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RESEARCH ARTICLE

RECREATIONAL ANGLERS' RESPONSES TOWARD THE IMPORTANCE OF FISHING TRIPS: A FACTOR-CLUSTER SEGMENTATION APPROACH

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ABSTRACT

Using data collected from the 2013 National Saltwater Angler Survey, this study examined respondents' answers to fifteen statements regarding the importance of fishing trips to discern patterns from individuals' preferences, and to classify groups exhibiting common patterns of responses. These statements were condensed into five dimensions using the principal components analysis. Empirical results based on the two-stage cluster analysis identified three groups of respondents. Discriminant analysis was conducted to identify significant differences among the clusters. A series of statistical tests employed that can detect the gender and region differences on the importance of fishing trips factors and groups. Results of this study may provide insight into the understanding of the importance of fishing trips among saltwater recreational anglers for saltwater recreational fishing planning and management purposes.

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INTRODUCTION

Marine recreational fishing is a popular pastime across the nation that generates significant economic impacts to both local economies and to the nation. In February 2015, NOAA Fisheries released the National Saltwater Recreational Fisheries Policy, to provide guidance in pertaining to development and maintenance of enduring and sustainable high quality saltwater recreational fisheries, which recognized the importance of saltwater recreational fishing to the nation. In 2011, over 70 million recreational fishing trips were taken by more than 11 million marine anglers in the United States. It is estimated that marine anglers spent an estimated $4.4 billion on trip-based expenditures (e.g., ice, bait, and fuel) and another $19 billion on fishing equipment and durable goods (e.g., fishing rods, fishing tackle, and boats) (Lovell, *et al*., 2013). It is also shown that they contributed an estimated $56 billion in total output impacts, $29 billion in value-added impacts (i.e., contribution to gross domestic product), $18 billion in income impacts, and supported 364 thousand jobs in the United States (Lovell *et al*., 2013). According to the American Sport fishing Association, saltwater anglers spending amounted to over $13.4 billion in retail sales, supported 243,226 jobs, and produced over $4.2 billion in federal, state and local tax revenues in the U.S. in 2011. Total economic benefits generated by saltwater fishing in 2011 was estimated to be $73 billion in the U.S. (Southwick Associates, 2012). In Maryland, saltwater anglers spending amounted to over $133 million in retail sales, supported 2,017 jobs, and produced over $16.3 million in state sales and income tax revenues in 2011. Total economic benefits generated by saltwater fishing in 2011 was estimated to be $218,824,482 (Southwick Associates, 2012). A growing number of research studies has adopted market segmentation approach to analyze recreational anglers' fishing motivations (Connelly *et al*., 2000, Chi, 2006; Kuehn, *et al*., 2013). No systematic study has been conducted related to understanding saltwater recreational anglers from the importance of fishing trips perspective and specifically on profiling these groups of anglers using the importance of fishing trips approach. The purposes of this study are to examine respondents' answers to fifteen statements regarding the importance of fishing trips to discern patterns from individuals' preferences, to classify groups exhibiting common

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patterns of responses, and to detect the gender and region differences on the importance of fishing trips. Results of this study may provide insight into the understanding of the importance of fishing trips among saltwater recreational anglers for saltwater recreational fishing planning and management purposes.

MATERIALS AND METHODS

The data used in this study was extracted from the 2013 National Saltwater Angler Survey (Brinson and Wallmo, 2013), which was developed by the NOAA Fisheries and collected by the CIC Research in 2013. The survey targeted saltwater recreational anglers, 16 years of age and older who had been saltwater fishing at least once in their life, to elicit their participation, fishing preferences, and angler attitudes. The survey was implemented in six regions including North Atlantic, Mid-Atlantic, South Atlantic, Gulf of Mexico, West Coast, and Alaska. Respondents were asked, "On most of your fishing trips, how important is it to ---", to indicate 15 statements regarding the importance of fishing trips, using a Likert-type scale that ranged from 1 (Not important at all) through 5 (Extremely important). This study examined the psychometric properties of the importance of fishing tripsfrom the 8,584 saltwater recreational anglers who provided complete information for all 15 statements (Table 1). First, the dimensionality of the 15-item regarding the importance of fishing tripsis assessed by examining the factor solution (Gerbing and Anderson, 1988). Specifically, the amount of variance explained by the extracted factors (i.e., their eigen values) is noted. In addition, item-factor correlations (i.e., factor loadings) and other indices of model adequacy are examined. A principal component analysis is used to determine the factors identified to the sample in this study. Second, a cluster analysis of respondents is conducted using a two-stage process to identify respondent groups exhibiting common patterns of responses.

RESULTS

The original 15-item regarding the importance of fishing tripsis factor analyzed with varimax rotation, providing a clearer separation of the factors. As a result of the exploratory factor analysis, five factors are identified. The KMO measure of sampling adequacy was 0.751, which meet the fundamental requirements for factor analysis. The Bartlett's test of Sphericity shows that nonzero correlations exist at the significance level of 0.001 (Table 2). Each factor is named by examining the content of the variable making the greatest contribution to each of the dimensions. An initial interpretation of these factors suggests that Factor 1 named "Catch Motivations" factor comprises five items (structure coefficients ranging from 0.808 to 0.565) and explains 17.206 percent of the variance with an eigenvalue of 2.581. Factor 2 emphasized "Information" factor comprises four items (structure coefficients ranging from 0.852 to 0.510) and explains 15.446 percent of the variance with an eigenvalue of 2.317. Factor 3 focuses on "Site Preferences" factor comprises only two items (structure coefficients ranging from 0.717 to 0.637) and explains 9.720 percent of the variance with an eigenvalue of 1.4582.

Factor 4 focuses on "Social" factor comprises two items (structure coefficients ranging from 0.791 to 0.767) and explains 9.600 percent of the variance with an eigenvalue of 1.440. Factor 5 focuses on "Management" factor comprises two items as well (structure coefficients ranging from 0.770 to 0.672) and explains 9.478 percent of the variance with an eigenvalue of 1.422. The Cronbach's alpha is the most widely used measure of reliability which is an assessment of the degree of consistency between multiple measurements of a variable. The generally agreed upon lower limit for the Cronbach's alpha is 0.70, although it may decrease to 0.60 in exploratory research (Hair, *et al*., 1998). The internal consistency coefficient score of the 15-item regarding the importance of fishing trips showed the Cronbach's alpha of 0.736 was acceptable, which explains a cumulative 61.451 percent of the variance in statement response (Table 2). Cluster analysis techniques assign objects to groups so that there is as much similarity within groups, and difference between groups, as possible (Churchill and Iacobucci, 2005).

Table 1. Descriptive Analysis of the Importance of Fishing Trips

On most of your fishing trips, how important is it to ---	Mean	S.D.	Communalities
Catch fish	4.13	0.866	0.513
Catch as many fish as I can for consumption	2.98	1.288	0.702
Catch-and-release as many fish as possible	3.15	1.219	0.670
Catch a trophy-sized fish	3.03	1.294	0.646
Target a particular species	3.31	1.199	0.531
Catch the bag limit of a species I am targeting	2.75	1.304	0.702
Know that I will encounter abundant fish	3.63	1.072	0.583
Fish in an area that is not heavily congested	4.00	0.894	0.542
Be close to amenities	2.96	1.296	0.572
See information concerning fishing regulations clearly posted	3.63	1.276	0.682
Have access to staff to answer questions or provide information	2.79	1.278	0.748
Have easy access to weather and tide information	3.99	1.114	0.402
Fish in a scenic area	3.28	1.157	0.506
Fish with family or friends	4.33	0.849	0.716
Teach others about fishing	3.74	1.071	0.703

(Extremely important = 5, Somewhat important = 4, Neutral = 3, Somewhat unimportant = 2, Not important at all = 1)

Factor scores of the importance of fishing tripsdimensions are used to cluster saltwater recreational anglers. Cluster analysis is applied as a two-stage process to the saved factor scores. In the first stage, Ward's hierarchical clustering method is employed to provide an indication of the appropriate number of clusters. In the second stage, the K-means clustering method

is used to identify a solution with the specified number of clusters. Consequently a three-cluster solution is agreed upon. The clusters are labeled as "Catch and Management", "Regulatory and Social Environment", and "Fishing Related" groups (Table 3).

"Catch and Management" cluster: this is the smallest group comprising of approximately 27.5 percent of the respondents. These respondents are positively connected with "Catch Motivations" and "Management", but negatively identify with "Information", "Site Preferences" and "Social"."Regulatory and Social Environment" cluster: with 28.3 percent of the

Table 2. Factor Analysis and Reliability Coefficient of the Importance of Fishing Trips

On most of your fishing trips, how important is it to ---	Factor1	Factor2	Factor3	Factor4	Factor5
Catch Motivations					
Catch the bag limit of a species I am targeting	0.808				
Catch as many fish as I can for consumption	0.740				
Target a particular species	0.622				
Catch fish	0.618				
Know that I will encounter abundant fish	0.565				
Information					
Have access to staff to answer questions or provide information		0.852			
See information concerning fishing regulations clearly posted		0.814			
Be close to amenities		0.721			
Have easy access to weather and tide information		0.510			
Site Preferences					
Fish in an area that is not heavily congested			0.717		
Fish in a scenic area			0.637		
Social					
Fish with family or friends				0.791	
Teach others about fishing				0.767	
Management					
Catch-and-release as many fish as possible					0.770
Catch a trophy-sized fish					0.672
Eigenvalue	2.581	2.317	1.458	1.440	1.422
% of variance	17.206	15.446	9.720	9.600	9.478
Cumulative %	17.206	32.652	42.373	51.973	61.451
Reliability Alpha Coefficient of All 12 Items = 0.736					
Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy = 0.751					
Bartlett's Test of Sphericity: Approx. Chi-Square = 27977.077; *df* = 105; Sig. = 0.000					

Table 3. Mean Factor Scores for Clusters of the Importance of Fishing Trips

	Catch and Management	Regulatory and Social Environment	Fishing Related
Catch Motivations	0.1011	-0.6166	0.3330
Information	-0.0962	0.2295	-0.0875
Site Preferences	-0.0662	-0.7979	0.5537
Social	-1.1155	0.5290	0.3549
Management	0.4018	0.1185	-0.3263
n = 8,584	2360	2434	3790
Percentage	27.5	28.3	44.2

Table 4. Canonical Correlation of Discriminant Functions

Function	Eigenvalue	% of Variance	Canonical Correlation
1	1.224*	53.1	0.742
2	1.083*	46.9	0.721
* First 2 canonical discriminant functions were used in the analysis.			

Table 5. Standardized Canonical Discriminant Function Coefficient

	Function 1	Function 2
Catch Motivations	-0.474	0.561
Information	0.236	-0.163
Site Preferences	-0.424	0.830
Social	0.909	0.424
Management	-0.223	-0.545

Table 6. Gender Differences in the Importance of Fishing Trips Factors

Fishing Motivations / Gender	Male		Female		Differences	
	Mean	S.D.	Mean	S.D.	*t*	*P*
Catch Motivations	0.292	0.976	-0.118	1.098	5.039	0.000
Information	-0.034	0.996	0.133	1.001	-5.713	0.000
Site Preferences	-0.031	0.991	0.160	1.034	-6.540	0.000
Social	0.003	1.003	-0.024	0.986	0.929	0.353
Management	0.082	0.974	-0.395	1.030	16.611	0.000

(n = 8,394, due to missing information)

respondents, this group is named after the positively strong association with "Information", "Social" and "Management", but negatively identify with "Catch Motivations" and "Site Preferences". "Fishing Related" cluster: this is the largest group, comprising of approximately 44.2 percent of the respondents, named because of the positive factor score associated with "Catch Motivations", "Site Preferences" and "Social" among these respondents, negatively identify with "Information" and "Management". Results of the cluster analysis are tested for accuracy using the multiple discriminant analysis employed as a useful complement to cluster analysis, which is used primarily to predict membership in two or more mutually exclusive groups. In this case, the null hypothesis of equal population covariance matrices is rejected at 1% level of significance (the Box's M = 1249.857; $F = 41.626$; $p = 0.000$), and the Wilk's Lambda scores are 0.216 ($\chi^2 = 13149.100$; $df = 10$; $p = 0.000$) and 0.480($\chi^2 = 6293.598$; $df = 4$; $p = 0.000$) for both discriminant functions, respectively, indicating that group means are significantly different. The canonical correlation results are both above 0.7, supporting that there are strong relationships between the discriminant score and the cluster membership (Table 4). Two discriminant functions are formulated (Table 5).

The first function is a function for discriminating between "Catch and Management" and "Regulatory and Social Environment" and "Fishing Related" combined, and the second function for discriminating between "Regulatory and Social Environment" and "Fishing Related", respectively. Though mathematically different, each discriminant function is a dimension which differentiates a case into categories of the dependent variable ("Catch and Management", "Regulatory and Social Environment" or "Fishing Related") based on its values on the independent variables. The first function is the most powerful differentiating dimension, but the second function may also represent additional significant dimensions of differentiation. Since one of the purposes in this study is to compare the differences in the importance of fishing trips between the female and male saltwater recreational anglers, the factor score of the five factors was saved for further statistical analysis. In order to test the significant differences between the male and female respondents, the t-test is performed with the five-factor scores. Overall, gender had significant differences in "Catch Motivations", "Information", "Site Preferences", and "Management"; but no differences in "Social" significantly (Table 6).

Table 7. Gender Composition of the Importance of Fishing Trips Clusters

Group / Gender	Male	Female	Total
Catch and Management	2005	312	2317
Regulatory and Social Environment	1992	365	2357
Fishing Related	2989	731	3720
Total	6986	1408	8394

(n = 8,394, due to missing information)

Table 8. Region Differences in the Importance of Fishing Trips Factors

		df	*F*	*P*
Catch Motivations	Between Groups	5	46.198	0.000
	Within Groups	8578		
Information	Between Groups	5	11.293	0.000
	Within Groups	8578		
Site Preferences	Between Groups	5	16.156	0.000
	Within Groups	8578		
Social	Between Groups	5	2.648	0.021
	Within Groups	8578		
Management	Between Groups	5	54.900	0.000
	Within Groups	8578		

Table 9. Region Composition of the Importance of Fishing Trips Clusters

Region / Group	Catch and Management	Regulatory and Social Environment	Fishing Related	Total
Alaska	50	31	122	203
West Coast	352	329	617	1298
North Atlantic	375	383	441	1199
Mid-Atlantic	578	658	714	1950
South Atlantic	526	531	901	1958
Gulf of Mexico	479	502	995	1976
Total	2360	2434	3790	8584

Table 10. Significant Multivariate Effects on the Five Identified Factors (MANOVA)

Variable	Pillai's Trace	*F*	*P*
Group	0.487	538.349	0.000
Gender	0.017	28.342	0.000
Region	0.029	9.640	0.000
Group*Gender	0.002	1.990	0.030
Group*Region	0.007	1.133	0.241
Gender*Region	0.004	1.487	0.056
Group*Gender*Region	0.005	0.758	0.895

The results also showed that male were more likely than female in "Catch Motivations (t = 5.039; p = 0.000) and "Management" (t = 16.611; p = 0.000), respectively. Female were more likely than male in "Information" (t = -5.713; p = 0.000) and "Site Preferences" (t = -6.540; p = 0.000), respectively. Using the Chi-square test, the importance of fishing trips groups demonstrated significant differences in respondent gender composition (χ^2 = 43.016; df = 2; p = 0.000) (Table 7). A one-way ANOVA is performed to examine the effects of region composition on the five factors identified. The results showed that significant differences among region composition were found with the five factors identified (Table 8).Those of significant differences were "Catch Motivations" (F(5, 8578) = 46.198, p = 0.000), "Information" (F(5, 8578) = 11.293, p = 0.000),"Site Preferences" (F(5,8578) = 16.156, p = 0.000), "Social" (F(5,8578) = 2.648, p = 0.021), and "Management" (F(5,8578) = 54.900, p = 0.000). Similarly, the importance of fishing trips groups using the Chi-square test also demonstrated significant differences in region composition (χ^2 = 140.655; df = 10; p = 0.000) (Table 9).

By examining how independent variables influence some patterning of response on the dependent variables, a multivariate analysis of variance (MANOVA) was employed (Table 10). The independent variables studied were the identified group, gender, and region composition. The dependent variables considered in this study were: "Catch Motivations", "Information", "Site Preferences", "Social" and "Management". Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted. There was a statistically significant difference among three clustered groups on the combined dependent variables: Pillai's Trace =0.487, F(10, 16710) = 538.349, p = 0.000; Wilk's Lambda = 0.572; partial eta squared = 0.244. When the results for the dependent variables were considered separately, all the dependent variables reached statistical significance among these three groups. Similarly, for gender, Pillai's Trace=0.017, F(5, 8354) = 28.342, p = 0.000; Wilks' Lambda = 0.983; partial eta squared = 0.017, for region composition, F(25, 41790) = 9.640, p = 0.000; Wilks' Lambda = 0.972; partial eta squared = 0.006. Group and Gender combined showed statistically significant effect on the combined dependent variables at the 0.05 level. Gender and Region combined also showed statistically significant effect on the combined dependent variables at the 0.10 level.

DISCUSSION

Historically management has focused on commercial fisheries, with less attention being directed to the recreational fisheries. Less is known about the values associated with recreational fishing. In order to gauge our effectiveness in managing the fisheries resources and habitats, and to provide increased opportunities for anglers use and enjoyment, we need input from the whole spectrum of anglers from saltwater recreational fishing in order to profile the use and enjoyment of our fisheries resources and habitats, and to guide us in making proper decisions about their future planning and management. This will be especially important when management restrictions are proposed for threatened species and species that are being overfished where economic consequences of those restrictions will be needed. Understanding what motivates people to participate in angling could give managers insight regarding the needs and interests of their different user groups. It is difficult to attract diverse angler markets with different motivations and interests when information regarding the reasons or motives for angling among different angler segments is lacking. This study has both theoretical and practical implications. With updated testing of the well-developed conceptual framework of the importance of fishing trips among saltwater recreational anglers, this study contributes to existing decision-making literature by either providing more evidence of the validity and robustness of this framework or by providing suggestions for adaptation in applying this framework to understand saltwater recreational angler groups across different backgrounds and cultures. Also, this study adds more to the existing literature on the dynamically changing saltwater recreational anglers. This study may provide practical marketing implications for environmental education by proposing effective ways to understand and target these consumers. Research results may provide direction for environmental education developing marketing strategies, which target the saltwater recreational anglers.

The information gathered from this study may assist recreational fisheries managers in designing practical recreational fisheries management strategies to address concerns of anglers of saltwater recreational fishing and to benefit fisheries populations. Local planners and developers that sponsor saltwater fishing tournament would find this information useful to attract additional participants through major marketing efforts. Government officials would find this information helpful in drafting new management regulations and analyzing the extent that a change in regulation may have on coastal communities and the anglers that participant in recreational fishing tournaments.

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