shallow reef area .....	1	2	3	4	5
d. Fed fish .....	1	2	3	4	5
e. Swam close to marine mammals .....	1	2	3	4	5
f. Touched marine mammals .....	1	2	3	4	5
g. Left garbage on the sea floor .....	1	2	3	4	5
h. Operated a boat too close to a dive flag .....	1	2	3	4	5
i. Took pieces of dead coral .....	1	2	3	4	5
j. Broke off pieces of live coral .....	1	2	3	4	5
k. Removed shells from a reef .....	1	2	3	4	5
l. Knowingly anchored a boat on coral .....	1	2	3	4	5

## Diving in the Florida Keys

In the following section, we are interested in learning more about the activity you engaged in on your most recent trip to the Florida Keys. Please answer the following questions based on the response you give to QUESTION #23 below.

23. On your most recent trip to a coral reef in the Florida Keys, did you spend more time snorkeling or SCUBA diving? (Please circle one response).

- 1 Snorkeling
- 2 SCUBA diving

24. To what extent were you able to accomplish each of the following during your most recent snorkel/SCUBA dive on a coral reef in the Florida Keys?

		Completely unable to accomplish	Slightly able to accomplish	Moderately able to accomplish	Mostly able to accomplish	Completely able to accomplish
a. To see a healthy reef .....	1	2	3	4	5	
b. To experience easy snorkel/SCUBA conditions .....	1	2	3	4	5	
c. To experience good underwater visibility .....	1	2	3	4	5	
d. To see undamaged reef sites .....	1	2	3	4	5	
e. To see marine life .....	1	2	3	4	5	
f. To see large fish .....	1	2	3	4	5	
g. To see unique underwater formations .....	1	2	3	4	5	
h. To see live coral .....	1	2	3	4	5	
i. To experience natural surroundings .....	1	2	3	4	5	
j. To relax .....	1	2	3	4	5	

25. On your most recent trip to a coral reef in the Florida Keys, about how many other snorkelers and SCUBA divers did you expect to see at any one moment while you were actually snorkeling/diving in the water? (If you didn't know what to expect, please check that box).

\_\_\_\_\_ Number of snorkelers       I didn't know what to expect

\_\_\_\_\_ Number of SCUBA divers       I didn't know what to expect

## Human Dimensions of Marine and Coastal Ecosystems

26. On your most recent trip to a coral reef in the Florida Keys, about how many other boats did you expect to see at any one moment during your time at a dive site?

\_\_\_\_\_ Number of boats       I didn't know what to expect

27. Included is a map of the Florida Keys. It is divided into three regions (upper, middle, and lower Keys). Within each region are three additional areas arranged outward from the shore to the reefs. Thus, there are a total of nine unique zones on the map. Please review the map and 1) record below the zone number for where you visited on your most recent snorkeling/SCUBA diving trip to the Keys, and 2) with an X, mark on the map the specific location of your visit, if possible. Please return the map with your survey.

Zone number \_\_\_\_\_

28. Below is a list of coral reef characteristics that you may notice while snorkeling/SCUBA diving. Consider your most recent snorkeling/SCUBA diving experience at a coral reef in the Florida Keys and rate the condition of the reef for each of the following items.

		Extremely poor condition	Very poor condition	Poor condition	Average condition	Good condition	Very good condition	Extremely good condition
a. Amount of algae .....	1	2	3	4	5	6	7	
b. Underwater visibility .....	1	2	3	4	5	6	7	
c. Color of the coral .....	1	2	3	4	5	6	7	
d. Number of fish .....	1	2	3	4	5	6	7	
e. Different kinds of fish .....	1	2	3	4	5	6	7	
f. Size of fish .....	1	2	3	4	5	6	7	
g. Amount of coral disease .....	1	2	3	4	5	6	7	
h. Amount of live coral .....	1	2	3	4	5	6	7	
i. Size of corals .....	1	2	3	4	5	6	7	
j. Different kinds of coral .....	1	2	3	4	5	6	7	

29. Please indicate below how crowded you felt on-site during your most recent trip to a coral reef in the Florida Keys. (Please circle only one number).

1 ..... 2 ..... 3 ..... 4 ..... 5 ..... 6 ..... 7 ..... 8 ..... 9  
 Not at all crowded Extremely crowded

## Diving in the Florida Keys

30. If asked by a friend whether he/she should snorkel or dive on the coral reef you visited on your **most recent trip** to the Florida Keys, what advice would you give?

- 1 Strongly advise against
- 2 Advise against
- 3 Not sure
- 4 Recommend
- 5 Strongly recommend

31. If you were to snorkel or dive in the Florida Keys again, would **you** return to the coral reef you visited on your **most recent trip**?

- 1 Definitely not
- 2 Probably not
- 3 Not sure
- 4 Maybe
- 5 Definitely

32. How **satisfied** were you with each of the following during your **most recent** snorkel/SCUBA dive on a coral reef in the Florida Keys?

	<i>Not at all satisfied</i>	<i>Slightly satisfied</i>	<i>Moderately satisfied</i>	<i>Very satisfied</i>	<i>Extremely satisfied</i>
a. Seeing a healthy reef .....	1	2	3	4	5
b. Experiencing easy snorkeling/SCUBA diving conditions .....	1	2	3	4	5
c. Experiencing good underwater visibility .....	1	2	3	4	5
d. Seeing undamaged reef sites .....	1	2	3	4	5
e. Seeing marine life .....	1	2	3	4	5
f. Seeing large fish .....	1	2	3	4	5
g. Seeing unique underwater formations .....	1	2	3	4	5
h. Seeing live coral .....	1	2	3	4	5
i. Experiencing natural surroundings .....	1	2	3	4	5
j. Relaxing .....	1	2	3	4	5

## Human Dimensions of Marine and Coastal Ecosystems

33. On your most recent visit to a coral reef in the Florida Keys, about how many other snorkelers and SCUBA divers do you remember seeing at any one moment when you were actually snorkeling/SCUBA diving in the water?

\_\_\_\_\_ Number of snorkelers

\_\_\_\_\_ Number of SCUBA divers

34. On your most recent visit to a coral reef in the Florida Keys, about how many other boats do you remember actually seeing at any one moment during your time at a dive site?

\_\_\_\_\_ Number of boats

35. Overall, do you feel the following are having a positive or negative impact on the ecological health of coral reefs in the Florida Keys?

	<i>Extremely negative impact</i>	<i>Moderately negative impact</i>	<i>Slightly negative impact</i>	<i>No positive or negative impact</i>	<i>Slightly positive impact</i>	<i>Moderately positive impact</i>	<i>Extremely positive impact</i>
a. Water quality .....	1	2	3	4	5	6	7
b. SCUBA diving .....	1	2	3	4	5	6	7
c. Commercial fishing .....	1	2	3	4	5	6	7
d. Hurricanes .....	1	2	3	4	5	6	7
e. Snorkeling .....	1	2	3	4	5	6	7
f. Recreational fishing .....	1	2	3	4	5	6	7
g. Global climate change .....	1	2	3	4	5	6	7

36. Overall, how would you rate the current ecological health of the coral reefs in the Florida Keys?

- 1 Poor
- 2 Fair
- 3 Good
- 4 Very good
- 5 Excellent

## Diving in the Florida Keys

**37. Do you feel that the ecological health of the coral reefs in the Florida Keys is improving, declining, or staying the same?**

- 1 Declining substantially
- 2 Declining somewhat
- 3 Staying the same
- 4 Improving somewhat
- 5 Improving substantially

**38. Please indicate the extent to which you agree or disagree with the following statements.**

	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neutral</i>	<i>Agree</i>	<i>Strongly agree</i>
a. Coral reefs in the Florida Keys are able to easily recover from any impacts due to <u>snorkeling/diving</u> without any long-term damage ..... 1	2	3	4	5	
b. Coral reefs in the Florida Keys are able to easily recover from any impacts due to <u>commercial fishing</u> without any long-term damage ..... 1	2	3	4	5	
c. Coral reefs in the Florida Keys are generally in a healthy condition ..... 1	2	3	4	5	
d. <u>Snorkelers/divers</u> cause some damage to reefs in the Florida Keys, which has long-lasting effects on reef health ..... 1	2	3	4	5	
e. <u>Recreational anglers</u> cause some damage to reefs in the Florida Keys, which has long-lasting effects on reef health ..... 1	2	3	4	5	
f. The Florida Keys reefs where I typically snorkel or dive are in a healthy condition ..... 1	2	3	4	5	

**39. If you had to replace the snorkeling/SCUBA diving equipment that you currently own with similar equipment, how much would it cost to replace? Please indicate the amount for your primary activity, as you indicated in QUESTION #3 on page 2. (Only include equipment that is directly used during snorkeling/SCUBA diving; exclude supplemental items like boats, trailers, etc.).**

\$ \_\_\_\_\_ Amount to replace snorkeling/SCUBA diving equipment

## Human Dimensions of Marine and Coastal Ecosystems

The following questions will help us improve our understanding of snorkelers and SCUBA divers in the Florida Keys. The information you provide will remain strictly confidential. Your name will never be associated with your answers.

40. Are you a permanent or seasonal resident of Monroe County, Florida?

- 1 Yes, I am a permanent resident of Monroe County, FL
- 2 Yes, I am a seasonal resident of Monroe County, FL
- 3 No, I am a visitor to Monroe County, FL

41. What is your age? \_\_\_\_\_ Years

42. Are you:

- 1 Male
- 2 Female

43. What is your marital status?

- 1 Single
- 2 Married
- 3 Divorced
- 4 Separated
- 5 Widowed

44. Which of the following categories best describes your annual household income?

- |   |                      |    |                        |
|---|----------------------|----|------------------------|
| 1 | Under \$5,000        | 9  | \$40,000 to \$44,999   |
| 2 | \$5,000 to \$9,999   | 10 | \$45,000 to \$49,999   |
| 3 | \$10,000 to \$14,999 | 11 | \$50,000 to \$59,999   |
| 4 | \$15,000 to \$19,999 | 12 | \$60,000 to \$74,999   |
| 5 | \$20,000 to \$24,999 | 13 | \$75,000 to \$99,999   |
| 6 | \$25,000 to \$29,999 | 14 | \$100,000 to \$149,999 |
| 7 | \$30,000 to \$34,999 | 15 | \$150,000 or More      |
| 8 | \$35,000 to \$39,999 |    |                        |

**Diving in the Florida Keys**

45. Would you classify yourself as Spanish/Hispanic/Latino?

- 1 Yes
- 2 No

46. Which racial category best describes you?

- 1 American Indian or Native Alaskan
- 2 Asian
- 3 Black or African American
- 4 Native Hawaiian or other Pacific Islander
- 5 White

**Is there anything else about snorkeling or diving in the Florida Keys that you would like to share with us?**

---

---

---

---

**Your contribution to this effort is greatly appreciated. Please return your completed questionnaire and map in the enclosed postage paid business reply envelope as soon as possible. Thank you.**

*Please direct all inquiries to:*  
**David K. Loomis**  
**University of Massachusetts Amherst**  
**Holdsworth Natural Resources Center**  
**Amherst, MA 01003-9285**

Questionnaire #

16

## Human Dimensions of Marine and Coastal Ecosystems

### Literature Cited

- Ajzen I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*. 52:27–58
- Ajzen I., Fishbein M. (2000). Attitudes and the attitude–behavior relationship: reasoned and automatic processes. *European Review of Social Psychology*. 11:1–33.
- Bright, A. D.& Barro, S. C. (2000). Integrative complexity and attitudes: A case study of plant and wildlife species protection. *Human Dimensions of Wildlife*, 5(4): 30 – 47.
- Brooks, J. J., R. J. Warren, M. G. Melms, & Tarrant M.A. (1999). Visitor attitudes and knowledge of restored bobcats on Cumberland Island National Seashore, Georgia. *Wildlife Society Bulletin* 27:1089-1097.
- Bryan, H. (1977). Leisure value systems and recreation specialization: The case of trout fishermen. *Journal of Leisure Research*, 9(3), 174-187.
- Cesar, H.S.J & van Beukering, P.J.H (2004). Economic valuation of the coral reefs of Hawai'i. *Pacific Science*, 58(2), 231.
- Cialdini R.B., Reno R. R., & Kallgren C.A. (1990). A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. *Journal of Personality and Social Psychology*, 58(6), 1015-1026
- Dillman, D. A. (1978). Mail and telephone surveys: The total design method. New York, NY: [John Wiley & Sons](#).
- Ditton, R. B., Loomis, D. K., & Choi, S. (1992). Recreation specialization: reconceptualization from a social worlds perspective. *Journal of Leisure Research*, 24(1), 35-51.
- Donnelly, M.P., Vaske, J.J., DeRuiter, D.S., & King, T.B. (1996). Person-occasion segmentation of state park visitors. *Journal of Park and Recreation Administration*, 14(2), 95-106.
- Eagly A.& Chaiken S. (1993). The Psychology of Attitudes. Orlando, Florida: Harcourt
- Enck, J. W. and T. L. Brown. 2002. New Yorkers' attitudes toward restoring wolves to the Adirondack Park. *Wildlife Society Bulletin* 30: 16-28.
- Graefe, A. R. (1980). The relationship between level of participation and selected aspects of specialization in recreational fishing. Unpublished doctoral dissertation, Texas A&M University, College Station.

## Diving in the Florida Keys

Johns, G.M., Leeworthy, V.R., Bell, F.W., and Bonn, M.A. 2003. Socioeconomic Study of Reefs in Southeast Florida: Final Report October 19, 2001 as revised April 18, 2003 for Broward County, Palm Beach County, Miami-Dade County, Monroe County, Florida Fish and Wildlife Conservation Commission, and the National Oceanic and Atmospheric Administration. Hazen and Sawyer, Hollywood, Florida. Pp.349. Available at:

<http://marineeconomics.noaa.gov/Reefs/PDF's/Document.pdf>

Kauffman, R. B. & Graefe, A. R. (1984). Canoeing specialization, expected rewards and resource related attitudes. In J.S. Popodic, D. I. Butterfield, D. H. Anderson, & M. R.

Kidder, L. & Judd, C. (1986). Research Methods in Social Relations. New York: CBS College Publishing.

Koval, J.H. & Mertig, A.G. (2004). Public attitudes toward lethal coyote control. *Human Dimensions of Wildlife*, 11: 289 - 100

Krueger, C.C., Decker, D.J., & Gavin, T.A. (1986). A concept of natural resource management: an application to unicorns. *Transactions of the Northeast Section of the Wildlife Society*, 43: 50-56.

Lee, M. E., & Miller, R.. (2003). Managing elk in the wildland-urban interface: attitudes of Flagstaff, Arizona residents. *Wildlife Society Bulletin* 31: 185-191.

Leeworthy, V R. and Bowker, J.M. 1997. NonMarket Economic User Values of the Florida Keys/Key West. National Oceanic and Atmospheric Administration, Silver Spring, MD and U.S. Forest Service, Athens, GA. October 1997, pp 41. Available at: <http://marineeconomics.noaa.gov/SocmonFK/publications/97-30.pdf>

Leeworthy, V, Wiley, P, English D, & Kriesel W. (1996). Economic contribution of recreating visitors to the Florida Keys/Key. NOAA, (22 pp).

McCleery, R., Ditton, R., Sell, J, & Lopez, R. (2006). Understanding and improving attitudinal research in wildlife sciences. *Wildlife Society Bulletin*, 32 (2): 537-541.

Reno, R. R., Cialdini, R. B., & Kallgren, C. A. (1993). The transsituational influence of social norms. *Journal of Personality and Social Psychology*, 64, 104-112.

Saltz, R. J., Loomis, D. K., & Finn, K. L. (2001). Development and validation of a specialization index and testing of specialization theory. *Human Dimensions of Wildlife*, 6, 239–258.

Schwartz, Shalom H. (1977). Normative Influences on Altruism. In L. Berkowitz (ed.), Advances in Experimental Social Psychology, Volume 10, 221-279. New York: Academic Press.

Shelby B, Stankey G., Shindler B.(1992).Defining wilderness quality: the role of standards in wilderness management—a workshop proceedings; 1990 April 10-11; Fort Collins, CO. PNW-GTR-305. Portland, OR: U.S. Department of Agriculture,

## Human Dimensions of Marine and Coastal Ecosystems

Forest Service, Pacific Northwest Research Station. 114 p.

Shibutani, T. 1955. "Reference Groups as Perspectives." *American Journal of Sociology* 60: 562-569.

Spurgeon, J.P.G. (1992). The economic valuation of coral reefs. *Marine Pollution Bulletin*, 24(1) 529-536.

Teel, T. L., R. S. Krannich, & Schmidt, R.H. (2002). Utah's stakeholders' attitudes toward selected cougar and black bear management practices. *Wildlife Society Bulletin* 30:2-15.

UNEP. (2007). The Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities. from <http://www.gpa.unep.org/>

Unruh, D.R. (1979). Characteristics and types of participation in social worlds. *Symbolic Interaction*, 2, 115-130.

Wellman, J.D., Roggenbuck, J.W., & Smith, A.C. (1982). Recreation specialization and norms of depreciative behavior among canoeists. *Journal of Leisure Research*, 14, 323-340.