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Abstract.—This paper focuses on selected human-dimensions indicators of the Texas recreational fishery using the Index of Qualitative Variation (IQV) and Spearman Rank-Order Correlation Coefficient. Minority (Hispanic, Spanish, and females) participation and the overall participation rate in saltwater fishing did not keep pace with a dramatic population transformation in Texas over the last 16 years. Recreation behavior indicators also demonstrated a positive trend in that saltwater anglers have more experience and rate themselves as more skilled over time. Self-assessed skill improved steadily over the last decade. This finding suggests there are more high-specialization (higher levels of skill, experience, and commitment) anglers in the Texas saltwater angler population than previously. The extent of angler satisfaction has been high and increased consistently over time. Also, an increasing preference for red drum (Sciaenops ocellatus) is important because stocks of this species are currently being enhanced through hatchery production. Finally, this paper demonstrates the need for consistent human-dimensions questions over time and the types of important sociodemographic, recreation behavior, and resource use questions that can be answered using longitudinal data.

1.0 INTRODUCTION

In general, outdoor recreation research lacks studies that test hypotheses that may be affected by temporal processes. Most outdoor recreation research has used cross-sectional study designs, which provide “instantaneous” or “point in time” perspectives. While this approach is useful, it has limitations. Often, these limitations result from a narrow time perspective. For example, it would not be safe to infer that anglers become more skillful as household income increases, based on cross-sectional data. If anglers spend more money than before, it cannot be concluded that anglers are more involved and skillful; a more plausible explanation is that the economic situation of saltwater anglers has improved over time (a period effect).

Longitudinal studies, or studies with repeated measures over time, can provide better information than typical cross-sectional surveys (Bohnsack 2002). In particular, longitudinal analyses have been adopted by social scientists interested in change, process, and the dynamic aspects of social and cultural phenomena (Glenn & Frisbie 1977).

In this paper, selected human-dimensions indicators of the Texas saltwater fishing were used, along with a longitudinal analysis. Six statewide angler survey data sets (1989, 1990, 1993, 1998, 2002, and 2005) were used to analyze selected human dimensions indicators.

2.0 METHODS

Survey procedures followed the Total Design Method (TDM) and modified TDM created by Dillman in 1978 and 1994, respectively. Data for these six studies were obtained from a series of stratified random samples of Texas resident fishing license holders. To ensure adequate numbers of saltwater anglers in the sample, 49% of the anglers sampled lived in the first tier of Texas coastal counties. This practice has been used in statewide surveys of resident licensed anglers in 2002 (Anderson & Ditton 2004), 1998 (Bohnsack & Ditton 1999), 1994 (Ditton & Hunt 1996), 1990 (Ditton & Fisher 1992), and 1989 (Hunt & Ditton 1991). None of the samples included persons age 65 and older as they were exempted from the general angler license category. Telephone follow-up interviews (Hunt & Ditton 1991) were used to extrapolate the non-response adjustment in the first two statewide surveys. Since the 1994 statewide survey, logistic regression (Fisher 1996) was used for non-response adjustment purposes.

2.1 Analysis Variables

In this study, three groups of human-dimensions indicators were used to identify stability, change, and
direction of change in Texas saltwater fishing. Three
groups of variables were included: Sociodemographic,
Recreation Behavior, and Resource Use indicators.

Sociodemographic Indicators
Sociodemographic indicators were assessed using gender,
age, ethnicity, and household income. The age variable
was measured by years of age; ethnicity was asked by
dichotomous choice of whether or not they were of
Spanish or Hispanic origin. Household income was
measured by anglers’ approximate annual household
income using standard $10,000 categories to $99,999.

Recreation Behavior Indicators
Saltwater fishing participation, years of experience, and
self-assessed fishing skill were used as recreation behavior
indicators. Participation was measured by whether they
had participated in saltwater fishing in the previous
12 months. Experience was measured by the years of
previous saltwater fishing participation. Self-assessed
fishing skill included only assessments of above average
and below average self-assessed skill.

Resource Use Indicators
Saltwater fishing days, fish species targeted, and
satisfaction level were selected as resource use indicators.
Saltwater fishing days was measured by the total days
in saltwater fishing in the previous 12 months. Fishing
targets were ascertained by asking for the first, second,
and third favorite saltwater fishing species. Satisfaction
level consisted of three groups: (1) Unsatisfied, including
those reporting they were not at all or slightly satisfied,
(2) Moderate satisfied, and (3) Satisfied, including those
reporting they were very or extremely satisfied.

2.2 Measures
Two measurements were used to measure the indicator
trends in this study. The index of qualitative variation
(IQV) was used to measure variability for nominal
variables. It is based on the ratio of total number of
differences in the distribution to the maximum number
of possible differences within the same distribution. The
index can vary from 0.00 to 1.00. A minimum number
means no variation (or diversity) in the category. In
contrast, when variables are distributed evenly across the
category, there is maximum variation (or diversity) and
the IQV is 1.00 (Frankfort-Nachmias & Leon-Guerrero
2002).

\[
IQV = \frac{K(100^2 - \sum Pc^2)}{100^2(K-1)}
\]

where
K = the number of categories
N = the total number of cases in the distribution
\[\sum Pc^2 = \text{the sum of all squared percentages in the distribution}\]

Spearman Rank-Order Correlation Coefficient \((r_s)\) is a
supplementary technique used to test the direction and
strength of the relationship between two variables. In
other words, it is useful to show whether any one set of
numbers has an effect on another set of numbers. In this
study, all three groups of human dimensions indicators
were measured by Spearman Rank Correlation. The
temporal correlation between indicators and time series
provides a stochastic measure of secular trend (Maraschilo

\[
r_s = 1 - \frac{6\sum D^2}{N(N^2 - 1)}
\]

where:
\(D = \text{the difference between the ranks of corresponding}
values of } X \text{ and } Y, \text{ and}
N = \text{the number of pairs of values}

For example, the distribution of male saltwater anglers in
Texas varied from 78.14 percent to 83.07 percent across
the six surveys. The first step in the Spearman Analysis is
to rank the values within each category from smallest to
largest. The rank from 1989 to 2005 is 5th, 3rd, 4th, 6th,
2nd and 1st, respectively. Indicators were compared with
the time series using the Spearman rank. The correlation
gave an objective value for the direction and magnitude
of each of indicators over a 16-year period.

3.0 RESULTS
Tables 1, 2, and 3 summarize the temporal correlation
for sociodemographic, recreation behavior, and resource
use indicators in Texas saltwater fishing, respectively.
At the nationwide level, the increase in females fishing
outstripped the males, with a 19 percent increase from
1980 to 1995. Furthermore, there was a 33 percent
increase in the number of females fishing in 1990 compared to 1980 (Aiken 1999). In the Texas survey, however, the gender indicator showed no significant change for either percentage or IQV descriptive statistics over time. Another non-significant trend in age indicated relative stability in saltwater fishing in Texas. According to U.S. Census for Texas from 1990 to 2000, Hispanic population growth in Texas is a long-term trend with the total percentage growing from 25% to 32% in the last decade (Codina 2002). However, the Hispanic fishing population has not increased over time in Texas. The surveys indicated that fishing in Texas is still dominated by the Anglo population. In sum, gender, age, and ethnicity indicators showed no long-term trends over time. However, the Spearman rank correlation and IQV in average household income increased simultaneously. The median household income category of saltwater anglers had increased from $40,000- $49,999 to $50,000- $59,999 since the 1993 statewide survey (Ditton & Hunt 1996). In the 2005 survey, the median group advanced to a higher household income level, $60,000- 69,999. The household income over the median group ($50,000- $59,999) revealed a steady upward trend over time.

Recreation behavior correlations are shown in Table 2. Although the saltwater fishing participation rate has fluctuated from 35 percent to 48 percent over the last 16 years, there was still no significant trend for either percent or IQV descriptive statistics. Participation rate has kept pace with the nationwide level of saltwater fishing. From 1991 to 2001 nationwide surveys, participation in saltwater fishing increased by 2 percent, but this rise was not statistically significant (Norton et al. 2002). Although

**Table 1.—Sociodemographic Indicators of Texas Saltwater Anglers**

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<tbody>
<tr>
<td>A. Gender</td>
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| 1. Percent Male | 79.69 | 79.87 | 79.85 | 78.14 | 82.61 | 83.07 | +.600
| 2. Gender Distribution(IQV) | 0.625 | 0.606 | 0.562 | 0.632 | 0.488 | 0.487 | -.600
| B. Age | | | | | | | |
| 1. Percent working age (18-64) | 97.71 | 95.76 | 93.53 | 95.65 | 94.60 | 95.90 | -.257
| 2. Age Distribution (IQV) | 0.089 | 0.162 | 0.242 | 0.167 | 0.204 | 0.157 | +.257
| C. Spanish/Hispanic Origin | | | | | | | |
| 1. Percent Hispanic | 10.69 | 10.33 | 9.25 | 13.34 | 10.19 | 11.94 | -.200
| 2. Hispanic Distribution (IQV) | 0.382 | 0.370 | 0.336 | 0.462 | 0.366 | 0.421 | +.200
| D. Household Income | | | | | | | |
| 1. Percent over average household income | 32.06 | 36.78 | 58.64 | 55.10 | 63.24 | 65.78 | -.943**
| 2. Income Distribution (IQV) | 0.871 | 0.930 | 0.970 | 0.990 | 0.930 | 0.900 | +.174

** The Spearman rank correlation coefficient was significant at alpha= .05

**Table 2.—Recreation Behavior Indicators of Texas Saltwater Anglers**

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<tr>
<td>A. Saltwater fishing participation rate</td>
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| 1. Percent Participation | 43.91 | 45.89 | 42.04 | 43.61 | 34.94 | 48.07 | +.143
| 2. Participation Distribution(IQV) | 0.985 | 0.993 | 0.975 | 1.000 | 0.909 | 0.999 | +.143
| B. Saltwater fishing experience by years | | | | | | | |
| 1. Percent of saltwater anglers fishing experience | 41.82 | 42.45 | 43.63 | 42.21 | 43.79 | +.700
| 2. Experience Distribution (IQV) | 0.973 | 0.977 | 0.984 | 0.976 | 0.985 | N/A | +.700
| C. Self-assessed saltwater fishing skill | | | | | | | |
| 1. Percent with average skill | 62.97 | 64.39 | 64.14 | 64.37 | 64.72 | 67.74 | +.829**
| 2. Skill Distribution (IQV) | 0.933 | 0.917 | 0.920 | 0.917 | 0.913 | 0.874 | -.899**

** The Spearman rank correlation coefficient was significant at alpha= .05
not statistically significant, the data nevertheless suggest a slightly upward trend of more experienced anglers engaging in saltwater fishing. In terms of self-assessed skill, the IQV and percent change of above average self-reported skill increased significantly. The Spearman rank correlation coefficients were significant with an alpha of less than .05.

A longitudinal perspective of saltwater fishing natural resource use is provided in Table 3. These analyses monitored changes in the relative composition of saltwater fishing resource utilization in Texas. The total fishing days in saltwater represented a slight decrease over time, but it was not a significant difference. The temporal correlation between favorite angler species and time series increased significantly over time. Red drum has been the most popular species in saltwater fishing in Texas since 1989, probably due to its power, speed, and good eating quality. While the extent of angler satisfaction has been high and has increased consistently over time, variation has decreased significantly from 0.972 to 0.841. Thus, the temporal correlation between satisfaction and time series decreased significantly at alpha less than .05.

### 4.0 DISCUSSION

The nine sociodemographic, recreation behavior, and resource use indicators demonstrated some similar and some unique patterns of change for saltwater fishing in Texas. If managers are to achieve an accurate understanding of anglers and their dynamic nature, they need to view them in successive frames or states using a longitudinal perspective (Boulding 1978). Longitudinal analysis is touted as an approach for establishing temporal order, measuring change, and making stronger causal interpretations. Another advantage of a longitudinal perspective is the examination of change, not in values or levels of variables over time, but in the relationships between or among variables over time (Menard 2002).

#### 4.1 Change in Demographic Indicators

Concurrent with demographic change in Texas, there was a need to know more about angler sub-populations (seniors, women, African-Americans, and Hispanic-Americans) not well represented in most previous study results as programs were underway or being developed to socialize more individuals from these groups into fishing (Anderson & Ditton 2004). Results revealed a downward trend in the female saltwater fishing population as demonstrated by the IQV decrease. To reverse this trend, fishery interests will need to understand more about females and their attitudes toward and expectations from angling. Bohnsack (2002) suggested that the responses of females differed significantly from males in terms of their resource dependency and their attitudes toward activity-specific and activity-general aspects of their angling experiences. Gender differences existed for a few of the measures tested; however, significant differences were not present for most measures tested.

The exponential growth of the Hispanic population over the past two decades raises another question about their underparticipation in fishing. Our finding of no

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Table 3—Resource Use Indicators of Texas Saltwater Anglers

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<tbody>
<tr>
<td>A. Fishing days in salt water</td>
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</tr>
<tr>
<td>1. Percent of saltwater fishing days</td>
<td>45.01</td>
<td>43.16</td>
<td>44.99</td>
<td>43.64</td>
<td>45.46</td>
<td>42.58</td>
</tr>
<tr>
<td>2. Saltwater fishing days Distribution (IQV)</td>
<td>0.990</td>
<td>0.981</td>
<td>0.990</td>
<td>0.984</td>
<td>0.992</td>
<td>0.978</td>
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<tr>
<td>B. Saltwater fishing targets</td>
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<tr>
<td>1. Percent red drum (the favorite species in saltwater fishing)</td>
<td>32.10</td>
<td>29.70</td>
<td>32.60</td>
<td>37.00</td>
<td>38.00</td>
<td>42.58</td>
</tr>
<tr>
<td>2. Fishing targets Distribution (IQV)</td>
<td>0.988</td>
<td>0.993</td>
<td>0.972</td>
<td>0.984</td>
<td>0.965</td>
<td>0.875</td>
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<tr>
<td>C. Satisfaction extent in participating saltwater fishing</td>
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<tr>
<td>1. Percent with the two highest levels of satisfaction</td>
<td>34.89</td>
<td>27.94</td>
<td>46.03</td>
<td>54.11</td>
<td>50.85</td>
<td>55.14</td>
</tr>
<tr>
<td>2. Satisfaction Distribution (IQV)</td>
<td>0.972</td>
<td>0.987</td>
<td>0.917</td>
<td>0.850</td>
<td>0.881</td>
<td>0.841</td>
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</table>

** The Spearman rank correlation coefficient was significant at alpha=.05
significant trend toward a greater rate of participation by Hispanics may suggest a disconnection between providers and this ethnicity group. Besides a number of constraints that may be present, the image of fishing and the nature of experiences currently provided may not rate highly with this population group. For example, Shaull and Gramann (1998) indicated Hispanics view fishing more as an opportunity for relaxed social interaction with family and extended family. Because of Hispanics’ strong family attachment to the nuclear and extended kinship network, a secure and supportive social space for shared experiences with family and extended family is a more important management goal than focusing on the size and nature of the fish and the sporting experiences provided. Because the content of environmental consciousness likely varies substantially with cultural background, Anglo-Americans’ and Hispanic-Americans’ concerns will probably differ, and the expression of even common concerns will vary (Lynch 1993).

4.2 Improvement in Skill Magnitude
There was a significant trend in self-reports of increased skill in saltwater fishing among Texas anglers. This fishing trend may be evidence of growth and development in the fishing population and movement along the specialization continuum (Snepenger & Ditton 1985). Bryan (1977) postulates that as people become more familiar with fishing, they may advance through a predictable set of alternatives in reaching their goals. According to specialization theory, the least specialized angler will likely be aware of and seek only the most superficial and apparent elements of the experience (Ditton & Loomis 1992). To the contrary, more specialized anglers are likely to prefer a more pristine environment for their fishing experience. Self-assessment skill is one of the important variables for testing the specialization level. Scott and Shafer (Scott & Shafer 2001) suggested using three dimensions (behavior, skill and knowledge, and commitment) of indicators to fit the specialization model. In this study, saltwater anglers that rate their skill level as higher than others are likely to be more specialized anglers.

4.3 Resource Use Indicators
As a resource use indicator, anglers’ preference for red drum has always been high and has continued to increase. The increasing preference for this species is important because stocks of this species are currently being enhanced through hatchery production and there may be limits to meeting angler demands for this species. Likewise with increasing levels of satisfaction, it is reasonable to expect those who are more satisfied with fishing overall to be more inclined to appreciate the resource management practices than those who are less satisfied. Accordingly, fishery managers in Texas who would like to promulgate resource conservation and sustainability are more likely to be supported by the increasing percentage of high specialization anglers than by low specialization anglers (Oh et al. 2005). Researchers or managers can scrutinize the changing directions in resource use and satisfaction magnitude over time with a longitudinal perspective and perhaps reach different conclusions from time series research results.

5.0 CITATIONS


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