USING MULTINOMIAL LOGISTIC REGRESSION ANALYSIS TO UNDERSTAND ANGLERS WILLINGNESS TO SUBSTITUTE OTHER FISHING LOCATIONS

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Abstract.—The concept of recreation substitutability has been a continuing research topic for outdoor recreation researchers. This study explores the relationships among variables regarding the willingness to substitute one location for another location. The objectives of the study are 1) to ascertain and predict the extent to which saltwater anglers were willing to substitute fishing at one location for fishing at another location; and 2) identify the relationship between independent variables such as demographic characteristics, constraints, and anglers' specialization variables as predictors and anglers' willingness to substitute one fishing location for another. From the results of the multinomial logistic regression analysis, anglers' willingness to substitute was affected negatively by age, and affected positively by a constraint variable; and anglers' willingness to substitute was negatively associated with specialization variables. Exploring the relationships between recreationists' willingness to substitute and specialization has implications for future research, and can be helpful to outdoor recreation managers for understanding recreationists' substitution behavior.

1.0 INTRODUCTION

The concept of recreation substitutability has been a continuing research topic for outdoor recreation researchers interested in the behavior of recreation users as well as economists and social psychologists studying recreation demand and motivation (Manning 1999, Shelby & Vaske 1991). The study of substitutability affecting leisure behavior is closely related to a research question about what kinds of indicators influence recreationists' willingness to substitute leisure behaviors that may bring about actual substitution in the future (Iso-Ahola 1986). Previous studies of substitutability have shown that each individual's perceptions could affect recreation substitutability whether it involves activity replacement or location displacement (Iso-Ahola 1980). The application of substitutability to recreational fishing research occurs when anglers participating in recreation fishing encounter constraints such as new regulations, limits to use, and conflicts with other recreation activities that in some way limit their fishing satisfaction.

Generally, there are four types of substitution alternatives involving resource and activity alternatives. These can be best viewed in a matrix format as provided by Shelby & Vaske (1991). These are the available alternatives for changing activity or resource or setting that recreationists could consider in making substitution decisions to get the same benefits and satisfaction (Manning 1999). Among the substitution alternatives identified by Shelby & Vaske (1991), first of all, there is the temporal/strategic substitute (changed behavior at the same resource and in the same activity) whereby users adjust their time schedule or use some alternative strategy to achieve the benefits they seek. Second, a resource substitute involves a situation where recreationists can choose to participate in the same activity but at a different location. Third, activity substitution involves a choice whereby users participate in an alternative activity at the same location. Finally, a resource and activity substitute occurs when recreationists choose to change both the resource and their activity. In the case of recreational fishing, anglers may choose one of these four types of substitution alternatives to get the same recreational satisfaction and benefits they get from fishing.

Resource substitution occurs when an individual engaged in recreation (e.g., fishing for largemouth bass) cannot enjoy the same experience due to some new regulations for the activity, and therefore he/she chooses to substitute the resource for others to achieve a similar level of satisfaction and benefits from the activity (Brunson & Shelby 1993, Hendee & Burdge 1974, Iso-Ahola 1986). Resource substitution is a behavioral change by anglers seeking similar benefits and satisfaction by

engaging in the same activity at a different site and at a similar cost. This may happen when anglers encounter constraints such as regulation, crowding, and poor fishing conditions. Although there have been a few studies regarding resource substitutability, previous research has explored the unsymmetrical nature of resource substitution (Shelby 1984), interactive effects between resource and activity (Ditton et al. 1975), and substitution between public and private recreation areas (Cordell 1976). Shelby (1984) argued that some anglers in a different fishing resource setting would be willing to substitute other locations while others would not. Otherwise, Ditton et al. (1975) has shown that each individual's participation frequency in recreation activity is strongly affected by the various types of environmental settings available. Cordell (1976) also reported there has been resource substitution between public and private recreational sites, due mainly to increasing recreation demand.

Bryan (1977) defined specialization as a continuum of behavior from the general level to the specialist level in a recreation activity. For measuring recreation specialization, there are three dimensions such as behavior, skill/knowledge, and commitment (Scott & Shafer 2001). Previous studies associated with recreational specialization of anglers have focused on segmenting them into groups based on specialization level. This research showed that substitution behaviors could be affected by recreationists' specialization level; for example, anglers with a high level of specialization tend to be less willing to make substitution decisions than those with a low level of specialization (Choi et al. 1994).

In substitution decision-making, previous studies have shown which predictors affect recreationists' substitution behavior. First, in the relationship between willingness to substitute and demographic variables, Ditton and Sutton (2004) showed that anglers' willingness to substitute was negatively related to age, positively related to education level, and greater for males than females in gender. Otherwise, Sutton and Ditton (2005) argued that females were more willing to substitute than males. This study investigated saltwater anglers' willingness to substitute for their most preferred species. Second, personal characteristics such as participation frequency and skill level have been shown to affect people's willingness to substitute (Snow 1980, Vaske & Donnelly 1982). Willingness to substitute has also been associated with recreation specialization (Bryan 1977, Ditton et al. 1992, Fisher 1997), in which high specialization or involvement is negatively related to willingness to substitute (Scott & Schafer 2001). Personal experience is directly related to a user's willingness to substitute among resource substitute locations through recreational place bonding (Hammitt et al. 2004). Baumgartner (1978) argued that recreation substitutability was determined by various elements regarding the entire experience. Previous research has shown that recreation substitution has a negative relationship with place attachment, resulting from long-term use in recreation resource, and an individual's previous experience could be an indicator with which recreationists evaluate recreation locations (Schreyer et al. 1984).

The objectives of this paper are 1) to ascertain and predict the extent to which saltwater anglers were willing to substitute fishing at one location for fishing at another location; and 2) identify the relationship between independent variables such as demographic characteristics, constraints, and anglers' specialization levels as predictors and anglers' willingness to substitute one fishing location for another. Most importantly, this study explores the relationship between specialization variables (behavior, skill/knowledge, and commitment) and anglers' willingness to substitute.

2.0 METHODS

2.1 Data Collection

This study used data regarding willingness to substitute from a stratified random sample of saltwater anglers. The sample frame for this study included licensed Texas resident anglers who fished in saltwater from 1997 to 1998. First, a random sample of 10,000 anglers was selected from the license database maintained by the Texas Parks and Wildlife Department, with 49 percent of the sample being anglers that resided in the first tier of Texas coastal counties. This was done to ensure a sufficient number of saltwater anglers. The usable number of angler responses from the Texas statewide survey was 4,052 (Bohnsack & Ditton 1999) of which 2,073 licensed anglers (51%) had gone fishing in

Table 1.—Dependent variable classified by four categories

Category	Description
1	I would choose another location along the Texas coast to go saltwater fishing
2	I would choose to go fishing in freshwater
3	I would cancel my fishing trip
4	It would not affect my fishing plans

saltwater one or more days during the previous twelve months. The sampling frame was all anglers that reported fishing one or more days in saltwater in the first phase, and the sample size was 2,073 licensed saltwater anglers.

Of the 2,073 questionnaires sent to the 2,073 anglers, 1,102 were returned. When nondeliverables were deleted (n = 971), there were 1,102 returns for an effective rate of 57 percent. About 1,005 were completed and hence usable for data analysis.

An eleven-page self-administered mail questionnaire was used to collect data and the survey process was consistent with the Dillman (1978) methodology. All mail questionnaires were sent by first-class mail, and also a postage-paid business reply envelope was used to increase return rate of the survey (Hiett & Worrall 1977, Chase & Godbey 1983, Chase & Harada 1984).

Questions in the survey questionnaire dealt with saltwater anglers' demographic characteristics; recreational specialization characteristics, consisting of behavior (total fishing days since last year), skill/knowledge (fishing skill, equipment, and guide), and commitment (fishing club membership and tournament participation); and constraints (e.g., regulation, fishing costs, fish types to catch, and fishing license fee).

2.2 Variables

Dependent Variable—Resource Substitution Behavior

Anglers' willingness to substitute was assessed by the following direct question.

> "In recent years, areas of the Texas coast have experienced red tide events and public health fishing advisories at particular locations. TPW and other state agencies issue public notices about these events. How would such an event at your favorite fishing destination affect your next fishing trip?"

From this question, respondents willing to substitute other resources can choose a resource substitute they considered acceptable. The basic question was based on previous work by Shelby and Vaske (1991), who used a multiple-choice question format (yes or no answer for each water body) and asked anglers to consider all acceptable resource substitutes. In contrast with this approach, our question sought to understand their exact meaning of a substitution by providing specific constraints such as red tide events and public health fishing advisories to understand what they say they will do to get the same fishing enjoyment and satisfaction at a similar cost. An answer with four categories was ordered from substitution of another saltwater fishing location to no substitution (Table 1). This question enables respondents to more accurately indicate specific locations they consider to be acceptable resource substitutes.

Independent Variables as Predictors

Independent variables as predictors of resource substitution behavior included recreation specialization variables (e.g., behavior, skill/knowledge, and commitment), demographic variables (e.g., age, gender, income), and constraints (e.g., perceived too many fishing regulations, too high overall cost, confusing fishing regulations, too confusing in differences between State and Federal fishing regulations, too expensive fishing licenses, and not always able to identify the types of fish to catch). A description of independent variables hypothesized as affecting anglers' willingness to substitute other locations is provided in Table 2.

Table 2.—Variable Names and Definitions of Variables Used in the Analysis

Variable	Description
Demographic Variable	
AGE	Anglers' age
GENDER	0 = Male, 1 = Female
INCOME	Income level (coded 1 to 11: 1 = Under $10,000, 11 = $100,000 and above)
Specialization	
TOTDAYS	Total number of fishing days since last year
TOTDAYSW	Total number of fishing days in saltwater since last year
ABILESW	Self evaluated fishing skills (1= less skilled, 2 = equally skilled, 3 = more skilled)
REPLACE	Replacement cost for all fishing equipment owned by angler
GUIDE	Fishing without a guide (0 = no, 1 = yes)
CLUB	Member of a fishing club or organization (0 = no, 1 = yes)
TOURNSW	Participation in a saltwater fishing tournament (0 = no, 1 = yes)
Constraints	
CONST1	Too many fishing regulations (1 = Strongly Disagree to 7 = Strongly Agree)
CONST2	Too high overall cost (1 = Strongly Disagree to 7 = Strongly Agree)
CONST3	Too confusing fishing regulations (1 = Strongly Disagree to 7 = Strongly Agree)
CONST4	Too confusing in differences between State and Federal fishing regulations (1 = Strongly Disagree to 7 = Strongly Agree)
CONST5	Too expensive fishing licenses (1 = Strongly Disagree to 7 = Strongly Agree)
CONST6	Not always be able to identify the types of fish to catch (1 = Strongly Disagree to 7 = Strongly Agree)

To measure the effect of specialization variables on willingness to substitute of anglers, seven items (two behavior items, three skill/knowledge items, and two commitment items) were used (TOTDAYS & TOTDAYSW; ABILESW, REPLACE & GUIDE; CLUB & TOURNSW).

2.3 Analysis

Logistic regression analysis was used to identify the relationships between dependent variable (resource substitution behavior) and independent variables (recreation specialization, socioeconomic characteristics, and constraints). The logistic regression model is shown as the following form:

$$\ln(p/1\text{-}p) = \beta_o + \beta_i X_i$$

where p = the probability of resource substitution behavior; (p/1-p) = odds of resource substitution behavior; β_o = constant; X_i = vector of independent variables; β_i = parameter estimate for the ith independent variable. The logistic regression is powerful in its ability to estimate the individual effects of continuous or categorical independent variables on categorical dependent variables (Wright 1995).

The multinomial logistic regression model used is generally effective where the dependent variable is composed of a polytomous category having multiple choices. The basic concept was generalized from binary logistic regression (Aldrich & Nelson 1984, Hosmer & Lemeshow 2000). In a multinomial logistic regression model, the estimates for the parameter can be identified compared to a baseline category (Long, 1997). In this study, having no willingness to substitute was specified as the baseline category. The multinomial logistic regression model with a baseline category would be expressed as follows:

$$\text{Log}\ (\pi_i / \pi_I) = \alpha_i + \beta_i x,\ i = 1,\ldots..,I\text{-}1.$$

The logistic model uses the baseline-category logits with a predictor x. This multinomial logistic regression model can be a useful tool for modeling where the dependent variable is a discrete set of more than two choices (Agresti, 1996). The multinomial logistic regression model used in this study estimates the effect of the individual variables on the probability of choosing a type of alternative resource substitute for their recreational fishing activity.

Table 3.—Descriptive Statistics for All Variables Included in the Analysis

	Mean	Std. Dev.	Minimum	Maximum
Demographic Variables				
AGE	45.02	10.89	18	77
GENDER	0.17	0.37	0	1
INCOME	6.76	2.90	1	11
Behavior				
TOTDAYS	27.62	33.53	0	310
TOTDAYSW	22.40	35.70	0	440
Skill/Knowledge				
ABILESW	1.85	0.67	1	3
REPLACE	11858.4	23089.8	0	352000
GUIDE	0.50	0.50	0	1
Commitment				
CLUB	0.84	0.37	0	1
TOURNSW	0.18	0.38	0	3
Constraints				
CONST1	3.81	1.91	1	7
CONST2	4.65	1.78	1	7
CONST3	4.06	1.90	1	7
CONST4	4.48	1.74	1	7
CONST5	4.48	2.02	1	7
CONST6	3.44	2.08	1	7

3.0 RESULTS

Most anglers (83.2%) were male. About 18 percent of the anglers said their annual household income was $100,000 or above, and 47.4 percent reported an annual household income between $30,000 and $69,999. Most anglers (58%) were between the ages of 31 and 50. Most (90.3%) indicated a willingness to substitute other water resources or to cancel their fishing trip that would provide the same fishing satisfaction and enjoyment with their current fishing activity. Descriptive statistics for the 16 independent variables included in the analysis are presented in Table 3.

Only 10.2 percent of the anglers reported that there was no substitute for their original fishing plans. Most anglers (89.8%) said that there was another fishing location or that canceling their fishing trip could be substituted for saltwater fishing. In more detail, 48.7 percent of the anglers said they would choose another location along the Texas coast to go saltwater fishing; 16.2 percent said they would go fishing in freshwater, and 24.9 percent said they would cancel their fishing trip. Most anglers (59%) also reported there were other recreational activities that would provide the same level of satisfaction and enjoyment as saltwater fishing. The most frequently identified substitutable recreational activities for saltwater anglers were freshwater fishing (40.1%), hunting (32.6%), camping (20.3%), and golf (11.0%).

The final model specification of Table 4 was statistically significant ($\chi^2 = 85.817$; $p < 0.0001$). From the results of the multinomial logistic regression analysis in the model, anglers' willingness to substitute was affected negatively by age, and anglers' willingness to substitute was strongly affected negatively by specialization variables (behavior: Total days in saltwater; skill/knowledge: Fishing without guide; commitment: Club membership and Tournament participation). There was no significant effect of gender, income, total fishing days since last year, fishing skill compared to other anglers, and equipment costs and most other constraints on anglers' willingness to substitute other locations. The results are in accordance with predictions from previous studies and show the relationship between specialization variables and anglers' willingness to substitute, and how much anglers' willingness to substitute is affected by recreation specialization variables.

Table 4.—Results of the Multinomial Logistic Regression in the Final Model showing Significant Effects on Anglers' Willingness to Substitute other locations (Final model included only significant variables at .05 level)

Anglers' Willingness to Substitute Decision[a]		Estimate	SE	Wald	df	p (Sig.)	Odds ratio
1	Intercept	4.424	1.137	15.145	1	.000	
Choosing another location	AGE	-.256	.129	3.920	1	.048	.774
to go to saltwater fishing	GUIDE	-1.018	.304	11.237	1	.001	.361
2	Intercept	5.107	1.289	15.698	1	.000	
Choosing freshwater fishing	TOTDAYSW	-.489	.188	6.750	1	.009	.613
	CLUB	-1.038	.485	4.574	1	.032	.354
	TOURNSW	-1.321	.516	6.569	1	.010	.267
	GUIDE	-.748	.346	4.662	1	.031	.473
3	Intercept	3.757	1.226	9.393	1	.002	
Canceling fishing trip	GUIDE	-.812	.327	6.177	1	.013	.444
	CONST2	.269	.120	5.051	1	.025	1.309

N= 629 (no substitute for saltwater fishing = 61; substitution for other locations = 568).
Model chi-square = 85.817; p<0.0001, –2 log likelihood = -1409.979, Pseudo R2 (Nagelkerke) = 0.140.
a The reference category is: 4 (Not willing to Substitute other locations)

4.0 DISCUSSION

To better understand anglers' willingness to substitute alternate locations, this study used predictors such as specialization, socio-demographic, and constraint variables. Among them, recreation specialization was expected to be an important factor to affect recreationists' future behavior in outdoor recreation research as well as management issues. As such, this study examined the relationship between anglers' substitutability and three kinds of recreation specialization dimensions, which were divided into behavioral (behavior), cognitive (skill/knowledge), and affective (commitment).

As shown in this study, resource substitutability by saltwater anglers can be measured by the level of a willingness to substitute another location for one location. Results showed anglers' willingness to substitute was around 90 percent and that only 10 percent of the anglers reported they were not going to change their original saltwater fishing plans. The result of anglers' willingness to substitute was consistent with Shelby and Vaske (1991), which showed that if anglers could not go salmon fishing on the Rakaia and Waimakariri rivers, most anglers (70% and 75% on each river, respectively) in recreational salmon fishing were not willing to substitute other rivers for their first choices. Since there have been only a few previous studies dealing with resource substitutability in outdoor recreation activities, we cannot assume our results can be compared directly with previous studies. However, we know that many studies regarding substitution have been concentrated on recreationists' willingness to substitute under some hypothetical condition (substitutability) rather than actual behavioral change in their resources or activities.

The multinomial logistic regression model provided sufficient evidence that recreation specialization was closely associated with an individual's willingness to substitute other locations as in a previous study (McFarlane 2004), which means that recreation specialization influences anglers' substitution behavior. The results showed how much specialization, constraints, and demographic variables are related to anglers' willingness to substitute other fishing locations for one location. The multinomial logistic regression using a classification method for the dependent variable would provide a more satisfactory solution compared to other analysis techniques because it not only requires strict assumptions, but enables a direct interpretation of the relationship between independent variables and the dependent variable (Press & Wilson 1978). Findings of substitutability studies to understand recreationists' future behaviors have been applied to management issues even though results were not clear-cut (Manfredo & Anderson 1987, Absher & Graefe 1988).

Future research needs to extend the study range to apply to resource management and development decisions. This effort involves how the three dimensions of recreation specialization are associated with recreationists' involvement, motivation, and social groups. This study as pre-research for future research will help various stakeholders (e.g., voluntary association groups, national or regional agencies, and other related groups) and researchers understand recreationists' substitution behavior. Additionally, the results of this study suggested that recreationists' specialization level (behavioral, cognitive, and affective) is closely related to their future behavior pattern, such as recreation substitutability. While this study did not deal with other unknown indicators that may affect willingness to substitute, it provides recreation site managers and researchers with some management implications such as the important factors affecting recreationists' substitution behavior. This study may also help managers understand how to maintain recreation areas.

5.0 CITATIONS

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