

ARTICLE

Determinants of Saltwater Anglers' Satisfaction with Fisheries Management: Regional Perspectives in the United States

Ayeisha A. Brinson* and Kristy Wallmo

National Oceanic and Atmospheric Administration Fisheries, Office of Science and Technology,
1315 East-West Highway, Silver Spring, Maryland 20910, USA

Abstract

Understanding saltwater angler preferences, motivations, and satisfaction levels can assist recreational fisheries managers in providing high-quality fishing experiences for their constituents. To better understand the relationship between anglers' motivations, preferences, and satisfaction with fisheries management and any regional differences that may exist, the National Marine Fisheries Service implemented a mail survey using a large national sample of saltwater recreational anglers. The survey collected information about recreational fisheries management, fishing trip characteristics, fishing motivations, and demographic variables. Binary logit models estimated for six regions—Alaska, West Coast, Gulf of Mexico, South Atlantic, Mid-Atlantic, and New England—show that several variables, including trip characteristics, fishing motivations, avidity, demographic variables, and angler preferences for specific types of management strategies, are significant determinants of satisfaction with the fisheries management process and outcomes; however, these findings vary considerably among regions. Results also show variation in overall satisfaction levels, with anglers in the South Atlantic being generally more satisfied with both the management process and management outcomes and anglers on the West Coast being generally less satisfied with both the management process and management outcomes than anglers in other regions. Results can help inform federal fisheries management on the types of management strategies and outcomes anglers prefer and in developing or improving communication and outreach efforts, particularly in regions where angler satisfaction is comparatively low.

Saltwater recreational fishing is culturally and economically important in the United States. In 2012, 11 million anglers took 72 million saltwater trips. These trips generated US\$ 5.8×10^{10} in sales impacts and supported 381,000 jobs related to recreational saltwater fishing (National Marine Fisheries Service 2014). Despite these statistics, there has been a 16% decline in the number of saltwater fishing trips from 2003 to 2012 (National Marine Fisheries Service 2014), and some have noted a decline in recreational fishing (Schramm and Gerard 2004). As participation in recreational fisheries declines, stewards of the marine environment (such as the National Marine

Fisheries Service [NMFS]) should strive to understand angler preferences, motivations, and satisfaction, so that they improve the general context of recreational fisheries management. Understanding angler preferences, motivations, and satisfaction may not be applicable to a specific management action, but rather this understanding is useful for improving the general context of recreational fisheries management.

This need is highlighted in the National Saltwater Recreational Fisheries Policy, which identifies enabling “enduring participation in, and enjoyment of, saltwater recreational fisheries through science-based conservation and management”

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited, and is not altered, transformed, or built upon in any way. The moral rights of the named author(s) have been asserted.

*Corresponding author: ayeisha.brinson@noaa.gov
Received November 5, 2015; accepted August 24, 2016

as one of its goals (National Marine Fisheries Service 2015). Another guiding principle in the policy is to ensure public access to recreational fishing opportunities. As such, the NMFS is interested in what drives anglers' participation in saltwater recreational fishing. Arlinghaus (2006) suggested that increasing satisfaction from recreational fishing may influence fishing participation levels. Research has shown that catching fish is not the primary motivation for fishing, nor is catching fish the main determinant for satisfaction with fishing and fisheries management (Ditton et al. 1978); therefore, management must provide elements beyond the simple availability of fish to target.

Many have written on the motivations that drive recreational anglers to seek fishing activities (e.g., Fedler and Ditton 1994; Arlinghaus 2006). Anglers' motivations are heterogeneous and include some psychological benefits, such as relaxation and getting away from the routine of daily life. Anglers are motivated to enjoy the natural environment by being outdoors and experiencing natural surroundings (Driver and Knopf 1976). There are also social motivations for fishing, such as being with family and friends but away from other people. Finally, anglers are motivated by the actual fishing resource, more specifically the challenge of the sport, catching fish, or catching trophy-sized fish (Schroeder et al. 2008).

Understanding anglers' motivations is important for increasing satisfaction as managers can tailor specific policies for different types of anglers. Anglers who are motivated by experiencing the natural environment can be targeted for certain policies; for example, policies to preserve scenic areas may appeal to anglers in urban areas who indicate that environmental protection is important (Fedler and Ditton 1994). Managers may implement strategies to maintain a scenic, isolated area with quality fishing opportunities to satisfy anglers who have psychological (seeking solitude) or natural environment (pristine nature of a site) motivations (Driver and Knopf 1976).

Anglers' motivations are not completely transparent as there are many caveats with these motivations, and this will have important implications for management. For example, anglers who are motivated by catching fish and who attain that desire during a fishing trip may still be dissatisfied with other aspects of the trip. These other aspects may potentially outweigh the satisfaction attained by catching fish. Catch-related motivations for fishing may vary when anglers are grouped by mode or species sought (Ditton et al. 1978; Fedler and Ditton 1994). Furthermore, catching fish as a motivation does not necessarily mean that catching a lot of fish was the most important feature of a trip, if the qualitative aspects of the catch were considered more important than the actual number of fish caught (Ditton et al. 1978).

Numerous studies have found that noncatch motivations for fishing are more important than catch motivations (e.g., Fedler and Ditton 1994). This may be because anglers have the most control over noncatch aspects of a trip (Beardmore et al. 2015); however, this phenomenon is only true when motivations are assessed without any specific context and at a general

level (such as relaxation, association with peers and friends, or experiencing natural surroundings). Depending on the target species or specific fishery, different aspects of the catch can be more important for the primary motivation (Beardmore et al. 2011, 2015). Noncatch motivations can affect satisfaction with fishing; for example, as crowding by other fishers increases, some anglers may feel an increased sense of competition over (already limited) fishery resources (Shindler and Shelby 1995) and may choose other sites to avoid these crowds (Hunt 2005).

Managers may be inclined to implement policies that increase the chances of catching fish; however, catching fish is only one factor in determining satisfaction for anglers or a fishing trip (Ditton et al. 1978). Ditton et al. (1992) shows that as angler specialization increases, the importance of catch decreases, as does the support for more restrictive regulations. However, Fisher (1997) found that as angler specialization increased, support for management actions such as catch-and-release policies increased as well. This does not mean that catch is unimportant. Catch-related motives for fishing are still important in determining trip, holiday, or angling-year satisfaction (Graefe and Fedler 1986; Connelly and Brown 2000; Herrmann et al. 2002; Arlinghaus and Mehner 2005).

Satisfaction with a specific trip is related to individual catch success, such as positive catch rates, increased catch quality, larger fish, or success with targeted species (Arlinghaus and Mehner 2005). Other factors influencing trip satisfaction include competition with other members of a group, number of species caught, and length of the fishing trip (Beardmore et al. 2015). Management can have little effect on these types of factors as these factors are more related to individual skill or specific site characteristics.

Satisfied users can be a measure of success for recreational fishing management (Royce 1983). During the federal scoping process, anglers and members of the public may submit comments on proposed regulatory actions. The NMFS must address these comments in their final regulation; however, managers often do not have the resources to evaluate the effect of final management rules on anglers' overall satisfaction with fisheries management (National Environmental Policy Act of 1970). Managers may also have difficulty understanding anglers' satisfaction with management because there can be a divide between what anglers state is their most important motivations and what actually determines angler satisfaction. Arlinghaus (2006) also states, "the mere existence of certain motives driving an angler to fish neither guarantees satisfaction with these motivations nor explains the aspects of the fishing experience that constrain an angler's satisfaction." If this is true, how can fisheries management address anglers' satisfaction?

This paper examines the determinants of satisfaction with the recreational fishing process and management by assessing the relationship between fishing motivations, preferences for management, behavior, demographics, and satisfaction. Binary logit models are estimated to identify determinants of both satisfaction with the management process and satisfaction with management

outcomes in six of the eight U.S. regions, including Alaska, West Coast (California, Oregon, Washington), Gulf of Mexico (Texas, Louisiana Mississippi, Alabama, West Coast Florida), South Atlantic (East Coast Florida, Georgia, South Carolina, North Carolina), Mid-Atlantic (Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York), and New England (Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut). These regions correspond to the Regional Fishery Management Councils, which manage marine recreational fisheries outside of coastal waters (i.e., beyond the Exclusive Economic Zone) in collaboration with the NMFS. The results may be used to inform federal fisheries management (i.e., NMFS and Regional Fishery Management Councils), and may also have utility for state or local management entities interested in gaining a better understanding of saltwater anglers' attitudes and perceptions.

METHODS

Survey design.—The survey was developed through a collaborative process that used both quantitative and qualitative research. The survey was initially designed based upon previous research and surveys of saltwater anglers (Gentner et al. 2001; Lovell et al. 2013). National Marine Fisheries Service regional recreational coordinators reviewed the survey to incorporate regional topical issues. Representatives from key recreational fishing stakeholder groups provided input on issues of key issues of importance to their membership. Finally, four focus groups involving members of the general public were conducted. Two focus groups were held in Orlando, Florida, and another two were held in San Diego, California. The final survey incorporated the results of these focus groups, reviews from NMFS economists, and input from regional recreational fishing coordinators and key stakeholder groups.

In February 2013, NMFS implemented the survey of saltwater recreational anglers across the United States (with the exception of Hawaii). The survey collected information on anglers' attitudes, demographics, motivations for recreational fishing, preferences for management strategies and objectives, satisfaction with management, and perceptions of threats to the marine environment (Brinson and Wallmo 2013). The sampling frame consisted of anglers who purchased a saltwater fishing license in 2012. Based on the target number of completed surveys and an expected response rate for a given region, a proportional random sample was drawn from each state in a region. Expected response rates were based on the 2011 National Marine Recreational Fishing Expenditure Survey's actual completion rates (Lovell et al. 2013). Surveys were distributed by mail to each angler, followed with a reminder postcard and an additional mailing (Dillman 2007).

Data analysis and modeling approach.—Thirty-five percent of the surveys were returned. See Table 1 for the response rate breakdown by each region. For more detailed information

regarding survey administration and initial data processing, see Brinson and Wallmo (2013). Anglers were asked to rate how important or unimportant certain characteristics were to most of their fishing trips, such as motivations for catch or site preferences. Motivations include the importance of catching fish, catching fish for consumption, targeting a particular species, being close to amenities such as parking, and seeing information concerning regulations clearly posted (Table 2). Responses of not important at all or not important were coded as a -2 or -1, respectively. Extremely important or important responses were coded as a 1 or 2, respectively. Neutral responses were coded as a zero. Following this method, responses were coded on a scale from -2 to 2 (not important at all to extremely important).

Anglers were also asked to rate their preferences for certain management strategies. These management strategies were separated into five indices that examine the effect of specific types of management strategies: management strategies that affect harvest, catch and release, access, allocation, and habitat (Table 3). Anglers responded using a scale of do not prefer at all, slightly prefer, somewhat prefer, and strongly prefer, coded from 0 to 3, respectively. A composite management strategy score was created by summing the responses to each of the questions and dividing by the number of questions in each composite management strategy. For example, the harvest management strategy preference score summed the three responses and divided by three to arrive at a composite score, with a minimum of zero and a maximum of nine.

Anglers were also asked to rate their satisfaction with how recreational fisheries management addresses certain aspects of management. Each of these individual questions was separated into satisfaction with the management process and satisfaction with management outcomes (Table 4). A composite management process variable was created by summing responses to the individual satisfaction with management process questions. Not satisfied at all or not satisfied responses were coded as a -2 or -1, respectively. Extremely satisfied or somewhat satisfied responses were coded as a 1 or 2, respectively. Neutral responses were coded as a zero. Following this method, responses were coded on a scale from -2 to 2 (not satisfied at all to extremely satisfied). The same process was followed to create the composite management outcome variable. Using the summed score for both management process and management outcome, we assigned a binary outcome, where any score less than 0 was assigned a 0 and any score that was greater than or equal to 0 was assigned a 1.

We included a number of behavioral characteristics (e.g., the number of years fishing, avidity, and location of fishing [inshore]). These results could potentially be used to target segments of the recreational fishing community. Avidity and years fishing are included in the model because previous research has shown that experience with recreational fishing and avidity may influence satisfaction with recreational fishing and management (Arlinghaus 2006). Years fishing and avidity

TABLE 1. The number of initial mailings, undeliverables, completed surveys, and response rates for each region.

Region	Initial mailing	Undeliverable	Completed survey	Response rate (%)
Alaska	920	49	212	24
West Coast	4,362	373	1,417	36
Gulf of Mexico	10,831	910	2,096	21
South Atlantic	9,090	655	2,084	25
Mid-Atlantic	7,625	561	2,118	30
New England	3,564	171	1,299	38

TABLE 2. Catch motivations for fishing trips from the survey question: "On most of your fishing trips, how important is it to...?"

	No. of responses	Mean	SD
Catch fish	9,159	1.124	0.873
Catch as many fish as I can for consumption	9,117	-0.011	1.294
Catch and release as many fish as possible	9,083	0.140	1.226
Catch a trophy-sized fish	9,101	0.016	1.299
Target a particular species	9,058	0.304	1.206
Catch the bag limit of a species I am targeting	9,125	-0.233	1.310
Be close to amenities such as parking, restrooms, cleaning stations, boat launches, etc.	9,165	-0.037	1.304
See information concerning fishing regulations clearly posted	9,165	0.638	1.277

TABLE 3. Harvest, catch-and-release, access, and allocation and habitat management strategies.

Harvest	Catch and release	Access	Allocation	Habitat
Establish minimum size limits of the fish you can catch	Manage some species as catch and release only	Establish longer seasons with more restrictive bag limits	Increase the recreational harvest limit by decreasing the commercial harvest limit	Provide artificial habitat (e.g., artificial reef) in some areas of the ocean
Establish maximum size limits of the fish you can catch	Require the use of release techniques that reduce fish mortality	Establish shorter seasons with less restrictive bag limits	Divide the recreational harvest limit among different modes (e.g., private anglers and for-hire/charter boat anglers)	Protect and restore fish habitat that has been degraded
Limit the total number of fish you can keep	Designate some areas of the ocean as marine reserves with catch-and-release fishing only	Establish shorter seasons with a larger variety of species you can legally catch Restrict certain types of fishing gear Close some areas of the ocean for certain seasons		
Mean (SD) harvest management strategy score, 1.988 (0.810)	Mean (SD) catch-and-release management strategy score, 1.862 (0.855)	Mean (SD) access management strategy score, 1.130 (0.597)	Mean (SD) allocation management strategy score, 1.549 (0.896)	Mean (SD) habitat management strategy score, 2.456 (0.691)

TABLE 4. Management outcome and management process objectives.

Management process objectives	Management outcome objectives
Using management strategies that minimize costs to anglers	Managing fish stocks to provide high-quality fishing opportunities
Adjusting regulations in a timely manner to address changing conditions of the fishery	Restoring fish stocks that have been depleted
Incorporating stakeholder interests in policymaking	Protecting fish or shellfish species that are declining
Monitoring and enforcing recreational fishing regulations	Protecting marine habitats
Ensuring that the annual harvest limit provides enough fish for recreational fisheries	Addressing conflicts between anglers and marine mammals
Ensuring that state and federal regulations are consistent	
Using high-quality data and assessments in policymaking	
Mean (SD) management process score, 0.7810 (0.4136)	Mean (SD) management outcome score, 0.8075 (0.3943)

were calculated directly from respondents' answers on the survey. Years fishing is defined as the number of years a respondent indicated that they participated in recreational saltwater fishing, while avidity is the number of days that anglers indicated that they spent saltwater fishing in the previous year. The inshore variable is included because fisheries managers are interested in the differences among anglers who generally fish in offshore (>3 mi offshore) or inshore (<3 mi offshore) waters. We also included certain demographic and experience variables in the model to segment the recreational fishing community. Certain demographic variables (i.e., income, gender, and age) were shown to influence recreational fishing participation (Arlinghaus et al. 2014), and because participation influences satisfaction, we included age, education level, and income in this analysis. Gender and race were not included as the sample was largely homogenous; respondents were 84% male and 92% white.

As recreational fisheries management is regionally specific, we created regional models to correspond to the survey administration areas: Alaska, West Coast, New England, Mid-

Atlantic, South Atlantic, and Gulf of Mexico. For each regional model, we modeled satisfaction as a function of motivations, preference for management strategies, years fishing, avidity, inshore, age, educational level, and income by using a binary logit. In each region, there were two satisfaction models: one for satisfaction with the management process and one for satisfaction with management outcomes. Assuming that the error terms, E , are logistically distributed with a mean 0 and variance of 1, a binary logit model may be estimated, where

$$\Pr(y_i = 1) = \pi_i = \frac{\exp^{z_i}}{1 + \exp^{z_i}},$$

where $y_i = 1$ indicates that angler i is satisfied,

$$z_i = B_0 + B_{\text{motive}} + B_{\text{preference}} + B_{\text{years fish}} + B_{\text{avidity}} + B_{\text{inshore}} + B_{\text{age}} + B_{\text{education}} + B_{\text{income}} + E; E \sim \Lambda(0, 1),$$

RESULTS

Based upon 9,200 completed surveys, anglers tended to be middle aged (mean age was 53 years), were educated (about half of the respondents had completed an associate's degree, bachelor's degree, or an advanced degree), and had slightly above average income (mean income was at least \$80,000). On average, anglers have been fishing for 28 years and fished approximately 25 d in the previous year, with most of those trips occurring in inshore waters. For more detailed results for each question in the individual scale items, see Brinson and Wallmo (2013). Of the catch and noncatch motivations, anglers were most motivated to catch fish (mean = 1.124; SD = 0.873), to see clearly posted information about regulations (mean = 0.638; SD = 1.277), and to target a particular species (mean = 0.304; SD = 1.206; Table 2). Anglers preferred management strategies that affected habitat (mean = 2.456; SD = 0.691); they somewhat preferred management strategies that restricted the harvest (mean = 1.988; SD = 0.810) and that affected catch-and-release policies (mean = 1.862; SD = 0.855; Table 3). Anglers had less of a preference for access (mean = 1.130; SD = 0.597) and allocation-related management strategies (mean = 1.549; SD = 0.896; Table 3). Anglers were also somewhat satisfied with the management process (mean = 0.7810; SD = 0.4136) and management outcomes (mean = 0.8075; SD = 0.3943; Table 4).

Who Is Satisfied?

Anglers who responded to this survey were somewhat satisfied with most of the management process. Satisfaction with the management process was greater in Alaska (mean satisfaction with process = 0.87, $t = -3.267$, $\Pr[T < t] = 0.0005$) and the South Atlantic (mean satisfaction with process = 0.82, $t = -4.67$, $\Pr[T < t] = 0.000$), relative to the rest of the country. Anglers who purchased fishing permits on the West

Coast had lower satisfaction with the management process (mean = 0.73, $t = 5.145$, $\text{Pr}[T > t] = 0.000$) than those in the rest of the country. There were no significant differences with mean management process satisfaction scores in the Mid-Atlantic, Gulf of Mexico, and New England, compared with scores in the rest of the country.

Anglers responding to the survey had a mean satisfaction with management outcomes score of 0.81 (standard deviation, -0.394). Satisfaction with management outcomes was greater in the South Atlantic (mean management outcome satisfaction = 0.85, $t = -4.9422$, $\text{Pr}[T < t] = 0.000$) and the Gulf of Mexico regions (mean management outcome satisfaction = 0.84, $t = -3.9403$ $\text{Pr}[T < t] = 0.000$) than in the rest of the country. Satisfaction with management outcome scores were significantly different on the West Coast (mean management outcome satisfaction = 0.73, $t = 8.2488$, $\text{Pr}[T > t] = 0.000$) and in New England (mean management outcome satisfaction = 0.78, $t = 2.5017$, $\text{Pr}[T > t] = 0.0062$), relative to that in the rest of the country. There were no significant differences with management outcomes for the Alaska or Mid-Atlantic regions, compared with the rest of the country.

What Determines Anglers' Satisfaction?

On the basis of preliminary analyses of the survey results (Brinson and Wallmo 2013) and previous studies (Ditton et al. 1978; Arlinghaus 2006; Arlinghaus et al. 2014), we expected that anglers who were motivated by catching fish, were younger, less avid, and less experienced; and had lower levels of education and income would be more satisfied than other groups with the fisheries management process and management outcomes. However, certain variables performed better than others across both the regional management process and management outcomes satisfaction models (Tables 5 and 6). The coefficients can be interpreted as the rate of change in the satisfaction log odds, that is, the likelihood that an angler is satisfied with the management process. Positive signs on a coefficient indicate that a unit increase in the variable increases the likelihood of satisfaction and a negative sign on a coefficient has the opposite effect. The SE is the SD of the mean and describes the accuracy of the population mean; whereas, the SD describes the spread of values in the sample. For example, in Alaska, anglers who are motivated by catching fish are more likely than those who are not to be satisfied with the management process. Specifically, for each unit increase in the catching fish motivation variable, an angler is $4.4 (e^{Bx})$ times more likely to be satisfied with management. Likewise, in Alaska, anglers who have more years of fishing are less likely to be satisfied with the management process, specifically 0.92 times less likely for each additional year of fishing.

Years fishing, inshore, age, management strategies affecting allocation, access, catch and release, harvest, and motivations to consume fish and see information clearly posted were significant in a majority of the regional submodels. Anglers with

fewer years fishing experience were more likely to be satisfied with the management process in all regions except the South Atlantic, compared with those in the rest of the country (Table 5). Older anglers were more likely to be satisfied with the management process in all regions except Alaska and the Gulf of Mexico, relative to those in the rest of the country. Anglers who did not prefer allocation-related management strategies were more likely to be satisfied with the management process in all regions except the Mid-Atlantic and Gulf of Mexico, relative to those in the rest of the country (Table 5). Motivations to catch fish for consumption and habitat management strategies did not significantly affect satisfaction with the management process in any of the regional models. Angler motivations to catch fish or catch and release as many fish as possible also did not significantly affect any regional models, except for Alaska (catch fish) and the West Coast (catch-and-release motivation; Table 5).

The variables capturing catch and noncatch motivations for fishing trips had variable effects in most of the regional models. Of these motivations, seeing information clearly posted and catching fish for consumption were significant in most of the regional models. Anglers who were motivated by seeing information clearly posted significantly influenced satisfaction with the management process in Alaska, the South Atlantic, and Gulf of Mexico regional models, relative to those in the rest of the country (Table 5). Anglers who were motivated by seeing information clearly posted significantly influenced the regional satisfaction with management outcomes models in New England, the West Coast, and Gulf of Mexico, compared with those in the rest of the country (Table 6). Anglers who were motivated to catch fish for consumption were significantly more satisfied with management outcomes in the New England, relative to those in the rest of the country (Table 6). Consumption was not a significant motivation affecting satisfaction with the management process in any of the regional models (Table 5).

Anglers' preferences for management strategies influenced satisfaction with the management process and management outcomes. Harvest- and allocation-related management preferences performed the best in the management process regional models. Anglers who did not prefer allocation management strategies were satisfied with the management process in the Alaska, West Coast, and South Atlantic regional models, compared with those in the rest of the country (Table 5). Anglers who preferred harvest-related management strategies were satisfied with the management process in the Mid-Atlantic and Gulf of Mexico regional models, relative to those in the rest of the country (Table 5). Harvest- and allocation-related management preferences performed the best in the management outcome regional models. Anglers on the West Coast and Mid-Atlantic, who preferred harvest management strategies, were more satisfied with management outcomes than those in the rest of the country, whereas anglers who did not prefer allocation management strategies on the West

Coast, New England, and South Atlantic were more satisfied with management outcomes than were those in the rest of the country (Table 6).

These results suggest anglers may not fully understand more controversial management strategies such as different allocation policies or catch and release. Anglers who prefer management strategies affecting access or harvest may be more satisfied because it is easier to understand the outcome of these strategies (e.g., restricted harvest or limited access translates into increased availability of harvestable fish). Allocation management strategies are more controversial and the results may get lost in the discussion.

Some of the behavioral and demographic variables performed better in the management process and management outcome regional models. Older anglers with fewer years of fishing experience tended to be more satisfied with the management process and management outcomes. Number of years fishing negatively influenced satisfaction with the management process in all of the regional models, except in the South Atlantic (Table 5). Years fishing, age, and the inshore variable influenced satisfaction with management outcomes. Anglers with fewer years of fishing experience were satisfied with management outcomes in all regions, except in Alaska and the West Coast, compared with those in the rest of the country (Table 6). Older anglers who fished in inshore waters were more satisfied with management outcomes in all regional models, except in Alaska and the West Coast (Table 6).

Older anglers who are less experienced are more satisfied with the recreational fisheries management process and outcome. Increased age was a good predictor of increased satisfaction with the management process for the West Coast, New England, and Mid-Atlantic regional models than in the other regions of the country. Age was also significant for New England, Mid-Atlantic, South Atlantic, and Gulf of Mexico regional models of management outcome satisfaction than in the rest of the country. This result could be because the age of respondents was greater than the average U.S. population age (53 years versus 37; U.S. Census Bureau 2014).

DISCUSSION

Outreach and extension specialists could use the results of this study to target anglers in the South Atlantic and West Coast regions. Respondents who purchased fishing permits in the South Atlantic were more satisfied with both the management process and management outcomes, relative to anglers in the rest of the country. West Coast anglers were less satisfied than those to the rest of the country with both the management process and management outcomes. Managers should evaluate the outreach strategies used, the status of recreational fisheries, and the level of engagement in these regions. The survey results show that the regions are generally homogeneous, but there could be some underlying sociopolitical circumstances that were not measured driving satisfaction.

The catch and noncatch motivations for anglers were relatively important; however, these motivations were not always a determinant of angler satisfaction. Many studies have found evidence that catch motivation is the main determinant for angler satisfaction (see, e.g., Arlinghaus 2006 or Graefe and Fedler 1986). In contrast, this study did not find as strong of an association between catch and noncatch motivations and satisfaction. This could reflect a methodological difference because the motivations in this study were not segmented into high, medium, or low catch motivation groups. However, similar to Arlinghaus (2006) and Vaske et al. (1982), this study did find a disconnect between anglers' stated motivations and satisfaction with both the management process and outcomes. Anglers' motivations for recreational fishing may be more nuanced than anticipated here, and surveys of this type may not be able to identify the connection between motivations and satisfaction.

Recreational fishing managers looking to improve satisfaction with fisheries management should use public outreach strategies that target less experienced anglers to maintain their satisfaction with recreational fisheries management. Inversely, managers can target those anglers who are more experienced to improve their satisfaction levels. Federal fisheries managers should also increase their partnerships with the states as most of the saltwater anglers fish in state waters. The results of this research should be shared with state partners to create joint targeted outreach campaigns that increase the understanding of more complex and controversial management strategies such as catch-and-release regulations or the use of artificial habitat and closed seasons.

In future collaborations with state agencies and stakeholders, managers can take note of previous participatory research with commercial fishery stakeholders. In those participatory projects, Hanna (1995) found that ad hoc participation was successful when the process was slow enough to allow users to learn about the issues and resources, information was freely shared, participants had a stake in the outcome, change was incremental, participants' knowledge of the industry was a positive factor in that it led to increased compliance, and the resource conditions were stable. This final factor in successful participatory exchanges is particularly important for recreational fisheries. As there are trade-offs between efficiency, resilience, equity, and stewardship, stakeholders are more likely to freely participate in the management process when resource conditions are stable enough so that one group does not bear the brunt of the management restrictions (Hanna 1995).

Future research could better explain what drives saltwater anglers' satisfaction with fisheries management. Oftentimes, managers create policies in response to anglers' criticisms of current management. These anglers most likely represent a vocal minority of avid saltwater anglers whose views differ from the general angler with an average amount of experience. It would also be useful to segment anglers based on an engagement index, that is, on a model to understand how engagement, whether an angler is passively engaged or actively engaged in fisheries management, influences satisfaction with fisheries

TABLE 5. Results of the binomial logit model for satisfaction with the management process. Coefficients (coeff.; β) can be interpreted as the rate of change in the satisfaction log odds. For example, in Alaska, for a 1-unit increase of the variable "catch fish," the likelihood of satisfaction increases by a factor of $e^{1.4880} (e^{\beta_y})$, holding all other variables constant; F = the individual regional model specified for that column; $z = P < 0.01$; $y = P < 0.05$; $x = P < 0.1$.

Variable	Alaska coeff. (SE)	West Coast coeff. (SE)	New England coeff. (SE)	Mid-Atlantic coeff. (SE)	South Atlantic coeff. (SE)	Gulf of Mexico coeff. (SE)
Motivations						
Catch fish	1.4880 (0.7131) <i>y</i>	-0.0474 (0.1212)	0.2055 (0.1322)	-0.0711 (0.0984)	-0.0278 (0.1211)	0.0183 (0.1004)
Consumption	0.0127 (0.4905)	0.0548 (0.0994)	-0.0201 (0.1038)	0.1118 (0.0777)	0.0390 (0.0877)	0.0458 (0.0810)
Catch and release	0.2478 (0.3744)	-0.2114 (0.0844) <i>z</i>	-0.0034 (0.0910)	-0.0866 (0.0799)	-0.0025 (0.0854)	-0.0638 (0.0708)
Trophy	-0.2947 (0.3871)	0.0843 (0.0801)	-0.0100 (0.0948)	-0.0389 (0.0706)	-0.0218 (0.0772)	0.0074 (0.0645)
Target	-0.3667 (0.5135)	-0.0076 (0.0973)	-0.0972 (0.1076)	-0.2824 (0.0848) <i>z</i>	0.0581 (0.0830)	-0.1660 (0.0756) <i>y</i>
Bag limit	0.4576 (0.5005)	-0.0368 (0.0959)	0.0932 (0.1109)	-0.0041 (0.0823)	-0.0946 (0.0862)	-0.0489 (0.0805)
Amenities	-0.4273 (0.4196)	-0.0139 (0.0811)	0.1191 (0.0861)	0.0207 (0.0645)	0.0912 (0.0718)	0.0115 (0.0688)
Info posted	0.6430 (0.3596) <i>x</i>	0.0638 (0.0788)	0.0627 (0.0913)	0.0600 (0.0703)	0.1398 (0.0758) <i>x</i>	0.2640 (0.0666) <i>z</i>
Management strategies						
Harvest	0.7196 (0.4584)	0.2960 (0.1311) <i>y</i>	-0.1029 (0.1652)	0.2325 (0.1141) <i>y</i>	0.1081 (0.1190)	0.2580 (0.1014) <i>z</i>
Catch and release	0.9722 (0.6773)	0.0765 (0.1472)	0.5987 (0.1820) <i>z</i>	0.0524 (0.1307)	0.3400 (0.1496) <i>y</i>	0.4062 (0.1277) <i>z</i>
Access	0.2197 (1.0432)	0.5043 (0.1968) <i>z</i>	-0.3070 (0.2192)	0.0251 (0.1598)	0.3715 (0.1869) <i>y</i>	0.0481 (0.1616)
Allocation	1.4272 (0.5608) <i>z</i>	-0.2763 (0.1061) <i>z</i>	-0.1411 (0.1204)	-0.1099 (0.0941)	-0.4543 (0.1068) <i>z</i>	-0.0671 (0.0900)
Habitat	-0.0698 (0.5233)	-0.0004 (0.1263)	-0.0803 (0.1491)	0.1359 (0.1195)	-0.1290 (0.1387)	-0.1479 (0.1144)
Demographic and behavioral variables						
Years fishing	-0.0864 (0.0255) <i>z</i>	-0.0170 (0.0065) <i>x</i>	-0.0174 (0.0073) <i>y</i>	-0.0258 (0.0060) <i>z</i>	-0.0093 (0.0064)	-0.0095 (0.0052) <i>x</i>
Avidity	0.0042 (0.0027)	-0.0006 (0.0004)	-0.0002 (0.0003)	0.0002 (0.0003)	0.0005 (0.0003)	0.0001 (0.0003)
Inshore	-0.1024 (0.6847)	-0.0133 (0.1916)	0.7874 (0.2605) <i>z</i>	0.3157 (0.1916)	0.9034 (0.1956) <i>z</i>	0.4148 (0.1633) <i>z</i>
Age	-0.0073 (0.0220)	0.0168 (0.0081) <i>y</i>	0.0222 (0.0086) <i>z</i>	0.0304 (0.0070) <i>z</i>	0.0113 (0.0070)	0.0084 (0.0058)
Income	0.6338 (0.2712) <i>y</i>	-0.0735 (0.0444) <i>x</i>	-0.0139 (0.0558)	0.0810 (0.0444) <i>x</i>	0.0454 (0.0507)	0.0332 (0.0398)
Education	-0.4473 (0.3813)	0.0343 (0.0824)	-0.0650 (0.0917)	-0.1815 (0.0719) <i>z</i>	-0.0584 (0.0758)	-0.1451 (0.0663)
<i>F</i>	1.2235	5.0543	6.9211	9.6861	13.7873	11.5562
<i>P</i> > <i>F</i>	0.2654	0.0000	0.0000	0.0000	0.0000	0.0000
Number of observations	87	665	568	951	960	1,042

TABLE 6. Results of logit analysis for satisfaction with the management outcome across all regions. Coefficients (coeff.; β) can be interpreted as the rate of change in the satisfaction log odds. For example, in Alaska, for a 1-unit increase of the variable "catch the bag limit," the likelihood of satisfaction increases by a factor of $e^{0.8875} (e^{\beta_5})$, holding all other variables constant; F = the individual regional model specified for that column; $z = P < 0.01$; $y = P < 0.05$; $x = P < 0.1$.

Variable	Alaska coeff. (SE)	West Coast coeff. (SE)	New England coeff. (SE)	Mid-Atlantic coeff. (SE)	South Atlantic coeff. (SE)	Gulf of Mexico coeff. (SE)
Catch motivations						
Catch fish	0.4064 (0.4984)	-0.1263 (0.1218)	0.2401 (0.1343) x	-0.0158 (0.0986)	-0.1244 (0.1217)	-0.0708 (0.1130)
Consumption	-0.6733 (0.2639) y	0.1931 (0.0982) y	0.0170 (0.1096)	0.1381 (0.0807) x	0.0434 (0.0877)	0.1038 (0.0894)
Catch and release	-0.1115 (0.3971)	-0.0915 (0.0837)	0.0487 (0.0933)	-0.0043 (0.0839)	-0.0654 (0.0915)	-0.0725 (0.0768)
Trophy	0.2878 (0.3788)	0.2095 (0.0809) z	-0.0030 (0.0934)	-0.0018 (0.0728)	0.0938 (0.0815)	0.1588 (0.0740) y
Target	-0.2313 (0.3589)	-0.0303 (0.0969)	-0.0507 (0.1032)	-0.1787 (0.0906) y	0.1381 (0.0884)	-0.0639 (0.0836)
Bag limit	0.8875 (0.4022) y	-0.1288 (0.0972)	0.1827 (0.1121)	0.0227 (0.0837)	0.0131 (0.0864)	-0.1462 (0.0875) x
Amenities	0.0064 (0.4007)	0.0701 (0.0783)	0.0115 (0.0846)	-0.0835 (0.0692)	0.0938 (0.0736)	0.0155 (0.0745)
Info posted	0.4774 (0.3030)	0.1664 (0.0775) y	0.1546 (0.0900) x	0.0596 (0.0746)	0.0679 (0.0784)	0.2350 (0.0731) z
Management strategies						
Harvest	0.3220 (0.4883)	0.4610 (0.1312) z	-0.0126 (0.1465)	0.2147 (0.1181) x	0.1546 (0.1222)	0.3628 (0.1046)
Catch and release	-1.8955 (0.6765) z	-0.2158 (0.1539)	0.2035 (0.1888)	-0.0645 (0.1390)	0.1857 (0.1533)	0.3978 (0.1354) z
Access	0.4810 (0.7152)	0.3222 (0.1977)	-0.0134 (0.2274)	0.0663 (0.1591)	0.2080 (0.1948)	-0.2805 (0.1736)
Allocation	-0.5560 (0.5264)	-0.4029 (0.1085) z	-0.2793 (0.1255) y	-0.0273 (0.0966)	-0.5240 (0.1104)	0.0906 (0.1025)
Habitat	1.4536 (0.6117) y	0.1244 (0.1270)	-0.3254 (0.1525) y	0.1020 (0.1268)	0.1615 (0.1454)	-0.1540 (0.1230)
Demographic and behavioral variables						
Years fishing	-0.0074 (0.0226)	-0.0147 (0.0065)	-0.0178 (0.0078) y	-0.0175 (0.0056)	-0.0132 (0.0068) y	-0.0112 (0.0059) x
Avidity	-0.0021 (0.0012) x	-0.0002 (0.0004)	0.0001 (0.0004)	0.0003 (0.0003)	0.0011 (0.0004) z	0.0003 (0.0003)
Inshore	-1.2110 (0.9707)	0.1019 (0.1916)	1.0567 (0.2596) z	0.4275 (0.1961) y	0.9638 (0.2001) z	0.4514 (0.1669) z
Age	0.0129 (0.0221)	0.0020 (0.0080)	0.0312 (0.0090) z	0.0197 (0.0066) z	0.0138 (0.0072) x	0.0158 (0.0067) x
Income	0.1484 (0.2006)	-0.0027 (0.044)	0.0325 (0.0561) z	0.1465 (0.0456)	0.0578 (0.0541)	0.0702 (0.0432)
Education	0.2662 (0.2249)	0.1567 (0.0826)	-0.0382 (0.0928)	-0.1966 (0.0718) z	-0.0548 (0.0829)	-0.1230 (0.0729) x
<i>F</i>	1.4538	5.0046	7.0913	12.3929	15.3398	14.6538
<i>P</i> > <i>F</i>	0.1316	0.0000	0.0000	951	960	0.0000
Number of observations	87	665	568			1,042

management. Furthermore, more research on the degree of an anglers' catch motivation and their resulting satisfaction should be conducted because this study was not able to assess the degree of catch motivation. As management is regionally specific, future research on specific management topics (e.g., a regulatory action that could affect Red Snapper *Lutjanus campechanus* allocation in the Gulf of Mexico) could enhance our understanding of the determinants of anglers' satisfaction with recreational fisheries management.

These results are useful for improving the general context of recreational fisheries management; however, they may not be applicable to a specific management action. Understanding stakeholders' attitudes, preferences, and satisfaction levels with recreational fisheries management improves management overall and may lead to increased participation. As such, federal management is interested in gaining this understanding (National Marine Fisheries Service 2015). Anecdotally, at a recent workshop sponsored by the Theodore Roosevelt Conservation Partnership, stakeholders mentioned that they did not feel included in the management process because they were often referred to as "users" rather than the more inclusive term "stakeholders." In this example, incorporating inclusive language may not improve satisfaction with a specific policy but it may help the conversation begin on a more positive note. This first step may be a critical step towards improving anglers' satisfaction with management, and these results can inform those first steps.

ACKNOWLEDGMENTS

We thank all of the participants who took the time to respond to the 2013 National Saltwater Angler Survey. Without their participation, this work would not have been possible. We acknowledge CIC Research and Ernie Brazier for conducting the field work for this project. We also thank Cliff Hutt, Rita Curtis, and the anonymous reviewers for their thoughtful comments and suggestions on earlier versions of this manuscript.

REFERENCES

Arlinghaus, R. 2006. On the apparently striking disconnect between motivation and satisfaction in recreational fishing: the case of catch orientation of German anglers. *North American Journal of Fisheries Management* 26:592–605.

Arlinghaus, R., and T. Mehner. 2005. Determinants of management preferences of recreational anglers in Germany: habitat management versus fish stocking. *Limnologica* 35:2–17.

Arlinghaus, R., R. Tillner, and M. Bork. 2014. Explaining participation rates in recreational fishing across industrialised countries. *Fisheries Management and Ecology* 22:45–55.

Beardmore, B., W. Haider, L. M. Hunt, and R. Arlinghaus. 2011. The importance of trip context for determining primary angler motivations: are more specialized anglers more catch-oriented than previously believed? *North American Journal of Fisheries Management* 31:861–879.

Beardmore, B. L., M. Hunt, W. Haider, M. Dorow, and R. Arlinghaus. 2015. Effectively managing angler satisfaction in recreational fisheries requires understanding the fish species and the anglers. *Canadian Journal of Fisheries and Aquatic Sciences* 72:500–513.

Brinson, A. A., and K. Wallmo. 2013. Attitudes and preferences of saltwater recreational anglers: report from the 2013 national saltwater angler survey, volume I. NOAA Technical Memorandum NMFS-F/SPO-135.

Connelly, N. A., and T. L. Brown. 2000. Options for maintaining high fishing satisfaction in situations of declining catch rates. *Human Dimensions of Wildlife* 5:18–31.

Dillman, D. A. 2007. Mail and Internet surveys: the tailored design method, 2nd edition–2007 update. Wiley, Hoboken. New Jersey.

Ditton, R. B., D. K. Loomis, and S. Choi. 1992. Recreation specialization: re-conceptualization from a social worlds perspective. *Journal of Leisure Research* 24:33–51.

Ditton, R. B., T. J. Mertens, and M. P. Schwartz. 1978. Characteristics, participation and motivations of Texas charter boat fishermen. *Marine Fisheries Review* 40:8–13.

Driver, B. L., and R. C. Knopf. 1976. Temporary escape: one product of sport fisheries management. *Fisheries* 1(2):2–29.

Fedler, A. J., and R. B. Ditton. 1994. Understanding angler motivations in fisheries management. *Fisheries* 19(4):6–13.

Fisher, M. R. 1997. Segmentation of the angler population by catch preference, participation, and experience: a management-oriented application of recreation specialization. *North American Journal of Fisheries Management* 17:1–10.

Gentner, B., M. Price, and S. Steinback. 2001. Marine angler expenditures in the Pacific coast region, 1999. NOAA Technical Memorandum NMFS-F/SPO-48.

Graefe, A. R., and A. J. Fedler. 1986. Situational and subjective determinants of satisfaction in marine recreational fishing. *Leisure Sciences* 8:275–295.

Hanna, S. S. 1995. User participation and fishery management performance within the Pacific Fishery Management Council. *Ocean and Coastal Management* 28:23–44.

Herrmann, M., L. M. Milner, K. L. Giraud, M. S. Baker, and R. F. Hiser. 2002. German participation in Alaska sport fisheries in 1998. *Alaska Fishery Research Bulletin* 9:27–43.

Hunt, L. M. 2005. Recreational fishing site choice models: insights and future opportunities. *Human Dimensions of Wildlife* 10:153–172.

Lovell, S., S. Steinback, and J. Hilger. 2013. The economic contribution of marine angler expenditures in the United States, 2011. NOAA Technical Memorandum NMFS-F/SPO-134.

National Environmental Policy Act of 1970. U.S. Code, volume 42, sections 4321–4370h.

National Marine Fisheries Service. 2014. Fisheries economics of the United States, 2012. NOAA Technical Memorandum NMFS-F/SPO-137.

National Marine Fisheries Service. 2015. National saltwater recreational fisheries policy. Available: <http://www.nmfs.noaa.gov/sfa/management/recreational/policy/>. (October 2016).

Royce, W. F. 1983. Trends in fishery science. *Fisheries* 8(1):10–13.

Schramm, H. L. Jr., and P. D. Gerard. 2004. Temporal changes in fishing motivation among fishing club anglers in the United States. *Fisheries Management and Ecology* 11:313–321.

Schroeder, S. A., D. C. Fulton, M. L. Nemeth, R. E. Sigurdson, and R. J. Walsh. 2008. Fishing in the neighborhood: understanding motivations and constraints for angling among Minneapolis–St. Paul, Minnesota metro residents. Pages 77–95 in R. T. Eades, J. W. Neal, T. J. Lang, K. M. Hunt, and P. Pajak, editors. *Urban and community fisheries programs: development, management, and evaluation*. American Fisheries Society, Symposium 67, Bethesda, Maryland.

Shindler, B., and B. Shelby. 1995. Product shift in recreation settings: findings and implications from panel research. *Leisure Sciences* 17:91–107.

U.S. Census Bureau. 2014. 2014 American community survey 1-year estimates. Available: <http://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2014/1-year.html>. (October 2016).

Vaske, J. J., M. P. Donnelly, T. A. Heberlein, and B. Shelby. 1982. Differences in reported satisfaction ratings by consumptive and nonconsumptive recreationists. *Journal of Leisure Research* 14:195–206.