

LONGITUDINAL ANALYSIS OF FISHING BEHAVIOR AMONG TEXAS ANGLERS (1990-2006)

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Abstract.—This study examined fishing participation and experience preferences of Texas anglers from a longitudinal perspective. Data were obtained from five independent statewide surveys of licensed Texas anglers conducted by Texas A and M University in 1990, 1994, 1998, 2002, and 2006. We observed the following changes between 1990 and 2006: 1) Fishing participation, especially saltwater fishing, increased; 2) male and minority participation increased; 3) the average age of anglers rose; and 4) the number of anglers from rural areas decreased. There were also changes in fishing motivations. For example, *getting away from the demands of other people* and *being with friends* declined in importance. The number of anglers motivated by social factors and a desire to be in a natural environment increased rapidly over the 16 years; this group of anglers reported a higher participation rate for saltwater fishing, were more likely to own a boat, and felt more satisfied with their fishing experience.

1.0 INTRODUCTION

Expanding cross-sectional survey research into a longitudinal context allows more in-depth analysis of user trends and uncovers the dynamics of recreation behaviors. Yet, with few exceptions, longitudinal analysis in recreation research is rare. Research has shown national declines in the angler population. However, less is known about whether anglers' motivations and behaviors have changed correspondingly. Understanding these trends provides information to create strategies for maximizing

human benefits, engaging current and potential anglers, and conserving natural resources. The purpose of this study was to examine changes in the social, demographic, and psychological characteristics of Texas anglers over time by compiling five statewide surveys (the 1990, 1994, 1998, 2002, and 2006 Statewide Surveys of Texas Anglers) into one large data set for trend analysis.

2.0 LITERATURE REVIEW

2.1 Longitudinal Design in Recreation and Human Dimension Research

To date, most longitudinal studies in recreation are trend studies focusing on profiles of participants. Snepenger and Ditton (1985) explored trends in several socio-demographic, recreation behavior, and resource use indicators for recreational hunting and fishing using the National Survey of Fishing, Hunting and Wildlife-Associated Recreation (FHWAR) (1955-1980). By integrating trend analysis of FHWAR 1980-2006 (United States Fish and Wildlife Service 2007 and U.S Census data 2000-2030, Schuett et al. (2009) found that participation rates for hunting, fishing and wildlife-associated recreation have declined over the last generation. Overall, projections of participation are modest; however, participation increases are expected in the growth areas of the South and West and among nonwhite populations. Kuentzel and Heberlein (2003) conducted a more in-depth trend analysis using combined panel and trend study designs to study relationships among changing visitor characteristics, behaviors, normative standards, and perceived crowding from 1975 to 1997. Their findings suggest that the relationship between crowding perceptions and visitor numbers are unstable over time. Consequently, developing capacities based on a normative model requires continual monitoring of both norms and perceived crowding.

2.2 Motivation-based Trend Studies

In a study of temporal changes in the motivations of freshwater-fishing club members over a 10-year span, Schramm and Gerard (2004) also concluded that

some motivations for fishing (e.g., being outdoors, relaxation, and the experience of the catch) remained consistent over time, while other motivations (e.g., family recreation, being with friends, and obtaining fish for eating) declined in importance. However, their study focused on individual motivational items and did not examine motivations from a multivariate approach. Legare and Haider (2008) used trend study and time series design to explore how the introduction of several restrictive management policies affected hikers at the Chilkoot Trail National Historic Site of Canada. They found that motivation-based clusters differed in their reactions to indicator variables such as advance booking time, perceived management problems, encounters, and satisfaction. One limitation of their work is that the cluster segmentation did not preserve motivation trails identified from the factor analysis.

Trend studies are an important longitudinal method for assessing changes in Americans' recreation participation and use of natural resources. However, there are few motivation-based trend studies in the literature. This study sought to explore changes in Texas anglers' experience preferences in addition to their profiles and participation, using multiple cross-sectional datasets. This study's objectives were to: 1) conduct Spearman's Rank Order Correlation analysis to examine secular trends of anglers' socio-demographic characteristics and participation; 2) examine trends in the importance of individual motivation items; 3) identify motivational factors using principal component analysis; 4) develop motivational clusters (with preserved factor traits) using cluster analysis with K-mode as the centroid and Hamming distance as the distance between the subject and the cluster; and 5) examine participation trends among motivational clusters.

3.0 METHODS

Data were obtained from five independent statewide angler surveys in Texas. The Texas A and M University Human Dimensions Laboratory conducted studies of anglers who obtained licenses in 1990, 1994, 1998, 2002, and 2006 from the Texas Parks and Wildlife Department (TPWD). Computer-generated random samples were selected from the list of licensed anglers

maintained by the TPWD in corresponding years. The questionnaires contained information on anglers' demographics, participation, catch and noncatch motivations, resource use indicators, and attitudes and opinions on a variety of resource management issues.

4.0 RESULTS

4.1 Demographic and Participation Trends

Table 1 summarizes demographic and participation variables. Due to the small number of temporal observations in this study, Spearman's Rank Order Correlation coefficients were employed to demonstrate secular trends over time. Secular trends consist of gradual increases or decreases over time. The Spearman's Rank Order Correlation coefficient is a nonparametric measure of the monotonic relationship between two variables that makes no assumptions about the frequency distribution of the variables (McDonald 2008). Large absolute values for the test statistics are required for monotonic change to be considered significant with a small number of temporal points (Snepenger and Ditton 1985).

The proportion of males in the angler population increased from 79 percent to 85 percent during the study period. The rank order correlation shows that survey year and gender ratio are positively and significantly correlated ($r_s \geq 0.9$, $p = 0.05$, $n = 5$). Changes were identified in the distribution of age cohorts ($r_s \geq 0.9$, $p = 0.05$, $n = 5$). The 45- to 54-year old and 55- to 64-year-old age groups collectively increased from 35 percent in 1990 to 55 percent in 2006. On the other hand, the number of anglers younger than 45 years old declined 20 percent. Upward trends were observed in average household income ($r_s \geq 0.9$, $p = 0.05$, $n = 5$). Although whites continued to be the dominant racial group, the percentage decreased from 92 percent to 84 percent ($r_s \geq 0.9$, $p = 0.05$, $n = 5$). Notably, the population of Hispanic anglers increased over time (from 1 percent to 10 percent) and is now the second largest racial group of Texas anglers. Participation trends for other racial groups such as African Americans and Asians are not monotonic ($|r_s| \leq 0.9$). Finally, a trend of anglers increasingly coming from urban centers was noted ($r_s \geq 0.9$, $p = 0.05$, $n = 5$).

Table 1.—Demographic and participation trends for Texas anglers, 1990-2006

Variables	1990	1994	1998	2002	2006	rs
Gender (%)						
Male	79.6	82.3	80.9	84.0	84.9	0.9*
Female	20.4	17.7	19.1	16	15.1	-0.9*
Age (%)						
18-24	6.5	3.4	5.9	4.2	3.9	-0.4
25-34	23.6	19.5	16.9	12.6	11.9	-1*
35-44	30.3	31.5	30.2	25.7	24.8	-0.9*
45-54	22	25.5	26.6	30.9	29.7	0.9*
55-64	14.5	15.4	17.7	23.1	26.6	1*
>65	3.2	4.7	2.7	3.5	2	-0.5
Income (Median)	40,000-49,999	40,000-49,999	50,000-59,999	60,000-69,999	60,000-69,999	1*
Race						
White	91.1	87.0	83.7	85.2	83.2	-0.9*
Black	3.5	3.6	2.7	2.8	3.8	0.2
Hispanic	0.7	7.9	6.9	10.1	10.1	0.87
Asian/American Indian	4.6	1.1	2.4	1.2	1.6	-0.3
Multi-racial	0	0.4	4.4	0.7	1.5	0.7
Residence						
Rural	77.1	74.5	72.0	71.9	66.3	-1*
Urban	22.9	25.5	28.0	28.1	33.7	1*
Participation (%) in						
Freshwater fishing	70.3	81.4	76.2	71.7	75	0.1
Saltwater fishing	47.8	53.8	59.7	53.6	63.4	0.7
Days fishing in						
Freshwater	23.8	24.8	23.9	22.9	24.9	0.3
Saltwater	18.6	20.4	18.7	19.7	18.4	-0.3
Satisfaction (Mean) ^a						
Freshwater fishing	3.3	3.4	3.5	3.4	3.5	0.7
Saltwater fishing	2.9	3.4	3.4	3.5	3.6	0.9*
Self-perceived skill level (mean) ^b						
Freshwater fishing	1.7	1.7	1.8	1.8	1.8	0.9*
Saltwater fishing	1.7	1.8	1.8	1.8	1.9	1*

^a Measured on a 5-point scale with response categories ranging from 1 (not at all satisfied) to 5 (extremely satisfied).

^b Measured on a 3-point scale with response categories ranging from 1 (less skilled than other anglers) to 3 (more skilled than other anglers).

Freshwater fishing continued to be a favorite activity for Texas anglers. More than 70 percent of respondents indicated that they had fished in freshwater during the previous year in all five surveys. However, the participation rate for freshwater fishing fluctuated over time; freshwater participation peaked in 1994 (81 percent), declined in 1998 (76 percent) and 2002 (72 percent), and then bounced back in 2006 (75 percent). Saltwater fishing participation grew rapidly from 48 percent in 1990 to 67 percent in 2006 except between 1998 and 2002. In 2006, anglers spent an average of 25

days fishing in freshwater, a 1-day increase since 1990. Days spent fishing in saltwater remained constant during the survey period (18 days on average). Self-perceived fishing skill increased moderately for both freshwater and saltwater fishing. The mean score of 1.8 (based on a 5-point scale) indicates that most anglers consider themselves as skilled as or more skilled than other anglers.

4.2 Experience Preference Trends

Overall, anglers' motivations did not change drastically over 16 years (Table 2). The motivations of relaxation,

Table 2.—Importance of motivations^a, 1990-2006

Motivation items	Mean difference		P value ^b	Mean difference		P value	Rank difference	
	1990	1998		1998	2006		1990	2006
To be outdoors	4.05	4.18		4.18	4.21		2	2
For family recreation	3.59	3.77	*	3.77	3.92	*	8	7
To experience new and different things	2.99	3.19	*	3.19	3.36		13	13
For relaxation	4.19	4.31	*	4.31	4.27		1	1
To be close to the water	3.31	3.60	*	3.60	3.78	**	11	9
To obtain fish for eating	2.84	2.87		2.87	2.94		14	14
To get away from the demands of other people	3.66	3.75		3.75	3.77		6	10
For the experience of the catch	3.66	3.92	**	3.92	4.07	**	6	5
To test my equipment	2.06	2.24	**	2.24	2.36		16	16
To be with friends	3.35	3.46		3.46	3.66	*	10	11
To experience unpolluted natural surroundings	3.95	3.94		3.94	3.99	*	5	6
To win a trophy or prize	1.53	1.61	**	1.61	1.57		18	18
To develop my skills	2.59	2.76		2.76	2.87	*	15	15
To get away from the regular routine	4.01	4.06		4.06	4.11	*	4	4
To obtain a “trophy” fish	2.01	2.19	**	2.19	2.17		17	17
For the challenge or sport	3.29	3.41	*	3.41	3.42		12	12
For the fun of catching fish	4.02	4.18		4.18	4.24	*	3	3
To experience adventure and excitement	3.58	3.77	**	3.77	3.86	*	9	8

^a Based on a scale from 1 = very important to 5 = not important at all.

^b Independent samples t-tests; * means $\alpha < .05$; ** means $\alpha < .001$.

being outdoors, for the fun of catching fish, and getting away from the regular routine were consistently the most important motivational items. Winning a trophy or prize, obtaining a “trophy” fish, and testing equipment were consistently the least important motivations. There were significant increases in the importance of many motivation items, but some were not consistent in between-year comparisons. One notable exception was the increasing importance of the experience of catching fish ($p = 0.000$) in both years. On the list of motivations, its ranking increased from seventh in 1990 to fifth in 2006. The motive to get away from the demands of other people dropped from sixth in importance in 1990 to twelfth in 2006, and the item to be with friends had dropped off the top-ten list of items by 2006.

A principal component analysis of all motivations for fishing resulted in four factors with an Eigenvalue

greater than 1 (Table 3). These factors explained 54 percent of the total variance. The four factors were then labeled as: natural environment and social factors (F1), challenge and adventure (F2), skill and equipment (F3), and escape and relaxation (F4). The tests of internal consistency (all $\alpha > .60$) indicated good scale reliability. These motivational dimensions were used for a cluster analysis to segment anglers into homogenous groups. In the variants used in the analysis, distances were computed based on the responses to questions in a particular factor dimension. In other words, this approach preserved the factor or motivational trait.

Figure 1 documents the change in the relative proportion of respondents in each of the segments over the observed time period. The most notable trend was the steady increase in the F1 cluster ($r_s = 1$, $p = 0.05$, $n = 5$) as it gained 11 percentage points to become the second largest

Table 3.—Factor analysis of motivational items

Motivation Items	Component			
	F1 Natural/ Social Environment	F2 Challenge/ Adventure	F3 Skill/ Equipment	F4 Escape/ Relaxation
To be outdoors	.58			
For family recreation	.70			
To experience new and different things	.68			
To be close to the water	.55			
To experience unpolluted natural surroundings	.49			
To be with friends	.44			
For the fun of catching fish		.83		
For the experience of the catch		.71		
For the challenge or sport		.68		
To experience adventure and excitement		.66		
To win a trophy or prize			.83	
To obtain a “ trophy” fish			.76	
To develop my skills			.64	
To test my equipment			.62	
To get away from the demands of other people				.80
To get away from the regular routine				.80
For relaxation				.62
Eigenvalue	5.37	2.02	1.22	1.12
Cronbach’s alpha	0.63	0.79	0.77	0.70
Factor mean	3.54	3.76	2.17	4.00

cluster (29 percent) as of 2006. The F4 cluster contained the largest proportion of anglers during each survey and no significant change over time was found. The number of anglers in the F2 and F3 groups declined, although not significantly. Finally, MANOVA and chi-square tests revealed behavioral differences between clusters. For instance, the F1 anglers had higher participation rates for saltwater fishing than anglers in other groups, were more likely to own a boat, and were more satisfied with their fishing experience.

5.0 DISCUSSION

The objective of this study was to explore trends in demographics, motivations for fishing, and consumptive orientation of recreational anglers from a multi-dimensional, longitudinal perspective. A comparison of our results on demographics and participation with the report of FHWAR (1991, 1996, 2001, and

2006) revealed that the percentage of Caucasian anglers consistently decreased over time in Texas and nationwide. At the same time, Hispanic and other minority groups were quickly increasing their angling participation. These changes were more dramatic in Texas than in the U.S population generally. Texas also had fewer female and senior (above age 65) anglers than the national estimates. On the other hand, Texas had higher saltwater fishing participation rates and more days spent fishing for both freshwater and saltwater anglers. Although fishing participation in the United States continued to decline from 1990 to 2006, the participation of license-purchasing anglers increased in Texas, especially for saltwater fishing. The results suggest a transition to fewer, but more active, anglers. Previous literature indicated that Hispanic anglers are more likely to participate in saltwater fishing (Bissell et al. 1998, Ditton et al.1998, Hunt and Ditton 2001). The dramatic

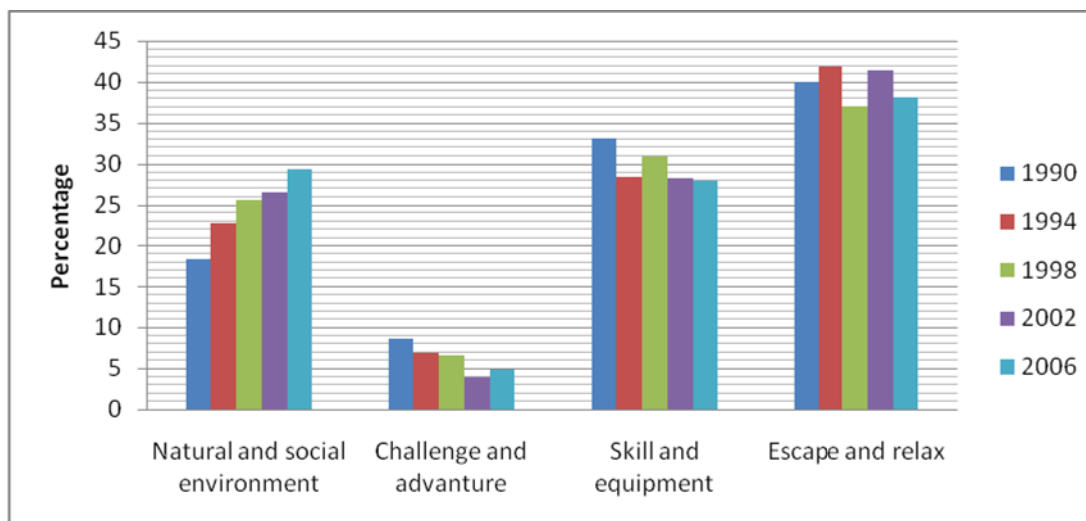


Figure 1.—Trends in motivation clusters 1990-2006.

increases of Hispanic and other minority populations in Texas could be contributing to increased saltwater participation.

Study results on experience preferences indicated that relaxation, being outdoors, experiencing the fun of catching fish, and escaping the day-to-day routine remained important reasons for fishing. Similar motivation items were also as important in other angler studies (Schramm and Gerard 2004). Consistency in the ranking of the majority of the motivation items over time is reasonable because motives are often viewed as relatively stable characteristics of personality (Atkinson 1964). On the other hand, there were changes in the importance of a few motivations. For example, getting away from the demands of other people and being with friends declined substantially in importance. Being with friends may decline as a primary reason for recreational fishing as older anglers leave the fishing population (Schramm and Gerard 2004).

Results from the factor and cluster analyses suggested that anglers were increasingly concerned with the natural environment and social factors and were less motivated by escape, challenge, and skill development motives. We may offer at least two explanations for this trend. First, anglers from densely populated urban areas tend to rate *escape* of lower importance since they are aware that opportunities for fishing in solitude are limited (Fedler and Ditton 1994). Increases in the population

of Hispanic anglers (who tend to prefer family-oriented recreation activities) will positively affect the number of anglers primarily interested in group-based recreation.

6.0 CONCLUSION

The purpose of this study was to monitor changes in recreational fishing experience preferences. This paper has several implications for future research and management. First, this study demonstrates the potential for using secondary data to document baseline participation and to identify change over time. This study also demonstrates the value of examining data from regional populations. Many recreational trend studies still rely on national surveys, while attention should be paid to regional populations and to related social and environmental changes – factors which can impact fishing mode and motives. Managers using generalized results from national surveys may encounter local resistance to proposed statewide regulations. Other data sources are needed to identify regional and national differences. Finally, as anglers increasingly report motivations related to social and environmental factors, researchers and managers need to look beyond motives to understand their behaviors. Other forms of longitudinal study, such as panel surveys (i.e., researching the same anglers over time) could be used to understand micro-level changes. This study supports the need for more research on the relationships between motivational changes and behavioral responses over time, and provides support for including other variables (such as setting preference,

species sought, satisfaction, and response to management) in the analysis. Recreation researchers or managers need to re-evaluate their use of secondary datasets and explore how these datasets can be analyzed to provide useful longitudinal information. Longitudinal data can be most useful when researchers account for differences on questionnaires with respect to wording, contexts, sampling, or analysis techniques that might differ from one survey to the next.

7.0 CITATIONS

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