Evaluation of the Potential for a Marine Zoning Area for Southeast Florida

Southeast Florida Coral Reef Initiative

Fishing, Diving and Other Uses

Local Action Strategy Project 23

Evaluation of the Potential for a Marine Zoning Area for Southeast Florida

Final Report

Prepared By:
Leonard Berry [1]
Lakhdar Boukerrou [1]
Mantha Mehallis [1]
Diego Lirman [2]
Chad Grecsek [3]
Daphne Lambright [4]

[1] Center for Environmental Studies
Florida Atlantic University
777 Glades Road
Boca Raton, FL 33431-0991

[2] Rosenstiel School of Atmospheric and Marine Science
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149-1098

[3] CEPEMAR Group
3701 FAU Boulevard #209
Boca Raton, FL 33431-6491

[4] Biotechnical Support Services
19204 Autumn Woods Ave.
Tampa, FL 33647-3068

June 30, 2011

Completed in Fulfillment of RM052 for

The Southeast Coral Reef Initiative
Fishing, Diving and Other Uses
Local Action Strategy Project 23

and

Florida Department of Environmental Protection
Coral Reef Conservation Program
1277 N.E. 79th Street Causeway
Miami, FL 33138

This report should be cited as follows:
Berry, L., Boukerrou, L., Mehallis, M., Lirman, D., Grecsek, C., & Lambright, D. 2011. FDOU Project 23: Evaluation of the Potential for a Marine Zoning Area for Southeast Florida. Florida Department of Environmental Protection. Miami, FL. 209 pp.

This project and the preparation of this report were funded in part by Award No. NA05N0S4191008 from the National Oceanic and Atmospheric Administration (NOAA) through a contract with the Office of Coastal and Aquatic Managed Areas of the Florida Department of Environmental Protection. The total cost of the project was $44,000, of which 100 percent was provided by NOAA. The views expressed herein are those of the authors and do not necessarily reflect the views of the State of Florida, NOAA or any of its sub agencies.

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms

AA	Awareness and Appreciation
AP	Aquatic Preserve
BNP	Biscayne National Park
CHAMP	Coral Health and Monitoring Program
CRCP	Coral Reef Conservation Program
CREMP	Coral Reef Evaluation and Monitoring Project
CSA	Cambridge Scientific Abstracts
DTNP	Dry Tortugas National Park
ENP	Everglades National Park
FACE	Florida Area Coastal Environment
FAS	Freely Associated States
FAU-CES	Florida Atlantic University – Center for Environmental Studies
FDEP	Florida Department of Environmental Protection
FDOU	Fishing, Diving and Other Uses
FKNMS	Florida Keys National Marine Sanctuary
FMA	Fisheries Management Area
FRA	Fish Replenishment Area
FRT	Florida Reef Tract
FWC	Florida Fish and Wildlife Conservation Commission
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GIS	Geographic Information system
GPS	Global Positioning System
HAPC	Habitat Area of Particular Concern
ICM	Integrated Coastal Management
ICRAN	International Coral Reef Action Network
IUCN	The World Conservation Union
LADS	List Alternate Data Streams
LAS	Local Action Strategies
LBSP	Land-Based sources of Pollution
LIDAR	Light Detection and Ranging
MICCI	Maritime Industry and Coastal Construction Impacts
MLCD	Marine Life Conservation District
MMA	Marine Managed Area
MPA	Marine Protected Area
NCRI	National Coral Reef Institute
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service
NMPAC	National Marine Protected Areas Center

NMS	National Marine Sanctuary
NOAA	National Oceanic & Atmospheric Administration
NRC	National Research Council
NWR	National Wildlife Refuge
PA	Protected Area
REEF	Reef Environmental Education Foundation
SECREMP	Southeast Coral Reef Evaluation and Monitoring Program
SEFCRI	Southeast Florida Coral Reef Initiative
SLISPSP	St. Lucie Inlet Preserve State Park
SMZ	Special Management Zone
SPA	Sanctuary Preservation Area
TER	Tortugas Ecological Reserve
UM-RSMAS	University of Miami - Rosenstiel School of Marine and Atmospheric Science
U.S.	United States
USCRTF	U.S. Coral Reef Task Force
USVI	U.S. Virgin Islands
WSER	Western Sambo Ecological Reserve
WWF	World Wildlife Fund

Acknowledgements

Special thanks to Chantal Collier, Program Manager, Florida Department of Environmental Protection – Coral Reef Conservation Program, and to Rob Ruzicka, Project Coordinator, Fishing, Diving, and Other Uses (FDOU), for the opportunity to work on this project with them and for their assistance in reviewing the survey instrument and the draft report. The members of the FDOU Focus Team also deserve thanks for their contributions to this project. This project would not have been possible without the participation of the various stakeholders in southeast Florida and the Marine Protected Area managers from various countries. The recreational and commercial stakeholders deserve special thanks for answering the survey questions. The three reviewers, Barbara Brunnick, Brett Bibeau, and Todd Kellison provided valuable input and we thank them for that. Finally, the efforts of the field personnel Thais Boca, Mo Boukerrou, and Mike Lara are very much appreciated. The office support of Suyen Dauta, Sarah Gray, Shannon Kingston, and Shannon O'Brien is also greatly appreciated.

Executive Summary

The goal of this project was to identify and evaluate the effectiveness, and applicability according to stakeholders' perceptions, of marine protected areas (MPAs) and special management zones (SMZs) to the southeast region of Florida (Martin, Palm Beach, Broward, and Miami-Dade counties). MPAs refer to marine locations that protect natural and cultural resources. Many MPAs also contain smaller zones with different levels of protection (i.e., special management zones; SMZs). In some cases, SMZs are created independently from MPAs. Because of this, the terms special management zones (SMZs) and marine protected areas (MPAs) are used interchangeably in this report.

This goal was achieved by conducting and analyzing a global literature search, a survey of marine resource managers, and a survey of southeast Florida stakeholders. The project's objectives (tasks) were to:

1. Evaluate existing literature regarding effectiveness of special management zones and marine protected areas from around the world for applicability to this region;

2. Identify criteria useful for zoning reef resources as representative or unique areas;

3. Identify representative and unique areas needing enhanced management through local input in order to develop zoning alternatives by county;

4. Determine what is important to the users concerning marine zoning (i.e., fears, what they want to know, what they want, what they don't want, what is most important to them); and

5. Identify existing knowledge gaps related to marine zoning and reef protection plans.

This project is one of several managed by the Florida Department of Environmental Protection (FDEP). The FDEP is a member group of the United States Coral Reef Task Force (USCRTF), established by Presidential Executive Order 13089 in 1998 to lead U.S. efforts to preserve and protect coral reef ecosystems. In 2002, the USCRTF adopted the "Puerto Rico Resolution" which called for the development of Local Action Strategies (LAS) by each member group. These LAS are locally-driven roadmaps for collaborative and cooperative action among federal, state, territorial, and non-governmental partners, which identify and implement priority actions needed to reduce key threats to valuable coral reef resources. With guidance from the USCRTF, the FDEP and the Florida Fish and Wildlife Conservation Commission (FWC) coordinated the formation of the

Southeast Florida Coral Reef Initiative (SEFCRI) Team. The development of SECFRI LAS involves numerous stakeholders using a facilitated process that includes public reviews and input for the coral reefs located in Martin, Palm Beach, Broward, and Miami-Dade counties. The FDEP Coral Reef Conservation Program (CRCP) manages Florida's LAS and the SEFCRI.

The literature review portion of this project showed the importance of coral reefs worldwide as one of the most productive and diverse ecosystems. However, they are being degraded or threatened in most locations. The need for increased protection was emphasized and the USCRTF planned to place 20% of U.S. coral reefs within no-take status by 2010 (U.S. National Oceanic and Atmospheric Administration [NOAA], 2002). Reef resources within U.S. jurisdictions are presently managed under different levels of protection that range from unrestricted access to no-take zones. Protected reef resources in the U.S. are found within national marine sanctuaries, national parks, national monuments, wildlife refuges, national estuarine research reserves and estuary program areas, state, territory, and commonwealth parks, conservation areas, and marine reserves. A national system of Marine Protected Areas (MPAs) was proposed in Executive Order 13158 in 2000, in part to provide analyses of the types of protection levels that currently exist. The MPA inventory, updated in March 2011, recorded more than 1,600 MPAs in the U.S of which more than 86% are designated as "multiple-use" areas that allow a variety of human activities, including fishing. In contrast, only 14% of MPAs are designated as "no-take" areas which prohibit extractive uses (NOAA, 2011).

In Florida, reefs are an important economic asset to the state, with reef-related expenditures estimated at $6.3 billion annually supporting 72,000 full and part-time jobs. (Johns, Leeworthy, Bell, & Bonn, 2001; Johns, Milon, & Sayers, 2004) Of that, $5.7 billion and 61,000 jobs are attributed to the southeast Florida region (Martin, Palm Beach, Broward, and Miami-Dade counties). Despite their economic contribution, the majority of the protected reefs are located further south along the Florida coastline from Biscayne National Park to the Florida Keys. With the exception of one small state park, the coral reef resources north of Biscayne National Park currently do not fall within any SMZs or MPAs. Because the reefs in this region are located near the northern limit of coral growth and because of their close proximity to large urban centers, southeast Florida reefs are especially vulnerable.

The global literature search yielded 637 reports about SMZ/MPA management. Of these, 304 were considered relevant to this project

because they contained quantitative data on shallow tropical or subtropical reef habitats. The majority (95%) of the relevant reports documented some level of success in achieving their SMZ/MPA management and conservation goals. The factors most often cited as influencing this success are: (1) involvement of stakeholders at all stages of the design and implementation process; (2) effective legislation to enforce regulations; (3) adequate funding to enforce regulations and monitor resources; (4) implementation of adaptive management; and (5) appropriate selection of habitats and resources to protect based on sound scientific information. Worldwide, the greatest benefit of the implementation of SMZs/MPAs has been the recovery or increase in the biomass of fisheries resources (Keller & Donahue, 2006).

The reports reviewed indicate that practical considerations (e.g., funding levels, enforcement resources, compliance levels) often limit the size of the SMZs/MPAs that can be successfully established and managed, and that the size of reserves is commonly decided on a case-by-case basis, based on the resources available and the management priorities. Nevertheless, a report by the National Research Council (2001) suggests that networks of intermediate-sized reserves (10–100 km^2) will be more effective than fewer, larger reserves, particularly if the networks include a variety of representative habitats. A case study of the Florida Keys National Marine Sanctuary (FKNMS) showed that after five years of marine zoning there were encouraging initial results in coral cover and fish density within the fully protected zones (Keller & Donahue, 2006).

Criteria identified for zoning marine resources were obtained from a survey of marine resource managers and the literature review. Based on the literature review, the most effective SMZ/MPA models were those that: (1) use structured and quantitative approaches to SMZ/MPA design; (2) have an effective legislative base; (3) have a visible continuous management presence; and (4) have significant stakeholder involvement both in the planning and governance stages (Stevens, Jones, Howell, & Mee, 2006). The SMZ/MPA managers surveyed listed five factors important in the establishment of an SMZ/MPA: (1) well-defined boundaries; (2) size of individual zones; (3) number of zones; (4) zoning conditions for multiple users; and (5) no-take or exclusionary areas. For each of these factors, a list of issues was provided by the respondents. Well-defined boundaries were identified as the most important factor in establishing SMZs/MPAs. The respondents indicated that the boundaries should be biologically meaningful, large enough to cover the resources being protected, and include sufficient buffer zones. The biological diversity, conditions of the resources, and their type of use were important factors in determining the number of zones. To help protect

marine resources throughout their developmental life stages, zones should include habitat areas for all life stages of the key protected species (spawning, juvenile, and adult stages). Although the managers reported that the implementation of no-take or exclusionary areas can be the most effective way to restore a depleted resource, these areas should only be designated in certain circumstances. For example, no-take or exclusionary areas would be appropriate tools to protect species in cases where over-exploitation has been documented.

The main factors leading to success in SMZs/MPAs based on the survey responses from 17 marine resource managers were: (1) management goals and objectives for the area; (2) ability to enforce regulations; (3) use restrictions; (4) ability to manage; (5) size of area to be protected/managed; (6) regulations on extraction; and (7) community involvement.

The marine resource managers provided their opinions about the most effective SMZs/MPAs designs for southeast Florida. Forty-one percent (41%) of the 17 respondents recommended the use of a network of SMZs/MPAs rather than using individual areas. The three major criteria to consider in the establishment of SMZs/MPAs in southeast Florida were the ability to enforce regulations that would maintain successful SMZs/MPAs, promote stakeholder awareness of the regulations of the SMZs/MPAs, and implement successful outreach/education programs.

A stakeholder survey was developed for southeast Florida marine resource users to solicit their opinions on various marine zoning questions. Of the 298 respondents, the majority (93%) were recreational users: fishers, divers, boaters, and snorkelers. Among these recreational users, the largest number of responses (29%) was from recreational fishers. The number of responses from commercial user groups, although lower than the number of responses from recreational user groups, was proportional to the actual number of licensed commercial users in southeast Florida. However, the total survey response rate (3%) for all user groups was lower than anticipated and needs to be noted in assessing the results of this survey.

The majority (77%) of stakeholder respondents identified themselves as Caucasian and 17% of the respondents identified themselves as Hispanic. The results represent the perceptions in regard to marine management of 298 individuals. The majority (60%) have been using marine resources in southeast Florida for more than 10 years. Many (54%) use southeast Florida marine resources on a weekly basis. Nearly 30% of the respondents have changed location within the last 5 years because of

perceived changes in marine resources and water quality. A majority (58%) believe that if nothing is done and the current management approach is continued, resource conditions will worsen.

Respondents are generally in favor of the establishment of SMZs/MPAs in southeast Florida. Nearly 75% believe that a different management approach is needed. Almost 60% of survey respondents favor the establishment of SMZs/MPAs.

Seventy-one percent (71%) of the marine users surveyed believe marine resources can be effectively managed within SMZs/MPAs. They believe specific issues such as land-based sources of pollution, water pollution/waste dumping, and water quality/sedimentation need to be addressed and regulated. They would also like to see MPAs address overfishing, ship groundings, and anchor damage. The respondents believed that more recreational users (fishers, divers, boaters, and snorkelers) would benefit than commercial users from the establishment of an SMZ/MPA in southeast Florida.

If an SMZ/MPA system was developed for coral reefs in southeast Florida, most respondents (65%) would be in favor of multiple use areas that either allow some fishing and diving consumptive use (38%) or allow a combination of multiple activities (26%). A small percentage (26%) of stakeholders would be in favor of non-consumptive SMZs/MPAs that either allow only non-consumptive activities (16%) or consist of small, isolated SMZs/MPA that restrict all activities (10%). Those respondents with concerns about establishing SMZs/MPAs identified insufficient enforcement and regulation, poor user compliance, and lack of stakeholder understanding of MPA benefits as their key concerns. Stakeholders also thought there were too few SMZs/MPAs. The users believe that while SMZs/MPAs should allow fishing and diving consumptive uses, these uses should be appropriately monitored by having more patrols with effective enforcement as well as more education and outreach programs. This approach will be important for the success of SMZs/MPAs in southeast Florida.

Based on the stakeholder surveys, respondents do not want their access to and use of the marine resources in southeast Florida to be restricted. However, they also do not want these resources to deteriorate. The respondents would like to see the issues which have the potential of affecting the quality of the marine resources managed to ensure the protection of these resources.

The important knowledge gaps identified during this project (i.e., literature search, manager survey, and stakeholder survey) include:

- **Sound Scientific Analysis and Monitoring:** An important part of the establishment of SMZs/MPAs is a sound knowledge base on which to build a single or a network of SMZs/MPAs. This base is also important in establishing trends and monitoring change with improved management. The current knowledge and monitoring conducted in southeast Florida is not adequate for this purpose.

- **Threat Analysis:** Another important gap is the more precise identification of the most important threats to the marine resource system. There is general agreement on listing of the threats in the literature and by stakeholders (land-based pollution, acidification of ocean waters, over-fishing, damage to reefs by ship groundings, anchor dragging, potential damage from diving, etc.) but no good basis for identification of the rank order of these threats. This information is necessary for reef managers to prioritize management actions.

- **Stakeholder Education and Outreach:** One of the issues which may challenge the planning, establishment, and management of SMZs/MPAs in southeast Florida is stakeholder support. Our stakeholder survey showed that not all stakeholder groups have the same perceptions about SMZs/MPAs. The major gaps are in understanding the main purpose of SMZs/MPAs, the issues impacting the quality of coral reefs, and the issues which should be addressed by SMZs/MPAs. Providing science-based information to stakeholders is important to enabling effective stakeholder participation.

- **Expanding the Stakeholder Survey Base:** The stakeholder survey elicited responses mainly from recreational users of marine resources. It may be important to use other methods to involve commercial users in this process, as well as expanding the base of opinion in recreational users. Focus groups or other forms of stakeholder participation might be helpful in this process.

Information obtained from the literature review, the manager surveys, and the stakeholder surveys all demonstrate that successful SMZs/MPAs need the support of stakeholders and the general public. Thus, raising the stakeholders' and the public's awareness about MPAs is vital to SMZ/MPA success. The design of education and outreach programs should reflect the information sources used by southeast Florida stakeholders and the diversity of the marine users in the southeast Florida region.

1 Introduction

1.1 Project Goals and Objectives

The southeast Florida region (Martin, Palm Beach, Broward, and Miami-Dade counties) was chosen for this project because its reefs are close to shore, are adjacent to intensely urbanized areas, and lack the type of coordinated management plan created for the Florida Keys National Marine Sanctuary (FKNMS; NOAA, 1995, 1996). After a comprehensive review and analysis, the Southeast Florida Coral Reef Initiative (SEFCRI) Local Action Strategy (LAS), the Fishing, Diving and Other Uses (FDOU) Focus Team determined the need to collect information and to facilitate stakeholder input in order to develop viable management options for southeast Florida's coral reefs and marine resources.

Thus, the goal of this SECFRI LAS project, FDOU Project 23, was to evaluate the potential for developing a science-based marine zoning plan for the southeast Florida region. The project's five objectives (tasks) were:

1) Evaluate existing literature regarding effectiveness of special management zones and marine protected areas from around the world for applicability to this region;

2) Identify criteria useful for zoning reef resources as representative or unique areas;

3) Identify representative and unique areas needing enhanced management through local input in order to develop zoning alternatives by county;

4) Determine what is important to the users concerning marine zoning (i.e., fears, what they want to know, what they want, what they don't want, what is most important to them); and

5) Identify existing knowledge gaps related to marine zoning and reef protection plans.

The overview, methods, results, and discussion for each of the five project objectives (tasks) are presented in Chapters 2 through 6 of this report.

1.2 Coral Reefs Global Overview

Coral reefs are recognized as among the most productive and diverse ecosystems in the world (Birkeland, 1997; Hughes et al., 2003; Odum & Odum, 1955). Although their value as centers of biodiversity and foci of primary and secondary productivity has always been recognized by the scientific community, their value to society has recently been emphasized in light of the widespread patterns of degradation that these keystone

ecosystems have experienced in the past few decades (Gardner, Coté, Gill, Grant, & Watkinson, 2003; Pandolfi et al., 2003; Wilkinson, 2004). Coral reefs are unique systems in which biological production results directly, through limestone deposition, in the creation of geomorphological structures that provide shoreline protection for coastal communities (Moberg & Folke, 1999), and essential habitat for thousands of associated plant, vertebrate, and invertebrate species (Reaka-Kudla, 1997).

Coral reefs are found in more than 100 tropical and subtropical countries and provide a source of income and subsistence for more than 100 million people who rely, both directly and indirectly, on the products and services derived from coral reefs (Bryant, Burke, McManus, & Spaulding, 1998; Burke & Maidens, 2004; Hoegh-Guldberg, 2004). Moreover, worldwide estimates indicate that coral reefs provide living and socioeconomic resources to humans with a value that exceeds $300 billion annually (Cesar, Burke, & Pet-Soede, 2003; Costanza et al., 1997). Therefore, the recent decline in reef health and extent poses a serious threat to the livelihood of human populations that, in many cases, are found in the poorest regions of the world (Wilkinson, 2004).

The degradation of reef resources has been reported frequently in the past, but it is only within last 5 to 10 years that regional data have become available to fully document the widespread global decline in reef condition. In his report on the status of the world's coral reefs, Wilkinson (2004) reported that 20% of the coral reefs of the world have been destroyed with limited prospects for recovery, 24% of reefs are under imminent risk of collapse, and an additional 26% are under long-term threat of collapse. These patterns and predictions are echoed by other regionally focused studies that report similar declines for Caribbean (Gardner et al., 2003; Burke & Maidens, 2004) and Indo-Pacific reefs (Bruno & Selig, 2007). This dramatic decline in abundance and condition has not been limited solely to stony corals, but has also been observed in numerous other guilds, including turtles, mammals (e.g., manatees, dugongs, seals), both large and small herbivorous and carnivorous fishes, suspension feeders, and seagrasses (Jackson et al., 2001; Pandolfi et al., 2003).

Although the spatial and temporal impacts of specific coral reef stressors can vary significantly, numerous sources of disturbance have been identified that are common to coral reefs worldwide (Birkeland, 1997 and references therein). These disturbances include over exploitation (e.g., overfishing, coral extraction); increased nutrient and sediment runoff; changes in salinity, temperature, and water chemistry; chemical pollution; diseases; physical impacts caused by storms and ship groundings; and biotic competition (e.g., predation, macroalgal and sponge overgrowth). In

a survey conducted among 286 participants at the 10th International Coral Reef Symposium held in Japan in 2004, the participants identified the highest threat to coral reefs was human population growth, while overfishing, coastal development, and sedimentation were ranked consistently at the top of the list of threats to reefs worldwide (Kleypas & Eakin, 2007).

Faced with declining reef conditions and fisheries resources, as well as increased pressure from human population growth and the potential for amplified impacts of stressors associated with global climate change (i.e., increased temperature, reduced calcification potential, sea-level changes), resource managers are increasingly relying on the establishment of Special Management Zones (SMZs) and Marine Protected Areas (MPAs) to preserve and enhance the condition of reef resources within their jurisdictions (Wilkinson, 2004). MPAs refer to marine locations that protect natural and cultural resources. Many MPAs also contain smaller zones with different levels of protection (i.e., special management zones; SMZs). In some cases, SMZs are created independently from MPAs. The terms special management zones (SMZs) and marine protected areas (MPAs) are used interchangeably in this report.

In a recent survey, 26% of reef scientists and resource managers considered the establishment of new SMZs/MPAs to be an effective tool to improve the overall state of reefs worldwide (Kleypas & Eakin, 2007). Mora et al. (2006) identified 980 SMZs/MPAs worldwide, protecting an area greater than 98,000 km^2 or 18.7% of the world's coral reef habitats. Of these SMZ/MPA protected reefs, 5.3% lie inside extractive or open-access SMZs/MPAs, 12% lie inside multi-use SMZs/MPAs with some fishing restrictions, and 1.4% lie within fully protected, no-take SMZs/MPAs (Mora et al., 2006). Within this context, the recent declaration of 33% of the Great Barrier Reef and associated ecosystems within a no-take, protected status is recognized as a major achievement in the conservation of reef resources (Fernandes et al., 2005). In a similar step towards enhancing reef protection, the U.S. Coral Reef Task Force (NOAA, 2005b) recognizes the value of no-take ecological reserves in maintaining the biodiversity, productivity, and ecological function of coral reefs. The USCRTF planned to place 20% of the U.S. coral reefs within no-take status by 2010.

1.3 U.S. Coral Reefs

Shallow-water (less than 30 m deep) coral reef ecosystems are located within U.S. maritime boundaries in the Caribbean, Gulf of Mexico, and the Atlantic and Pacific Oceans (Figure 1). U.S. states with shallow coral reefs include Florida and Hawaii. Reef communities of the Flower Garden Banks lie in Federal waters off the coast of Texas. U.S. Territories with

reefs are found in the U.S. Virgin Islands (USVI), American Samoa, and Guam. The Commonwealths of Puerto Rico and the Northern Marianas Islands contain coral reefs (Turgeon et al., 2002; Waddell, 2005). Analyzing ocean depth contours using Geographic Information System (GIS), Rohmann, Hayes, Newhall, Monaco, and Grigg (2005) estimated that potentially 36,816 km^2 of coral reef habitat may be found in U.S. waters less than 18 m deep, and an additional 143,058 km^2 of coral reef habitat may be found in waters 18 m to 180 m deep.

The rates of decline in the state of coral resources within U.S. states, territories, and commonwealths have mirrored those documented in other reef systems worldwide (Pandolfi et al., 2005; Wilkinson, 2004). In a recent report on the status of coral reefs in the 7 U.S. states, territories, and commonwealths, Waddell (2005) identified the following stressors as factors contributing to the observed patterns of coral reef decline: climate change and bleaching, diseases, storms, coastal development and runoff, coastal pollution, tourism and recreation, fishing, commercial trade in coral and other reef species, ship groundings, marine debris, invasive species, and oil and gas exploration. Based on expert opinion, the three main sources of concern for the long-term survivorship of U.S. coral reef resources were identified as (1) overfishing, which was cited as a moderate-high threat in all of the 7 U.S. jurisdictions; (2) climate change, identified as a moderate-high threat to reefs in 6 of the 7 jurisdictions; and (3) coastal development and population growth, identified as a moderate-high threat to reefs in all of the 7 jurisdictions. When the information collected in 2004 was compared to the same information collected in 2001, 48% of threats remained at a medium-high level of concern. The threat categories perceived to have increased in severity since 2002 were overfishing, climate change and coral bleaching, coastal development and runoff, tourism and recreation, and diseases (Waddell, 2005).

Reef resources within U.S. jurisdictions are presently managed under different levels of protection that range from unrestricted access to no-take zones. Protected areas with reefs are found within national marine sanctuaries, national parks, national monuments, national wildlife refuges, national estuarine research reserves, and national estuary program areas, state, territory, and commonwealth parks, conservation areas, and marine reserves (Turgeon et al., 2002). In 2009, marine areas protected by no-take provisions covered more than 1,200 km^2 or roughly 8% of shallow reef habitats within U.S. jurisdiction (NOAA, 2009).

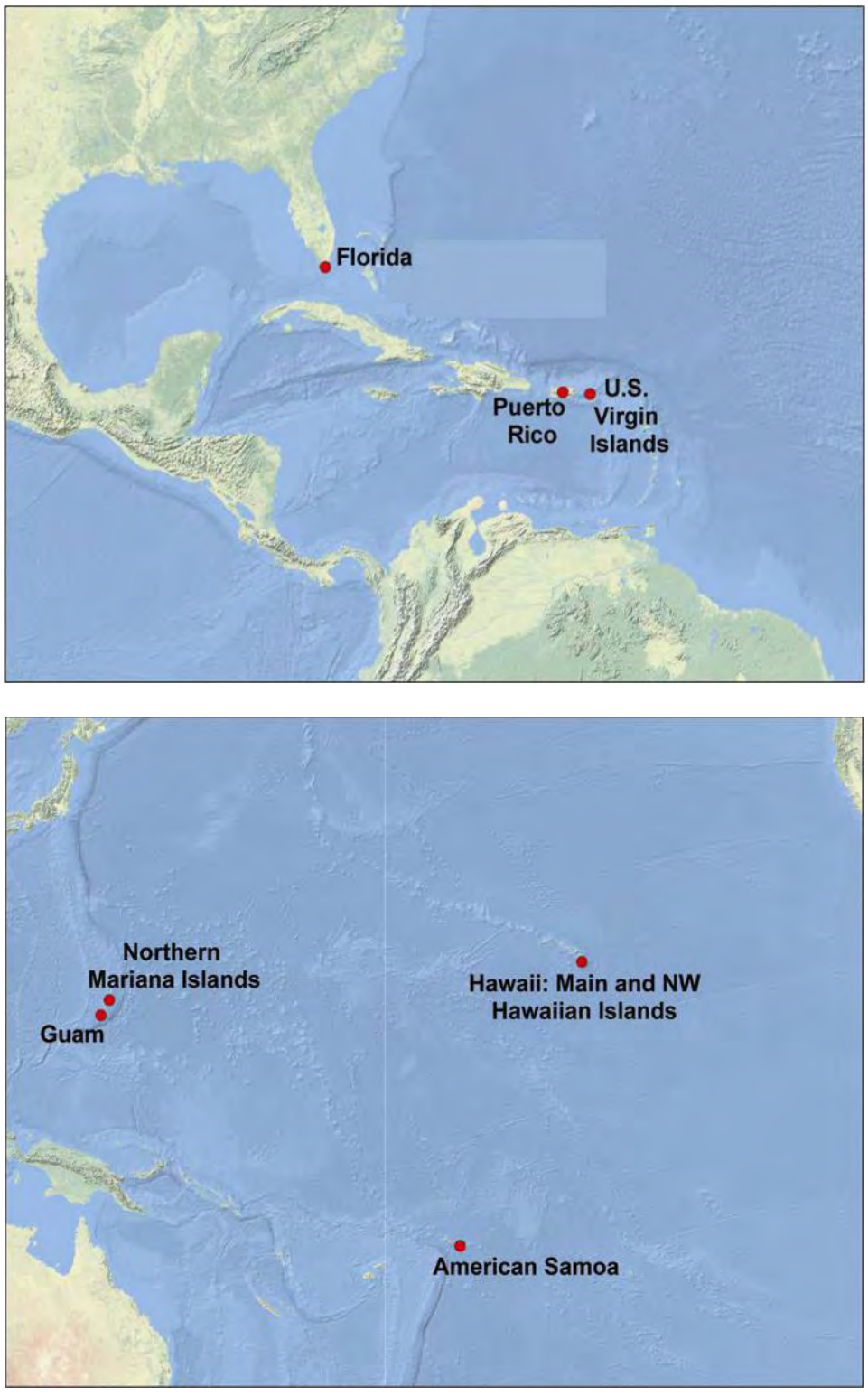


Figure 1. Location of the seven U.S. shallow-water coral reef areas within the Caribbean/Atlantic and the Pacific Oceans (Source: NOAA, 2009).

1.4 Marine Protection in the U.S.

In May 2000, President Clinton signed Executive Order No. 13158 to "protect the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the Nation's system of marine protected areas (MPAs) . . . ." This executive order defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The term "MPA" as used in this Executive Order denotes levels of protection that range from areas that allow multiple-use activities to areas that restrict take and/or access. Furthermore, the Executive Order calls for the establishment of a National System of MPAs defined as "an assemblage of MPA sites, systems, and networks established and managed by federal, state, tribal, or local governments that collectively work together at the regional and national level to achieve common objectives for conserving the nation's important natural and cultural resources."

Prior to the establishment of the proposed the National System of MPAs, the MPA Center (http://www.mpa.gov/dataanalysis/mpainventory/) compiled an inventory of existing Marine Protected Areas (MPAs) in U.S. waters. The inventory, updated in March 2011, recorded more than 1,600 MPAs in the U.S. (Figure 2). More than 86% of existing U.S. MPAs are designated as "multiple-use" areas which allow a variety of human activities, including fishing. In contrast, only 14% of MPAs are designated as "no-take" areas, where extractive uses are prohibited. The majority (69%) of the U.S. MPAs were established to conserve the comprehensive ecosystem functions and the ecological, economic, and cultural services provided by intact ecosystems, while 24% of MPAs target a more limited suite of resources or habitat features, such as endangered species or an impacted stock. In Florida, 428 MPAs were identified, 384 of these sites are under the jurisdiction of the State of Florida and 44 fall under Federal jurisdiction (NOAA, 2011). The MPAs in Florida allow for varying amounts of human activities and therefore have varying levels of protection.

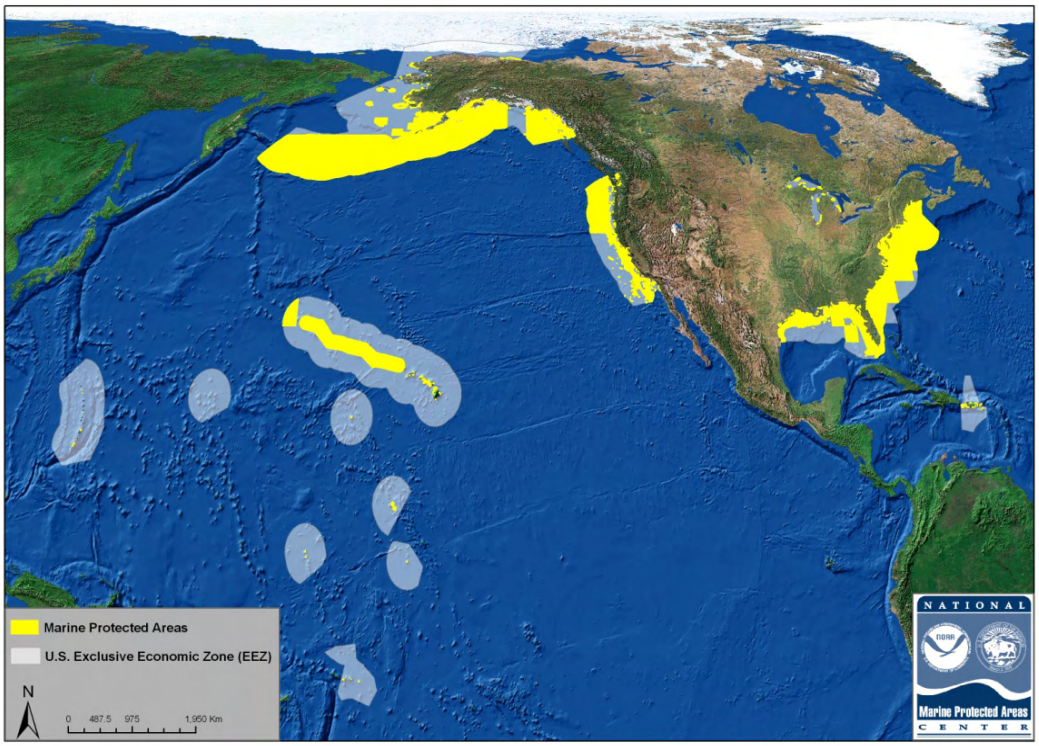


Figure 2. Marine Protected Areas (MPAs) in the U.S. in 2006. Source: http://www.mpa.gov/helpful_resources/inventoryfiles/eez_mpas_wallmap.pdf).

The National System of MPAs addresses three main conservation themes for new and existing MPAs in the U.S. (NMPAC, 2006):

1) **Natural Heritage:** MPAs established and managed to sustain, conserve, restore, and understand the protected area's natural biodiversity, populations, communities, habitats, and ecosystems; the ecological and physical processes upon which they depend; and, the ecological services, human uses, and values they provide to this and future generations.

2) **Cultural Heritage:** MPAs or zones established and managed wholly or in part to protect and understand submerged cultural resources that reflect the nation's maritime history and traditional cultural connections to the sea.

3) **Sustainable Production:** MPAs or zones established and managed with the explicit purpose of supporting the continued extraction of renewable living resources (e.g., fish, shellfish, plants) that live within the MPA, or that are exploited elsewhere but depend upon the protected area's habitat for essential aspects

of their ecology or life history (e.g., feeding, spawning, mating, nursery grounds).

Moreover, MPAs in the U.S. commonly fall within one the following levels of protection (NMPAC, 2006):

1) **Uniform Multiple-Use:** MPAs or zones with a consistent level of protection and allowable activities, including certain extractive uses, across the entire protected area (e.g., most U.S. national parks).

2) **Zoned Multiple-Use:** MPAs that allow some extractive activities throughout the entire site, but that use marine zoning to allocate specific uses to compatible places or times in order to reduce user conflicts and adverse impacts (e.g., fisheries management areas [FMAs] and fish replenishment areas [FRAs] in Hawaii).

3) **Zoned Multiple-Use With No-Take Area(s):** Multiple-use MPAs that contain at least one legally established management zone in which all resource extraction is prohibited (e.g., national marine sanctuaries).

4) **No-Take:** MPAs that allow human access and even some potentially harmful uses, but that totally prohibit the extraction or significant destruction of natural or cultural resources (e.g., sanctuary preservation areas [SPAs] in the FKNMS).

5) **No Impact:** MPAs that allow human access, but that prohibit all activities that could harm the site's resources or disrupt the ecological or cultural services they provide (e.g., fishing, collecting, mining, discharge of pollutants) (e.g., Research-only Areas in the FKNMS).

6) **No Access:** MPAs that restrict all human access to the area to prevent potential ecological disturbance, unless specifically permitted for designated special uses such as research, monitoring, or restoration (e.g., Legare Anchorage in Biscayne National Park).

MPAs also differ in their temporal scale or permanence of protection (NMPAC, 2006). The time that protection remains in effect can range from continuous (e.g., most U.S. marine sanctuaries and national parks) to temporary. Seasonal closures are a common conservation strategy to protect fisheries resources, spawning aggregations, and endangered species (e.g., FRAs and FMAs in Hawaii) (Waddell, 2005). Partial closures are another type of strategy that cycle protection levels among geographic areas through rotating MPAs to meet short-term management goals such

as stock replenishment. However, this type of MPA is not considered as effective as fixed closures (Roberts & Hawkins, 2000) and is not commonly used in the U.S. (NMPAC, 2006).

1.5 Florida Reef Tract

The reef communities of the Florida Reef Tract (FRT) represent the only living tropical coral reef system in the continental U.S. and extend approximately 450 kilometers from the Dry Tortugas in Monroe County to the St. Lucie Inlet in Martin County (Figures 3 and 4). Several interacting factors have contributed to the consideration of this ecologically, economically, and aesthetically unique system as an "ecosystem at risk" (Bryant et al., 1998). Florida reefs are adjacent to large and rapidly growing urban centers which makes this system vulnerable to anthropogenic disturbances commonly associated with coastal development and industrial and agricultural activities including eutrophication, sedimentation, and pollution (Glynn, Szmant, Corcoran, & Cofer-Shabica, 1989; Lapointe & Clark, 1992; Lipp et al., 2002; Porter et al., 2002). Similarly, the Florida Reef Tract and adjoining coastal lagoons (i.e., Florida Bay, Biscayne Bay, Lake Worth Lagoon, Indian River Lagoon) support recreational and commercial fishing and harvesting activities that provide a multi-billion dollar income to the local economy (Johns et al., 2001), but these activities have resulted in significant overfishing and depletion of most harvested stocks as well as direct physical damage to coral reefs from boating activities (Ault, Bohnsack, & Meester, 1998; Lirman & Miller, 2003).

Reefs of the Florida Keys, from Key West to Key Biscayne, are commonly divided into two main types: offshore shelf-margin reefs and lagoonal patch reefs. Offshore shelf-margin reefs with spur and groove habitats are generally oriented perpendicular to the shelf and are found on the seaward face of the shelf-margin (Marszalek, Babashoff, Noel, & Worley, 1977). Patch reefs can be high-relief features (up to 9 m of vertical relief) located within the inner lagoon between the Florida Keys and the shelf-margin reefs. Patch reefs are commonly dome or linear-shaped, and range in size from a few meters to 700 m in diameter (Jaap, 1984; Marszalek et al., 1977).

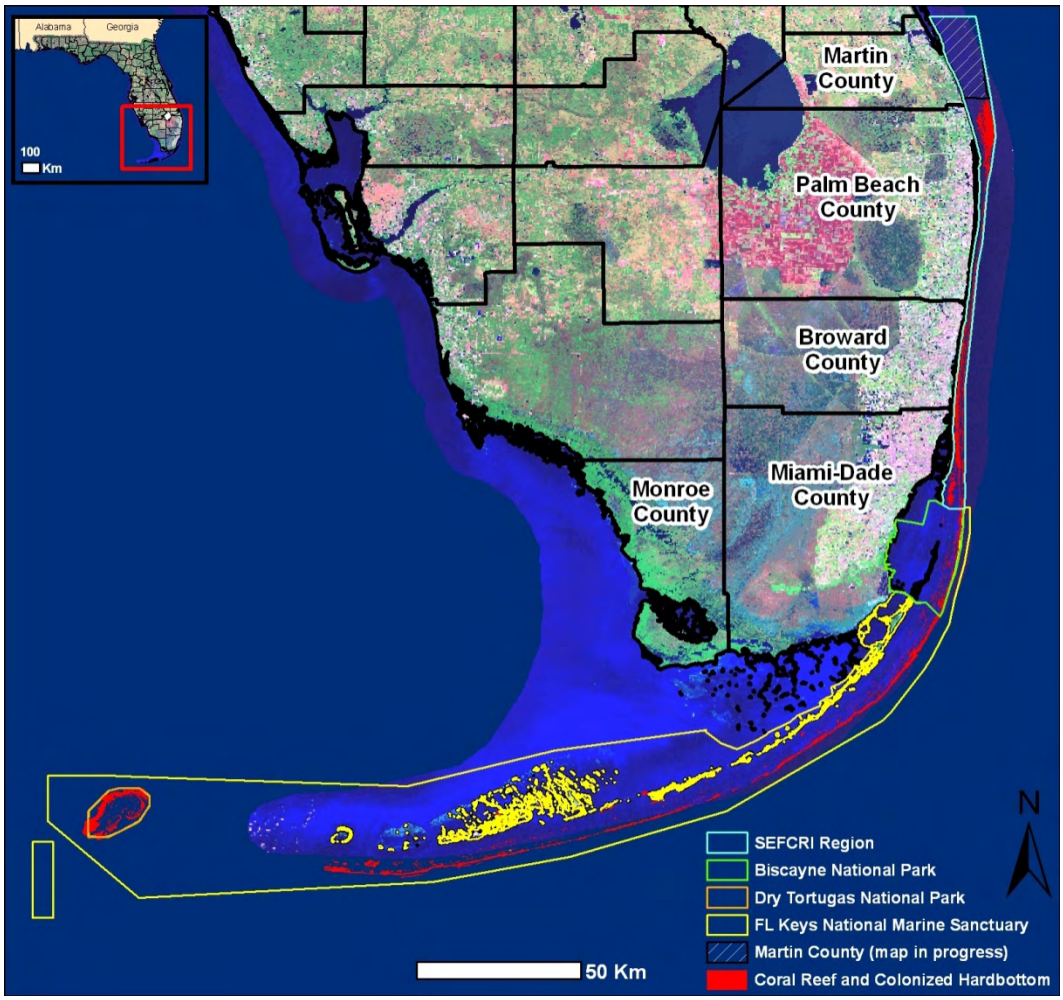


Figure 3. **Map of south Florida showing the location of coral reefs in the southeast Florida, or SEFCRI, region, Biscayne National Park, Dry Tortugas National Park, and the Florida Keys National Marine Sanctuary.**

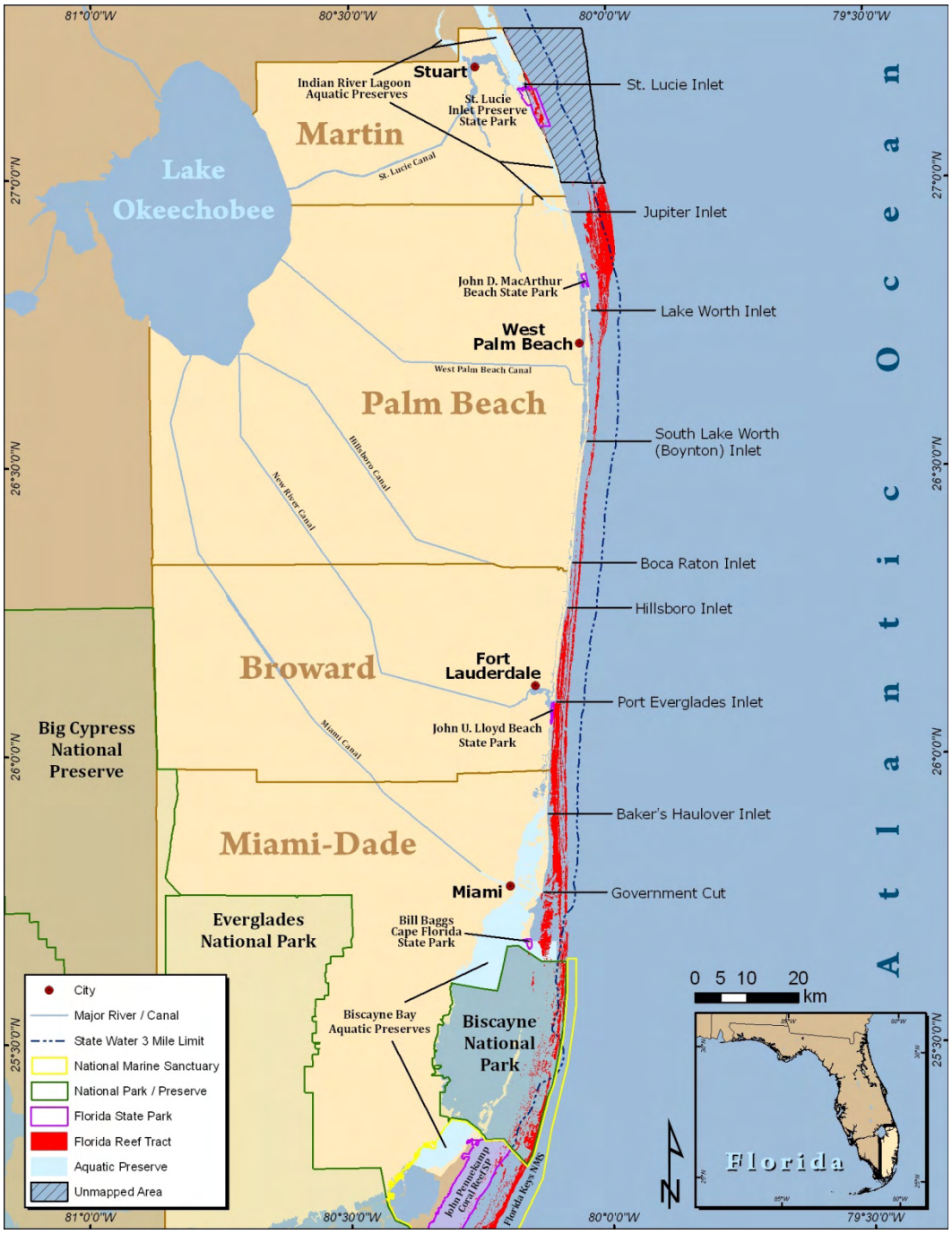


Figure 4. Map of the southeast Florida, or Southeast Florida Coral Reef Initiative (SECFRI), region from Miami-Dade County to Martin County.

The geomorphology of coral reefs north of the Florida Keys differs considerably from that found within the Keys. In the area north of Key Biscayne, present-day coral communities are found growing on subparallel ridges submerged during the late Pleistocene to early Holocene (Moyer, Riegl, Banks, & Dodge, 2003; Vargas-Angel, Thomas, &

Hoke, 2003). These communities consist of a sparse mixture of stony corals, soft corals, and sponges on hard bottom habitats which occur throughout southeast Florida. Many of these coral communities are found on remnant, low-profile habitats lacking significant zonation and topographical development (< 1 m of vertical relief) in areas where sediment accumulation is less than 5 cm in depth (Lirman et al., 2003). These habitats are characterized by low coral cover and small coral colony size (Blair & Flynn, 1989; Butler et al., 1995; Chiappone & Sullivan, 1994), although exceptions occur within Broward County (Gilliam, 2006) and extend to the St. Lucie Inlet Preserve State Park (SLIPSP), marking the northern limit for subtropical coral reefs in southeast Florida (Andrews, Nall, Jeffrey, & Pittman, 2005; Herren, 2004).

In Florida, reef decline is similar to that reported for the whole Caribbean region (Gardner et al., 2003). In the Florida Keys, coral cover has been lost at an average rate of 12.6% per year from 1996-1999 (Porter et al., 2002). Although the pattern of coral decline is widespread, the main reef-building coral taxa in Florida, *Acropora* spp. and *Montastraea* spp., have been especially impacted. Miller, Bourque, and Bohnsack (2002) reported declines of 93% and 97% in the total live area of *A. palmata* and *A. cervicornis* respectively at Looe Key in the Lower Florida Keys between 1983 and 2000. A similar decline in the abundance of *A. cervicornis* (96% reduction) was reported by Jaap, Halas, and Muller (1988) at Molasses Reef in the Upper Florida Keys from 1981-1986. In the Upper Keys at Carysfort Reef, patterns of long-term decline in coral cover and condition since 1975 have also been documented (Dustan, 1999; Dustan, Dobson, & Nelson, 2001). From Biscayne Bay south to Looe Key, steady declines in coral cover, especially on those sites dominated by *A. palmata*, were documented at permanent sites from 1984-1991 by Porter and Meier (1992) and from 1996 to 2000 by Patterson et al. (2002). Although the decline in coral condition may have begun at least 30 years ago, more recent studies report a continuing decrease in coral abundance and diversity. For example, Porter et al. (2002) reported a decline in coral richness at 67% of permanent transects between 1996 and 2000, and a corresponding 38% decline in coral cover during the same period. All sectors showed negative relative percent changes in coral cover between 1996 and 2000, but the Upper Keys experienced the most significant losses, with declines up to 72% at all stations.

Coral reef monitoring activities in areas north of the Florida Keys (i.e., Miami-Dade, Broward, Palm Beach, and Martin counties) have only recently been implemented, therefore only limited data are available on the long-term trends in coral condition for the southeast Florida region. Data collected by the southeast Florida Coral Reef Evaluation and

Monitoring Program (SECREMP) in Miami-Dade, Broward, and Palm Beach counties between 2003 and 2005 revealed that coral indicators such as coral cover and species richness remained stable during this 3-year period with the exception of a site in Palm Beach County where corals were buried by sand (Gilliam, 2006). Data from the FKNMS over the same period indicates a slight decrease in coral cover, but no difference in species richness.

The potential causal factors implicated in the observed decline in Florida are those common to other reef systems around the world (see review by Brown, 1997) and include hurricanes (Lirman & Fong, 1997; Porter & Meier, 1992), ship groundings (Gilliam, 2006; Lirman & Miller, 2003), impacts from beach renourishment projects (Lindeman & Snyder, 1999), the demise of the sea urchin *Diadema antillarum* and increased macroalgal competition (Forcucci, 1994; Lapointe et al., 2006; Lirman, 2001), coral diseases (Porter, et al. 2001; Richardson & Voss, 2005), increased nutrients (Lapointe, Matzie, & Barile, 2002), sedimentation (Dustan, 1999), high temperature and bleaching events (Jaap, 1979, 1985; Manzello et al., 2007), cold water events (Hudson, 1981; Walker, Roberts, Rouse, & Huh, 1982), and phytoplankton (Hu et al., 2003) and cyanobacterial (Paul, Thacker, Banks, & Golubic, 2005) blooms.

1.6 U.S. Coral Reef Task Force and Southeast Florida Coral Reef Initiative

In 2002, the USCRTF adopted the "Puerto Rico Resolution" which called for the development of Local Action Strategies (LAS) by each of its seven member U.S. states (Florida and Hawaii), territories (U.S. Virgin Islands, American Samoa, Guam), and commonwealths (Puerto Rico, Northern Mariana Islands). These LAS are locally-driven roadmaps for collaborative and cooperative action among federal, state, territory, and non-governmental partners, which identify and implement priority actions needed to reduce key threats to valuable coral reef resources. The goals and objectives of the LAS are linked to those found in the U.S. National Action Plan to Conserve Coral Reefs, adopted by the USCRTF in 2000. Of the thirteen goals identified in the National Action Plan, the USCRTF prioritized six threat areas as the focus for immediate local action:

1) Overfishing
2) Land-based sources of pollution
3) Recreational overuse and misuse
4) Lack of public awareness
5) Climate change
6) Coral bleaching and disease

Additional focus areas were identified in some jurisdictions, and in Florida, the impacts from the maritime industry and coastal construction were added. With guidance from the USCRTF, the Florida Department of Environmental Protection (FDEP) and the Florida Fish and Wildlife Conservation Commission (FWC) coordinated the formation of a team of marine resource professionals (state, regional, and federal agencies), scientists, non-governmental organization representatives, and other coral reef stakeholders. This team, named the Southeast Florida Coral Reef Initiative (SEFCRI) Team, was assembled in 2003 to develop Florida's LAS targeting coral ecosystems of the coast of Miami-Dade, Broward, Palm Beach, and Martin counties.

The SEFCRI LAS addresses four general focus areas:

1) Awareness and Appreciation (AA)
2) Land-Based Sources of Pollution (LBSP)
3) Maritime Industry and Coastal Construction Impacts (MICCI)
4) Fishing, Diving and Other Uses (FDOU)

The SEFCRI Team identified issues within each of these focus areas and developed goals, objectives, and individual projects to address these issues. Efforts through SEFCRI have been initiated to raise awareness and protect coral reefs within its region of oversight; however at this time there is no single comprehensive marine management plan in place for this area nor is the SEFCRI region designated as a managed area.

One of the goals of the SEFCRI is to balance all fishing and recreational activities within the sustainable limits of the reef ecosystem to minimize user conflicts, provide equitable uses, protect the coral reef ecosystem, and ensure optimal benefits to present and future generations. As identified as FDOU Project #23 in the SEFCRI LAS, this evaluation of the potential for marine zoning areas for southeast Florida was undertaken by a team of scientists from the Center for Environmental Studies at Florida Atlantic University, CEPEMAR, and the Rosenstiel School of Atmospheric and Marine Sciences at the University of Miami.

1.7 Reef Protection in Florida

The protection of reef resources is crucial to Florida where a substantial portion of revenue and jobs are dependent both directly and indirectly on the status of reef resources. The importance of coral reef habitats to the economic welfare of Florida was documented in studies by Johns, et al. (2001; 2004) which reported that reef-related expenditures generated more than $6.3 billion in sales, and supported over 72,000 full and part-time jobs in 2000-2001 in Monroe, Miami-Dade, Broward, Palm Beach, and Martin counties. The majority of resident reef-users (45% of respondents in Martin County, 65% of respondents in Palm Beach, 63% in Broward, 61% in Miami-Dade, and 57% in Monroe) indicated that they would support the establishment of no-take zones within their county of residence as a means of protecting reef resources. The same reef-users stated that they would like to see 16% to 35% of coral reefs in their county of residence designated as no-take zones.

1.7.1 Federal Reef Protection in Florida

The current level of protection of reef resources varies among the counties of Florida and ranges from unrestricted access to no-take and research-only areas with access limited by permitting. In 1990, the Florida Keys National Marine Sanctuary and Protection Act designated 9,950 km^2 of coastal waters in the Florida Keys as an MPA to offer protection to over 1,400 km^2 of coral reef habitat found within the Sanctuary (http://floridakeys.noaa.gov; NOAA, 1995, 2005a) (Figure 3). In 1997, the management plan of the Florida Keys National Marine Sanctuary (FKNMS) created a network of protected zones to achieve biodiversity conservation, wildlife protection, and the separation of incompatible uses (NOAA, 2005a). Zone types include wildlife management areas to minimize disturbance to sensitive wildlife and habitats; ecological reserves to protect large and contiguous habitats; sanctuary preservation areas (SPAs) to protect heavily used reefs; and special-use areas for scientific research, education, restoration, or monitoring (NOAA, 2005a). The original 24 fully protected zones prohibit extractive and consumptive activities and include 65% of the shallow coral reef habitats and 10% of all reef resources in the FKNMS (Keller & Donahue, 2006). In addition to the SPAs established in 1997, the Tortugas Ecological Reserve was implemented in 2001, increasing the amount of FKNMS coral reef habitat within no-take zones to 10% (NOAA, 2000, 2005a). The Tortugas Ecological Reserve, located in the westernmost portion of the Florida Reef Tract, is the largest (517.9 km^2) of the Sanctuary's fully-protected zones.

Just west of the FKNMS, Dry Tortugas National Park (DTNP) encompasses 262 km^2 and protects 88 km^2 of coral reefs and coral-

dominated habitats (Figure 3). One zone within DTNP, the recently (2007) designated Research Natural Area (RNA; 129 km^2), prohibits anchoring and fishing activities and is located adjacent to the FNKMS Tortugas Ecological Reserve. Together, the Tortugas Ecological Reserve and the Dry Tortugas National Park's RNA fully protect nearshore to deep reef habitats and form one of the largest marine reserves in the U.S. (NOAA, 2000). Other federally protected areas in the Florida Keys include Key West National Wildlife Refuge, Key Deer National Wildlife Refuge, and the Great White Heron National Wildlife Refuge.

Just north of the FKNMS, Biscayne National Park (BNP) encompasses a large portion of the northern Florida Reef Tract with 291 km^2 of coral reefs and coral-dominated habitats (Figure 3). Although extractive activities (e.g., fishing, spearfishing, lobster and crab collection) are still permitted within Biscayne National Park, a revision of its General Management Plan (GMP) is underway. Several of the alternatives proposed in this GMP revision include the designation of SMZs where fisheries resources and nursery habitats would be protected from fishing and other disturbances (http://www.nps.gov/bisc/parkmgmt/information-about-the-current-and-developing-general-management-plans.htm).

The coral reef resources in the region north of Biscayne National Park (from Miami-Dade to Martin counties; Figure 4) do not currently fall within any federal marine protected area. However, north of southeast Florida, the *Oculina* Bank Habitat Area of Particular Concern (HAPC), established in 1984, runs from Ft. Pierce to Cape Canaveral and protects deep-water populations of the ivory coral (*Oculina*).

1.7.2 State Reef Protection

In addition to areas with federal protection, Florida reef resources are also found within a number of state parks and aquatic preserves that presently offer limited protection to corals and reef associated resources. Examples of these include John Pennekamp Coral Reef State Park, and Lignumvitae Key Botanical State Park in the Florida Keys, and Biscayne Bay Aquatic Preserve, and St. Lucie Inlet Preserve State Park in the southeast Florida region.

1.7.3 Local Reef Protection

Although local (county) governments are able to pass resolutions regarding marine resource management, establishing local SMZs/MPAs is not a strategy currently used in Florida.

2 Literature Review

The purpose of this task (Task 1) was to compile and evaluate existing literature regarding the effectiveness of marine protected areas (MPAs) and special management zones (SMZs) from around the world for applicability to southeast Florida.

2.1 Literature Review Methods

A total of 637 published references on the subject of Marine Zoning, Marine Protection, and SMZs/MPAs were compiled for the purposes of this review. The initial list of references was obtained from extensive literature searches using online electronic scientific databases (e.g., Web of Science, Cambridge Scientific Abstracts) as well as digital libraries maintained by the MPA Center (http://www.mpa.gov), ReefBase (http://www.reefbase.org), and the Florida Keys National Marine Sanctuary (http://floridakeys.noaa.gov/tortugas/benefits/biblio/b.html). After the initial database was compiled, its contents were made available to scientists through NOAA's Coral Health and Monitoring Program (CHAMP) listserver, which has more than 3,000 members worldwide and focuses on issues related to reef ecology, reef health, conservation, and monitoring. The members of the listserver were asked to review the references included in the initial database and provide additional references if missing. The initial database was well received by the researchers and managers that responded to the posting and more than 100 references were added to the initial database based on their suggestions.

A subset of the references included in the final version of the database were evaluated in detail by the collaborators of this project to provide guidelines and suggestions for the development of a science-based marine zoning plan for the southeast Florida region based on the literature. The publications and reports included in this review were chosen to identify information useful for zoning reef resources in the southeast Florida region. The following guidelines were used to select appropriate sources:

1) Reports must be available for review in digital or hard-copy version;

2) Reports must be from tropical or subtropical regions of the world;

3) Reports must be from shallow (< 50 m in depth), reef-dominated habitats;

4) Reports must contain quantitative data that can be used to assess the effectiveness of the protection of corals and reef-associated resources, and/or contain information that can be used to determine the factors that contribute to the success or failure of SMZs/MPAs.

Out of the 637 reports included in the final MPA database, 304 publications fulfilled the guidelines described and were reviewed in detail. The information obtained from these reports is summarized in the following sections and was also used to develop the survey instruments used in Tasks 3-5 of this project. The countries or territories included in this review are, in alphabetical order: Anguilla, Australia, Bahamas, Barbados, Belize, Cambodia, China, Cuba, Dominican Republic, Egypt, Fiji, Honduras, Indonesia, Israel, Kenya, Madagascar, Malaysia, Mauritius, Mexico, New Caledonia, New Zealand, Nicaragua, Palau, Papua New Guinea, Philippines, Saba, Samoa, Seychelles, Solomon Islands, St. Lucia, Thailand, Tanzania, Turks and Caicos, and U.S. (Florida, Hawaii, USVI). Examples of coral reef SMZs/MPAs considered in this review, including information on management successes and challenges, appear in Table 1.

Table 1. Examples of coral reef SMZs/MPAs around the world.

Country/Region	References	Type/ Method	Management Successes	Challenges
Australia	• Fernandes et al., 2005	• Wide range of state and territory models • Great Barrier Reef Marine Park Authority (GBRMPA)	• Public participation • Increased planning effectiveness and purpose built legislation, all states enacted highly protected areas • Serves as model for large scale ecosystem protection • Key stakeholders agree to 25 year vision • 30% of reef region "No Take" • Supportive public, much buy-in	• States/ territories less well resourced than GBRMPA • Lack of monitoring and evaluation to support adaptive management
Belize	• McField, 2000 • Pomeroy & Goetze, 2003	• Network of zoned SMZs/MPAs • Mixed management	• Special legislation	• Threat from land-based impacts-sedimentation, nutrient loads • Limited resources for enforcement and coordination
East Africa	• Kelleher, Bleakley, & Wells, 1995 • Kennedy, 1990	• Variety of models from small fisheries to large multiuse SMZs/MPAs	• NGO programs helping to create and finance SMZs/MPAs	• Ineffective management • Non-compliance • Lack of enforcement
Kenya	• McClanahan & Kaunda-Arara, 1996	• Network of fishing and no-take reserves	• Recovery of both fish biomass and size structure within reserves	• Intense fishing along reserve boundaries • Vulnerable to poaching

Table 1. (continued).

Country/Region	References	Type/ Method	Management Successes	Challenges
New Zealand	• Ballantine, 1995	• Network of marine reserves	• No-take areas established under purpose built legislation	• Only 0.3% marine territory protected • Opposition from fishers
Philippines	• Russ & Alcala, 1999 • White, 1986	• Large numbers of very small SMZs/MPAs • Often created autonomously	• Integrated Coastal Management (ICM) principles that incorporates local stakeholders	• Poor management • Increased fishing in areas adjacent to SMZs/MPAs • Lack of ongoing management, lack of coordination
South Africa	• Tunley, 2009	• Network of SMZs/MPAs • Partnership arrangement-Directorate of Marine and Coastal Management (MCM) and national and provincial natural resource management agencies	• Program meets multiple objectives • Collaborative management • Effective, mature evaluation methods • Purpose-built legislation • Large “No Take” zones	• Lack of capacity • Lack of resources • Lack of management plans • Low public awareness and support for MPAs
St. Lucia	• Roberts, Bohnsack, Gell, Hawkins, & Goodridge, 2001	• Network of small reserves • Mix of fishing and no-take zones	• Small successful reserves • Local partnerships (e.g., hotels) participation in resource protection	• Vulnerable to poaching

Table 1. (continued).

Country/Region	References	Type/ Method	Management Successes	Challenges
U.S. (Hawaii)	• NOAA, 2006	• Network of Marine Life Conservation Districts (MLCDs), Fish Replenishment Areas (FRAs), Fisheries Management Areas (FMAs) of different sizes • Zones with different levels of protection (no-take, temporal closures, gear restrictions)	• MLCDs sustain larger fish biomass than open-access areas • Large community involvement • Largest SMZ/MPA in U.S.	• Introduced species • Land-based sources of pollution • Poaching for aquarium trade
U.S. (south Florida)	• Waddell, 2005 • Wusinich-Mendez & Trappe, 2007	• FKNMS (network of 24 no-take zones) • Everglades National Park, Biscayne National Park, and State Parks (limited no-take regulations) • Dry Tortugas National Park (no-take Natural Research Area)	• Stakeholder involvement in planning process • Effective enforcement	• Large user base • Rapid urban development • Large influence of land-based sources of pollution

2.2 Literature Review Results

Our review of the effectiveness of SMZs/MPAs throughout the world has revealed that the majority of reports (greater than 95%) have documented some level of success of the protective measures ranging from small increases in biomass, diversity, and other indicators of stock or habitat condition to 10-fold increases in some indicators such as fish biomass in exceptional cases. These findings are consistent with previous reviews of the effectiveness of SMZs/MPAs with respect to stock indicators by Halpern (2003), Halpern and Warner (2003), and Roberts and Hawkins (2000).

The data and information contained in these reports was weighted heavily towards the impacts of SMZs/MPAs on fisheries resources (e.g., fishes, lobsters, shrimp, conch). In fact, only a limited number of studies documented the impacts of SMZs/MPAs on the status of corals and other sessile reef organisms (Keller & Donahue, 2006; Mumby et al., 2007; Oliver & Berkelmans, 2001). Although habitat protection is often an explicit goal in the development and implementation of marine reserves, monitoring programs commonly concentrate on evaluating the status of fisheries resources (e.g., change in fish biomass), and limited attention is afforded to monitoring the status of benthic resources. Exceptions to these patterns can be found in MPA programs established in areas with higher availability of financial resources (e.g., U.S., Australia) where both benthic and fisheries monitoring programs are implemented simultaneously.

Only 14 of the 304 (5%) reviewed reports stated that the goals of the established SMZs/MPAs were not met or that no significant benefits of the regulations were detected. In these studies, the reasons cited for failure were: (1) lack of compliance (e.g., poaching); (2) lack of enforcement; (3) limited stakeholder involvement; (4) errors in the design of the protected areas; and (5) lack of continuous protection. In one study, Rogers and Beets (2001) indicate that both lack of compliance and natural disturbances beyond management control (e.g., hurricanes) are responsible for the lack of success of several SMZs/MPAs in the U.S. Virgin Islands (USVI). In another report, the failure to protect grouper spawning aggregations in Florida was due to the incorrect placing of the SMZ/MPA boundaries (Eklund, McClellan, & Harper, 2000). Poaching, enabled by the lack of enforcement, was also recognized as the main factor influencing the failure of established SMZs/MPAs in a global review by Mora et al. (2006). Finally, a case study from New Zealand indicated that partial closures (i.e., no commercial fishing allowed) are an ineffective in protecting reef fish stocks when recreational and subsistence fishing are not also restricted (Denny & Babcock, 2004).

For those studies that documented the successful achievement of management and conservation goals, the factors most often cited as influencing the success are: (1) involvement of stakeholders at all stages of the design and implementation process; (2) effective legislation to enforce regulations; (3) adequate funding to enforce regulations and monitor resources; (4) implementation of adaptive management; and (5) appropriate choice of habitats and resources to protect backed by sound science.

The greatest benefit of the implementation of SMZs/MPAs worldwide has been the recovery or increase in the biomass of fisheries resources. This result is consistent with a review by Halpern (2003) of marine reserves in the United Kingdom. He reported that 90% of the 89 marine reserves had higher fish biomass than fished areas, 83% had larger-sized carnivorous fish and invertebrates, 63% had higher fish densities, and 59% had higher biodiversity than fished areas. Although the rates of biomass recovery may range from a few years (Halpern & Warner, 2002) to decades (McClanahan, Graham, Calnan, & Macneil, 2007), both partial and complete closures within SMZs/MPAs have a positive influence on fish abundance, size, biomass, and diversity. Moreover, the establishment of SMZs/MPAs can also restore the trophic structure that may have been lost due to increased fishing pressure or natural and anthropogenic disturbances (Mumby et al., 2007).

In most areas of the world, the establishment of SMZs/MPAs is targeted to protect specific high-value habitats or stocks. Examples of this include the protection of spawning grouper aggregations or the establishment of the Tortugas Ecological Reserve, which was designed to protect the diverse marine life and lush coral reefs of the Tortugas. This targeted approach emphasizes the protection of unique habitats or resources as well as the protection of resources especially vulnerable to exploitation, but often lacks replication of sites within habitats and fails to protect all habitat types within a region. In fact, the lack of basic design principles during the planning and implementation steps has been recognized as a major limitation for the success of marine reserves in the Caribbean region by Appeldoorn and Lindeman (2003). The most notable case in which a science-based systematic approach was taken to protect both unique as well as representative habitats is the system of SMZs/MPAs recently established in the Great Barrier Reef (GBR) (Day et al., 2002; Fernandes et al., 2005). In this case, efforts were made to ensure that all habitat types were protected with an adequate number of replication sites within habitats.

Our review highlighted a number of key scientific knowledge gaps that were recognized as research priorities and were partly responsible for the 5% of SMZs/MPAs lacking long-term success. Some of the most important pieces of information commonly lacking in the planning stages of the SMZ/MPA selection process is detailed information on the extent, spatial distribution, and condition of both habitats and resources. This information is crucial for the selection of both unique and representative habitats or stocks to preserve (Appeldoorn & Lindeman, 2003; Recksiek & Hinchcliff, 2002; Roberts et al., 2003a, b). Notable exceptions to this pattern of limited data availability are the GBR, the Florida Keys, and Hawaii where strong existing mapping and benthic and fisheries monitoring programs have contributed to the successful establishment of networks of SMZs/MPAs within these regions (Day et al., 2002; Waddell, 2005). A general lack of initial data on the condition of stocks has also hindered the full documentation of the effectiveness of SMZs/MPAs in less-developed regions of the world like southeast Asia and Africa (Roberts & Hawkins, 2000). Other important science and information needs highlighted in our review include: (1) expanded research to improve patterns of habitat connectivity, larval transport, recruitment, and the influence of physical oceanography on these processes; (2) expanded research on habitat-species links; and (3) further development of modeling tools to enhance understanding of existing SMZs/MPAs and predict long-term impacts of closures.

The size of marine reserves is an issue that is commonly discussed in reviews of SMZs/MPAs throughout the world, and this discussion is often presented as a trade-off between the benefits of a single large or several small reserves (Carr et al., 2003; Halpern & Warner, 2003). The size of the SMZs/MPAs included in our review ranged from very small 0.03 km^2 in St. Lucia (Roberts & Hawkins, 1997) to some of the largest SMZs/MPAs in the world such as the network of reserves in the GBR (Fernandes et al., 2005) and those within the FKNMS and the Dry Tortugas National Park (NOAA, 2000; 2005b). Although the size of particular SMZs/MPAs is clearly a significant issue and large marine reserves may be needed to reach certain management goals, even the smallest SMZs/MPAs have been shown to offer some level of protection for depleted resources under high levels of exploitation (Halpern, 2003). This review indicates that practical considerations (e.g., funding levels, enforcement resources, compliance levels) often limit the size of the reserves that can be successfully established and managed, and that the size of reserves is commonly decided on a case-by-case basis, based on the resources available and the management priorities. Nevertheless, a report by the National Research Council (2001) suggests that networks of intermediate-sized reserves (10–100 km^2) will be more effective than

fewer, larger reserves, particularly if the networks include a variety of representative habitats.

Although the size of individual SMZs/MPAs, the minimum percentage of habitats to be protected, and the type of protection (i.e., partial closures, multiple uses, no-take) needed to optimize conservation objectives for both habitats and resources are still being discussed (Gell & Roberts, 2003; Roberts et al. 2003a, b), the advantages of establishing SMZs/MPAs as a closely linked network of sites that include all the habitats essential to the developmental life stages of the resources has been identified as a priority (Halpern & Warner, 2003). The success of networks of SMZs/MPAs in different parts of the world highlights the value of this approach (Agardy, 1994; Roberts & Hawkins, 2000). In southeast Florida, offshore and inshore reefs, hardbottom, seagrass beds, mangroves, and sandy habitats have all been identified as essential habitats that need to be included in management plans to provide full protection for the different developmental life stages of reef fishes (Ault, Bohnsack, Smith, & Luo, 2005; Lindeman, 1997).

Previous reviews on the design of SMZ/MPA networks indicate that the spacing or distance between sites should ideally be based on factors like the habitat requirements of the organisms to be protected, the hydrodynamic connectivity among sites (e.g., currents), the migratory characteristics of mobile fauna, and dispersal characteristics of organisms (Palumbi, 2003; Roberts et al., 2003a, b).

An important qualification of our literature review summary is that these studies use different methods to assess the effectiveness of the SMZs/MPAs in protecting their resources. The meta-analyses and interpretation of SMZ/MPA data is problematic because of the inconsistent methods used by the different studies (McClanahan et al., 2007).

2.3 Case Study: Effects of Marine Zoning on Benthic and Fisheries Resources of the Florida Keys National Marine Sanctuary

In 1997, the management plan of the FKNMS created a network of 24 fully protected zones (sanctuary preservation areas; SPAs) where extractive and consumptive activities are prohibited. In addition, the Tortugas Ecological Reserve was implemented in 2001, increasing the amount of coral reef habitat within no-take zones to 10% of the reef habitats in the FKNMS (NOAA, 2000; 2005a). In addition to implementing protected zones, a monitoring program was developed to determine effects of the protection measures on exploited fish, invertebrates, and benthic communities. Data on the abundance and size of fishes, spiny lobster, queen conch, algal

cover, and coral cover, diversity, and recruitment are collected on a regular basis from fully protected zones and adjacent non-protected reference sites (Keller & Donahue, 2006).

One year after the establishment of the SPAs within the FKNMS, the mean densities of exploited species in the no-take sites were the highest observed in the region for yellowtail snapper, groupers, and hogfish, and the second highest for gray snapper compared to the 9-year period prior to the implementation of the SPAs (Bohnsack et al., 1999). Similarly, surveys of reef-fish populations 3 years after the 2001 implementation of the no-take Tortugas Ecological Reserve in the Dry Tortugas found evidence for increased fish size, abundance, and distribution suggesting that no-take marine reserves can contribute to building sustainable fisheries in Florida (Ault et al., 2006). Some of the key findings of this study included: (1) no declines in the abundance of exploited fish species within the reserve and in the surrounding, non-protected areas; (2) significantly greater abundance and increased length for some fish species like black grouper in the national park and the reserve; (3) a higher proportion of larger, longer individuals within the reserve and no change in length in non-protected, fished areas; and (4) increases in the occurrence and abundance of mutton snapper throughout the SPAs and in the surrounding, non-protected areas.

An ecosystem report card was compiled containing information on the status of benthic habitats and fisheries resources within the FKNMS for the 5 years after implementation of marine zoning in 1997 (Keller & Donahue, 2006). The main findings in this report were:

- There was an increase in the mean size of lobsters (mean size of male lobsters had increased 10 mm in 5 years) and in the percentage of legal-sized lobsters in the Western Sambo Ecological Reserve (WSER) compared to non-protected reference areas in the FKNMS (Cox, Jue, Darcy, & Hunt, 2003). Moreover, almost twice as many lobsters were found inside three no-take ecological reserves (Eastern Sambo, Western Sambo, Looe Key) than in non-protected reference sites (Cox, 2006). Similarly, catch rates of lobsters in traps were higher within WSER than in two adjacent non-protected areas (Gregory, 2003).

- Significant increases in density were documented for several exploited reef-fish species (e.g., gray snapper, yellowtail snapper, black grouper) in the no-take zones established in 1997 compared to the non-protected, reference sites (Bohnsack et al., 2003; 2006). Mean densities of gray snapper, combined grouper

species, and yellowtail snapper were greater in no-take zones than in non-protected, reference sites.

- A survey of reef fish species richness conducted at pairs of protected, no-take and non-protected, reference sites showed that in 12 of the 16 paired sites, species richness was greater in the protected, no-take sites and the abundance of fish species increased more in protected, no-take zones than in non-protected, reference sites (REEF, 2003; 2006).

- In contrast, no significant differences in patterns of mortality, recruitment, cover, or abundance were observed for fish, lobsters, and benthic species such as corals and sponges within the protected, no-take areas possibly due to the short period since implementation of the FKNMS zoning plan and the high variability of these parameters among sites (Aronson, Miller, Smith, Murdoch, & Ogden, 2003; Ogden, Aronson, Miller, Smith, & Murdoch, 2002; Smith, Aronson, Murdoch, & Ogden, 2006). Similarly, no significant differences in queen conch population density, abundance, and aggregation size have been detected between protected, no-take and non-protected, reference sites (Glazer & Delgado, 2003; 2006).

- Additionally, the displacement of commercial fishers from the Western Sambo Ecological Reserve did not cause short-term financial losses (Murray, Shivlani, & Leeworthy, 2002).

In summary, after 5 years of marine zoning, the 24 fully protected marine zones of the FKNMS have yielded some encouraging initial results. Patterns of fish abundance, distribution, and size, as well as patterns of lobster size and abundance were greater in the protected, no-take zones than in similar non-protected habitats. In contrast, benthic attributes (e.g., coral abundance, condition, recruitment), which may take longer to respond to changes in management strategies, have shown high variability among sites and no significant patterns with respect to protection levels.

After the release of the FKNMS Draft Management Plan (NOAA, 1995) but before the release of the FKNMS Final Management Plan (NOAA, 1996), a survey of the Florida Keys commercial fishers' perceptions and attitudes about the plan was conducted by Milton, Suman, Shivlani, and Cochran (1997). Of the 337 commercial fishers interviewed, 82.4% did not believe that commercially important fish species (spiny lobster, stone crab, shrimp, and reef fish) would increase in areas surrounding the protected reserves and that the overall effect of the reserves on specific fish stocks

within the Florida Keys would be insignificant. In addition, the commercial fishers' believed that commercial and recreational fishers would not benefit from the reserve. According to commercial fishers, recreational divers were perceived as the primary beneficiaries of SMZs/MPAs. The commercial fishers did not believe that the proposed reserves would have a long-term positive economic benefit. At that time, over 75% of the commercial fishers who responded to the survey stated that they did not support the establishment of the FKNMS, and a large majority viewed the proposed SMZs/MPAs as ineffective for reducing user conflicts and for restoring coral reefs. Based on the survey there were marked differences between the expectations of commercial fishers and of SMZ/MPA advocates.

3 Criteria Useful for Zoning Reef Resources

3.1 Introduction

The purpose of this task (Task 2) was to identify criteria useful for zoning reef resources for representative or unique areas that are applicable to southeast Florida. The following steps were completed:

1) Identify criteria used to develop special management zones;

2) Utilize data to inform stakeholders and solicit input criteria and any additional criteria they may propose;

3) Develop a summary of the criteria identified as useful in zoning reef resources, specifically keeping in mind relevance to southeast Florida, the methodology, and conclusions with a discussion of implications.

3.2 Methods

The implementation of this task (Task 2) relied on the information obtained through the literature review in Task 1 as well as through an online survey (Appendix A) of resource managers. The interviewed resource managers were involved in developing zoning plans and/or managing MPAs in various regions of the world. The format and content of the survey was agreed upon by the FDOU Project 23 Team before the survey was posted on the FAU-CES website with a link on the SEFCRI website.

A list of current and former MPA managers was obtained through a contact provided by the FDOU Project Coordinator. A total of 262 managers and former managers were contacted via email. In addition, on November 1, 2006, an announcement (Appendix B) was posted on NOAA's coral listserver (coral-list@coral.aoml.noaa.gov) to alert and encourage current and former MPA managers to participate in the survey. A total of 17 marine resource managers (a 6.5% response rate) completed the survey.

3.3 Results

The success of SMZs/MPAs is commonly based on the successful implementation of multiple management criteria. Stevens, Jones, Howell, and Mee (2006) reviewed established SMZs/MPAs worldwide and grouped important management criteria into three areas: (1) planning and technical processes; (2) governance structures and processes; and (3) effectiveness of management. The review revealed that SMZ/MPA models generally perform well through the planning and technical stages,

but that their management success is hindered by failures in administration and governance and by a lack of acceptance and support on the part of local users. The most effective SMZ/MPA models were found to be those that: (1) use structured and quantitative approaches to SMZ/MPA design; (2) have an effective legislative base; (3) have a visible continuous management presence; and (4) have significant stakeholder involvement both in the planning and governance stages (Stevens et al., 2006).

Governance principles that recognize the values, concerns, knowledge, and customs of stakeholders and engage stakeholders throughout the SMZ/MPA planning and implementation process have been particularly effective in the success of SMZs/MPAs (Jones, 2002). Although no single governance strategy can be effective for the management of all SMZs/MPAs because of the wide range of social, economical, ecological, cultural, and political factors specific to each particular site, a successful SMZ/MPA governance system should generally consider: (1) significant involvement of diverse stakeholders in the decision-making processes; (2) development of a management structure that incorporates facilitation, decision-making, and conflict management arrangements; (3) a system that takes into account and manages uncertainty; (4) a system that promotes economic and socio-cultural development opportunities; and (5) a system that promotes institutional sustainability and is based on effective legislation (Stevens et al., 2006).

Kelleher, Bleakley, and Wells (1995) reviewed information from 1,306 SMZ/MPAs from different areas of the world and concluded that data on the management effectiveness are very limited due to a general lack of appropriate evaluation tools. For the regions where data were available (383 out of 1,306 SMZ/MPAs), management effectiveness was ranked from low to high. For those sites where the effectiveness of management was considered low (29% of 383 sites), none of the management objectives were met. For those SMZ/MPA sites with moderate levels of management effectiveness, the management objectives were partially met (40% of 383 sites). For those sites with high levels of management effectiveness (31% of 383 sites), all of the management objectives were achieved (Kelleher et al., 1995).

These results were similar to those reported by Appeldoorn and Lindeman (2003) who concluded that only 16% of SMZs/MPAs within the Caribbean region had high levels of compliance. The main issues responsible for the lack of management effectiveness included: (1) insufficient financial and technical resources to implement management plans; (2) a lack of enforcement, monitoring, and research tools to support

management decisions; (3) lack of stakeholder support; (4) impacts from activities (e.g., pollution, over-exploitation) in areas outside the boundaries of SMZs/MPAs; and (5) lack of coordination among agencies with responsibilities relevant to SMZs/MPAs (Kelleher et al., 1995). The lack of practical assessment tools to determine the effectiveness of a protected zone is of particular concern. If an SMZ/MPA is failing to fulfill its objectives and the failure is not detected in time, managers and stakeholders may have a false sense of security that may lead to the decline of resources protected by the SMZs/MPAs and erode future support for local or regional SMZs/MPAs (Jones, 2002; Murray et al., 1999).

The MPA managers who responded to the online survey as part of Task 2 provided additional insight into what has worked in the development of SMZs/MPAs, issues that have arisen, and what approaches seemed to be more successful. The information provided by the MPA respondents generally agrees with what was reported in the literature review and will be valuable in the development of a potential marine zoning area for southeast Florida.

3.3.1 MPA Managers' Backgrounds

Fifty-nine percent (59%) of the 17 respondents have been involved in the development of an MPA/SMZ in the U.S. (Washington, Oregon, and Florida). The respondents currently manage or have managed a wide range of marine resources (humpback whales; marine, terrestrial, and estuarine ecosystems; submerged cultural resources; commercial fishery resources), habitats (e.g., coastal zone coral reefs, seagrass beds, beaches, mangroves, shallow bays with seagrass beds), activities (fishing, boating, diving, and harvesting), and types of MPAs/SMZs (aquatic preserves, national estuarine research reserves, MPAs, national marine sanctuaries (NMSs), and national parks).

Thirty-five percent (35%) of the respondents have served as Resource/Marine Protected Area Managers for less than 5 years and 24% have served for 5 to 10 years. The largest number of respondents (41%) served as managers of marine resources for more than 10 years.

The respondents served as managers in a variety of locations within U.S. states and territories and other countries. SMZs/MPAs represented in the survey include:

- Grenada – St. George's Grand Mal Marine Protected Area
- Mexico – Puerto Morelos Reef National Park
- Florida – Florida Keys National Marine Sanctuary

- Florida – Biscayne Bay Aquatic Preserve
- Florida – John Pennekamp Coral Reef State Park
- Washington – Ft. Casey State Park
- Oregon – South Slough National Estuarine Research Reserve
- Alaska – Glacier Bay National Park and Preserve

3.3.2 Criteria for Zoning Reef Resources

The survey questions dealt with SMZ/MPA establishment and development issues (Appendix A). More specifically, the SMZ/MPA managers were asked about success factors, issues to avoid, establishment issues, and development tools. This section summarizes the information provided by the survey respondents.

3.3.2.1 Issues Important to Establishment

The SMZ/MPA managers surveyed listed five factors important in the establishment of an SMZ/MPA: (1) boundaries; (2) size of individual zones; (3) number of zones; (4) conditions for zoning for multiple users; and (5) no-take or exclusionary areas. For each of these factors, a list of issues was provided by the respondents, as shown below.

3.3.2.2 Boundaries

Well-defined boundaries were identified as the most important factor in establishing SMZs/MPAs. The respondents indicated that the boundaries should be biologically meaningful, large enough to cover the resources being protected, and include sufficient buffer zones. They should have visible landmarks that clearly define the boundaries of the SMZ/MPA. The boundaries should also allow for ease of protection and enforcement and should reflect the goals and objectives of the SMZ/MPA. They further added that the boundaries should also be decided with stakeholders input and based on social values and economic importance, while considering budgetary and financial constraints.

3.3.2.3 Size of Individual Zones

Managers agreed that the size of individual protected/managed zones depends on the particular site/habitat to be protected. The factors to consider should include the following:

- Management goals and objectives
- Stakeholder and community acceptance
- Biological and ecological indicators and ecosystem dynamics
- Identification of natural resources and biodiversity to be protected

- Resource location (visible and buried components of resource)
- Historical and current use of the resources
- Resource density and use type for each resource
- Economic activities

3.3.2.4 Number of Zones Necessary for a Successful SMZ/MPA

In addition to the management goals and objectives, the respondents identified a number of important factors for determining the number of zones for successful SMZs/MPAs. The biological diversity, conditions of the resources, and the types of resource used were important factors in determining the number of zones. To help protect resources' development throughout the different life stages, the zones should include areas for all phases of the life cycles of the key protected species (i.e., spawning, juvenile, and adult habitats). According to the respondents, the resources will be affected by the number of users, the type of usage (e.g., fishing, diving, boating), and the cumulative effects of multiple uses in a particular area.

3.3.2.5 Conditions for Zoning for Multiple Uses

The existing conditions of the resources, the number of users exploiting these resources, and potential conflicts which might arise from multiple users were important factors to consider when evaluating multiple uses within SMZs/MPAs. Historical use, the impact of future uses, and the socio-economic characteristics of the area were also mentioned as being important. To create the best conditions within multiple-use SMZs/MPAs, managers felt the zoned areas should be surrounded by buffer zones to protect the resources within the core areas.

3.3.2.6 No-take or Exclusionary Areas

Although the managers reported that the implementation of no-take or exclusionary areas can be the most effective way to restore a depleted resource, these areas should only be designated in certain circumstances. For example, no-take or exclusionary areas would be appropriate tools to protect species in cases where over-exploitation has been documented. No-take areas also provide habitat protection for resource restoration (e.g., spawning, breeding, nesting sites). The number of species present, level of use, dependence by people, and migration of key species are also major factors in determining the suitability of implementing no-take areas. When evaluating the establishment of no-take or exclusionary areas it is important to assess the concentration of species of concern and to identify

credible threats to species that can be remedied directly by the management exclusions.

3.3.2.7 Issues Important to Successful SMZ/MPA Management

The majority of the managers considered research and work conducted in other parts of the world when establishing their SMZs/MPAs. While working on developing SMZs/MPAs, the managers identified several key factors for success. These factors included agreed-upon management goals and objectives, the legal authority of the SMZs/MPAs to prohibit or reduce illegal activities, and the ability to enforce regulations. In addition, the managers cited the need to have adequate staffing and financial resources to meet SMZs/MPAs management objectives. They also believe that the recovery and stabilization of resources within the managed area depend on: (1) limiting disturbances and destructive activities, and (2) the sizes of SMZs/MPAs.

Marine managers were asked to choose important SMZ/MPA success criteria. Each manager could choose more than one success criterion. The seven most frequently selected factors are presented in Figure 5.

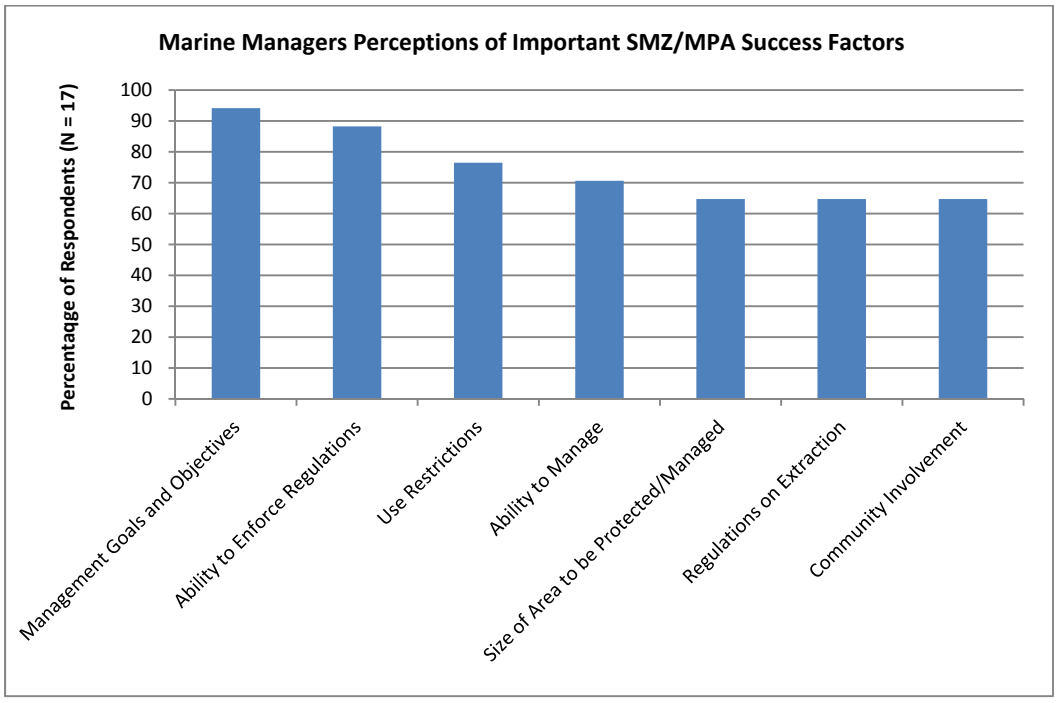


Figure 5. Percentage of marine managers' selection of specific SMZ/MPA success factors.

Managers also believe that the establishment of successful SMZs/MPAs requires the implementation of specific programs and services to enhance

the protection of the marine resources. Such programs and services include:

- Involving stakeholders and government agencies in the development of the SMZ/MPA objectives and management plan
- Providing capacity building activities or assistance to community members, government personnel, and scientific advisors to understand the issue of marine resources protection
- Creating an advisory council, and public support or volunteer (steward) groups
- Implementing public awareness programs with stakeholder participation
- Collecting baseline data on existing marine resources (e.g., fisheries, benthic organisms)
- Scientific monitoring to determine if SMZs/MPAs goals are being met
- Maintaining a continuous dialogue among managing agencies, stakeholders, and the general public to resolve SMZs/MPAs issues
- Providing consistent information to stakeholders about why marine resources in the SMZs/MPAs should be protected

3.3.2.8 Issues Detrimental to Successful Management

Four major issues were identified as detrimental to the success of SMZs/MPAs: (1) poor communication with the stakeholders and a lack of stakeholder involvement in the decision-making process; (2) lack of full management control by the managing authority to implement and enforce the management plan; (3) concessions to opposition groups before and after the implementation; and (4) a lack of enforceable rules and regulations due to lack of capacity.

3.3.3 Southeast Florida SMZ/MPA Design

The managers were asked to provide their opinions on what they believe are the most effective SMZs/MPAs designs for southeast Florida. Forty-one percent (41%) of the respondents identified a network of SMZs/MPAs as being the most effective design rather than using individual small or large areas. The major criteria to consider in the establishment of SMZs/MPAs in southeast Florida were the ability to enforce regulations that would maintain successful SMZs/MPAs, promote stakeholder awareness of the regulations of the SMZs/MPAs, and implement successful outreach/education programs.

Different stakeholders will react differently to the creation of SMZs/MPAs. Based on past experiences, the managers expect stakeholders to react to the creation of SMZs/MPAs in the following ways:

- Decision makers will be divided, some supporting, some not.
- Environmentalists, educators, and tourists will provide sustained support.
- Users (recreational and commercial) will first challenge the creation of SMZs/MPAs but eventually will be supportive.

Opposition and challenges to the establishment of SMZs/MPAs can be minimized by creating an atmosphere of community buy-in and with stakeholder involvement. Thus, it is important to involve stakeholders early in the process and to seek their input directly via forums, focus groups, and other means.

3.4 Discussion

Although responses from the marine resource managers are qualitative, they provide important insights into the establishment and management of successful SMZs/MPAs. The goals and objectives of the management plan are major factors that define SMZ/MPA purposes and strategies. According to the managers surveyed, multiple zones might be the best solution for managing the marine resources in southeast Florida. The sizes of the areas to be protected are important because smaller areas facilitate enforcement of the regulations and the ability of staff to manage the resources. Thus, the ability of agencies to enforce rules and regulations and to manage marine resource use is critical to the success of SMZs/MPAs.

Stakeholder involvement from the beginning of the process of establishing a new SMZ/MPA is vital for the acceptance, support and success of SMZs/MPAs. To accomplish this, public outreach and involvement should be included in all phases of the SMZs/MPAs (i.e., planning, creation, establishment, and maintenance). In order to maintain community buy-in, stakeholders should be kept well informed of issues that may inhibit or promote the success of their SMZs/MPAs.

It is important to provide simple yet clearly defined boundaries, with an adequate number of zones based upon the goals of resource protection and SMZ/MPA size to establish successful SMZs/MPAs. The status of the marine resources and the goals of resource protection will determine whether or not it is necessary to have no-take or exclusionary zones. How

the SMZ/MPA should be designed and regulated should be based on strategies and tools that have yielded positive results elsewhere.

Methods and tools for designing and establishing SMZs/MPAs are becoming increasingly sophisticated in their ability to optimize management solutions for diverse social and cultural contexts. SMZ/MPA establishment can benefit from many of the latest technologically advanced methods of positioning and mapping, such as Global Positioning System/Geographic Information System (GPS/GIS), Light Detection and Ranging (LIDAR), List Alternate Data Streams (LADS), and aerial photography. These tools contribute to highly informative bathymetric, benthic, and digitized maps of resources.

The establishment of SMZs/MPAs is aided by scientific, historical, and current information. Understanding the issues (e.g., stakeholders' desires, shipping lanes, and ocean exploration) is vital. Coral reef assessments, fisheries data, other uses data (e.g., diving, snorkeling), and human population dynamics all have an influence on the establishment of SMZs/MPAs. Finally, the major challenge in implementing and ensuring the long-term success of SMZs/MPAs is to obtain decision-makers' funding and stakeholders' support.

4 Stakeholders' Perceptions of Areas Needing Different Management

4.1 Introduction

The purpose of this task (Task 3) was to identify representative or unique areas of the southeast Florida reef tract that would benefit from enhanced management through local input in order to develop zoning alternative by county. To identify these areas, information was collected from local commercial and recreational marine resource users (also referred to in this document as stakeholders) about the sites they visit and their perceptions of marine resource management. A stakeholder survey was developed in collaboration with members of the FDOU Project 23 Team and Project Coordinator and captured information about the following:

1. Are there unique areas or specific reefs representative of southeast Florida reef tract that need different management?
2. How do stakeholders of southeast Florida marine resources choose which areas to visit?
3. Have stakeholders changed which southeast Florida reef locations they visit?
4. If stakeholders have changed reef locations, why and how long ago?

The collected data will assist in identifying unique areas in southeast Florida with potential for marine zoning alternatives.

4.2 Methods

4.2.1 Survey Development and Identification of Stakeholders

The SEFCRI FDOU Project 23 Team assisted with the development of a survey for commercial and recreational reef resource users. After approval of the survey instrument (Appendix C) by the SEFCRI FDOU Team, it was reviewed and approved by FAU's Institutional Review Board.

Specifically targeted populations of recreational and commercial reef users within the southeast Florida region were selected to receive the stakeholders' survey. The primary stakeholder groups to be surveyed were commercial fishers, recreational fishers, charter boat fishers, recreational boaters, commercial divers, commercial dive operators, recreational divers, and recreational snorkelers. A stratified random sampling design was developed for contacting recreational fishers using county of residence as described in section 4.2.2: Survey Implementation.

The methods used to identify and contact the targeted stakeholders are summarized below.

- Commercial Fishers: License records for commercial fishers registered within the southeast Florida region were obtained from an FWC database which includes a total of 1,560 registered commercial fishers. All commercial fishers were mailed postcards (Appendix D) which described the survey and requested them to complete the online survey.

- Recreational Fishers: License information of all registered recreational fishers within the southeast Florida region was obtained from the FWC database. A total of 87,676 licensed recreational fishers were registered in the southeast Florida region in 2006. Postcards (Appendix D) were mailed to a subsample of 2,500 or 0.28% of the licensed recreational fishers. The postcard had a link to the survey website and requested them to complete the online survey.

- Charter Boat Fishers: A list of licensed charter boat fishers within the southeast Florida region was obtained from the FWC database. One hundred and ten (110) charter boat fishers were identified. All were mailed survey postcards (Appendix D) asking them to participate in the online survey.

- Recreational Boaters, Recreational Snorkelers, Other Recreational Users (i.e., surfers, kitesurfers, and kayakers): The FAU-CES team conducted intercept surveys at nine (9) boat ramps in the southeast Florida region to survey these marine resource users (Table 2).

- Recreational and Commercial Divers: Efforts were made to reach recreational and commercial divers through dive shops located in the southeast Florida region. A total of 67 dive shops were identified through internet and phone book research. After calling the shops, 48 individual dive shops were visited. The FAU-CES team also conducted intercept surveys at four (4) dive shops in Broward County (Table 3).

Table 2. Boat ramp intercept survey locations used to contact recreational marine resource users by southeast Florida county.

County / Location	Number of Surveys	Dates of 2006 Surveys
Martin County	**37**	
Jensen Beach Causeway	37	09/21, 09/22, 09/29
Palm Beach County	**19**	
Silver Palm Park	17	09/15, 09/29
Jupiter (Egret's Landing)	2	09/22
Broward County	**33**	
15th Street Boat Ramps	4	09/14
John U. Lloyd State Park	18	09/14, 09/15
Lantana/Boynton Inlet	11	09/21
Miami-Dade County	**42**	
Haulover Park	19	09/14, 09/15, 09/22
Pelican Harbor Marina Boat Ramp	15	09/29
Legion Memorial Park	8	09/21
Total	**131**	

Table 3. Broward County dive shop intercept survey locations used to contact recreational marine resource users.

Broward County Dive Shops	Number of Surveys	Dates of 2006 Surveys
Scuba Network	9	09/21
Island Water Sports	10	09/22
Lighthouse Dive	9	09/29
Dixie Divers	2	09/28
Total	**30**	

4.2.2 Survey Implementation

The three different approaches used to contact the sample population are described below.

- **Online Survey:** The survey was made available online at a website hosted by FAU-CES. Upon entering the site, the respondents were given a brief description of the project, its goals and objectives, and then directed to the survey. The survey remained online for a 5-month period from October 2006 to March 2007. The survey was advertised through the following methods:

- **Postcards:** Postcards, which included a description of the project, its objectives, and a link to the online survey, were mailed to 4,170 stakeholders from the target user groups. The postcard describing the survey is shown in Appendix D. Postcards were mailed to all the commercial fishers (1,560) and charter boat fishers (110) listed in the southeast Florida region (Table 4) and a sub-sample of 2,500 registered recreational fishers (Table 5). The 2,500 sample size for recreational fishers was determined based on the goal of mailing a total of 4,000 to 4,500 postcards to all stakeholder groups.

Table 4 Number of postcards mailed to commercial and charter boat fishers by southeast Florida county.

County	Commercial Fishers	Charter Boat Fishers
Martin	173	8
Palm Beach	456	38
Broward	273	36
Miami-Dade	658	28
Total	**1,560**	**110**

To determine the number of recreational fishers to target from each county, the percentage of recreational fishers within each county was calculated based on the total number of recreational fishers within the southeast Florida region. This proportion was used to calculate how many fishers would be targeted for each county (Table 5). The sub-samples of recreational fishers selected for each county were chosen randomly. In addition to the 4,170 postcards mailed, 200 postcards were handed out during the intercept surveying periods to those individuals who did not wish to complete the survey at that time.

Table 5. Number of postcards mailed to a subsample of recreational fishers by southeast Florida county.

County	Recreational Fishers	% of Total	Mailed
Martin	9,180	10	250
Palm Beach	24,436	29	700
Broward	23,833	27	675
Miami-Dade	30,227	34	875
Total	**87,676**	**100**	**2,500**

- **Web-based Advertising:** Two web banners were created and posted on the *Florida Sportsman* website, (http://floridasportsman.com/), a popular fishing magazine in an effort to contact more users and advertise the online survey. In order to avoid participation from individuals outside the southeast Florida region, the banners only appeared when accessed by an Internet Protocol address registered in southeast Florida between February 12, 2007 and March 5, 2007. An announcement was also made to members of the SEFCRI email distribution list to inform them the survey was available online. The banners are shown in Appendix G.

- **Intercept Surveys:** To reach a wide array of marine resource users, in-person surveys were conducted during three weekends in September 2006 at boat ramps and dive shops located in the southeast Florida region which were judged by the FAU-CES team to be most active. The survey periods were typically from 8 am to 5 pm. Students were trained in the implementation of the survey by FAU faculty and were certified through the FAU Division of Sponsored Research as qualified to conduct research with human subjects. Stakeholders were approached at the boat ramps and were asked if they would like to participate in the survey. If the answer was yes, they were given a brief explanation about the survey's purpose. The student then proceeded to ask the survey questions and record the respondent's answers. Reef users not interested in taking the survey were given a postcard (Appendix D) with information regarding the project, including the website link, and encouraged to take the survey online. The locations, dates, and number of surveys completed are summarized in Table 2. Weather conditions influenced the success of conducting intercept surveys because on sunny days stakeholders were less willing to answer the survey questions and on cloudy/windy days there were fewer stakeholders at boat ramps. Information on weather conditions is provided in Appendix E.

- **Dive Shop Solicitation:** The FAU-CES team compiled a list of dive shops within the southeast Florida region. All 67 shops were contacted by phone to determine if they would be willing to post fliers and/or hand out postcards to their patrons. Forty-eight (48) shops agreed to cooperate and were visited in person. Twenty-six (26) of these shops agreed to post and distribute the postcards. Some dive shops also agreed to disseminate the survey through emails to their patrons. A summary of the dive shops visited by

county is included in Appendix F. Surveys were conducted by the team at 4 dive shops in Broward County (Table 3).

4.2.3 Data Analysis

The objective of the survey was to identify representative or unique areas needing alternative management. The data collected were analyzed as follows:

1. Respondents' demographics were analyzed using frequency of responses.
2. Respondents' use of representative or unique areas were compared using frequency of responses.
3. Specific activities were reported using rating scores and frequency of responses.

4.3 Results

A total of 298 surveys were completed and returned: 161 were completed via intercept surveys and 137 were completed online. Of the 4,370 postcards mailed or handed out, the 137 online responses represent a 3.14% return. Of the 161 intercept surveys, 131 surveys were completed during the boat ramp intercepts and another 30 surveys were completed during the dive shop visits. The total of 298 completed surveys was fewer than anticipated in spite of repeated efforts and follow-up activities. Due to the small sample size, results should be interpreted cautiously.

4.3.1 Respondent Demographics

Information regarding the Florida residency status, age group, and ethnicity was collected to determine the demographics of the respondents. Of the 298 respondents, 87.2% (260 respondents) indicated that they were residents in one of the southeast Florida counties (Martin, Palm Beach, Broward, or Miami-Dade) and the remaining 12.8% (38 respondents) were from outside the 4-county southeast Florida area (Figure 6).

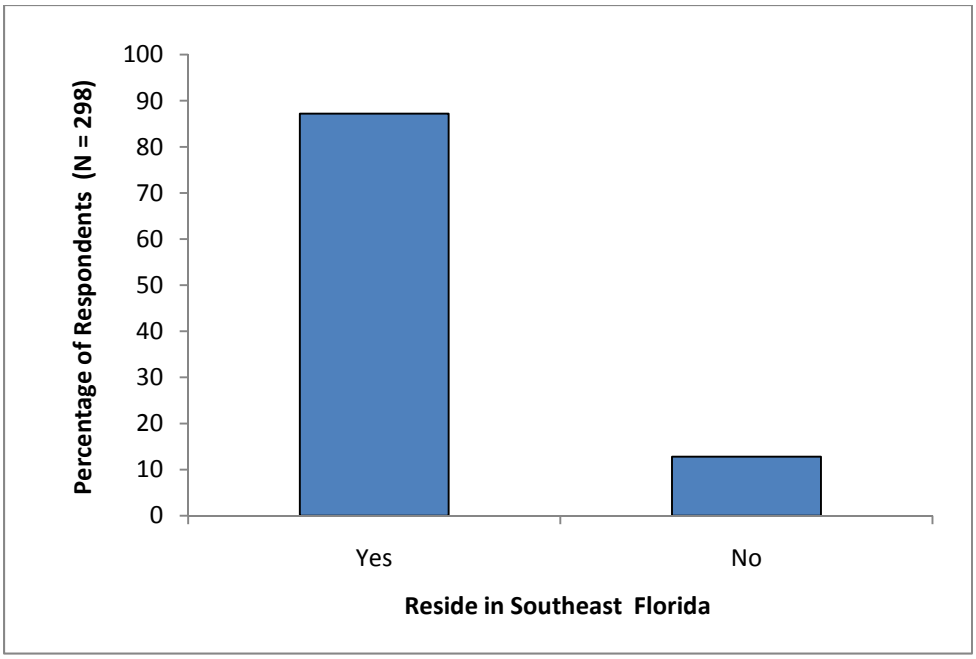


Figure 6. Percentage of respondents who reside in southeast Florida (Martin, Palm Beach, Broward, or Miami-Dade counties).

Of the 260 respondents who are residents of the southeast Florida area, 97.3% are year-round residents, 2.3% consider themselves seasonal residents, (Figure 7) and 1 individual (0.4%) did not answer this question.

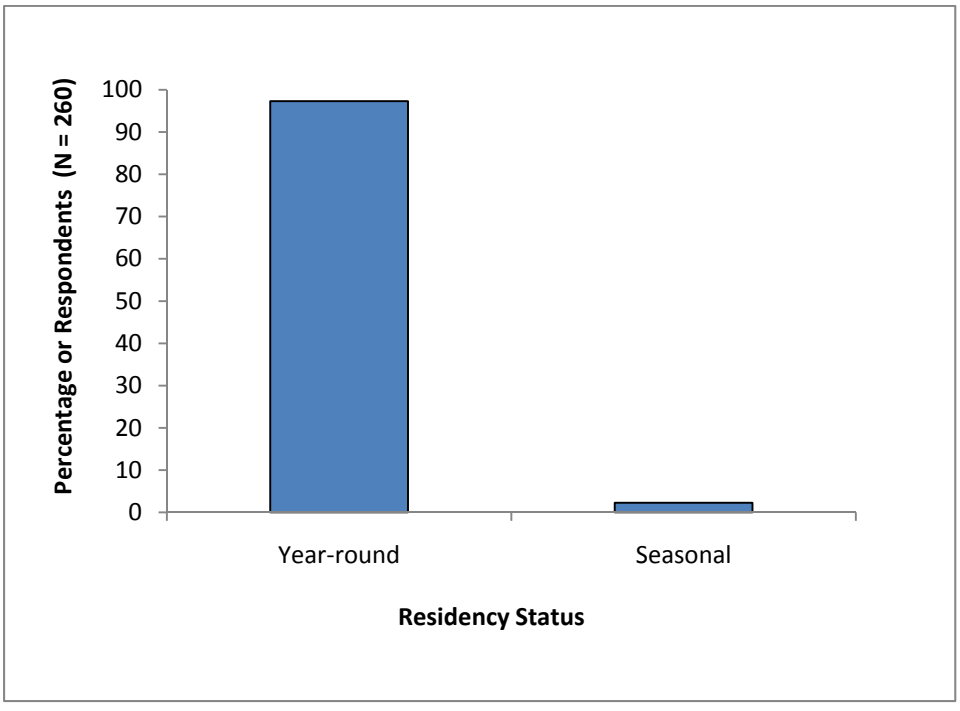


Figure 7. Percentage of southeast Florida respondents who are either year-round or seasonal residents.

Most of the 260 southeast Florida respondents reside in Broward and Palm Beach counties, 32.2% and 28.9%, respectively (Figure 8). The proportion of Martin and Palm Beach county respondents were 4 and 1.5 times higher, respectively, than the actual county populations. The proportion of respondents in Broward County (37%) was similar to the actual distribution of the county's population (31.5%) (Fedstats, 2007). The proportion of Miami-Dade County respondents was less than half of the actual population (Figure 7). According to the 2007 Federal Statistics, the actual population distribution in the southeast Florida region is 2.5% in Martin County, 22.8% in Palm Beach County, 31.5% in Broward County, and 43.2% in Miami-Dade County.

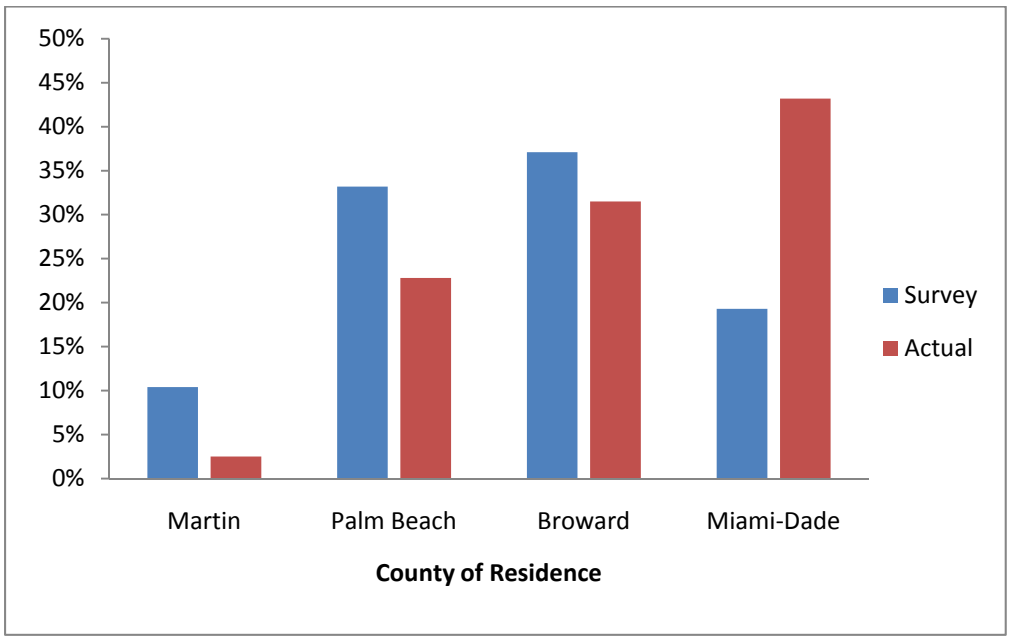


Figure 8. Comparison of the actual vs. survey population percentage in Martin, Palm Beach, Broward, and Miami-Dade counties.

4.3.1.1 User Groups

The respondents categorized themselves into user groups based on their primary activities along the southeast Florida coast. Respondents could select more than one user group activity. The majority of responses (92%) were for recreational activities: 29% recreational fishers, 21% recreational divers, 17% recreational boaters, 15% recreational snorkelers, and 10% other recreational users (e.g., surfers, kitesurfers, and kayakers). The remaining responses (8%) were for non-recreational activities: 3% charter boat fishers, 2% commercial dive operators, 1% commercial fishers, and 2% commercial divers (Figure 9). Because respondents could select more than one user group activity, many respondents selected both recreational

and non-recreational activities. For example, for those respondents selecting the commercial fishing activity, more than 50% also selected recreational fishing and recreational diving activities.

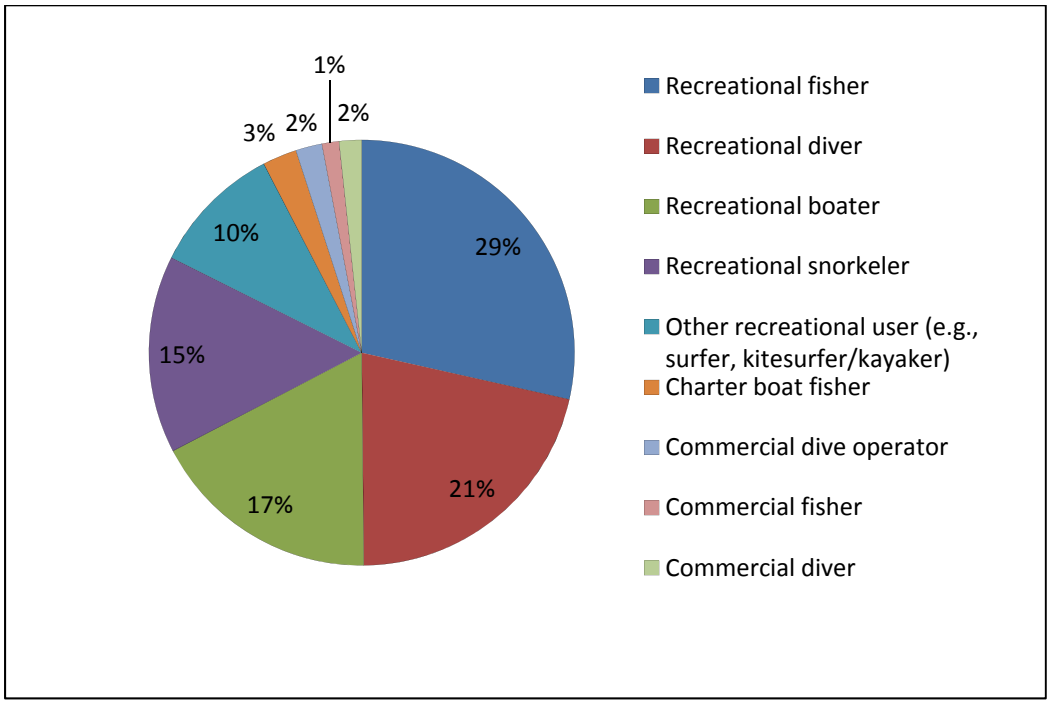


Figure 9. Percentage of responses for each user group activity.

As described in Section 4.2.1, three groups of stakeholders were identified for this survey: licensed recreational fishers, licensed commercial fishers, and licensed charter boat fishers. Of the 87,676 licensed recreational fishers, 173 (0.2%) completed the survey. For commercial fishers, 8 individuals (0.5%) of 1,560 licensed commercial fishers completed the survey. Over 15% (16 individuals) of the 110 licensed charter boat fishers completed the survey.

4.3.1.2 Age Groups

A wide range of age groups is represented by the survey respondents. The majority of respondents were from 18 to 50 years of age and accounted for 74% of the sample. Of the remaining respondents, 76 (25.5%) were over 50 years of age and 1 individual was less than 18 years of age (Figure 10).

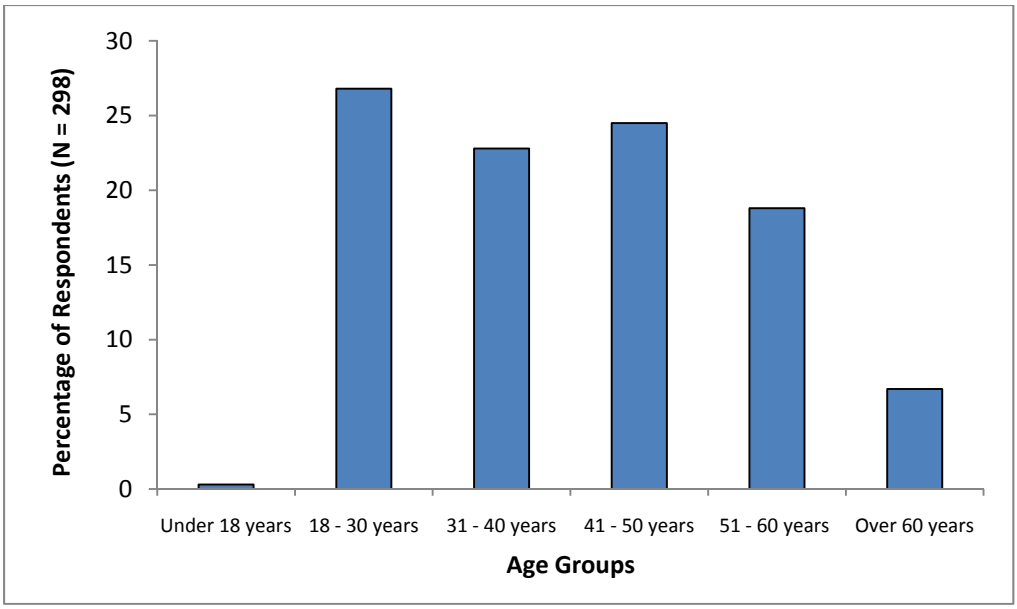


Figure 10. Percentage of respondents by age group.

4.3.1.3 Ethnicity

Caucasian/White respondents accounted for 77% of the surveys, whereas Hispanics represented 17% of the respondents (Figure 11). The remaining respondents identified their ethnicity as African-American (7 respondents, 2.3%), Native American (2 respondents, 0.7%), Other (7 respondents, 2.3%), and 2 individuals (0.7%) did not answer. Of the 7 respondents who selected "Other", 1 individual listed Haitian and 1 individual listed Asian.

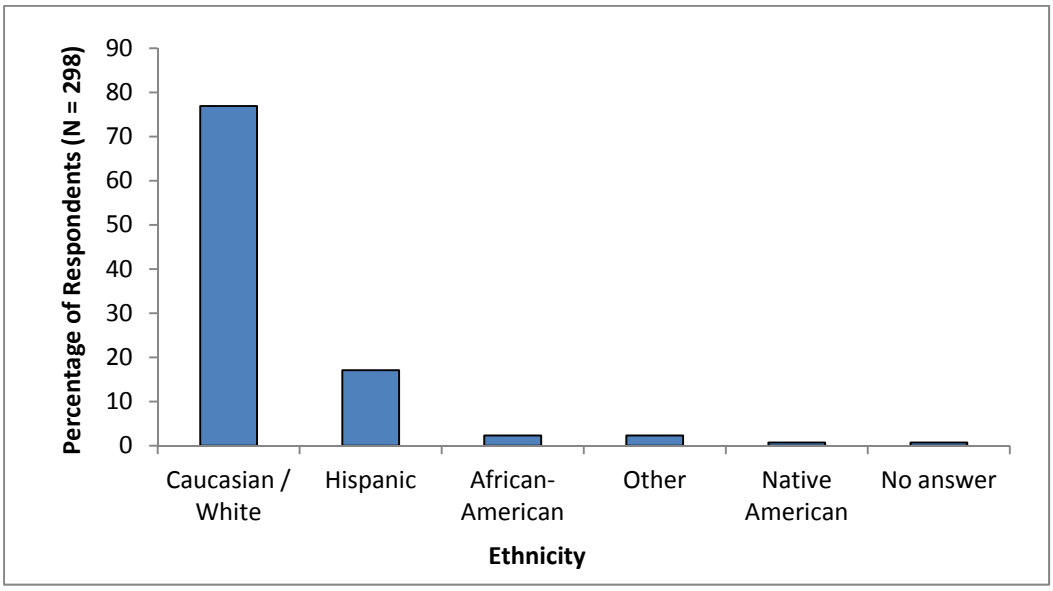


Figure 11. Percentage of respondents grouped by ethnicity.

The proportion of Hispanic respondents was similar to the actual composition of the region's population (Fedstats, 2007) except for Miami-Dade County (48.9%) which was somewhat lower and Palm Beach County (4.8%) which was about a fourth of the actual Hispanic population (Figure 12). For Martin County (7.7%) and Broward County (21.1%) surveyed Hispanic populations were similar to the actual proportions. According to the 2007 federal population estimates, the actual Hispanic population is 62% in Miami-Dade County, 23% in Broward County, 17% in Palm Beach County, and 10% in Martin County.

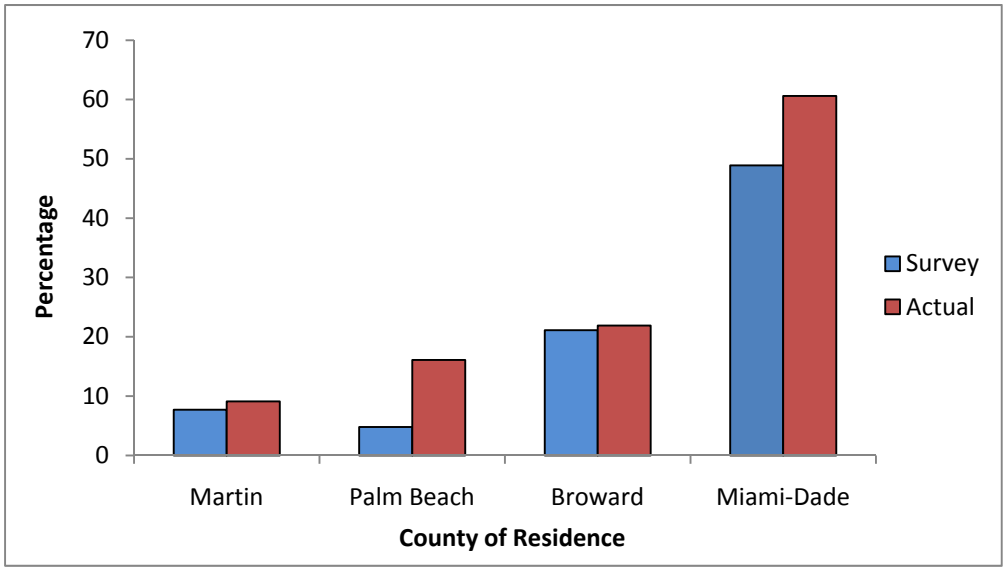


Figure 12. Comparison of the actual vs. survey Hispanic population percentage by county.

4.3.1.4 Club or Organization Affiliation

Of the 113 respondents who indicated an affiliation with at least one organization or club, the largest percentage belongs to a dive club (63.7%). Approximately 30% of respondents belong to an angling club, 29% belong to a boating club, and 12% belong to a surfing club. Of those 9 respondents (14%) who selected "Other" clubs, 5 belong to other types of recreational groups (snorkeling, spearfishing) and 4 were members of environmental or professional groups (U.S. Coast Guard, Reef Rescue, Sierra Club). The percentages exceed 100% because 56 respondents reported belonging to more than one organization or club (Figure 13).

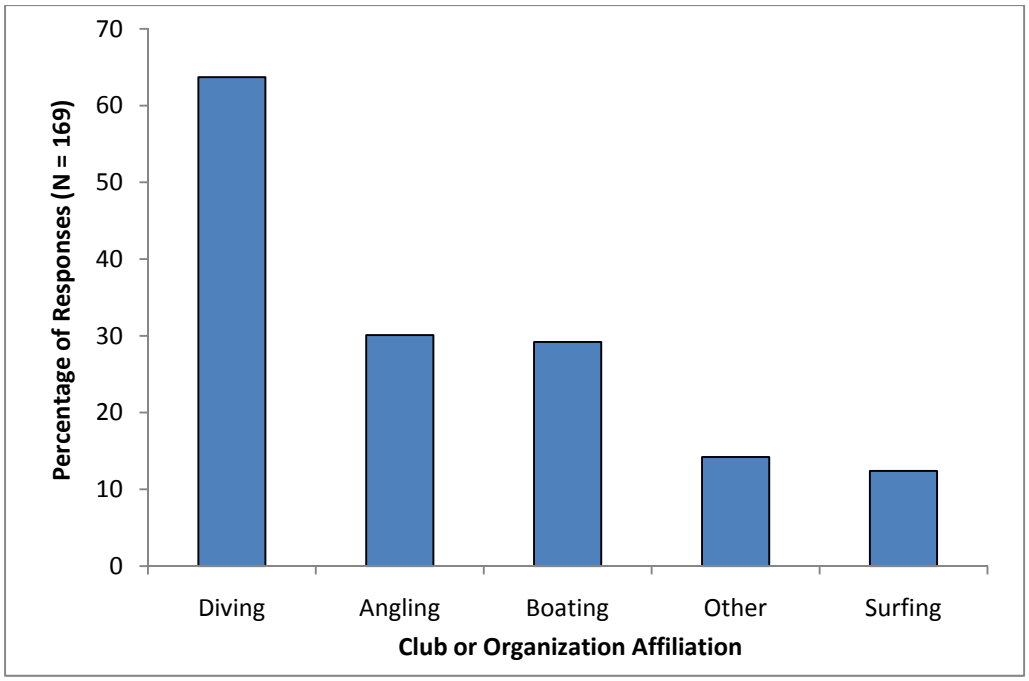


Figure 13. Percentage of responses grouped by club or organization affiliation.

4.3.2 Resource Use

4.3.2.1 Location

More than 50% of the respondents from each county (75% in Martin, 82% in Palm Beach, 56% in Broward, and 68% in Miami-Dade) indicated that they spend 51% or more of their time using marine resources within their county's waters (Table 6). The overall mean percentage of all respondents who spend more than 50% of their time within their county's waters was almost 70% (Table 6).

Table 6. Total number and percentage of respondents by county who spend time in southeast Florida county waters.

County	Percent time spent in county waters	Martin	Palm Beach	Broward	Miami-Dade
Martin (n = 20)					
	0	2 (10%)	--	--	--
	1-25	1 (5%)	4 (20%)	--	--
	26-50	2 (10%)	3 (15%)	--	--
	51-75	8 (40%)	--	--	--
	76-100	7 (35%)	2 (10%)	--	--
	> 50	**15 (75%)**			
Palm Beach (n = 76)					
	0	--	5 (7%)	--	--
	1-25	3 (4%)	1 (1%)	11 (14%)	2 (3%)
	26-50	2 (3%)	8 (11%)	9 (12%)	1 (1%)
	51-75	--	10 (13%)	1 (1%)	--
	76-100	1 (1%)	52 (68%)	2 (3%)	--
	> 50		**62 (81%)**		
Broward (n = 81)					
	0	--	--	7 (8%)	--
	1-25	3 (4%)	11 (14%)	7 (8%)	14 (17%)
	26-50	--	12 (15%)	22 (27%)	9 (11%)
	51-75	--	5 (6%)	10 (12%)	1 (1%)
	76-100	--	3 (4%)	35 (43%)	3 (4%)
	> 50			**45 (55%)**	
Miami-Dade (n = 44)					
	0	--	--	--	4 (9%)
	1-25	1 (2%)	4 (9%)	5 (11%)	5 (11%)
	26-50	--	--	2 (4%)	5 (11%)
	51-75	--	--	1 (2%)	1 (2%)
	76-100	--	--	3 (7%)	29 (66%)
	> 50				**30 (68%)**
Overall Mean > 50% time in own county waters = 152 (68.8%); Total responses = 221					

Approximately 70% of the respondents indicated that they have used the same southeast Florida resource location since they started using marine resources (Figure 14). Of the 82 respondents who changed locations, 26% (21) switched less than a year ago, 50% (41) changed locations between 1 and 5 years ago, and 24% (20) changed locations more than 5 years ago (Figure 15).

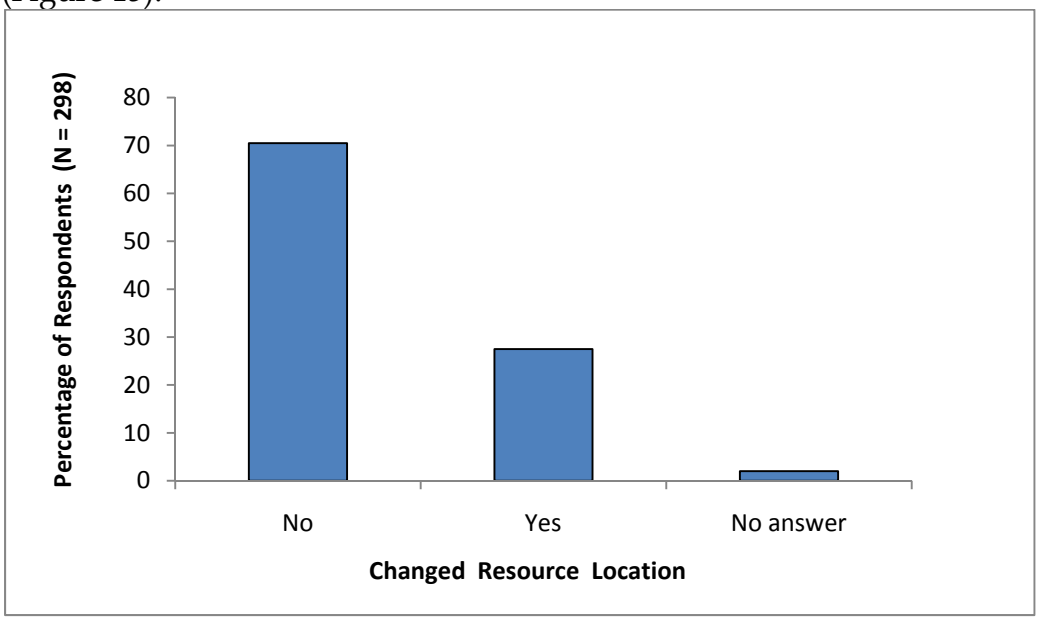


Figure 14. Percentage of respondents who changed marine resource location.

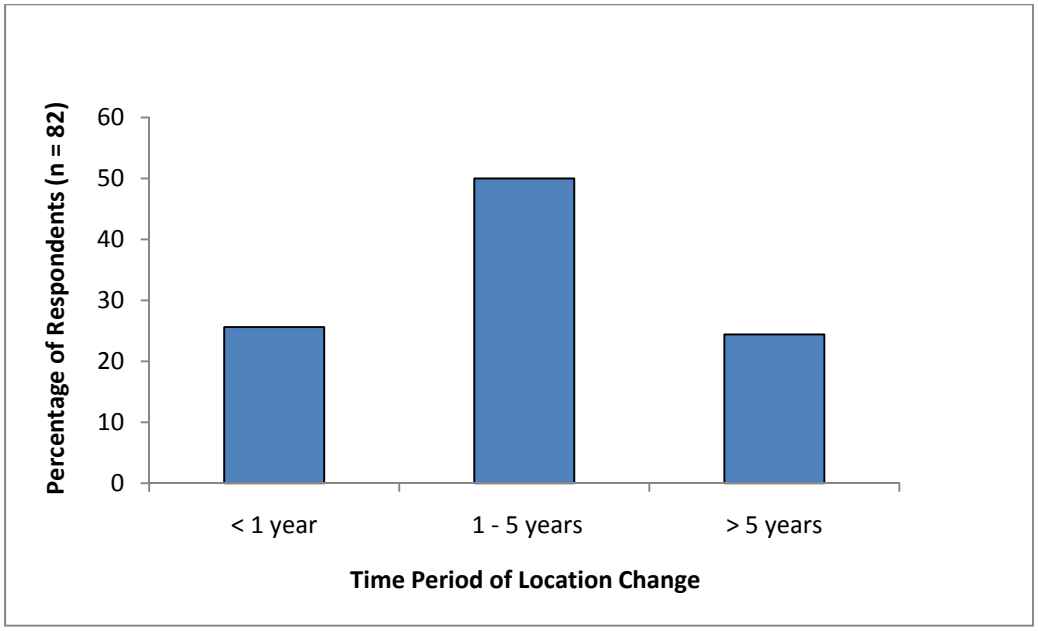


Figure 15. Percentage of respondents who changed marine resource location grouped by time period.

There were some differences in the reasons for changing locations among the three groups (Figure 16). Regardless of when individuals changed location, a primary reason was ease of access. For those individuals changing location within the past year, other reasons included changes in resource and reef conditions. Individuals who changed location between one and five years ago, other reasons included changes in water quality and resource conditions. Those individuals who changed locations more than 5 years ago, other reasons included competition of utilization and change in resource condition. One survey response allowed respondents to describe "Other" reasons for changing location. Of the "Other" reasons listed, 3 were related to changed reef conditions, 3 were related to residential moves, 3 were related to boat dock conditions, and 4 were related to access to marine resources.

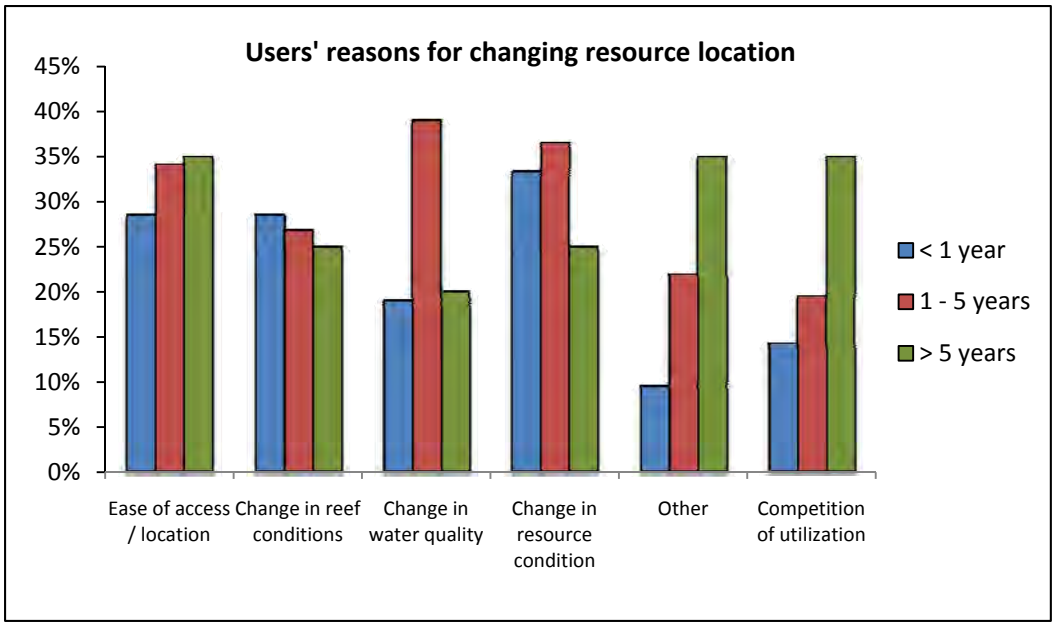


Figure 16. Respondents' reasons for changing marine resource location as percentage grouped by time period.

When marine users were asked to indicate their reason(s) for using a specific location, ease of access to the marine resources was most frequently selected (66%) as the most important (rating = 5) reason (Figure 17). Resource abundance (38%), reef condition (30%), and water quality (39%) were also ranked as most important, but each of these choices was chosen less frequently than ease of access. The most frequently chosen, least important reason (rating = 1) for choosing a resource location was the lack of use by other users (29%) (Figure 17). Other specific reasons listed included close proximity to home, familiarity with area, and availability of other recreational activities. This pattern was consistent across user group, county of residence, age group, and ethnicity.

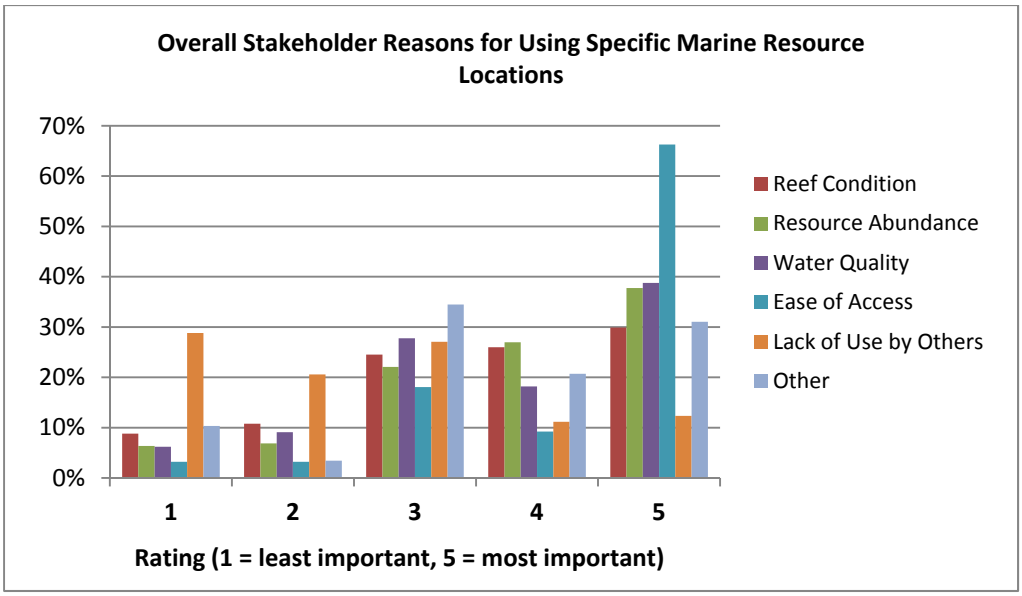


Figure 17. Rating of respondents' reasons for using specific marine resource locations as percentage.

4.3.2.2 Length and Frequency of Use

The majority of respondents (82%) have been using the marine resources in southeast Florida between 5 and 40 years with the largest group of users (28%) using area resources from 11 to 20 years (Figure 18).

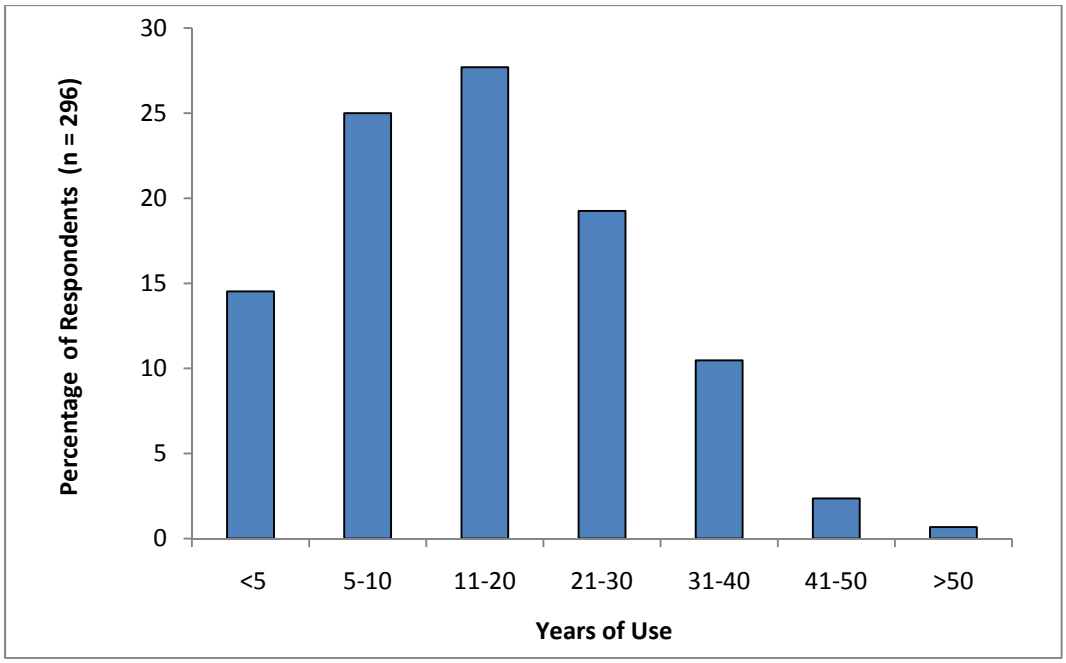


Figure 18. Percentage of respondents grouped by the number of years they have been involved in marine activities in southeast Florida.

More than half of the respondents (54%) indicated they use southeast Florida's coast or ocean weekly (Figure 19). One of the respondents who selected "Other" for frequency of use, listed first-time user. This long-term and regular use of the marine resources provides a good basis for the users to make informed judgments on resource conditions and issues.

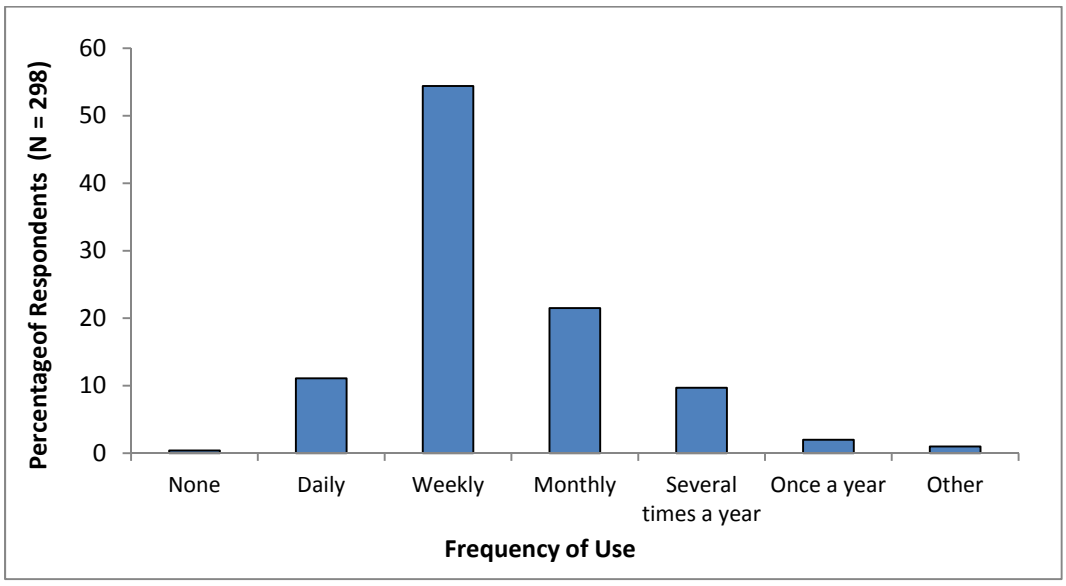


Figure 19. Percentage of respondents grouped by the frequency of use of southeast Florida's marine resources.

4.3.3 Unique or Representative Areas

In response to the question about the locations they go to in southeast Florida, respondents identified some of the unique and representative areas they usually visit:

- Lake Worth Lagoon
- Lake Worth Inlet
- Boca Inlet
- Boynton Beach Inlet
- Fort Pierce Inlet
- Hillsboro Inlet
- Palm Beach Inlet
- Florida Keys
- Government Cut
- Biscayne Bay
- Biscayne National Park
- Florida Reef Tract
- Port Everglades
- Pennekamp Park

4.3.3.1 Specific Marine Area/Resource Sites

Respondents were evenly distributed on whether any specific marine area/resource sites require management. Almost half (46%) of the respondents indicated that specific marine areas/resource sites required management (Figure 20). The largest number of respondents (60/125) listed coral reefs as requiring management. Estuaries and mangroves were the second most commonly listed area. The two most common marine management issues listed were enforcement of catch size and limits and increased monitoring of water quality/pollution.

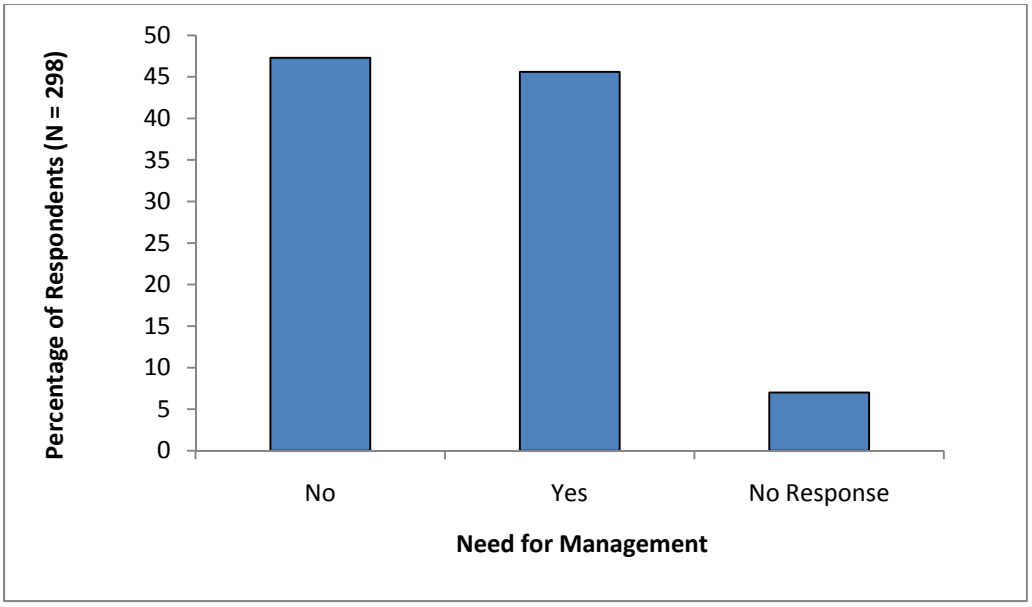


Figure 20. Percentage of respondents who believe specific marine resources require management.

Some respondents identified specific southeast Florida marine areas/resources they believe require management:

- Red Reef Park
- Biscayne Bay
- Lauderdale by the Sea
- Breakers Reef
- Bathtub Reef

4.3.3.2 Artificial Reefs

Artificial reefs (e.g., vessels, limestone boulders) have been used in southeast Florida to provide alternative dive sites and help alleviate overuse of natural reefs. The majority of respondents (60%) reported using artificial reefs (Figure 21).

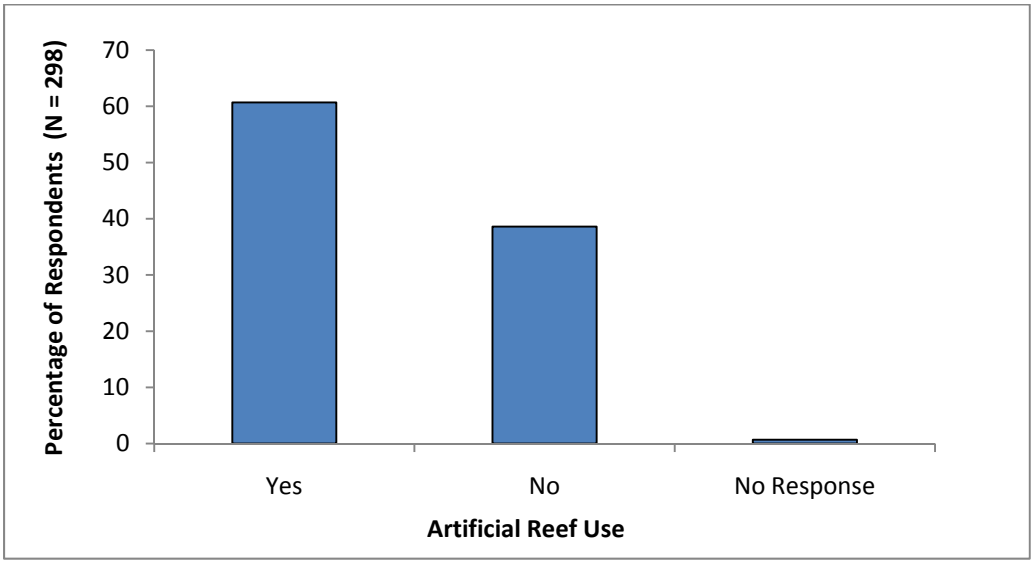


Figure 21. Percentage of respondents who use artificial reefs.

Martin, Palm Beach, and Broward counties have a higher percentage of respondents who use artificial reefs than does Miami-Dade County (Figure 22). Of the 395 artificial reefs reported for southeast Florida in 2006, 40% (160) were located in Miami-Dade County, 26% (101) were in Broward County, and Palm Beach and Martin counties each had 17% (67) artificial reefs (Horn, 2010).

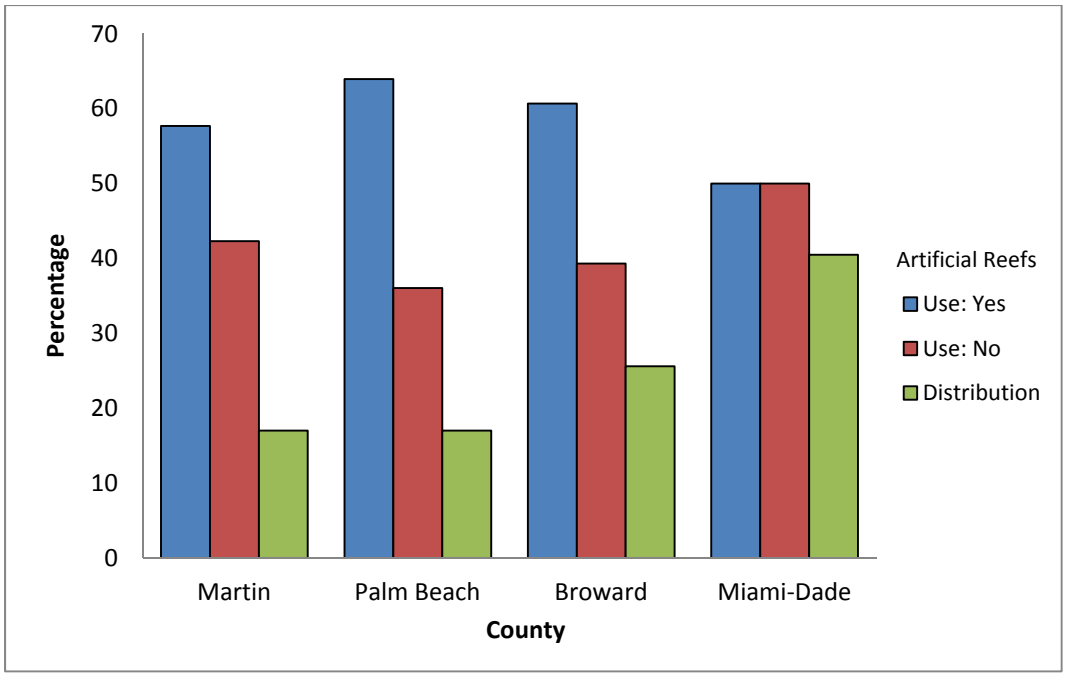


Figure 22. Percentage of respondents who use artificial reefs by county of residence and distribution of artificial reefs by county.

A high percentage (60.7%) of all respondents favors artificial reef management (Figure 23).

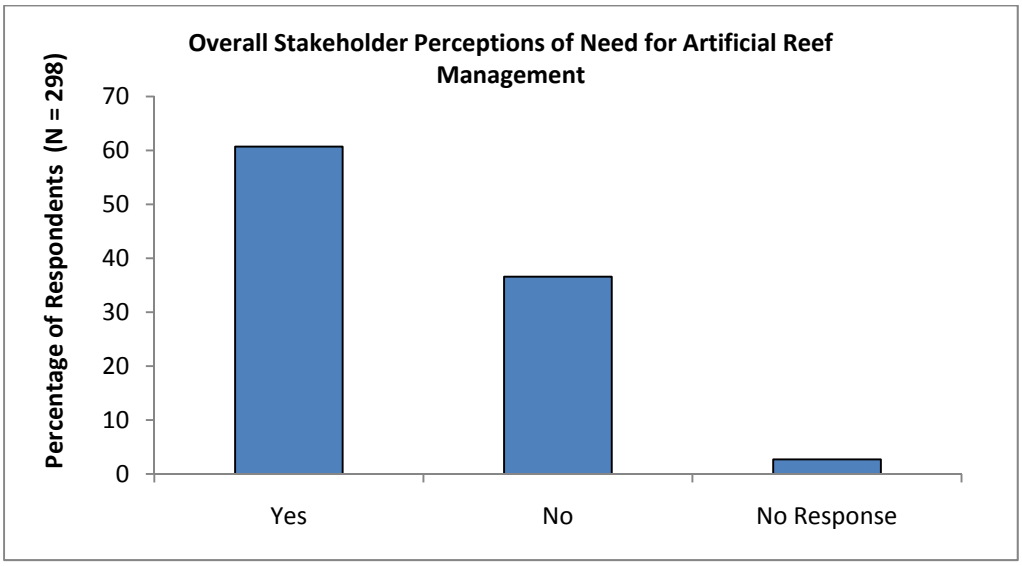


Figure 23. Percentage of respondents who believe artificial reefs require management.

Based on county of residence, between 57% and 68% of the respondents believe that artificial reefs require management. Miami-Dade County had

largest proportion of artificial reefs (Figure 22) and the highest percentage of respondents that supported artificial reef management (Figure 24).

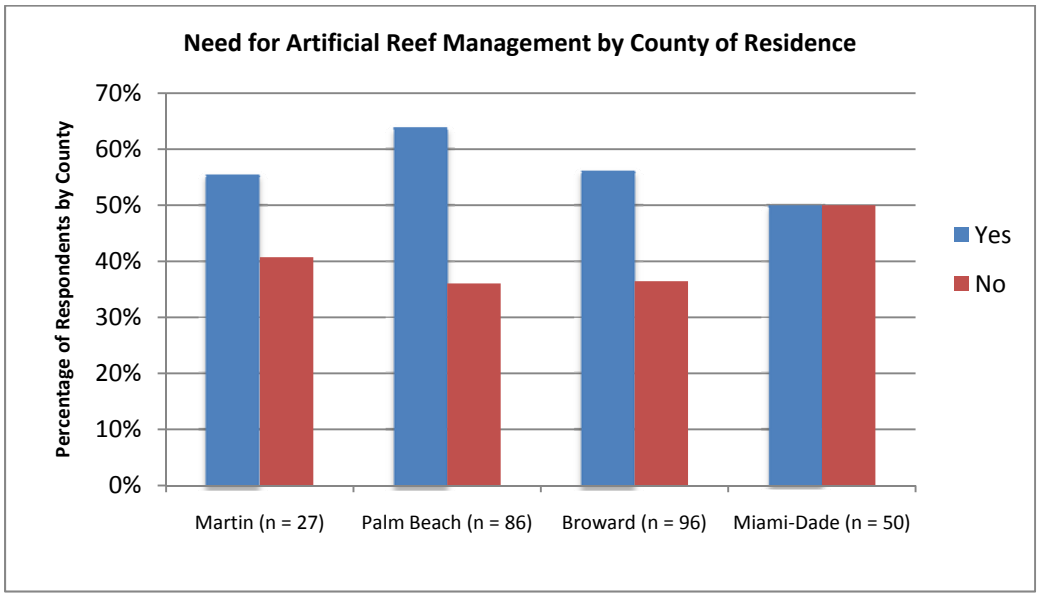


Figure 24. Percentage of respondents by county of residence who believe artificial reefs require management.

4.4 Discussion

These results characterize the beliefs and perceptions of almost 300 southeast Florida reef users and stakeholders by user group. The stakeholders' identified unique or representative marine areas within the region and the locations of resources they use. The majority of respondents are year-round residents (Figure 7), live in Martin, Palm Beach, Broward, or Miami-Dade counties (Figure 8), are between 18 and 50 years of age (Figure 10), and are Caucasian (Figure 11).

User Groups - The marine resources of southeast Florida are used by a wide range of user groups. Respondents could select more than one user group activity which is reflected the relative size of each group. The largest number of responses (92%) was for recreational activities (Figure 9). The remaining responses (8%) were for non-recreational activities: commercial fishers, commercial divers, commercial dive operators, and charter boat fishers. Among recreational user activities, recreational fishers (29%) and recreational divers (21%) had the highest number of responses. Other recreational user activities included boaters, snorkelers, surfers, kitesurfers, and kayakers. Overall, the survey response rate for recreational fishers (0.2%) and commercial fishers (0.5%), was lower than anticipated and needs to be noted in assessing the results of this survey.

Unique or Representative Areas - In general, respondents primarily use the reefs in their own county of residence (Table 6). Although there may be differences in the reefs from county to county, these differences are not great enough to encourage most users to visit other areas.

Artificial reefs in the southeast Florida region are one type of unique area used by a considerable proportion (60.7%) of the respondents (Figure 21). The majority of respondents (60%) believe artificial reefs require management (Figure 23). Artificial reefs are used by between 50% (Miami-Dade County) and 66% (Palm Beach County) of residents (Figure 22). One of the goals for establishing artificial reefs is to alleviate the pressure on natural reefs. Although these results reflect a relatively high degree of user interest, these results may be skewed because the survey instrument only listed artificial reefs as potential unique or representative areas. There are county-specific differences in the use and management of artificial reefs. For example, the proportion of Miami-Dade County stakeholders who use artificial reefs is lower than stakeholders in other counties even though Miami-Dade County has the largest number of artificial reefs (Figure 22). This likely reflects the small sample of Miami-Dade County respondents relative to the actual population (Figure 8). However, more Miami-Dade County stakeholders believe artificial reefs require management than do other county stakeholders. This may indicate that artificial reefs in Miami-Dade County require more attention. These survey results suggest that management of artificial reefs in all southeast Florida counties should be strengthened by the appropriate county, state, and federal agencies.

Marine resource areas are important to user groups regardless of whether the reefs are natural or artificial. Nearly half (46%) of the respondents believe that specific marine areas or resources require management (Figure 20). Sixty percent (60%) of respondents also favor management of artificial reefs (Figure 23). If marine zoning plans are implemented in southeast Florida, marine users have indicated that the management of artificial reefs should be included with other marine resources.

Choice of Location - Only a relatively small number (27%) of respondents changed to another marine resource location (Figure 14). Of this group of respondents, nearly one-fourth (24%) changed location more than 5 years ago, 26% changed location in the last year, and 50% changed location between 1 and 5 years ago (Figure 15). Ease of access to marine resources was a primary reason for changing location regardless of when the individual changed location. For those who changed location in the last 12 months, the two other main reasons were changes in resource conditions and reef conditions (Figure 16). The most important criterion respondents use for selecting marine resource areas is ease of access. Resource abundance, reef condition, and water quality were moderately important criteria (Figure 17). The lack of use by other users was the least important criterion.

Other possible reasons relatively small numbers of respondents changed location that were not explored in this study include:

- Stakeholders may have limited resources such as gas, tackle, etc. which restrict them to nearby waters.
- Resource status is similar throughout the region so traveling greater distances is not worthwhile.

Tracking resource location changes over a longer period may determine whether the changes in location seen over the past year are part of a larger trend. Future surveys and focus groups should ask participants who have changed locations the reasons for that change.

Marine Resource Areas - The areas the most widely used by the respondents are those marine areas within their county of residence (Table 6). Approximately 69% of all respondents indicated that they use the areas/resources in their own county waters more than 51% of the time (Table 6). These areas provide the fastest and easiest access to the marine resources. The respondents gave the highest ranking to ease of access, resource abundance, and water quality. Respondents may believe that the resources in their own area are just as good as those in adjacent areas since they seldom travel to use the resources in other counties. Future marine resource management options should be consistently applied throughout the southeast Florida region. Based on the results of this survey, these management options should be similar across counties.

Although reefs worldwide are in a state of decline, there is the perception among survey respondents that artificial reefs also have a need for management. Respondents may believe that natural reefs are self-sustaining and thus do not require much management. The importance of managing all reef resources for sustainability is an important component

of education and outreach programs. The number of respondents who believe marine resources need management (45%) is nearly identical to the number of respondents who do not believe marine resources need management (47%) (Figure 20). This response pattern suggests that stakeholders: (1) do not see a relationship between management and status, recovery, and sustainability of marine resources; (2) do not want more government involvement in resource management; (3) believe the resources are good shape and do not need management; and/or (4) do not know the potential benefits of management because of a lack of education and perhaps misinformation.

5 Users' Perceptions of Marine Zoning

5.1 Overview

The purpose of this task (Task 4) was to obtain local stakeholder input to: (1) assess local marine resource users' knowledge regarding marine management; (2) identify what is important to marine resource users regarding the management of marine resources in southeast Florida; and (3) to identify marine user concerns and perceptions regarding the potential for a marine zoning plan for southeast Florida.

As described in Chapter 4, a stakeholder survey was developed for southeast Florida commercial and recreational reef resource users to answer the following questions:

1) What do marine resource users know of marine zoning, including positive and negative perceptions?

2) What do users believe are the goals of SMZs/MPAs, their purpose and effectiveness?

3) In terms of marine resource management, what plan would users favor or not favor?

4) What are the users' concerns associated with SMZs/MPAs and how do they feel about how SMZs/MPAs manage marine resources?

5) What criteria do users use to determine if an SMZ/MPA is successful?

5.2 Methods

5.2.1 Survey Development, Identification of Stakeholders, and Survey Implementation

One survey instrument was used to obtain marine users' input for Tasks 3 and 4. Using one survey instrument avoided saturating the target audience with multiple surveys on similar topics. The primary stakeholder user activity groups were commercial fishers, recreational fishers, charter boat fishers, recreational boaters, commercial divers, commercial dive operators, recreational divers, and recreational snorkelers. The survey methods discussed in Chapter 4 were also used for this task.

5.2.2 Data Analysis

The marine users' responses to the survey instrument were analyzed using frequency or percentage of responses and using frequency or percentage of ratings (from 1, least important, to 5, most important). The data collected were analyzed to identify the following:

1) Stakeholders' perceptions of benefits of MPAs in southeast Florida based on user groups, county of residence, age, and ethnicity
2) Stakeholders' primary concerns associated with SMZs/MPAs
3) Stakeholders' perceptions of issues impacting coral reefs in southeast Florida
4) Stakeholders' perceptions about establishing SMZs/MPAs in southeast Florida
5) Stakeholders' sources of information about SMZs/MPAs and coral reef issues

5.3 Results

The survey results are presented below using ratings and percentages. The stakeholder perceptions were analyzed overall and by user group, county of residence, age group, ethnicity, and number of years using marine resources.

5.3.1 Stakeholders' Perceptions of MPA Beneficiaries

5.3.1.1 Perceptions Based on User Group

As presented in Chapter 4 respondents categorized themselves into user groups based on their primary activities. The percentage of responses for each activity were: 29% recreational fishers, 21% recreational divers, 17% recreational boaters, 15% recreational snorkelers, 10% other recreational users, 3% charter boat fishers, 2% commercial dive operators, 2% commercial divers, and 1% commercial fishers (Figure 9). Because each respondent could choose more than one activity, there were 606 total activity responses from the 298 respondents. Similarly, because respondents could choose multiple user groups as beneficiaries, there were 2,648 total responses. The results are presented as percentages of responses based on the total number of individuals in each user group.

When asked to choose which users benefit from the establishment of a SMZ/MPA, the four most frequently chosen categories were for recreational users. Recreational divers, recreational snorkelers, recreational fishers, and recreational boaters received 56% of the

responses. The non-recreational group of commercial dive operators, commercial fishers, charter boat fishers, and commercial divers received 37% of the responses. In general, respondents believed all groups would benefit to some extent (Figure 25).

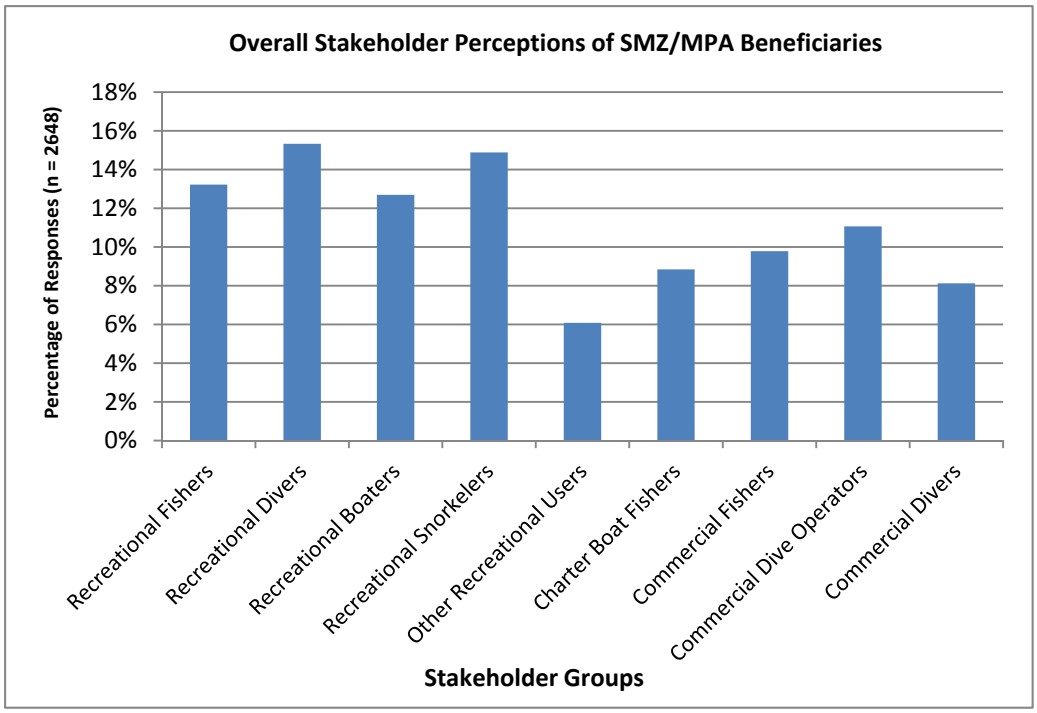


Figure 25. Percentage of respondents' selection of a particular user group as the beneficiary from the establishment of SMZs/MPAs.

5.3.1.1.1 Recreational Activity Groups' Perceptions

Recreational Fishers: The recreational fishers' (n = 173) perception is that the recreational groups which would benefit the most from the establishment of SMZs/MPAs are themselves (57%), recreational divers (59%), and recreational snorkelers (56%) (Figure 26). From their perspective, the non-recreational groups that would benefit the most from SMZs/MPAs are the commercial fishers (35%) and the commercial dive operators (36%).

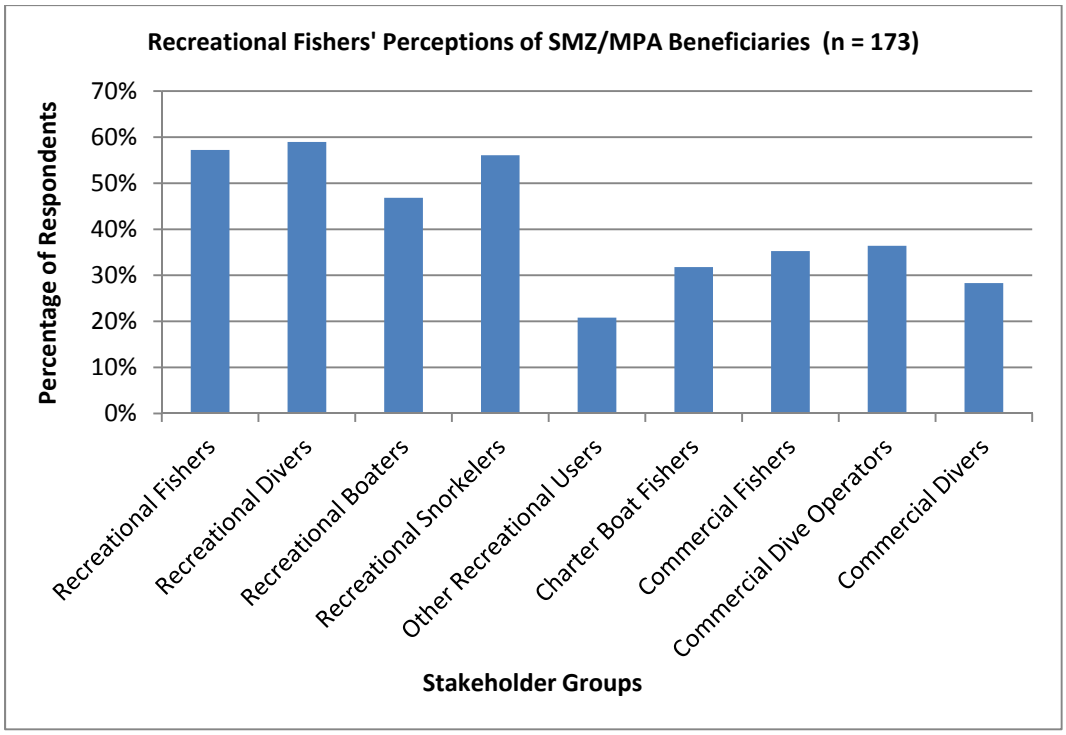


Figure 26. Recreational fishers' perceptions of the stakeholder groups that benefit from the establishment of SMZs/MPAs.

Recreational Divers: Besides themselves (69%), recreational divers (n = 129) perceive the other recreational group which could benefit the most from the establishment of SMZs/MPAs (Figure 27) was recreational snorkelers (65%). From their perspective, the non-recreational groups that would benefit the most from SMZs/MPAs are the commercial fishers (41%) and the commercial dive operators (50%).

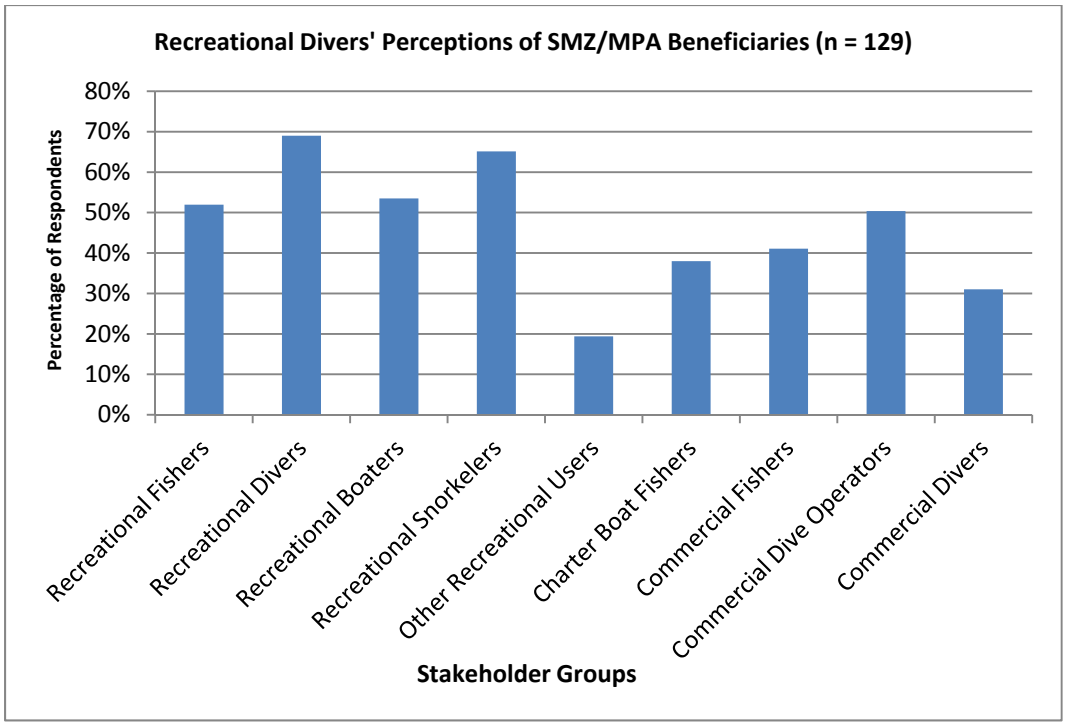


Figure 27. Recreational divers' perceptions of the stakeholder groups that benefit from the establishment of SMZs/MPAs.

Recreational Boaters: Recreational boaters (n = 106) perceive all recreational groups (fishers [57%], divers [70%], snorkelers [67%]), including themselves (67%), will benefit from the establishment of SMZs/MPAs (Figure 28). From their perspective, the non-recreational groups that would benefit the most from SMZs/MPAs are the commercial fishers (44%) and the commercial dive operators (51%).

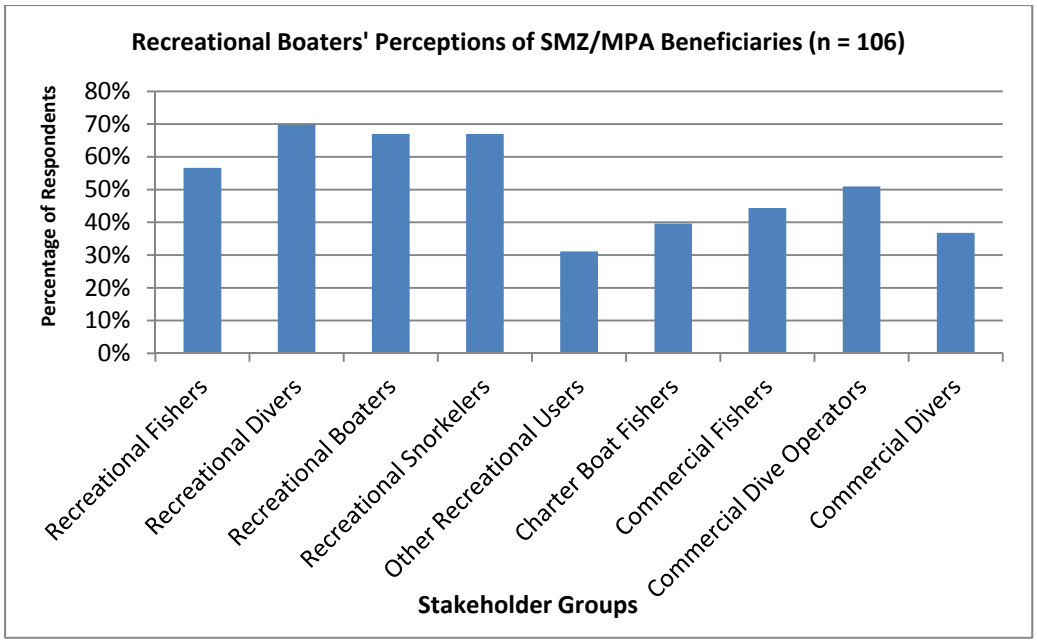


Figure 28. Recreational boaters' perceptions of the stakeholder groups that benefit from the establishment of SMZs/MPAs.

Recreational Snorkelers: The perception of the recreational snorkelers (n = 91) of which user group will benefit from the establishment of SMZs/MPAs is very similar to that of the recreational boaters (Figure 29). They believe all the recreational users (fishers [69%], divers [80%], boaters [69%]), including themselves (82%), as benefiting from the establishment of SMZs/MPAs. From their perspective, the non-recreational groups that would benefit the most from SMZs/MPAs are the commercial fishers (51%) and the commercial dive operators (59%).

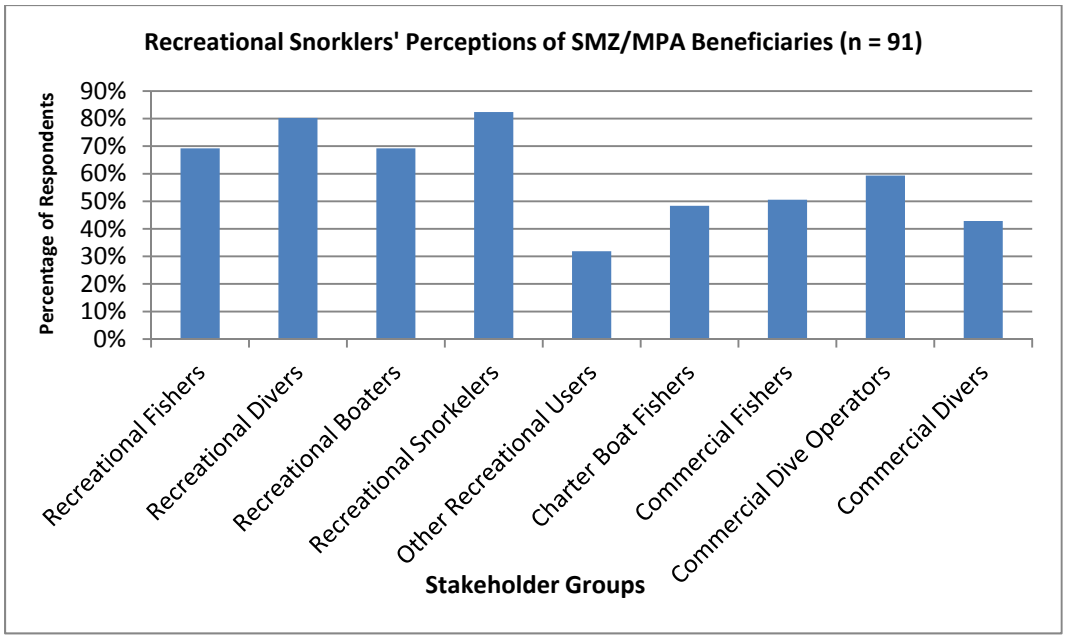


Figure 29. Recreational snorkelers' perceptions of the stakeholder groups that benefit from the establishment of SMZs/MPAs.

Other Recreational Users: The perception of the other recreational users (n = 61) which includes surfers, kayakers, and kitesurfers is that besides themselves (48%), snorkelers (69%), recreational divers (72%), and recreational fishers (59%) are the other stakeholder groups which would benefit the most from the establishment of SMZs/MPAs (Figure 30). From their perspective, the non-recreational groups that would benefit the most from SMZs/MPAs are the commercial fishers (52%) and the commercial dive operators (59%).

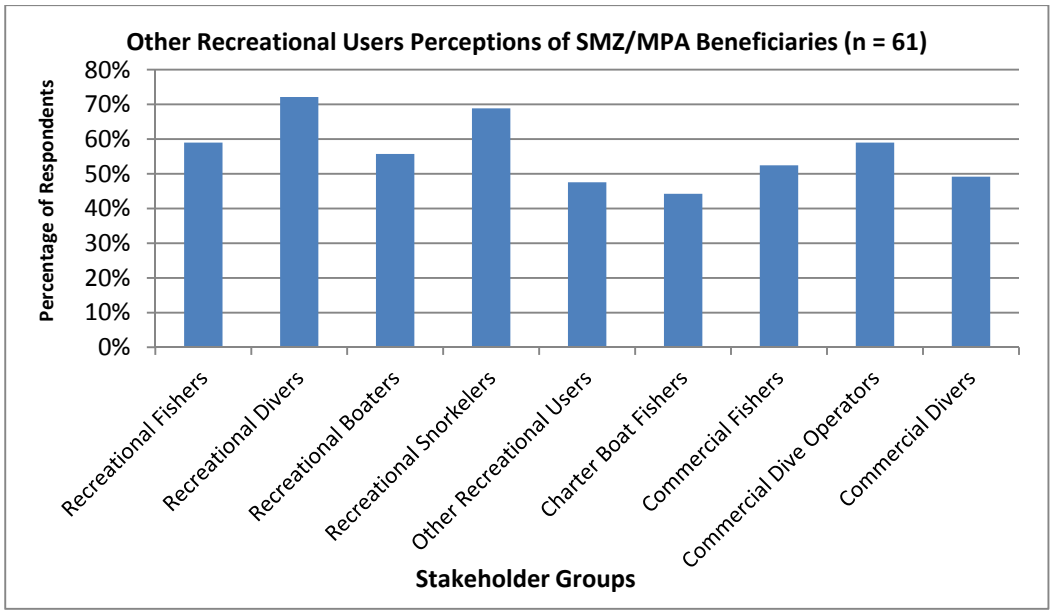


Figure 30. Other recreational users' perception of the stakeholder groups that benefit from the establishment of SMZs/MPAs.

5.3.1.1.2 Non-Recreational Activity Groups' Perceptions

The non-recreational users include commercial fishers (n = 8), charter boat fishers (n = 16), commercial dive operators (n = 12), and commercial divers (n = 10). At least 50% of each group of non-recreational users perceives recreational fishers as benefiting from the establishment of SMZs/MPAs (Table 7). At least 50% of the charter boat fishers believe that all recreational and non-recreational users would benefit from SMZs/MPAs. The majority of commercial dive operators believe that they (56%), commercial fishers (75%), commercial divers (63%), commercial dive operators (63%), recreational divers (58%), and recreational snorkelers (58%) will benefit from SMZs/MPAs. Commercial divers perceive recreational divers (50%) and recreational snorkelers (60%) as benefiting from SMZs/MPAs.

Table 7. Non-recreational users' perceptions of the stakeholder groups that benefit from the establishment of SMZs/MPAs.

User Group	Non-recreational Users' Perceptions			
	Commercial Fishers (n = 8)	Charter Boat Fishers (n = 16)	Commercial Dive Operators (n = 12)	Commercial Divers (n = 10)
Commercial Fishers	37.5%	75%	25%	20%
Recreational Fishers	50%	62.5%	50%	50%
Charter Boat Fishers	12.5%	56.25%	41.67%	20%
Commercial Dive Operators	0%	62.5%	58.33%	40%
Recreational Divers	25%	62.5%	58.33%	50%
Commercial Divers	12.5%	62.5%	41.67%	20%
Recreational Boaters	25%	50%	33.33%	40%
Recreational Snorkelers	37.5%	56.25%	58.33%	60%
Other Recreational Users	0%	37.5%	25%	0%

5.3.1.2

5.3.1.3 Perceptions Based on County of Residence

From the 257 southeast Florida county respondents, there were 1,050 responses. More than 68% of the responses from Palm Beach and Broward counties believed recreational divers would benefit more from the establishment of a SMZ/MPA (Figure 31). Many respondents (> 60%) from Palm Beach, Broward, and Miami-Dade counties believed that recreational snorkelers would benefit from SMZs/MPAs. At least 50% of the respondents from each county of the four counties believed that recreational fishers would benefit. For the non-recreational activity groups, at least 30% of the respondents from Palm Beach, Broward, and Miami-Dade counties believed that commercial fishers, commercial dive operators, and commercial divers would benefit from the establishment of SMZs/MPAs.

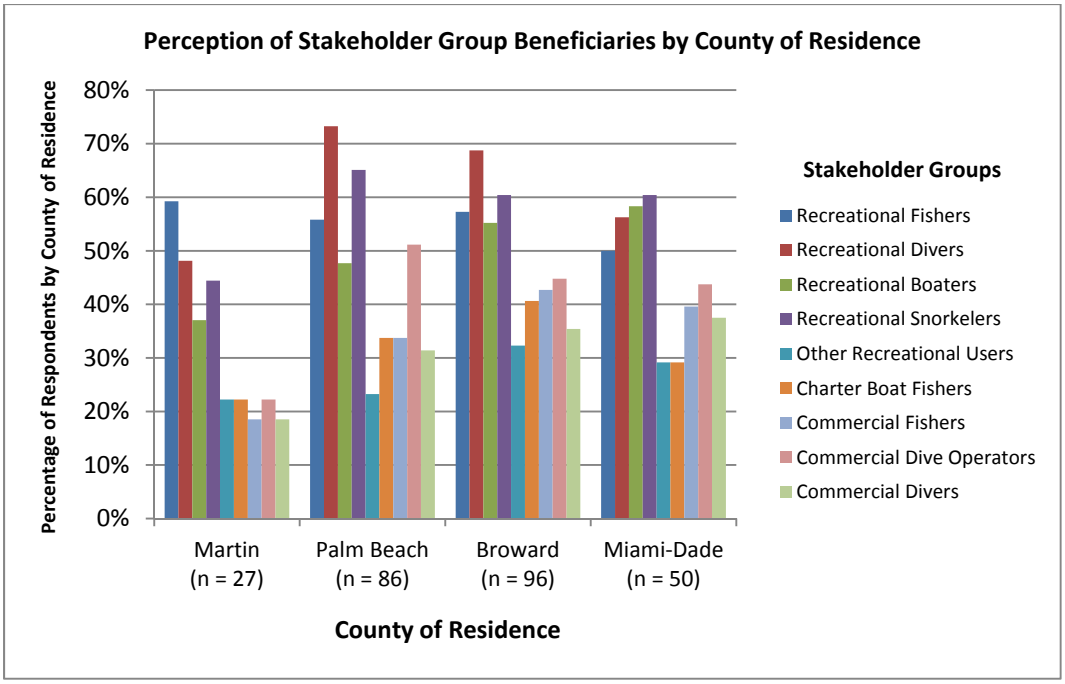


Figure 31. Respondents' perception by county of residence of the stakeholder groups which benefit from the establishment of SMZs/MPAs.

5.3.1.4 Perceptions Based on Age Group

From the 297 respondents, there were 1,214 responses. For each age group (18-30, 31-40, 41-50, 51-60, and over 60 years), most (≥ 50%) of the respondents perceived that the establishment of SMZs/MPAs would benefit one or more recreational user groups and at least 40% perceived that one or more non-recreational user groups would benefit (Figure 32). For respondents in the 18-30 year age group (n = 80), at least 60% believed recreational fishers and recreational divers would benefit; at least 45% believed commercial fishers, commercial divers, and commercial dive operators would benefit. For respondents in the 31-40 year age group (n = 68), at least 50% believed recreational fishers, recreational divers, and recreational snorkelers would benefit; at least 35% believed commercial fishers, commercial divers, and commercial dive operators would benefit. For respondents in the 41-50 year age group (n = 73), at least 50% believed recreational divers and recreational snorkelers would benefit; 43% believed commercial dive operators would benefit. For respondents in the 51-60 year age group (n = 56), at least 70% believed recreational divers and recreational snorkelers would benefit; 43% believed commercial dive operators would benefit. For respondents over 60 years of age (n = 20), 75% believed recreational fishers would benefit and 50% believed recreational divers would benefit; at least 40% believed charter boat

fishers, commercial fishers, and commercial dive operators would benefit. Note: The responses from the one individual who was less than 18 years old were not included in these analyses.

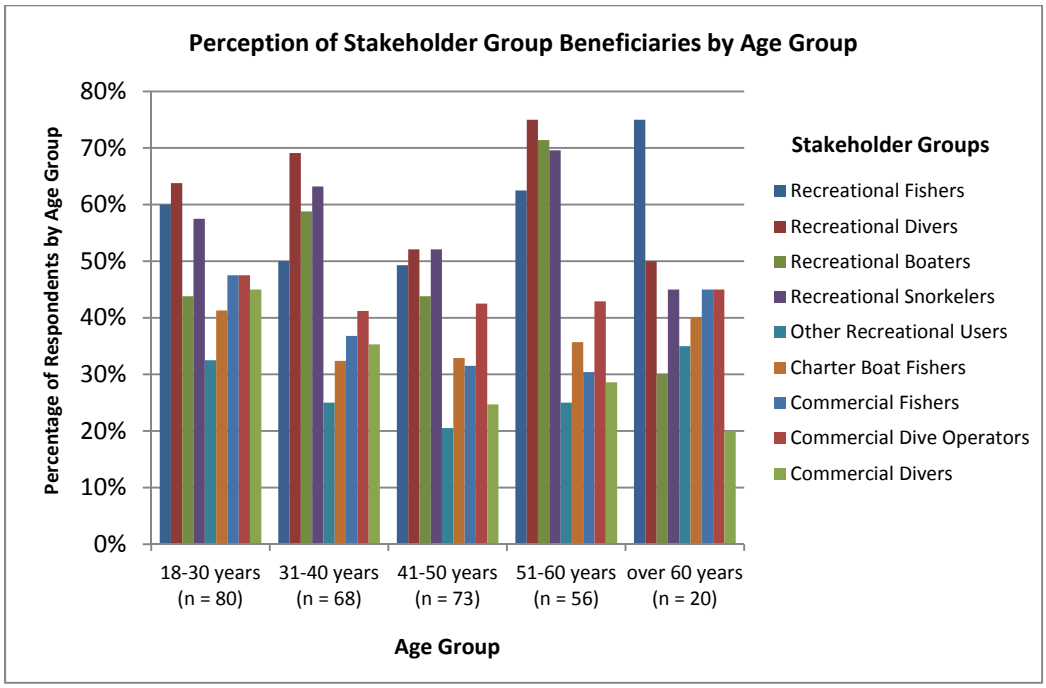


Figure 32. Respondents' perception by age group of the stakeholder groups which benefit from the establishment of SMZs/MPAs.

5.3.1.5 Perceptions Based on Ethnicity

From the 280 individuals who identified their ethnicity as either Caucasian or Hispanic, there were 1,141 responses. When responses were grouped by ethnic group, there was no marked difference between Caucasians and Hispanics about which stakeholder group(s) would benefit from SMZs/MPAs. The three recreational user groups which Caucasians and the Hispanics believe will benefit the most from SMZs/MPAs are recreational fishers (≥ 55%), recreational divers (≥ 53%), and recreational snorkelers (≥ 51%) (Figure 33). Both ethnic groups also believe all non-recreational activity groups (charter boat fishers [≥ 33%], commercial fishers [≥ 37%], commercial dive operators [≥ 33%], and commercial divers [≥ 33%]) will benefit from establishing SMZs/MPAs. Note: The other ethnic groups were not included in these analyses because of the small number of respondents.

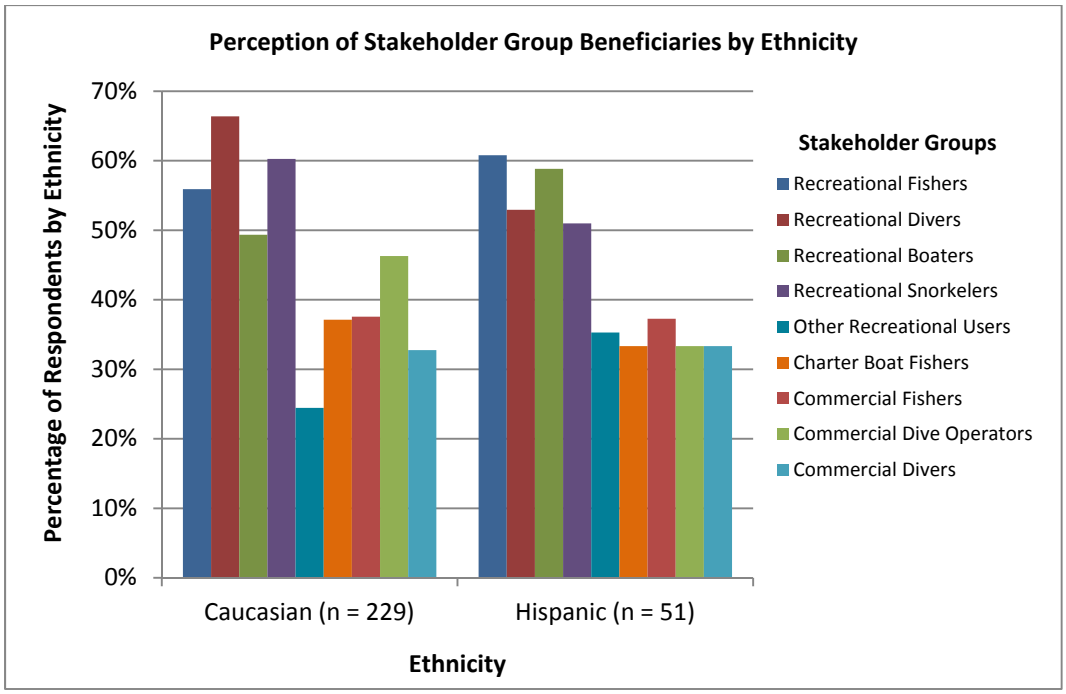


Figure 33. Respondents' perception by ethnicity of the stakeholder groups which benefit from the establishment of SMZs/MPAs.

5.3.2 Stakeholders' Knowledge and Perception of SMZs/MPAs Objectives

5.3.2.1 Goals of SMZs /MPAs

Stakeholders were asked to identify the most important goals of an SMZ/MPA. The choices of goals included: Restrict all activities (no commercial or recreational use); Allow only recreational activities (non-consumptive); Restrict recreational activities (limit boating speed and size); Allow some consumptive activities (fishing and diving); and, Allow multiple activities (both consumptive and non-consumptive). Because respondents could choose more than one goal, 306 choices were made by the 298 respondents (Figure 34).

The largest percentage of responses (36%) indicated that stakeholders perceived the main goal of an SMZ/MPA was to restrict recreational activities by limiting boat speed or boat size. Nearly half (45%) of the responses indicated that restricting all activities (12%) or allowing only non-consumptive recreational activities (33%) were the main goals for SMZs/MPAs. More than half (55%) of the responses indicated that main SMZ/MPA goals either allowed multiple (consumptive and non-consumptive) activities (30.7%) or allowed some consumptive activities (fishing and diving) (24.8%). A small percentage (12%) of responses

defined SMZs/MPAs as restricting all activities, recreational and commercial. Only 8.5% of the responses indicated "Other"; most responses concerned protecting habitats and species (6/22), protecting water quality (3/22), and enforcing regulations (3/22).

There were no marked differences in respondents' perceptions of SMZ/MPA goals among user groups, age groups, or ethnicity. The perceptions of respondents based on county of residence and years using marine resources are presented in the next sections.

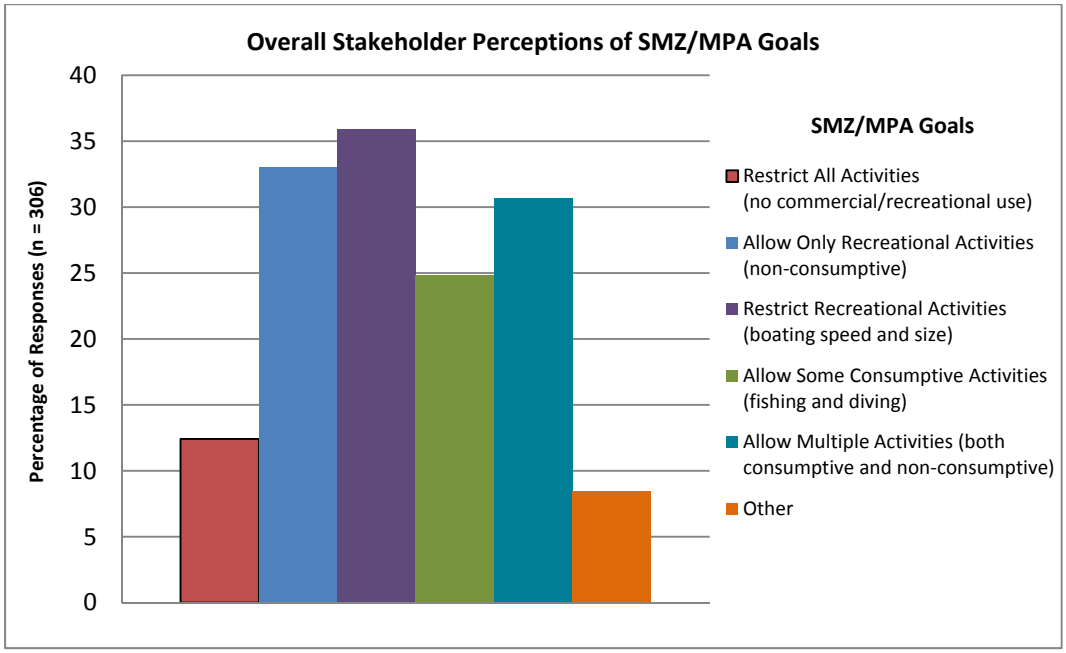


Figure 34. Respondents' perceptions of the goals of SMZs/MPAs.

5.3.2.1.1 Perceptions Based on County of Residence

When grouped by county, the respondents had similar choices for the goals of SMZs/MPAs. Respondents from each of the four counties perceived the goal of an SMZ/MPA as restricting recreational activities, such as boating speed. Thirty percent of the responses from Broward County respondents, more than any other county, felt that the goal of an SMZ/MPA was to restrict recreational activities. Of all counties, Miami-Dade had the largest percentage of respondents (43%) that believed SMZs/MPAs would either restrict all activities or would allow only recreational activities. However, at least 60% of the respondents from Martin, Palm Beach, and Broward counties believed SMZs/MPAs would either allow some consumptive activities (≥ 27%) or allow multiple activities (≥ 35%) (Figure 35).

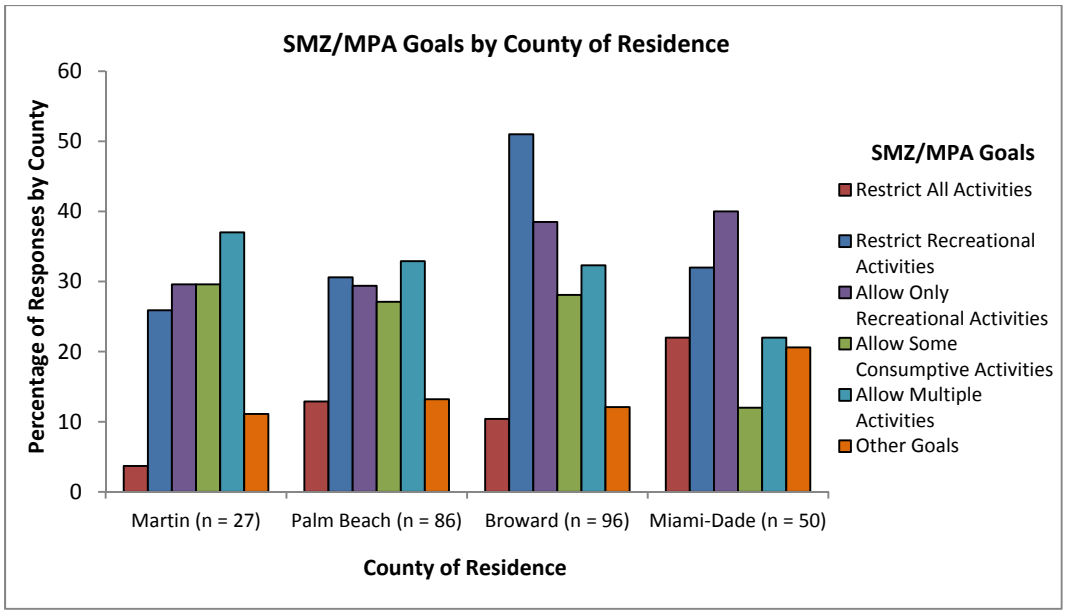


Figure 35. Percentage of responses by county and the respondents' perceptions about the goals of SMZs/MPAs.

5.3.2.1.2 Perceptions Based on Years Using Marine Resources

The respondents' perception of the goals of SMZs/MPAs varied based on the number of years they have been using marine resources. Of 7 respondents using resources for more than 40 years, 3 (43%) believed SMZs/MPAs restricted all activities and 3 (43%) believed SMZs/MPAs restrict recreational activities. However, a high percentage of respondents (≥40%) within each group believe that SMZs/MPAs would allow some consumptive activities or allow multiple activities (Figure 36). Note: There were only 2 individuals that had used marine resources for more than 50 years; their responses are not included in the analyses.

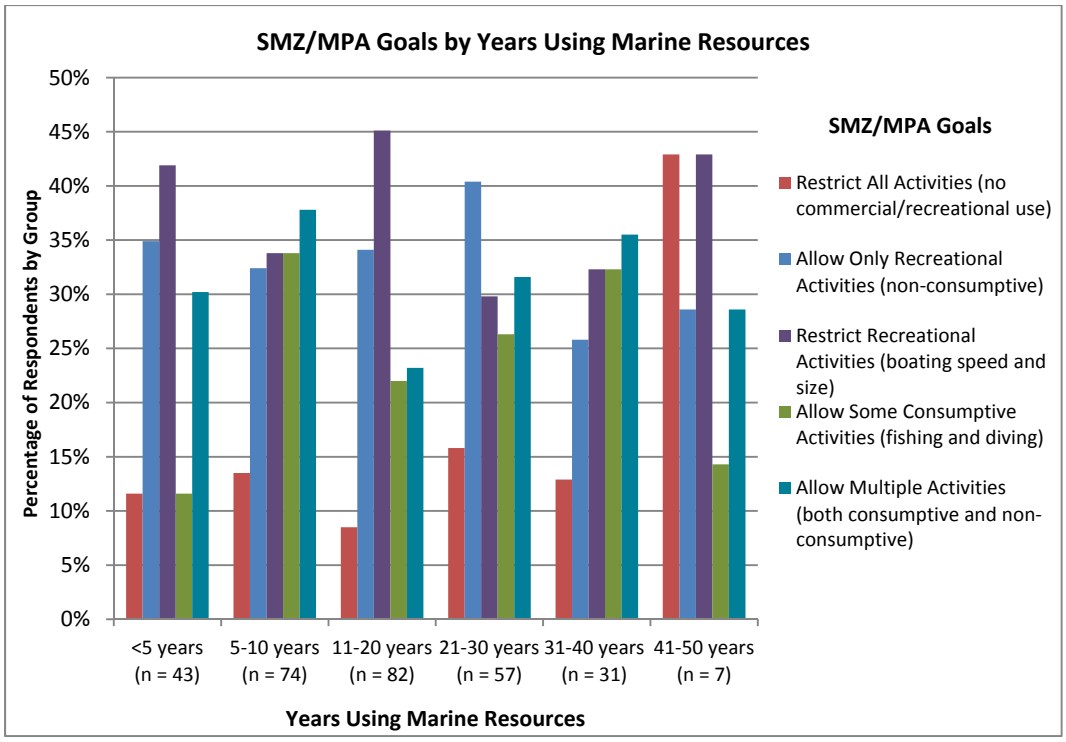


Figure 36. Respondents' perceptions of the goals of SMZs/MPAs by years using marine resources.

5.3.2.2 Purpose of SMZs/MPAs

Stakeholders were asked to identify the main purposes of an SMZ/MPA. The choices of purposes included: Replenish fishery stocks; Conserve and protect species; Preserve cultural heritage; Provide economic benefit; Improve or protect water quality; and, Protect users' rights. Because respondents could choose more than one purpose, 763 choices were made by the 298 respondents (Figure 37).

The largest number of responses were for the conservation and protection of species as the main purpose. Replenishing fishery stocks was the next most frequent choice and improving or protecting water quality was third. Over 70% of the choices were made for these three purposes. A small percentage of respondents (< 5%) listed "Other" purposes. The most common other purposes listed were prohibit fishing, protect natural resources, and enforce regulations.

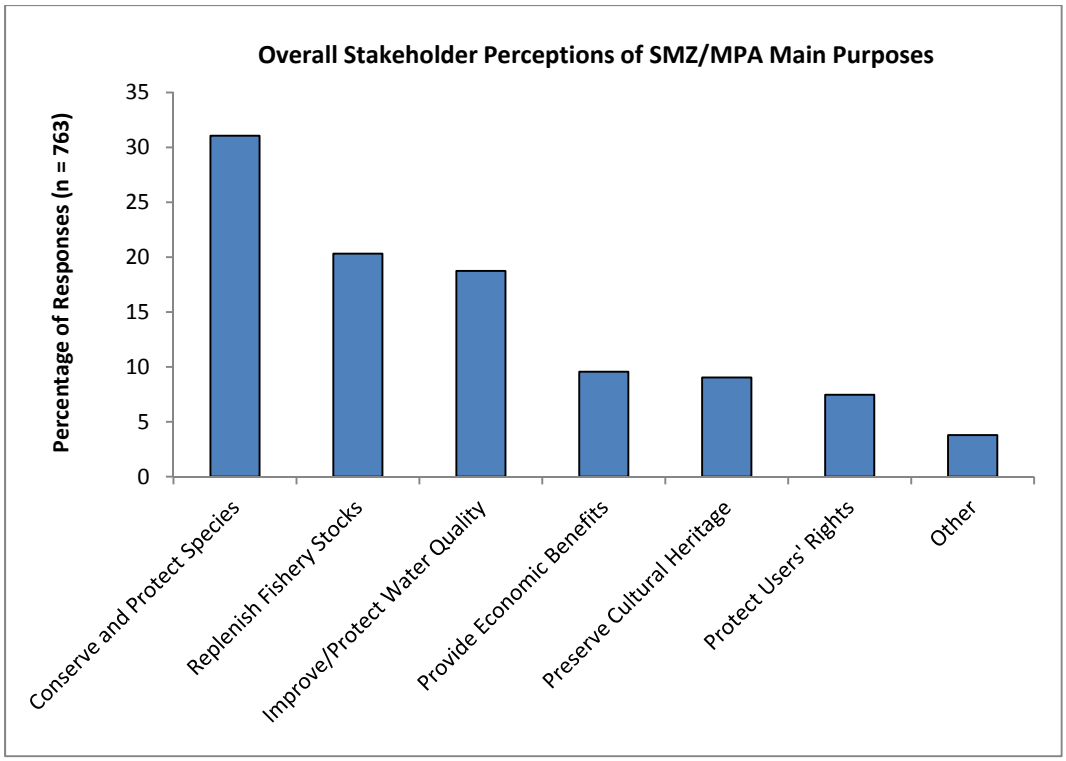


Figure 37. Respondents' identification of the main purposes of SMZs/MPAs.

5.3.2.2.1 User Groups

As presented in Chapter 4 respondents categorized themselves into user groups based on their primary activities. Because each respondent could choose more than one activity, there were 606 total activity responses from the 298 respondents. Similarly, because respondents could choose multiple purposes for SMZs/MPAs, there were 1,564 total responses. The results are presented as percentages of responses based on the total number of responses for each user group (Figure 38).

For recreational users (i.e., recreational fishers, recreational divers, recreational snorkelers), the three most frequently chosen purposes of SMZs/MPAs were to conserve/protect species (≥ 60%), replenish fishery stocks (≥ 50%), and improve water quality (≥ 40%).

Non-recreational users (charter boat fishers, commercial fishers, commercial dive operators and commercial divers) chose conserve/protect species at least 50% of the time. Charter boat operators, commercial fishers, and commercial divers chose replenish fishery stock at least 50% of the time. Commercial divers also chose provide economic benefit 50% of the time.

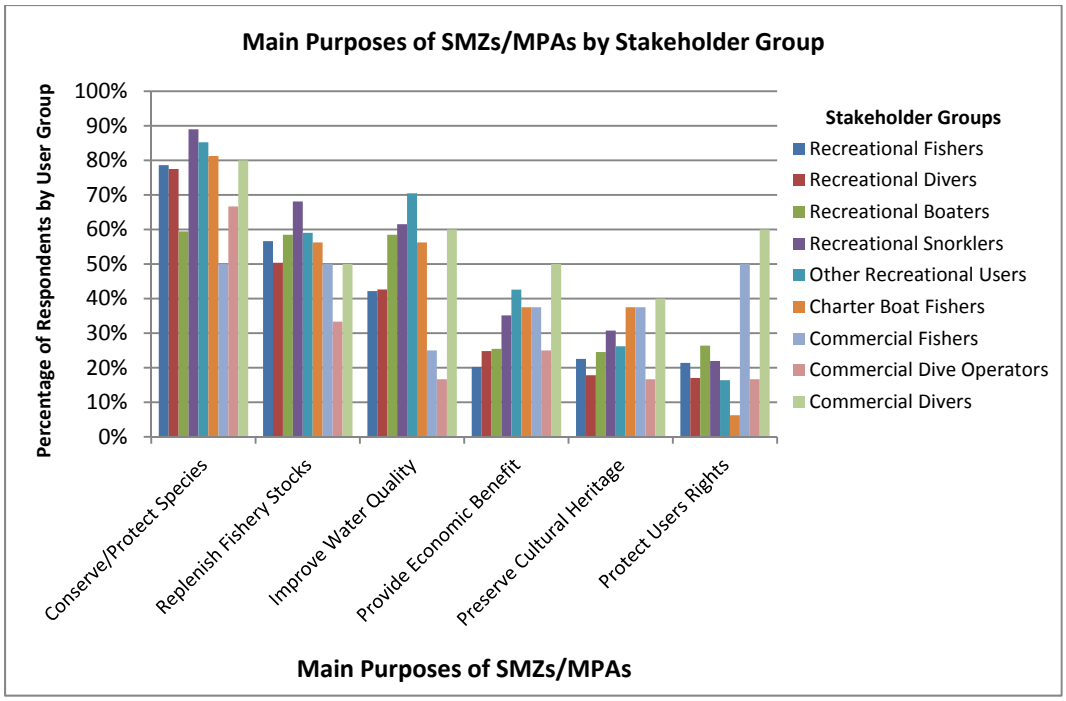


Figure 38. Respondents' identification of the main purposes of an SMZ/MPA by user group.

5.3.2.3 County of Residence

The county of residence did not influence the respondents' selection of the main purpose of an SMZ/MPA (Figure 39). The 259 respondents had 646 responses. More than half (> 50%) of the responses from residents in each county chose conserve and protect species as the main purpose of SMZs/MPAs. Replenishing fishery stocks and improving water quality were chosen by at least 40% of the respondents in each county. Preserving cultural heritage was selected by Martin County respondents nearly twice as often (41%) as the other three counties (19% - 26%). Fewer respondents from each county considered the main purpose of SMZs/MPAs to be providing economic benefits (22% - 28%) or protecting user rights (13% - 26%).

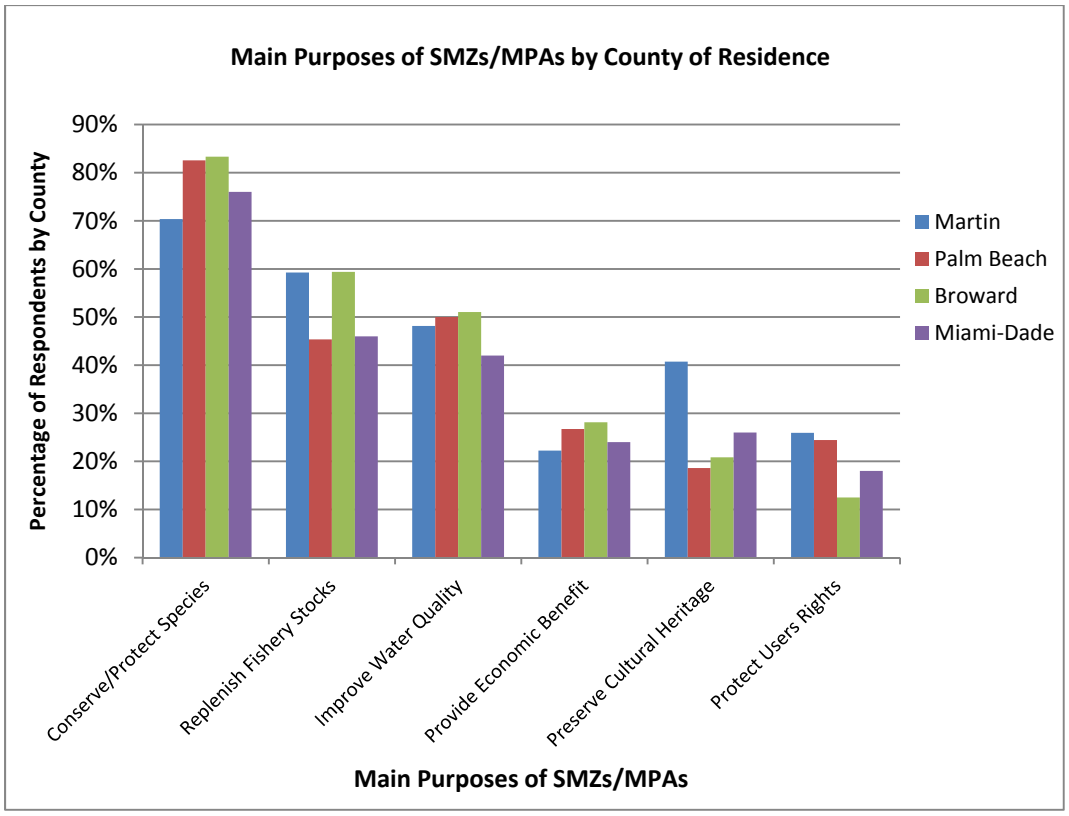


Figure 39. Respondents' identification of the main purposes of an SMZ/MPA by county of residence.

5.3.2.3.1 Age Group

All age groups had similar views about the main purposes of SMZs/MPAs. There were 733 responses from the 298 respondents. The main purpose identified by more than 25% of the respondents from all age groups was to conserve and protect species. The next most frequently chosen purposes were to replenish fishery stocks and to improve water quality (Figure 40). Note: The responses from the one individual who was less than 18 years old were not included in these analyses.

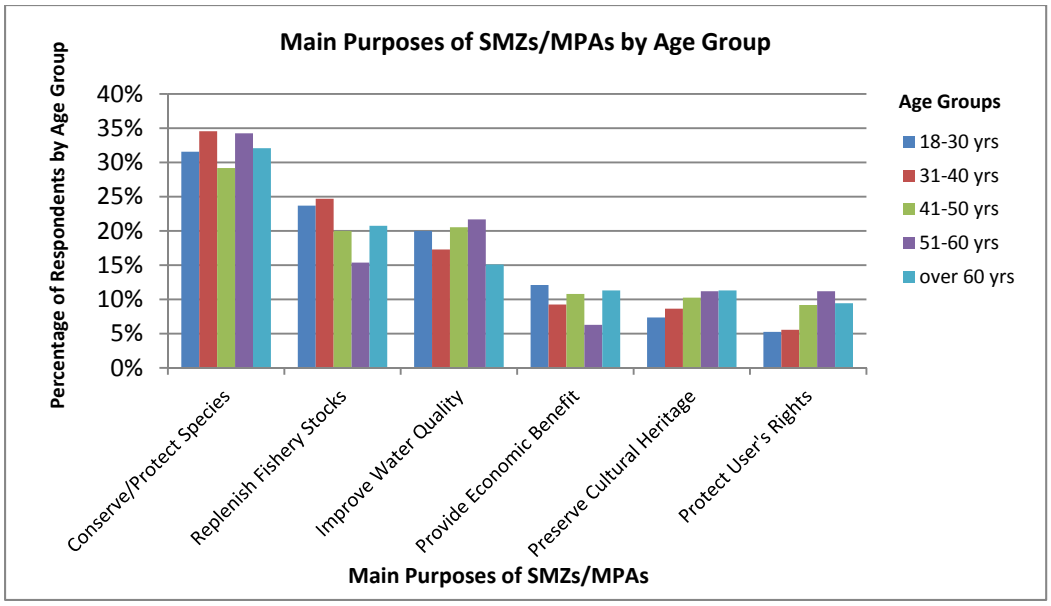


Figure 40. Respondents' identification of the main purposes of SMZs/MPAs by age group.

5.3.2.3.2 Ethnicity

Caucasians and Hispanics had similar views about the main purposes of SMZs/MPAs. There were 673 responses from the 280 Caucasian and Hispanic respondents. The main purpose identified by more than 75% of the respondents from both ethnicities was to conserve and protect species. The next most frequently chosen purposes were to replenish fishery stocks (≥ 50%) and to improve water quality (≥ 45%) (Figure 41). Note: The other ethnicities were not included in these analyses because of the small numbers of individuals.

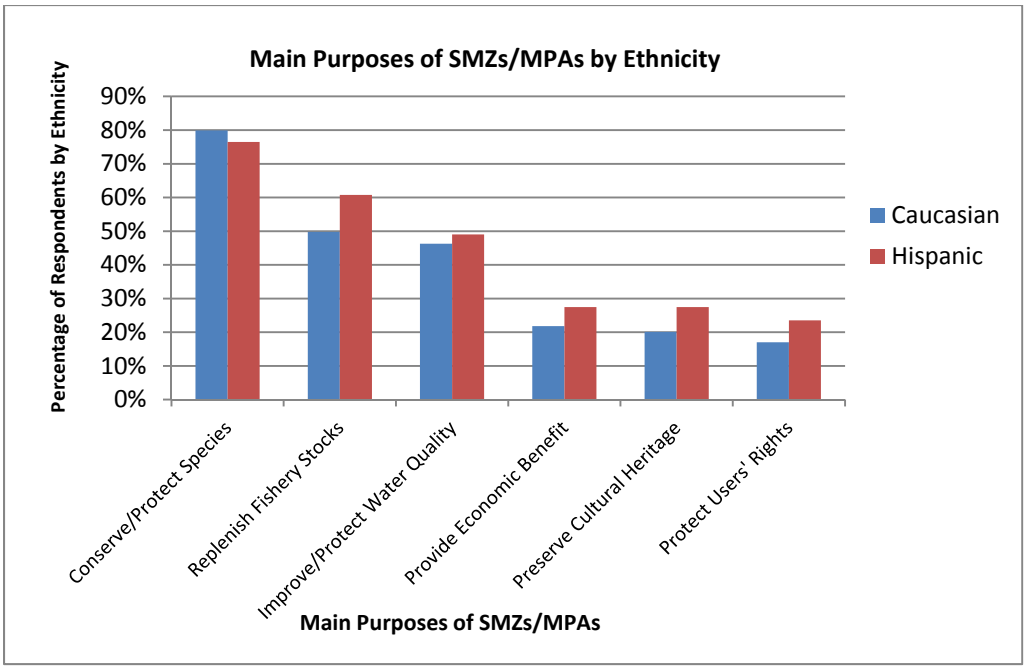


Figure 41. Respondents' identification of the main purposes of SMZs/MPAs by ethnicity.

5.3.2.3.3 Years Using Marine Resources

The number of years respondents have used marine resources did not influence the respondents' identification of the main purpose of an SMZ/MPA (Figure 42). The 296 respondents had 728 responses. The main purpose identified by more than 70% of respondents in each category was to conserve and protect species. The next most common purposes (more than 30%) were to replenish fishery stocks and to improve water quality. More than 30% of the respondents who have used marine resources for 5 to 10 years or for more than 30 years believe SMZs/MPAs provide economic benefit. Note: Only 2 individuals had used marine resources for more than 50 years; their responses are not included in the analyses.

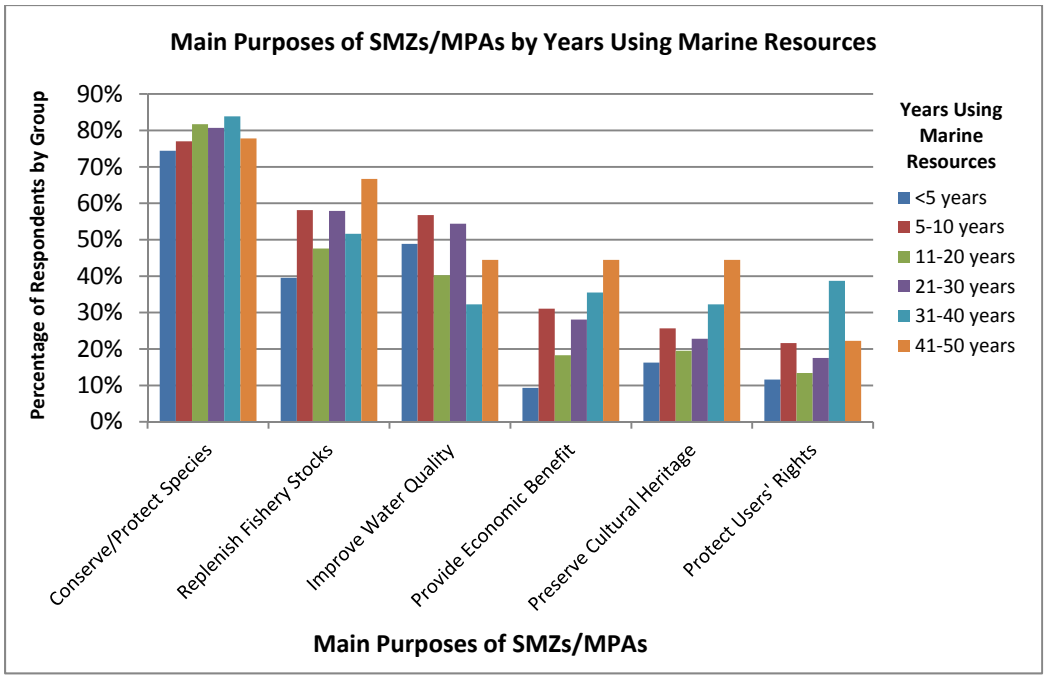


Figure 42. Respondents' identification of the main purposes of SMZs/MPAs by years using marine resources.

5.3.3 Major Concerns About SMZs/MPAs

A total of 298 respondents rated their concerns about MPAs/SMZs from 1, least problematic, to 5, most problematic. In general, respondents (> 35%) were most concerned (rating = 5) that SMZs/MPAs are not effectively enforced and regulated. Over 30% of the respondents were concerned (rating = 5) that there are too few MPAs and that there is poor user compliance with SMZ/MPA regulations. Respondents considered having too many SMZs/MPAs to be least problematic (rating = 1). More than 40% of respondents were concerned that MPA benefits were unclear (rating = 4 or 5) (Figure 43). Of the 27 respondents with "Other" concerns, more than 50% rated their other concerns as most problematic (rating = 5). However, there was no place on the survey form for respondents to describe their other concerns.

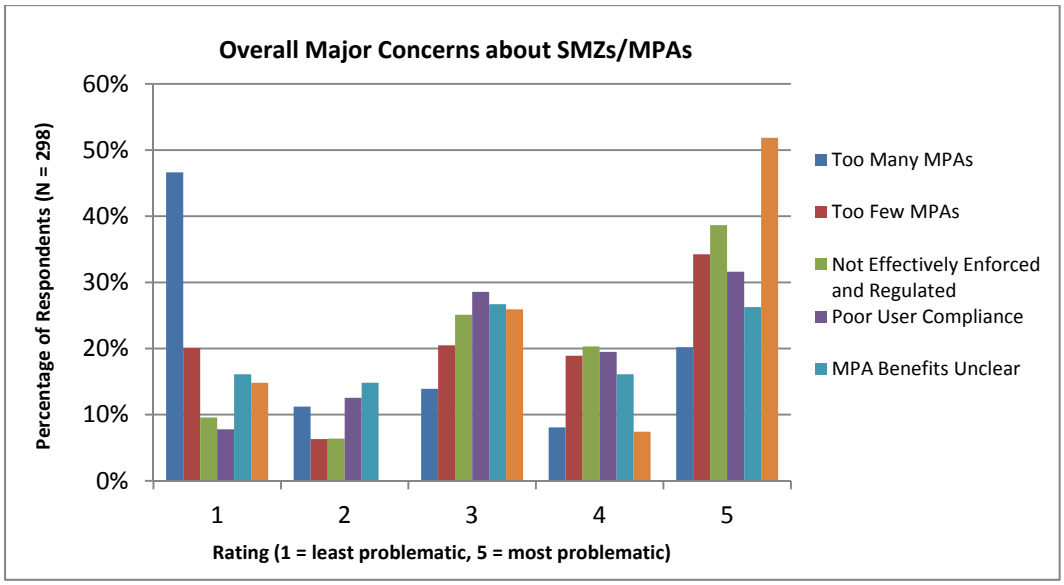


Figure 43. Respondents' rating of major concerns about SMZs/MPAs.

5.3.3.1 User Groups

The user groups differed in their rating of the major concerns they have about SMZs/MPAs. Recreational user groups (≥ 30%) considered too many SMZs/MPAs to be least problematic (rating = 1) (Figure 44).

Charter boat fishers, commercial dive operators, and commercial divers, (≥ 30%) considered too many SMZs/MPAs to be least problematic (rating = 1). However, 38% of commercial fishers considered too many SMZs/MPAs to be most problematic (rating = 5) (Figure 44).

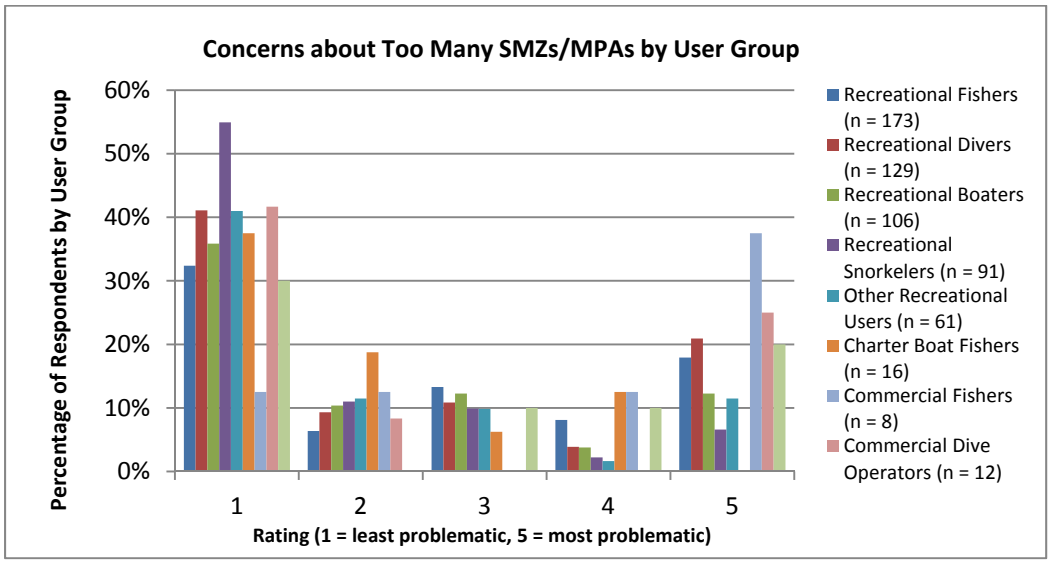


Figure 44. Respondents' rating of concerns about too many SMZs/MPAs by user group.

At least 32% of most recreational user groups considered too few SMZs/MPAs to be most problematic (rating = 5). However, only 24% of recreational fishers considered too few SMZs/MPAs to be most problematic (rating = 5); 21% considered too few SMZs/MPAs to be least problematic (rating = 1) (Figure 45).

For the non-recreational users, charter boat fishers (44%), commercial dive operators (33%), and commercial divers (30%) also considered too few SMZs/MPAs to be most problematic (rating = 5). However, 25% of commercial fishers considered too few SMZs/MPAs to be most problematic; another 25% considered too few SMZs/MPAs to be least problematic (Figure 45).

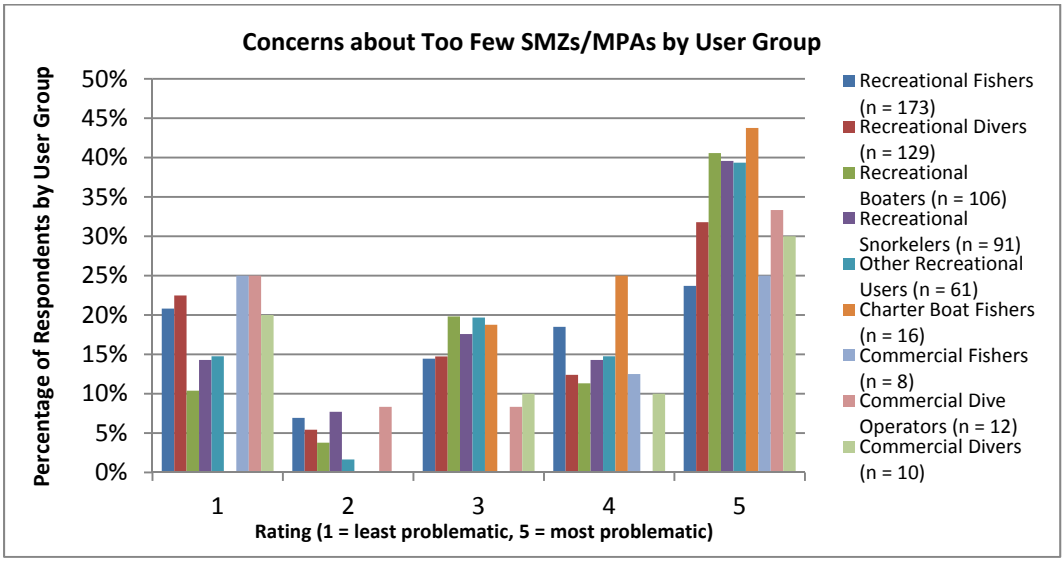


Figure 45. Respondents' rating of concerns about too few SMZs/MPAs by user group.

Recreational users were most concerned that SMZs/MPAs are not effectively enforced and regulated. More than 30% of each recreational group rated this issue as most problematic (rating = 5) (Figure 46).

For the non-recreational users, 56% of charter boat fishers and 40% of commercial divers were also most concerned that SMZs/MPAs are not effectively enforced and regulated. Commercial fishers (50%) and commercial dive operators (42%) considered ineffective SMZ/MPA enforcement and regulation to be problematic (rating = 4 or 5) (Figure 46).

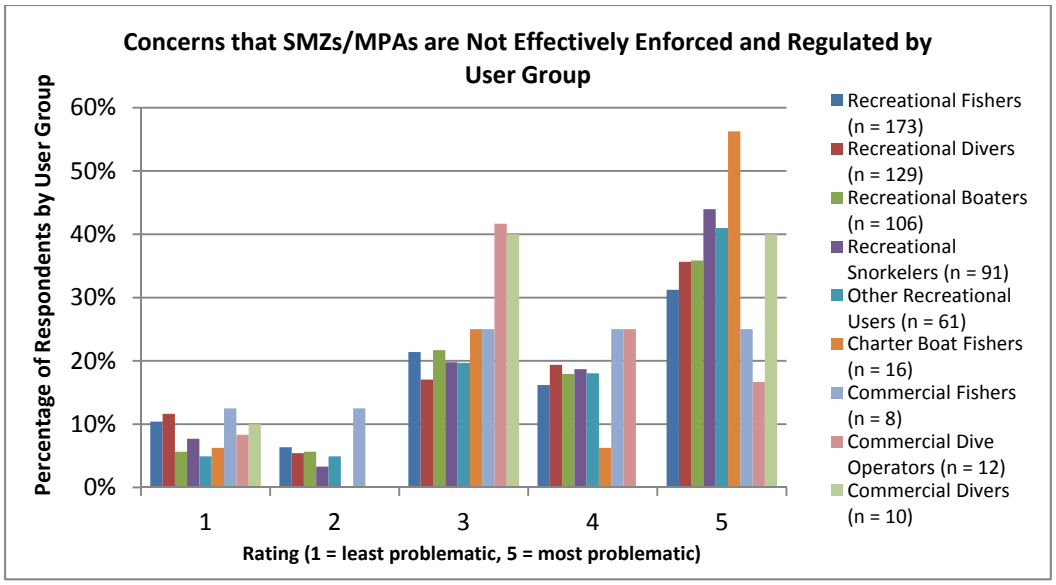


Figure 46. Respondents' rating of concerns that SMZs/MPAs are not effectively enforced and regulated by user group.

Recreational boaters (36%), recreational snorkelers (37%), and other recreational users (41%) considered poor user compliance with SMZ/MPA regulations to be most problematic (rating = 5) (Figure 47).

For non-recreational users, 63% of charter boat fishers considered poor user compliance with SMZ/MPA regulations to be most problematic (rating = 5) (Figure 47).

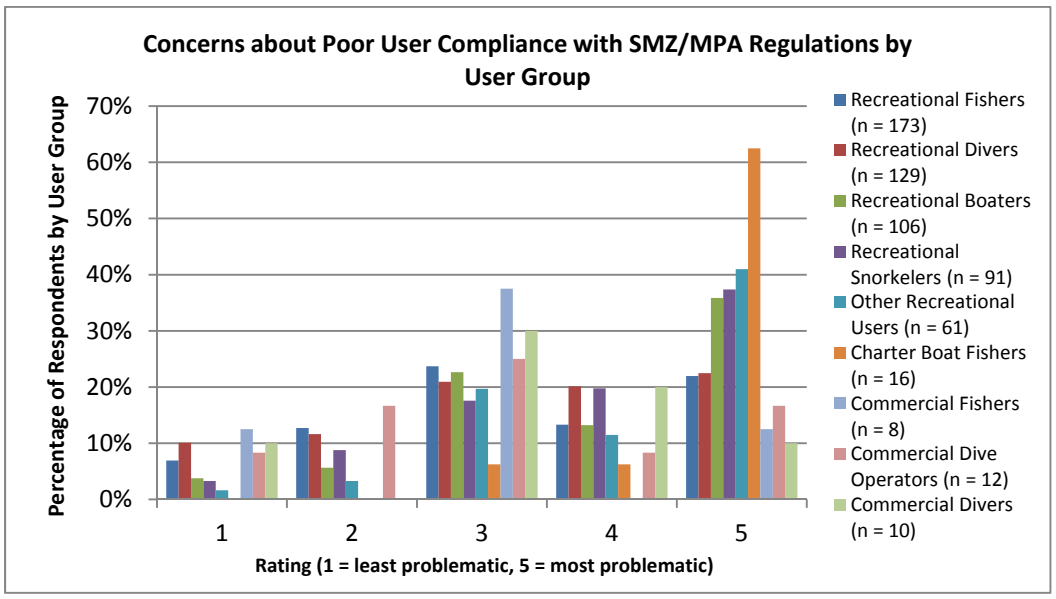


Figure 47. Respondents' rating of concerns about poor user compliance with SMZ/MPA regulations by user group.

Of all the recreational groups, recreational divers (28%) considered unclear SMZ/MPA benefits to be most problematic (rating = 5) (Figure 48).

For the non-recreational users, 38% of commercial fishers and 33% of commercial dive operators considered unclear SMZ/MPA benefits to be most problematic (rating = 5). Charter boat fishers (31%) considered unclear SMZ/MPA benefits to be least problematic (rating = 1) (Figure 48).

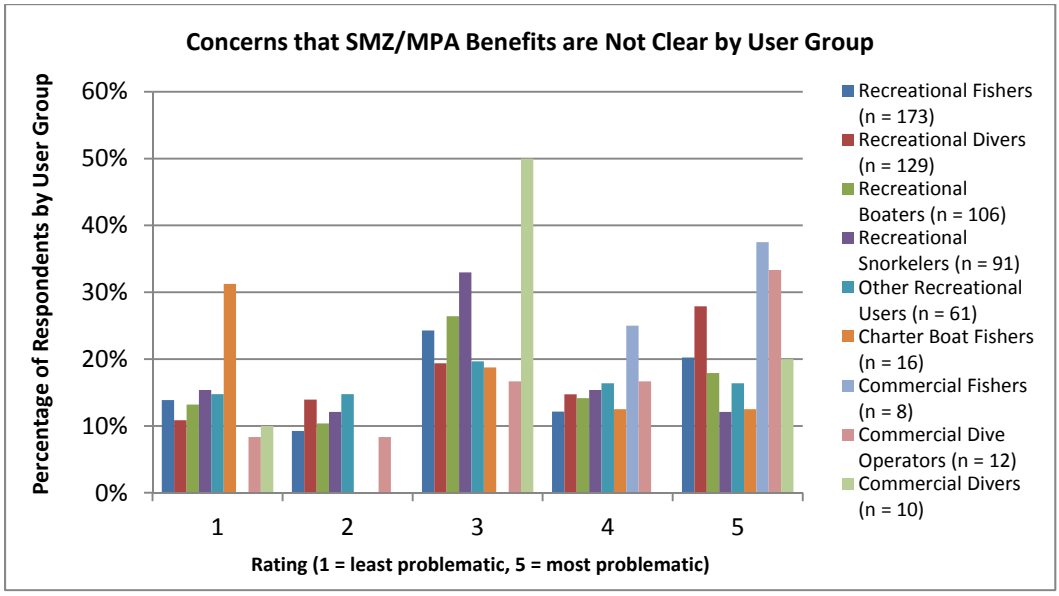


Figure 48. Respondents' rating of concerns that SMZ/MPA benefits are not clear by user group.

5.3.3.2 County of Residence

Southeast Florida residents had similar levels of concern about most SMZ/MPA issues. More than 40% of residents from each county considered too many SMZs/MPAs to be least problematic (rating = 1) (Figure 49).

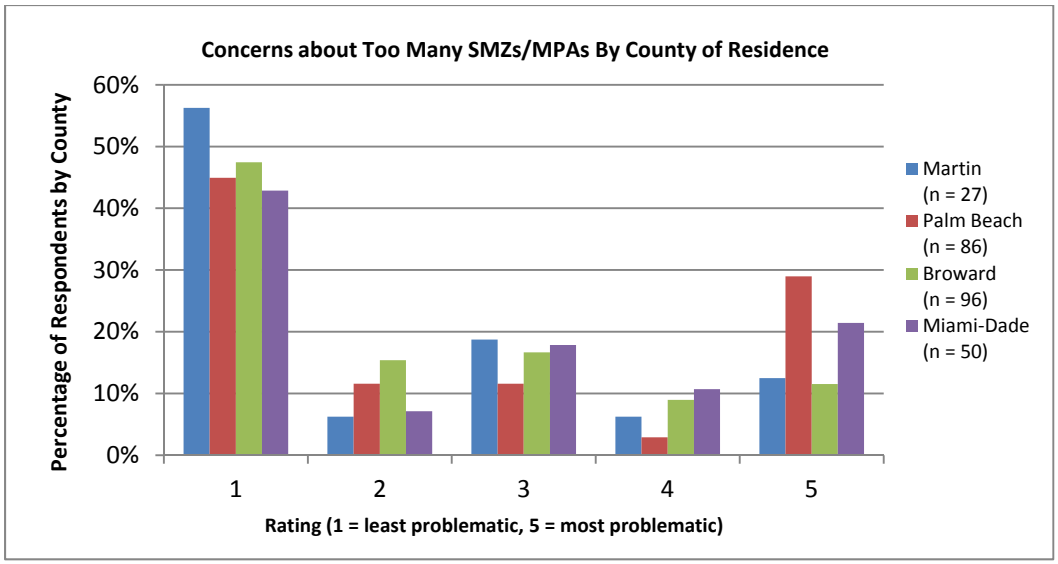


Figure 49. Rating of the concerns about too many SMZs/MPAs by respondents from each county.

More than 30% of the residents in Palm Beach, Broward, and Miami-Dade counties considered too few SMZs/MPAs as most problematic (rating = 5). Over 40% of Martin County residents did not consider too few SMZs/MPAs to be problematic (rating = 3) (Figure 50).

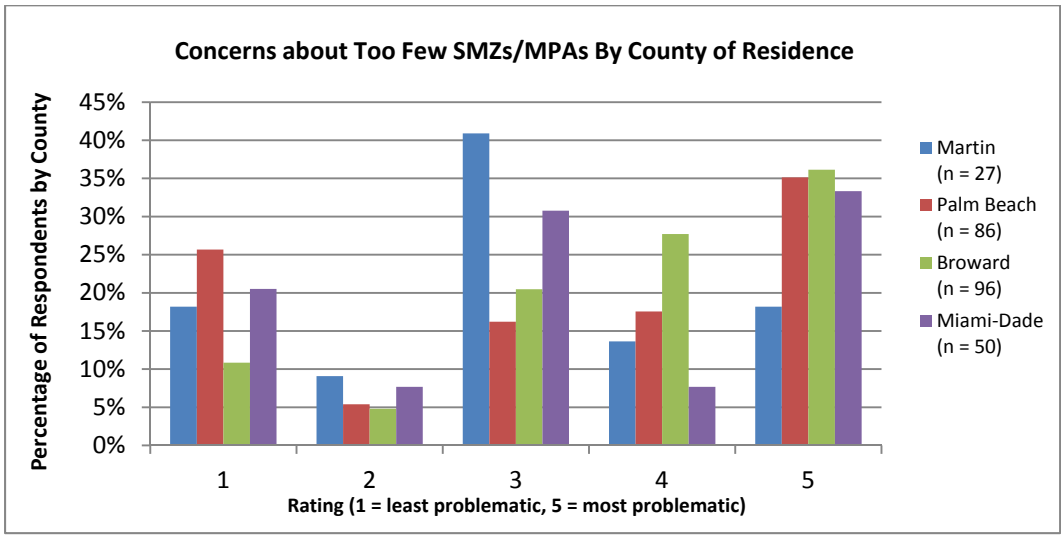


Figure 50. Rating of the concern about too few SMZs/MPAs by respondents from each county.

At least 35% of the residents in Palm Beach, Broward, and Miami-Dade counties were concerned that SMZs/MPAs were not effectively enforced and regulated (rating = 5). Over 35% of Martin County residents did not consider SMZ/MPA enforcement and regulation to be problematic (rating = 3) (Figure 51).

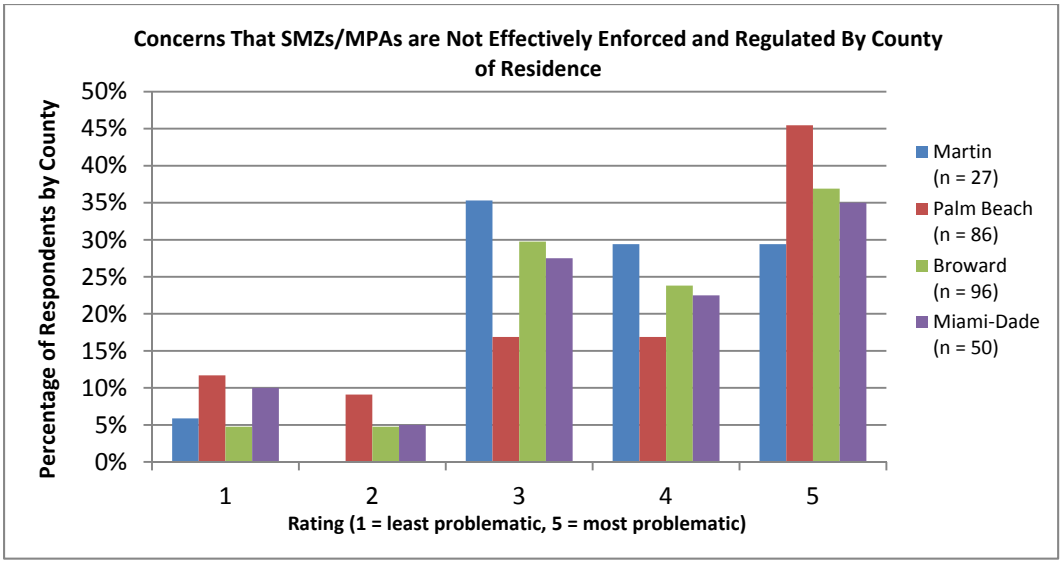


Figure 51. Rating of the concern that SMZs/MPAs are not effectively enforced and regulated by respondents from each county.

Respondents from Broward (45%) and Miami-Dade (34%) counties believe that poor user compliance is the most problematic issue (rating = 5) for SMZs/MPAs (Figure 52).

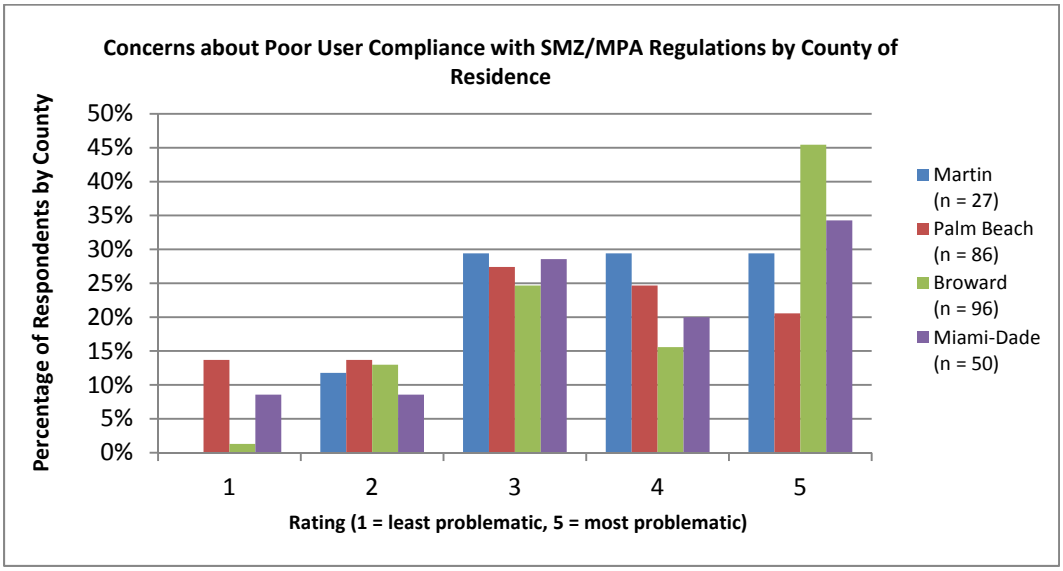


Figure 52. Rating of concerns about poor user compliance with SMZ/MPA regulations by respondents from each county.

Respondents from Martin (> 30%) and Miami-Dade (> 25%) counties are most concerned that SMZ/MPA benefits are not clear (rating = 5). Residents of Palm Beach (> 30%) and Broward (> 25%) counties did not consider this issue to be problematic (rating = 3) (Figure 53).

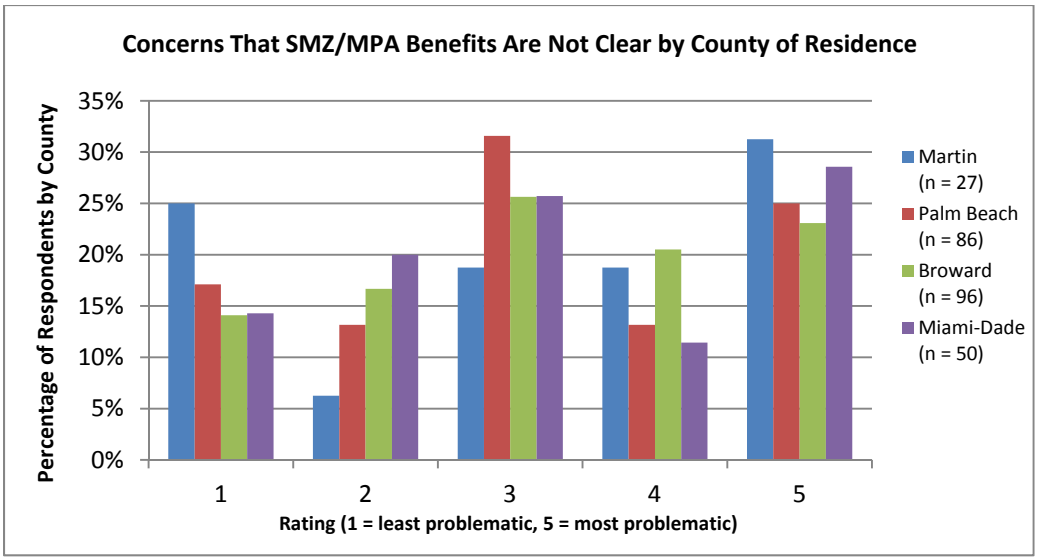


Figure 53. Rating of concerns that SMZ/MPA benefits are not clear by respondents from each county.

5.3.3.3 Age Group

The age groups differed in their rating of the major concerns they have about SMZs/MPAs. The age groups are 18-30, 31-40, 41-50, 51-60, and over 60 years; the one individual who was less than 18 years of age is not included in these analyses. At least 30% of the respondents in each age group considered too many SMZs/MPAs to be least problematic (rating = 1) (Figure 54).

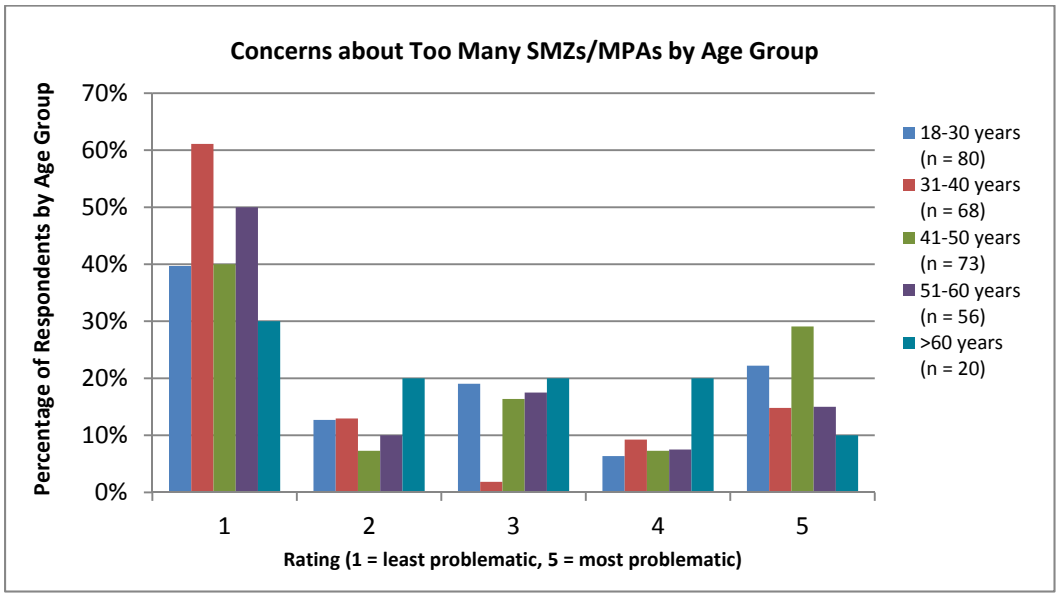


Figure 54. Respondents' rating of concerns about too many SMZs/MPAs by age group.

Similarly, except for the group over 60 years of age, at least 30% of the respondents rated too few SMZs/MPAs as most problematic (rating = 5). Nearly 60% of the over 60 years group rated too few SMZs/MPAs as a 3 (Figure 55).

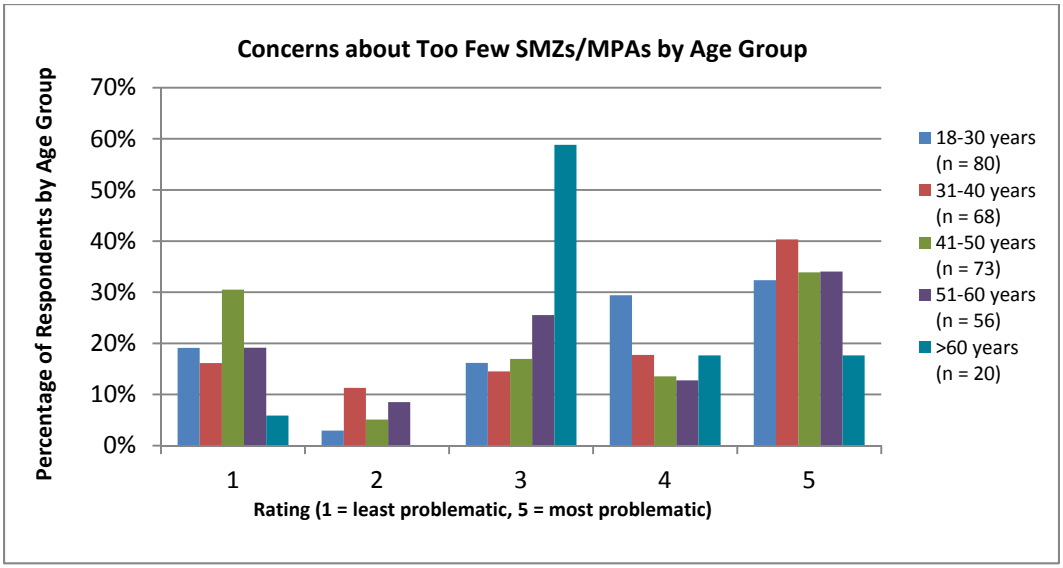


Figure 55. Respondents' rating of concerns about too few SMZs/MPAs by age group.

At least 25% of the respondents in each age group considered the issue that SMZs/MPAs are not effectively enforced and regulated to be most problematic (rating = 5). Over 45% of the 18-30 year-old group rated this issue a 5 (Figure 56).

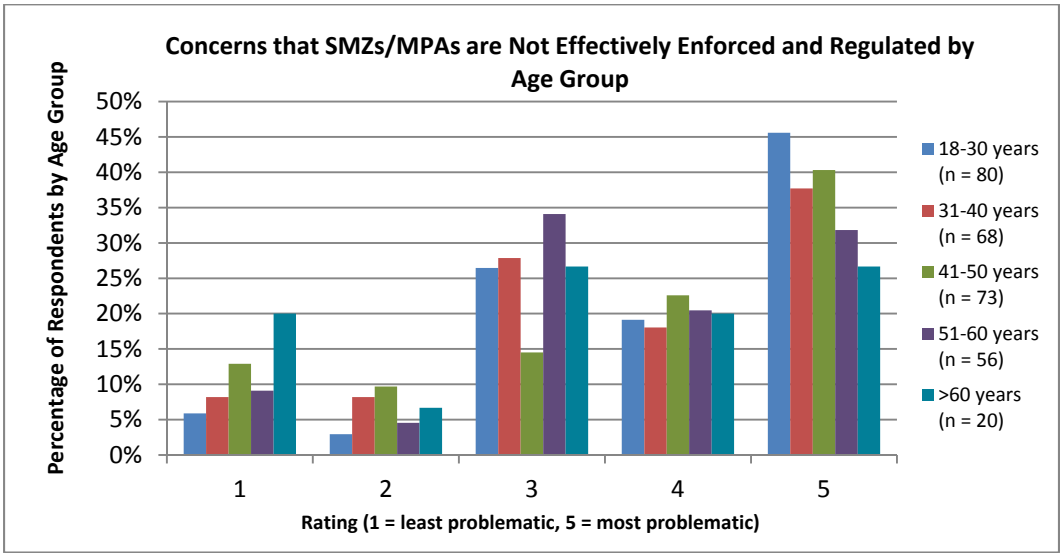


Figure 56. Respondents' rating of concerns that SMZs/MPAs are not effectively enforced and regulated by age group.

Similarly, more than 45% of the respondents in the 18-30 year-old group rated poor user compliance with SMZ/MPA regulations as most problematic (rating = 5) (Figure 57).

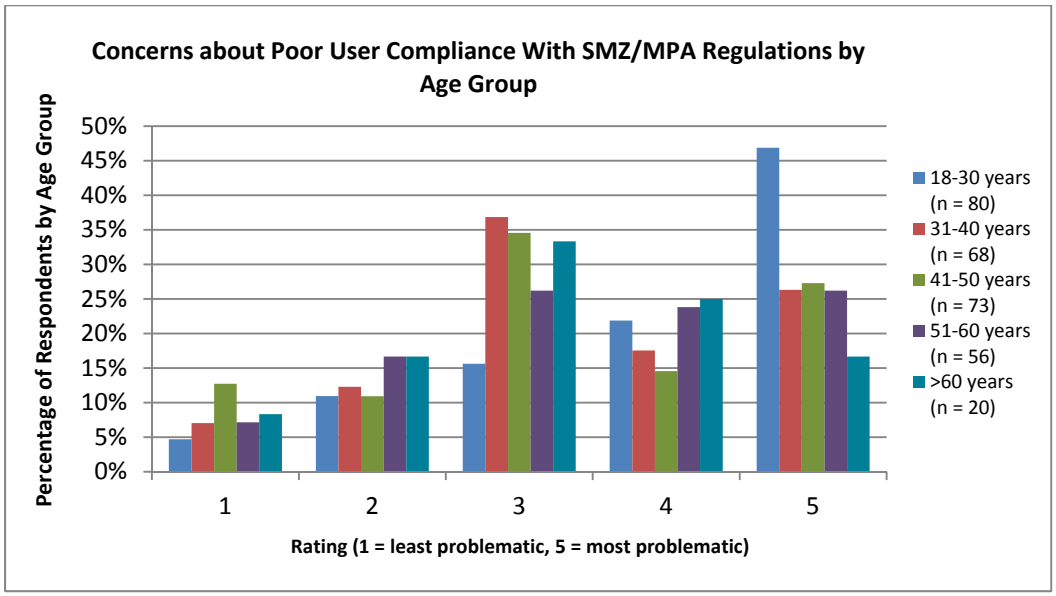


Figure 57. Respondents' rating of concerns about poor user compliance with SMZ/MPA regulation by age group.

At least 30% of the respondents in the 41–50 and the 51-60 year-old groups considered unclear SMZ/MPA benefits to be most problematic (rating = 5). Conversely, one-third (33%) of the over 60 year-old group considered unclear SMZ/MPA benefits to be least problematic (rating = 1) (Figure 58).

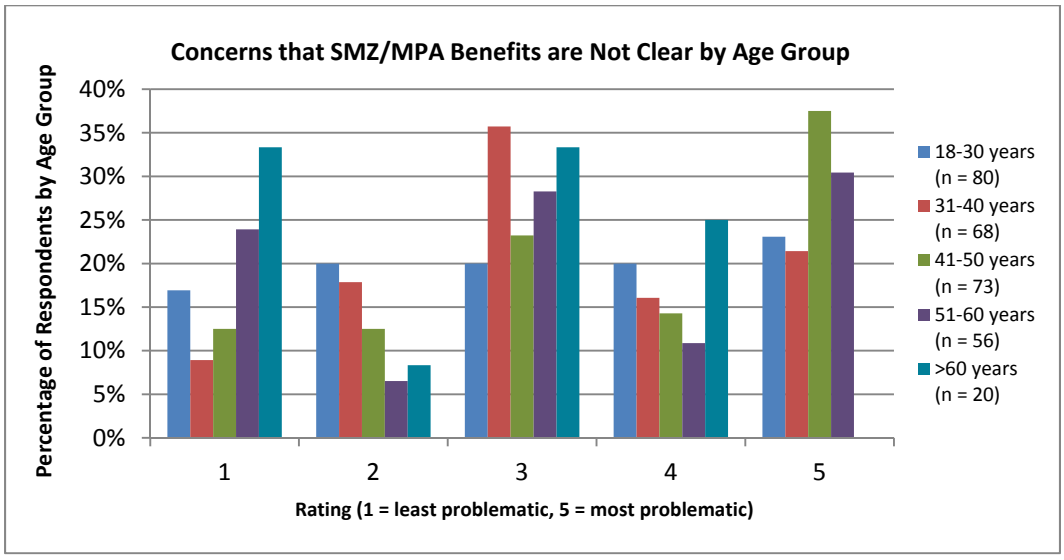


Figure 58. Respondents' rating of concerns that SMZ/MPA benefits are not clear by age group.

5.3.3.4 Ethnicity

Caucasians and Hispanics had similar levels of concern about most SMZ/MPA issues. Both ethnic groups were least concerned (rating = 1) about too many SMZs/MPAs (> 35%) (Figure 59). Each group considered the following three issues to be most problematic (rating = 5): too few SMZs/MPAs (≥ 35%) (Figure 60); SMZs/MPAs are not effectively enforced and regulated (≥ 33%) (Figure 61); and, poor user compliance with SMZ/MPA regulations (≥ 31%) (Figure 62).

Regarding concerns that SMZ/MPA benefits are not clear, Caucasians more frequently (29%) rated this issue as most problematic (rating = 5) than did Hispanics (15%) (Figure 63).

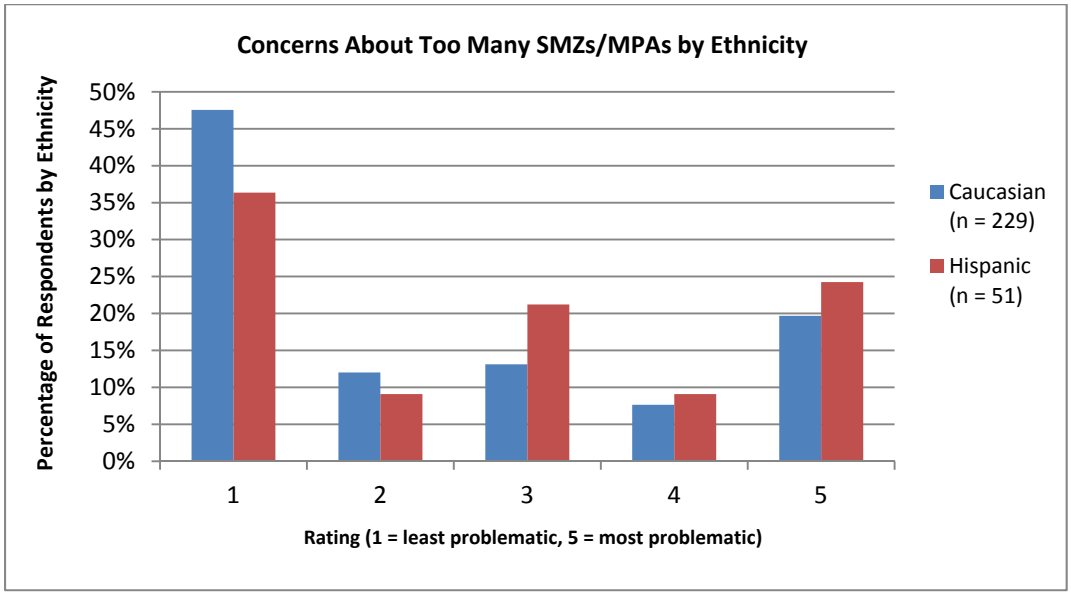


Figure 59. Respondents' rating of concerns about too many SMZs/MPAs by ethnicity.

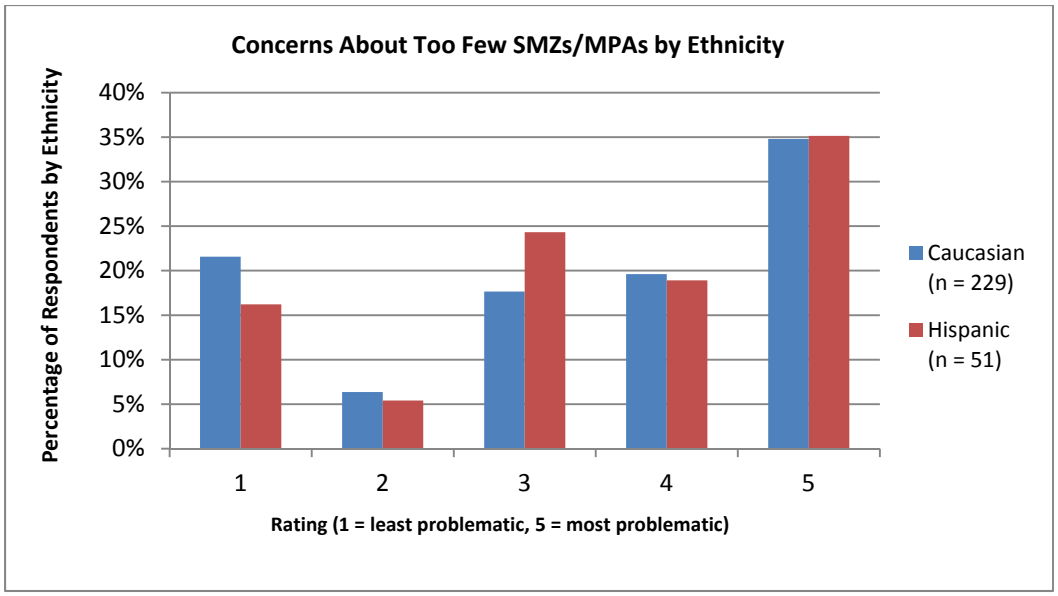


Figure 60. Respondents' rating of concerns about too few SMZs/MPAs by ethnicity.

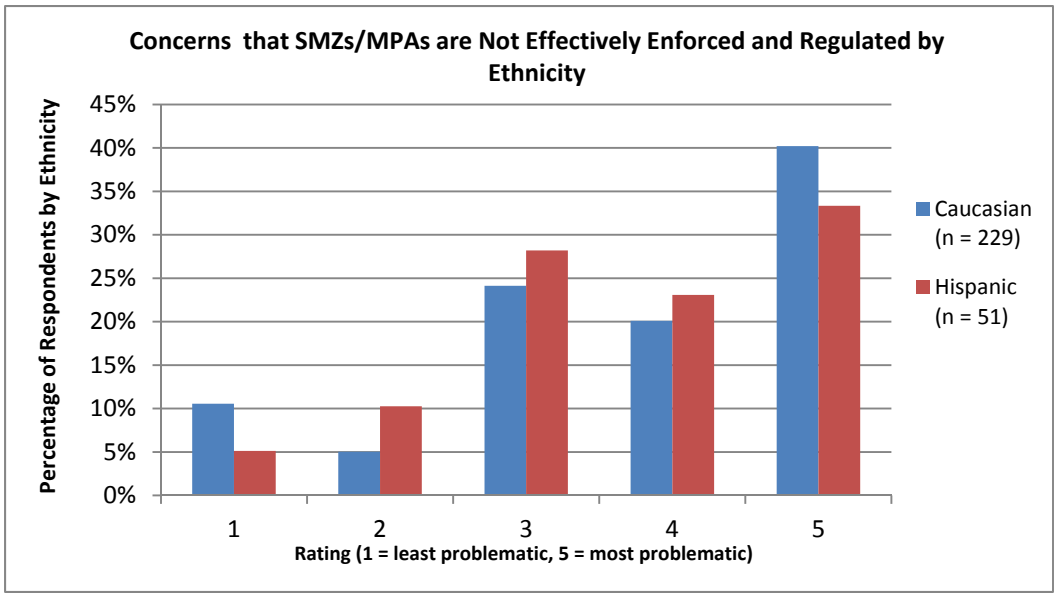


Figure 61. Respondents' rating of concerns that SMZs/MPAs are not effectively enforced and regulated by ethnicity.

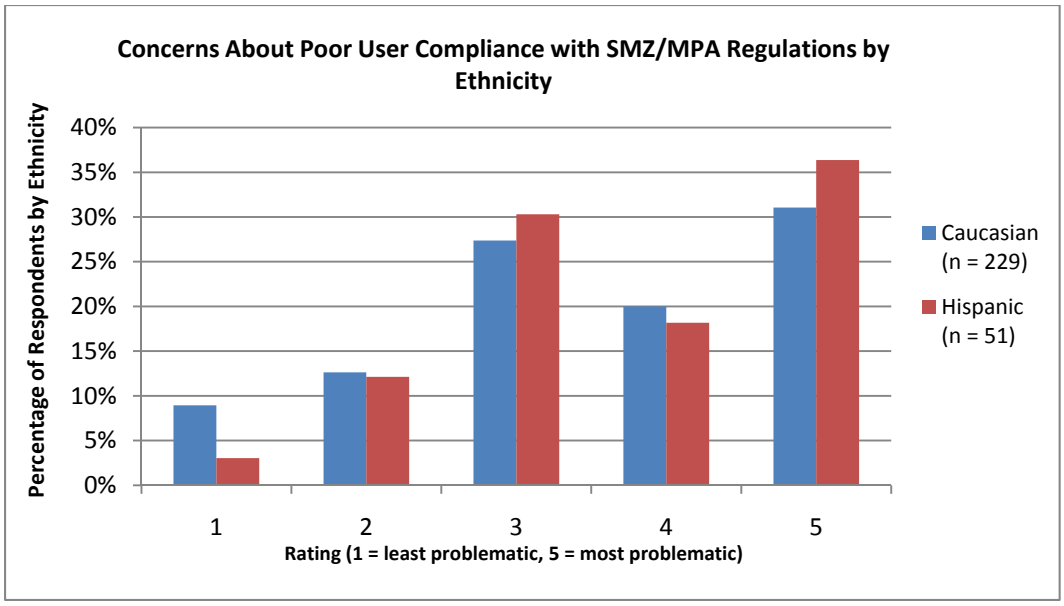


Figure 62. Respondents' rating of concerns about poor user compliance with SMZ/MPA regulations by ethnicity.

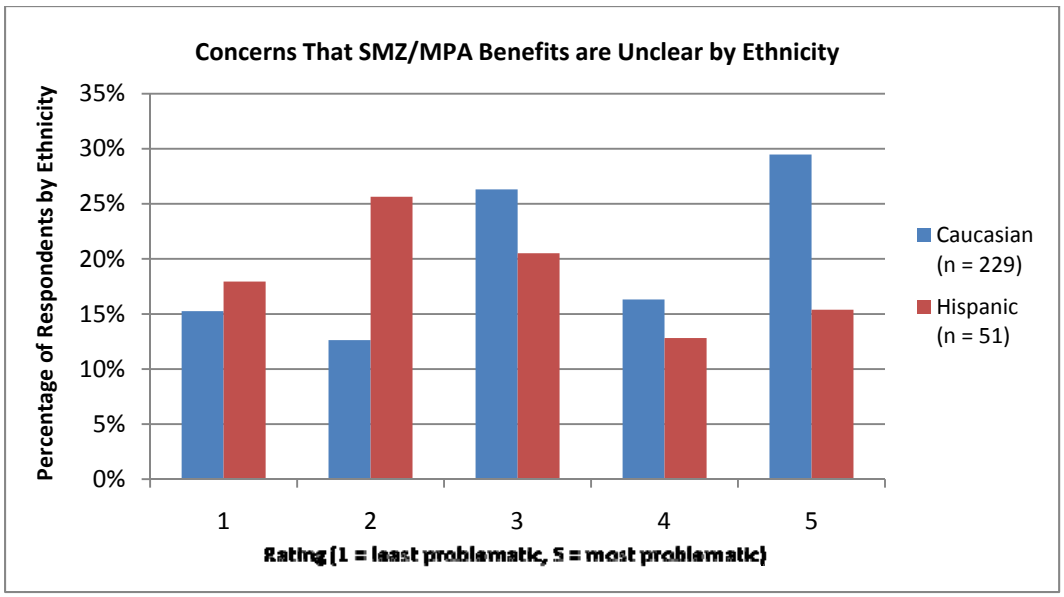


Figure 63. Respondents' rating of concerns that SMZ/MPA benefits are unclear by ethnicity.

5.3.4 Effectiveness of SMZs/MPAs

Stakeholders were asked if they believed SMZs/MPAs are an effective way to manage marine resources. Over 70% of those surveyed indicated that they believed SMZs/MPAs can effectively manage marine resources (Figure 64).

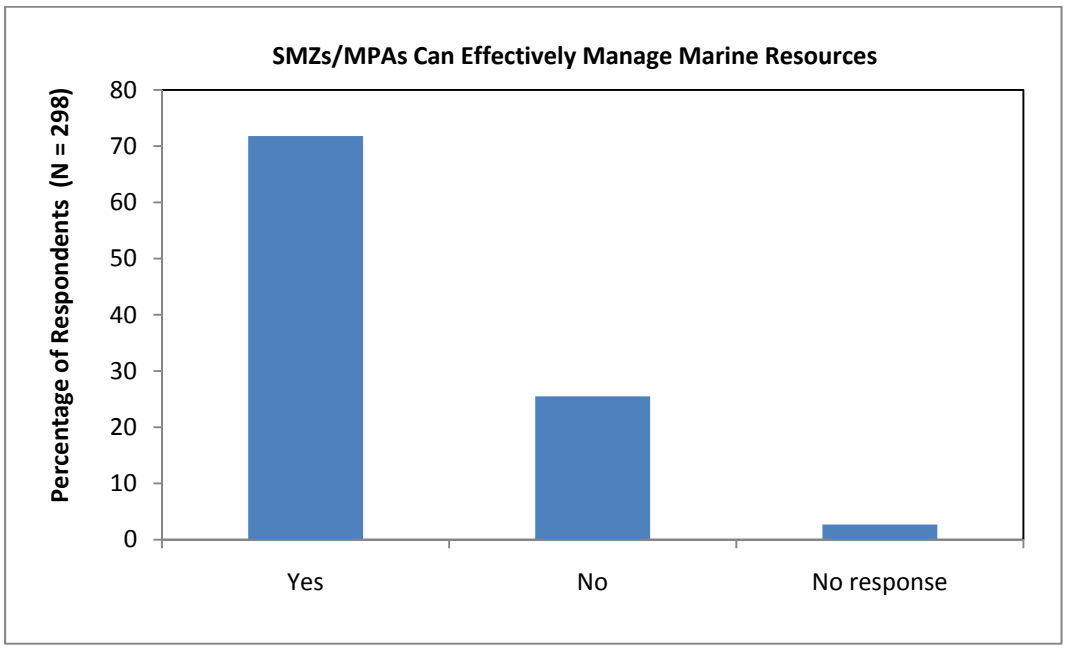


Figure 64. Percentage of respondents who believe SMZs/MPAs can effectively manage marine resources.

5.3.4.1 User Group

The majority of all recreational user groups (> 65%) believed that SMZs/MPAs can be an effective tool to manage marine resources. This opinion was especially strong among recreational boaters, recreational snorkelers, and other recreational users.

More than 60% of the respondents in three of the four non-recreational groups (charter boat fishers, commercial dive operators, and commercial divers) believe that SMZs/MPAs can be an effective tool to manage marine resources. However, more than 50% of the commercial fishers (4 of the 7 respondents) do not believe that SMZs/MPAs can effectively manage marine resources (Figure 65).

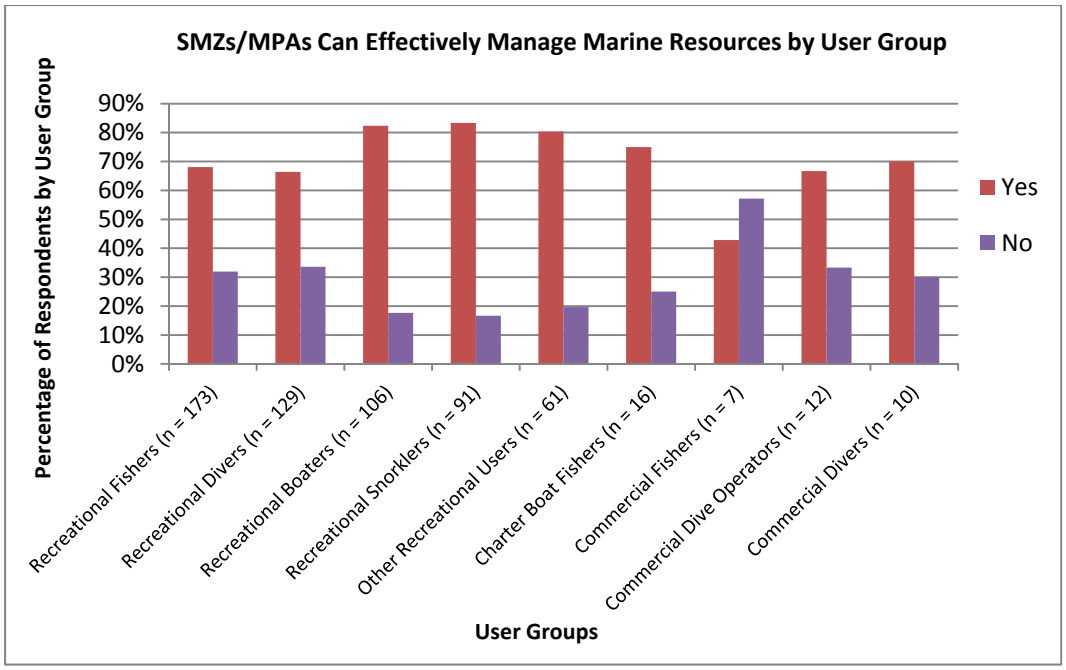


Figure 65. Percentage of respondents who believe SMZs/MPAs can effectively manage marine resources by user group.

5.3.4.2 County of Residence

The majority (> 65%) of respondents in each county believe that SMZs/MPAs manage marine resources effectively (Figure 66).

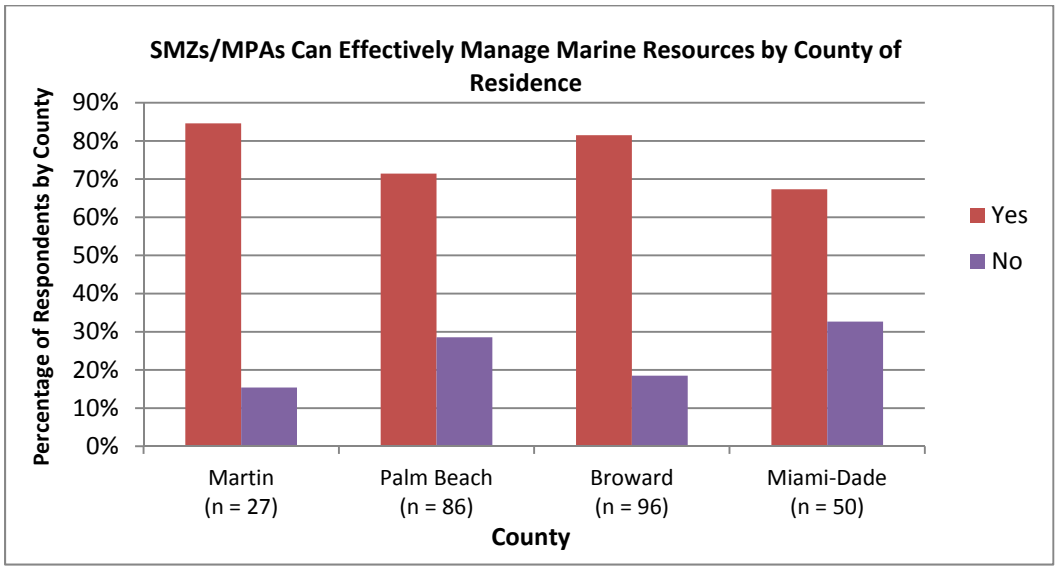


Figure 66. Percentage of respondents by county of residence who believe SMZs/MPAs can effectively manage marine resources.

5.3.4.3 Age Group

The majority (> 60%) of the members in each age group believe that SMZs/MPAs can effectively manage marine resources (Figure 67).

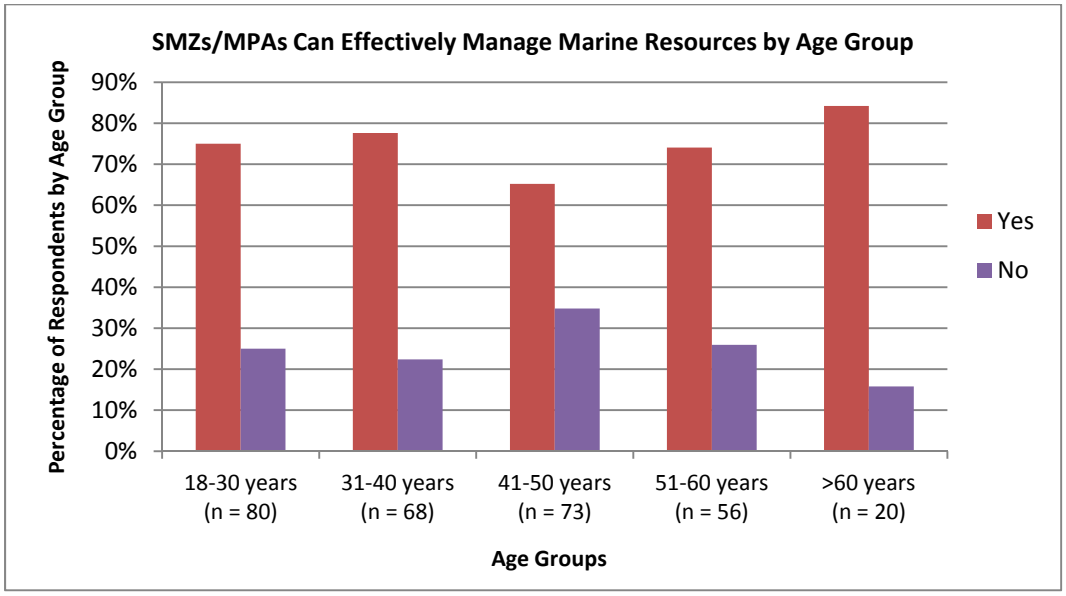


Figure 67. Percentage of respondents who believe SMZs/MPAs can effectively manage marine resources by age group.

5.3.4.4 Ethnicity

The majority of Caucasian (73%) and Hispanic (77%) respondents believe that SMZs/MPAs can manage resources effectively (Figure 68).

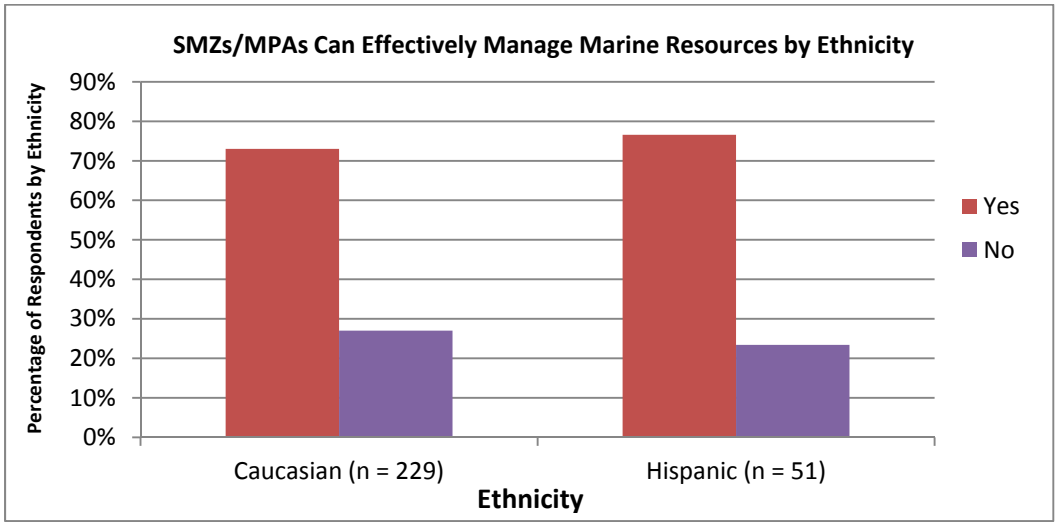


Figure 68. Percentage of respondents by ethnicity who believe SMZs/MPAs can effectively manage marine resources.

5.3.5 Issues Impacting Quality of Southeast Florida Coral Reefs

More than 55% of respondents perceive water pollution/waste dumping, land-based sources of pollution, coastal construction, and water quality/sedimentation as the top four most important issues (rating = 5) impacting the quality of coral reefs in southeast Florida. The next two most frequently (≥ 40%) identified important issues (rating = 5) are over-fishing and lack of education/outreach. The respondents were least concerned (rating 1) about impacts from diving on the coral reefs in this survey (Figure 69).

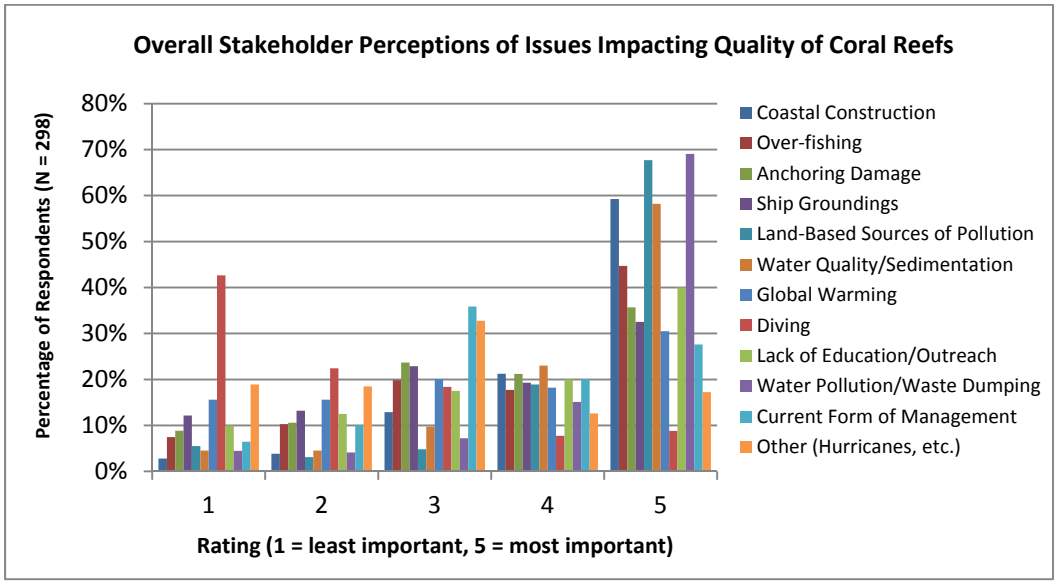


Figure 69. Respondents' ratings of issues impacting quality of coral reefs.

5.3.5.1 User Groups

Respondents categorized themselves into user groups based on their primary activities. Because each respondent could choose more than one activity, there were 606 total activity responses from the 298 respondents. Similarly, because respondents could choose multiple issues that impact coral reef quality, there were 3,339 total responses. The results are presented as percentages of responses based on the total number of responses for each user group (Figures 70 -78).

For recreational users (recreational fishers, recreational divers, recreational boaters, recreational snorkelers, and other recreational users), the four most frequently (≥ 50%) identified most important issues (rating = 5) impacting coral reef quality were coastal construction, land-based sources of pollution, water quality/sedimentation, and water pollution/waste dumping (Figures 70-74).

Fifty percent or more of the non-recreational users (charter boat fishers, commercial fishers, commercial dive operators, and commercial divers) identified coastal construction, land-based sources of pollution, water quality/sedimentation, and water pollution/waste dumping as the four most important issues (rating = 5) impacting coral reef quality (Figures 75-78).

In addition to the four main issues impacting coral reefs, recreational fishers (> 40%) also considered over-fishing to be a most important issue (rating = 5) impacting coral reef quality. This group (> 40%) was least concerned (rating = 1) about the impact of diving on coral reefs (Figure 70).

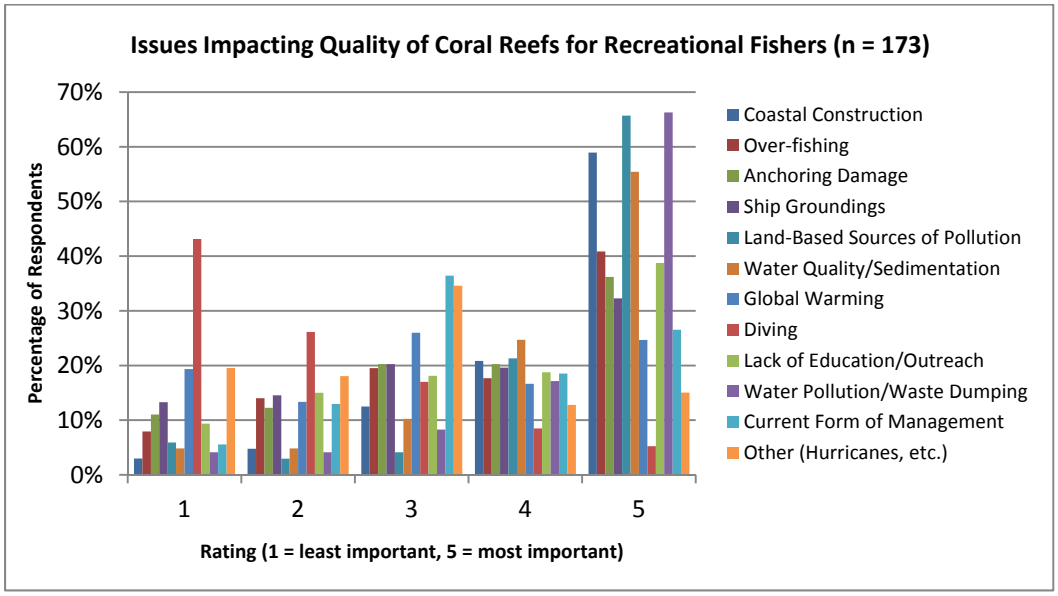


Figure 70. Recreational fishers' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, recreational divers (> 45%) also considered over-fishing as a most important issue (rating = 5) impacting the quality of southeast Florida coral reefs. The majority (> 50%) of recreational divers are not concerned (rating = 5) about the impacts of diving on coral reefs (Figure 71).

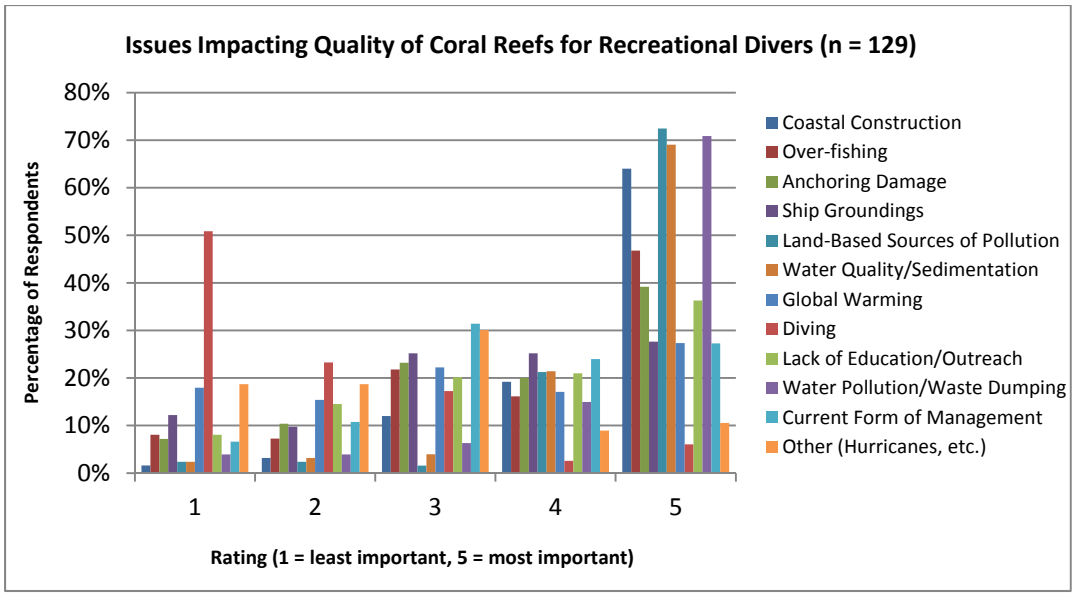


Figure 71. Recreational divers' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, recreational boaters also consider over-fishing (> 50%), anchoring damage (40%), and lack of education/outreach (> 45%) issues to be most important (rating = 5) (Figure 72).

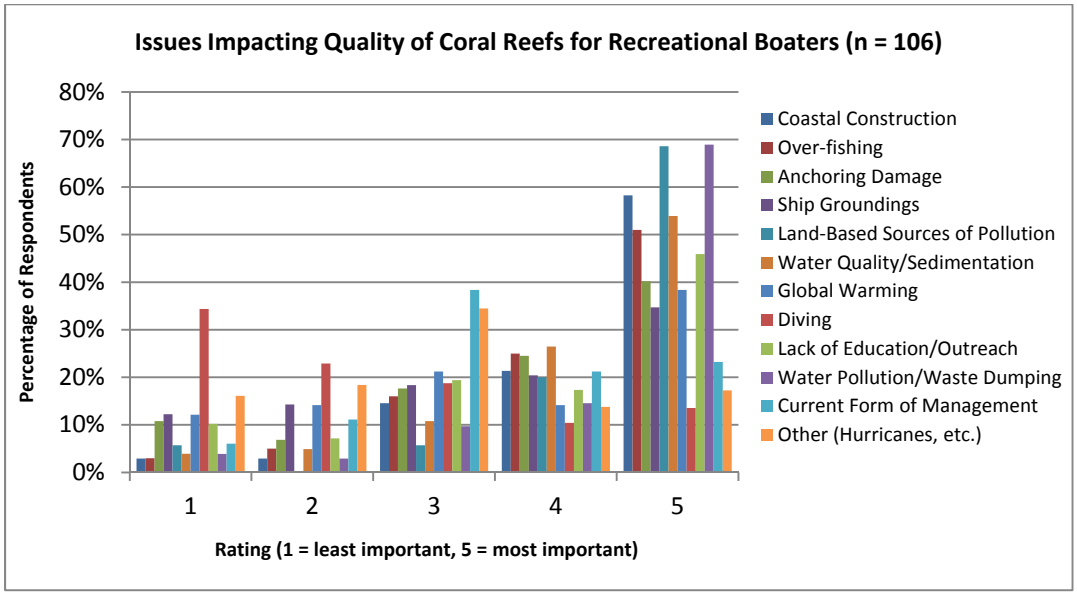


Figure 72. Recreational boaters' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, recreational snorkelers (60%) also believe over-fishing is a most important issue (rating = 5) impacting the quality of coral reefs in southeast Florida (Figure 73).

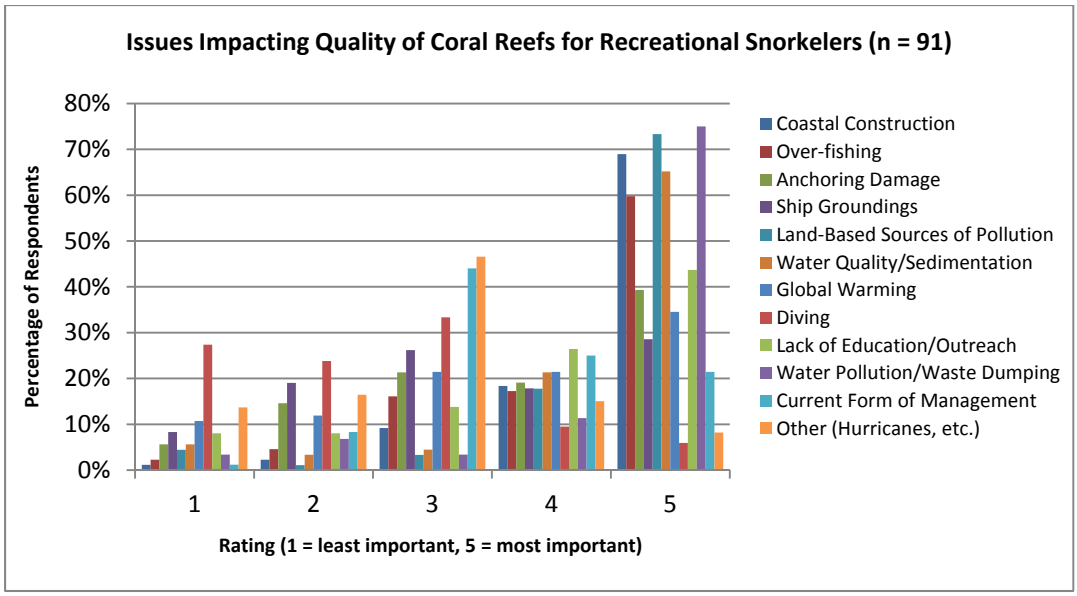


Figure 73. Recreational snorkelers' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, of the other recreational users, more than 50% also consider over-fishing and lack of education/outreach as most important issues (rating = 5) impacting of coral reef quality (Figure 74).

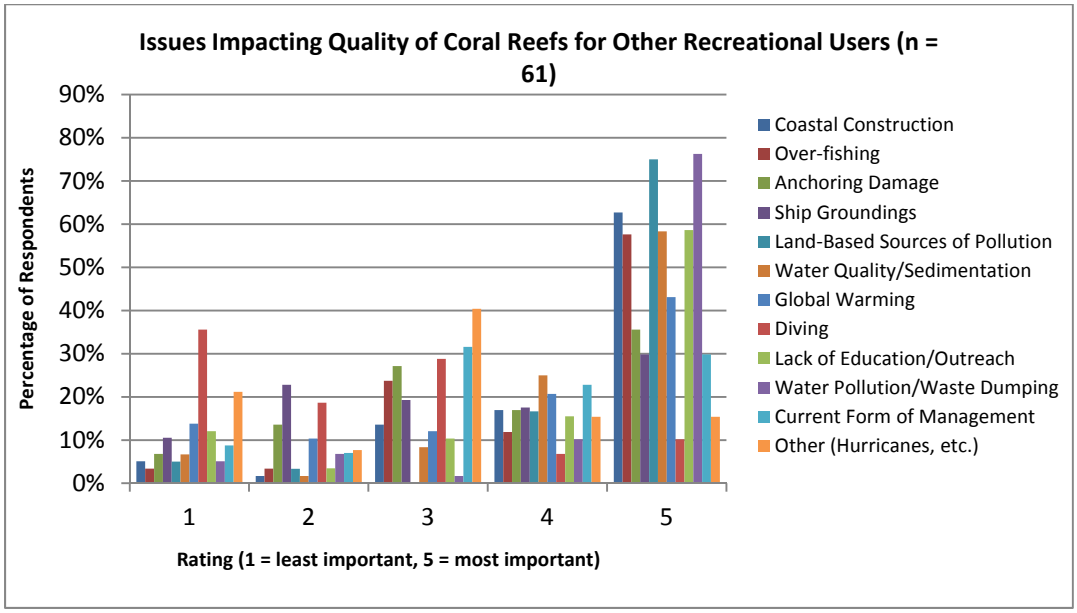


Figure 74. Other recreational users' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, charter boat fishers consider over-fishing (> 55%) and lack of education/outreach (50%) to be most important (rating = 5) issues (Figure 75).

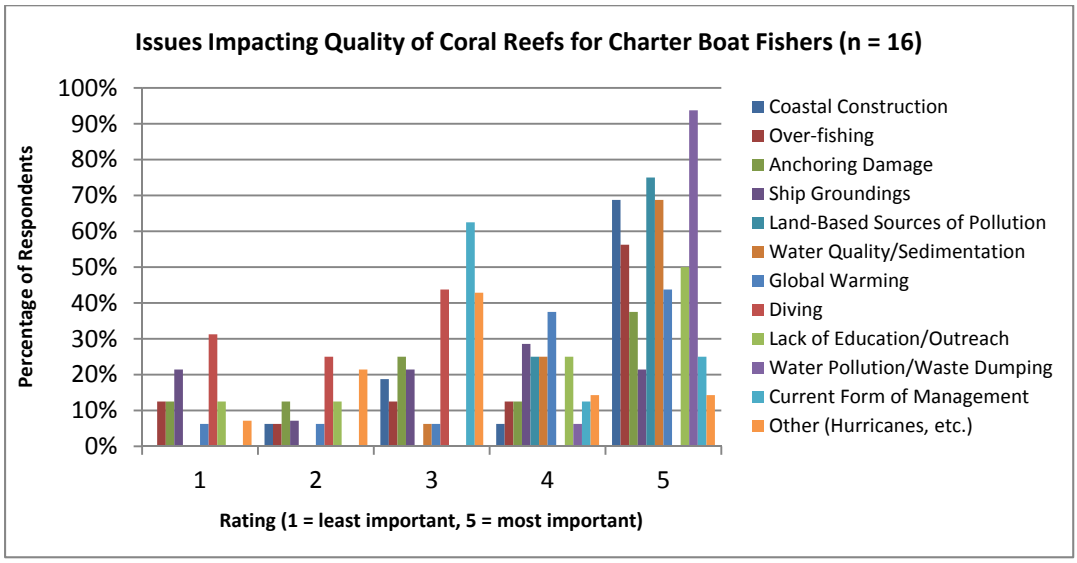


Figure 75. Charter boat fishers' ratings of issues impacting quality of coral reefs.

For commercial fishers, the three most important (rating = 5) issues impacting coral reefs are water pollution/waste dumping (63%), coastal construction (50%), and water quality/sedimentation (50%). Commercial fishers consider over-fishing and diving to have minimal impacts (38%, rating = 2) on coral reef quality (Figure 76).

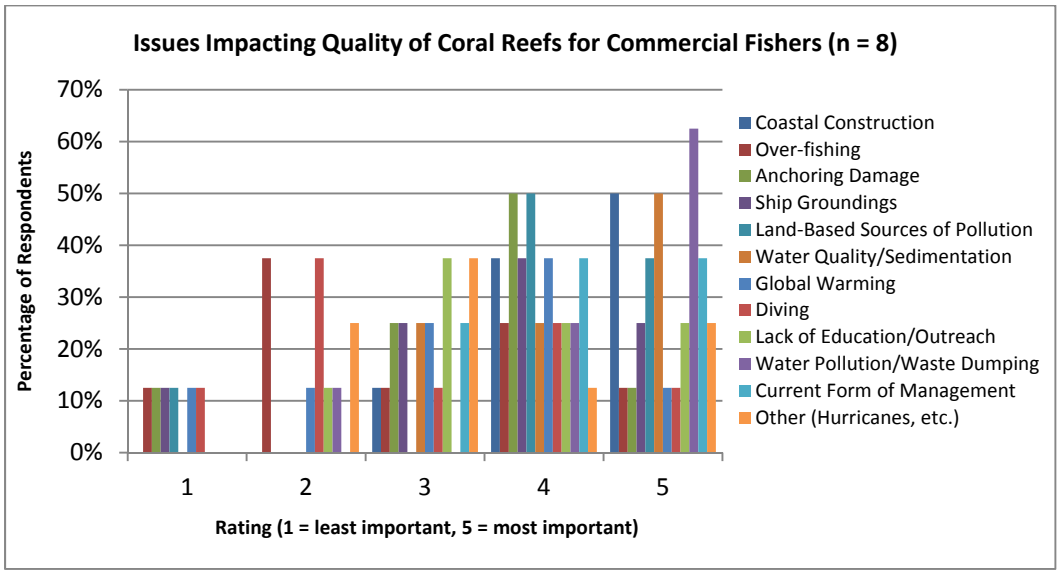


Figure 76. Commercial fishers' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, commercial dive operators are also most concerned about the impacts of over-fishing (> 50%) and ship groundings (50%) on coral reef quality. The majority (73%) of commercial dive operators considered diving to be the least important issue (rating = 1) (Figure 77).

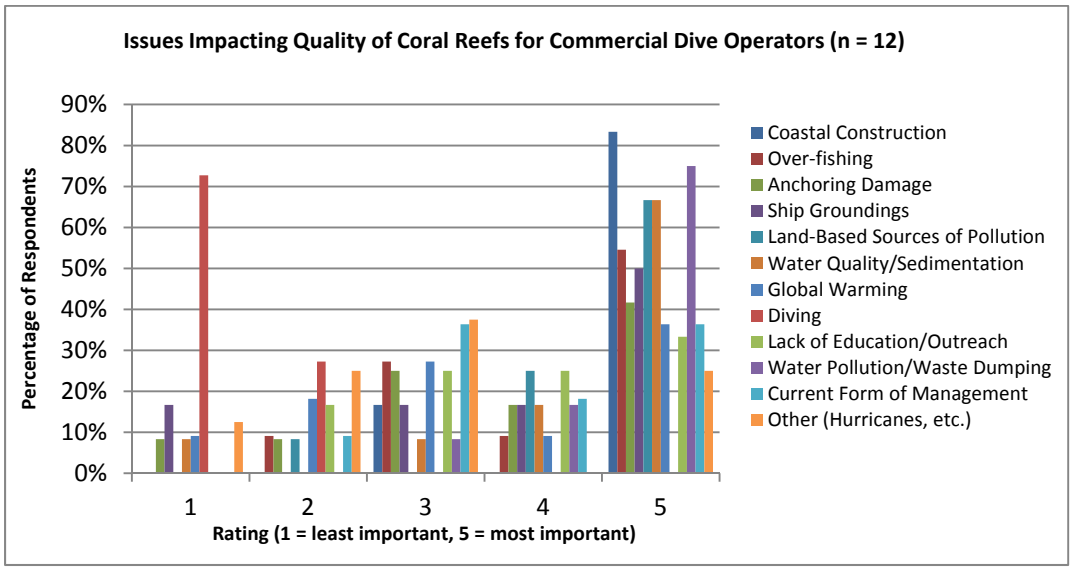


Figure 77. Commercial dive operators' ratings of issues impacting quality of coral reefs.

In addition to the four main issues impacting coral reefs, commercial divers also consider anchoring damage (50%) and ship groundings (50%) to be most important issues (rating = 5) (Figure 78).

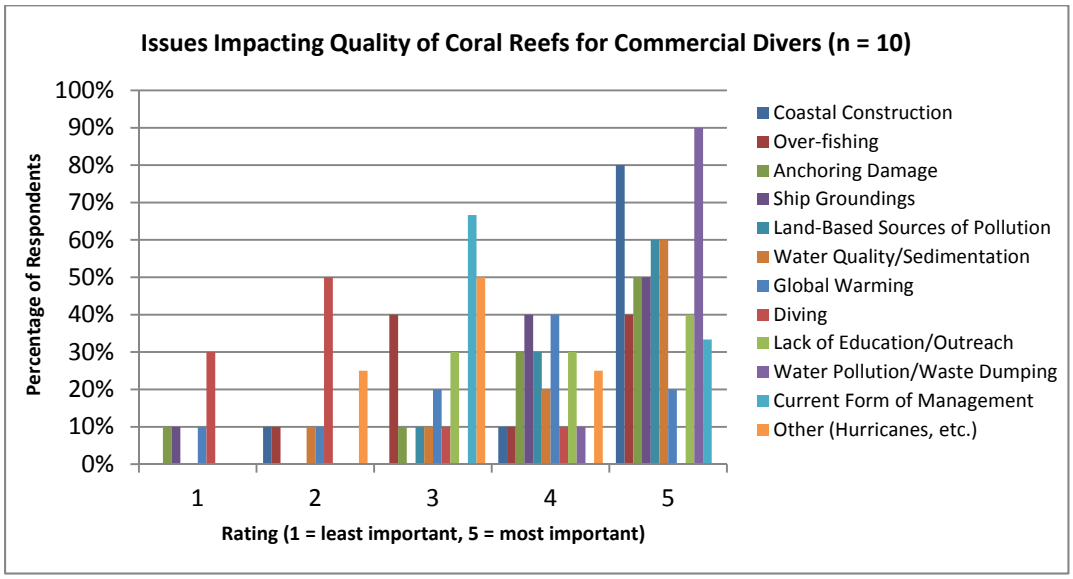


Figure 78. Commercial divers' ratings of issues impacting quality of coral reefs.

5.3.5.2 County of Residence

Over 50% of the respondents from each county (Martin, Palm Beach, Broward, and Miami-Dade) considered water pollution/waste dumping, land-based sources of pollution, coastal construction, and water quality/sedimentation as the most important issues (rating = 5) impacting the quality of southeast Florida coral reefs, respectively. At least 40% of the respondents from each county considered diving to be least important (rating 1) issue impacting coral reef quality (Figures 79-82).

For Martin County respondents, in addition to the four main issues impacting coral reefs, they also considered over-fishing (40%) and global warming (48%) to be most important issues (rating = 5) (Figure 79).

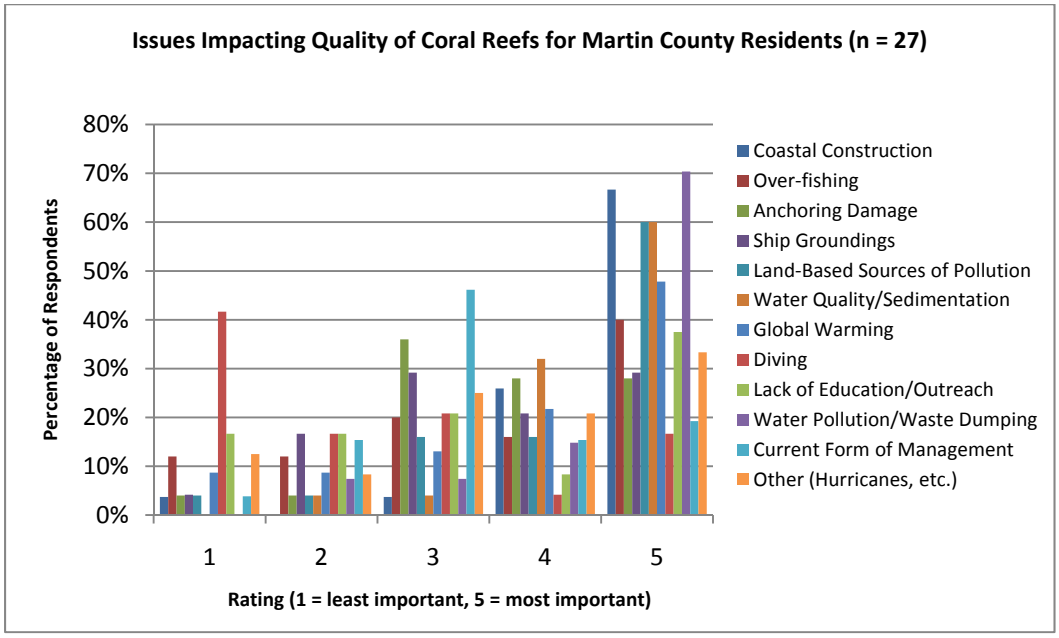


Figure 79. Rating of issues impacting quality of coral reefs for Martin County residents.

For Palm Beach County respondents, in addition to the four main issues impacting coral reefs, they also consider over-fishing (40%), anchoring damage (36%), and lack of education/outreach (35%) to be most important issues (rating = 5) (Figure 80).

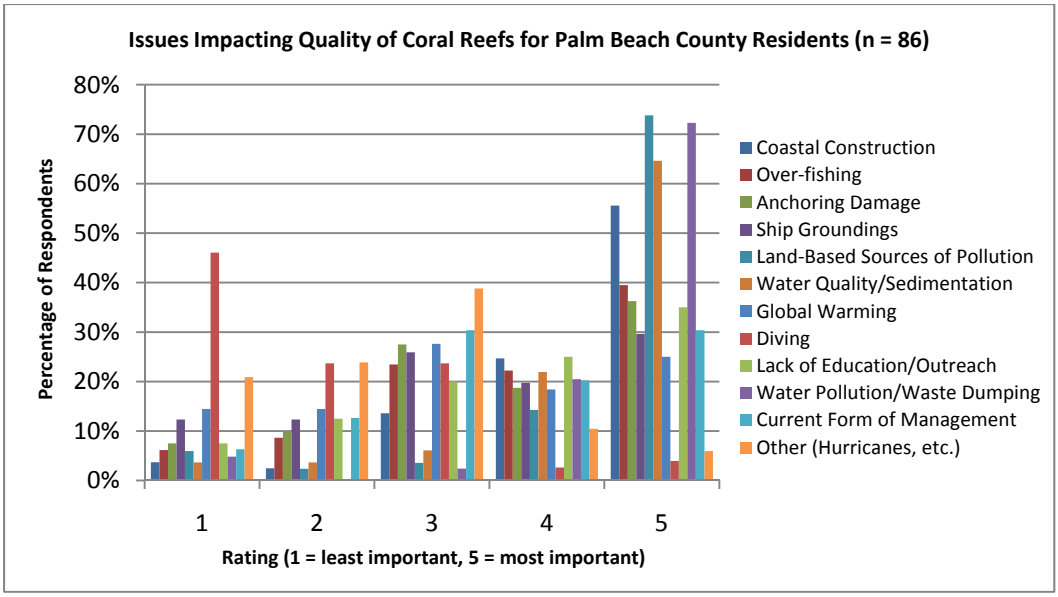


Figure 80. Rating of issues impacting quality of coral reefs for Palm Beach County residents.

For Broward County respondents, in addition to the four main issues impacting coral reefs, they also consider over-fishing (55%) and lack of education/outreach (44%) to be most important issues (rating = 5) (Figure 81).

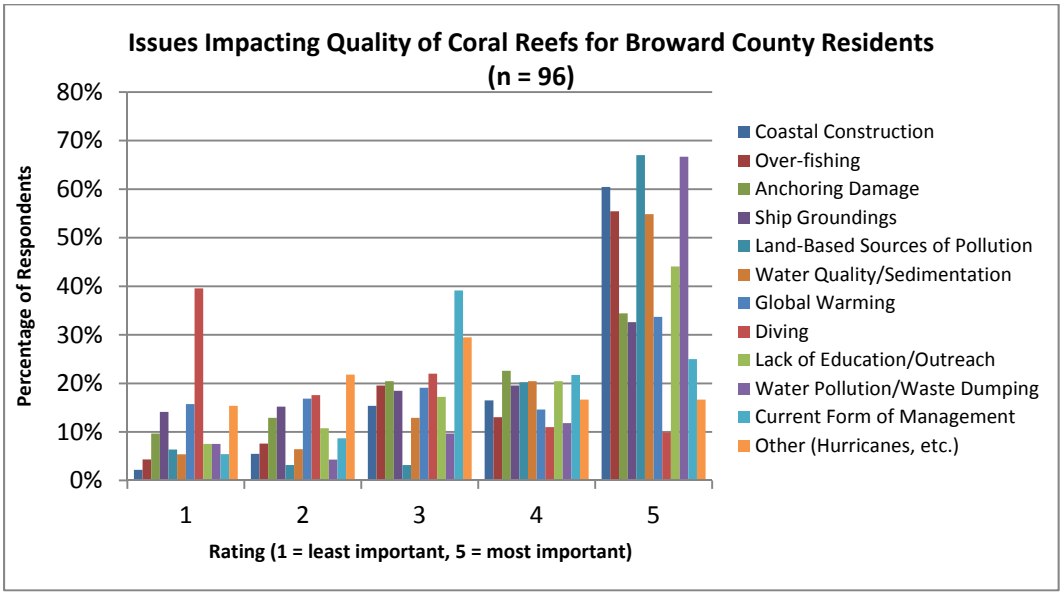


Figure 81. Rating of issues impacting quality of coral reefs for Broward County residents.

For Miami-Dade County respondents, in addition to the four main issues impacting coral reefs, other important issues (rating = 5) included over-

fishing (43%), anchoring damage (44%), ship groundings (40%), and lack of education/outreach (49%) (Figure 82).

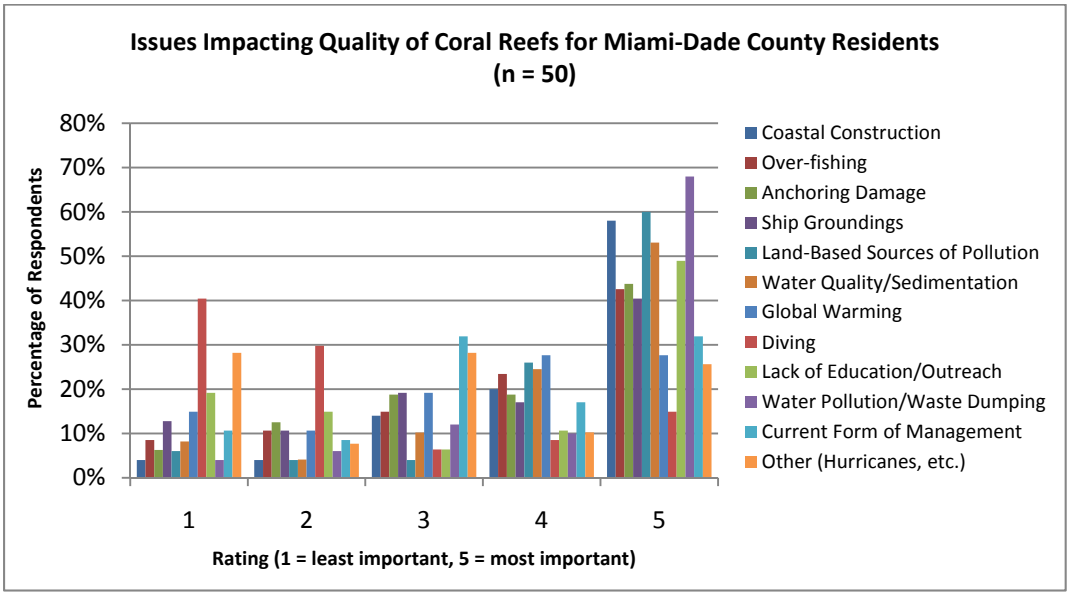


Figure 82. Rating of issues impacting quality of coral reefs for Miami-Dade County residents.

5.3.5.3 Age Groups

The most important issues that impact quality of coral reefs (rating = 5) for at least 50% of respondents in each age group are coastal construction, land-based sources of pollution, water quality/sedimentation, and water pollution/waste dumping (Figures 83-87).

For the 18-30 year-old group, in addition to the four main issues impacting coral reefs, other important issues (rating = 5) included over-fishing (58%), lack of education/outreach (46%), and global warming (40%). Diving was considered to be the least important issue (rating = 1) by 34% of the respondents (Figure 83).

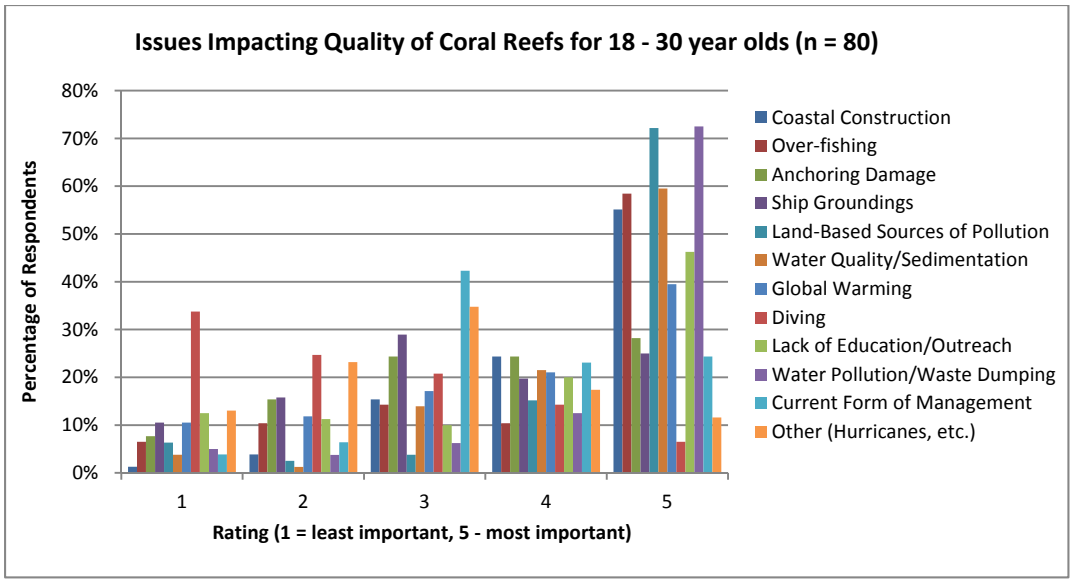


Figure 83. Rating of issues impacting quality of coral reefs by 18-30 year-olds.

In addition to the four main issues impacting coral reefs, for the 31-40 year-old group, two other important issues (rating = 5) were over-fishing (35%) and lack of education/outreach (38%). Diving was considered to be the least important issue (rating = 1) by 45% of the respondents (Figure 84).

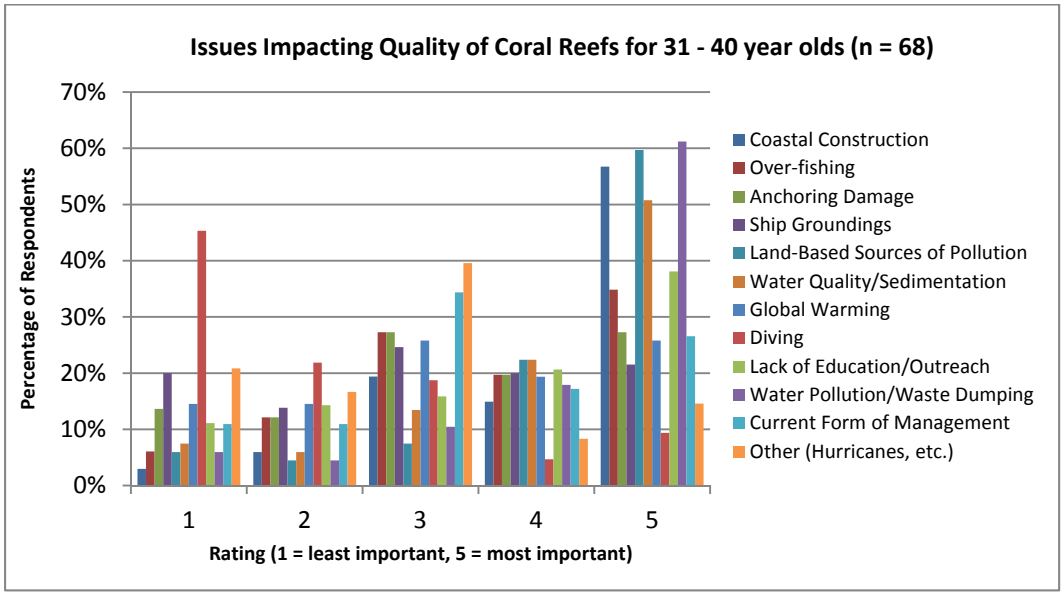


Figure 84. Rating of issues impacting quality of coral reefs by 31-40 year-olds.

For the 41-50 year-old group, in addition to the four main issues impacting coral reefs, four other important issues (rating = 5) were over-

fishing (38%), anchoring damage (49%), ship groundings (46%), and lack of education/outreach (37%). Diving was considered to be the least important issue (rating = 1) by 54% of the respondents (Figure 85).

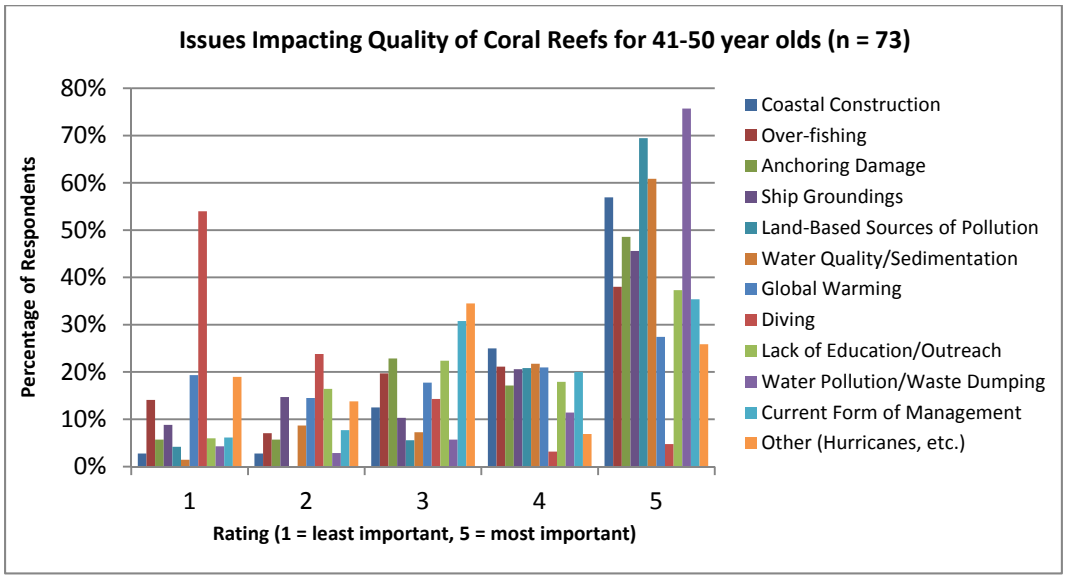


Figure 85. Rating of issues impacting quality of coral reefs by 41-50 year-olds.

For the 51-60 year-old group, in addition to the four main issues impacting coral reefs, four other important issues (rating = 5) were over-fishing (47%), anchoring damage (42%), ship groundings (40%), and lack of education/outreach (40%). Diving was considered to be the least important issue (rating = 1) by 43% of the respondents (Figure 86).

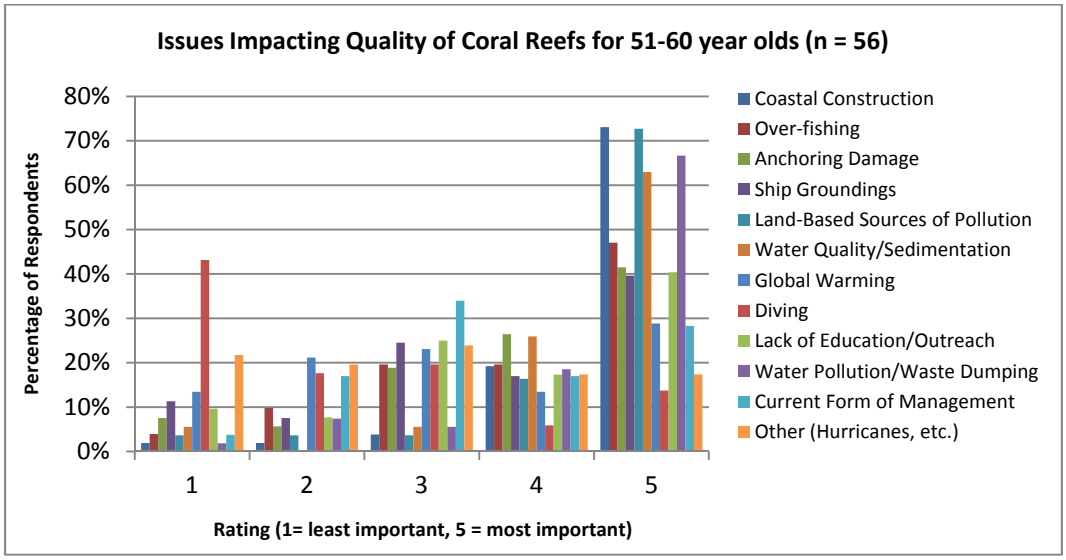


Figure 86. Rating of issues impacting quality of coral reefs by 51-60 year-olds.

In addition to the four main issues impacting coral reefs, for those respondents over 60 years old, another important issue (rating = 5) was over-fishing (44%). The least important issues (rating = 1) were global warming (38%), other (hurricanes, etc.) (31%), and diving (25%) (Figure 87).

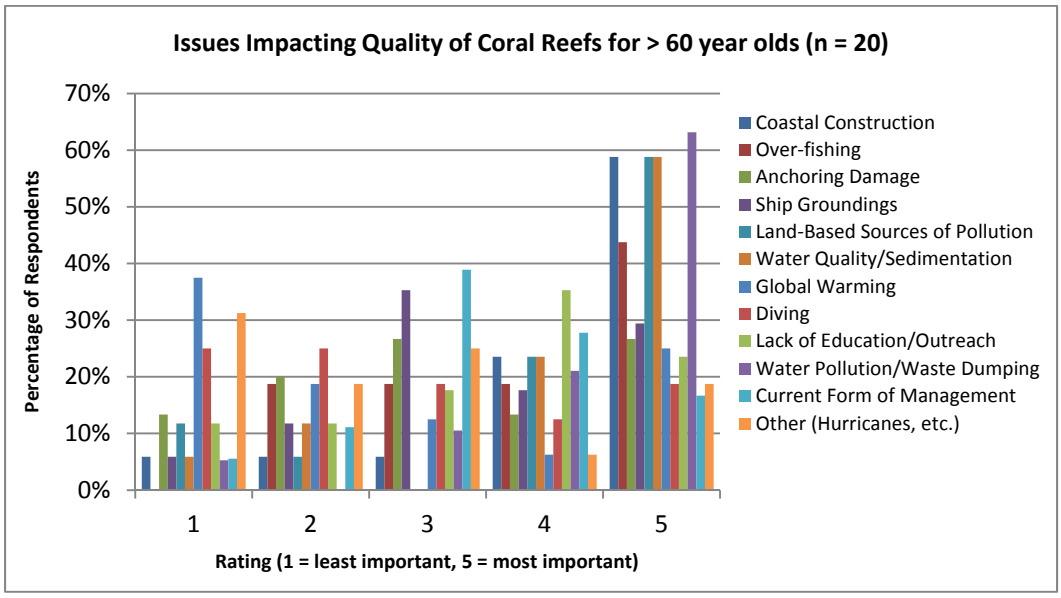


Figure 87. Rating of issues impacting quality of coral reefs by respondents over 60 years old.

5.3.5.4 Ethnicity

For the majority of Caucasians (≥ 60%) and Hispanics (≥ 50%), the four most important issues that impact coral reefs (rating = 5) are coastal construction, land-based pollution, water quality/sedimentation, and water pollution/waste dumping (Figures 88 and 89). Respondents in each ethnic group (> 40%) considered diving as having the least important impact (rating = 1) on coral reefs.

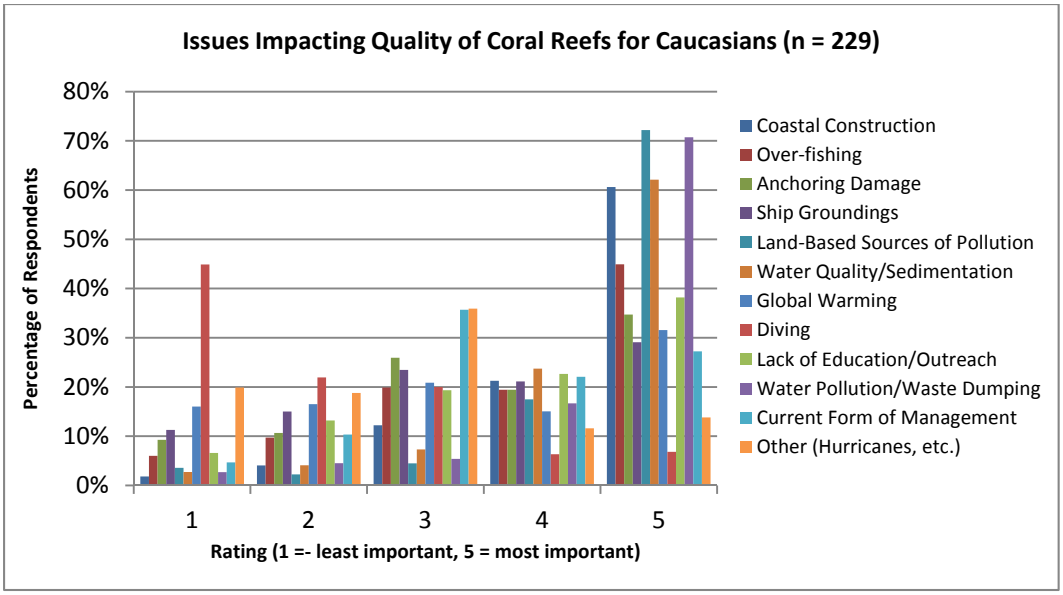


Figure 88. Rating of issues impacting quality of coral reefs by Caucasians.

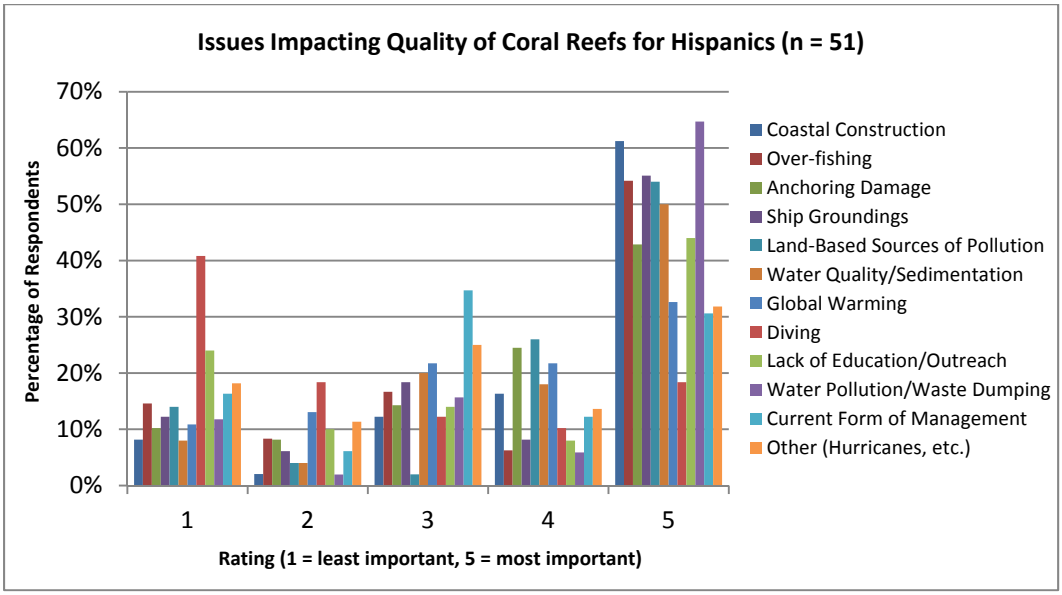


Figure 89. Rating of issues impacting quality of coral reefs by Hispanics.

There were some differences in perspective between Caucasians and Hispanics on which issues have the most impact on the quality of coral reefs in southeast Florida. For example, only 35% of Caucasian respondents rated anchoring damage as most important (rating = 5) compared to 43% of Hispanics. Only 29% of Caucasian respondents rated ship groundings as most important (rating = 5) (Figure 88), compared to 55% of Hispanics (Figure 89). Similarly, only 45% of Caucasian

respondents rate over-fishing as most important (rating = 5), compared to 54% of Hispanics. Lack of education/outreach was also considered most important (rating = 5) by 44% of Hispanic respondents and 38% of Caucasian respondents.

5.3.5.5 Length of Time Using Marine Resources

Regardless of how long stakeholders have been using the marine resources in the area, the two most important issues (rating = 5) identified by at least 50% of the respondents are land-based sources of pollution and water pollution/waste dumping. At least 40% of the respondents in each group also identified coastal construction and water quality/sedimentation as important issues (Figures 90-95).

For those respondents using marine resources for less than 5 years (n = 43), other important issues (rating = 5) were coastal construction (44%), over-fishing (35%), and water quality/sedimentation (47%) (Figure 90).

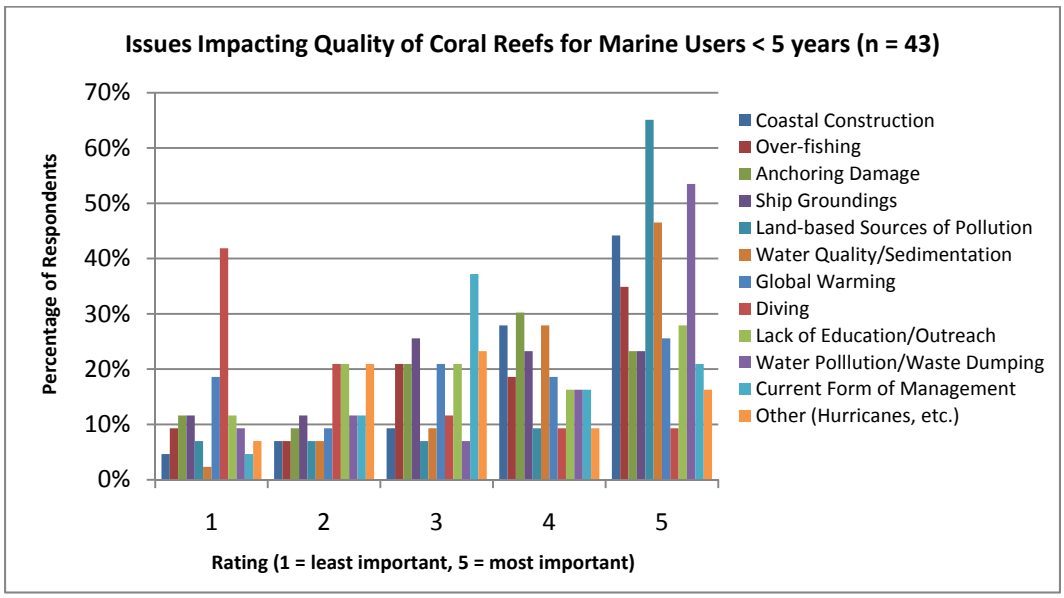


Figure 90. Rating of issues impacting quality of coral reefs for respondents using marine resources for less than 5 years.

For those respondents using marine resources for 5 to 10 years (n = 74), other important issues (rating = 5) were coastal construction (69%), water quality/sedimentation (61%), and lack of education/outreach (43%) (Figure 91).

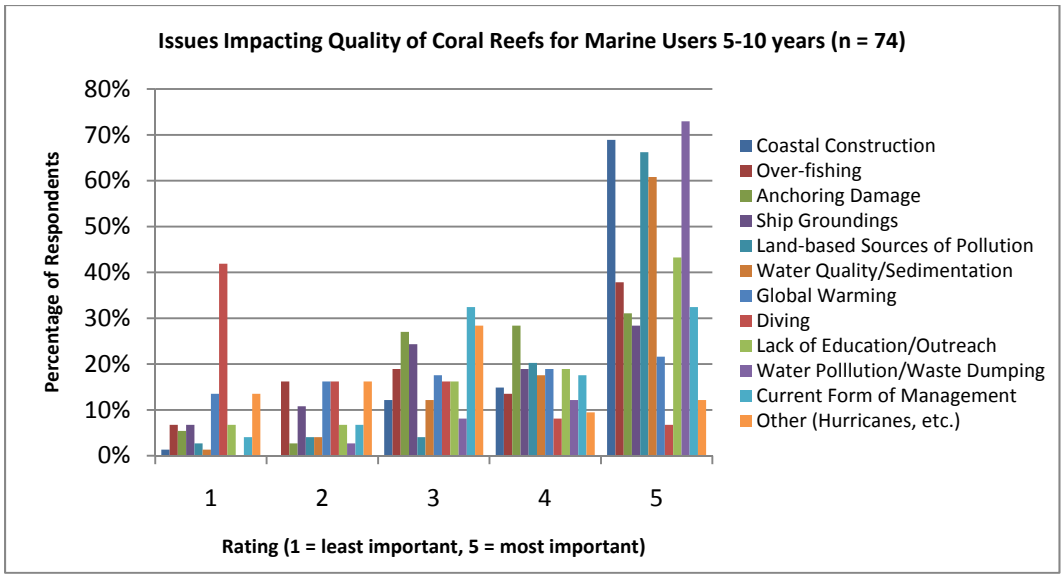


Figure 91. Rating of issues impacting quality of coral reefs for respondents using marine resources for 5-10 years.

For those respondents using marine resources for 11 to 20 years (n = 82), other important issues (rating = 5) were coastal construction (56%), water quality/sedimentation (55%), and over-fishing (43%) (Figure 92).

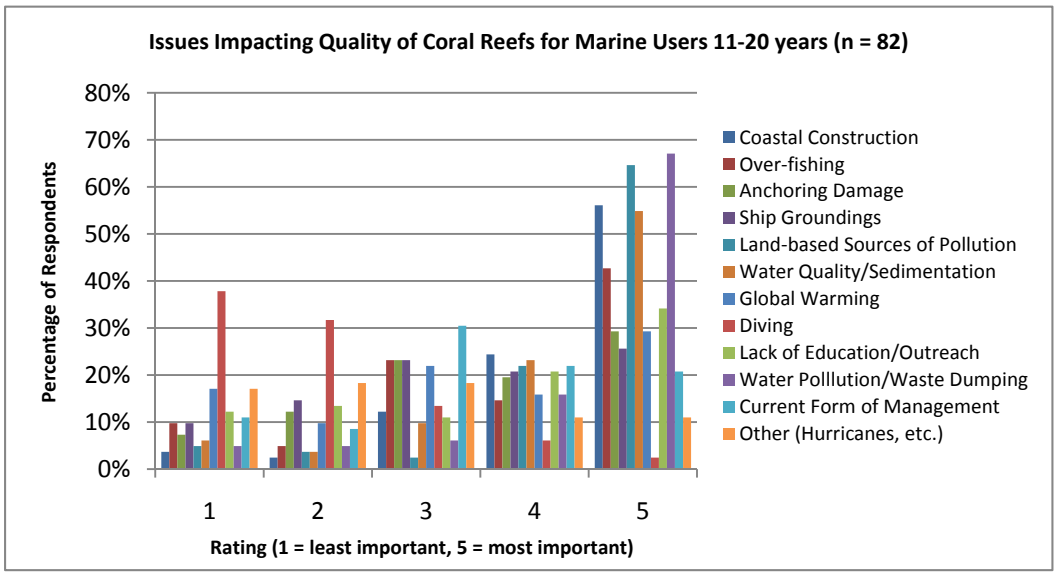


Figure 92. Rating of issues impacting quality of coral reefs for respondents using marine resources for 11-20 years.

For those respondents using marine resources for 21 to 30 years (n = 57), other important issues (rating = 5) were coastal construction (60%), water quality/sedimentation (56%), over-fishing (46%), anchoring damage (40%), and lack of education/outreach (40%) (Figure 93).

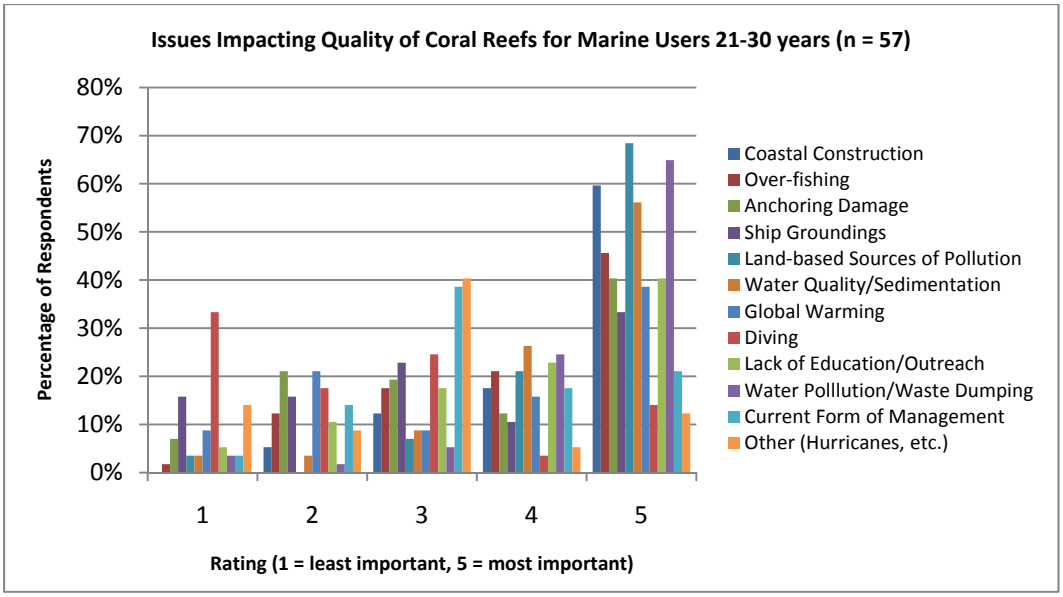


Figure 93. Rating of issues impacting quality of coral reefs for respondents using marine resources for 21-30 years.

For those respondents using marine resources for 31 to 40 years (n = 31), other important issues (rating = 5) were coastal construction (55%), over-fishing (58%), anchoring damage (55%), ship groundings (52%), and water quality/sedimentation (61%) (Figure 94).

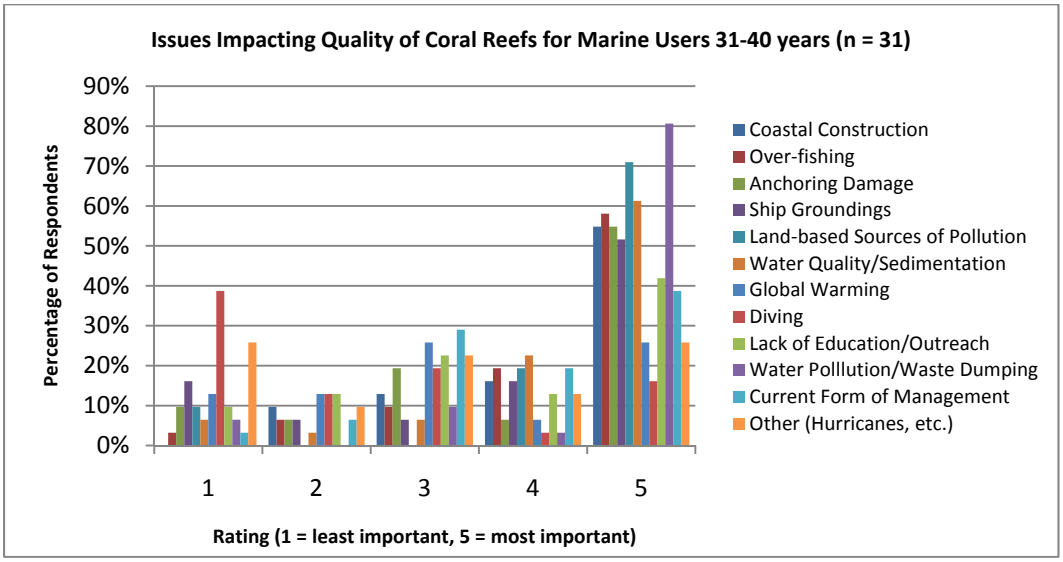


Figure 94. Rating of issues impacting quality of coral reefs for respondents using marine resources for 31-40 years.

For those respondents using marine resources for 41 to 50 years (n = 7), other important issues (rating = 5) were anchoring damage (57%) and water quality/sedimentation (71%) (Figure 95).

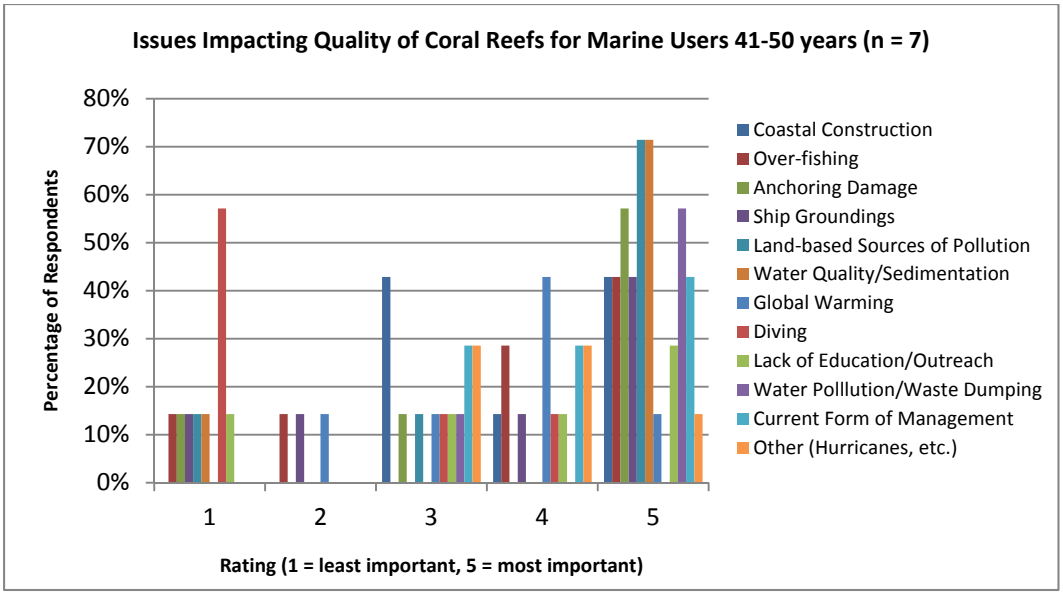


Figure 95. Rating of issues impacting quality of coral reefs for respondents using marine resources for 41-50 years.

5.3.6 Perceptions About the Establishment of SMZs/MPAs

5.3.6.1 The Need for a Different Management Approach

When asked about whether a different management approach should be used to manage the coral reefs in southeast Florida, seventy-four percent (74%) of the 298 respondents believed that an alternative management approach should be used (Figure 96).

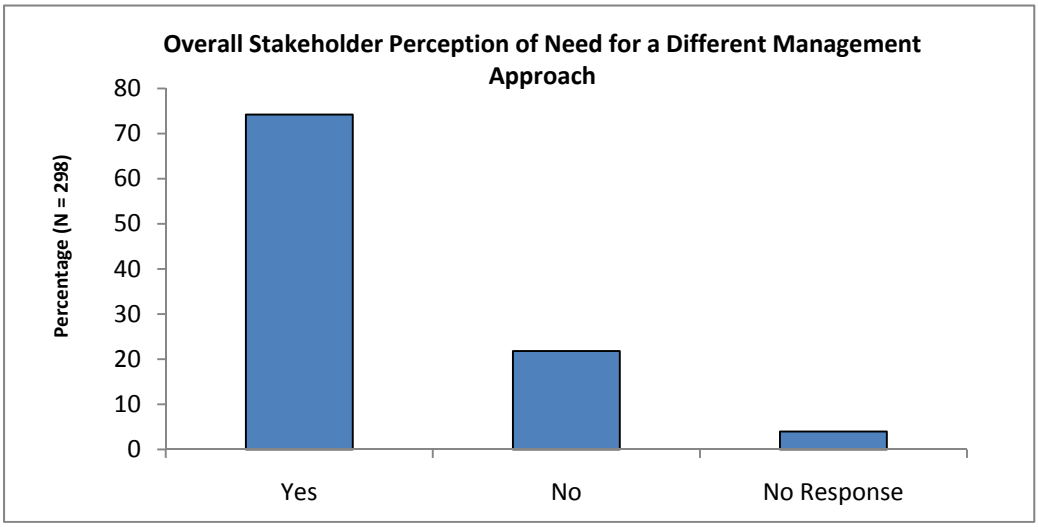


Figure 96. Percentage of respondents who believe a different management approach should be used to manage southeast Florida marine resources.

5.3.6.1.1 User Group

Over 70% of respondents from each user group (recreational users and non-recreational users) believe a different management approach is needed (Figure 97).

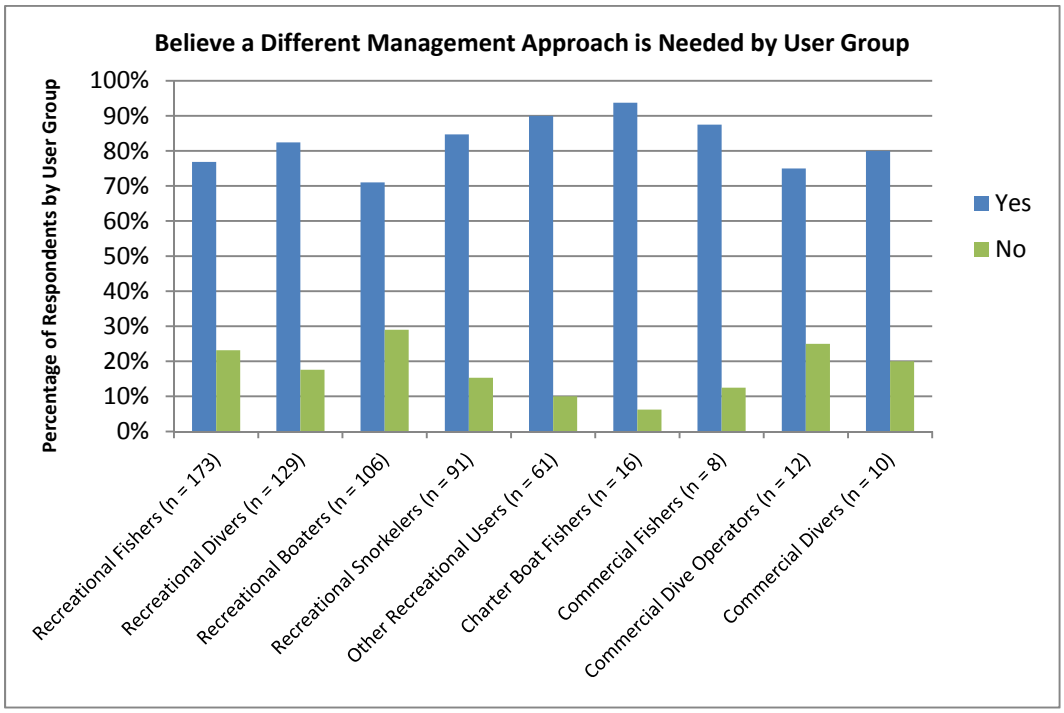


Figure 97. Percentage of respondents who believe a different management approach should be used to manage southeast Florida marine resources by user group.

5.3.6.1.2 County of Residence

At least 80% of respondents from Martin, Palm Beach, and Broward counties believe a different management approach is needed. Nearly 70% of Miami-Dade County respondents believe a different management approach is needed (Figure 98).

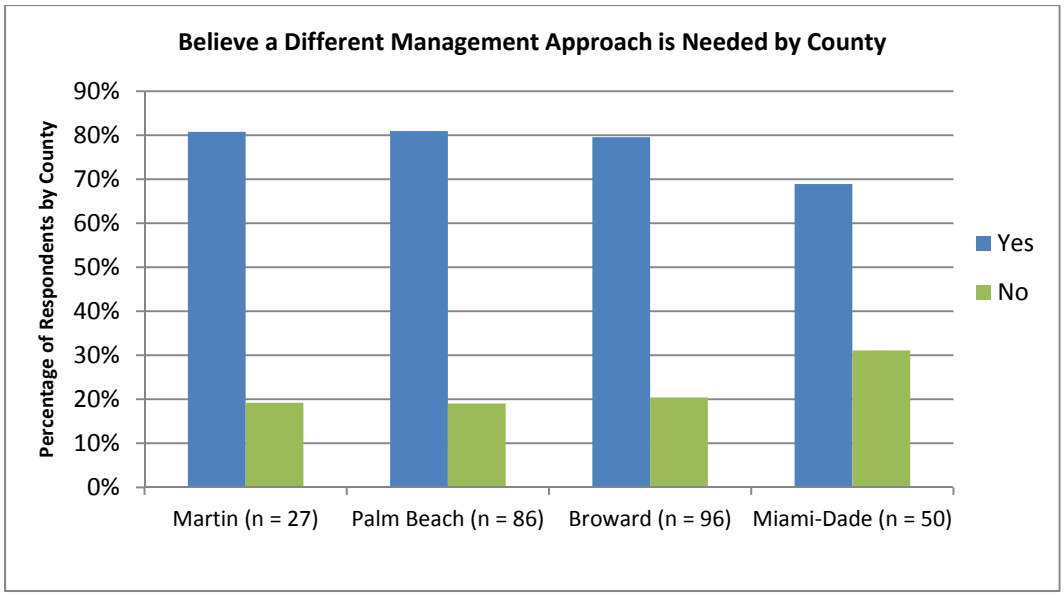


Figure 98. Percentage of respondents who believe a different management approach should be used to manage southeast Florida marine resources by county.

5.3.6.1.3 Age Group

Regardless of age group, the majority of respondents (≥ 65%) believe a different management approach is needed (Figure 99).

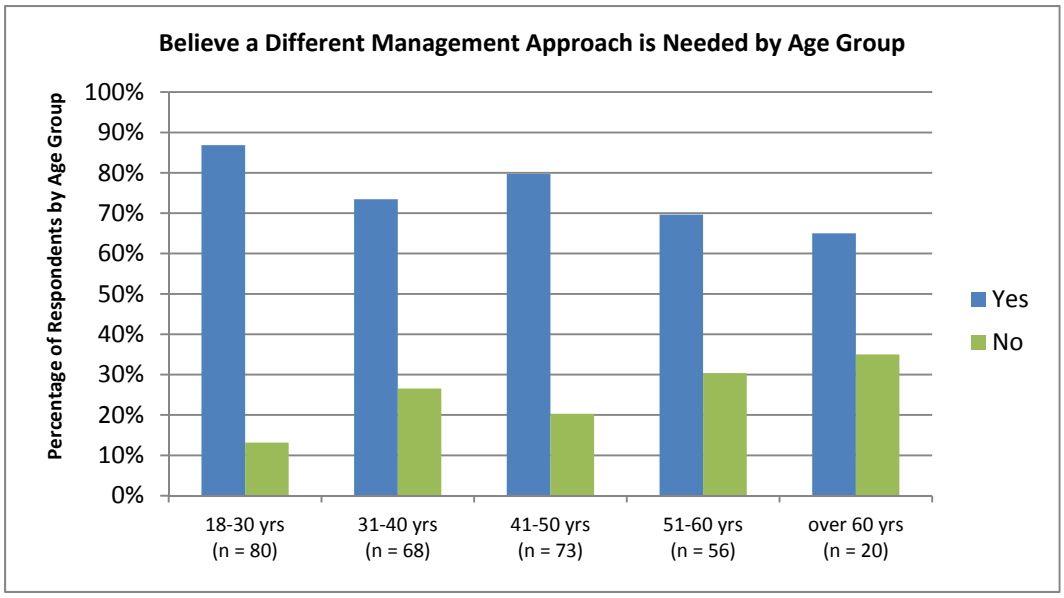


Figure 99. Percentage of respondents who believe a different management approach should be used to manage southeast Florida marine resources by age group.

5.3.6.1.4 Ethnicity

The majority of Caucasians (77%) and Hispanics (74%) are in favor of a different management approach (Figure 100).

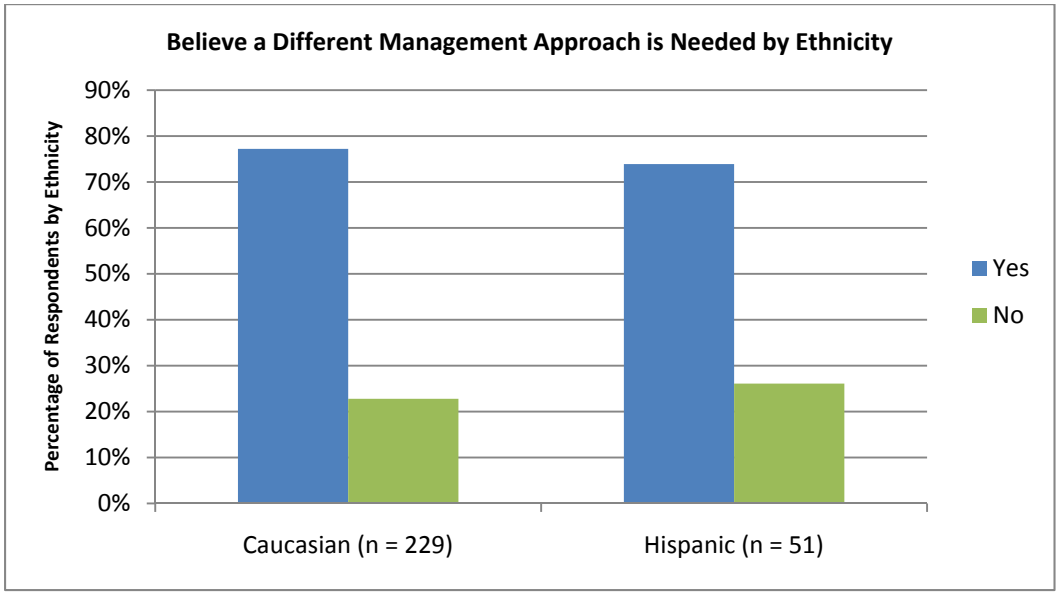


Figure 100. Percentage of respondents who believe a different management approach should be used to manage southeast Florida marine resources by ethnicity.

5.3.6.2 Condition of Resources Without Management Change

The majority of the 295 respondents (58%) also believe that if the current management approach is not changed, the conditions of the resource will worsen (Figure 101).

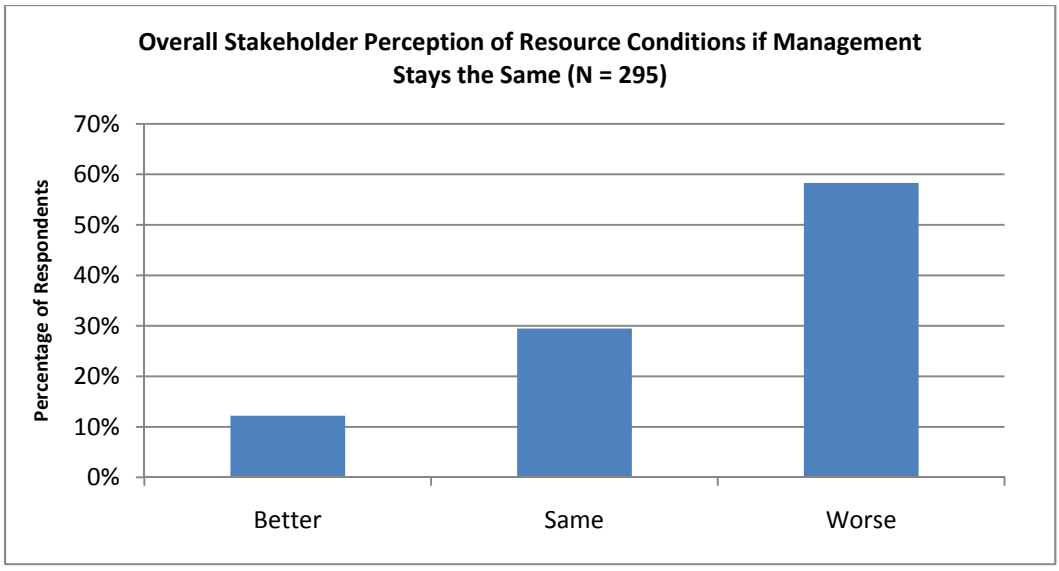


Figure 101. Percentage of respondents grouped by what they believe will happen to resource conditions if the same management approach is kept.

5.3.6.2.1 User Groups

Over 55% of the respondents from each recreational user group (recreational fishers, recreational divers, recreational boaters, recreational snorkelers, and other recreational users) believe that without a different management approach marine resource conditions will worsen (Figure 102).

Of the non-recreational user groups, the majority of charter boat fishers (> 80%) and commercial dive operators (> 65%) believe conditions will worsen without a different management approach. For commercial fishers, 50% believe conditions will get better and 25% believe conditions will remain the same if the current management approach is continued. For commercial divers, 40% believe conditions will worsen and another 40% believe resource conditions will remain the same without a different management approach (Figure 102).

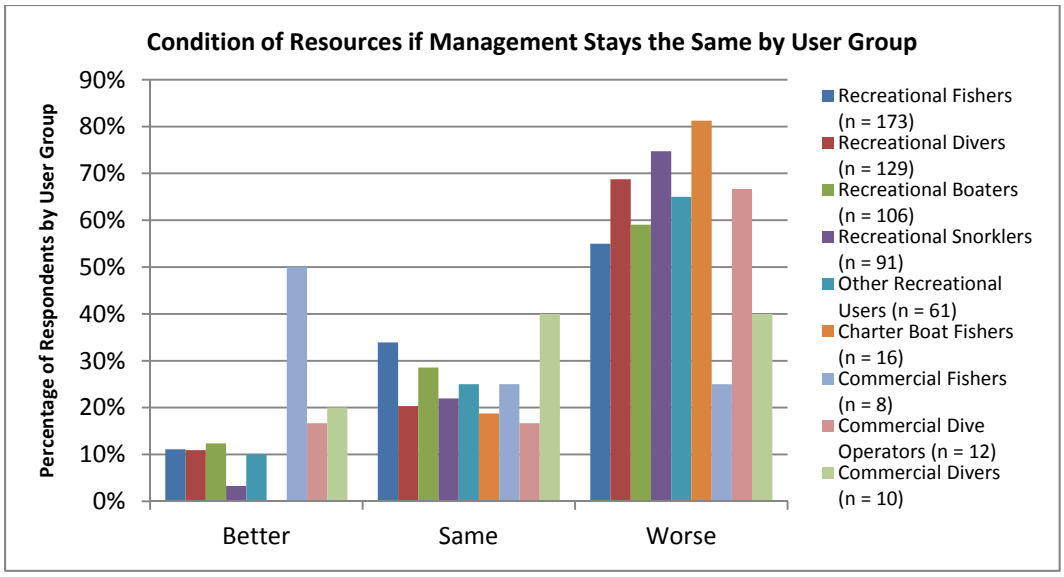


Figure 102. Percentage of respondents grouped by what they believe will happen to resource conditions if the same management approach is kept by user group.

5.3.6.2.2 County of Residence

Over 50% of Martin, Palm Beach, and Broward county respondents believe that without a different management approach marine resource conditions will worsen. In Miami-Dade County, 45% believe conditions will remain the same and 37% believe conditions will worsen with the current management approach (Figure 103).

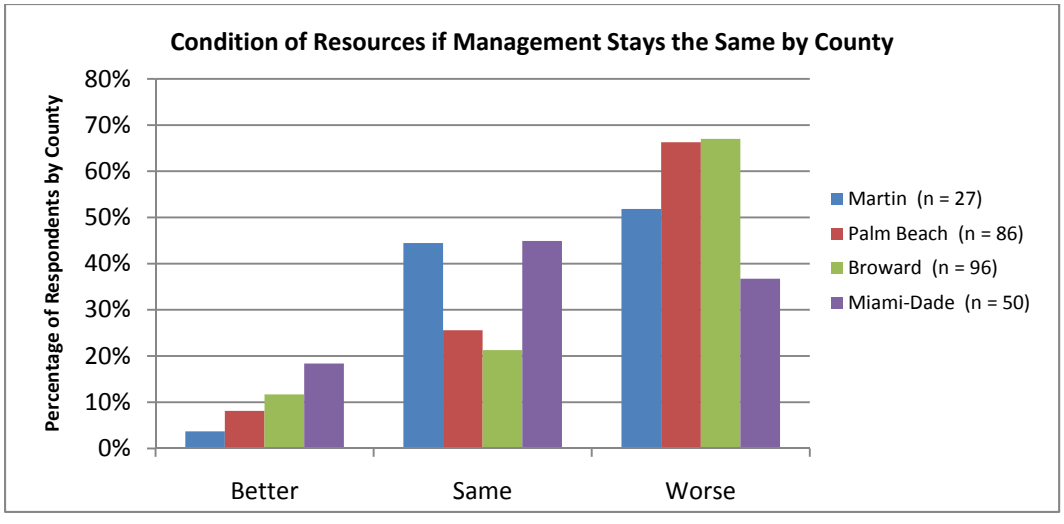


Figure 103. Percentage of respondents grouped by what they believe will happen to resource conditions if the same management approach is kept by county.

5.3.6.2.3 Age Group

Over 50% of the respondents in the 18-30 year-old group and over 60% of the respondents in the 31-40, 41-50, and the 51-60 year-old groups believe marine resource conditions will worsen without a different management approach. For respondents in the over 60 year-old group, 45% believe marine resource conditions will remain the same and 40% believe conditions will worsen with the current management approach (Figure 104).

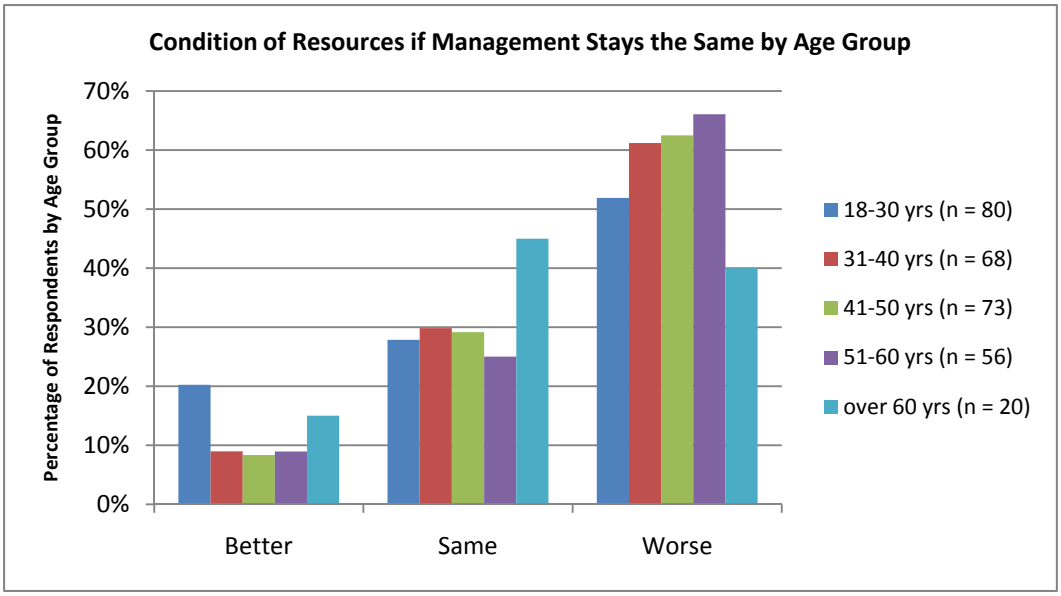


Figure 104. Percentage of respondents grouped by what they believe will happen to resource conditions if the same management approach is kept by age group.

5.3.6.2.4 Ethnicity

There were differences in perspective between Caucasians and Hispanics about what will happen to marine resources if the same management approach is kept. Over 60% of the Caucasian respondents believe marine resource conditions will worsen without a different management approach compared to 38% of the Hispanic respondents In contrast, only 10% of the Caucasian respondents believe marine resource conditions will get better with the current management approach compared to 25% of the Hispanic respondents (Figure 105).

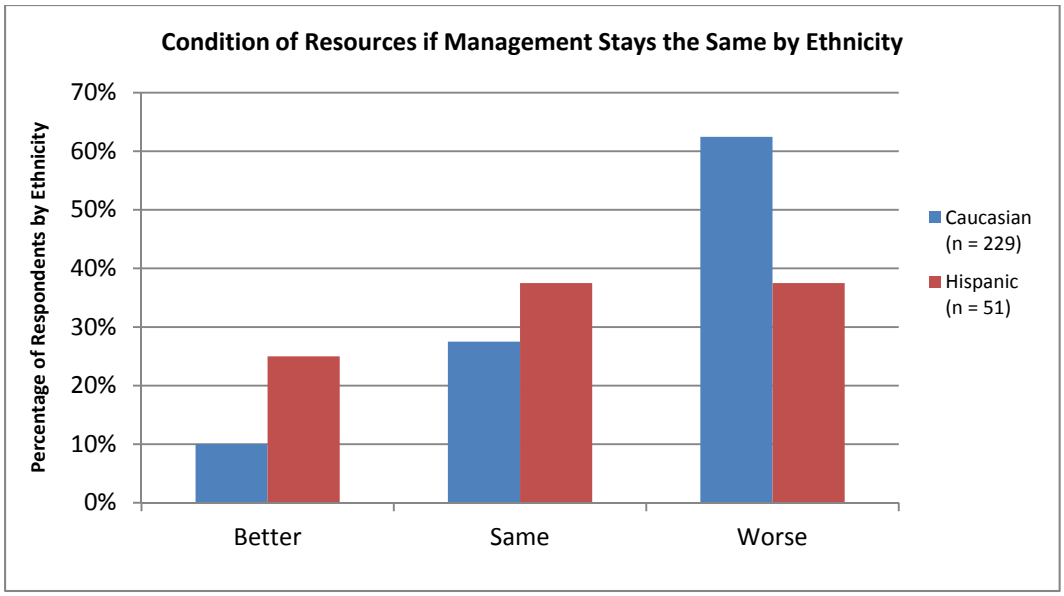


Figure 105. Percentage of respondents grouped by what they believe will happen to resource conditions if the same management approach is kept by ethnicity.

5.3.6.3 Establishment of SMZs/MPAs

A large percentage of respondents (74%) indicated that they would be in favor of establishing SMZs/MPAs (rating = 1 or 2). Only 38 of the 277 respondents (14%) strongly disagree (rating = 5) with the establishment of SMZs/MPAs in southeast Florida (Figure 106).

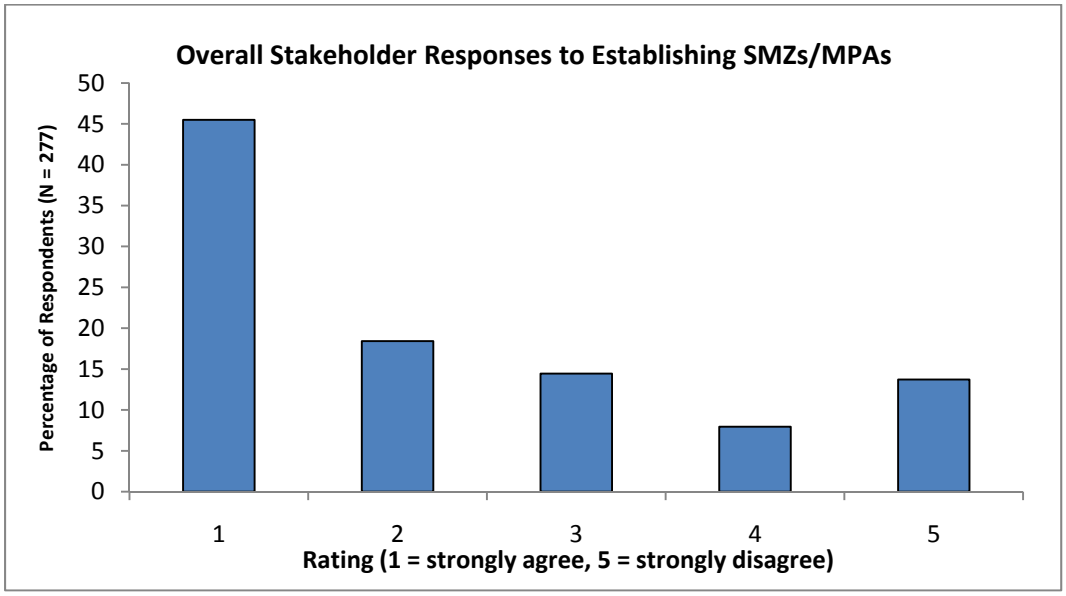


Figure 106. Overall stakeholder ratings about establishing SMZs/MPAs in southeast Florida.

5.3.6.3.1 User Groups

Of the recreational user groups, 38% of recreational fishers, 46% of recreational divers, 55% of recreational boaters, 60% of recreational snorkelers, and 67% of other recreational users strongly favor (rating = 1) establishing SMZs/MPAs (Figure 107).

Of the non-recreational user groups, the majority of charter boat fishers (80%) and commercial dive operators (64%) are strongly in favor of establishing SMZs/MPAs. Only 33% of commercial divers strongly favor establishing SMZs/MPAs. Commercial fishers (43%) strongly disagree (rating = 5) with establishing SMZs/MPAs; none strongly agree (rating = 1) with the establishment of SMZs/MPAs (Figure 107).

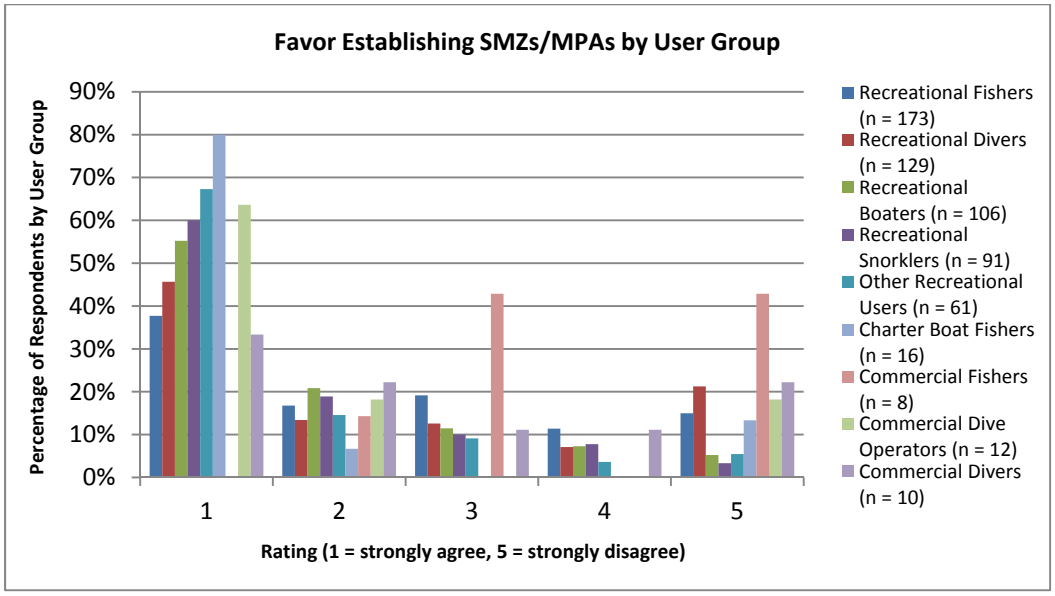


Figure 107. Rating by respondents to establish SMZs/MPAs in southeast Florida by user group.

5.3.6.3.2 County of Residence

When grouped by county, the largest number of the respondents in each of the four counties indicated that they would strongly favor (rating = 1) establishing SMZs/MPAs in southeast Florida; 38% from Martin County, 41% from Palm Beach County, 56% from Broward County, 41% from Palm Beach County (41%), and 44% from Miami-Dade County(Figure 108).

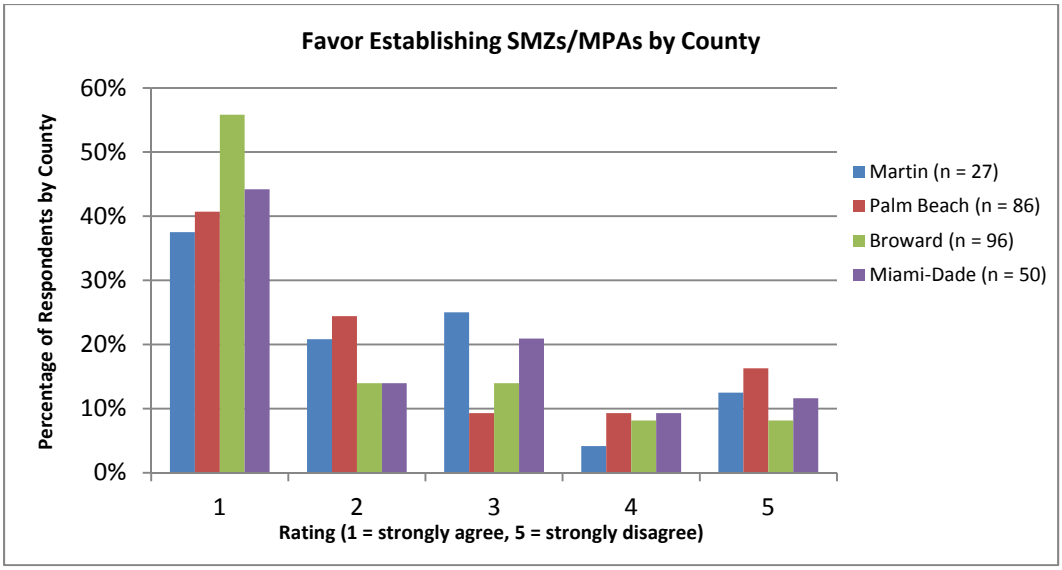


Figure 108. Rating by respondents to establish SMZs/MPAs in southeast Florida by county.

5.3.6.3.3 Age Groups

At least 50% of the respondents in the 18-30, 41-50, and over 60-year-old groups strongly favor (rating = 1) establishing SMZs/MPAs. Nearly 60% of the 31-40 year-old group and over 70% of the 51-60 year-old group favor (rating = 1 or 2) establishing SMZs/MPAs) (Figure 109).

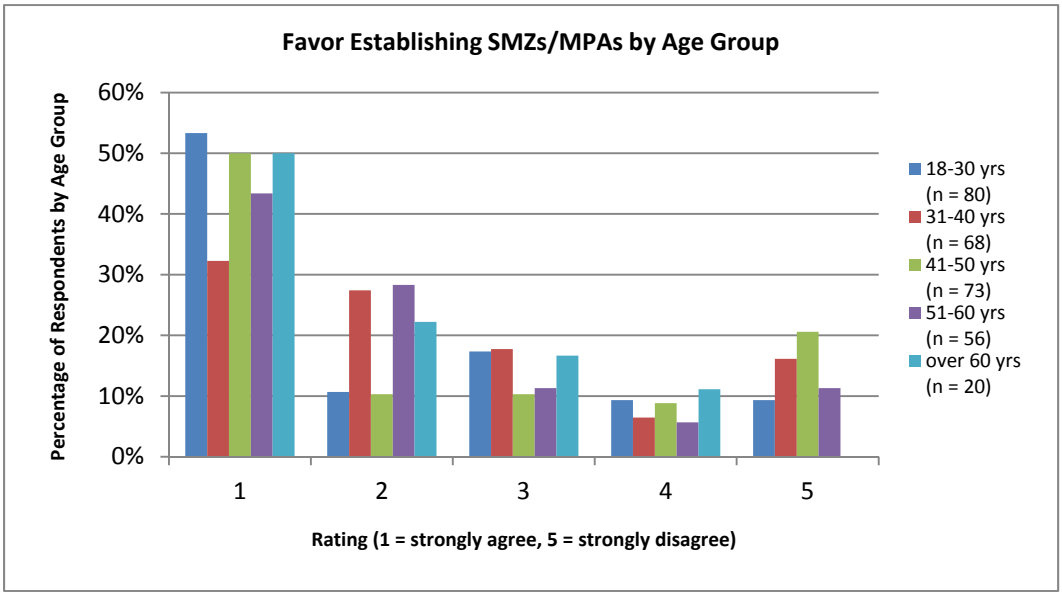


Figure 109. Rating by respondents to establish SMZs/MPAs in southeast Florida by age group.

5.3.6.3.4 Ethnicity

Members of the two ethnic groups also favor (rating = 1 or 2) establishing of SMZs/MPAs. The majority of Caucasians (> 65%) and Hispanics (> 50%) believe that SMZs/MPAs should be established in southeast Florida. Less than 25% of the respondents from each ethnic group did not favor (rating = 4 or 5) establishing SMZs/MPAs, 22% of Caucasians and 24% of Hispanics (Figure 110).

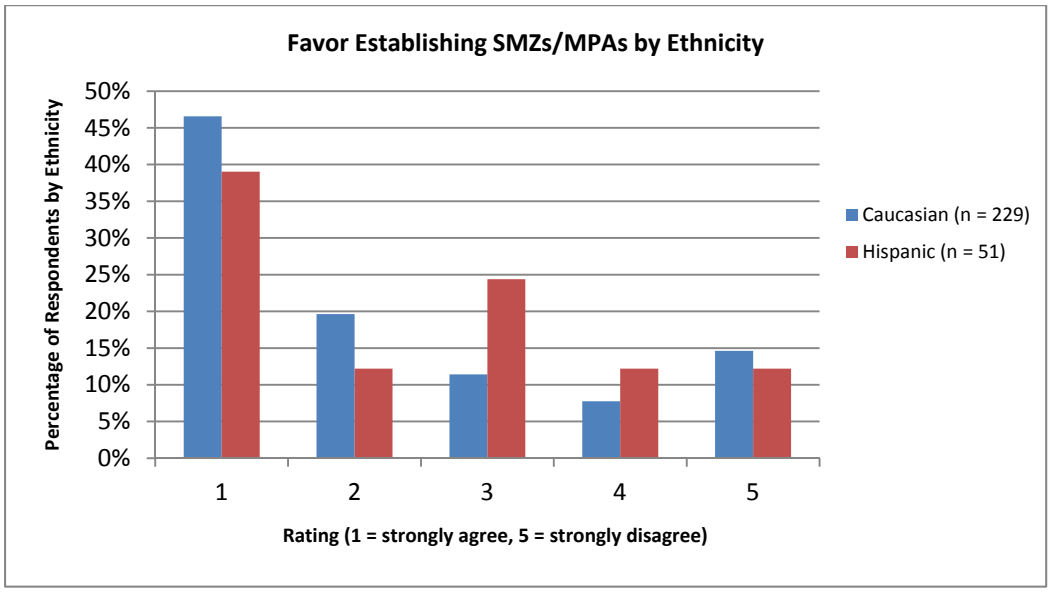


Figure 110. Rating by respondents to establish SMZs/MPAs in southeast Florida by ethnicity.

5.3.6.4 Issues SMZs/MPAs Should Address

More than half of the respondents considered three water quality issues as the highest priority (rating = 5). The three water quality issues were land-based sources of pollution (69%), water pollution/waste dumping (68%), and water quality/sedimentation (55%). Overfishing was considered a highest priority (rating = 5) by 40% of the respondents. Issues which might cause physical damage to the coral reef, anchoring damage (33%) and ship groundings (29%), were considered highest priority issues (rating = 5) less frequently. Almost 35% of respondents considered diving the lowest priority issue (rating = 1) to be addressed by SMZs/MPAs in southeast Florida (Figure 111). Of the 27 respondents who selected Other Issues, only 7 listed a specific issue. The issues listed were lack of education/outreach (3/7), Lake Okeechobee/St. Lucie discharges (2/7), poor user compliance (1/7), and coral reef diseases (1/7).

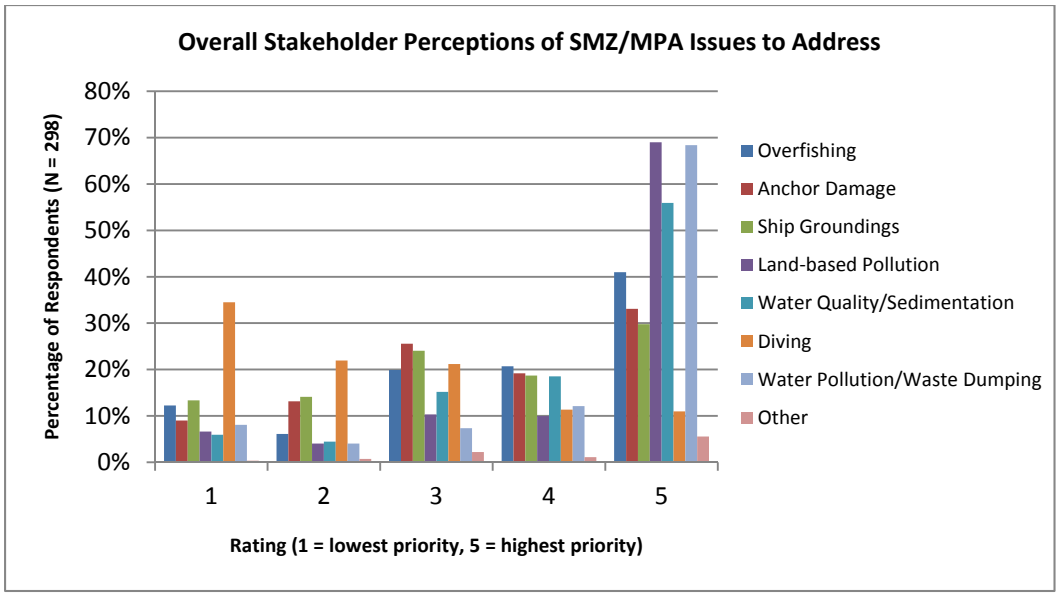


Figure 111. Respondents' rating of issues which should be addressed by SMZs/MPAs in southeast Florida.

5.3.6.4.1 User Group SMZ/MPA Issues

In general, the recreational user groups (recreational fishers, recreational divers, recreational boaters, recreational snorkelers, and other recreational users) and the non-recreational user groups (charter boat fishers, commercial fishers, commercial dive operators, and commercial divers) had similar ratings for the SMZ/MPA issues.

Overfishing: Over 30% of the recreational fishers and over 40% of the recreational divers, boaters, and snorkelers considered overfishing to be the highest priority (rating = 5). Nearly 70% of the charter boat fishers rated overfishing as the highest priority. Almost 30% of commercial fishers, over 35% of commercial diver operators, and 22% of commercial divers rated overfishing as the highest priority (Figure 112).

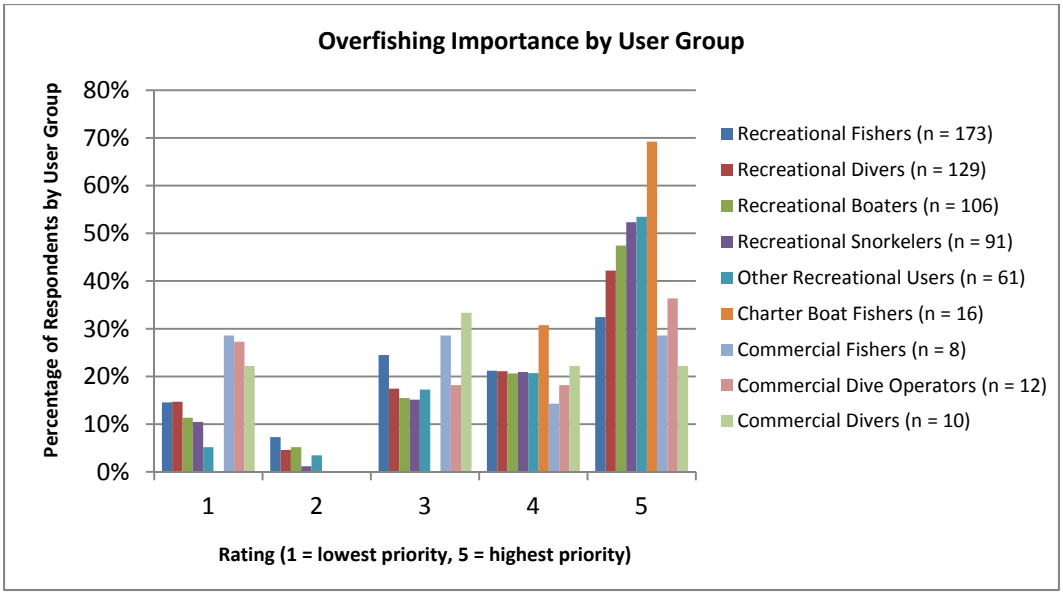


Figure 112. Respondents' rating of importance of overfishing as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

Anchoring Damage: Over 30% of recreational fishers, recreational divers, recreational boaters, and recreational snorkelers considered anchoring damage to be the highest priority (rating = 5). At least 40% of commercial dive operators and commercial divers and more than 35% of the charter boat fishers rated anchoring damage as the highest priority (Figure 113).

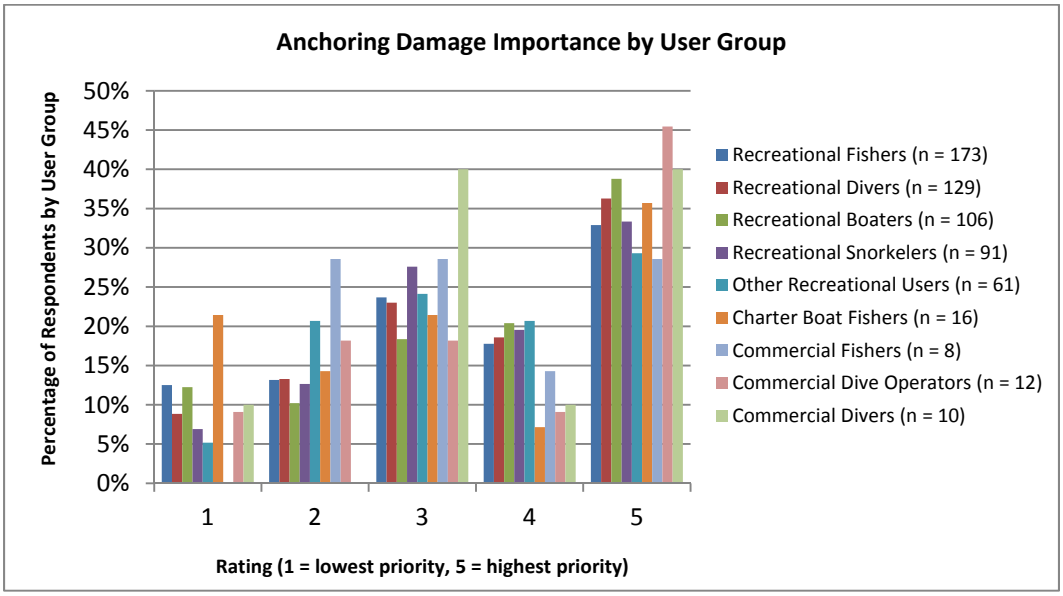


Figure 113. Respondents' rating of importance of anchoring damage as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

Ship Groundings: Less than 30% of respondents from each recreational user group rated ship groundings as the highest priority (rating = 5). However, at least 40% of commercial fishers, commercial dive operators, and commercial divers rated ship groundings as the highest priority (Figure 114).

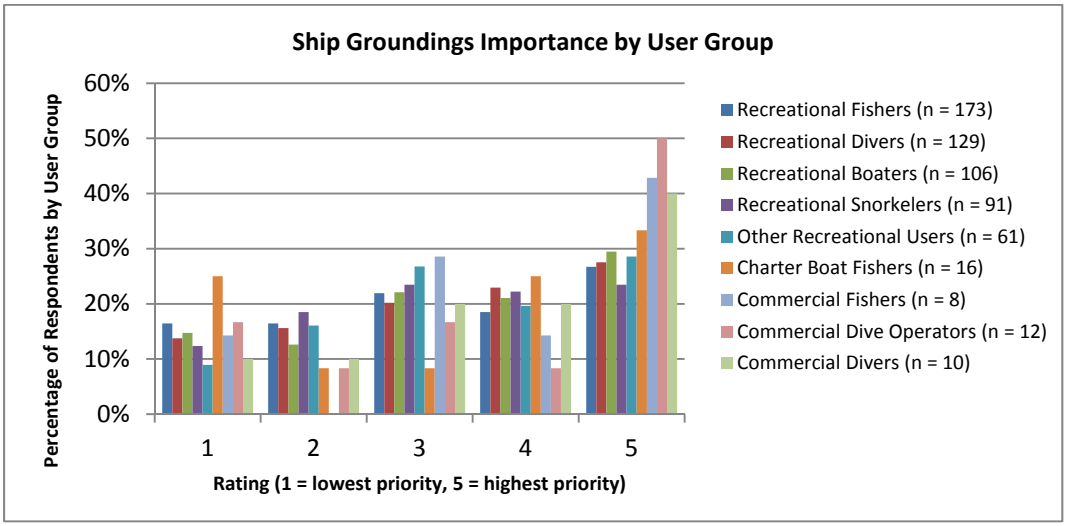


Figure 114. Respondents' rating of importance of ship groundings as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

Land-based Pollution: At least 60% of respondents from all user groups except commercial fishers rated land-based pollution as the highest priority (rating = 5). Over 70% of the commercial fishers rated land-based pollution as a 4 or 5 (Figure 115).

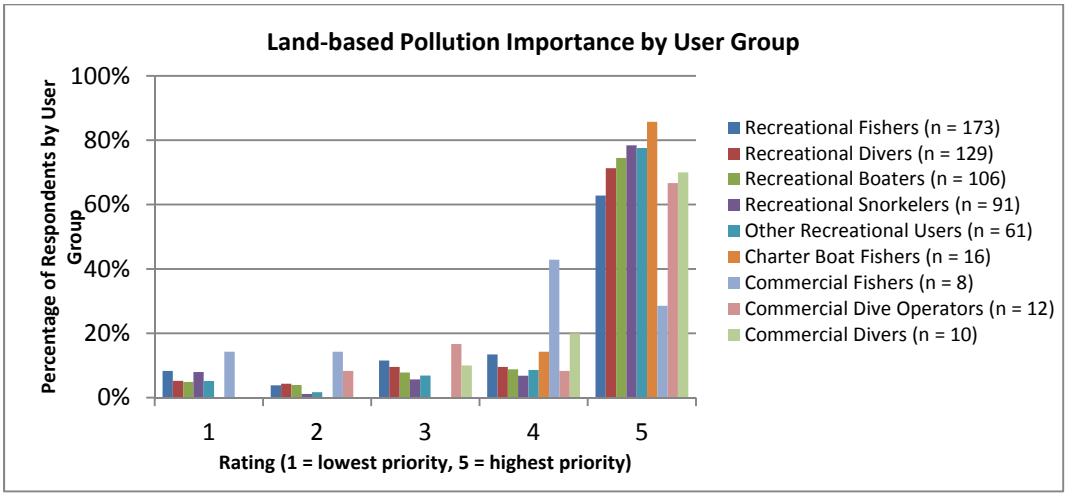


Figure 115. Respondents' rating of importance of land-based pollution as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

Water Quality/Sedimentation: At least 50% of the respondents in the recreational user groups rated this issue the highest priority (rating = 5). Of the non-recreational user groups, 78% of commercial divers, 71% of charter boat fishers, and 58% of commercial dive operators rated this issue a 5. Over 70% of the commercial fishers rated this issue as a 4 or 5 (Figure 116).

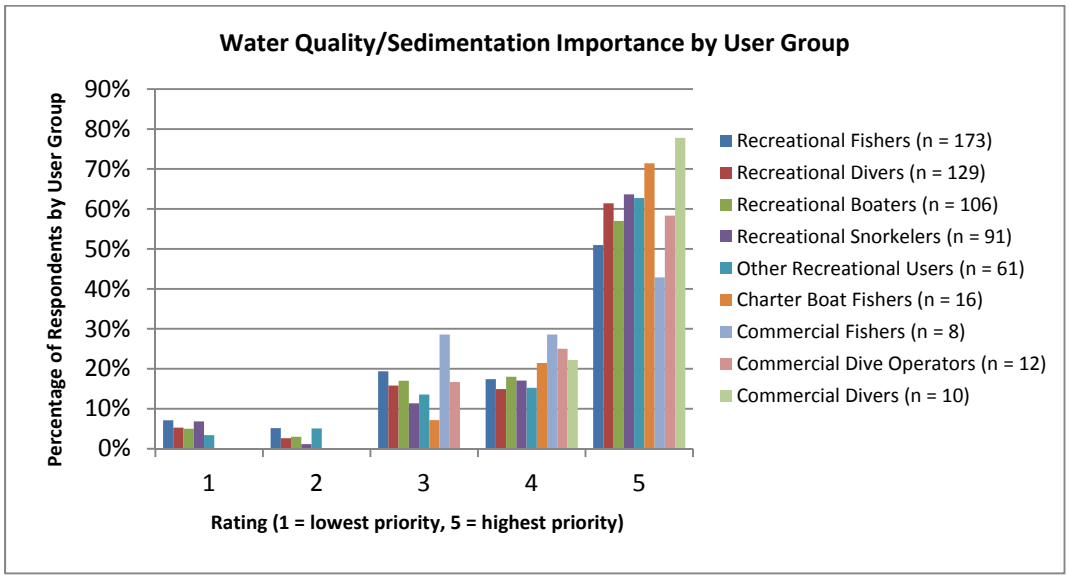


Figure 116. Respondents' rating of importance of water quality/ sedimentation as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

Diving: The majority of user group respondents rated diving a 1, 2, or 3 and consider diving to be a low priority issue. Over 65% of recreational divers, over 95% of commercial dive operators, and over 75% of commercial divers rated diving a 1 and 2. Most users do not believe diving is a high priority issue (rating = 4 or 5) that should be addressed by SMZs/MPAs in southeast Florida (Figure 117).

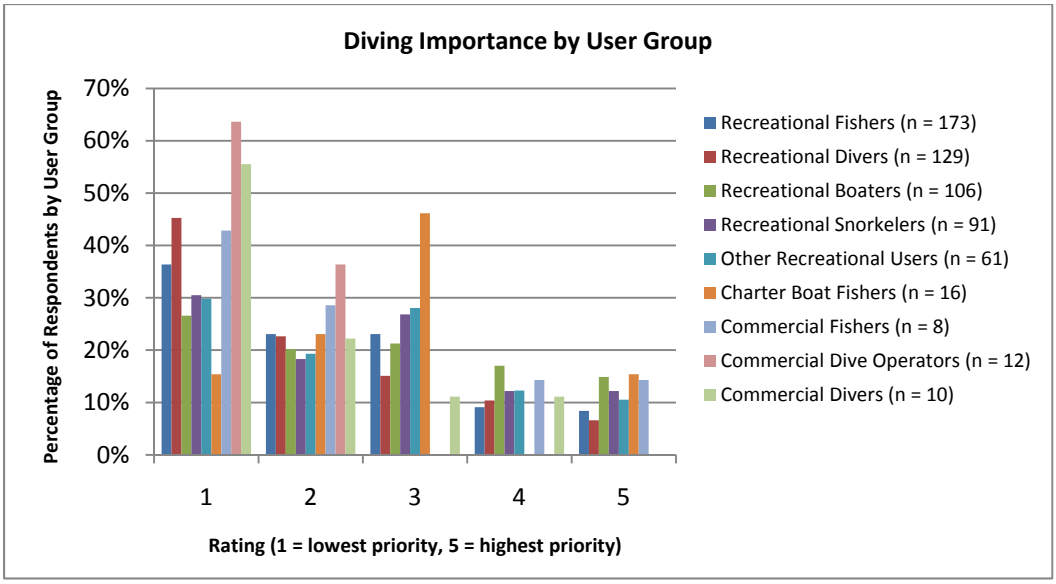


Figure 117. Respondents' rating of importance of diving as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

Water Pollution/Waste Dumping: The majority (over 60%) of respondents in all user groups, except commercial fishers, rated water pollution/waste dumping a high priority (rating = 5). Over 70% of commercial fishers rated this issue a 4 or 5 (Figure 118).

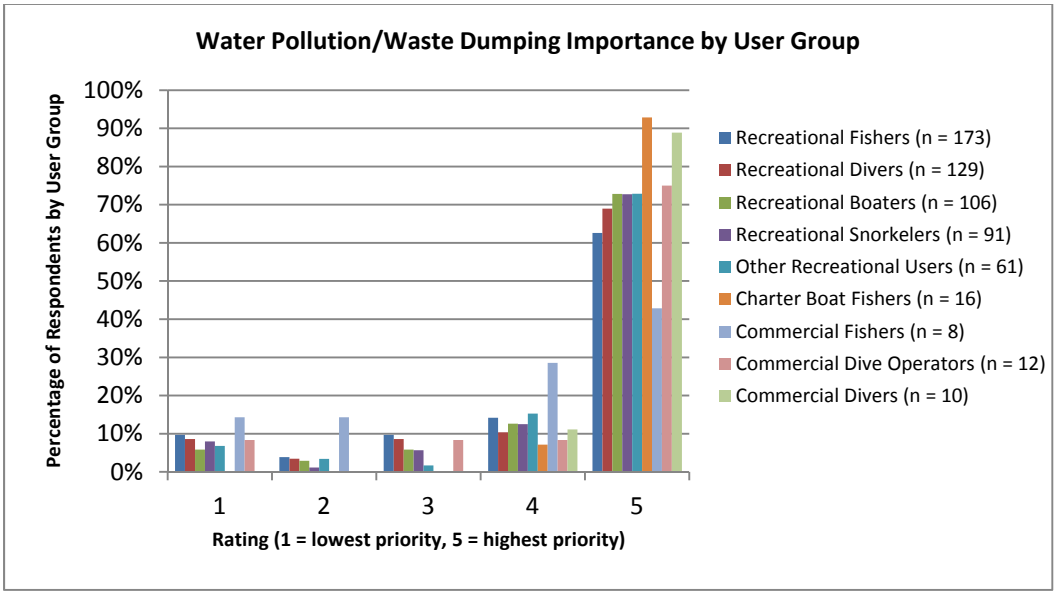


Figure 118. Respondents' rating of importance of water pollution/waste dumping as an issue to be addressed by SMZs/MPAs in southeast Florida by user group.

5.3.6.4.2 County of Residence

The majority (over 50%) of respondents from each county rated three issues as the highest priorities: land-based pollution, water quality/sedimentation, and water pollution/waste dumping. Overfishing was rated as a high priority (rating = 5) by over 45% of respondents from Broward and Miami-Dade county and by 34% to 36% of Martin and Palm Beach county respondents. Anchor damage was rated a high priority issue (rating = 5) by over 37% of respondents from Broward and Miami-Dade county and by 31% to 32% of Martin and Palm Beach county respondents. Ship grounding was considered a high priority issue (rating = 5) by 36% of Miami-Dade, 37% of Broward, 26% of Palm Beach, and 25% of Martin county respondents. Diving was consistently rated a low priority (rating = 1 or 2) by over 50% of the respondents from each county (Figures 119-122).

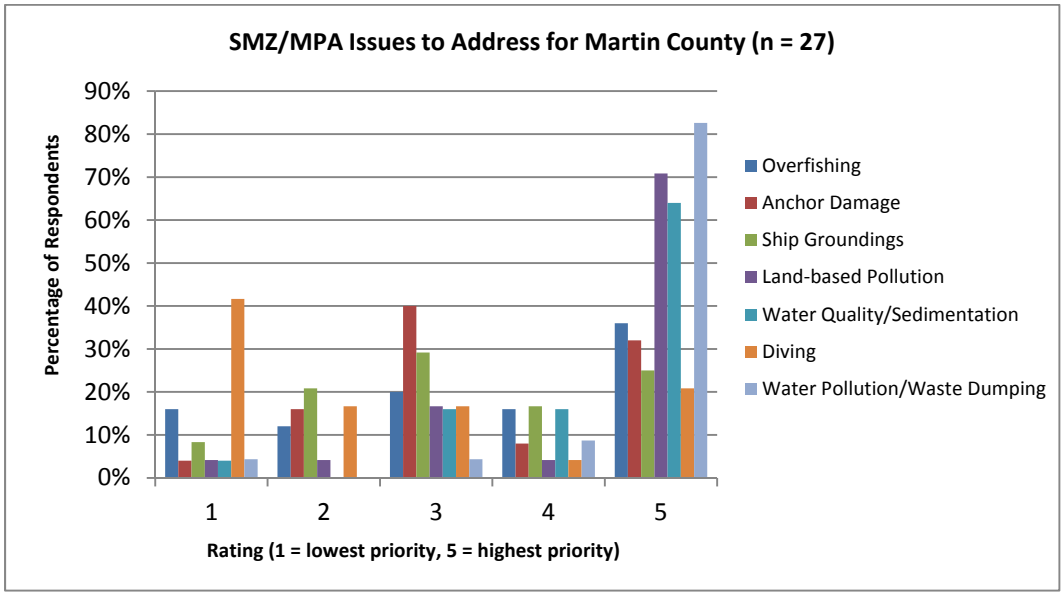


Figure 119. Respondents' rating of issues which should be addressed by SMZs/MPAs in southeast Florida by Martin County residents.

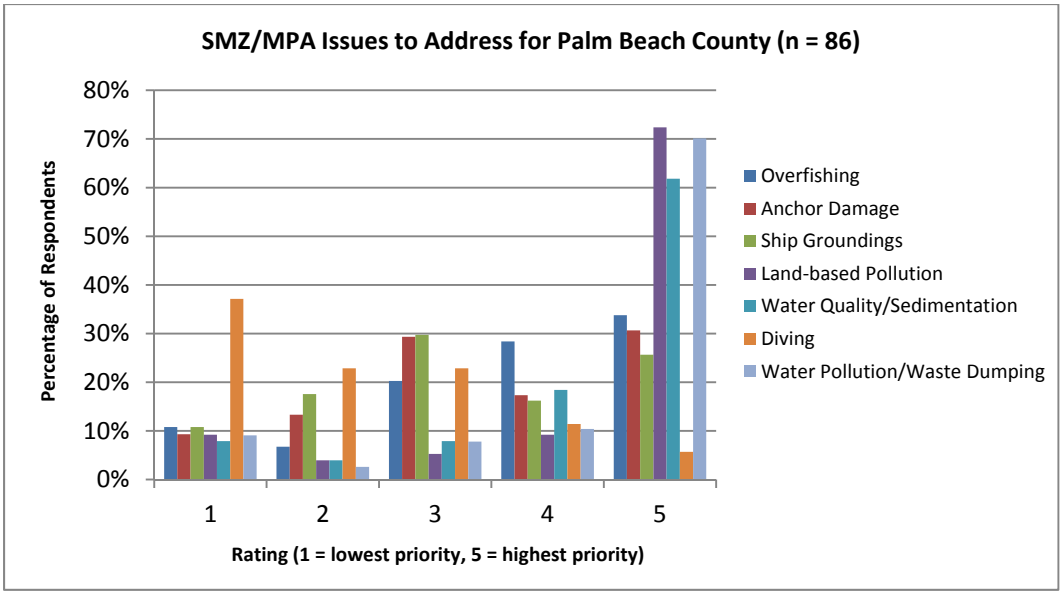


Figure 120. Respondents' rating of issues which should be addressed by SMZs/MPAs in southeast Florida by Palm Beach County residents.

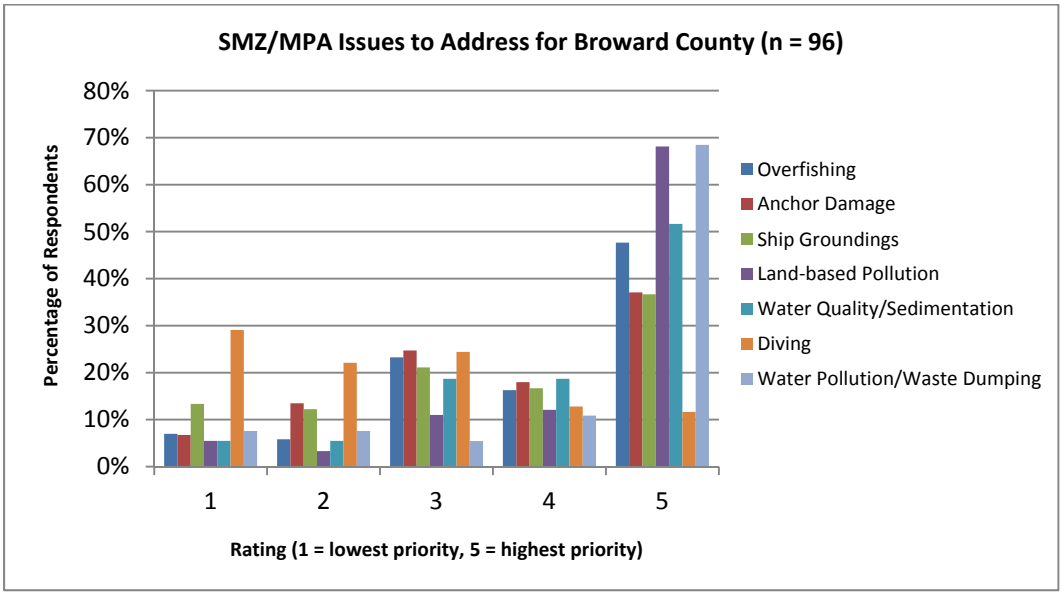


Figure 121. Respondents' rating of issues which should be addressed by SMZs/MPAs in southeast Florida by Broward County residents.

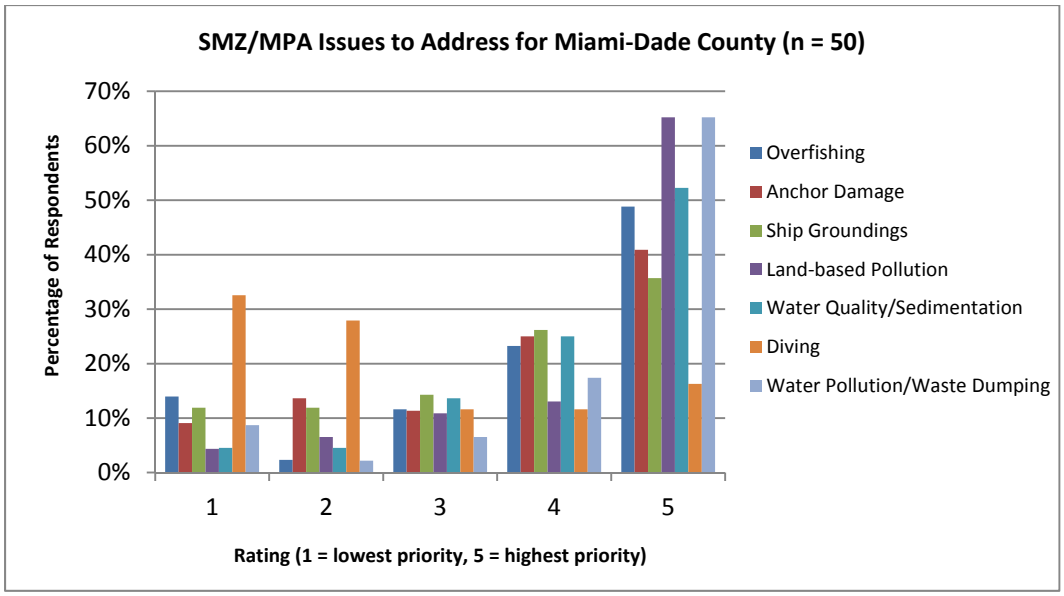


Figure 122. Respondents' rating of issues which should be addressed by SMZs/MPAs in southeast Florida by Miami-Dade County residents.

5.3.6.4.3 Age Group

The majority (over 50%) of respondents from each age group rated two issues as the highest priorities (rating = 5): land-based pollution and water pollution/waste dumping. Almost 40% of the 31-40 year-old group rated water quality/sedimentation as the highest priority (rating = 5); over 50% of the respondents in the other age groups also rated this issue a 5. Overfishing was rated a highest priority issue (rating = 5) by at least 30% of respondents in each age group. Diving was consistently rated a low priority (rating = 1 or 2) by over 35% of the respondents from the over 60-year-old group, over 45% of the 18-30 year-old group, and by over 50% of respondents in the other age groups (Figures 123-127).

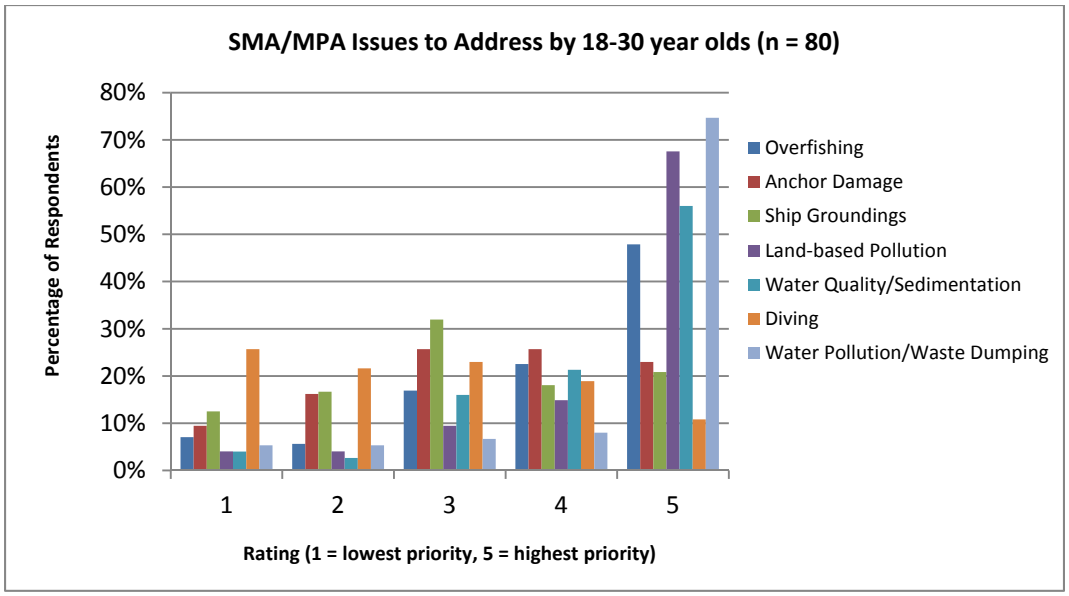


Figure 123. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by 18-30 year olds.

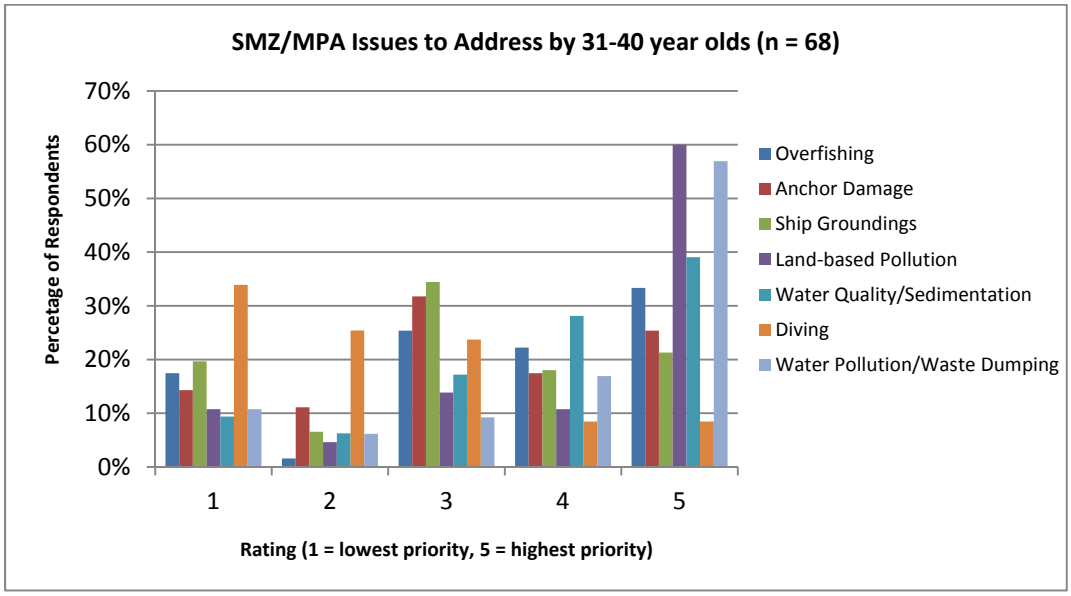


Figure 124. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by 31-40 year olds.

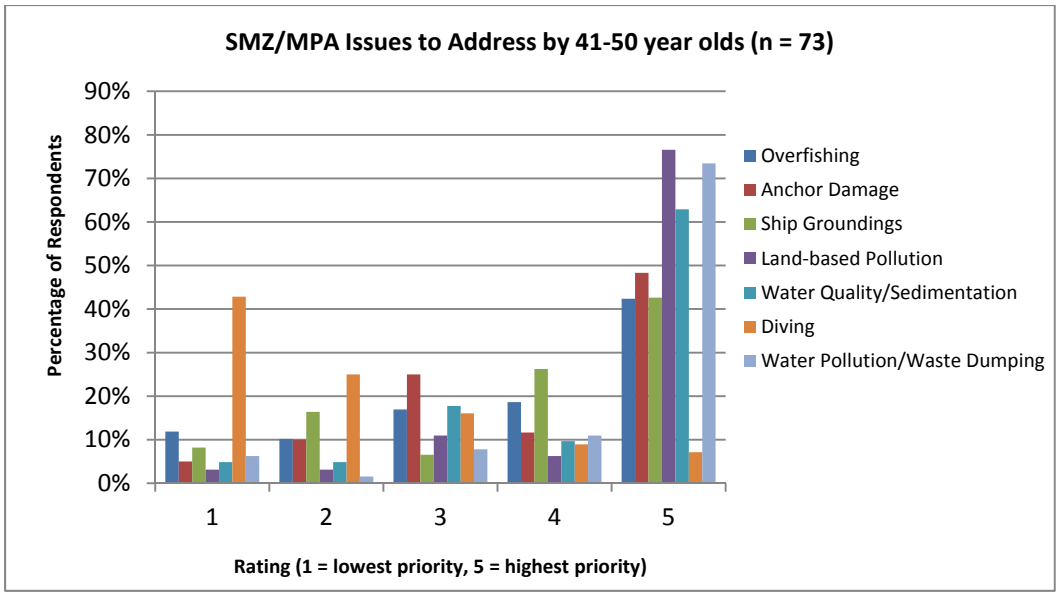


Figure 125. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by 41-50 year olds.

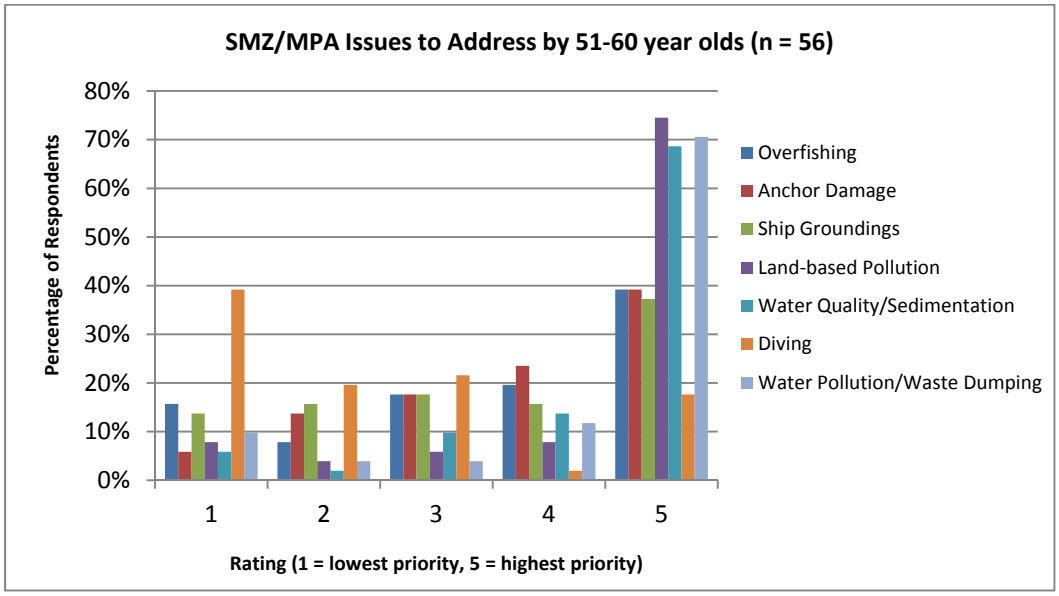


Figure 126. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by 51-60 year olds.

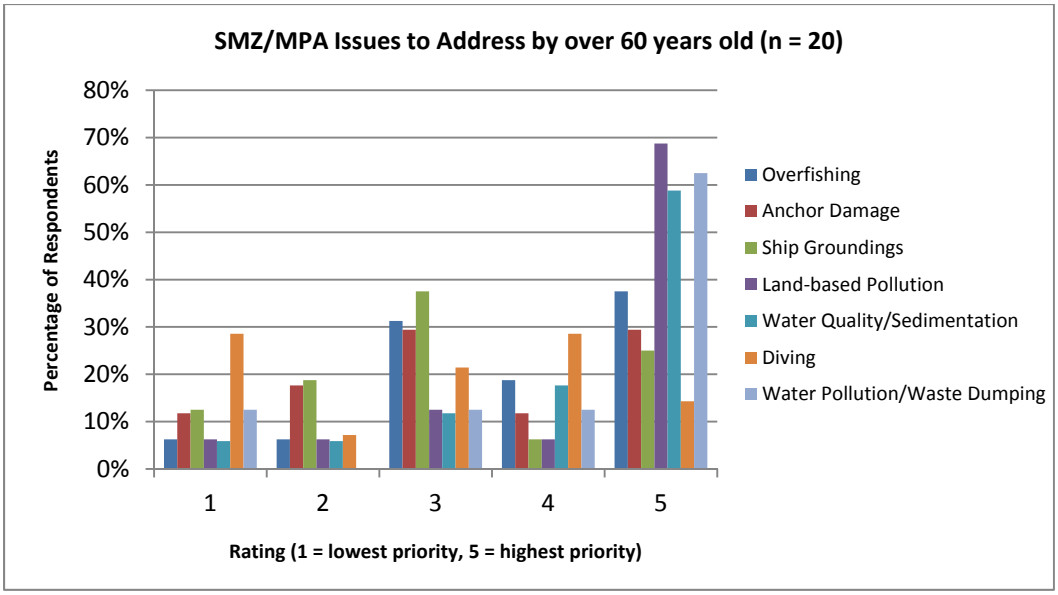


Figure 127. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by respondents over 60 years old.

5.3.6.4.4 Ethnicity

The majority (over 50%) of Caucasians and Hispanics rated three issues as the highest priorities (rating = 5): land-based pollution, water quality/sedimentation, and water pollution/waste dumping. Over 40% of respondents in each ethnic group rated overfishing as the highest priority (rating = 5). Diving was rated a low priority (rating = 1 or 2) by over 60% of Caucasians and by over 40% of Hispanics. Hispanics rated two issues, ship groundings (52%) and anchor damage (44%) as the highest priorities (rating = 5) more frequently than Caucasians, 26% and 33%, respectively (Figures 128 and 129).

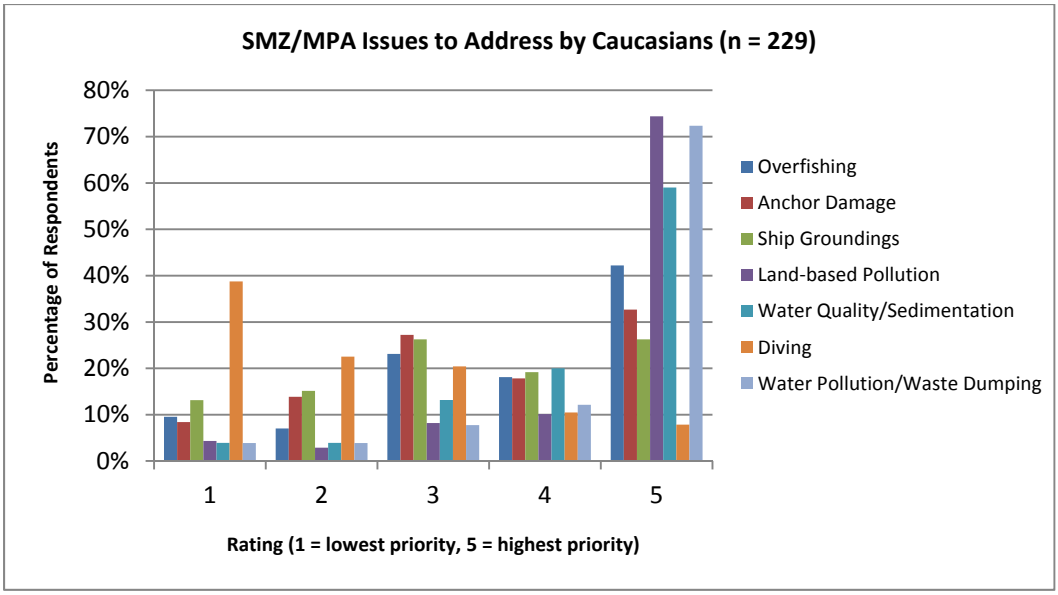


Figure 128. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by Caucasians.

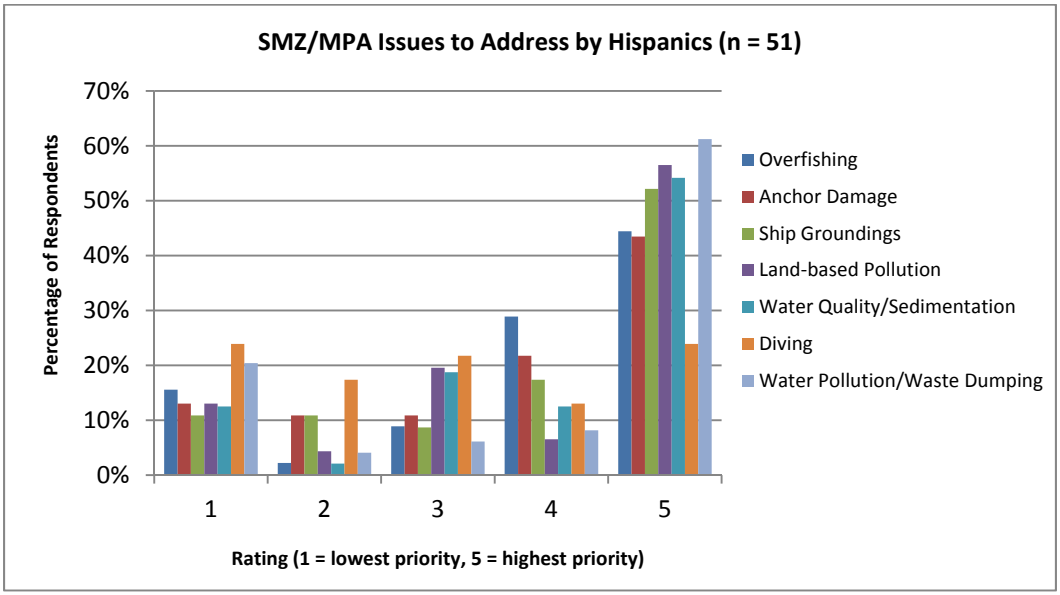


Figure 129. Respondents' rating of importance of issues to be addressed by SMZs/MPAs in southeast Florida by Hispanics.

5.3.6.5 Type of SMZ/MPA

Respondents were asked what type of SMZ/MPA they would be in favor of if one was developed in southeast Florida. Respondents were in favor of SMZs/MPAs that allow multiple activities (26%) or that allow some

consumptive use (39%). Fewer respondents were in favor non-consumptive SMZs/MPAs that either would allow only non-consumptive activities (16%) or small, isolated SMZs/MPAs that restrict all activities (10%). Less than 10% were in favor of keeping the same form of management (Figure 130).

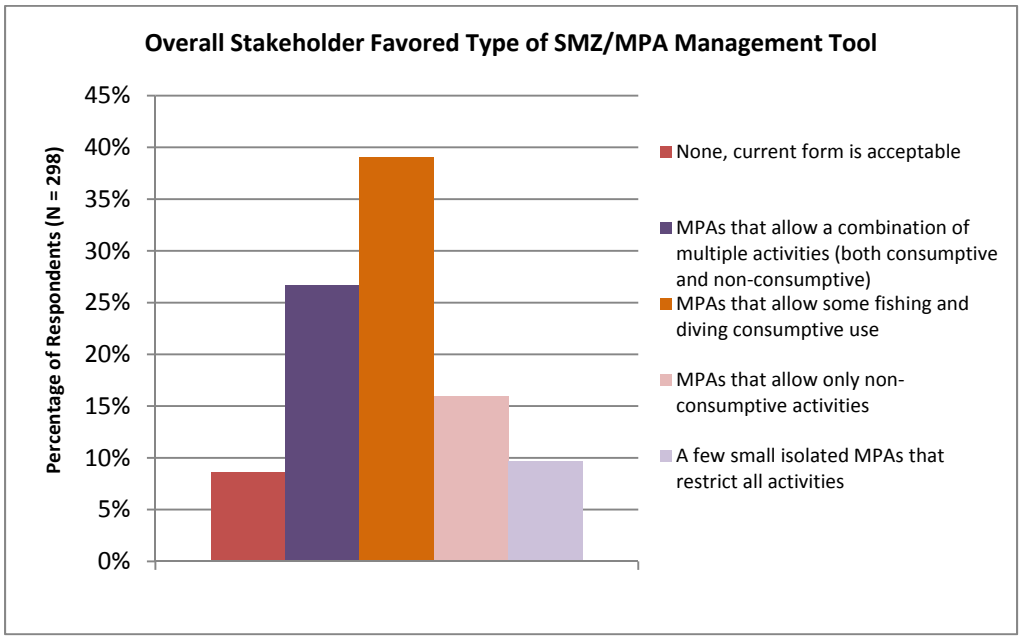


Figure 130. Percentage of respondents with favored SMZ/MPA management tool.

5.3.6.5.1 User Group

In general, the at least 25% of recreational user groups (recreational fishers, recreational divers, recreational boaters, recreational snorkelers, and other recreational users) and the non-recreational user groups (charter boat fishers, commercial fishers, commercial dive operators, and commercial divers) favored SMZs/MPAs that some fishing and diving consumptive use. Over 25% of recreational users favored SMZs/MPAs that allow a combination of consumptive and non-consumptive activities. More than 40% of charter boat fishers also favored SMZs/MPAs that allow a combination of consumptive and non-consumptive activities. More than 15% of the commercial fishers, commercial diver operators, and commercial divers were in favor of keeping the same form of management (Figure 131).

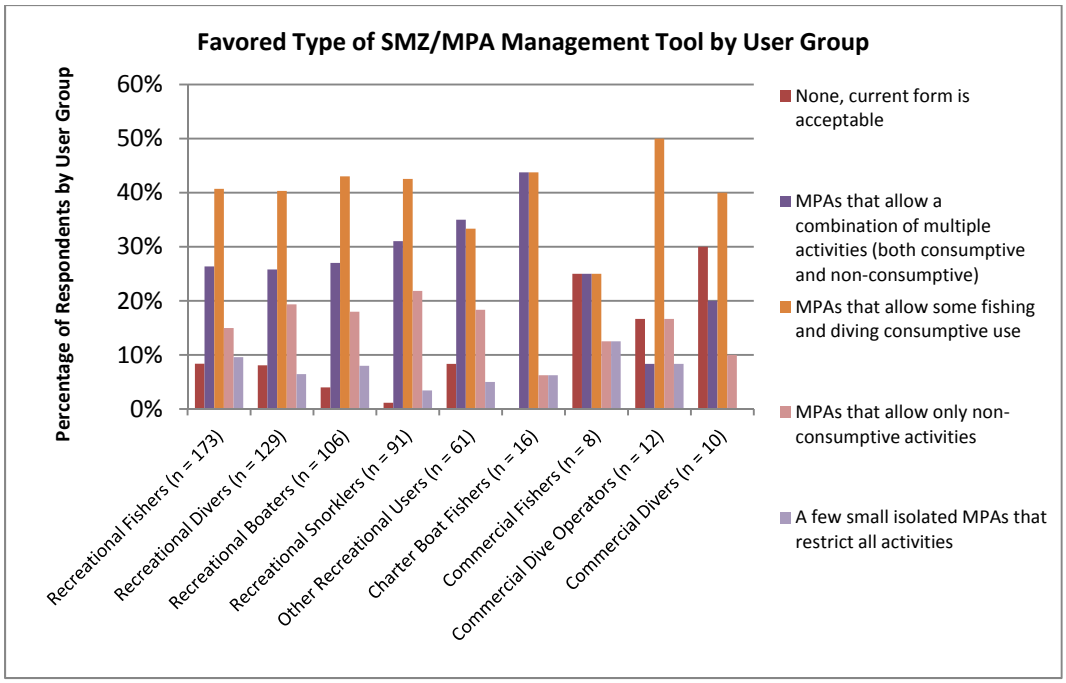


Figure 131. Percentage of respondents with favored SMZ/MPA management tool by user group.

5.3.6.5.2 County of Residence

The highest frequency (over 30%) of respondents from each county favored SMZs/MPAs that allowed some fishing and diving consumptive use. Over 20% of respondents from Palm Beach, Broward, and Miami-Dade counties and 15% of respondents from Martin County favored SMZs/MPAs that allow a combination of consumptive and non-consumptive activities. More than 20% of respondents from Miami-Dade County favored small, isolated SMZ/MPAs that restrict all activities (Figure 132).

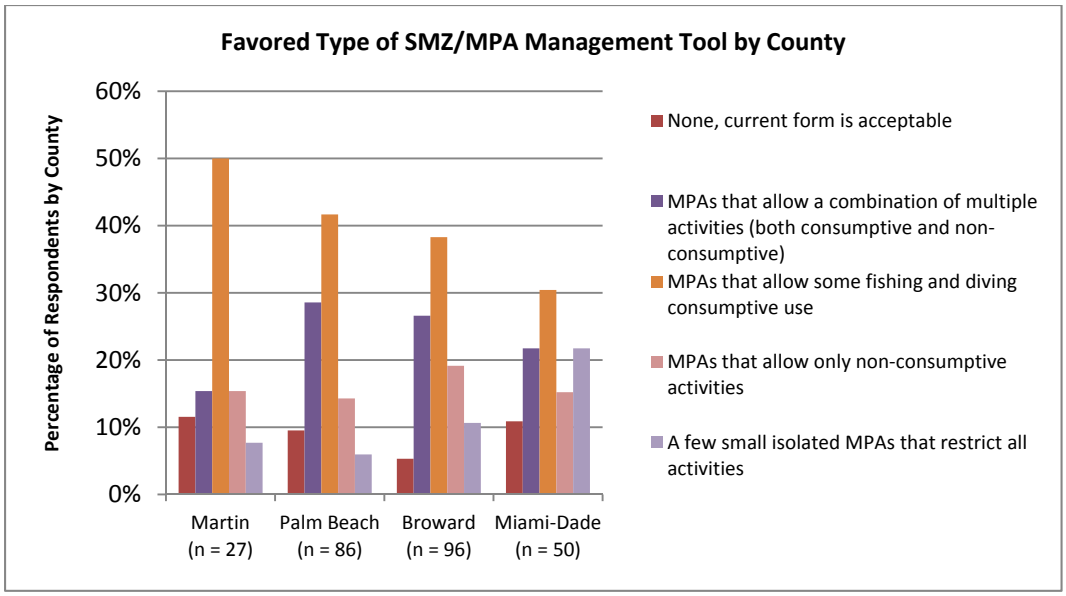


Figure 132. Percentage of respondents with favored SMZ/MPA management tool by county of residence.

5.3.6.5.3 Age Group

Over 35% of the respondents from the 31-40, 41-50, 51-60, and over 60 year-old groups and nearly 30% of the 18-30 year-old group favored SMZs/MPAs that allowed some fishing and diving consumptive use. More than 35% of the 18-30 year-old group, almost 30% of the 31-40 year-old group, and between 15% and 20% of the other age groups favored SMZs/MPAs that allow a combination of consumptive and non-consumptive activities. At least 15% of the respondents in the 31-40, 41-50, 51-60, and over 60 year-old groups favored SMZs/MPAs that allow only non-consumptive activities. More than 15% of respondents from the 18-30 year-old group favored small, isolated SMZ/MPAs that restrict all activities (Figure 133).

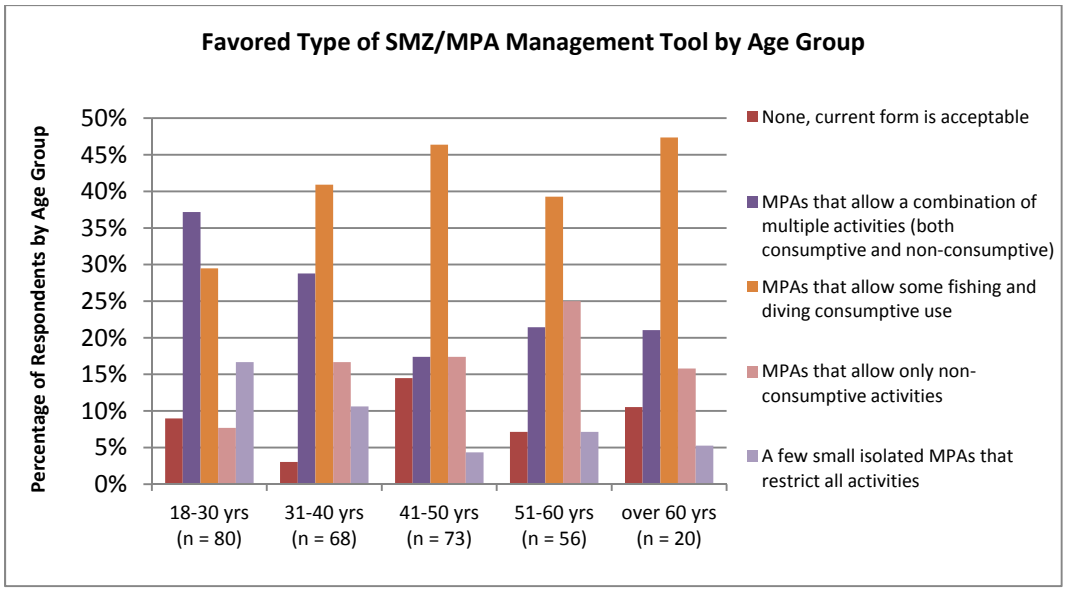


Figure 133. Percentage of respondents with favored SMZ/MPA management tool by age group.

5.3.6.5.4 Ethnicity

Most (over 35%) of Caucasians and Hispanics favored SMZs/MPAs that allowed some fishing and diving consumptive use. Over 20% of Caucasians and Hispanics favored SMZs/MPAs that allow a combination of consumptive and non-consumptive activities. More than 15% of Caucasians were in favor of SMZs/MPAs that allow only non-consumptive activities. More than 15% of Hispanics were in favor of small, isolated SMZs/MPAs that restrict all activities (Figure 134).

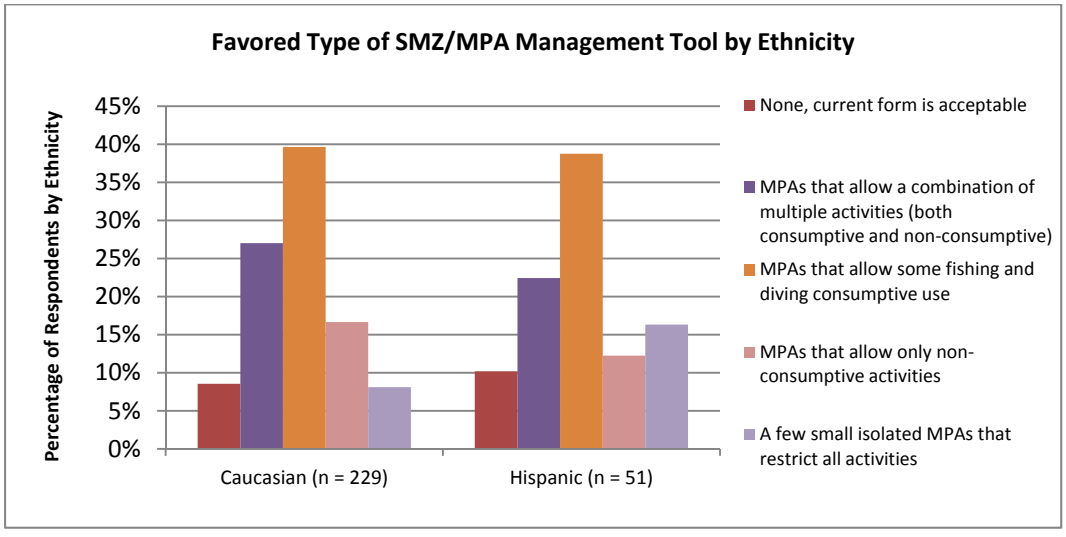


Figure 134. Percentage of respondents with favored SMZ/MPA management tool by ethnicity.

5.3.6.6 Issues Important for SMZ/MPA Success

To ensure SMZ/MPA success, the majority (> 50%) of users indicated that the most important issues to address were appropriate monitoring, more patrols and enforcement, and more outreach and education. Higher penalties were selected by 40% of the respondents (Figure 135). Almost 10% of the respondents who selected Other Issues listed a specific issue. The most common issues listed were that MPAs are ineffective (8/23), provide better/increased enforcement (6/23), and should restrict commercial consumptive use (4/23).

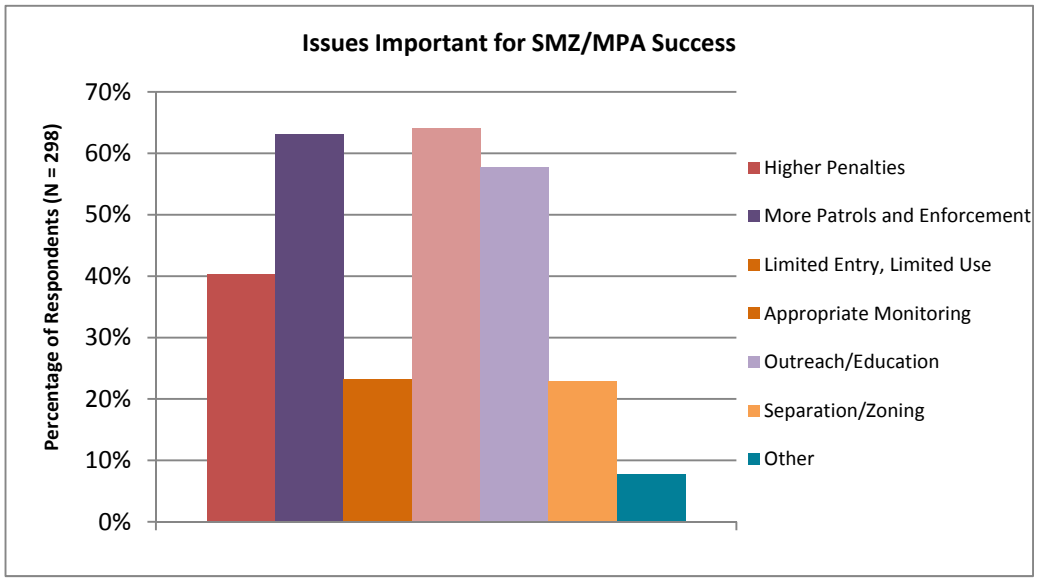


Figure 135. Respondents' choices of important issues to ensure the success of SMZs/MPAs.

5.3.6.6.1 User Groups

The majority (≥ 55%) of recreational users (recreational fishers, recreational divers, recreational boaters, recreational snorkelers, and other recreational users) and non-recreational users (charter boat fishers, commercial fishers, commercial dive operators, and commercial divers) selected the same three important SMZ/MPA issues: appropriate monitoring, more patrols and enforcement, and outreach and education (Figure 136).

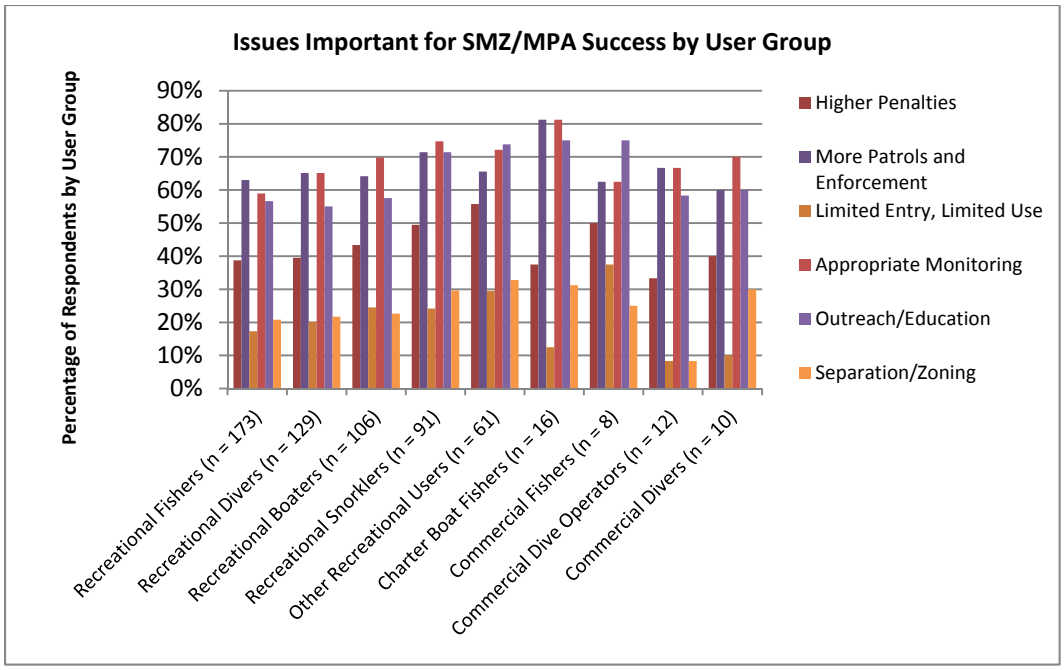


Figure 136. Respondents' choices of important issues to ensure the success of SMZs/MPAs by user group.

5.3.6.6.2 County

The majority (> 50%) of respondents from each county selected the same three important SMZ/MPA issues: appropriate monitoring, more patrols and enforcement, and outreach and education (Figure 137).

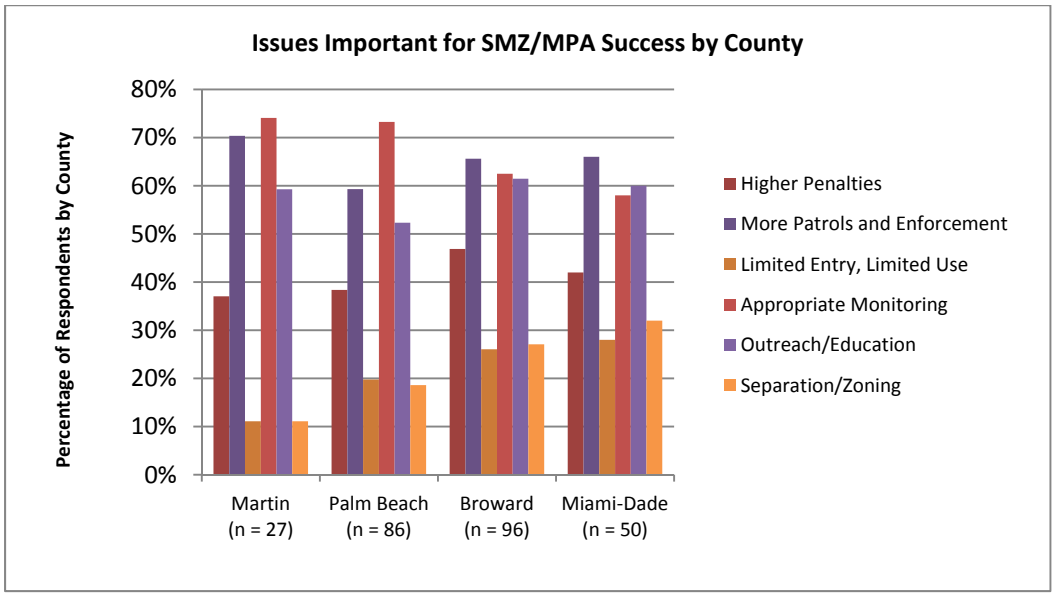


Figure 137. Respondents' choices of important issues to ensure the success of SMZs/MPAs by county.

5.3.6.6.3 Age Group

Most (≥ 55%) of the respondents from each age group selected the same three important SMZ/MPA issues: appropriate monitoring, more patrols and enforcement, and outreach and education (Figure 138).

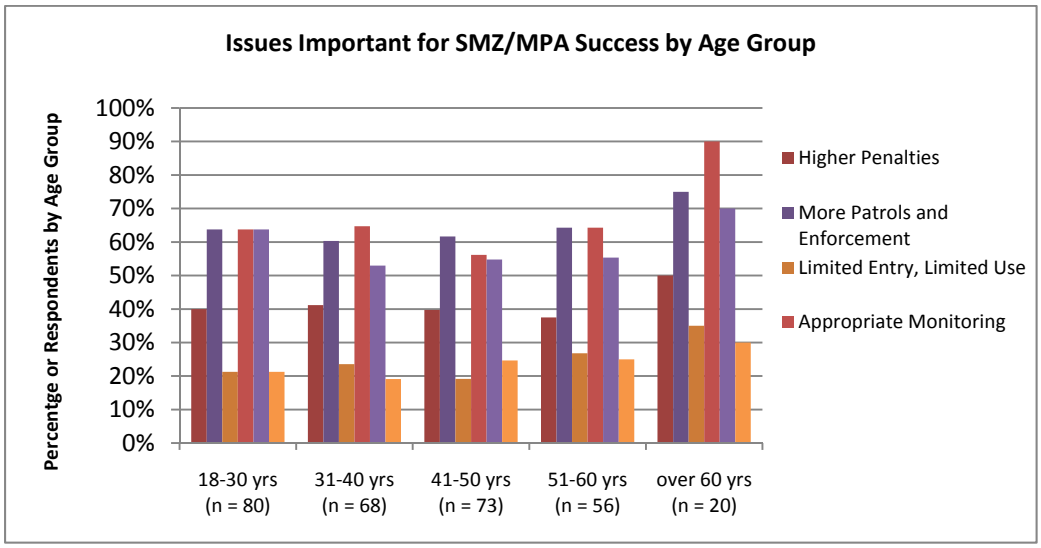


Figure 138. Respondents' choices of important issues to ensure the success of SMZs/MPAs by age group.

5.3.6.6.4 Ethnicity

The majority (> 55%) of Caucasians and Hispanics selected the same three important SMZ/MPA issues: appropriate monitoring, more patrols and enforcement, and outreach and education (Figure 139).

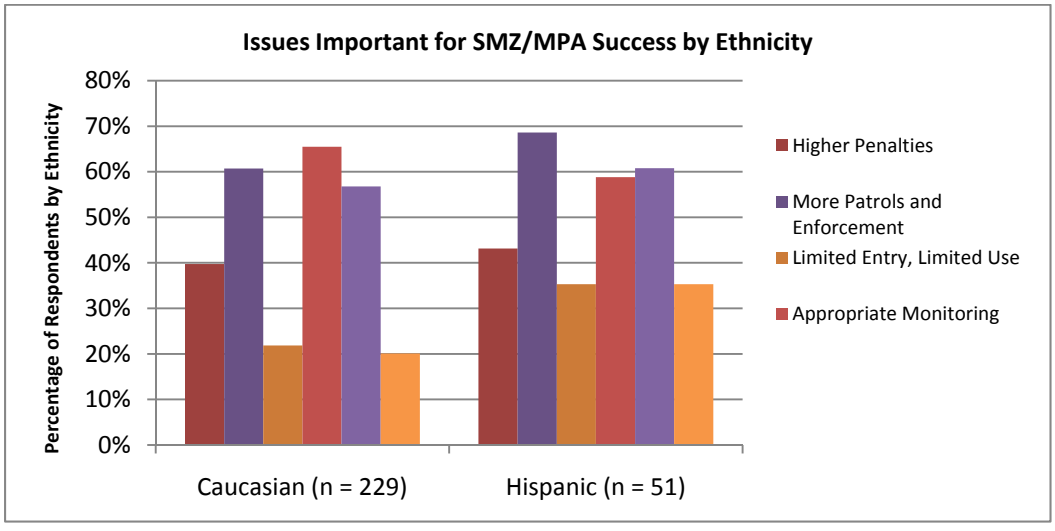


Figure 139. Respondents' choices of important issues to ensure the success of SMZs/MPAs by ethnicity.

5.3.7 Information Sources

Sixty-five percent (65%) of respondents indicated that they seek information related to marine management (Figure 140).

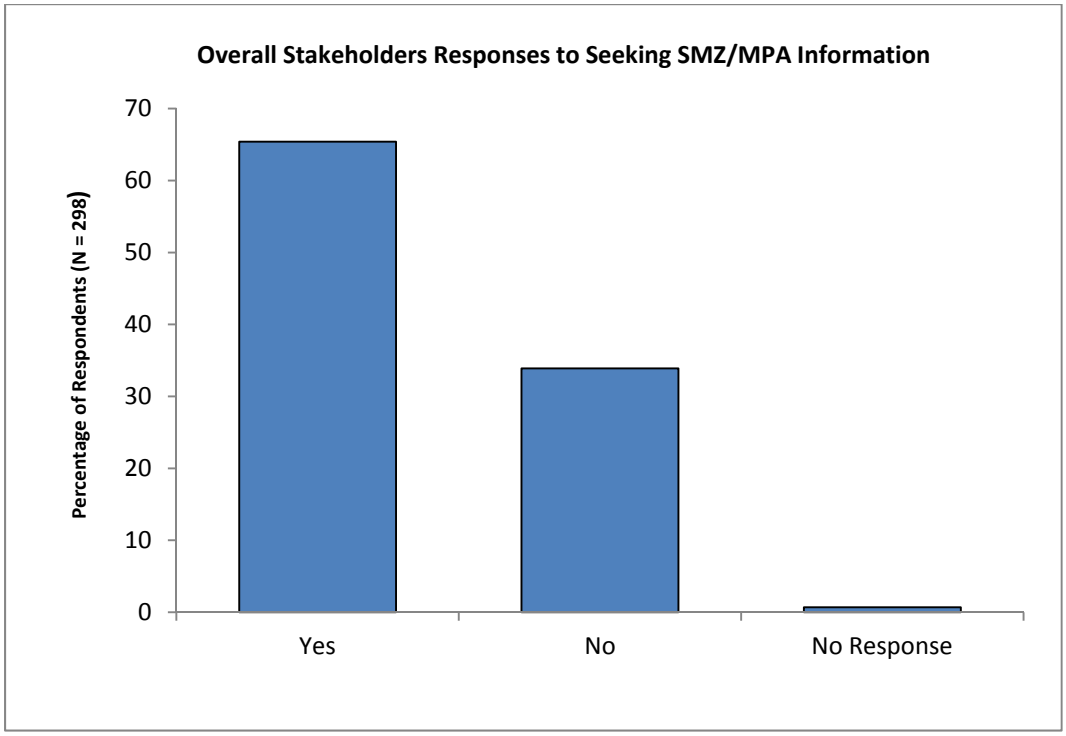


Figure 140. Percentage of respondents who seek information about SMZs/MPAs and related marine management.

For the 195 respondents who seek SMZ/MPA information, the most commonly used sources were the internet (48%), followed by dive shops (24%), and magazine subscriptions (22%). Angling events, boat shows, and boat ramps/signage were identified less frequently (≤ 10%) as sources of information on marine management (Figure 141). The most commonly listed "Other" sources of information were personal knowledge (7/14), colleges/schools (3/14), newspapers (2/14), and bait/tackle shops (2/14).

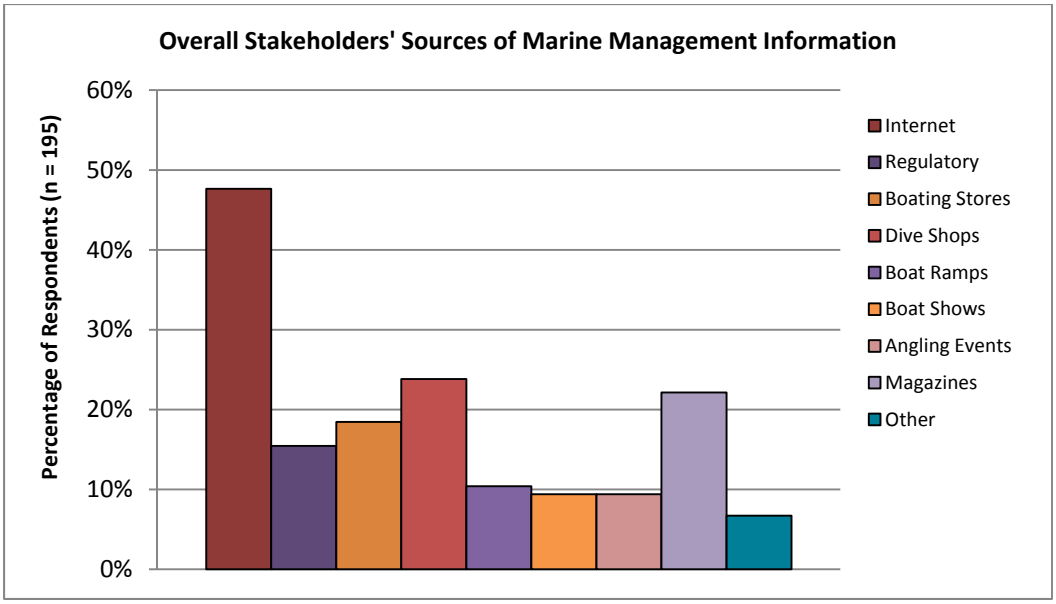


Figure 141. Respondents sources of SMZs/MPAs or related marine management information.

5.3.7.1 User Groups

The most frequently (≥ 40%) identified information source from all respondents regardless of user group was the internet. Recreational and commercial divers, recreational snorkelers, and commercial dive operators often (≥ 25%) used dive shops as information sources. Half (50%) of the commercial fishers used magazines as information sources (Figure 142).

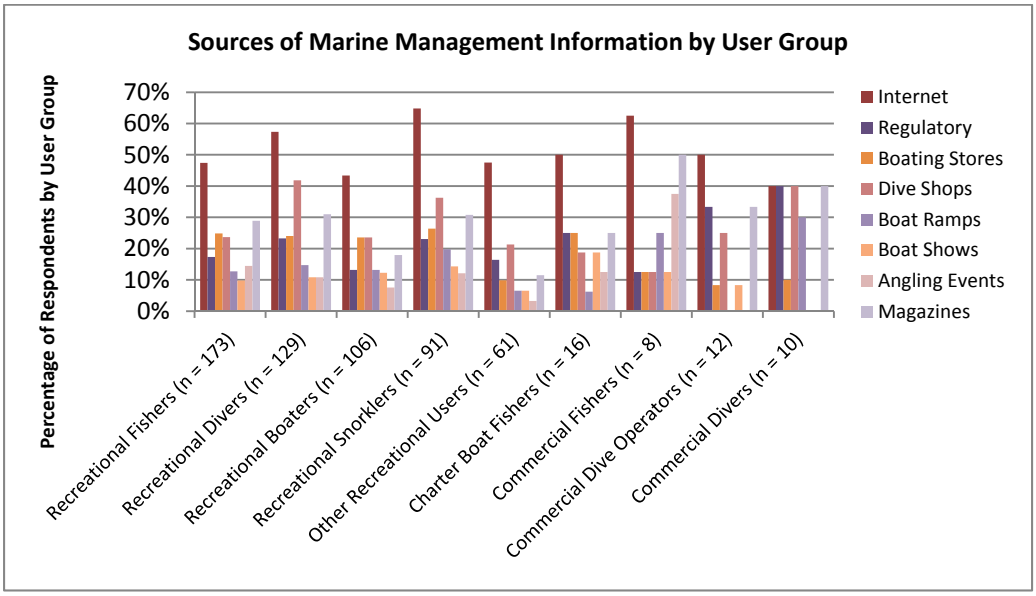


Figure 142. Respondents sources of SMZs/MPAs or related marine management information by user group.

5.3.7.2 County

The most frequently (≥ 40%) identified information source from all county respondents was the internet. Martin County respondents often (37%) use boating stores for information. Magazines are used as information sources by at least 30% of the Martin and Palm Beach county respondents. Dive shops are common (29%) information sources for Palm Beach County respondents (Figure 143).

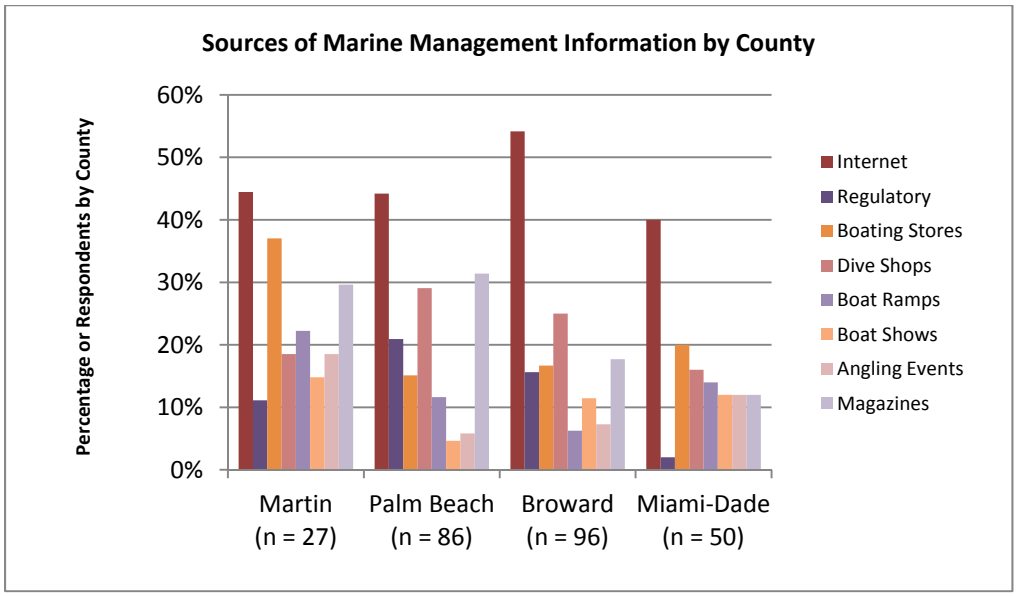


Figure 143. Respondents sources of SMZs/MPAs or related marine management information by county.

5.3.7.3 Age Group

The most frequently selected source of information for any age group was the internet. At least 45%of the 18-30, 31-40, 41-50, and 51-60 year-old group respondents use the internet whereas 30% of the over 60 year-old group uses the internet (Figure 144).

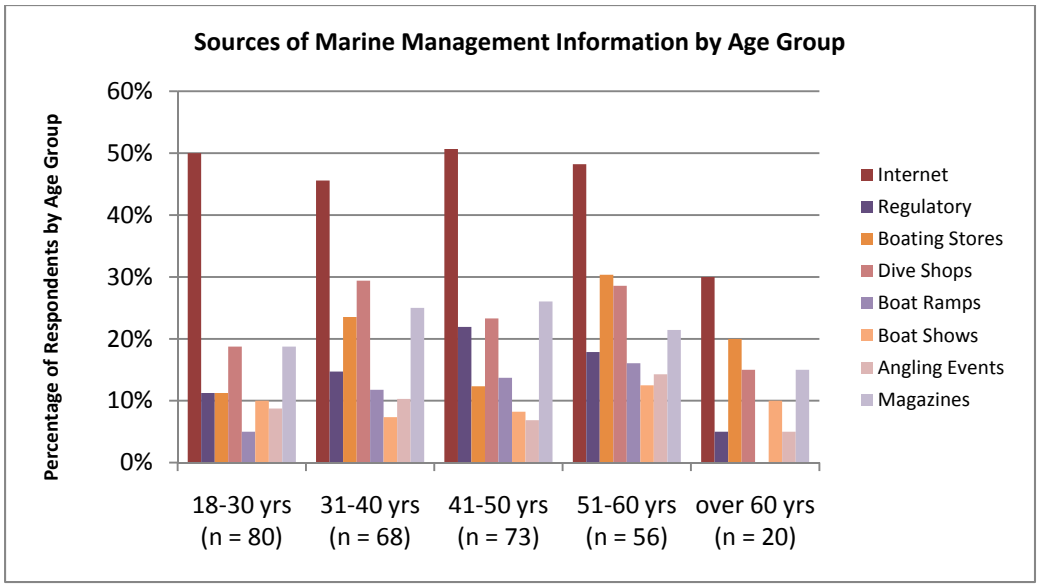


Figure 144. Respondents sources of SMZs/MPAs or related marine management information by age group.

5.3.7.4 Ethnicity

The internet is the most commonly used information source for Caucasians (50%) and Hispanics (47%) (Figure 145). Caucasians (27%) are twice as likely to use dive shops as sources of information than Hispanics (14%). Hispanics are three times less likely (6%) to get their information from regulatory agencies than Caucasians (18%).

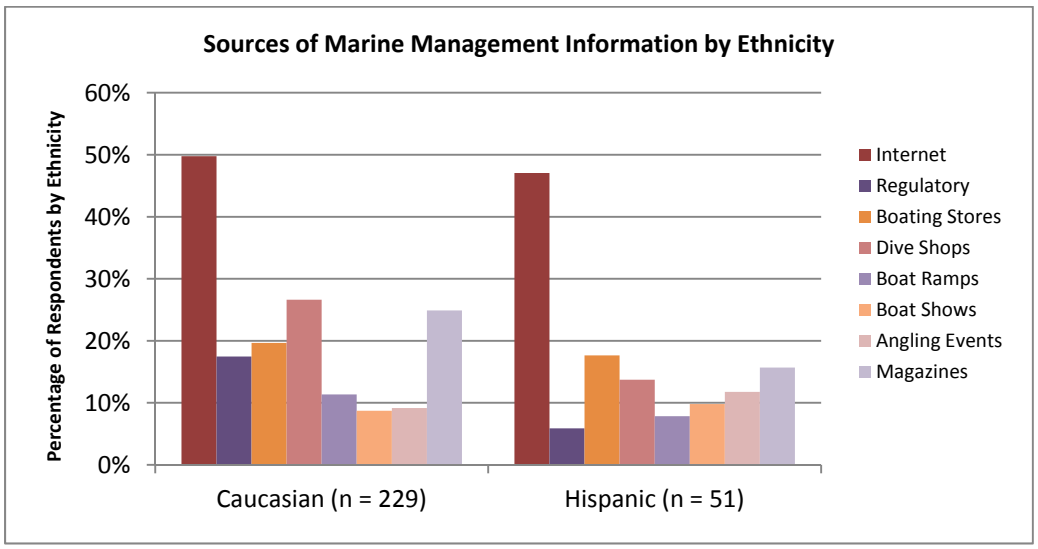


Figure 145. Respondents sources of SMZs/MPAs or related marine management information by ethnicity.

5.4 Discussion

The results summarized here represent the perceptions of marine zoning by 298 stakeholder respondents. The survey results were used to identify stakeholders' perceptions of MPA beneficiaries, the goals and objectives of SMZs/MPAs, the important marine management issues, and user concerns about the potential for a marine zoning plan for southeast Florida.

Although the overall stakeholder response rate (3%) was lower than anticipated, the majority of respondents (60%) have been using marine resources in southeast Florida for more than 10 years. Many respondents (54%) use southeast Florida resources on a weekly basis and, based upon this experience, may provide a reliable measure of how local stakeholders feel about SMZs/MPAs and their potential establishment in southeast Florida.

5.4.1 Stakeholder Demographics and Perceptions

5.4.1.1 User Groups

Stakeholders believed all recreational and non-recreational user groups would benefit from SMZs/MPAs (Figure 25). The overall survey response rate of 3% for all user groups combined was lower than anticipated and needs to be considered when assessing the results of this survey.

In general, it does not appear that user group had a marked impact on the perceptions of the respondents. However, there was a small difference between the frequency of responses between recreational users and non-recreational users. Recreational users generally selected other recreational user groups 10% to 30% more often than non-recreational user groups as potential SMZ/MPA beneficiaries (Figures 26-30).

All user groups most frequently identified three main purposes of SMZs/MPAs: conserve/protect species, replenish fishery stocks, and improve water quality. Commercial fishers (50%) and commercial divers (60%) also identified protect users rights (Figure 38).

Although most user groups had similar concerns about SMZs/MPAs, there were a few differences (Figures 44-48). Commercial fishers (38%) considered too many SMZs/MPAs to be most problematic (rating = 5); conversely, 25% considered too few SMZs/MPAs to be most problematic. Charter boat fishers considered ineffective SMZ/MPA regulation and enforcement (56%) and poor user compliance with SMZ/MPA regulations (61%) to be most problematic (rating = 5). More than 60% of most user groups believe SMZs/MPAs can effectively manage marine resources. However, most (> 55%) commercial fishers do not believe SMZs/MPAs

can effectively manage marine resources (Figure 65). Although most user groups believe resource conditions will worsen if management remains the same, 50% of commercial fishers believe resource conditions will get better if management remains the same (Figure 102). Whereas most user groups (>35%) strongly agree (rating = 1) with the establishment of SMZs/MPAs, more than 40% of commercial fishers strongly disagree (rating = 5) with establishing SMZs/MPAs (Figure 107). Commercial fishers (25%) and commercial divers (30%) favor keeping the same SMZ/MPA management tool (Figure 131) whereas more than 90% of recreational users favor a change.

These differences between recreational users and non-recreational users may require different approaches toward developing and delivering SMZ/MPA educational and outreach programs.

5.4.1.2 County of Residence

County of residence does not appear to have had a marked impact on the perceptions of the respondents. Regarding type of SMZ/MPA management tool, Miami-Dade County residents were twice a likely (>20%) to favor few, small isolated MPAs that restrict all activities than any other county (Figure 132).

5.4.1.3 Age Groups

In general, it does not appear that age had a marked impact on the perceptions of the respondents. However, in the 18 to 30-year-old group more than 45% rated the SMZ/MPA concerns ineffective enforcement and regulation (Figure 51) and poor user compliance (Figure 52) as most problematic (rating = 5). The 18 to 30-year-old group also more frequently (40%) considered global warming to be an important issue (rating = 5) impacting coral reefs than did other age groups (Figure 83).

5.4.1.4 Ethnicity

For some issues, ethnicity had a marked impact on the perceptions of the respondents. Caucasians are twice as likely (30%) to rate SMZ/MPA benefits are unclear as most problematic (rating = 5) than Hispanics (15%) (Figure 58). Caucasians and Hispanics also differ on which issues have the most impact on the quality of the resources in southeast Florida. For example, the percentage of Hispanics (55%) who believe ship groundings are a high priority issue (rating = 5) is nearly double that of Caucasians (29%). Also, more than 70% of Caucasians and more than 50% of Hispanics believe that land-based sources of pollution have an impact on reef quality. More than 60% of Caucasians believe marine resource

conditions will worsen if management stays the same compared to 38% of Hispanics (Figure 105).

Caucasians and Hispanics also differ on the frequency they seek information on SMZs/MPAs or related marine management from various sources. Caucasians are three times more likely (18%) to use regulatory agencies and twice as likely (28%) to use dive shops as information sources than Hispanics, 6% and 14% respectively (Figure 145).

These differences between Caucasians and Hispanics may require different approaches towards developing and delivering educational and outreach programs. Spanish language publications may be important to Hispanics although this was not a question on the survey.

Marine resource users believe that SMZs/MPAs generally benefit all user groups but they do not believe SMZs/MPAs provide any significant economic benefits. This may indicate a need to develop education and outreach programs that describe the important economic benefits of SMZs/MPAs. In addition, if SMZs/MPAs are implemented, their goals and objectives need to be well defined and presented to the stakeholders. Results from the literature review also stress the importance of stakeholders' involvement in every stage to facilitate successful SMZ/MPA implementation. The best way to inform all stakeholders about SMZs/MPAs in the SEFCRI region is by using the Internet, boat ramps/signage, boat shows, angling events/competitions, and magazines are.

5.4.2 Knowledge, Perceptions, and Concerns

In general, users seem to have a broad knowledge of the purpose of marine zoning but the groups varied in their understanding of how SMZs/MPAs could impact them and their use of marine resources.

- **What do users want, not want, and what are their concerns associated with SMZs/MPAs?**

Respondents are generally in favor of the establishment of SMZs/MPAs in southeast Florida. Nearly three-quarters (74%) of the respondents believe that a different management approach is needed, and more than half (58%) believe that the quality of marine resources will worsen if management stays the same. Almost 60% favor (rating = 1 or 2) the establishment of SMZs/MPAs.

The majority (71%) of the marine users surveyed believe that SMZs/MPAs can effectively manage marine resources. They believe specific issues, such as land-based sources of pollution, water

pollution/waste dumping, and water quality/sedimentation, need to be addressed in creating MPAs in southeast Florida. They also would like to see MPAs address overfishing, ship groundings, and anchor damage.

If a management tool was developed for coral reefs in southeast Florida, most users would be in favor of multiple use areas; approximately 39% would favor some fishing and diving consumptive use, and an additional 26% would prefer a combination of multiple activities. A small percentage of stakeholders prefer SMZs/MPAs which only allow non-consumptive activities.

When asked what issues would be important in defining an SMZ/MPA, users indicated land and water-based pollution, degraded water quality, and impacts on fisheries were the biggest threats to the reefs. This indicates that the general user population does have knowledge and opinions regarding key issues impacting reef resources. This supports the role of stakeholders in the SMZ/MPA planning process.

Respondents that had concerns about the establishment of SMZs/MPAs, identified insufficient enforcement, poor user compliance, and lack of stakeholder understanding of the benefits of marine zoning as their key reasons. Somewhat inconsistently they also thought there were too few SMZs/MPAs.

In summary, it appears that the establishment of SMZs/MPAs in southeast Florida would meet with general stakeholders' approval, especially from recreational users. As the respondents generally favor the establishment of SMZs/MPAs, believe specific issues need to be addressed and regulated and have opinions on the greatest threats to coral reefs, they should participate in the planning process, if one is undertaken. The literature review reinforces the involvement of stakeholders and the information on the potential threats to the coral reefs as important components of this process.

5.4.3 Stakeholders' Criteria for Success of SMZs/MPAs

Marine resource users surveyed believe that although SMZs/MPAs should allow fishing and diving consumptive uses, these uses should be appropriately monitored by having more patrols with effective enforcement as well as more education and outreach programs. This approach will be important for the success of SMZs/MPAs in southeast Florida.

Many respondents indicated they would like to learn more about SMZs/MPAs and the potential for marine management in southeast Florida. The use of certain information sources, as indicated by the users'

preferences, would be effective tools for distributing information for future outreach and awareness regarding marine management in southeast Florida.

In conclusion, it appears from the survey that the respondents do not want to compromise their use of the marine resources in southeast Florida, yet at the same time, they do not want these resources to deteriorate. The respondents would like to see the issues which have the potential of affecting the quality of the marine resources managed to ensure the protection of these resources.

6 Existing Knowledge Gaps

6.1 Introduction

The purpose of this task (Task 5) was to identify existing knowledge gaps related to marine zoning and reef protection plans based on manager and stakeholder survey responses.

An information gap analysis was designed to evaluate the management options for southeast Florida coral reefs according to theoretical and applied approaches, and locally desired wishes. The review of existing information gaps was conducted through the completion of the following steps:

- Review the literature database, literature, and information related to SMZs/MPAs and marine resources throughout the world and more specifically those studies that are representative of southeast Florida (Task 1)
- Evaluate marine manager survey results in relation to southeast Florida and marine zoning criteria (Task 2)
- Analyze and interpret the results from southeast Florida stakeholder surveys (Tasks 3 and 4)

6.2 Comparison of Literature Review and Survey Results

6.2.1 Criteria Identified in Literature Review

The following criteria were identified as the most important benefits of SMZs/MPAs:

- Fisheries productivity increase
- Fisheries biodiversity protection
- Habitat protection for threatened species
- Sustainable recreational and commercial activities
- Increase knowledge of marine ecosystems
- Cultural heritage protection

Based on the literature review, one of the top priorities of any marine management program is to build public support for the concept of protecting marine resources by highlighting the environmental and the economic benefits of such programs. Outreach and education programs are instrumental in obtaining support for the necessary legislation and for securing adequate funding for the three important steps of planning, establishing, and managing an SMZ/MPA. The SMZs/MPAs that have

been successful in other parts of the world are those which involved the decentralization of the SMZ/MPA management from central government to regional or local organizations. This made the community and stakeholder participation in those SMZs/MPAs a vital factor in their success. Among the key scientific gaps that the literature review identified was the information, commonly lacking in the planning process, on the extent, spatial distribution, and condition of both habitats and resources. This information is crucial to the selection of unique or representative habitats or stocks to preserve. The Florida Keys National Marine Sanctuary was identified as an exception to this shortcoming.

There is world-wide recognition of the importance of developing effective and sound management partnerships with local communities for SMZs/MPAs. There are a number of countries (England, Italy, Philippines, and Canada) and U.S. states (California and Hawaii) that have implemented partnerships with local communities and non-governmental organizations or have actually given the oversight of marine protected area to local governments. The southeast Florida local four-county approach is particularly relevant to the literature review findings about decentralizing to regional organizations and the need for community and stakeholder participation.

6.2.2 Criteria Cited by Marine Resource Managers

The marine resource managers surveyed listed five important criteria to consider when establishing an SMZ/MPA: (1) boundaries; (2) size of individual zones; (3) number of zones; (4) conditions for zoning for multiple users; and (5) no-take or exclusionary areas. Well-defined boundaries were identified as the most important factor in establishing SMZs/MPAs. The boundaries of any proposed SMZ/MPA should be biologically meaningful, large enough to cover the resources being protected, and include sufficient buffer zones. The biological diversity, conditions of the resources, and their type of use were deemed prominent factors in determining the number of zones to be included in the SMZ/MPA. Although the managers reported that the implementation of no-take or exclusionary areas can be the most effective way to restore a depleted resource, these areas should only be designated under certain circumstances. The managers' survey suggested that no single governance strategy applied to all SMZs/MPAs but that a successful governance system should consider significant involvement of diverse stakeholders in the decision-making process; have a management structure that incorporates facilitation, decision making, and conflict management; be able to deal with uncertainties; and promote economic and socio-cultural development and institutional stability.

The main factors considered important by the managers for the success of SMZs/MPAs were: (1) management goals and objectives for the area; (2) ability to enforce regulations; (3) use restrictions; (4) ability to manage; (5) size of area to be protected/managed; (6) regulations on extraction; and (7) community involvement. The size of individual zones depends on the particular characteristics of the site or habitat to be protected. In addition, the uses, single versus multiple, are determined based on the current conditions of the resources and the number of users who are going to be allowed to exploit these resources. These seven factors are all relevant to southeast Florida.

6.2.3 Criteria for Success in Areas Similar to the Southeast Florida Region

The literature review shows that for areas similar to the southeast Florida region, there are two ways of establishing functional SMZs/MPAs: (1) a network of many protected small zones or (2) a few large multiple-use zones with strictly protected areas within them. The marine resource managers believe that the most effective SMZs/MPAs designs are networks of SMZs/MPAs as opposed to small or large single areas. Furthermore, the managers mentioned that the zoned areas (core areas) should be surrounded by buffer zones to further protect the resources within the core areas.

SMZs/MPAs developed in areas similar to the southeast Florida region have taken into account the historical uses, the impact of future uses, and the socio-economic characteristics of the area when defining the main characteristics of SMZs/MPAs.

6.2.4 Stakeholders Opinions

Stakeholders were in general agreement that SMZs/MPAs are an effective way of managing marine resources. This finding was consistent across all demographics, counties, and among all age and stakeholder groups, with the exception of a small cohort of commercial fishers. When asked to identify concerns, all respondents cited the lack of effective regulations or poor compliance and enforcement of regulations as major concerns. From the responses on concerns, there was diversity of opinion and some lack of understanding of what required to establish SMZs/MPAs.

6.3 Discussion

Are the criteria cited in the literature for SMZs/MPAs consistent with the views of current managers? What are the implications for southeast Florida coral reefs?

In general, there was agreement between the views of the managers and the criteria cited in the literature. Key issues included the definition of the goals and objectives of SMZs/MPAs, the ability to manage and enforce regulations, the need for stakeholder participation, and the need for stakeholder education and outreach programs. There was also general agreement between the managers and the literature on the importance of good scientific data in the design of an effective SMZ/MPA and of the importance of a sound governance and management structure.

The marine resource managers used their experience and knowledge of the southeast Florida region to provide their opinions on what the most effective SMZs/MPAs designs for southeast Florida are. Without identifying the specific purpose(s) of SMZs/MPAs, the managers felt that a network of SMZs/MPAs will be the most effective and suitable design for southeast Florida rather than either small or large single areas. The implications for southeast Florida are important in the next stage in planning SMZs/MPAs. Defining core areas for each of a network of SMZs/MPAs would take extensive planning based on good scientific data and with governance and management issues to be worked out among county, state, and federal agencies.

Are the views of local stakeholders about SMZs/MPAs consistent with the findings of the literature review and current management approaches?

The majority of southeast Florida stakeholders who participated in the survey have used the marine resources in southeast Florida for many years. Overall, the perceptions, wants, and needs of those southeast Florida stakeholders were consistent with the literature and the managers' opinions. All the important criteria listed in the literature and mentioned by the managers were also identified by the stakeholder groups, though not necessarily in the same order of importance.

The stakeholders perceived the main purposes of SMZs/MPAs as conserving and protecting species and improving fishery stocks. This is consistent with the literature where protecting biodiversity and improving fisheries productivity are listed as important SMZ/MPA purposes/benefits. Another consistency with the literature and the managers is the stakeholders' opinion about the goals of SMZs/MPAs. Although the stakeholders' opinions differ about the best goal for an

SMZ/MPA, they agree that the three major approaches should be to: restrict recreational activities, allow only recreational non-consumptive activities, and allow both consumptive and non-extractive activities. The main goals identified in the literature and the managers' survey is to improve the status of reef resources and to restore declining fishery stocks.

The managers, the literature review, and the stakeholders all want effective regulation and compliance enforcement. This calls for an approach to promote the capacity of the SMZ/MPA managers in southeast Florida and to develop effective regulation and an enforcement mechanism to ensure the success of the local SMZs/MPAs. This is exactly what the managers surveyed mentioned as important criteria for the success of SMZs/MPAs.

What are the major inconsistencies and knowledge gaps which need to be addressed in establishing SMZs/MPAs in southeast Florida?

Sound Scientific Analysis and Monitoring

The literature and the managers' survey indicated that an important factor in the lack of success in some SMZs/MPAs was the lack of information during the planning process on the extent, spatial distribution, and condition of both habitats and resources. The Florida Keys National Marine Sanctuary, the Great Barrier Reef Marine Park Authority, and Hawaii were cited as areas where the requisite scientific details were available. The literature review did not identify a similar body of knowledge for the reefs of southeast Florida. Nor to our knowledge is there any ongoing monitoring of reef resources and marine resources conditions in a systematic replicable way in any way parallel to the work performed in Florida Bay and the Florida Keys National Marine Sanctuary. An important part of the establishment of SMZs/MPAs is a sound knowledge base on which to build a single or a network of SMZs/MPAs. This information is also important in establishing trends and monitoring change with improved management.

Threat Analysis

Another important knowledge gap is need for more precise identification and ranking of the most important threats to the marine resource system. There is general agreement on listing of the threats in the literature and by stakeholders (land-based pollution, acidification of ocean waters, overfishing, damage to reefs caused by ship groundings, anchor dragging, potential damage from diving, etc.) but no good basis for identification of the rank order of such threats. There is general ongoing concern about the discharge of untreated or partially treated sewage off the coast and plans

to reduce this pollution. Periodic headlines of ship groundings attract attention, although the ongoing high use of the reefs by divers and anchor dragging are all seen as important threats, but there are very different opinions about their relative importance in reef damage. The importance of rising sea temperature is also a factor. There may be ongoing studies of some of these issues and any results will be of importance. However, a concerted effort to rank these threats is an important step in their reduction.

Stakeholder Education and Outreach

One of the issues which can challenge the planning, establishment, and management of SMZs/MPAs in southeast Florida is stakeholder support. Not all stakeholder groups had the same perceptions about SMZs/MPAs. The major knowledge gaps are understanding the main purpose of SMZs/MPAs, the issues impacting the quality of coral reefs, and the issues which should be addressed by SMZs/MPAs. These knowledge gaps could be remedied by developing outreach and education programs that explain the science-based information about the southeast Florida region marine ecosystems to stakeholders. Changes in reef utilization appear from the survey to have occurred in the last year or so. Reef use changes need to be monitored over a long period and the causes examined. This could provide important clues as to changes in the state of the reef and users' perceptions of them.

The stakeholders' survey elicited responses mainly from recreational users of marine resources. It may be important to use other techniques to involve commercial users in this process, as well to expand the base of recreational users. Focus groups or other forms of stakeholders' participation might be helpful in this process. In addition to stakeholder involvement there should also be a public awareness program and a wide ranging ongoing process which could include: focus groups, an advisory committee of stakeholders, outreach materials, and media releases. There will also need to be a directed outreach commercial fishers, charter boat captains, commercial divers, and commercial dive operators.

In conclusion, the literature review, the managers' survey, and the users' survey all showed that to be successful, SMZs/MPAs need to have the support of the stakeholders and the public. Thus, raising the stakeholders' and the public's awareness about marine protected areas is a vital condition for their success. The design of outreach and education programs should take into account the way southeast Florida stakeholders get their information and the diversity of the marine users in the southeast Florida region.

7 References

Agardy, T. (1994). Advances in marine conservation: The role of marine protected areas. *Trends in Ecology & Evolution, 9*, 267-270.

Andrews, K., Nall, L., Jeffrey, C., & Pittman, S. (Eds.). (2005). The state of coral reef ecosystems of Florida. In J. E. Waddell (Ed.), *The state of coral reef ecosystems of the United States and Pacific Freely Associated States*: *2005* (pp. 150-200). NOAA Technical Memorandum NOS NCCOS 11. Silver Spring, MD: NOAA.

Appeldoorn, R., & Lindeman, K. (2003). A Caribbean-wide survey of marine reserves: Spatial coverage and attributes of effectiveness. *Gulf and Caribbean Research, 14*, 139-154.

Aronson, R. B., Miller, M. W., Smith, S. R., Murdoch, T., & Ogden, J. C. (2003). Coral reef ecosystem process studies in the fully protected zones of the Florida Keys National Marine Sanctuary. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 36-42). Silver Spring, MD: NOAA.

Ault, J. S., Bohnsack, J. A., & Meester, G. A. (1998). A retrospective (1979-1996) multispecies assessment of coral reef fish stocks in the Florida Keys. *Fishery Bulletin, 96*, 395-414.

Ault, J. S., Bohnsack, J. A., Smith, S. G., & Luo, J. (2005). Towards sustainable multispecies fisheries in the Florida, USA, coral reef ecosystem. *Bulletin of Marine Science, 76*, 595-622.

Ault, J. S., Smith, S. G., Bohnsack, J. A., Luo, J., Harper, D. E., & McClellan, D. B. (2006). Building sustainable fisheries in Florida's coral reef ecosystem: Positive signs in the Dry Tortugas. *Bulletin of Marine Science, 78*, 633–654.

Ballantine, W. J. (1995). The New Zealand experience with "no-take" Reserves. Presented to a symposium at the Fisheries Society Conference, Florida.

Birkeland, C. E. (Ed). (1997). *Life and death of coral reefs*. New York, NY: Chapman & Hall.

Blair, S. M., & Flynn, B. S. (1989). Biological monitoring of hardbottom reef communities off Dade County, Florida. *Diving for Science, 1989*, 9-24.

Bohnsack, J. A, McClellan, D. B., Harper, D. E., Ault, J., Smith, S. G., Meester, G., & Luo, J. (2006). Preliminary analysis of FKNMS reef fish monitoring through 2002. In B. D. Keller & S. Donahue (Eds.). *2002-03 Florida Keys National Marine Sanctuary science report: An ecosystem report card after five years of marine zoning* (pp. 119-130). Marine Sanctuaries Conservation Series NMSP-06-12. Silver Spring, MD: NOAA.

Bohnsack, J. A., McClellan, D. B., Harper, D. E., Ault, J., Smith, S., Meester, G., & Luo, J. (2003). Preliminary analysis of FKNMS reef fish monitoring through 2001. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 54-60). Silver Spring, MD: NOAA.

Bohnsack, J.A., McClellan, D. B., Harper, D. E., Davenport, G. S., Konoval, G. J., Eklund, A. M., Luo, J. (1999). *Baseline data for evaluating fish populations in the Florida Keys, 1979-1998*, NOAA Technical Memorandum NMFS-SEFSC-427. Silver Spring, MD: NOAA. 61 pp.

Brown, B. E. (1997). Disturbance to coral reefs in recent times. In C. Birkeland (Ed.), *Life and death of coral reefs* (pp. 354-379). New York, NY: Chapman Hill.

Bruno J. F. & Selig, E. R. (2007). Regional decline of coral cover in the Indo-Pacific: Timing, extent, and subregional comparisons. *PLoS ONE 2(8)*, e711.

Bryant, D., Burke, L., McManus, J., & Spalding, M. (1998). *Reefs at risk: A map-based indicator of potential threats to the world's coral reefs*. Washington, DC: World Resources Institute.

Burke, L. & Maidens, J. (2004). *Reefs at risk in the Caribbean*. Washington, DC: World Resources Institute.

Butler, M. J. IV, Hunt, J. H., Herrnkind, W. F., Matthews, T., Childress, M., Bertelsen, R., Marshall, H. (1995). Cascading disturbances in Florida Bay, USA: Cyanobacteria blooms, sponge mortality, and implications for juvenile spiny lobster *Panulirus argus*. *Marine Ecology Progress Series, 129,* 119-125.

Carr, M. H., Neigel, J. E., Estes, J. A., Andelman, S. J., Warner, R. R., Largier, J. L., & Lubchenco, J. (2003). Comparing marine and terrestrial ecosystems: Implications for principles of reserve design in coastal marine ecosystems. *Ecological Applications, 13(1),* Supplement, S90–S107.

Cesar, H., Burke, L., & Pet Soede, L. (2003). *Economics of worldwide coral reef degradation*. World Wildlife Fund-Netherlands and International Coral Reef Action Network. 24 pp.

Chiappone, M., & Sullivan, K. M. (1994). Patterns of coral abundance defining nearshore hardbottom communities of the Florida Keys. *Florida Scientist, 57*, 108-125.

Costanza, R., d'Arge, R., deGroot, R., Farber, S., Grasso, M., Hannon, B.,. Vandenbelt, M. (1997). The value of the world's ecosystem services and natural capital. *Nature, 387*, 253-260.

Cox, C. (2006). Monitoring Caribbean spiny lobsters in the Florida Keys National Marine Sanctuary, 1997-2002. In B. D. Keller & S. Donahue (Eds.), *2002-03 Sanctuary science report: An ecosystem report card after five years of marine zoning* (pp. 131-137). Silver Spring, MD: NOAA.

Cox, C., Jue, N. K., Darcy, M. C., & Hunt, J. H. (2003). Monitoring Caribbean spiny lobsters in the Florida Keys National Marine Sanctuary, 1997 – 2001. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 71-75). Silver Spring, MD: NOAA.

Day, J., Fernandes, L., Lewis, A., De'ath, G., Slegers, S. Barnett, B., Lowe, D. (2002). The representative areas program for protecting biodiversity in the Great Barrier Reef World Heritage Area. *Proceedings of the Ninth International Coral Reef Symposium, Bali, 2,* 687-696.

Denny, C. M., & Babcock, R. C. (2004). Do partial marine reserves protect reef fish assemblages? *Biological Conservation, 116*, 119-129.

Dustan, P. (1999). Coral reefs under stress: Sources of mortality in the Florida Keys. *Natural Resource Forum*, *23*, 147-155.

Dustan, P., Dobson, E., & Nelson, G. (2001). Landsat thematic mapper: Detection of shifts in community composition of coral reefs. *Conservation Biology 15*, 892-902.

Eklund, A., McClellan, D. B., & Harper, D. E. (2000). Black grouper aggregations in relation to protected areas within the Florida Keys National Marine Sanctuary. *Bulletin of Marine Science, 66*, 721-728.

Executive Order 13089. (1998). Coral Reef Protection. 63 Federal Register, 32701.

Executive Order 13158. (2000). Marine Protected Areas. 3 C.F.R. 13158, reprinted in 64 Federal Register, 65 (105), 34909.

Fedstats. (2007). *Mapstats: Florida by county*. http://www.fedstats.gov/qf/states/12000.html Accessed 2/1/2011.

Fernandes, F., Day, J., Lewis, A., Slegers, S., Kerrigan, B., Breen, D., . . . Stapleton, K. (2005). Establishing representative no-rake areas in the Great Barrier Reef: Large-scale implementation of theory on marine protected areas. *Conservation Biology, 19*, 1733-1744.

Forcucci, D. (1994). Population density, recruitment and 1991 mortality event of *Diadema antillarum* in the Florida Keys. *Bulletin of Marine Science, 54*, 917-928.

Gardner, T. A., Coté, I. M., Gill, J. A., Grant, A., & Watkinson, A. R. (2003). Long-term region-wide declines in Caribbean corals. *Science, 301*, 958-960.

Gell, F. R., & Roberts, C. M. (2003). The fishery effects of marine reserves and fishery closures. Washington, DC: World Wildlife Fund.

Gilliam, D. S. (2006). *Southeast Florida coral reef evaluation and monitoring project 2005 year 3 final report*. Tallahassee, FL: Florida Fish and Wildlife Conservation Commission, Fish & Wildlife Research Institute, Florida Department of Environmental Protection. 26 pp.

Glazer, R., & Delgado, G. (2003). Queen conch marine reserve monitoring. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 82-90). Silver Spring, MD: NOAA.

Glazer, R. A., & Delgado, G. A. (2006). Queen conch monitoring. In B. D. Keller & S. Donahue (Eds.), *2002-03 Sanctuary science report: An ecosystem report card after five years of marine zoning* (pp. 139-148). Silver Spring, MD: NOAA.

Glynn, P. W., Szmant, A. M., Corcoran, E. F., & Cofer-Shabica, S. V. (1989). Condition of coral reef cnidarians from the Northern Florida Reef Tract: Pesticides, heavy metals, and histopathological examination. *Marine Pollution Bulletin, 20*, 568-576.

Gregory, D. R. (2003). Sentinel lobster fisheries project for the Florida Keys National Marine Sanctuary, January-December, 2001. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 76-81). Silver Spring, MD: NOAA.

Halpern, B. S. (2003). The impact of marine reserves: Do reserves work and does reserve size matter? *Ecological Applications, 13(1) Supplement*, S117–S137.

Halpern, B. S., & Warner, R. R. (2002). Marine reserves have rapid and lasting effects. *Ecology Letters, 5*, 361-366.

Halpern, B. S., & Warner, R. R. (2003). Matching marine reserve design to reserve objectives. *Proceedings of the Royal Society of London: B Biological Science, 270*, 1871–1878.

Herren, L. (2004). *St. Lucie Inlet Preserve State Park reef monitoring program, Progress Report No. 2*. Tallahassee, FL: Florida Department of Environmental Protection.

Hoegh-Guldberg, O. (2004). Coral reefs in a century of rapid environmental change. *Symbiosis, 37*, 1-31.

Horn, B. (2010). *State of Florida artificial reef locations* (as of February 12, 2010). Tallahassee, FL: Florida Fish and Wildlife Commission. http://myfwc.com/media/131585/REEFS.pdf

Hu, C., Hackett, K. E., Callahan, M. K., Andréfouët, S., Wheaton, J. L., Porter, J. W., & Muller-Karger, F. E. (2003). The 2002 ocean color anomaly in the Florida Bight: A cause of local coral reef decline? *Geophysical Research Letters, 30*, 1151.

Hudson, J. H. (1981). Response of *Montastraea annularis* to environmental change in the Florida Keys. *Proceedings of the Fourth International Coral Reef Symposium, Manila, 2*, 233-240.

Hughes, T. P., Baird, A. H., Bellwood, D. R., Card, M., Connolly, S. R., Folke, C., . . . Roughgarden, J. (2003). Climate change, human impacts, and the resilience of coral reefs. *Science, 301*, 929-933.

Jaap, W. C. (1979). Observations on zooxanthellae expulsion at Middle Sambo Reef, Florida Keys. *Bulletin of Marine Science, 29*, 414-422.

Jaap, W. C. (1984). *The ecology of the south Florida coral reefs: A community profile.* FWS/OBS-82/08 and MMS 84-0038. Washington, DC: U.S. Fish and Wildlife Service and Minerals Management Service, Office of Biological Services.

Jaap, W. C. (1985). An epidemic zooxanthellae expulsion during 1983 in the Lower Florida Keys coral reefs: Hyperthermic etiology. *Proceedings of the Fifth International Coral Reef Congress, Tahiti, 6*, 143-148.

Jaap, W. C., Halas, J. C., & Muller, R. G. (1988). Community dynamics of stony corals (*Milleporina* and *Scleractinia*) at Key Largo National Marine Sanctuary, Florida, during 1981-1986. *Proceedings of the 6th International Coral Reef Symposium, Australia, 2*, 237-243.

Jackson, B. C., Kirby, M. X., Berger, W. H., Bjorndal, K. A., Botsford, L. W., Bourque, B. J., . . . Warner, R. R. (2001). Historical overfishing and the recent collapse of coastal ecosystems. *Science, 293*, 629-638.

Johns, G. M., Leeworthy, V. R., Bell, F. W., & Bonn, M. A. (2001). *Socioeconomic study of reefs in southeast Florida: Final report*. Hollywood, FL: Broward County, Palm Beach County, Miami-Dade County, Monroe County, Florida. Fish and Wildlife Conservation Commission, and National Oceanic and Atmospheric Administration.

Johns, G. M., Milon, J. W. & Sayers D. (2004) *Socioeconomic study of reefs in Martin County, Florida: Final report*. Hazen and Sawyer Environmental Engineers & Scientists. Hollywood, Florida Martin County Public Services Department, and Florida Fish and Wildlife Conservation Commission. 120 pp.

Jones, P. J. S. (2002). Marine protected area strategies: Issues, divergences and the search for middle ground. *Reviews in Fish Biology and Fisheries, 11*, 197-216.

Kelleher, G., Bleakley, C., & Wells, S. (Eds.). (1995). *A global representative system of marine protected areas: Volume II*. Washington, DC: The Great Barrier Reef Marine Park Authority, The World Bank, and The World Conservation Union.

Keller, B. D., & Donahue, S. (Eds.). (2006). *2002-03 sanctuary science report: An ecosystem report card after five years of marine zoning.* Marine Sanctuaries Conservation Series NMSP-06-12. Silver Spring, MD: NOAA.

Kennedy, A. D. (1990). Marine reserve management in developing nations: Mida Creek – A cast study from east Africa. *Ocean Shoreline Management, 14*(2), 105-132.

Kleypas, J. A., & Eakin, C. M. (2007). Scientists' perceptions of threats to coral reefs: Results of a survey of coral reef researchers. *Bulletin of Marine Science, 80(2)*, 419-436.

Lapointe, B. E., Bedford, B. J., & Baumberger, R. (2006). Hurricanes Frances and Jeanne remove blooms of the invasive green alga *Caulerpa brachypus forma parvifolia* (Harvey) Cribb from coral reefs off northern Palm Beach County, Florida. *Estuaries, 29*, 966-971.

Lapointe, B. E., & Clark, M. W. (1992). Nutrient inputs from the watershed and coastal eutrophication in the Florida Keys. *Estuaries, 15*, 465-476.

Lapointe, B. E., Matzie, W. R., & Barile, P. J. (2002). Biotic phase-shifts in Florida Bay and fore reef communities of the Florida Keys: Linkages with historical freshwater flows and nitrogen loading from Everglades runoff. In J. W. Porter & K. G. Porter (Eds.), *The Everglades, Florida Bay and coral reefs of the Florida Keys: An ecosystem sourcebook* (pp. 629-648). Boca Raton, FL: CRC Press.

Lindeman, K., & Snyder, D. B. (1999). Nearshore hardbottom fishes of southeast Florida and effects of habitat burial caused by dredging. *Fishery Bulletin, 97*, 508-535.

Lindeman, K. C. (1997). *Development of grunts and snappers of southeast Florida: Cross shelf distributions and effects of beach management alternatives.* Dissertation. Coral Gables, FL: University of Miami.

Lipp, E. K., Jarrell, J. L., Griffin, D.W., Lukasik, J., Jacukiewicz, J., & Rose, J. B. (2002). Preliminary evidence for human fecal contamination in corals of the Florida Keys, USA. *Marine Pollution Bulletin, 44*, 666-670.

Lirman, D. (2001). Competition between macroalgae and corals: Effects of herbivore exclusion and increased algal biomass on coral survivorship and growth. *Coral Reefs, 19*, 392-399.

Lirman, D., & Fong, P. (1997). Susceptibility of coral communities to storm intensity, duration and frequency. *Proceedings of the Eighth International Reef Symposium, Panama, 1*, 561-566.

Lirman, D., & Miller, M. (2003). Modeling and monitoring tools to assess recovery status and convergence rates between restored and undisturbed coral reef habitats. *Restoration Ecology, 11*, 488-456.

Lirman, D., Orlando, B., Maciá, S., Manzello, D., Kaufman, L., Biber, P., & Jones, T. (2003). Coral communities of Biscayne Bay, Florida and adjacent offshore areas: Diversity, abundance, distribution, and environmental correlates. *Aquatic Conservation, 13*, 121-135.

Manzello, D. P., Brandt, M., Smith, T. B., Lirman, D., Hendee, J. C., & Nemeth, R. S. (2007). Hurricane-associated cooling benefits bleached corals. *Proceedings of the National Academy of Sciences, 104,* 12035-12039.

Marszalek, D. D., Babashoff, G., Noel, M. R., & Worley, D. R. (1977). Reef distribution in South Florida. *Proceedings of the Third International Coral Reef Symposium, Miami, 2*, 223-229.

McClanahan, T. R., & Kaunda-Arara, B. (1996). Fishery recovery in a coral-reef marine park and its effect on the adjacent fishery. *Conservation Biology*, 10, 1187-1199.

McClanahan, T. R., Graham, N. A. J., Calnan, J. M., & Macneil, M. A. (2007). Toward pristine biomass: Reef fish recovery in coral reef marine protected areas in Kenya. *Ecological Applications, 17*, 1055–1067.

McField, M. (2000). Evaluation of management effectiveness: Belize Marine Protected Areas System. Unpublished report, Coastal Zone Management Authority, Belize City. 22 pp. MBRS Technical Document No. 5, Methodology for Monitoring Effectiveness of MPA Management, 44.

Miller, M. W., Bourque, A. S., & Bohnsack, J. A. (2002). An analysis of the loss of acroporid corals at Looe Key, Florida, USA: 1983-2000. *Coral Reefs, 21*, 179-182.

Milton, J. W., Suman, D. O., Shivlani, M., & Cochran, K. A. (1997). *Commercial Fishers' Perceptions of Marine Reserves for the Florida Keys National Marine Sanctuary*. Gainesville, FL: Florida Sea Grant.

Moberg, F., & Folke, C. (1999). Ecological goods and services of coral reef ecosystems. *Ecological Economics*, *29*, 215-233.

Mora, C., Andrefouet, S., Costello, M. J., Kranenburg, C., Rollo, A., Veron, J., . . . Myers, R. A. (2006). Coral reefs and the global network of marine protected areas. *Science, 312*, 1750-1751.

Moyer, R. P., Riegl, B., Banks, K., & Dodge, R. E. (2003). Spatial patterns and ecology of benthic communities on a high-latitude South Florida (Broward County, USA) reef system. *Coral Reefs, 22*, 447-464.

Mumby, P. J., Harborne, A. R., Williams, J., Kappel, C. V., Brumbaugh, D. R., Micheli, F., . . . Blackwell, P. G. (2007). Trophic cascade facilitates coral recruitment in a marine reserve. *Proceedings of the National Academy of Sciences, 104*, 8362-8367.

Murray, S. N., Ambrose, R. F., Bohnsack, J. A., Botsford, L. W., Carr, M. H., Davis, G. E., . . . Yoklavich, M. M. (1999). No-take reserve networks: Protection for fishery populations and marine ecosystems. *Fisheries, 24(11)*, 11-25.

Murray, T., Shivlani, M., & Leeworthy, B. (2002). Socioeconomic monitoring of commercial fishing panels. In *Sanctuary monitoring report 2000: Florida Keys National Marine Sanctuary*. Silver Spring, MD: NOAA. 49 pp.

National Marine Protected Areas Center. (2006). *Framework for developing the National System of Marine Protected Areas*. Silver Spring, MD: Office of Ocean and Coastal Resource Management, NOAA. 60 pp.

National Oceanic & Atmospheric Administration. (1995). *Florida Keys National Marine Sanctuary draft management plan* (Vols. I-III). Silver Spring, MD: NOAA.

National Oceanic & Atmospheric Administration (1996). *Florida Keys National Marine Sanctuary final management plan/environmental impact statement* (Vols. I-III). Silver Spring, MD: NOAA.

National Oceanic & Atmospheric Administration. (2000). *Tortugas Ecological Reserve. Final Supplemental Environmental Impact Statement/ Final Supplemental Management Plan.* Silver Spring, MD: NOAA. 335 pp.

National Oceanic & Atmospheric Administration. (2002). *A national coral reef action strategy: Report to Congress.* Silver Spring, MD: NOAA. (http://www.coralreef.noaa.gov/activities/actionstrategy/action_reef_final.pdf)

National Oceanic & Atmospheric Administration. (2005a). *Florida Keys National Marine Sanctuary draft revised management plan*. Silver Spring, MD: NOAA. 361 pp.

National Oceanic & Atmospheric Administration. (2005b). *Implementation of the National Coral Reef Action Strategy: Report on U.S. Coral Reef Task Force Agency Activities from 2002 to 2003*. Silver Spring, MD: NOAA. 124 pp. (http://www.coralreef.noaa.gov/review/tab_iii_Ch5_mpas.pdf).

National Oceanic & Atmospheric Administration. (2006). *State of the Reserve: Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve 2000-2005*. Silver Spring, MD: NOAA. 52 pp.

National Oceanic & Atmospheric Administration. (2009). *Coral Reef Habitat Assessment for U.S. Marine Protected Areas: A National Summary*. Silver Spring, MD: NOAA. 4 pp. (http://coris.noaa.gov/activities/habitat_assessment/national_summary.pdf).

National Oceanic & Atmospheric Administration (2011). *Snapshot of United States MPAs – April 2011*. Silver Spring, MD: NOAA. 4 pp. (http://www.mpa.gov/pdf/helpful-resources/us_mpas_snapshot.pdf).

National Research Council. (2001). *2001 Report of the committee on the evaluation, design and monitoring of marine reserves and protected areas in the United States.* Washington, DC: National Academy Press.

Odum, H. H., & Odum, E. P. (1955). Trophic structure and productivity of a windward coral reef community on Eniwatok Atoll. *Ecological Monographs, 25*, 291-320.

Ogden, J. C., Aronson, R. B., Miller, M. W., Smith, S. R., & Murdoch, T. (2002). Dynamics of coral reef benthic communities. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 19-21). Silver Spring, MD: NOAA.

Oliver, J., & Berkelmans, R. (2001). Monitoring of corals, bleaching and protected areas on the Great Barrier Reef. In R. V. Salm & S. L. Coles (Eds.), *Coral bleaching and marine protected areas: Proceedings of the workshop on mitigating coral bleaching impact through SMZ/MPA design.* Asia Pacific Coastal Marine Program Report No. 0102 (pp. 72-81). Honolulu, HI: The Nature Conservancy.

Palumbi, S. R. (2003). Population genetics, demographic connectivity, and the design of marine reserves. *Ecological Applications, 13*, S146–S158.

Pandolfi, J. M., Bradbury, R. H., Sala, E., Hughes, T. P., Bjorndal, K. A., Cooke, R. G., . . . Jackson, J. B. C. (2003). Global trajectories of the long-term decline of coral reef ecosystems. *Science, 301*, 955-958.

Pandolfi, J. M., Jackson, J. B. C., Baron, N., Bradbury, R. H., Guzman, H. M., Hughes, T. P., . . . Sala, E. (2005). Are U.S. coral reefs on the slippery slope to slime? *Science, 307*, 1725-1726.

Patterson K. L., Porter, J. W., Ritchie, K. B., Polson, S. W., Mueller, E, Peters, E. C., . . . Smith, G. W. (2002). The etiology of white pox, a lethal disease of the Caribbean elkhorn coral, *Acropora palmata*. *Proceedings of the National Academy of Sciences, 99*, 8725-8730.

Paul, V. J., Thacker, R. W., Banks, K., & Golubic, S. (2005). Benthic cyanobacterial bloom impacts the reefs of South Florida (Broward County, USA). *Coral Reefs, 24*, 693-697.

Pomeroy, R. S., & Goetze, T. (2003) Belize case study: Marine Protected Areas co-managed by Friends of Nature, Carribean Conservation Associationa (CCA) in association with the University of the West Indies Centre for Resource Management and Environmental Studies (CERMES) and Marine Resources Assessment Group Ltd. (MRAG). 64 pp.

Porter, J. W., & Meier, O. W. (1992). Quantification of loss and change in Floridian reef coral populations. *American Zoologist, 32*, 625-640.

Porter, J. W., Dustan, P., Jaap, W. C., Patterson, K. L., Kosmynin, V., Meier, O. W., . . . Parsons, M. (2001). Patterns of spread of coral disease in the Florida Keys. *Hydrobiologia, 460*, 1-24.

Porter, J. W., Kosmynin, V., Patterson, K. L., Jaap, W. C., Wheaton, J. L., Hackett, K., . . . Dustan, P. (2002). Detection of coral reef change in the Florida Keys Coral Reef Monitoring Project. In J. W. Porter & K. G. Porter (Eds.), *The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An Ecosystem Sourcebook*, (pp. 749-769). Boca Raton, FL: CRC Press.

Reaka-Kudla, M. (1997). The global biodiversity of coral reefs: A comparison with rain forests. In M. Reaka- Kudla, D. E. Wilson, & E. O. Wilson (Eds.), *Biodiversity II: Understanding and protecting our biological resources* (pp. 83-108). Washington, DC: Joseph Henry Press.

Recksiek, H. & Hinchcliff, G. (2002). *National protected areas needs assessment final report.* Silver Spring, MD: NOAA Coastal Services Center. 95 pp.

Reef Environmental Education Foundation. (2003). Volunteer reef fish monitoring in the Florida Keys National Marine Sanctuary. In *Sanctuary monitoring report 2001: An ecosystem report card, Florida Keys National Marine Sanctuary* (pp. 61-70). Silver Spring, MD: NOAA.

Reef Environmental Education Foundation. (2006). Volunteer reef fish monitoring in the Florida Keys National Marine Sanctuary: 2002 Update. In B. D. Keller & S. Donahue (Eds.), *2002-03 sanctuary science report: An ecosystem report card after five years of marine zoning* (pp. 125-130). Marine Sanctuaries Conservation Series NMSP-06-12. Silver Spring, MD: NOAA.

Richardson, L. L., & Voss, J. D. (2005). Changes in a coral population on reefs of the northern Florida Keys following a coral disease epizootic. *Marine Ecology Progress Series, 297*, 147-156.

Roberts, C. M., & Hawkins, J. P. (1997). How small can a marine reserve be and still be effective? *Coral Reefs, 16*, 150.

Roberts, C. M., & Hawkins, J. P. (2000). *Fully-protected marine reserves: A guide.* Washington, DC: WWF Endangered Seas Campaign and York, UK: Environment Department, University of York.

Roberts, C. M., Bohnsack, J. A., Gell, F., Hawkins, J. P., & Goodridge, R. (2001). Effects of marine reserves on adjacent fisheries. *Science*, 294, 1920-1923.

Roberts, C. M., Branch, G., Bustamante, R., Castilla, J., Dugan, J., Halpern, B., . . . Warner, R. (2003a). Applications of ecological criteria in selecting marine reserves and developing reserve networks. *Ecological Applications, 13(1) Supplement*, S215-S228.

Roberts, C. M., Andelman, S., Branch, G., Bustamante, R. H., Castilla, J. C., Dugan, J., . . . Warner, R. R. (2003b). Ecological criteria for evaluating candidate sites for marine reserves. *Ecological Applications, 13(1) Supplement*, S199-S214.

Rogers, C. S., & Beets, J. (2001). Degradation of marine ecosystems and decline of fishery resources in marine protected areas in the U.S. Virgin Islands. *Environmental Conservation, 28*, 312-322.

Rohmann, S., Hayes, J., Newhall, R., Monaco, M., & Grigg, R. (2005). The area of potential shallow-water tropical and subtropical coral ecosystems in the United States. *Coral Reefs 24*, 370-383.

Russ, G., & Alcala, A. (1999). Management histories of Sumilon and Apo Marine Reserves, Phillipines, and their influence on national marine resource policy. *Coral Reefs*, 19, 307-319.

Smith, S. R., Aronson, R. B., Murdoch, T., & Ogden, J. C. (2006). Processes and coral reef recovery in the Florida Keys. In B. D. Keller & S. Donahue (Eds.), *2002-03 Sanctuary Science Report: An Ecosystem Report Card after Five Years of Marine Zoning* (pp. 85-93). Marine Sanctuaries Conservation Series NMSP-06-12. Silver Spring, MD: NOAA.

Stevens, T., Jones, P., Howell, K., & Mee, L. (2006). *Methods for managing marine protected areas: Options for establishing and managing a marine protected area system in the UK*. Report for Natural England. 49 pp.

Tunley, K. (2009). State of management of South Africa's marine protected areas. WWF South Africa Report Series – 2009/Marine/001.

Turgeon, D. D., Asch, R. G., Causey, B. D., Dodge, R.E., Jaap, W., Banks, K., . . . Vander Velde, N. (2002). *The state of coral reef ecosystems of the United States and Pacific Freely Associated States: 2002*. Silver Spring, MD: NOAA. 265 pp.

U.S. Coral Reef Task Force. (2000). *The national action plan to conserve coral reefs*. Washington, DC: USCRTF. http://www.coralreef.gov/about/CRTFAxnPlan9.pdf

Vargas-Angel, B., Thomas, J. D., & Hoke, S. M. (2003). High latitude *Acropora cervicornis* thickets off Fort Lauderdale, Florida, USA. *Coral Reefs, 22*, 465-473.

Waddell, J. E. (Ed). (2005). *The state of coral reef ecosystems of the United States and Pacific Freely Associated States: 2005*. NOAA Technical Memorandum NOS NCCOS 11. Silver Spring, MD: NOAA. 522 pp.

Walker N. D., Roberts, H. H., Rouse, L. J. Jr., & Huh, O. K. (1982). Thermal history of reef-associated environments during a record cold-air outbreak event. *Coral Reefs, 1*, 83-87.

White, A. T. (1986). Marine reserves: How effective are(?) management strategies for Philippine, Indonesian and Malaysian coral reef environments? *Ocean Management*, 10, 137-159.

Wilkinson, C. (Ed.) (2004). *Status of coral reefs of the world: 2004*. Townsville, Queensland, Australia: Australian Institute of Marine Science.

Wusinich-Mendez, D. & Trappe, C. (Eds). (2007). Report on the Status of marine protected areas in coral reef ecosystems of the United States. Volume 1 : Marine Protected Areas Managed by U.S. States, Territories, and Commonwealths : 2007. NOAA Technical Memorandum CRCP 2. NOAA Coral Reef Conservation Program. Silver Spring, MD. 129 pp. + Appendices.

Appendix A. SMZ/MPA Manager Survey Instruments

MARINE ZONING PLAN CRITERIA SURVEY
FOR MARINE RESOURCE MANAGERS

Your input is important to us - Please answer all the questions if possible

General Information

1. How long have you served as a Resource/Marine Protected Area (MPA) Manager?
   a. _____ 0 - 5 years
   b. _____ 5 – 10 years
   c. _____ > 10 years

2. Where have you served as a resource/MPA manager? (please check all that apply)
   a) _____ Florida
      - _____ Aquatic Preserve (which one(s): _____)
      - _____ Florida Keys National Marine Sanctuary (FKNMS)
   b) _____ Africa
   c) _____ Asia
   d) _____ Caribbean
   e) _____ Central America
   f) _____ North America
   g) _____ South America
   h) _____ Australia
   i) _____ New Zealand
   j) _____ Other location(s): Florida or other regions

   Please specify the country(ies) and/or the state/providence in the region you selected above.
   _____

3. What types of resources are/were you responsible for managing?

   _____

   _____

4. Have you been involved in the development of an MPA?
   a) Yes, (if yes, please indicate where and when) _____
      _____
      _____
   b) No

Additional Criteria Questions

5. What criteria do you feel are important in developing an MPA?

   a) _____ Management goals and objectives for the area
   b) _____ Size of area to be protected/managed
   c) _____ Zoning characteristics
   d) _____ Use restrictions
   e) _____ MPA isolation
   f) _____ External risks
   g) _____ Regulations on extraction
   h) _____ Ability to enforce regulations
   i) _____ Ability to manage
   j) _____ Prevention of harvesting / poaching/ over utilization
   k) _____ Cultural significance
   l) _____ Other

6. When developing an MPA, what criteria from the list above do you feel is most important to ensure that the MPA is successful?

   _____

7. When using the criteria you selected in question 6, please indicate what factors should be used to determine if an MPA is successful?

   _____

   _____

8. What factors should be avoided when trying to establish an MPA?

   _____

9. What services or programs should be established to ensure MPA objectives will be met?

   _____

10. What criteria would you use to identify the boundaries of a MPA?

    _____

11. What indicators are used in determining the size of individual zones?

    a) _____
    b) _____
    c) _____
    d) _____
    e) _____

12. What are the most significant management issues associated with SMZs/MPAs?

    _____

13. What factors indicate the amount of different zones necessary for an MPA to be successful?

_____

14. What are the major indicators you look for when establishing a no-take or exclusionary zones?

_____

15. What indicates that an area can be zoned for multiple uses?

_____

16. What tools should be used to develop an MPA / zoning areas (GIS, monitoring etc.)

_____

17. Did you take into account research conducted in other parts of the world when establishing your MPA?

    a) Yes

    b) No

18. *If you are familiar with Southeast Florida resources,* please list the five major criteria which should be used to establish an MPA in Southeast Florida (Martin, Palm Beach, Broward, Miami-Dade Counties)?

    a) _____
    b) _____
    c) _____
    d) _____
    e) _____

19. In your opinion, how would the users react to the creation of new SMZs/MPAs in Southeast Florida?

    _____
    _____
    _____

20. Which do you believe would be the most effective basic MPA design in Southeast Florida?
    a) _____ Small single area
    b) _____ Large single area
    c) _____ Network of areas

For Current SMZ/MPA Manager

21. If you are currently an MPA Manager, please rate the following on a scale of 1 to 5 (1 being the highest.)

a) How well are the regulations of the MPA being enforced? _____

b) How aware do you believe the users are of the MPA's regulations? _____

c) How important is outreach/education in implementing a successful MPA? _____

d) How important are regulations in developing/maintaining a successful MPA? _____

e) How important is enforcement in maintaining a successful MPA? _____

Optional Contact Information

Please provide us with your contact information in case we would like to follow up with a phone call or email.

Name: _____
Mailing Address: _____
_____
Email Address: _____
Tel: _____ Fax: _____

Thank you for your assistance

If you have any questions about this survey, please contact:
Dr. Lakhdar Boukerrou
Center for Environmental Studies
Florida Atlantic University
3932 RCA Blvd., Suite 3210
Palm Beach Gardens, FL 33341
Tel: (561) 799-8513
Email: lboukerrou@ces.fau.edu

This survey is available online at http://pollux.ces.fau.edu/survey/mpa_managers.html

Appendix B. Email that was posted on the coral list

Dear Marine Resource Manager:

The Southeast Florida Coral Reef Initiative (SEFCRI), part of the Florida Department of Environmental Protection's Coral Reef Conservation Program, is conducting an online survey targeting input from marine resource managers about Marine Protected Areas. If you have been or are currently involved in the management of marine resources please read the announcement below.

We apologize if you have already received a request to participate in this survey; however we are trying to reach as broad an audience as possible.

Thank you in advance for your time and assistance

Announcement:

The Southeast Florida Coral Reef Initiative (SEFCRI) in conjunction with Florida Atlantic University's (FAU) Center for Environmental Studies (CES) is conducting online surveys to evaluate the potential of a marine management plan for Southeast Florida. Several surveys have been developed to assess whether a management plan to further protect the coral reef resources of Southeast Florida should be implemented. Coral reef resources of the SEFCRI geographic region include those of Martin, Palm Beach, Broward, and Miami-Dade counties of Florida.

This survey is solely seeking individuals that have been involved in the development of or are currently managing existing Marine Protected Areas (MPAs). Questions in this survey were designed to address issues facing the creation and management of SMZs/MPAs and focuses on three primary areas:

1.) Identification of factors critical for creating an SMZ/MPA.

2.) Identification of factors that contribute to a successfully managed SMZ/MPA (both before and after implementation).

3.) Identification of the factors that contribute to an unsuccessfully managed SMZ/MPA (both before and after implementation).

Please participate in this survey if you have been or are involved in the management of marine resources. This information will be instrumental in the protection of coral reef resources of Southeast Florida.

To take the survey, please visit:
http://pollux.ces.fau.edu/survey/mpa_managers.html

The survey will be available online until November 20, 2006. If you have any questions, please contact:

Dr. Lakhdar Boukerrou
Center for Environmental Studies
Florida Atlantic University
3932 RCA Blvd., Suite 3210
Palm Beach Gardens, FL 33341
Tel: (561) 799-8573
Email: lboukerrou@ces.fau.edu

Appendix C. Stakeholder Survey Instruments

PERCEPTION OF MARINE PROTECTED AREAS IN SOUTHEAST FLORIDA

Interview Date: _____
Survey Number: _____
Interview Location: _____

GENERAL

1. Are you a resident of Southeast Florida? (Martin, Palm Beach, Broward, Miami-Dade county.)

   a. ____ Yes
   b. ____ No

2. If yes, in what county do you reside?

   a. ____ Martin
   b. ____ Palm Beach
   c. ____ Broward
   d. ____ Miami-Dade
   e. If no please indicate country, county, city and state of residence._____

3. Are you a:

   a. ____ Year-round resident
   b. ____ Seasonal resident
   c. ____ Visitor / tourist

4. Which of the following activities best describes you? (check as many as apply and note your primary activity with the number 1).

   a. ____ Commercial fisherman
   b. ____ Recreational fisherman
   c. ____ Charter boat fisherman
   d. ____ Commercial dive operator
   e. ____ Recreational diver
   f. ____ Commercial diver
   g. ____ Recreational boater (non-consumptive)
   h. ____ Recreational snorkelers
   i. ____ Other recreational user (surfer, kitesurfer kayaker etc.)

5. How many years have you been involved in the above activity(ies) in Southeast Florida? (Martin, Palm Beach, Broward, Miami-Dade County).

   _____ years

6. How often do you use Southeast Florida's coast or ocean?
   a. ____Daily
   b. ____Weekly
   c. ____Monthly
   d. ____Several times a year
   e. ____Once a year
   f. ____ Other _____

7. Are you a member/ affiliated with any of the following organizations?

   a. ____ Angling community/club
   Name:_____
   b. ____ Diving community/club
   Name:_____
   c. ____ Surfing community/club:
   Name:_____
   d. ____ Boating community/club:
   Name:_____
   e. ____ Other user community/club:
   Name:_____

PERCEPTION

Definition: Marine Protected Area (MPA)

8. Based upon the choices below, which method best describes the goal(s) of Marine Protected Areas? (Check all that apply.)

   a. ____ Restrict recreational activities (boating speed and size)
   b. ____ Restrict all activities (no commercial/recreational use)
   c. ____ Allow some consumptive activities (fishing and diving)
   d. ____ Allow only recreational activities (non-consumptive)
   e. ____ Allow multiple activities (both consumptive and non-extractive)
   g. ____ Other: _____

9. In your opinion, what is the MAIN PURPOSE of a Marine Protected Area? (you may choose more than one response).

   a. ____ Replenish fishery stocks
   b. ____ Conserve and protect species
   c. ____ Preserve cultural heritage
   d. ____ Provide economic benefit
   e. ____ Improve or protect water quality
   f. ____ Protect users' rights
   e. _____ Other_____
   _____

10. Which users benefit from the establishment of Marine Protected Areas? (you may choose more than one response)

    a.____ Commercial fishermen
    b.____ Recreational fishermen
    c.____ Charter boat fishermen
    d.____ Commercial dive operators
    e.____ Recreational divers
    f.____ Commercial divers
    g.____ Recreational boaters (non-consumptive)
    h.____ Recreational snorklers
    i.____ Other Recreational users (surfers, kitesurfers, kayakers, etc)
    j.____ None of the above

11. What are your major concerns about Marine Protected Areas? (Please rank your answers on a scale of 1 to 5; with 1 being the most problematic and 5 the least problematic.)

    a.____ There are too many
    b.____ There are too few
    c.____ They are not effectively enforced and regulated
    c.____ Poor user compliance with MPA regulations
    d.____ The benefits of MPAs are not clear
    e.____ Other

12. Do you believe that MPAs can effectively manage marine resources?

    a. ____ Yes
    b. ____ No

13. Listed below are issues which may impact the quality of Southeast Florida coral reefs. (Please rate the impact of these issues on the coral reef using a scale of 1 to 5, where 1 has the greatest impact and 5 the least.)

    a. Coastal construction:
    1 2 3 4 5 N/A

    b. Over-fishing:
    1 2 3 4 5 N/A

    c. Anchoring damage:
    1 2 3 4 5 N/A

    d. Ship groundings:
    1 2 3 4 5 N/A

    e. Land-based sources of pollution:
    1 2 3 4 5 N/A

    f. Water quality/sedimentation:
    1 2 3 4 5 N/A

    g. Global warming:
    1 2 3 4 5 N/A

    h. Diving:
    1 2 3 4 5 N/A

    i. Lack of education and outreach:
    1 2 3 4 5 N/A

    j. Water pollution/Waste dumping:
    1 2 3 4 5 N/A

    k. Current form of management:
    1 2 3 4 5 N/A

    l. Other (hurricanes, etc.):
    1 2 3 4 5 N/A

14. Should a different management approach be used to manage the coral reefs of Southeast Florida (Martin, Palm Beach, Broward and Miami-Dade counties)?

    a. ____ Yes
    b. ____ No

15. If we do nothing and keep the same management approach, do you think resource conditions will:
    a. ____ Get better
    b. ____ Stay the same
    c. ____ Get worse

16. I would be in favor of the establishment of Marine Protected Areas in Southeast Florida. (Please rank this statement on a scale of 1 to 5. 1 = Strongly Agree, 5 = Strongly Disagree.)

    1 2 3 4 5 I don't know

17. If you are in favor of the establishment of marine protected areas, which issues should the MPAs be addressing in Southeast Florida? (Please rate the issues on a scale of 1 to 5; with 1 being the highest priority and 5 the least priority).

    a. Over-fishing:
    1 2 3 4 5 N/A

    b. Anchoring damage:
    1 2 3 4 5 N/A

    c. Ship groundings:
    1 2 3 4 5 N/A

    d. Land-based sources of pollution:
    1 2 3 4 5 N/A

    e. Water quality/sedimentation:
    1 2 3 4 5 N/A

    f. Diving:
    1 2 3 4 5 N/A

    g. Water pollution / waste dumping:
    1 2 3 4 5 N/A

    h. ____ Other: _____
    1 2 3 4 5 N/A

18. If a management tool was developed for reefs in Southeast Florida, what would you be in favor of?

    a.____ None, current form of management is acceptable
    b.____ A few, small isolated MPAs which restrict all activities (no commercial or recreational use)
    c.____ MPAs which allow some fishing and diving consumptive use (snorkeling, diving, boating, etc.)
    d. ____ MPAs which allow only non-consumptive activities
    e. ____ MPAs that allow a combination of multiple activities allowed (both consumptive and non-extractive)

19. What are the most important issues that need to be addressed to make an MPA successful (check all that apply)?

    a. ____ Higher penalties
    b. ____ More patrols and enforcement
    c. ____ Limited entry, limited use
    d. ____ Appropriate monitoring (e.g. water quality, species)
    e. ____ More outreach and education
    f. ____ Use separation via zoning
    g. ____ Other _____

UNIQUE AREAS IDEAL FOR MANAGEMENT

20. Do you use artificial reefs (wrecks, limestone boulders, etc.) in Southeast Florida?

    a. ____ Yes
    b. ____ No

21. Do you feel artificial reefs require management?

    a. ____ Yes
    b. ____ No

22. Are there specific marine areas/resources that you feel require management?

    a. ____ Yes (if yes – please indicate area/resource)
    _____
    _____

    b. ____ No

23. Using the map (enclosed/attached), please draw in or point out the areas used in terms of percentage of trips taken to each location (e.g.. 50%, 100% etc.)

    - SEE MAP -

24. Why do you go to these locations? (please rank from 1 to 5; with 1 being the greatest reason and 5 being the least important reason).

    a. ____ Conditions of the reef
    b. ____ Conditions/ abundance of the resource
    c. ____ Water quality
    d. ____ Location/ ease of use
    e. ____ Lack of use from other users
    f. ____ Other _____

25. Have you changed your location since you first started utilizing the coral reef resources in Southeast Florida (Martin, Palm Beach, Broward, Miami-Dade counties)?

    a. ____ Yes

    If YES, how long ago (check one):
    i. ____ <1 yr
    ii. ____ 1-5 yr
    iii. ____ >5 yr

    If you have any questions about this survey, please contact:
    Dr. Lakhdar Boukerrou
    Center for Environmental Studies
    Florida Atlantic University
    3932 RCA Blvd., Suite 3210
    Palm Beach Gardens, FL 33341
    Tel: (561) 799-8513
    Email: LBOUKERROU@CES.FAU.EDU

    If YES please tell us why by checking all the reasons that apply.
    i. ____ Change in reef conditions
    ii. ____ Change in resource conditions
    iii. ____ Change in water quality
    iv. ____ Ease of access/location
    v. ____ Competition of utilization
    vi. ____ Other: _____

    b. ____ No

26. Do seek information about marine protected areas or related marine management?

    a. ____ Yes
    b. ____ No

    If YES, where do you go to get your information? (Please circle all those that apply)

    a. ____ Internet sources_____
    b. ____ Regulatory Agency
    i. ____ State
    ii. ____ Federal
    iii. ____ Local
    c. ____ Boating stores
    d. ____ Dive shops
    e. ____ Boat ramps / signage
    f. ____ Boat shows
    g. ____ Angling events / competitions
    h. ____ Magazine subscription (please indicate name):
    _____
    i. ____ Other:_____

PERSONAL INFORMATION

27. Which of the following describes your age group?

    a. ____ Under 18
    b. ____ 18 to 30
    c. ____ 31 to 40
    d. ____ 41 to 50
    e. ____ 51 to 60
    f. ____ 61 or above

28. Which of the following describes your ethnicity?

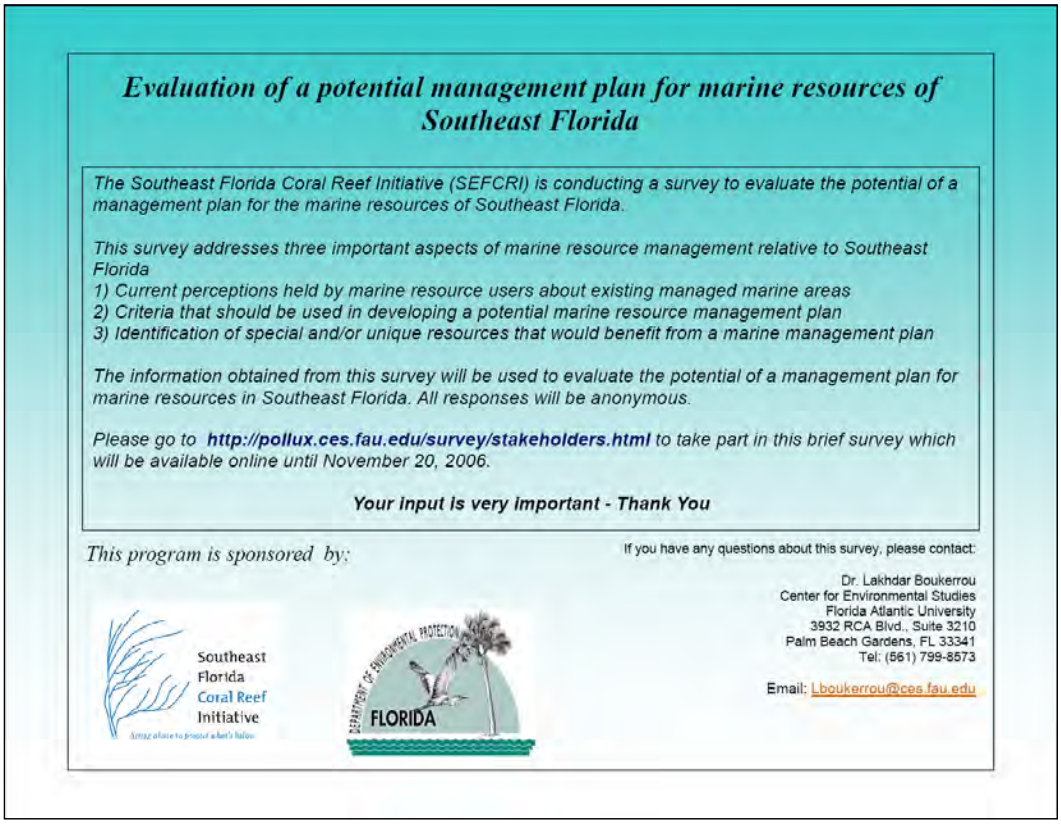
    a. ____ Caucasian / White
    b. ____ Hispanic
    c. ____ African-American
    d. ____ Native American
    e. ____ Other _____

This survey is available online at www.ces.fau.edu

For Official Use Only:

Date Received: _____
Date Processed: _____
User Group: _____

Appendix D. Survey Postcard



Appendix E. Weather Conditions during the Intercept Surveys

Survey Date	County	Temperature Average (High and Low)	Conditions	Max Wind Speed (MPH)	Wind Direction
09/14/2007	Broward	84 ºF (90 ºF-78 ºF)	Partly cloudy, rain and thunderstorms	16	SSW – WSW - SSE
	Miami-Dade	85 ºF (91ºF-78 ºF)	Mostly cloudy	14	S – SSE – SE
09/15/2007	Palm Beach	86 ºF (93 ºF-80 ºF)	Clear / Scattered clouds	8	W – WNW - ENE
	Broward	84 ºF (91 ºF-76 ºF)	Mostly cloudy, light rain	13	NW - ESE
	Miami-Dade	86 ºF (94 ºF-78 ºF)	Scattered clouds	14	WSW – N - SSE
09/21/2007	Martin	80 ºF (87 ºF-73 ºF)	Scattered clouds	13	E
	Broward	84 ºF (90 ºF-77 ºF)	Partly cloudy	13	E
	Miami-Dade	85 ºF (92 ºF-77 ºF)	Partly cloudy	14	W – NW - ENE
09/22/2007	Martin	82 ºF (86 ºF-78 ºF)	Scattered clouds	12	E – ENE - E
	Palm Beach	84 ºF (87 ºF-80 ºF)	Clear	12	E – SE - SE
	Broward	85 ºF (89 ºF-80 ºF)	Partly cloudy	15	E
	Miami-Dade	85 ºF (89 ºF-80 ºF)	Mostly cloudy	17	E
09/28/2007	Broward	81 ºF (85 ºF-78 ºF)	Rain/Most cloudy	16	SW – NNW - NNW
09/29/2007	Broward	82 ºF (87 ºF-76 ºF)	Mostly cloudy	15	N – NNE - NE
	Martin	78 ºF (84 ºF-71 ºF)	Scattered clouds	10	NNW – NE - NE
	Miami-Dade	82 ºF (88 ºF-76 ºF)	Mostly cloudy	17	NNE - NE
	Palm Beach	82 ºF (87 ºF-77 ºF)	Clear	13	NNW – NNE

Source: http://weather.sun-sentinel.com/US/FL/Fort_Lauderdale.html?main=1&SouthFlorida=1

Appendix F. Summary of Dive Shops Visited

County	Visited	Agreed to Post	Declined	Not in Business	Phone # Disconnected	No Answer	Not a Dive Shop	Closed at Time of Visit	Total
Martin	2	2	0	0	0	0	0	0	2
Palm Beach	13	7	0	0	1	3	1	3	17
Broward	26	12	3	7	2	1	4	5	34
Miami-Dade	9	7	0	1	5	0	1	0	14
Total	50	26	3	10	8	4	6	8	67

Appendix G. Web Banners