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Social Stratification in Fishing Participation in the United States

A Multiple Hierarchy Stratification Perspective

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Abstract

Using the multiple hierarchy stratification perspective (MHSP), this paper investigated Americans' freshwater and saltwater fishing participation in 2011. Data from the *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* were examined using two hierarchical generalized linear models. Level 1 variables were age, education, sex (male, female), income, and race/ethnicity. Interactions among these demographic variables were also examined. Level 2 variables for freshwater and saltwater fishing were per capita inland water area in a state and the existence of coastline within each state, respectively. Sex was the most important Level 1 predictor for both freshwater and saltwater fishing participation. The two Level 2 variables were also significantly associated with freshwater fishing and saltwater fishing participation. Moreover, MHSP was an effective theoretical approach to explain Americans' fishing participation. Implications and suggestions for fishery management are discussed.

Keywords: *Outdoor participation, opportunity theory, multilevel logistic analysis, interactions*

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Introduction

Fishing is among the most popular forms of wildlife-dependent recreation in the United States. The *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* reported that 37.4 million U.S. residents 16 years of age and older went fishing in 2011 (U.S. Department of Interior, 2012). Fishing provides numerous economic, environmental, and social benefits to communities and individuals (Dann, 1993; Ditton, 2004). U.S. residents, for example, reported spending approximately $42 billion on fishing in 2011 (U.S. Department of the Interior, 2012). The sale of fishing licenses is an important revenue source for conservation and habitat restoration programs, and recreational anglers tend to be strongly interested in conservation activities (Arlinghaus, 2006; Granek et al., 2008). Moreover, fishing can promote family cohesion (Hunt & Ditton, 2002; Toth & Brown, 1997), mental relaxation (Driver, Brown, & Peterson, 1991), and opportunities for escape (Fedler & Ditton, 1994).

Despite these benefits, fishing has decreased in popularity over the last few decades (Arlinghaus, Tillner, & Bork, 2015; Bruskottter & Fulton, 2013). The number of anglers in the U.S. declined by approximately one million from 2001 to 2011 (U.S. Department of the Interior, 2012). Moreover, the decline in anglers is expected to continue due to a number of reasons, such as urbanization and industrialization (Schuett, Scott, & O'Leary, 2009). This trend is a concern for policymakers given that anglers have long been advocates for conservation of fishing resources. Understanding factors associated with recreational fishing participation helps provide insights into reasons for declining participation in the activity.

Researchers started analyzing fishing participation based on demographic variables in the early 1960s (e.g., Mueller & Gurin, 1962). In general, studies have noted that seniors, females, non-Whites, and individuals with low income or education levels generally experience greater constraints to overall leisure participation (e.g., Floyd, 1999; Henderson, Bialeschki, Shaw, & Freysinger, 1989; Zanon, Doucouliagos, Hall, & Lockstone-Binney, 2013). Findings from fishing studies have also documented that fishing has generally been a more popular outdoor recreation activity among males than females (Dargitz, 1988; Duda, 1993) and Whites compared to people of color (Harris, 2012; Hunt & Ditton, 2002). Age, education, and income were found to be less important predictors of fishing participation than sex (male, female) and race (Fedler & Ditton, 2001; Floyd & Lee, 2002). Researchers have also examined effects of various other factors on fishing participation such as fish stocking, motivation, household structure, population density, and access to water area (Arlinghaus et al., 2015; Dabrowska, Haider, & Hunt, 2014; Kuehn, Luzadis, & Brincka, 2013; Loomis & Fix, 1998). These studies suggest that some geographic factors can also play an important role in fishing participation.

To contribute to this body of knowledge, this paper uses the multiple hierarchy stratification perspective (MHSP) to examine associations between the combined effects of age, education, income, race/ethnicity, sex, and supply of fishing opportunities (i.e., water acreage) with Americans' participation in freshwater and saltwater fishing in 2011. MHSP was developed in the field of gerontology to explain how *multiple* statuses facilitate *and* constrain people's access to a myriad of goods, including housing, health coverage, and life satisfaction (Markides, Liang, & Jackson, 1990). Social scientists have long recognized that life chances—opportunities people have to improve the quality of their lives—are inexorably related to their social status (Weber, 1978). In most cultures, privilege and access to material and non-material resources vary by sex, social class, race and ethnicity, and age (Fishkin, 1983; Massey, 2007). However, these factors often do not operate independently, but are highly interrelated. MHSP posits that White younger adult males with high levels of education and income occupy the highest level in the status hierarchy in the U.S. and have superior access to valued resources compared to elderly non-White females with lower levels of education and income. A central tenet of MHSP is that the *additive effects* of these statuses are far more influential than the effect of any single status in predicting life chances.

MHSP was introduced in the field of leisure studies in the 1990s to examine cumulative effects of multiple social statuses on leisure behavior. Over the last two decades, MHSP has effectively predicted various facets of leisure and outdoor recreation involvement, including leisure preferences (Shinew, Floyd, McGuire, & Noe, 1995), leisure benefits (Philipp, 1997), leisure constraints (Arnold & Shinew, 1998; Shores, Scott, & Floyd, 2007), state park visitation (Lee, Scott, & Floyd, 2001), cross-country skiing (Pouta, Neuvonen, & Sievänen, 2009), wildlife watching (Lee & Scott, 2011), and outdoor recreation in general (Lee et al., 2001). For fishing participation, Floyd, Nicholas, Lee, Lee, and Scott (2006) employed MHSP to understand Americans' fishing participation. Consistent with the underlying tenets of MHSP, they found that fishing participation was particularly problematic for people with disadvantaged statuses.

Although Floyd et al. (2006) provided important insights into fishing involvement using the MHSP, their analytic perspective can be expanded in three ways. First, the MHSP can take into account people's proximity to leisure resources. Opportunity theory reflects the notion that recreation participation depends on the availability of proximal recreational resources (Gómez, 2002; Scott & Mowen, 2010). Studies have documented that rural residents, irrespective of their socioeconomic background and other statuses, are more likely to participate in many outdoor recreation activities compared to urban residents simply because they live close to outdoor recreation environs (Floyd & Lee, 2002; Lee & Scott, 2011; Pouta et al., 2009). Moreover, and not surprisingly, researchers found that people who live close to water resources such as lakes are more likely to fish compared to those who live away from lakes (Arlinghaus et al., 2015; Carlin, Schroeder, & Fulton, 2012; Dabrowska et al., 2014). Thus, incorporating physical proximity to fishing resource into MHSP furthers understanding of fishing participation.

Second, the interactive effects of socio-economic and demographic variables can explain fishing participation. MHSP does not privilege one status over another in explaining leisure phenomena. Studies using MHSP consistently show that various statuses are more or less related to constraints (e.g., Shores et al., 2007) and participation in different outdoor recreation activities (e.g., Floyd et al., 2006). Given its focus on the additive effects of multiple statuses, applications of MHSP to date ignore possible interactions among various statuses in predicting different facets of leisure involvement. Yet, social scientists stress that demographic factors significantly intersect with one another and impact every aspect of Americans' life, including leisure activities (Bowser, 2007; Collins, 2000; Feagin, 2014; Massey, 2007). Thus, it is worth investigating how demographic interactions affect MHSP's explanatory power in the context of fishing. Third, Floyd et al. (2006) focused on fishing participation only in Texas. A more comprehensive analysis, based on a national sample, is desirable for drawing stronger conclusions about the MHSP and fishing, and informing national level policy (Lee & Scott, 2011).

Therefore, this study examines the following four research questions: (a) Does the MHSP effectively explain Americans' participation in freshwater and saltwater fishing? (b) How does the proximity to water resource impact Americans' freshwater and saltwater fishing? (c) Do demographic interactions influence Americans' freshwater and saltwater fishing participation?, and (d) Does the model fit improve when demographic interactions are included in a fishing model?

Methods

Using secondary data from the *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (NSFHWAR), two hierarchical generalized linear models (HGLM) were estimated for fishing participation. The difference between the two models is the existence of 10 demographic interactions in the model specification. Model 1 has no interactions whereas Model 2 has the 10 demographic interactions. The analysis also involved likelihood ratio tests using deviance statistics to test if Model 2 exhibited greater explanatory power and provided a better explanation for Americans' fishing participation than Model 1.

Data in the NSFHWAR were collected by a multiple probability sampling method that consisted of two phases. The first phase was an initial screening of households to identify potential wildlife-related recreation participants. The total screening sample was 48,600 households. Subsequently, screening surveys were conducted with 30,400 households for a response rate of 71%. The second phase entailed a series of follow-up surveys of selected people who stated during the first phase they had participated or planned to participate in fishing and hunting activities. Approximately 16,400 people were designated for the telephone survey and about 11,300 detailed sportspersons questionnaires were completed at a response rate of 69%. Surveys were conducted primarily by telephone; in-person surveys were conducted with respondents who could not be reached by telephone. The data were weighted to estimate the total number of fishing participants in the country. More detailed descriptions of the sampling design and data collection procedure can be found in Appendices C and D of the 2011 NSFHWAR (U.S. Department of the Interior, 2012).

Multilevel logistic regression analyses with the Laplace approach were conducted using HLM 7.01. Multilevel modeling is based on the premise that individuals are nested within larger social units (e.g., families, neighborhoods, cities, countries) and that individual behavior is influenced by both personal and contextual characteristics (Bryk & Raudenbush, 1992). Thus, the model distinguishes individual level variables and contextual variables, and examines the influence of both the personal and contextual characteristics on outcome variables (Snijders & Bosker, 2011). In the case of understanding fishing participation, for example, contextual differences are critical because it is reasonable to expect that people who live in a region or state with abundant inland water resources fish more frequently than people who live in a state with limited water resources. Neglecting the effect of context on individual behavior poses two problems related to model estimation: (a) omission of an important source of variance, and (b) violation of the statistical assumption of independent observations (Sibthorp, Witter, Well, & Ellis, 2004). Although the hierarchical linear model can be a useful analytic tool for understanding leisure and recreational behaviors, leisure studies researchers have used it infrequently (Sibthorp et al., 2004). Laplace's approach was used because it provides more accurate approximation to maximum likelihood and produces better results for two-level HGLM, compared to penalized quasi-likelihood estimation that is the default approach of logit modeling in HLM 7.01 (Raudenbush, Bryk, Cheong, Congdon, & Toit, 2011; Raudenbush, Yang, Meng-Li , & Yosef, 2000).

Logistic regression was used for testing predictions of MHSP. Although MHSP explains how different social statuses impact resource acquisition, logistic regression accommodates dichotomous status variables indicating advantaged and disadvantaged status group categories to examine how different combinations of status characteristics associate with fishing participation. Another advantage of this analysis is that odds ratios make the interpretation of the effect of independent variables more straightforward and intuitively meaningful than ordinary least squares regression coefficients (Treiman, 2009). To date, researchers have used logistic regression to test MHSP in various leisure contexts (e.g., Lee & Scott, 2011; Shores et al., 2007).

This study used age, education, sex, annual household income, and race/ethnicity as Level 1 variables. To dichotomize the five independent variables, cut-points were sought that properly distinguish advantaged and disadvantaged status in American society in general, with "1" identifying the advantaged status. Cut points similar to previous MHSP research were used. Age was divided into 65 years and higher and 64 and lower (1 = Younger). Sixty-five years of age is commonly accepted as a retirement age. Negative stereotypes toward retirees and elderly people persist that they do not engage in productive and meaningful activities, and they are declining physically and experience poor health (Nelson, 2002; Palmore, 2004). Education level was dichotomized based on whether or not a respondent held a bachelor's degree (1 = Yes). According to Massey (2007), access to higher education is a crucial determinant of social status and income level in post-industrial society. Sex was dichotomized into male and female (1 = Male). Although sex inequality in the United States has dramatically declined in the past several decades, males continue to occupy a more advantaged status in occupational and income status than do females (Massey, 2007). Income was dichotomized using an annual household income of $25,000 as a cutoff point (1 = Higher income). This cut-point is based on the 2011 poverty line for a four-person family in the United States, which is $22,350 (U.S. Department of Health & Human Services, 2011). Race/ethnicity was divided into White/non-Hispanic and non-White (1 = White/non-Hispanic). The latter group has historically occupied a subordinate position in the United States (Feagin, 2014).

Dichotomizing variables using cut points may lead to some loss of information related to individual variables. However, MHSP focuses on the combined effects of variables related to stratification rather than the direct main effects of individual variables. Using binary independent variables is one of the most effective and practical approaches to operationalize status differences. Odds ratios associated with binary variables allow direct comparisons of the effect of advantaged and disadvantaged statuses on fishing participation. Moreover, the additive effect of different status characteristics can be calculated and more clearly visualized. Due to these benefits, MHSP studies have used dichotomized independent variables (e.g., Floyd et al., 2006; Lee & Scott, 2011; Pouta et al., 2009). The present study advocates this approach following previous MHSP studies.

Level 2 variables were operationalized using information from *State Area Measurements and Internal Point Coordinates* (U.S. Census Bureau, 2010) and 2010 Census (U.S. Census Bureau, 2014). For freshwater fishing, each state's total inland water area was divided by state population to create a per capita water resource variable. The variable was then dichotomized using 0.000225 per capita rate as a cut-point to distinguish superior and inferior accessibility to fishing resources (1 = Affluent water resource state, 0 = Scarce water resource state). Given that 25 of 51 states (data treated the District of Columbia as one state) possessed less than 0.000225 per capita rate of inland water area, the cut-point made for an almost even dichotomization. For saltwater fishing, a per capita saltwater area ratio for each state was also calculated, yet this approach did not make any difference with using the existence of coastline as a cut-point because of a clear ratio difference between 28 non-coastal states and 23 coastal states. Thus, a Level 2 variable for saltwater fishing was created based on the existence of coastline in the states (1 = Coastal state, 0 = Non-coastal state). People who live in states with abundant per capita inland water area or coastline were expected to possess a higher rate of fishing participation. The dependent variables were participation in freshwater fishing and saltwater fishing in the United States in 2011. Participation was coded 1 whereas non-participation was coded 0.

A two-step analytic procedure was implemented for the two HGLM models. First, a null model was tested to obtain preliminary information about the outcome variable of freshwater and saltwater fishing participation. This null model allows researchers to ascertain how much variance in the dependent variable is explained by contextual variables (Bryk & Raudenbush, 1992). Second, once a significant amount of variance was attributed to the states, the null model was expanded by subsequently adding both Level 1 and Level 2 variables. The null models' tau coefficients (τ) were compared with full models' to estimate the percentage of variance explained by the full models. A statistical weight provided by the survey data was applied in this procedure. Eventually, 46,238 cases were used for the analyses. Table 1 provides descriptive statistics of the unweighted sample.

Table 1

Descriptive Statistics of Demographic Variables (Unweighted–46,238 Respondents)

	N	%	Mean	SD	Max	Min
Age	--	--	.81	.391	1	0
65 years old and older (0)	8,702	19	--	--	--	--
Younger than 65 years old (1)	37,536	81	--	--	--	--
Education	--	--	.32	.467	1	0
No Bachelor's degree (0)	31,342	68	--	--	--	--
Bachelor's degree and higher (1)	14,896	32	--	--	--	--
Sex	--	--	.49	.5	1	0
Female (0)	23,755	51	--	--	--	--
Male (1)	22,483	49	--	--	--	--
Income	--	--	.82	.982	1	0
$0~$24,999 (0)	8,203	18	--	--	--	--
$25,000 and higher (1)	38,035	82	--	--	--	--
Race	--	--	.77	.421	1	0
Minorities (0)	10,650	23	--	--	--	--
White (Non-Hispanic) (1)	35,588	77	--	--	--	--

The combined effects of the independent variables were examined to explore the probability of freshwater and saltwater fishing participation across different statuses using Model 1, the one without the demographic interactions. Model 1 was used because it is problematic to stratify individuals' social status using the interactions, and MHSP does not provide any explanation for the interaction terms. This analysis is the most direct test of the MHSP because it examines the additive effect of independent variables. Based on 64 different combinations of six dichotomous variables, 64 status characteristics were constructed, and they were stratified in hierarchical order. For each stratum, the probability of participating in freshwater fishing and saltwater fishing was calculated based on regression coefficients (Agresti & Finlay, 1997; Hamilton, 1992). The following formula was used:

$$\pi = \frac{e^{\alpha + \beta 1 X1 + \cdots \beta k Xk}}{1 + e^{\alpha + \beta 1 X1 + \cdots \beta k Xk}}$$

Results

The analyses revealed that Model 1 and Model 2 exhibited different outcomes on freshwater and saltwater fishing participation. Table 2 summarizes the outcome of the multilevel logistic regression analyses of Model 1. All Level 1 variables were statistically significant for freshwater fishing. The odds ratios showed that freshwater fishing participation was approximately 1.8 times more likely for younger age groups (exp [.585] = 1.796), 1.1 times more likely for individuals with low education level (1/exp [-.12] = 1.128), approximately 3.5 times more likely for males (exp [1.243] = 3.468), approximately 1.5 times more likely for individuals with higher incomes (exp [.375] = 1.456), and approximately 1.9 times more likely for White/non-Hispanics (exp [.635] = 1.888). The Level 2 variable was significantly associated with freshwater fishing. The odds ratio showed that people who lived in the state with more per capita inland water area were 1.5 times more likely to participate in freshwater fishing (exp [.427] = 1.533). Overall, the full theoretical model explained 41% more variance in freshwater fishing in comparison to the null model.

Table 2

Multilevel Logistic Regression Estimates of Freshwater and Saltwater Fishing Participation: Model 1

	Freshwater Fishing	Saltwater Fishing
Intercept	-4.622(.009)***	-7.121(.001)***
Age (1= younger than 65)	.585(1.796)***	.475(1.608)***
Education (1= college graduate)	-.12(.886) ***	.248(1.282)***
Sex (1=male)	1.243(3.468)***	1.236(3.443)***
Income (1= $25,000 and more)	.375(1.456) ***	.677(1.969)***
Race/ethnicity (1=White/non-Hispanic)	.635(1.888)***	.427(1.533)***
Water Area (1 = .000225 per capita inland water area and more)	.427(1.533)***	--
Coastline (1= exist)	--	2.026(7.588)***
% of the variance in the intercept accounted by the model	41%	83%

Logistic regression coefficient *** $p < .001$ ** $p < .05$
Odds ratio in parentheses

These findings are similar to those observed with saltwater fishing. The odds ratios showed that saltwater fishing participation was 1.6 times more likely for younger age groups (exp [.475] = 1.608), approximately 1.3 times more likely for individuals with high education level (exp [.248] = 1.282), 3.4 times more likely for males (exp [1.236] = 3.443), approximately 2 times more likely for individuals with higher incomes (exp [.677] = 1.969), and 1.5 times more likely for White/non-Hispanics (exp [.427] = 1.533). The Level 2 variable was significantly associated with saltwater fishing, and people who resided in coastal states were approximately 7.6 times more likely to saltwater fish (exp [2.026] = 7.588). Overall, the full model explained 83% more variance in saltwater fishing in comparison to the null model.

Model 2 displayed some differences with Model 1 (Table 3). For freshwater fishing, the interaction between education and race/ethnicity (exp [.344] = 1.41), and income and race/ethnicity (exp [-.333] = .716) were significantly associated with activity participation. The effects of the interactions on the probability of freshwater fishing participation are shown in Figure 1. The probability was calculated by the formula mentioned in the methods section. The education and race/ethnicity interaction showed that Whites were more likely to freshwater fish than non-Whites regardless of their education. Notably, low education level increased the probability of freshwater fishing among non-Whites, whereas it actually decreased the probability of freshwater fishing among Whites. The income and race/ethnicity interaction showed that individuals with high income were more likely to freshwater fish than low income individuals regardless of their race/ethnic background, yet high income increased the probability of freshwater fishing among non-Whites more than it did for Whites. The odds ratios showed that freshwater fishing participation was 2.3 times more likely for younger generations (exp [.842] = 2.32) and approximately 3.9 times more likely for males (exp [1.352] = 3.865). The per capita inland water variable was significantly associated with freshwater fishing participation. Similar to Model 1, people who reside in the states with high per capita inland water area were 1.5 times more likely to participate in freshwater fishing (exp [.427] = 1.533). Overall, the full model explained 40% more variance in freshwater fishing in comparison to the null model.

For saltwater fishing, the interaction between education and race/ethnicity was significantly associated with activity participation (exp [.356] = 1.428). Figure 1 showed the effect of this interaction; individuals with high education were more likely to saltwater fish than individuals with low education regardless of their race/ethnic background. Notably, high education substantially increased the probability of saltwater fishing among Whites, whereas education had less effect on non-White participation. The odds ratios also showed that saltwater fishing participation was 2.6 times more likely for younger age groups (exp [.969] = 2.637), 4 times more likely for males (exp [1.394] = 4.031), and 2 times more likely for individuals with higher incomes (exp [.751] = 2.12). Living in a state with a coastline was the best predictor of saltwater participation. People who lived in the coastal states were 7.5 times more likely to engage in saltwater fishing compared to those who lived in the states without coastlines (exp [2.024] = 7.569). Overall, the full model explained 83% more variance in saltwater fishing in comparison to the null model.

Likelihood ratio tests showed that Model 2 has a better fit than Model 1. Compared to Model 1, Model 2 had a significantly lower deviance statistic for freshwater fishing ($\chi^2 = 48.23720$, $df = 10$, $p < .001$) and saltwater fishing ($\chi^2 = 21.75139$, $df = 10$, $p < .05$). Thus, demographic interactions significantly enhanced the models' explanatory power.

Using Model 1, the combined effects of six independent variables were also examined. Among 64 strata of status characteristics, this study only focused on the eight strata from the top (the most advantaged status characteristics) and eight from the bottom (the most disadvantaged status characteristics). The MHSP does not provide any explanation about the ordering of the rest (middle strata) because the effect of independent variables is randomly presented. As such, comparing the middle strata does not provide any meaningful explanation for a dependent variable. Given the MHSP suggests that the highest and lowest probability should be found in the top and bottom strata, probabilities for fishing should exhibit a downward trend with increasing combinations of lower statuses.

Table 3

Multilevel Logistic Regression Estimates of Freshwater and Saltwater Fishing Participation: Model 2

	Freshwater Fishing	Saltwater Fishing
Intercept	-4.703(.01)***	-7.217(.001)***
Age (1= younger than 65)	.842(2.32)***	.969(2.637)**
Education (1= college graduate)	-.525(.591)	.115(1.121)
Sex (1=male)	1.352(3.865)***	1.394(4.031)***
Income (1= $25,000 and more)	.690(1.994)**	.751(2.12)**
Race/ethnicity (1=White/non-Hispanic)	.327(1.387)	-.19(0.826)
Age*Education	-.016(.983)	-.234(.791)
Age*Sex	-.521(.593)	-.3(.74)
Age*Income	-.282(.753)	-.418(.657)
Age*Race/ethnicity	.414(1.512)	-.247(1.281)
Education*Sex	-.017(.982)	-.222(.8)
Education*Income	.124(1.132)	.208(1.231)
Education*Race/ethnicity	.344(1.41)**	.356(1.428)**
Sex*Income	.244(1.276)	.132(1.141)
Sex*Race/ethnicity	.167(1.182)	.096(1.101)
Income*Race/ethnicity	-.333(.716)**	.242(1.274)
Water Area (1 = .000225 per capita inland water area and more)	.427(1.533)***	--
Coastline (1= exist)	--	2.024(7.569)***
% of the variance in the intercept accounted by the model	40%	83%

Logistic regression coefficient *** $p < .001$ ** $p < .05$
Odds ratio in parentheses

Table 4 shows 16 strata of status characteristics and their fishing participation probabilities. A large gap exists between the highest (stratum 1) and lowest (stratum 64) strata's participation rates for the two measures of fishing, especially saltwater fishing. For freshwater fishing, the comparison of the highest and lowest strata showed that respondents in the highest were approximately 16 times more likely to fish compared to those in the lowest stratum. For saltwater fishing, individuals in the highest stratum were 145 times more likely to fish compared to those in the lowest. Respondents categorized into the six disadvantaged statuses were far less likely to participate in the fishing activities compared to those categorized into the six most advantaged statuses. Nevertheless, the negative effect of education on freshwater fishing did not correspond with expectations of MHSP. Figure 2 illustrates the participation rates for the various social strata. Although the highest freshwater fishing rate should be found in the highest stratum, the negative effect placed it in the third stratum (young White males with high income and non-college degree).

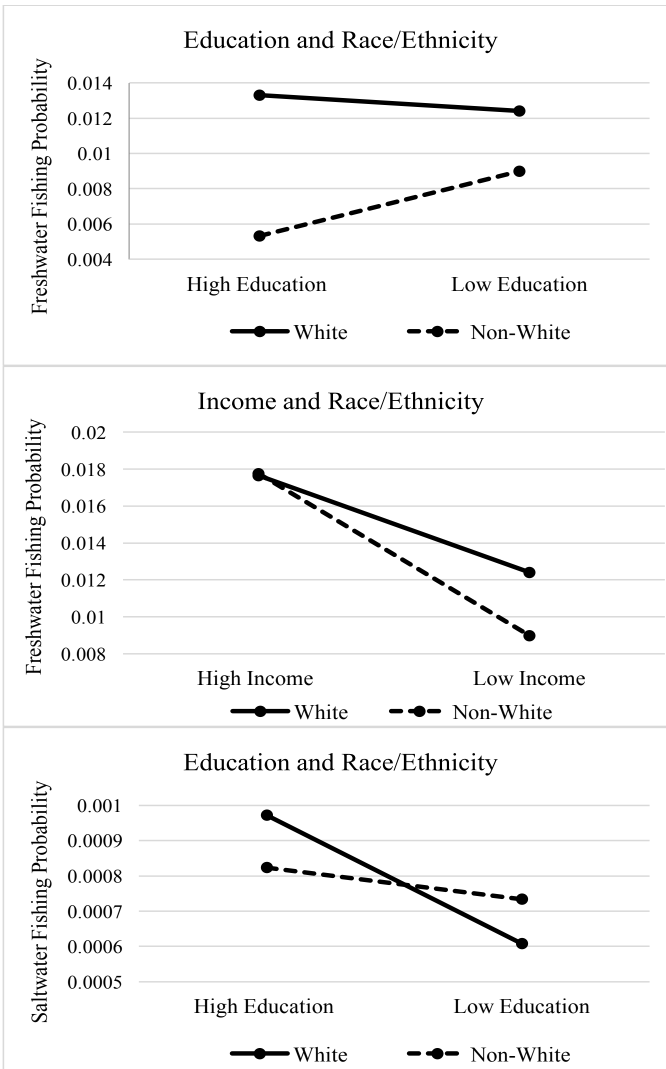

Figure 1. The Effect of Demographic Interactions on the Probability of Freshwater and Saltwater Fishing Participation

Table 4

Probability of Participation in Fishing Activities within the Multiple Hierarchy Stratification Perspective

Variables							Probability of participation	
Stratum	Race/ ethnicity	Sex	Age	Income	Education	Proximity to water (Residential status)	Freshwater fishing	Saltwater fishing
1	White	Male	Below 65	$25,000 and above	College	Affluent	.196	.116
2	White	Male	Below 65	$25,000 and above	College	Scarce	.144	.017
3	White	Male	Below 65	$25,000 and above	Non-college	Affluent	.215	.092
4	White	Male	Below 65	Below $25,000	College	Affluent	.144	.062
5	White	Male	65 and above	$25,000 and above	College	Affluent	.121	.075
6	White	Female	Below 65	$25,000 and above	College	Affluent	.067	.036
7	Non-White	Male	Below 65	$25,000 and above	College	Affluent	.116	.078
8	White	Female	65 and above	$25,000 and above	College	Affluent	.039	.023
57	White	Male	Below 65	Below $25,000	Non-college	Affluent	.159	.049
58	White	Female	65 and above	Below $25,000	Non-college	Scarce	.021	.001
59	Non-White	Male	65 and above	Below $25,000	Non-college	Scarce	.038	.002
60	Non-White	Female	Below 65	Below $25,000	Non-college	Scarce	.020	.001
61	Non-White	Female	65 and above	$25,000 and above	Non-college	Scarce	.017	.001
62	Non-White	Female	65 and above	Below $25,000	College	Scarce	.010	.001
63	Non-White	Female	65 and above	Below $25,000	Non-college	Affluent	.017	.006
64	Non-White	Female	65 and above	Below $25,000	Non-college	Scarce	.012	.001

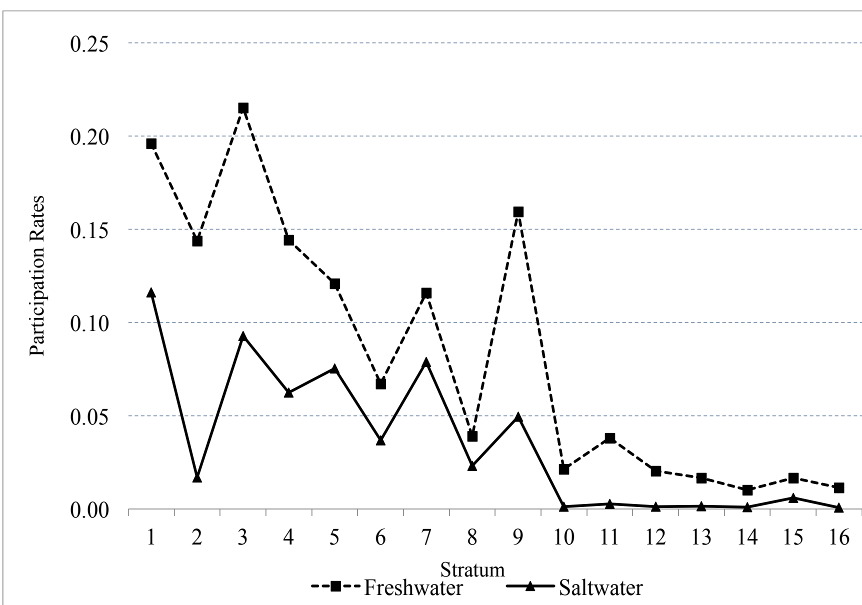

Figure 2. Probability of Participation in Fishing within the Multiple Hierarchy Stratification Perspective

Discussion

This study used MHSP to understand the effects of demographic variables, demographic interactions, and water supply variables on Americans' fishing participation on a national level. Findings provide qualified support of using MHSP to understand fishing participation, particularly saltwater fishing. Figure 2 showed that individuals with multiple advantaged statuses had substantially higher fishing participation rates compared to individuals with multiple disadvantaged statuses. Although the negative effect of education on freshwater fishing participation runs counter to the notion of MHSP, the wide gap between the highest stratum and lowest stratum clearly illustrates how fishing participation remains problematic for some population segments. Withstanding these caveats, MHSP provided a useful theoretical perspective for examining fishing participation in the U.S.

The two HGLM models showed that all Level 1 variables were important for explaining both freshwater and saltwater fishing. Sex in particular was the most influential and consistent demographic predictor for Americans' fishing participation. These findings are largely consistent with findings in earlier studies, which documented that minorities and women are less likely to fish compared to non-Hispanic White males (Dargitz, 1988; Duda, 1993; Fedler & Ditton, 2001; Floyd & Lee, 2002; Hunt & Ditton, 2002; Schroeder, Fulton, Currie, & Goeman, 2006). Non-Whites and females tend to experience several constraints to fishing, such as safety concerns (Johnson, Bowker, & Cordell, 2001), traditional gender role as a primary caregiver (Henderson, Bialeschki, Shaw, & Freysinger, 1989), and gendered or racialized meanings associated with fishing (Giltner, 2008; Toth & Brown, 1997). Findings here lend support to federal and state natural resource agencies' initiatives to recruit and retain diverse fishing participants. As non-Hispanic Whites continue to decline in the share of the U.S. population (Murdock, 2014), the recreational fishing industry will need to cultivate a more diverse fishing population to continue generating revenue for business owners and sustain user-supported fisheries programs (e.g., Federal Aid in Sport Fish Restoration). Efforts of natural resource agencies to address equity issues within their organizations are warranted.

Proximate access to water was central to predicting both freshwater and saltwater fishing participation. The effect of Level 2 variables was almost identical across Model 1 and Model 2 where both models showed that people who lived in states with high per capita inland water area were 1.5 times more likely to freshwater fish compared to people who lived in the states with scarce per capita inland water area. Similarly, people who lived in coastal states were approximately 7.6 times more likely to saltwater fish compared to those who lived in states without a coastline. These findings suggest the importance of environmental factors and available resources for fishing participation. Consistent with opportunity theory and previous fishing studies (Arlinghaus et al., 2015; Dabrowska et al., 2014), residential proximity to water resource was critical to both freshwater and saltwater fishing participation.

As noted, however, some findings were incongruent with previous studies and tenets of the MHSP. Holding a college degree exerted a negative effect on freshwater fishing. Figure 1 shows that the negative effect of education made the downward trend of freshwater fishing participation from the highest to lowest strata slightly uneven. For example, although MHSP suggests that the top stratum should possess the highest participation rate, it was found for the third stratum. Although some studies endorsed the utility of MHSP for various leisure activities (Lee et al., 2001; Pouta et al., 2009; Shores et al., 2007), findings here showed that the notion of MHSP does not perfectly align with freshwater fishing patterns at the national level.

Moreover, this study found that incorporating demographic interactions in the MHSP models significantly reduced deviance statistics and provided a better model fit for freshwater and saltwater fishing. Although previous MHSP studies overlooked possible interactions among various statuses in predicting different facets of leisure involvement, the improved explanatory power suggested that the MHSP's analytic perspective might be strengthened by taking into account *both* the interaction and additive effects of status variables. To explore this possibility, researchers are encouraged to test the applicability of statistical interactions within the MHSP using various samples and statistical models.

Some demographic interactions were significantly associated with freshwater and saltwater fishing. Three significant interactions illustrated a complex interplay among education, income, and race/ethnicity in freshwater and saltwater fishing participation. In particular, the interaction between education and race/ethnicity on both types of fishing are worth highlighting. For freshwater fishing, non-Whites with high education had lower freshwater fishing probability than non-Whites with low education. Although previous research has documented that American anglers tend to have high education, the present study showed that education negatively affected non-Whites' freshwater fishing participation. This finding suggests that non-Whites with a bachelor's degree are more likely to prefer other leisure activities or less likely to perceive freshwater fishing as an attractive and enjoyable leisure pursuit.

For saltwater fishing, non-Whites with low education were more likely to participate compared to Whites with low education. This finding is inconsistent with previous fishing studies that found lower fishing participation among non-Whites' compared to Whites (e.g., Floyd & Lee, 2002; Floyd et al., 2006; Hunt & Ditton, 2002; Jakus, Downing, Bevelhimer, & Fly, 1997). The discrepancy can be attributable to the fact that existing studies used statewide samples and either did not make a distinction between freshwater and saltwater fishing or focused solely on freshwater fishing. Thus, the present finding is a distinctive characteristic of Americans' saltwater fishing participation patterns.

One possible explanation for this finding is a disproportionally large number of non-White anglers resided in southern states with coastlines. A large number of African Americans and Hispanics reside in the southern area of the country. A report from U.S. Fish and Wildlife Service (Henderson, 2004) documented that 67% of African American anglers and 41% of Hispanic anglers live in 16 southern states. Among those 16 states, 11 states have coastline. Moreover, ancillary analysis here showed that nearly 90% of non-White saltwater fishing participants were residents of coastal states. Thus, the higher saltwater fishing participation rate among non-Whites might be partially due to the high concentration of non-White anglers in coastal states. Another possible explanation is cultural meanings associated with fishing in southern coastal states. Historically, fishing has been an important recreation and subsistence activity among African Americans in the U.S South (Brown & Toth, 2001; Giltner, 2008). It is possible that fishing has become a distinctive cultural activity that connects non-Whites to valued rural traditions and heritage. Thus, the unique culture embedded in fishing may be particularly attractive to non-Whites with low education compared to their White counterparts.

This study possesses three significant limitations. First, the operationalization of opportunity theory cannot capture multiple dimensions related to the context of fishing participation. In this study, the theory's effectiveness in explaining fishing participation was tested by incorporating per capita water area. Although the Level 2 variables provided valuable explanations about Americans' fishing participation, they do not take into account several important factors such as characteristics and quality of fishing locations, local fishing policies, travel time, and physical and cognitive distance. Previous studies on fishing site choice suggested these factors might also explain freshwater fishing participation (Hunt, 2005). For example, even if respondents live close to some water areas, they might not consider those places ideal fishing sites due to a number of reasons such as pollution and lack of preferred species of fish. Local fishing policy can be another important determinant of anglers' fishing site choice. Carlin et al. (2012) found that increases in bag and slot limits significantly raised Minnesota walleye anglers' preference for certain fishing lakes. The existing specialization literature has documented that experienced anglers tend to be selective in fishing site choice because they possess preferences for particular fishery resource attributes (Bryan, 2008; Fisher, 1997; Salz & Loomis, 2005). In other words, many anglers do not choose fishing locations blindly; they deliberately seek fishing sites that satisfy their specific recreation needs.

Moreover, although the operationalization of accessibility to water resources was based on the per capita water area and the existence of coastline in the states, some studies have indicated that travel time is a better indicator (Dubin, 1991; Weber & Sultana, 2013). They argued that accessibility to travel destinations should be understood based on travel time rather than distance because the latter can generate considerably different or erroneous outcomes in statistical analyses. Similarly, tourism scholars suggest that the concept of cognitive distance should be taken into account when conceptualizing accessibility because how tourists perceive the distance to their destination is considerably different than actual distance (Ankomah & Crompton, 1992; Ankomah, Crompton, & Baker, 1996). In sum, all the above information suggests that incorporating several other factors in operationalizing opportunity theory might provide different outcomes and expand understanding of fishing participation. Given that the data from the 2011 NSFHWAR do not provide these measures, the present study was not able to incorporate these factors. Researchers are encouraged to examine the relative influence of social status and various opportunity factors.

Second, results of logistic regression are subject to the way that independent variables are dichotomized. In this study, the five Level 1 variables were dichotomized based on existing literature on social inequality to differentiate advantaged and disadvantaged social status. Although previous MHSP studies advocated dichotomizing independent variables as one of the most practical approaches to operationalize the notion of the MHSP, this approach can cause loss of information about individual differences from constraining variance, overestimation of effect size, and potential to overlook non-linear relationships (MacCallum, Zhang, Preacher, & Rucker, 2002). However, as previous studies have shown, dichotomized measures are effective for characterizing status groups and their effects on fishing participation.

Finally, the data used in this study do not make a clear distinction between pure recreational fishers and quasi-subsistence fishers who rely on fishing to supplement food. Researchers have noted these groups have considerably different demographic characteristics and fishing orientation (Burger, 2002; Hunt, Floyd, & Ditton, 2007), suggesting that such difference can alter results of HGLM analyses. Due to the lack of available information, this study was not able to take into account these unique fishing dynamics into the statistical models.

Using MHSP as a theoretical perspective, this study documented that fishing participation is indeed highly related to the interplay of multiple status characteristics. As the number of American anglers is expected to continue declining, finding a way to rejuvenate fishing participation remains a serious concern for natural resource agencies and industries supported by recreational fishing. Fishing organizations should continue their efforts to promote fishing among all segments of the American population. On one hand, long-term outreach programs targeting groups who have not historically been exposed to fishing, such as urban residents, females, and non-Whites, are needed (Mangun & O'Leary, 2001). For general and targeted promotional programs, developing fishing interest and skills among youth is vital in coping with diminishing fishing popularity since people usually retain and revisit leisure activities experienced during socialization years (Bissell, Duda, & Young, 1998; Duda & Young, 1993; Scott & Willits, 1998). Moreover, to create effective marketing strategies for historically underserved groups, fishing and natural resource agencies should promote workforce diversity to foster a better understanding of the recreational needs and constraints of non-traditional users (Allison & Hibbler, 2004). On the other hand, fishing organizations should not neglect the needs of traditional users and must strive to retain existing clientele and stakeholder groups. Recognizing the ways in which social status affects fishing participation can inform strategies to reach under-served population segments and existing fishing constituencies. Continuing efforts of private and public sector fishing agencies' efforts to retain current participants and reach new audiences is critical to the future growth of the recreational fishing industry and broader expansion of benefits to individuals and communities.

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