Recreational Angler Perceptions, Attitudes, and Resource Use in Biscayne National Park

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RECREATIONAL ANGLER PERCEPTIONS, ATTITUDES, AND RESOURCE USE IN BISCAYNE NATIONAL PARK

By

Michelle S. Harangody

A THESIS

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RECREATIONAL ANGLER PERCEPTIONS, ATTITUDES, AND RESOURCE USE
IN BISCAYNE NATIONAL PARK

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In 2015, Biscayne National Park approved a new General Management Plan. The plan includes no-take marine reserve zone for ~ 6% of the park’s total area. The recreational fishing community criticized the action, and legislative initiatives coalesced at state and federal levels aimed at reversing the decision to implement a marine reserve zone. A survey of licensed saltwater anglers in Broward, Miami-Dade, and Monroe counties was conducted online. Participants were ranked by recreation specialization and their attitudes towards the plan, its development process, recreational fishing impacts, awareness of the plan and participation in the development process were compared to specialization. Specialization has a significant relationship with all factors, notably with opposition to the plan and strong pro-use attitudes. Survey results demonstrate that the vocal opposition is not representative of the majority opinion (14%). Spatial use data were also collected, and findings estimate only minor displacement (2.6%) and determine that highly and very specialized anglers are most impacted by displacement. These results support previous findings that stakeholders with negative perspectives about proposed management changes are more likely to vocalize their opposition publicly (Sutton, 2006; Sutton, 2008). Understanding the spectrum of attitudes within a stakeholder group
promotes greater compliance and leads to more stable biological outcomes for the protected area.
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Chapter 1: Introduction

1.1 History and Overview of Biscayne National Park

Biscayne National Park was first established as a National Monument in 1968. It was expanded in 1974 to include Swan and Gold Key and designated as a national park on June 28, 1980 by an Act of Congress under Public Law 96-287. The current boundaries in Figure 1 (Leynes and Cullison 1998).

There are four distinct ecosystems in Biscayne National Park: Shoreline hammocks created by mangrove forests, hardbottom and seagrass in the southern area of the bay, the string of islands that lead into the Florida Keys, and the northern tip of the world’s third largest coral reef system (“Natural Features & Ecosystems,” 2014).

Biscayne National Park is the largest marine national park in the US National Park System, covering roughly 180,000 acres. It is 95% aquatic, with the remaining 5% comprised of various small islands and coastal mangrove habitat. The only entrance point managed by the park is the Dante Fascell Visitor Center located at Convoy Point in Homestead, over 30 miles from the city of Miami. To the north, the park abuts the Biscayne Bay Aquatic Preserve, which also borders a small section of the southern boundary. John Pennekamp Coral Reef State Park and the Florida Keys National Marine Sanctuary line the southern and eastern sides of the park.
Fig. 1. Map of Biscayne National Park (www.nps.gov)
1.2 General Management Plan

Biscayne National Park’s General Management Plan (GMP) is a joint effort between the National Park Service (NPS) managers, park staff, planning teams, consulting agencies, and the public. It discerns the environmental conditions that should exist and the visitor experience that should be available considering a time frame between 20-30 years. It is the least specific, most generalized level of planning. According to *Park Program Planning Standards*, a GMP establishes an understanding between the NPS and the public in terms of the “resource conditions, opportunities for visitor experiences, and general kinds of management, access, and development” that serve the park’s purpose (NPS 2004 p. 18).

The GMP must adhere to the regulations imposed by Section 106 of the National Historic Preservation Act (16 USC 270, et seq.), which works to minimize adverse impacts to historical properties, and the National Environmental Policy Act (NEPA), which requires an Environmental Impact Statement (EIS) to be issued with a public review and comment period (42 USC 4371, et seq.).

1.3 A New General Management Plan for Biscayne National Park

The current General Management Plan guiding park objectives was approved in 1983. Urban sprawl and Miami’s population expansion has led to increased visitor volume and changes in visitor use. The new plan will use stakeholder and agency consultation to define resource and visitor use goals as well as provide a framework for maximizing each goal cohesively.

The process of constructing the new GMP began in 2000. A draft GMP which included five alternative plans emphasizing various aspects of management changes,
along with the companion EIS, was finally released in August 2011. In three of the five alternatives, including the Preferred Alternative, a no-take marine reserve zone was recommended. The Preferred Alternative is the backed by the agency (NPS) as the option that will most effectively address the issue at hand without compromising the agency’s statutory mission and responsibilities while evaluating the pertinent environmental, economic, and technical factors. Ranging from 10,522 acres in Alternatives 3 and 4 to 21,812 acres in Alternative 5, the marine reserve zone was the most drastic measure proposed in the draft GMP.

There was an immediate backlash from the fishing community concerning the infringement of their rights (McClenachan, 2013; Fleshler, 2013). An oversight hearing was held in April of 2012 by the House Committee on Natural Resources to discuss access rights. In addition to anglers’ concern about their continued access to the park, potential fishing closures in Biscayne National Park were compared to closures in the Cape Hatteras National Recreation Area (in coastal North Carolina), which has seen 50% declines in local business (House Committee on Natural Resources, 2012). Florida Senators Nelson and Rubio submitted letters that addressed these potential impacts on the local community.

In response to public commentary, the NPS “undertook an evaluative process to consider a number of management actions that could be deployed to achieve the goal of a healthier coral reef ecosystem within the zone to provide a more enjoyable and diverse visitor experience, while protecting the park’s natural and cultural resources” (NPS, 2013 p. iv). A supplementary draft GMP was released in November 2013 with two new alternatives. Alternative 6, the new Preferred Alternative, would allow year-round access
to fishing to a small percentage of anglers through a special permitting program for the zone. In Alternative 7, rather than issuing zone-specific licenses, seasonal zone closures would go into effect during the summer months. The FWC agreed to collaboratively engage in the application of each alternative except Alternative 7 because it did not require complete fishing closures, and the recreational fishing community still largely opposed these alternatives because they challenged the historical “open access” practices in the area. Three public meetings followed in Coral Gables, Florida City, and Homestead to inform the public and provide an open forum to discuss the material and submit comments, and the 90-day comment period ended February 20, 2014.

The park announced its final General Management Plan in April of 2015. Alternative 8, the final Preferred Alternative, included a 10,502 acre no-take marine reserve zone (Figure 2). In response, Representative Ros-Lehtinen introduced H.R. 3310, Preserving Public Access to Public Waters Act, to mandate state agency approval on any fishing restrictions proposed by the National Park Service or the Office of National Marine Sanctuaries. The Committee on Natural Resources and Committee on Small Business also held a joint oversight field hearing on "Restricted Access at Biscayne National Park and Implications for Fishermen, Small Businesses, the Local Economy and Environment” in August 2015 to assess potential impacts of the localized fishing ban. The committee’s concern was that an economic loss might arise from a theoretical decline in recreational fishing, but the Record of Decision was signed later the same month by NPS Southeast Regional Director, completing the EIS process. Despite the lengthy process of designing new alternatives and incorporating public comments and agency feedback, no data were collected on stakeholder preferences, attitudes, opinions,
or involvement. This study identified relationships between such data and recreation specialization to understand how and why stakeholder beliefs develop as well as where the majority opinion falls on the matter of a new GMP.

Fig. 2. Map of Alternative 8 for Biscayne National Park (www.nps.gov)
1.4 Marine Protected Areas

In recent decades, marine protected areas (MPAs) have been increasingly implemented as spatial management tools for marine resources. MPAs afford various levels of protection and aim to regulate types of activities and gear use for a specified area of ecological concern (Lester et al., 2009). Marine reserves, a subset of MPAs, are also referred to as “no-take” zones where extractive practices, specifically fishing, are prohibited (Gell and Roberts, 2003).

Coral reefs are one of the most biologically diverse ecosystems on the planet, but overfishing is a serious threat that can reduce reef resiliency after natural disasters and lead to shifts in community structure and trophic pathways (Done, 1992; Roberts, 1995; Hughes and Connell, 1999; Jackson et al., 2001; Cinner et al., 2009; NPS, 2015). By reducing or eliminating fishing effort, the protected area can benefit from increased species diversity, greater resilience to extreme environmental fluctuations, and less structural damage (Roberts, 1995; Hughes and Connell, 1999; Lester et al., 2009). This type of management also seeks to improve fish biomass within the reserve that can lead to a spillover in adjacent waters through the mechanisms of emigration from the reserve and pelagic eggs and larvae export (Gell and Roberts, 2003; McClanahan and Mangi, 2000).

With a loss of more than 80% of hard coral cover since the 1970’s and 77% of the 35 fish stocks in the recreational fishery being overfished, the overall marine ecosystem decline in southeast Florida is palpable (Gardner, Cote, Gill, Grant, and Watkinson, 2003; Ault, Smith, Luo, and Bohnsack, 2001). The reef platform in Biscayne National Park is just east of the outer keys. It comprises a majority of the northernmost section of the
Florida Reef Tract, which is the third largest barrier reef system in the world (NPS, 2015). The proposed marine reserve zone would include roughly 6% of the total park area, and approximately 30% of the park’s coral reefs; the other 70% of reef areas remain open to fishing (NPS, 2015).

1.5 Recreation Specialization

Analyzing anglers through the lens of recreation specialization has successfully illuminated links between attitudes, preferences, management decisions and regulatory processes. Recreation specialization, initially conceptualized by Bryan in 1977, is a tool used to categorize anglers along a continuum of behavior according to skills, equipment, and preferences for activity settings. Anglers have been grouped according to species preference (Wilde and Ditton, 1991), organization membership (Gigliottti and Peyton, 1993), place attachment (Hunt, 2008), and years of participation (Chipman and Helfrich, 1988) as a method for understanding differences in management preference and regulations. In 1992, Ditton, Loomis and Choi redefined recreation specialization according to a theory of social worlds developed by Unruh (1979) which states that members of the same social world create a group identity by sharing beliefs, attitudes, and motivations. Salz, Loomis and Finn (2001) developed a specialization index that divides anglers into four levels according to their orientation, experiences, relationships, and commitment, supporting the framework developed by Ditton et al. (1992). The levels of specialization are known as strangers, tourists, regulars, and insiders, and are assigned according to self-identified characteristics. This approach is multi-dimensional, creating a more robust and dynamic tool for assessing specialization. In terms of resource management, understanding the diversity of anglers prevents the homogenization of the
fishing experience where decisions are made based on average behavior and preferences (Salz and Loomis, 2005). Recognizing the scope of recreational angler expectations facilitates equitable management decisions while promoting a positive relationship between anglers and agencies (Wolfenden et al., 1994; Salz and Loomis, 2005; Sutton and Tobin, 2009).

Specialization theory predicts that as specialization increases, so does dependency on specific sites or resources (Bryan 1977; Ditton et al., 1992; Oh, Sutton and Sorice, 2013). If these resources, or sites, are included in a restrictive spatial management plan, recreational anglers will likely oppose such measures. Specialization theory also hypothesizes that more specialized anglers will show stronger support for regulations and management because they are the group most impacted by negative consequences of unregulated fishing and overexploitation (Ditton et al., 1992). Several studies in the freshwater fishing community have shown that more specialized anglers favor a range of stricter fishing regulations, but they were less likely to support the implementation of restricted fishing areas, potentially because it would threaten access to their regular or favorite sites (Bryan 1977; Salz et al., 2001). However, highly specialized anglers tend to value the holistic fishing experience above catching fish, so if anglers believe that implementing spatial restrictions could improve their experience, it is likely that they will support such regulations (Ditton et al., 1992; Salz et al., 2001). The variety of factors that influence support or opposition for increased regulations, specifically spatially restrictive initiatives, are complex, but understanding the relevant stakeholder breakdown allows management to make the most effective and successful decisions.
1.6 Marine Reserves and Spatial Displacement

Although the implementation of a marine reserve can produce a variety of ecological benefits, the redistribution of fishing effort may be cause for concern (Stevenson, Tissot, and Walsh, 2013). Angler response to a marine reserve plays a critical role in the success the protected area, and shifts in fishing behavior can impede the goal of restoration (De Freitas et al., 2013). The area of the reserve in Biscayne National Park is modest, accounting for about 6% of total park area, but the data on past and current fishing effort in this specific area are lacking, making it difficult to predict displacement and subsequent crowding. Several studies have accounted for displaced fishing effort in commercial fisheries, but circumstances surrounding recreational fishing displacement remain inconclusive (Stevenson, Tissot, and Walsh, 2013). It is expected that recreational anglers will find suitably equivalent alternative fishing sites in the event that their primary or preferred fishing sites are no longer an option (De Freitas et al., 2013). However, highly specialized anglers are likely to be less willing to find substitute sites due to their preference for site-specific attributes (Oh et al., 2013). Other potential changes include a decrease in recreational fishing activity, increased crowding at nearby alternative sites, reduced fishing quality, increased depletion of nearby fish stocks, new areas impacted by fishing disturbances (De Freitas et al., 2013).

It is extremely important to understand how this marine reserve will impact fishing effort reallocation not only from an ecological perspective but from a socioeconomic perspective as well. Florida is the top fishing destination for non-residents. It has the highest amount of saltwater anglers, boasting over 6.5 million anglers (both residential and non-residential) who spent more than $12.2 billion in 2014
(National Marine Fisheries Service, 2016). Angler displacement could be small and local or potentially larger, with anglers seeking fishing sites outside of South Florida or outside the state altogether. It is economically important to investigate the full circle of connections associated with marine spatial planning and the dearth of information surrounding this particular case.

1.7 Legal Significance

The U.S. government operates with a system known as “cooperative federalism,” which entails the local, state, and federal governments collectively sharing governing responsibility by denoting which areas each level of government has the ultimate authority. Sometimes the delineation of authority is explicit in legislation, sometimes it is decided through judicial actions, and sometimes the distinction remains unclear. The extent of Biscayne National Park’s governing responsibility overlaps in many instances with state agencies and distinct jurisdictions continue to be sorted out. Along with ecological and socioeconomic importance, the promulgation of the Park’s new General Management Plan has political significance, specifically about which agency has the authority to create a no-take marine reserve in a national park.

Biscayne National Park is a unique example of cooperative federalism. The Organic Act of 1916 states that the National Park Service (NPS) operates with the dual purpose of protecting natural resources from impairment while promoting visitor use and enjoyment of these resources, and is under the direction of the Secretary of the Interior (16 U.S.C. §1). When Biscayne National Monument was initially created, Section 4 of Public Law 90-606 (October 18, 1968) declared that the waters within the monument will remain open to fishing according to Florida state laws unless the Secretary of the Interior
deems it necessary to regulate fishing times, methods, or areas, or certain species, to ensure the sound conservation of resources; yet lands donated by the state after this date will conform to Florida fishing regulations. This language remained active when the monument was formally expanded to create Biscayne National Park in 1980 (16 U.S.C. § 410gg-2). However, in 1985, the State of Florida increased the size of the Park by 72,861 acres and asserted its power to regulate fisheries with the dedication “[a]ll rights to fish on the waters shall be retained and not transferred to the United States and fishing on the waters shall be subject to the Laws of the State of Florida” (NPS, 2014 p. 208).

There is no definitive delegation of authority in the Organic Act, or any other NPS legislation, so clarification is gleaned through several landmark court cases. The principle of Chevron deference, established by the US Supreme Court in 1984 in *Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc.*, is used in administrative law to give deference to an agency’s reasonable interpretation of statutes that mandate agency action (Cornell Law). Bicycle Trails Council of Marin v. Babbitt (1996) determined that the NPS has broad discretion in deciding how to best uphold the mandates of the Organic Act. Although the delegation of authority seems to be overlapping for the Park as a whole, it is ultimately the NPS that has the option to implement more restrictive fishing regulations if it is necessary to uphold NPS mandates.

Biscayne National Park began the process of designing a new general management plan and a new fishery management plan in 2001. The previous iteration of a general management plan was passed in 1983 and was due for an update to address changes in visitor use and environmental concerns. The decision to create a separate management plan for fisheries resources was spurred by increases in recreational and
commercial fishing, as well as studies that concluded numerous stocks in the bay were overfished (FMP 2014); it was also a method for the Park to separate cooperative jurisdiction over fisheries from autonomous jurisdiction over all other natural resources. In 2002 the NPS signed a Memorandum of Understanding (MOU) with the Florida Fish and Wildlife Conservation Commission (FWC) to work together in establishing the new Fishery Management Plan.

When the Park announced its final decision for Alternative 8 as the new policy for spatial management, the FWC claimed that it was a violation of the MOU and it was not in the Park’s power to independently regulate fisheries (NPS 2015). According to Title 36 Code of Federal Regulations 2.3 (c), the NPS must consult with state agencies before restricting or closing areas of a national park to fishing, but it does not mandate anything beyond consultation. The Park asserted its jurisdiction to create a marine reserve zone was to meet mandates to prevent impairment to coral reef resources, and the no-take area was not related to fisheries management (GMP 2015). Although the state plays a joint role in developing fisheries regulations with the federal government, there is no explicit delineation of the state’s role in regulations that pertain to fisheries but are intended to meet non-fishery goals. According to the Park’s interpretation, FWC has no role in general management capacities (Stoa, 2015).

National and local fishing interest groups led a vocal opposition to the establishment of a no-take area within Biscayne National Park (House Committee on Natural Resources, 2012). In July 2015, Representative Ileana Ros-Lehtinen introduced Preserving Public Access to Public Waters Act (H.R. 3310). This bill would require the National Park Service and the Office of National Marine Sanctuaries to seek approval
from the relevant state fish and wildlife agency before enacting new legislation pertaining to recreational and commercial fishing access. The bill has received bipartisan support and is presumably backed by “a diverse array of fishermen, conservationists, and industry groups” (“Ros-Lehtinen Introduces the Preserving Public Access to Public Waters Act,” 2015).

Saltwater angler interest groups have been gaining a presence in the discourse of public access to marine resources (Salz and Loomis, 2004). Traditional open-access rights are highly valued in the recreational fishing community, and any effort to establish a no-take area is met with strong opposition and has been perceived as step towards banning recreational fishing in Florida (Lindsey, 2016). The rhetoric of the marine reserve zone among fishing industry and interest groups has been based in fear and anger about losing access to fish. Organizations such as Keep America Fishing discuss how the closure “will only serve to keep the public from enjoying these public waters” and claim that fishermen were not included in the development process (“Biscayne National Park – Access Denied,” 2015). There is a large media presence of opposition to the new General Management Plan, and the introduction of H.R. 3310 could lead to foundational changes in how Biscayne National Park and other federally managed conservation areas are governed. The Park claims that a substantial amount of public comments were received during the planning process, approximately 43,000 in total, and that an overwhelming 90% favored a reserve (NPS, 2015; Staletovich, 2016). Other sources provide a less supportive story, indicating the crossover of a fisheries regulating authority stymied stakeholder participation. General statements about stakeholders’ disappointment in the planning process and concern over the Plan’s implications lacked data and supportive
evidence (Stoa, 2015; “Congressional Committees Announce Joint Oversight Hearing on Restricted Access at Biscayne National Park,” 2015). Although opposition seems large, several studies suggest that not all recreational anglers oppose spatial closures. Sutton and Tobin (2004) found that recreational anglers can be supportive of marine reserves if their goals align the impetus of a reserve and if they are encouraged to participate in the planning process. Arlinghaus (2006) revealed that recreational anglers, who see fishing as a source of pleasure, have an inherent interest in fisheries conservation and management processes.

Promulgating new regulations to fix a problem that may or may not be occurring is reckless and poses more problems than it solves. Several studies aimed at evaluating stakeholder attitudes towards marine protected areas recommend the use of surveys as method for accurately representing stakeholder groups and majority opinions, which have yet to be employed in this process (Wolfenden et al., 1994; Cocklin et al., 1998; Salz and Loomis, 2004; Aswani and Lauer, 2006). Previous studies also indicate that stakeholders with negative perspectives about proposed management changes are more likely to vocalize their opposition publicly (Sutton, 2006; Sutton, 2008).

1.8 Objectives

The overarching goal of this study is to evaluate the recreational angler attitudes, beliefs, and perceptions of the new General Management Plan and to compare these results to the vocal public opinion that is motivating legislative action against the plan’s implementation. Recreation specialization theory posits that meaningful groups can be delineated as recreationists, in this case, anglers, are arranged along a continuum composed of dynamic variables. These groups will be compared to awareness and
consequential participation in the planning process, support for the plan, perceptions about the planning process, and beliefs about recreational fishing impacts on the environment. An open-ended component will assess the relationship of specialization groups with spatial resource use. This assessment involves mapping out current spatial use patterns of recreational anglers using participatory mapping through an online platform called Map-Me. The spatial data was analyzed in ArcGIS to interpolate density, representing high use areas. Mapping recreational angler site preferences can quantify effort and estimate how effort will shift if anglers are displaced. Linking recreation specialization to site preferences is important to see which groups will be impacted by the new marine reserve zone and how it could affect their site selection.

This study tests the following hypotheses and conducts an exploratory analysis to assess angler attitudes towards the General Management Plan, the Plan development process, and spatial use consequences:

- **H$_1$**: Anglers with a higher level of specialization are more cognizant of the new General Management Plan.
- **H$_2$**: Highly specialized anglers were more active in the public participation aspects of formulating the new General Management Plan.
- **H$_3$**: Highly specialized anglers are less supportive of the marine reserve zone than less specialized anglers.
- **H$_4$**: Anglers who believe recreational fishing is detrimental to the marine environment are more likely to support the marine reserve.
- **Exploratory analysis**: Recreational angler spatial distributions and potential displacement.
Chapter 2: Methods

2.1 Implementation

An online survey was developed using previous survey methods from Ditton, Loomis, and Choi (1992), Salz and Loomis (2005), Sutton and Tobin (2009). The survey utilized two platforms. The first platform, Qualtrics, an online customizable survey platform, collected data pertaining to recreation specialization, attitudes toward the General Management Plan, awareness of the Plan and participation during its development, perceptions about the Plan’s necessity and development process, and recreational fishing beliefs. This platform also collected demographic data and information on fishing behavior. At the end of the Qualtrics survey, participants were transferred to a Map-Me survey which collected spatial data in terms of site preference using a spraycan tool on a Google Maps interface.

A database of current recreational saltwater license holders was obtained from the Florida Fish and Wildlife Conservation Commission. The sample frame included individuals who reside in Broward, Dade, and Monroe counties and were at least 18 years of age, totaling 72,912 individuals. Four pilot surveys were tested and each was sent to 250 individuals. The survey with the highest and most comprehensive response rate was selected for the study and pilot results were not included. Those with a valid email address were sent an introductory cover letter and asked to participate in the survey, with a follow-up reminder sent one week later as per Dillman survey techniques (2011).

2.2 Recreation Specialization

A recreation specialization index established by Salz, Loomis and Finn (2001) and tested in similar MPA attitudinal studies was used to identify anglers’ level of
specialization (Salz and Loomis, 2004; Salz and Loomis, 2005). The index is based on a social worlds theory of subworlds defined as Strangers, Tourists, Regulars, and Insiders (Unruh, 1979). Each subworld is delineated according to four characteristics: orientation, experiences, relationships, and commitment. The characteristics are used to place an individual in a subworld which translates to a level of specialization (least, moderately, very, and highly specialized).

A set of four questions, one per characteristic, is used to evaluate how participants rank themselves in the context of recreational fishing. Every question has four possible responses, ranging from least specialized (response value of 1) to most specialized (response value of 4). Responses were totaled and participants were divided into their respective specialization levels as follows:

- Total score 4 – 7 = index level 1 (least specialized)
- Total score 8 – 10 = index level 2 (moderately specialized)
- Total score 11 – 13 = index level 3 (very specialized)
- Total score 14 – 16 = index level 4 (highly specialized)

These groupings were based on research conducted by Salz, Loomis, and Finn (2001) and Salz and Loomis (2005) and were modified for the present study to create balanced groupings. The number of anglers classified as “least specialized” was very small, representing 3.4% of total respondents, as has been the case in previous similar studies (Salz, Loomis, and Finn, 2001; Salz and Loomis, 2005). The small number of anglers in this group is likely due to a time lag – the vast majority of anglers on the list had been
fishing for at least two years and would likely no longer feel like novice. The “least specialized” group was not included in further analysis.

To ensure each item in the index provided unique information without a strong overlap on another item, the correlation coefficient for each bi-variate relationship was measured (Babbie, 1995). The bivariate correlation coefficients ranged from 0.46 to 0.69. An item reliability test using Cronbach’s α was 0.83 for the item set (Cronbach, 1951). Thus, each item was validated within the index and the consistency of the index proved to be successful in assessing recreation specialization. The index level groupings used for analysis were 2 (moderately specialized), 3 (very specialized), and 4 (highly specialized).

2.3 Awareness and Participation

Three questions using ranked responses were used to determine awareness of the Plan. Although offering the option to select “not sure” or “don’t know” can potentially increase no-opinion responses, it can also reduce number of forced, inaccurate responses where participants are genuinely unsure or have no opinion (Best and Radcliff, 2005). Participants were asked if they have fished in Biscayne National Park in the past 12 months and if they were familiar with the new General Management Plan. If participants indicated they had either heard of the plan or had reviewed the plan, they were then asked if they had participated by attending public meetings, submitting comments on draft plans, serving on a committee, or by other means with the option to elaborate. A follow-up to this question asked participants to indicate where they found information about the Plan and select their most trusted source. Two Chi-Square tests of independence were conducted to evaluate how awareness of the plan and participation in the planning process differed across recreation specialization groups.
2.4 Support for the Plan: Marine Reserve Zone

A short introduction about the General Management Plan was provided in the survey, including a brief background and justification for the Plan. The Plan itself contains explicit goals that the marine reserve zone aims to achieve. These are:

1. Help ensure the survival of coral reefs in Florida
2. Improve coral reef health within the park
3. Reduce the impact of fishing on coral reefs within the park
4. Ensure sustainable fisheries within the park
5. Increase the number of fish within the park
6. Improve recreational fishing experience
7. Improve snorkeling and diving experience
8. Implement effective adaptive management strategies for the marine reserve zone
9. Reduce marine debris

Participants were asked the extent to which they agreed the new General Management Plan would meet its goals in terms of the marine reserve zone. Support for the marine reserve zone served as a proxy for stakeholders’ overall support of the General Management Plan since it is the most contentious change to current park management approach. Support was calculated by assigning a value of 1 – 5 to the Likert scale responses with strongly disagree having a value of 1 and strongly agree having a value of 5. “Not sure” responses were given a value of zero and not used to calculate the mean.

For discrete analysis, each respondent’s rounded mean score for the block of questions was used, grouped according to the Likert scale above (Sutton and Tobin, 2009). Since the goal is to evaluate support of the plan’s marine reserve zone initiative, the mean score
is useful to indicate an overall agreement or disagreement with the explicit goals under scrutiny. Cronbach’s $\alpha$ for the set of questions was 0.95 with a range of 0.94 to 0.95.

A Chi-Square test was conducted to assess the relationship between support for the plan and recreation specialization. Spearman’s rank correlation was used to test for a monotonic relationship between support and recreation specialization.

2.5 Perceptions of the General Management Plan Development Process

A set of questions developed by Sutton and Tobin (2009) to assess recreational anglers’ support for the plan in terms of necessity to maintain reef health and attitudes about adequate consultancy during the plan’s developmental process were incorporated to make similar evaluations. They were modified as follows:

Please indicate how you feel about the following statements concerning the necessity of the Marine Reserve Zone:

1) The marine reserve zone is necessary to maintain healthy coral reefs in the park

2) Protecting the diversity of marine life is the most important goal of managing Biscayne National Park

3) Rezoning the park is the best option for long-term protection of coral reefs in the park

Please indicate how you feel about the following questions concerning stakeholder consultation:

1) The concerns of recreational fishers were adequately considered while developing a new General Management Plan

2) Recreational fishers were adequately consulted about the new General Management Plan
3) Compared to other stakeholder groups, recreational fishers received fair treatment in the planning process for the new General Management Plan.

The Likert scale responses from the previous section were used with the same values assigned to each response. Mean scores were rounded and used as a representative variable for subsequent analysis. Cronbach’s $\alpha$ for the first set of questions about the necessity of the MRZ was 0.87 and ranged from 0.78 to 0.89. Cronbach’s $\alpha$ for the second set, pertaining to stakeholder consultation, was 0.94 and ranged from 0.91 to 0.90.

Two Chi-Square tests were conducted. The first evaluated the relationship between stakeholder perceptions of the necessity of the plan and recreation specialization, while the second assessed the relationship between stakeholder perception of consultation and recreation specialization. Spearman’s rank correlation tested for a monotonic relationship of recreation specialization with both necessity and consultation perceptions.

**2.6 Recreational Fishing Beliefs**

Salz and Loomis (2005) created two sets of questions to examine recreational anglers’ beliefs about recreational fishing. The first set reveals how beliefs about the ecological impact of fishing can be evaluated, listed below:

Please indicate how you feel about each of the following statements concerning the impacts of recreational fishing:

1) Recreational saltwater anglers don't harvest enough fish to have a negative impact on marine fish populations. (Use)

2) Commercial fishing is primarily to blame for the decline of marine fish populations. (Use)
3) For some saltwater species, the total number of fish harvested by recreational anglers is greater than the number harvested by commercial fishing. (Conservation)

4) The additive impact of recreational anglers can result in damage to the marine environment. (Conservation)

The second question set assessed angler beliefs about the long-term impact of reducing recreational fishing catch on stock abundance and the overall fishing experience, listed below:

Please indicate how you feel about each of the following statements concerning the long-term effects of recreational fishing:

1) By limiting recreational fishing catch today we can improve the quality of recreational fishing in the future. (Conservation)

2) Recreational saltwater fish species abundance is determined more by natural fluctuations than by the number of fish people catch. (Use)

3) Raising the minimum size limit for a given recreational species will ultimately result in a healthier population of that species for many years to come. (Conservation)

4) There is little connection between the number of fish caught by recreational saltwater anglers today and the number that will be available in the future. (Use)

The Likert scale responses from the previous section were used with the same values assigned to each response. Responses were re-grouped into pro-conservation and pro-use attitudes, as denoted above, and a Spearman’s rank correlation was calculated for each
group of questions and its relationship with both recreation specialization and support for the plan.

2.7 Map-Me Exploratory Spatial Use

Map-Me is an online public participation GIS (PPGIS) platform that uses an “airbrush” interface, much like that found in photo editing and digital coloring software, to enable participants to add vague spatial data to designated database (Huck et al., 2014). The participants were asked to indicate their first, second, and third favorite fishing site, each on a separate Google Map. The spray radius and dot diameter are set by the investigator, but the participants may zoom in or out, or move the map as they please. Each dot from a spray is linked to multi-attribute data, but only the latitude and longitude were used for this study. The use of vague spatial data reduces the potential for precision error while allowing for participants to determine the size of their preferred areas without constraints (Huck et al., 2013; Huck et al., 2014). This portion of the survey was linked to immediately following the Qualtrics questions, but it was not linked to the Qualtrics responses. Participants were asked “How would you rank yourself as a member of the recreational fishing community?” prior to accessing the maps. This question served as a proxy for ascertaining recreation specialization without redundancy. Participants selected from the following responses:

- No Response
- Not very involved, I don't do it often and I have a lot to learn
- Somewhat involved, I'm still learning but becoming more comfortable
- Involved, I spend lots of time fishing and have several friends that fish with me
• Very involved, I spend as much time fishing as possible and I encourage others to participate as well

A GIS database was created using a World Ocean basemap, a georeferenced shapefile of Biscayne National Park and the proposed marine reserve zone (BNP year), Florida zip code shapefile (Florida Geographic Data Library, 2012), and the Map-Me data points. Density of all three point sets (first, second, and third favorite fishing locations) combined was calculated as point density per square kilometer and kernel density per square kilometer. A comments sections was included at the end of the survey and several anglers stated that they fish the locations they selected only when visiting friends or family elsewhere in the state. Although Map-Me used a Google Maps API which could be zoomed in or out, the study area was narrowed down to include only South and Central Florida to represent interchangeable fishing locations with comparable travel costs. The number of points within the proposed marine reserve were counted to estimate total angler displacement, and responses from the proxy specialization question were linked to those points to calculate the percentage of anglers in each group that might be displaced.

Average annual household income for Broward, Dade, and Monroe counties was obtained from the website Income By Zipcode, based on inflation adjustments for the 2015 American Community survey 5-year estimates from the U.S. Census Bureau. Email addresses for participants who completed the Qualtrics recreation specialization index questions were linked to the FWC license database via Excel to obtain zip codes. A comparison of income by zip code and specialization density by zip code was conducted to evaluate the relationship of income with concentrations of recreation specialization.
Chapter 3: Results

3.1 Survey Data

Out of 9972 emails attempted, 9893 (99%) were successfully sent. A total of 687 surveys were started and 554 were complete for a completion rate of 80% and a response rate of 5.6% with a 4.5% margin of error. Survey statistics are based on data from the Qualtrics platform.

Analysis of demographic data indicated a slight response bias. In terms of ethnicity, individuals who identified as white were overrepresented (51% of total licensed anglers compared to 73% of respondents) while individuals who identify as Hispanic and black were underrepresented (41% of anglers compared to 24% or respondents and 5% of anglers compared to 1%, respectively). Internet access and English literacy may be factors contributing to ethnicity response bias. Despite this bias, a two-sample test for equal proportions indicated demographics of respondents were not significantly different from the total population.

Recreation specialization had a significant relationship with awareness, participation, support, perception on plan necessity and development, and pro-use beliefs. Highly specialized anglers were more aware of the plan, more active in the development process, and held stronger pro-use attitudes towards fisheries resources. However, they were also less supportive of the plan and perceived it as an unnecessary measure to protect the park’s reefs. Despite their increased participation, highly specialized anglers also perceived the stakeholder consultation to be inadequate.
Summary of demographic variables broken down by support for the General Management Plan

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<th>Total licensed anglers</th>
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<td>2%</td>
<td>5%</td>
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<td>9%</td>
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</table>

Table 1. Summary of demographic variables.
3.2 Awareness and Participation

When asked if they had fished in Biscayne National Park in the past 12 months, 47% (n=294) said yes, 49% (304) said no, and 3% (22) were unsure; approximately half of respondents had recently fished in the Park. Participants were then asked if they were familiar with the new General Management Plan in Biscayne National Park, to which 13% (n=79) responded “Yes, I’ve reviewed the plan,” 37% (232) responded “Yes, I’ve heard of it,” 45% (n=280) responded “No, I have not heard of it,” and 5% (n=31) responded “Not sure.” Again, half of the survey participants were aware of the plan. However, a further breakdown of those who have recently fished in the Park, represented by the hash marks on each figure (Fig. 3 and Fig. 4), suggest that not all anglers who visited the park were exposed to information concerning changes to the General Management Plan or how to participate in public meetings.

Highly specialized anglers were the most aware of the plan, and awareness decreased as specialization also decreased. The Chi-Square test of independence between recreation specialization and awareness of the plan was significant (χ² = 16.553, df = 2, n = 597, p < 0.01).

**Have you fished in BNP in the past 12 months?**

![Bar chart showing fishing activity](image)

Fig. 3. Respondents who have fished in BNP in the past 12 months.
Of the 309 individuals who knew about the General Management Plan, only 57 (18%) participated in the public planning process. Support for the plan was binned into 3 groups by using the rounded average of the question set: support (4 and 5), neutral (3), and oppose (2 and 1). Over half of the individuals who did not participate explicitly supported the plan (54%), while only 35% of those who participated reported to be supporters. Only 16% of nonparticipants explicitly opposed the plan compared to 29% of participants.
“Newspaper or magazine” was the most popular news source for information about the plan, with Biscayne National Park website ranked as the 4th most popular and a visit to Biscayne National Park as the 7th most prominent (Fig. 6). Despite enjoying less popularity, the Biscayne National Park website ranked as the most trusted source for information about the plan, followed closely by “newspaper or magazine.”

The Chi-Square analysis revealed that the relationship between recreation specialization and participation in the plan’s development process is significant ($\chi^2 = 11.331, df = 2, n = 298, p < 0.05$). Highly specialized anglers were more active in the planning process according to total participation and participation by group level. Highly specialized anglers comprised 65% (n=37) of participants, compared to 26% (n=15) who were very specialized, and 9% (n=5) who were moderately specialized. As for
participation rates, highly specialized anglers were also the most active in the developmental process, with 28% of the cohort participating compared to a 12% participation rate for both very specialized and moderately specialized anglers.

![Bar charts showing information sources and most trusted sources.](image)

Fig. 6. Sources for information on the new GMP ranked by popularity and level of trust.

### 3.3 Support for the Plan: Marine Reserve Zone

A Chi-Square test evaluated recreation specialization and support for the plan, revealing a significant relationship ($\chi^2 = 28.470$, df = 8, n = 527, p < 0.05). More specialized anglers tend to be less supportive of the plan (Spearman’s rank correlation: $\rho = -0.1483$, p < 0.05). The majority of anglers support the plan (86%). Opposition is a mere 14% and is comprised of only highly and very specialized anglers. A majority of supporters did not participate in the planning process (80% including “neutral”), contributing to the momentum of campaigns that suggest the recreational fishing community as a whole is against the new Plan’s regulations.
3.4 Perceptions of the General Management Plan Development Process

Significant relationships between recreation specialization and attitudes towards the necessity of the plan ($\chi^2 = 33.327, \text{df} = 8, n = 522, p < 0.05$) and the consultation process ($\chi^2 = 30.130, \text{df} = 8, n = 449, p < 0.05$) were found. More specialized anglers tend to agree less with the necessity of the plan to proactively manage the park’s reefs (Spearman’s rank correlation: $\rho = -0.1090, p < 0.05$). As specialization increases, so too does the perception that stakeholders were not adequately consulted during the process (Spearman’s rank correlation: $\rho = -0.2028, p < 0.05$).

3.5 Recreational Fishing Beliefs

The relationship of pro-conservation and pro-use beliefs with support for the plan is significant. Pro-conservation beliefs were positively correlated with increased support
for the plan ($\rho = 0.3643$, $p < 0.05$) while pro-use attitudes were negatively correlated with plan support ($\rho = -0.3736$, $p < 0.05$). Pro-conservation beliefs did not show a significant relationship with recreation specialization. However, pro-use attitudes were significantly related to recreation specialization, revealing a direct correlation between increasing specialization and more prevalent pro-use beliefs ($\rho = 0.0854$, $p < 0.05$).

### 3.6 Map-Me Exploratory Spatial Use

Spatial data for 321 individuals was collected, totaling 584,852 discrete data points. The highest density of points (45-50 per square km) was located just southeast of Key Biscayne, approximately 40% within Biscayne National Park (Figure 7). The proposed marine reserve zone fell within a density of 40-45 points, suggesting it is a desirable destination but does not receive the heaviest use. A kernel density analysis, which calculates the density of point features surrounding each raster cell, revealed specific fishing pressure intermittently along the coast from Boca Raton to Key Largo. A notable concentration 35-40 points per km$^2$ encompassed the marine reserve zone. The points that were located within the marine reserve zone constituted 2.6% of the total points, representing a small potential displacement. The majority (60%) of anglers who prefer sites in the proposed marine reserve zone are more specialized and indicated they are either “involved” or “highly involved” in the recreational fishing community.
Average annual household income by zip code for 2015 was highest for 33156, 33158, and 33146 (Figure 8). Linking participant emails to FWC data enabled a count of anglers by zip code, with 33157 ranking as the zip code with the most highly specialized anglers, immediately south of 33158. When point density of fishing sites is overlaid, the highest density is directly east of the zip codes with high annual income and highly specialized anglers (Figure 9). The immediate proximity of the highly preferred fishing areas suggests that site fidelity among highly specialized anglers may be less location specific and more travel cost specific.
Fig. 9. Density of site points for recreational anglers.
Fig. 10. Annual household income by zip code.
Fig. 11. Highly specialized anglers by zip code relative to point density.
Chapter 4: Discussion and Conclusion

Using recreation specialization to evaluate angler perceptions about the General Management Plan and its development process, as well as relevant ecological beliefs, can provide insight into stakeholder belief structures and attitude formation. As specialization increases, so does awareness of the General Management Plan, which is likely due to the higher dependency on mediated interaction, as Ditton et al. (1992) postulated. Fishing becomes a prioritized facet of life as specialization increases, leading to more fishing-related activities, such as membership with a fishing interest group or subscriptions to fishing related publications. In turn, these interest groups or publications serve a platform for the recreational fishing community to discuss issues and push agendas, most of which are largely supportive of the “open-access” approach to management (Salz and Loomis, 2004). Thus, with anglers seeking out more information (either directly or indirectly) as specialization increases, their chance of exposure to current issues, such as the new General Management Plan and ways to participate and provide feedback, increases.

The Biscayne National Park website ranked as the most trusted source for information about the plan, but ranked fourth as the most popular information source. The park can capitalize on its stance with stakeholders by providing more detailed information about the General Management Plan including how the development process works and ways to participate. The website is easily accessible and could serve as a platform to collect pertinent stakeholder information, both related to and separate from the planning process, and can provide scientifically sound information backing their decision to delineate a marine reserve in park waters.
Motivation to participate in the development process can come from a wide range of priorities. Recreation specialization theory posits that as anglers become more specialized, they will be more supportive of stricter regulations because it ensures longevity for the resource and does not pose a risk to their investments in the sport. However, as Salz and Loomis (2005) also found, support does not increase, or even follow through, when regulations pose a threat to anglers’ access. According to Ditton et al. (1992), site fidelity grows with specialization and can serve as motivation to vocalize opposition or support for spatial regulations. In this case, more specialized anglers have spoken out against the marine reserve zone because it reduces reef fishing options in Biscayne National Park by about 33% (NPS, 2015). Conducting an unlabeled survey of preferred fishing locations reveals that site preferences are actually most concentrated outside the proposed reserve, and kernel density indicates that the adjacent area is just as preferable as the reserve itself. One concern for marine protected area implementation is the potential for excessive fishing pressure on the border, which can reduce benefits such as biomass increases (McClanahan and Kaunda-Arara, 1996), could prove to be an issue for the Biscayne National Park reserve. However, if site fidelity is related more to travel cost, there are numerous options for alternative sites.

Another facet of highly specialized anglers is important to consider. Appreciation for non-activity-specific benefits increases with specialization (Ditton et al., 1992). As anglers become more specialized they will place more value on peripheral details, such as scenery, good company, and nostalgia, and less value on the event of catching fish. The vocal public opposition comes largely from highly specialized anglers who oppose the reserve due to reduced fishing area. If emphasis on a fishing experience shifts away from
catching fish, it is possible that the idea of “open access” precludes anglers from assessing what they value most about their fishing experiences, or that anglers in this region do not shift priorities as they become more specialized. A larger study across geographically and politically diverse groups is needed to sort out the complexities of shifting experiential values.

Accounting for anglers’ perceptions of the necessity of the plan and the consultation process is important to improve agency-stakeholder communications for future concerted regulation developments. In this case, as specialization increased, agreement with the necessity of the plan decreased. These questions dealt with necessity in terms of biodiversity and coral reef protection, which comprise less of an explicit priority as anglers move forward along the specialization continuum. Although anglers have a vested interest in conservation to ensure longevity of target resources, open access fishing may still be perceived as the most important end goal of conservation measures. A sharper decline in perceptions about adequate stakeholder consultation is seen as specialization increases. It is possible that since the most vocal constituency were highly specialized anglers, with the largest cohort in opposition to the reserve, a sense of marginalization materialized as the plan was eventually approved by Biscayne National Park. The larger disagreement with consultation compared to necessity across all specialization levels could be attributed to the large proportion of participants who remained unaware of the new General Management Plan prior to this survey. This lack of awareness may have led stakeholders to feel undervalued and left out of the planning process. It is difficult to assign blame to either side, but increasing stakeholder involvement through outreach and using stakeholder feedback to tailor outreach methods
can be applied to future development processes. However, if stakeholders fail to become more active in local natural resource politics, the impact of outreach will not be significant.

Anglers’ pro-conservation and pro-use attitudes develop and change over the course of their lives and can form independently from political affiliations and specialization progression. Stronger pro-conservation attitudes were correlated with higher support for the plan, but no significant relationship was discerned between conservation and recreation specialization. This highlights the intricate spectrum of relationships that anglers form with the environment. Highly specialized anglers have more invested in the sport which can lead to robust advocacy for either conservation or use priorities. When comparing pro-use attitudes to specialization, there is a correlation between higher specialization and stronger pro-use beliefs. It is likely that the increased investment of highly specialized anglers instills a sense of right to access and exploitation of resources, which can also serve as an explanation for the negative correlation between pro-use attitudes and support for the plan.

Investigating relationships between recreation specialization and attitudes, perceptions, and beliefs relating to Biscayne National Park’s General Management Plan is a bottom-up rather than top-down approach to understanding recreational angler motivations and behaviors. This framework has been tested for decades across various recreational fishing groups, reinforcing recreation specialization indices as capable tools for decoding angler motivations (Bryan, 1977; Chipman and Helfrich, 1988; Ditton et al., 1992; Salz and Loomis, 2005; Oh et al., 2013). Understanding stakeholder beliefs and desires is necessary to ensure regulations are adequate, appropriate, and effective.
Surveys are a practical and accessible method for collecting stakeholder data and ensuring that management changes will be effective and sufficiently reflect the diversity of anglers while highlighting an authentic majority opinion.

It is important to note that the majority of recreational anglers surveyed (80%) are either very or highly specialized. These are the only groups that reported any opposition to the plan; however, that opposition represents a minority opinion (14%) for recreational anglers in South Florida. Management decisions aim to meet the diverse needs of resource users. The success of regulations, such as implementing a marine reserve, is partly dependent on stakeholder perceptions and responses. Assuming the most vocal attitudes represent the majority opinion fails to account for the variety of stakeholder interests. This can lead to minimal support, reduced compliance, and ineffective management decisions.
References


Appendix 1.

Recreation Specialization Index Survey Questions

When I participate in saltwater fishing I feel like:
1) a beginner. I don't really feel like I am part of the fishing scene.
2) an occasional or irregular participant. Sometimes it's fun, entertaining, or rewarding to go saltwater fishing.
3) a habitual and regular participant in the sport.
4) an insider to the sport. Saltwater fishing is an important part of who I am.

During a recreational saltwater fishing experience I can best be described as:
1) having very little understanding of fishing. I am often unsure about how to do certain things.
2) having some understanding, but still in the process of learning.
3) being comfortable with the sport. I have a good understanding of what to do and how to do it.
4) a knowledgeable expert in the sport. I encourage, teach, and enhance opportunities for others who are interested in learning more.

My relationships with saltwater anglers are:
1) not established. I don't really know other anglers.
2) very limited. I know some other anglers by sight and sometimes talk with them, but I don't know their names.
3) one of familiarity. I know the names of other anglers and often speak with them.
4) close. I have personal relationships with other anglers, and these relationships often revolve around fishing.

My commitment to saltwater fishing is:
1) very slight. I have very little connection to saltwater fishing. I may or may not continue to participate in the sport in the future.
2) moderate. I will continue to go saltwater fishing as long as it is entertaining and provides the benefits I want.
3) fairly strong. I have a sense of being a member of the activity and it is likely that I will continue to fish in saltwater for a long time.
4) very strong. I am totally committed to saltwater fishing. I encourage others to participate and seek to ensure the activity continues in the future.