ANGLER SATISFACTION IN SOUTH DAKOTA

Kjetil R. Henderson¹ and Larry M. Gigliotti²*
¹United States Fish and Wildlife Service
Carterville Fish and Wildlife Conservation Office
Marion, IL 62959
²United States Geological Survey
South Dakota Cooperative Fish and Wildlife Research Unit
South Dakota State University
Brookings, SD 57007, USA
*Corresponding author: Larry.Gigliotti@sdstate.edu

ABSTRACT

Many industries use satisfaction measures to evaluate performance. The South Dakota Department of Game, Fish and Parks identified satisfaction as one of their performance measures for evaluating fishing in South Dakota. In fisheries management, the perspectives of license buyers are valuable to determine if management activities are providing the benefits anticipated by biologists. Surveys of South Dakota anglers are conducted to better understand licensees in order to promote satisfying angling experiences. Internet surveys were distributed to all license buyers providing email addresses in 2011 and 2012. Angler satisfaction was analyzed by angler type (demographics and fishing characteristics) to further clarify performance measures. Most anglers (> 70%) were satisfied with their angling experiences. Nonresidents expressed higher levels of satisfaction with fishing in South Dakota in 2011 and 2012 than residents. Anglers’ rating of fishing quality was more strongly correlated with satisfaction than their reported number of fish harvested, which suggests that strategies to influence angler perceptions and expectations can also be employed to influence satisfaction (in addition to techniques influencing fish populations). This research further integrates sociological data into South Dakota fisheries management processes.

Keywords

Angler satisfaction, surveys, angler segmentation, fisheries management

INTRODUCTION

Satisfaction is considered indiscernible from customer service quality (Burns et al. 2003; Oliver 2010). Accordingly, entities in many industries use satisfaction measures to evaluate performance (Burns et al. 2003; Oliver 2010). Although successful fisheries management encompasses multiple objectives (habitat conservation, species preservation, etc.), state agencies are ultimately beholden to the licensees who finance their programs. In this manner, evaluating performance from the consumer perspective (i.e., angler) is essential (Gigliotti et al. 2008).
Their viewpoints are particularly critical considering fisheries managers may have misconceptions about angler preferences (Connelly et al. 2000). Satisfaction and other sociological measures provide means to determine if management activities are giving licensees the benefits anticipated by fisheries professionals (SDGFP 2014).

Satisfaction is considered the principle product of recreational angling (Graefe and Fedler 1986; Holland and Ditton 1992). Satisfaction (or dissatisfaction) is the difference between the outcomes an angler wants or thinks should be received (i.e., motivations) and the perceived fulfillment of those outcomes (Holland and Ditton 1992; Arlinghaus 2006). The subjective nature of attitude assessment presents challenges to satisfaction measurement and its potential utilization in fisheries management (Graefe and Fedler 1986; Arlinghaus 2006). Authors generally categorize the experiences sought by anglers into activity-specific and activity-general elements (Fisher 1997; Arlinghaus 2006). Activity-specific elements are characteristics unique to fishing, and include the species pursued, fish size, number of fish and opportunity for harvest (Fedler and Ditton 1994; Arlinghaus 2006). Activity-general elements are characteristics common to general outdoor recreation and include relaxation, escape and experiencing nature (Fedler and Ditton 1994; Arlinghaus 2006). The relative importance of these satisfaction determinants varies by angler population, individual angler and even between separate fishing trips (Graefe and Fedler 1986; Arlinghaus 2006). Research suggests most anglers rate activity-general motivations more important than activity-specific motivations (Fedler and Ditton 1994; Fisher 1997; Hutt and Jackson 2008). However, activity-specific motivations may become more important over longer periods; anglers not catching fish on a particular trip may be satisfied but would likely grow frustrated with successive trips of this nature (Hutt and Jackson 2008).

Past research has addressed the diverse nature of anglers and illustrated the misnomer of the average angler (Ditton et al. 1992; Holland and Ditton 1992; Gigliotti 1996). Segmenting licensees has value (Holland and Ditton 1992; Fisher 1997; Fedler and Ditton 2001) for determining changes in group satisfaction in response to management actions (sensu Martin and Pope 2011). There are many ways to group licensees; primary among these are attitudes toward regulations, catch preferences (size, number of fish and harvest choices) and participation choices (Fedler and Ditton 2001; Martin and Pope 2011). Considering South Dakota Game, Fish and Parks’ (SDGFP) angler survey, anglers can be segmented based on license type, residence, type of fishing (shore vs. boat), management region fished, importance of fishing, age and gender. Examining the determinants of satisfaction by the various possible angler segments can provide additional information for understanding and potentially influencing future angler satisfaction.

Research has enhanced our understanding of the complexity of angler satisfaction. Satisfaction-related surveys entail several considerations. One is temporal scale; several authors suggest annual measurement is the broadest yet still meaningful timeframe (Pollock et al. 1994, Arlinghaus 2006). Trip-specific measures are likely more variable than annual counterparts (Arlinghaus 2006). Pollock et al. (1994) summarized popular approaches to measuring satisfaction in recre-
national fishing. Typically, the sums of scores to individual component questions are assumed to be related to the angler’s overall satisfaction (Graefe and Fedler 1986; Arlinghaus 2006). Unfortunately, no measurement standard has been established related to recreational fishing (Burns et al. 2003; Arlinghaus 2006).

Given that angler satisfaction is an important component of recreational fishing, providing satisfying angling opportunities is a primary objective of state agencies (Graefe and Fedler 1986; Holland and Ditton 1992; Radomski et al. 2001; SDGFP 2014). Some research has shown poor fishing quality is strongly related to dissatisfaction and a primary reason for why people stop angling (Sutton et al. 2009). As such, SDGFP has established angler satisfaction as a measure of agency performance (SDGFP 2014). The agency has conducted seven angler surveys since 1995 to collect critical information for managing fisheries (SDGFP 2014). However, infrequent surveys can only provide a snapshot of the constraints faced by anglers; the value of measuring satisfaction can be enhanced when it is consistently measured over time to analyze trends, which was SDGPF’s intention by selecting satisfaction as a performance measure.

The objective of this study was to further understand South Dakota angler satisfaction by evaluating its relationship to other survey measures, specifically: (1) correlations with fishing quality, harvest, effort, fishing methods (shore vs. boat), age and fishing importance; and (2) by angler groups determined by responses to questions addressing management regions fished, fishing methods used, gender and nonresidents’ future intention to fish South Dakota.

**METHODS**

**Sampling and Questionnaire**—All anglers providing email addresses were sent invitations to participate in the survey via an embedded link (to SurveyMonkey.com). Invitations were sent January 1 and 2 and those not responding to the email received two reminders encouraging participation, emailed approximately January 12 and 18, with the internet survey ultimately closing January 24 in both study years (2011 and 2012).

Surveys began with an introductory paragraph explaining the nature of the survey to encourage response. Questions were developed by SDGFP staff, and included standard questions from previous angler surveys to measure trends in attitudes, harvest and effort (Pollock et al. 1994; SDGFP 2014). Three separate attitudes were measured: (1) “How dissatisfied or satisfied were you with your total South Dakota fishing experience last year?” (2) “How would you rate the fishing in South Dakota last year in terms of numbers and size of fish caught?” and (3) “How important is fishing to you in relation to all your other types of recreation?”. These attitudes were scaled (Likert 1932) as follows: angler satisfaction (scale: -3 = very dissatisfied, -2 = moderately dissatisfied, -1 = slightly dissatisfied, 0 = neutral or no opinion, 1 = slightly satisfied, 2 = moderately satisfied and 3 = very satisfied), rating of fishing quality (scale: -2 = very poor, -1 = poor, 0 = fair, 1 = good, 2 = excellent and no opinion was coded as missing), and importance of recreational fishing (scale: 0 = not important, 1 = slightly important, 2 = moderately important, 3 = very important, 4 = most important and no opinion was coded as
Anglers were asked to estimate their annual harvest of walleye and/or sauger, bass (largemouth and/or smallmouth), northern pike, trout (rainbow, brown, brook, lake, splake, tiger), yellow perch, catfish and/or bullhead, sunfish (bluegill, green, rock bass) and crappie (common carp and/or silver carp was added to the list in 2012). Total number of fish caught for each fish group was added to the 2012 survey. Annual catch and harvest data were used to produce daily catch and harvest rates for the fish listed. Resource use questions measured total days fishing (statewide and four management regions), specific types of fishing (i.e., boat, shore, ice and spear/bow) and nonresidents’ future intention to fish in South Dakota. Demographic variables (gender and age) were also measured.

**Analysis**—Licenses were grouped into resident annual licenses (Annual, Combination, Senior Combination, Junior Combination and Senior Annual), nonresident annual licenses (Annual and Family) and nonresident temporary licenses (3-Day and 1-Day) for evaluating relationships between ratings of angler satisfaction and other survey measures. Satisfaction analysis was performed using Pearson correlation (r) with rating of fishing quality, importance of recreational fishing, percent of time spent shore fishing and boat fishing, annual fish harvested for the listed fish, daily catch rate, daily harvest rate, annual days fished, and age by license group (each year and combined). The same set of variables was also used in a stepwise linear regression with satisfaction as the dependent variable. Pearson correlations were denoted as follows: weak ≥ 0.1, moderate ≥ 0.3 and strong ≥ 0.5 (Vaske 2008). One-way ANOVA was used to compare mean satisfaction for anglers fishing exclusively in a particular management region (Figure 1; Black Hills, West River, Missouri River and East River), and percent of time shore and boat fishing for the three license groups. One-way ANOVA was also used to compare mean satisfaction by nonresidents’ intention to fish in

![Figure 1. South Dakota fisheries management regions: A, Black Hills; B, West River; C, Missouri River; and D, East River](image-url)
South Dakota next year (no, unsure or yes) and mean satisfaction by gender. A chi-square test was used to compare importance of fishing by license type. Analysis was performed in SPSS 21 (IBM 2012). Eta (η) and Cramer’s V were used to measure effect size (Vaske 2008). Differences were assessed at \( \alpha \leq 0.05 \).

**RESULTS**

The three license groups varied in email coverage and response rates. Email coverage was about 52\% for resident annual licenses (both years), 40\% for nonresident annual licenses (both years), and 24\% and 22\% for nonresident temporary licenses (2011 and 2012, respectively). Internet response rates in successive years were 33\% and 30\% for resident annual licenses, 44\% and 41\% for nonresident annual licenses, and 37\% and 36\% for nonresident temporary licenses. Potential coverage and nonresponse biases were determined to be minimal (e.g., small differences in gender and age that did not significantly affect estimates of other variables measured by the internet survey) (Henderson 2014). The Internet surveys resulted in data from 17,262 and 19,322 resident annual anglers, 3,420 and 4,063 nonresident annual anglers, and 2,343 and 2,858 nonresident temporary anglers in 2011 and 2012, respectively.

Pearson correlations between satisfaction and other variables measured by the statewide angler survey were similar for the three license types across years so we combined the data to measure these relationships (Table 1). Specifically, satisfaction was significantly correlated with rating of fishing quality, importance of recreational fishing, percent of time either boat or shore fishing, fish harvested (and harvest rate), catch rate, days fished and age. Only anglers’ rating of the fishing quality was strongly correlated with satisfaction (\( r = 0.67 \)) (Figure 2); all other significant variables were weakly correlated with angler satisfaction (\( r \leq 0.20 \)).

![Figure 2](image-url)

*Figure 2. Mean satisfaction of anglers fishing in South Dakota in 2011 and 2012 (resident and nonresident anglers combined) analyzed by anglers’ rating of fishing quality (\( r = 0.67 \)). Note: 95\% confidence intervals are mostly obscured by the squares marking the means for each rating response (ANOVA \( F_{(4,3453)} = 7116.38, P < 0.001, \eta = 0.675 \)).*
Table 1. Pearson correlation with angler satisfaction\(^1\) summarized for all 2011 and 2012 licenses.

<table>
<thead>
<tr>
<th></th>
<th>Rating of fishing(^2)</th>
<th>Importance of fishing(^3)</th>
<th>Shore fishing</th>
<th>Fish harvested</th>
<th>Boat fishing</th>
<th>Catch rate/day(^4)</th>
<th>Days of fishing(^5)</th>
<th>Harvest rate/day</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of fishing(^2)</td>
<td>0.67(^*)</td>
<td>0.20(^*)</td>
<td>-0.17(^*)</td>
<td>0.16(^*)</td>
<td>0.15(^*)</td>
<td>0.14(^**)</td>
<td>0.12(^*)</td>
<td>-0.02(^*)</td>
<td></td>
</tr>
<tr>
<td>Importance of fishing(^3)</td>
<td>0.22(^*)</td>
<td>-0.19(^*)</td>
<td>0.21(^*)</td>
<td>0.18(^*)</td>
<td>0.18(^*)</td>
<td>0.17(^*)</td>
<td>0.17(^*)</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>Shore fishing</td>
<td>-0.20(^*)</td>
<td>0.27(^*)</td>
<td>0.18(^*)</td>
<td>0.15(^*)</td>
<td>0.36(^*)</td>
<td>0.09(^*)</td>
<td>0.09(^*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish harvested</td>
<td>-0.14(^*)</td>
<td>-0.88(^*)</td>
<td>-0.18(^*)</td>
<td>-0.04(^*)</td>
<td>-0.20(^*)</td>
<td>-0.11(^*)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boat fishing</td>
<td></td>
<td></td>
<td>0.05(^*)</td>
<td>0.36(^*)</td>
<td>0.54(^*)</td>
<td>0.45(^*)</td>
<td>0.02(^*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catch rate/day(^4)</td>
<td></td>
<td></td>
<td></td>
<td>0.15(^*)</td>
<td>-0.01</td>
<td>0.13(^*)</td>
<td>0.17(^*)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days of fishing(^5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.02</td>
<td>0.57(^*)</td>
<td>-0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvest rate/day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.06(^*)</td>
<td></td>
</tr>
</tbody>
</table>

\(^*\) Correlation is significant at the 0.001 level (2-tailed).
\(^1\) Mean Satisfaction (7-point scale): -3 = Very Dissatisfied, -2 = Moderately Dissatisfied, -1 = Slightly Dissatisfied, 0 = Neutral or No Opinion, 1 = Slightly Satisfied, 2 = Moderately Satisfied, 3 = Very Satisfied.
\(^2\) Mean Rating of fishing quality (5-point scale): -2 = Very Poor, -1 = Poor, 0 = Fair, 1 = Good, 2 = Excellent, No Opinion = missing.
\(^3\) Mean Importance of recreational fishing (5-point scale): 0 = Not Important, 1 = Slightly Important, 2 = Moderately Important, 3 = Very Important, 4 = Most Important, No Opinion = missing.
\(^4\) Catch rate (fish caught per day) was only measured in the 2012 surveys.
\(^5\) Days fished not included in the analyses for the nonresident temporary license.
Although anglers’ “rating of fishing quality in terms of numbers and size of fish caught” explained about 44% ($r^2 = 0.44$) of the variance in angler satisfaction with their fishing experience, fishing variables like total recalled annual harvest, harvest per day or catch per day did not add any predictive value to a linear regression model for predicting angler satisfaction (Table 2). In addition, anglers rating of fishing quality had very low predictive ability in explaining total recalled annual harvest ($r^2 = 0.03$), harvest per day ($r^2 = 0.02$) and catch per day ($r^2 = 0.02$).

### Resident / Nonresident Comparisons related to Satisfaction

Mean satisfaction was similar between 2011 and 2012 for the three angler groups (Table 3). Nonresident annual and nonresident temporary anglers expressed higher levels of satisfaction with fishing in 2011 and 2012 than resident counterparts (Table 3). Percent of resident anglers satisfied (slightly, moderately and very combined) in 2011 and 2012 was 70% and 72%, respectively compared to 83% and 81% for nonresident annual anglers and 73% and 83% for nonresident temporary anglers (Figure 3). Although significant, the difference in percent satisfied between resident and nonresident anglers was small as measured by Cramer’s V in 2011 ($V = 0.052$) and 2012 ($V = 0.089$) (Figure 3). Additionally, both nonresident angler groups rated fishing quality in 2011 and 2012 higher than resident anglers (Table 4).

Nonresident annual anglers had a significantly higher percent of anglers rating fishing as their most important recreational activity (35%) compared to 15% of resident anglers ($P < 0.001$, $V = 0.247$) and 19% of nonresident temporary anglers ($P < 0.001$, $V = 0.073$) (Figure 4). Overall, importance of fishing had a weak correlation ($r = 0.195$) with satisfaction (Table 2).

Nonresidents spent a significantly higher percent of their time boat fishing in South Dakota in 2011 and 2012 (75% for nonresident annual anglers and 69% for nonresident temporary anglers) compared to resident annual anglers (52%) ($F_{(1, 38704)} = 1902.04$, $P < 0.001$, $\eta = 0.219$ and $F_{(1, 37193)} = 775.213$, $P < 0.001$, $\eta = 0.143$; respectively). Overall, the percent of time spent shore ($r = -0.172$) and boat ($r = 0.162$) fishing were weakly correlated with satisfaction (Table 2).

### Table 2. Stepwise linear regression with satisfaction as the dependent variable using all nine variables from Table 1 as independent variables.

<table>
<thead>
<tr>
<th>Variables Added</th>
<th>$r$</th>
<th>$r^2$</th>
<th>$r^2$ Change</th>
<th>$F$ Change</th>
<th>Sig. $F$ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of fishing quality</td>
<td>0.666</td>
<td>0.444</td>
<td>0.444</td>
<td>17367.72</td>
<td>0.000</td>
</tr>
<tr>
<td>Importance of fishing</td>
<td>0.668</td>
<td>0.446</td>
<td>0.003</td>
<td>99.84</td>
<td>0.000</td>
</tr>
<tr>
<td>Shore fishing (% time)</td>
<td>0.669</td>
<td>0.448</td>
<td>0.001</td>
<td>54.78</td>
<td>0.000</td>
</tr>
<tr>
<td>Age</td>
<td>0.670</td>
<td>0.449</td>
<td>0.001</td>
<td>37.45</td>
<td>0.000</td>
</tr>
<tr>
<td>Catch rate (per day)</td>
<td>0.670</td>
<td>0.449</td>
<td>0.000</td>
<td>11.80</td>
<td>0.001</td>
</tr>
<tr>
<td>Day of fishing (per year)</td>
<td>0.670</td>
<td>0.449</td>
<td>0.000</td>
<td>5.46</td>
<td>0.019</td>
</tr>
</tbody>
</table>

1IBM SPSS Statistics, Version 22. Model: Stepwise Linear Regression (Probability of F entry = 0.05 and removal = 0.10 with option: exclude cases pairwise).

2Variables excluded: fish harvested (total), boat fishing (% time), and harvest rate (per day).
Other noteworthy differences observed between the three license groups included: nonresident anglers (50% annual and 52% temporary) spending more time fishing in the Missouri River System compared to resident anglers (34%) (Table 4). Nonresidents reported overall higher satisfaction with their fishing compared to resident anglers and this was observed mainly in the Black Hills and East River management regions (Figure 5). Also, resident annual and nonresident annual male anglers were slightly more satisfied with their fishing in South Dakota compared to female counterparts; the eta values for these measurements indicates that the differences were very small ($\eta = 0.034$ and 0.036, respectively) (Table 5).

### Table 3. Satisfaction statistics comparing resident annual, nonresident annual and nonresident temporary anglers fishing in South Dakota (2011 and 2012).

<table>
<thead>
<tr>
<th>Angler Type</th>
<th>Year</th>
<th>$\bar{x}$ Satisfaction$^1$</th>
<th>s</th>
<th>n</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Annual</td>
<td>2011</td>
<td>1.36</td>
<td>1.520</td>
<td>10,505</td>
<td>1.33 – 1.39</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>1.37</td>
<td>1.506</td>
<td>16,150</td>
<td>1.35 – 1.40</td>
</tr>
<tr>
<td>Nonresident Annual</td>
<td>2011</td>
<td>1.68</td>
<td>1.554</td>
<td>1,441</td>
<td>1.59 – 1.76</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>1.76</td>
<td>1.525</td>
<td>3,747</td>
<td>1.71 – 1.81</td>
</tr>
<tr>
<td>Nonresident Temporary</td>
<td>2011</td>
<td>1.60</td>
<td>1.558</td>
<td>849</td>
<td>1.50 – 1.71</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>1.69</td>
<td>1.591</td>
<td>2,553</td>
<td>1.63 – 1.75</td>
</tr>
</tbody>
</table>

$^1$Mean Satisfaction (7-point scale): -3 = Very Dissatisfied, -2 = Moderately Dissatisfied, -1 = Slightly Dissatisfied, 0 = Neutral or No Opinion, 1 = Slightly Satisfied, 2 = Moderately Satisfied, 3 = Very Satisfied.

Figure 3. Angler satisfaction (percent) comparing resident annual anglers with nonresident annual anglers in 2011 ($\chi^2(2,11946) = 56.57, P < 0.001, V = 0.069$) and 2012 ($\chi^2(2,19897) = 275.17, P < 0.001, V = 0.118$) and comparing resident annual anglers with nonresident temporary anglers in 2011 ($\chi^2(2,14686) = 92.12, P < 0.001, V = 0.079$) and 2012 ($\chi^2(2,20331) = 149.20, P < 0.001, V = 0.086$).
Future Fishing and Satisfaction—More nonresident annual anglers (90%) than nonresident temporary anglers (66%) reported that they planned to fish in South Dakota next year, with 8% and 27% unsure (respectively) and 2% and 7% (respectively) not planning to fish South Dakota next year ($\chi^2 (2, 9188) = 754.62, P < 0.001, V = 0.287$). However, the correlation of future fishing with satisfaction was similar for the two types of nonresident licenses (annual license: $r = 0.20, P < 0.001$; temporary license: $r = 0.18, P < 0.001$). Nonresident anglers (annual and temporary combined) planning to fish South Dakota next year were significantly more satisfied ($P < 0.001$) than anglers not planning on returning to fish in South Dakota next year (Figure 6).

![Graph showing the importance of fishing comparing resident annual anglers with nonresident annual anglers ($\chi^2 (4, 40053) = 2437.95, P < 0.001, V = 0.247$) and resident annual anglers with nonresident temporary anglers ($\chi^2 (4, 38566) = 206.27, P < 0.001, V = 0.073$).]

Table 4. Anglers’ mean rating of fishing quality comparing resident annual, nonresident annual and nonresident temporary anglers fishing in South Dakota (2011 and 2012).

<table>
<thead>
<tr>
<th>Angler Type</th>
<th>Year</th>
<th>$\bar{x}$ Rating</th>
<th>$s$</th>
<th>$n$</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident Annual</td>
<td>2011</td>
<td>0.77</td>
<td>0.948</td>
<td>14,268</td>
<td>0.76 – 0.79</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.75</td>
<td>0.884</td>
<td>15,575</td>
<td>0.74 – 0.76</td>
</tr>
<tr>
<td>Nonresident Annual</td>
<td>2011</td>
<td>0.95</td>
<td>0.916</td>
<td>3,163</td>
<td>0.92 – 0.98</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.93</td>
<td>0.872</td>
<td>3,715</td>
<td>0.90 – 0.96</td>
</tr>
<tr>
<td>Nonresident Temporary</td>
<td>2011</td>
<td>0.85</td>
<td>1.027</td>
<td>2,088</td>
<td>0.81 – 0.90</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>0.83</td>
<td>0.971</td>
<td>2,487</td>
<td>0.79 – 0.87</td>
</tr>
</tbody>
</table>

$^1$Mean Rating of fishing quality (5-point scale): -2 = Very Poor, -1 = Poor, 0 = Fair, 1 = Good, 2 = Excellent, No Opinion = missing.
**Figure 5.** Mean satisfaction of resident and nonresident anglers fishing exclusively in the Black Hills (ANOVA $F_{(1,3578)} = 105.72, P < 0.001, \eta = 0.169$), West River region (ANOVA $F_{(1,1320)} = 2.19, P = 0.139, \eta = 0.041$), Missouri River system (ANOVA $F_{(1,8792)} = 26.25, P < 0.001, \eta = 0.055$) and East River region (ANOVA $F_{(1,12054)} = 184.43, P < 0.001, \eta = 0.123$) in 2011 and 2012.

**Figure 6.** Mean satisfaction of nonresident anglers (ANOVA $F_{(2,6534)} = 111.01, P < 0.001, \eta = 0.181$) in South Dakota in 2011 and 2012 analyzed by their response to the question asking if they planned to fish South Dakota next year with 95% confidence intervals (the 95% confidence intervals are smaller than the triangles marking the means for the “unsure” and “yes” responses).
Table 5. Percent of fishing time spent in each of the major fish management regions of South Dakota in 2011 and 2012 comparing resident annual anglers, nonresident annual anglers and nonresident temporary anglers.

<table>
<thead>
<tr>
<th>Regions</th>
<th>Resident Annual Anglers</th>
<th>Nonresident Annual Anglers</th>
<th>Nonresident Temporary Anglers</th>
<th>ANOVA</th>
<th>F</th>
<th>P</th>
<th>Eta (η)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Hills</td>
<td>13%</td>
<td>9%</td>
<td>15%</td>
<td>69.89</td>
<td>&lt; 0.001</td>
<td>0.056</td>
<td></td>
</tr>
<tr>
<td>West River</td>
<td>8%</td>
<td>4%</td>
<td>3%</td>
<td>158.02</td>
<td>&lt; 0.001</td>
<td>0.084</td>
<td></td>
</tr>
<tr>
<td>Missouri River System</td>
<td>34%</td>
<td>50%</td>
<td>52%</td>
<td>706.28</td>
<td>&lt; 0.001</td>
<td>0.176</td>
<td></td>
</tr>
<tr>
<td>East River</td>
<td>45%</td>
<td>37%</td>
<td>30%</td>
<td>298.49</td>
<td>&lt; 0.001</td>
<td>0.115</td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>32,433</td>
<td>7,201</td>
<td>4,786</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6. Mean satisfaction of anglers fishing in South Dakota (2011 and 2012) analyzed by gender and by angler license type.

<table>
<thead>
<tr>
<th>Angler license type</th>
<th>x Satisfaction1 (95% C.I.)</th>
<th>Number</th>
<th>ANOVA</th>
<th>F</th>
<th>P</th>
<th>Eta (η)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>ANOVA</td>
<td>F</td>
</tr>
<tr>
<td>Resident Annual</td>
<td>1.39 (1.37 – 1.41)</td>
<td>1.24 (1.18 –1.29)</td>
<td>22,978</td>
<td>3,352</td>
<td>29.80</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Nonresident Annual</td>
<td>1.75 (1.71 – 1.80)</td>
<td>1.53 (1.36 – 1.70)</td>
<td>4,797</td>
<td>333</td>
<td>6.81</td>
<td>0.009</td>
</tr>
<tr>
<td>Nonresident Temporary</td>
<td>1.67 (1.62 – 1.73)</td>
<td>1.62 (1.41 – 1.82)</td>
<td>3,086</td>
<td>269</td>
<td>0.33</td>
<td>0.566</td>
</tr>
</tbody>
</table>

1Mean Satisfaction (7-point scale): -3 = Very Dissatisfied, -2 = Moderately Dissatisfied, -1 = Slightly Dissatisfied, 0 = Neutral or No Opinion, 1 = Slightly Satisfied, 2 = Moderately Satisfied, 3 = Very Satisfied.
DISCUSSION

Angler satisfaction is a critical performance measure for effective fisheries management (Driver 1985; McCormick and Porter 2014). While there is no measurement standard for angler satisfaction in recreational fishing (Burns et al. 2003; Arlinghaus 2006), SDGFP has used a standardized measure of satisfaction since the 1990s. South Dakota Game, Fish and Parks established satisfaction as one of their performance measures as listed in their Statewide Strategic Plan (SDGFP 2014, pp. 59):

*Over a 5-year period, have an average of 70% of anglers surveyed during the annual statewide angler survey indicate satisfaction with their fishing during the past year.*

The performance measure of 70% satisfied is based on a summary statistic for both resident and nonresident anglers, while this research measured satisfaction based on three angler groups (resident annual, nonresident annual and nonresident temporary). Angler satisfaction for all three groups met or exceeded agency objectives in 2011 and 2012.

South Dakota Game, Fish and Parks’ statewide angler survey provides estimates of participation (total days fished and days fished by region and license type), type of fishing (shore, boat, ice and fly), harvest of nine types of fish, rating of fishing quality, importance of fishing, angler demographics (gender and age) and satisfaction. This monitoring is an excellent tool for identifying potential challenges to providing recreational fishing services (as determined by the measurement of participants’ overall satisfaction). A drop in satisfaction would indicate that something is negatively impacting anglers’ enjoyment of the fishing experience, which may warrant further inspection. Unfortunately, the variables collected by the monitoring survey do not provide an understanding of angler satisfaction applicable to some type of management action. The only measured variable predictive of satisfaction was anglers’ evaluation of the quality of fishing, but no variable effectively measured anglers’ evaluation of fishing quality and thus no clear management action. A drop in angler satisfaction can initiate a more detailed study of the reasons for low angler satisfaction. Also, some of the variables measured by the statewide angler survey may help focus the study to a particular component of fishing. For example, was the drop in satisfaction due mainly to a particular type of fishing, location, or experienced by a specific license type?

The high satisfaction correlations observed with anglers’ rating of fishing quality suggests that catching numbers of appropriate-sized fish is an important component of angler satisfaction. In this study fishing quality was the best predictor of satisfaction (Table 2) and it could very well be the most important factor affecting satisfaction, although the number of evaluation variables in the agency’s monitoring survey is not exhaustive. Success-related factors have been reported as antecedents to angler satisfaction in several studies (Hicks et al. 1983; Graefe and Fedler 1986; McMichael and Kaya 1991; Spencer 1993; Hunt et al. 2012; McCormick and Porter 2014), while others have reported non-success factors were stronger predictors of satisfaction (Hampton and Lackey 1976; Spencer and Spangler 1992; Arlinghaus 2006; Vaske and Roemer 2013). Satisfaction is too complex of a construct to be reduced to an either-or conclusion of which is
more important: success-related factors or non-success factors. The correlation between satisfaction and anglers’ rating of the fishing quality in South Dakota can explain about 44% of the variance in satisfaction, which leaves the probability that much of the unexplained variance in satisfaction is from unmeasured, non-success factors (Arlinghaus 2006).

While the high correlation between satisfaction and rating of fishing quality indicates that success-related factors are important, this information does not lead to a management solution. Other success-related, antecedent variables (e.g., total annual harvest, harvest rate per day, or catch rate per day) were not correlated with rating of fishing quality. In other words, the survey does not identify what variables affect anglers’ rating of the fishing quality. Thus, the angler survey is useful for identifying when and where there may be a need for a management action to improve angler satisfaction, but further study will be necessary to identify any appropriate actions that may be needed.

Because satisfaction is one of the agency’s performance measures, it is critical to understand the theoretical underpinnings of satisfaction and the factors associated with providing satisfying angling experiences (McCormick and Porter 2014). Holland and Ditton (1992) reported that motivations and satisfactions are interrelated and that both vary between angler groups. Anglers have both catch and non-catch motivations and related satisfactions (Holland and Ditton 1992). Satisfaction measurements summarize both catch related (i.e., species pursued, fish size, number of fish and harvest opportunities) and non-catch related components of the fishing experience (i.e., relaxation, reflection, sport, thrill, socializing, exploration and enjoying nature; Holland and Ditton 1992).

Expectancy theory may provide a useful model for guiding further inquiry into angler satisfaction (Manning 1999). The satisfaction construct is hypothesized to be determined by differences between expectations and actual outcomes achieved (Schreyer and Roggenbuck 1978). For example, what information or factors do anglers use to form an opinion about fishing quality and how does that relate to their expectations for future experiences? Such an approach will require incorporating a segmentation model recognizing the diversity of anglers (Gigliotti 1996). Different types of anglers will have different expectations. Arlinghaus (2006) segmented anglers by their catch orientation into three groups (low, medium and high catch orientation) and reported high catch-oriented anglers being significantly less satisfied with the previous angling season than were anglers with a low catch-orientation. Similar to our study, Arlinghaus (2006) reported that satisfaction was not related to catch or harvest rates and that all three catch orientation groups had similar catch and harvest rates, suggesting that “catch expectation was the primary driver of satisfaction.” The fact that perceptions of fishing quality are more relevant to satisfaction than the recalled numbers of fish caught is valuable because it suggests that strategies designed to influence angler perceptions (i.e., expectations) can also be employed to improve satisfaction rather than simply focusing on managing fish populations to influence satisfaction (Petering et al. 1995; Hutt and Jackson 2008).

South Dakota Game, Fish and Parks is entrusted with enhancing recreational opportunities and protecting South Dakota’s natural resources (SDGFP 2014). Success in this endeavor would be impossible without the funding provided by
anglers, and satisfaction is a critical performance measure for monitoring to ensure the agency is providing enjoyable recreational opportunities (Driver 1985; Radomski 2001; McCormick and Porter 2014). This research provides valuable information about satisfaction as it relates to other survey measures, including angler demographics, types of angling, and regions fished in SDGFP’s angler survey program. Additionally, this study contributes to other research suggesting that efforts to influence angler expectations may improve angler satisfaction (Spencer and Spangler 1992, Arlinghaus 2006; Hutt and Jackson 2008). The SDGFP statewide angler survey’s utility may be improved by including a catch-orientation or similar segmentation model coupled with a more detailed study of angler expectations.

Note—The use of trade names or products does not constitute endorsement by the U.S. Government.

ACKNOWLEDGEMENTS

We thank the Chipps lab, B. D. S. Graeb, K. N. Bertrand and M. A. Kaemingk for thoughtful comments on the article. Funding for this research was provided by Federal Aid in Sport Fish Restoration funds (Project F-15-R, Study 1523) administered by South Dakota Department of Game, Fish and Parks, and South Dakota State University, and by the U.S. Geological Survey, S.D. Cooperative Fish and Wildlife Research Unit.

LITERATURE CITED


