Measuring Birding Specialization: A Confirmatory Factor Analysis

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This purpose of this paper was to test a three-dimensional model of recreational specialization developed by Scott and Shafer (2001a). The model suggests recreational specialization could be conceptualized in terms of three distinct dimensions: behavior, skill and knowledge, and commitment. The model was tested using data from avid American birdwatchers (members of the American Birding Association). Results revealed behavior, skill and knowledge, and commitment were moderately related but did not always covary. In addition, the three-dimensional model was a better fit to the data than a traditional single additive model. These results supported previous arguments suggesting researchers need to explore the distinct impact of each dimension of specialization, rather than using additive indices, on various dependent variables. Future researchers may explore whether or not the model can be generalized to other populations of birders (e.g., less skilled birdwatchers) and other groups of recreationists (e.g., anglers, hunters, mountain climbers).

Keywords recreational specialization, birdwatching, confirmatory factor analysis, structural equation modeling

Introduction
Since Bryan’s (1977, 1979) early conceptualization of recreational specialization, different scholars have used the term in different ways. Following Bryan, many researchers have described the construct primarily as recreationists’ behavioral involvement in an activity (Choi, Loomis, & Ditton, 1994; Donnelly, Vaske, & Graefe, 1986; Williams, Schreyer, & Knopf, 1990), while a few researchers defined the term as recreationists’ psychological attitude toward an activity (McIntyre, 1989; Shafer & Hammit, 1995). Most researchers, however, have conceived recreational specialization as both a set of behaviors and an array of attitudes (Bricker & Kerstetter, 2000; Kuentzel & Heberlein, 1992; Wellman, Roggenbuck, & Smith, 1982).
Scholars also have used a variety of indicators to measure level of specialization, including past experience, frequency of participation, centrality to life style, enduring involvement, commitment, economic investments, and so on. From there, some researchers have combined behavioral and attitudinal items to create an additive index of recreational specialization (Bricker & Kerstetter, 2000; Donnelly et al., 1986; Wellman et al., 1982) and examined whether or not the index predicted various facets of involvement (e.g., motivations, destination choices, and place attachment). Although this approach has been criticized by several researchers (Kuentzel & McDonald, 1992; Scott & Shafer, 2001a), studies have not tested if a multidimensional model of recreational specialization is better than the additive approach in terms of empirical criteria such as goodness of fit, reliability, and validity.

Based on a review of previous works on recreational specialization, Scott and Shafer (2001a, 2001b) recently provided a new way to conceptualize the construct. They defined recreational specialization as a "process that entails a progression in how recreationists participate in and view the activity over time" (Scott & Shafer, 2001b, p. 357). Progression, they believed, was reflected by a focusing of behavior, the acquisition of skill and knowledge, and personal and behavioral commitment. They further argued the three dimensions of recreational specialization are conceptually different, do not necessarily covary, and do not progress in a lock step fashion.

The purpose of this study was to test the model of recreational specialization suggested by Scott and Shafer (2001a) using confirmatory factory analysis. Furthermore, we evaluated whether the three-dimensional measurement model of recreational specialization fit the data better than an additive approach. The sample was drawn from the membership list of the American Birding Association. This research may provide researchers a solid rationale for examining the relationship of different dimensions of recreational specialization to other facets of involvement.

**Review of Literature**

**Conceptualization of Recreational Specialization**

Since Bryan (1977, 1979) coined the term recreational specialization, the construct has been conceived in multiple ways. Little agreement exists on what exactly is meant by the term recreational specialization (Scott & Shafer, 2001a). A close look at previous studies, however, suggests researchers have conceived specialization in three ways: behavior only, attitudes only, and behavior and attitudes.

In his pioneering work, Bryan (1977) defined recreational specialization primarily in terms of behavior. He regarded recreational specialization as “a continuum of behavior from the general to the particular…” (p. 175). Following Bryan, many researchers measured recreational specialization solely using behavioral indicators (e.g., Choi et al., 1994; Ditton, Loomis, & Choi, 1992; Donnelly et al., 1986; Martin, 1997; Schreyer & Lime, 1984; Schreyer, Lime, & Williams, 1989; Williams, 1980; Williams et al., 1990). In contrast, a few other researchers have conceived and measured recreational specialization only in terms of attitudes. For example, McIntyre (1989) suggested level of enduring involvement is indicative of recreational specialization, while Shafer and Hammit (1995) regarded purism as an attitudinal manifestation of the construct.

Although some researchers have defined recreational specialization either in terms of behavior or attitudes, most have measured the concept using both behavioral and attitudinal indicators (Bricker & Kerstetter, 2000; Chipman & Helfrich, 1988; Kuentzel & Heberlein, 1992; Kuentzel & McDonald, 1992; Virden & Schreyer, 1988; Wellman et al., 1982). McIntyre and Pigram (1992) first theoretically elaborated on this approach by arguing
specialization included affective attachment, knowledge, and past experience. They defined affective attachment in terms of enduring involvement.

Based on a close look at Bryan’s original work and a comprehensive overview of previous recreational specialization research, Scott and Shafer (2001a) offered a new conceptualization of recreational specialization. They conceived recreational specialization as a process entailing a progression in behavior, skill, and commitment. Scott and Shafer pointed out even though researchers have used a diversity of indicators to measure behavioral involvement (e.g., years of experiences, frequency of participation, the number of sites visited, the types of equipment used, the amount of equipment purchased or owned, the number of activity related books and magazines purchased and owned), no single item is a perfect measure in and of itself. Alternatively, Scott and Shafer (2001a) suggested behavior must be assessed in light of recreationists’ involvement in other activities. For example, a birder’s level of behavioral involvement in the activity should be assessed by comparing it with his/her behavioral involvement in other leisure activities.

Scott and Shafer (2001a) also argued recreational specialization entailed skill development and the acquisition of knowledge. They noted that skill, knowledge, and familiarity should not be confused with experience (c.f., McIntyre, 1989; Schreyer et al., 1989). Doing so ignores the possibility that some individuals may participate in activities on a regular basis but demonstrate little skill or knowledge of advanced techniques (Scott & Godbey, 1992, 1994). In contrast, others may participate infrequently but show evidence of a high degree of skill and knowledge.

Further, Scott and Shafer (2001a) maintained specialization involves two types of commitment: personal and behavioral. Drawing upon sociological works (e.g., Becker, 1960; Buchanan, 1985; Johnson, 1973; Stebbins, 1992), they likened personal commitment to self-identity, which “entails a strong affective attachment and inner conviction that the activity is worth doing for its own sake” (p. 329). In contrast, they characterized behavioral commitment as those costs and penalties that make withdrawal from the leisure activity problematic (e.g., the loss of a strongly held identity, loss of friends, loss of a financial investment). Scott and Shafer also argued that “people with a strong personal and behavioral commitment to a leisure activity probably regard the activity as a central life interest” (p. 330). According to them, centrality entails a rejection of alternative leisure activities and involves making family and career decisions in light of one’s interest in the leisure activity.

In this study, we tested a measurement model of Scott and Shafer’s (2001a) conceptualization of recreational specialization (Figure 1). Although the three dimensions probably covary, we assumed they were conceptually distinct.
<table>
<thead>
<tr>
<th>Dimensions measurement</th>
<th>Behavior only</th>
<th>Attitude only</th>
<th>Behavior + Attitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Additive</td>
</tr>
</tbody>
</table>
Measuring Birding Specialization

FIGURE 1 Hypothetical measurement model of recreational specialization.

birdwatchers living in Manitoba. She measured specialization using indicators of past experience, economic commitment, and centrality to life style. Cluster analysis produced four groups: casual, novice, intermediate, and advanced birders. This procedure for segmenting recreationists by level of specialization appears to be useful when the sample is large and the study population is heterogeneous.

Wellman et al. (1982) may well be the first researchers to create an additive index of recreational specialization. Compared to the EUH index, they combined elements of behavior and attitudes (e.g., past experience, economic investment, and centrality of life style) to create a continuum of specialization from low to high. This approach has been applied and updated by several researchers (e.g., Bricker & Kerstetter, 2000; Donnelly et al., 1986; Virden & Schreyer, 1988; Williams & Huffman, 1986).

Although the additive index approach has been used widely, several researchers (e.g., Kuentzel & McDonald, 1992; Schreyer et al., 1986; Scott & Shafer, 2001a) have pointed out it ignores the very real possibility that different measures of recreational specialization are likely to vary in their relationship to other facets of involvement. This means different dimensions should be measured separately and analyzed for their different, rather than their additive, effects on recreation participation. To date, however, only a few studies (i.e., Bloch, Black, & Lichtenstein, 1989; Bricker & Kerstetter, 2000; Kuentzel & McDonald, 1992; Kuentzel & Heberlein, 1992; Scott, Baker, & Kim, 1999) have actually tested the separate effect of distinct dimensions of specialization on other facets of involvement. Moreover, no studies to date have compared a multidimensional measurement model of recreational specialization with an additive approach in terms of model goodness of fit, validity, and reliability. In this study, we used confirmatory factor analysis to test whether or not a three-dimensional measurement model of birding specialization fit the data better than an additive model.

Methods

Study Population and Sample Selection Process

The study population comprised members of the American Birding Association (ABA), which is North America’s largest membership organization for active birders. Founded in 1968 by a dedicated group of birders, the ABA currently has more than 22,000 members (www.americanbirding.org). Scott, Stewart, and Cole (1997) conducted a survey that had...
ABA members respond to questions about their behavior, level of birding skills and knowledge, commitment to birding, and preferred characteristics of birding destinations. For that study, 350 Texas ABA members and 350 non-Texas ABA members were randomly sampled. ABA members living in Texas were oversampled in 1997 because one goal of that study was to compare their responses to those of ABA members from other states. Altogether, 556 usable surveys were returned, amounting to an 83% response rate.

In this study, the sample frame included ABA members who responded to the survey by Scott et al. in 1997. In addition, 500 additional members who were not chosen for the 1997 survey were selected from the 2002 member list of the ABA.

**Data Collection Procedures and Response Rate**

A four-step data collection method was administered from early March to late April of 2002. A primary notification was sent to the 1,056 ABA members included in the sample frame (i.e., 556 from the panel sample and 500 from the new sample). This process entailed sending the members a postcard explaining the purpose of the study, advising them when they could expect to receive a questionnaire, and asking them for their assistance. The second mailing consisted of sending out the questionnaire. Each questionnaire was accompanied by a cover letter describing the purpose of the study and a self-addressed, postage-paid return envelope. One week later, a postcard reminder was mailed to individuals who had not returned a completed questionnaire. The final mailing took place two weeks later. In this case, a replacement questionnaire, a postage-paid return envelope, and a new cover letter were sent to those who had not returned a completed questionnaire. Among the original sample, 101 were undeliverable because of address changes and respondents who were deceased, resulting in an effective sample size of 955. A total of 642 useable surveys were returned, representing a 67.2% response rate.

**Measurement of Major Constructs**

We measured the behavior of the birders using two open-ended questions: the number of birding trips taken in 2001 and the number of days spent on birding trips in 2001. In the questionnaire, a birding trip was defined as "outings at least one mile from home in which birding is one of the activities.”

To measure level of birding skill and knowledge, respondents were asked, “How many birds are you able to identify by sight without a field guide?” and “How many birds are you able to identify by sound?” These two items were open-ended. In addition, respondents were asked to rate their ability to observe and identify birds on a seven-point scale from novice (1) to expert (7). These items were borrowed from previous studies of birdwatching (e.g., Cole & Scott, 1999; Kim, Scott, & Crompton, 1997; Scott et al., 1999).

Level of commitment was measured using four items previously employed by Scott and his colleagues (Cole & Scott, 1999; Kim et al., 1997; Scott et al., 1999). The four commitment items (i.e., “Other leisure activities don’t interest me as much as birding,” “I would rather go birding than do most anything else,” “If I stopped birding, I would probably lose touch with a lot of my friends,” and “If I couldn’t go birding, I am not sure what I would do”) reflected the rejection of alternative leisure activities (i.e., personal commitment) and the costs associated with ceasing participation in birding (i.e., behavioral commitments), which are two seminal aspects of commitment (Scott & Shafer, 2001a). Response categories included a seven-point Likert type scale ranging from strongly agree (1) to strongly disagree (7).
Statistical Procedure for the Model Test

Confirmatory factor analysis was employed to test a three-dimensional measurement model of recreational specialization. Confirmatory factor analysis is a type of Structural Equation Model (SEM) wherein researchers specify which observed variables are affected by specific common factors prior to empirical investigation based on an a-priori theory. We used EQS Version 5.7b as the statistical software to conduct confirmatory factor analysis.

A covariance matrix of indicators was used for model identification. In a single factor model of confirmatory factor analysis, a minimum of three indicators is recommended for identification. In confirmatory factor analysis, however, with multiple factors, as in this study, a model can be identified as long as a factor has at least two indicators (Bollen, 1989; Kline, 1998). For the purpose of model identification, the first indicator of each factor was fixed to 1.0. At the final stage all the parameters of the model were standardized and reported.

Dozens of model goodness of fit indices have been suggested in the SEM literature. Following the recommendations of Hu and Bentler (1998), we chose four goodness of fit indices: chi-square, Bentler’s comparative fit index [CFI], Bentler and Bonnett’s non-normed fit index [NNFI], and standardized root-mean square residual [SRMR]. Chi-Square shows the most basic index, which reflects the sample size and the value of the maximum likelihood fitting function. The model chi-square should be non-significant to support a model, even though the chi-square is not considered as the absolute standard fit index due to its sensitivity to sample size. Kline (1998) proposed $X^2/df$ ratio values of less than 3 are considered favorable for a large sample (i.e., sample sizes of 200 or more). More liberally, Marsh and Hocevar (1983) suggested in a SEM model, acceptable fit is denoted by a ratio ranging from 2 to 5. CFI indicates the portion in the improvement of the overall fit of the researcher’s model to a null model, while NNFI is an index that adjusts the overall portion of explained variance for model complexity. In contrast, SRMR indicates a standardized summary of the difference between the observed and model-implied covariance. These indices can have values ranging from 0 to 1.0 and previous estimation literature suggests values of at least .9 in CFI and NNFI indicate an acceptable fit, while an SRMR of less than .10 suggests a good fit (Hu & Bentler, 1998; Kline, 1998).

Results

Eighty-four percent of the birders had either a college degree or graduate or advanced degree. Thirty-one percent said their annual household income was $100,000 or more, and 34% reported an annual household income between $60,000 and $99,999. Seventy percent were married, and 64% were male. Just over half (52%) were between the ages of 46 and 65, and 32% were 66 years of age or older. These results were consistent with a previous study of ABA members (i.e., Scott et al., 1997) and appeared to reflect similar demographics of the organization, that were reported in the last ABA membership survey taken in 1994 (Cordell, Herbert, & Pandolfi, 1999).

Table 2 presents the means and standard deviations of the variables used to measure birding specialization. The data show ABA members took, on average, 35 birding trips and spent 47 days on birding trips in 2001, and can identify about 444 species by sight without a field guide and 143 species by sound. ABA members tended to see themselves as skilled birders ($mean = 4.9$). The table also revealed ABA members tended to agree with the statements: “Other leisure activities don’t interest me as much as birding” ($mean = 4.6$) and “I would rather go birding than do most anything else” ($mean = 4.6$). In contrast, they tended to disagree with the statements: “If I couldn’t go birding, I am not sure what I would
TABLE 2 Means and Standard Deviations of the Variables Used to Measure Birding Specialization (N = 617)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Variable symbols</th>
<th>Variable labels</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
<td>V1</td>
<td>How many trips have you taken that included birdwatching as an activity in 2001?</td>
<td>35</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>V2</td>
<td>How many days have you spent on birding trips in 2001?</td>
<td>47</td>
<td>65</td>
</tr>
<tr>
<td>Skill and knowledge</td>
<td>V3</td>
<td>How many birds can you identify by sight without a field guide?</td>
<td>444</td>
<td>417</td>
</tr>
<tr>
<td></td>
<td>V4</td>
<td>How many birds can you identify by sound?</td>
<td>143</td>
<td>196</td>
</tr>
<tr>
<td>Commitment</td>
<td>V5</td>
<td>Subjective level of skill</td>
<td>4.9</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>V6</td>
<td>Other leisure activities don’t interest me as much as birding</td>
<td>4.6</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>V7</td>
<td>If I couldn’t go birding, I am not sure what I would do</td>
<td>2.5</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>V8</td>
<td>If I stopped birding, I would probably lose touch with a lot of my friends</td>
<td>2.9</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>V9</td>
<td>I would rather go birding than do most anything else</td>
<td>4.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Table 2 also reveals that both behavioral involvement items and two skill and knowledge indicators (which were measured as open-ended questions) have larger standard deviations than means. This finding suggested these four indicators were probably not normally distributed. Skewness and kurtosis statistics revealed they were indeed highly peaked and positively skewed. An expected normality plot showed too many cases were below the diagonal at the very low and high values, reflecting patterns of skewness and kurtosis. This analysis also showed some extreme cases did not represent the characteristics of the study population in regard to level of behavioral involvement and skill and knowledge.

Data transformation literature suggests to correct for outliers and failure of normality, data can be transformed based on the characteristics of original data distribution (Tabachnick & Fidell, 1996). Because the four variables were substantially positively skewed, natural log transformations were performed (Tabachnick & Fidell, 1996). This procedure did not change the original characteristics of respondents’ scores on the four items. Instead, the procedure improved the analyses by reducing the impact of outliers on the covariance structures. Therefore, the transformation values of the four variables were used instead of the raw values.

Figure 2 shows a three-dimensional measurement model of recreational specialization. Specifically it shows the behavior construct (F1) was measured by two manifest variables
FIGURE 2 A three-dimensional measurement model of birding specialization.

(V1 and V2), the skill and knowledge construct (F2) was measured by three manifest variables (V3 to V5), and the commitment construct (F3) was assessed by four manifest variables (V6 to V9) (See Table 3 for a summary of variables labels). Applying Bentler’s (1995) suggestion in Figure 2, the letter L indicates the standardized coefficient between the manifest variables and latent variables, the letter E represents errors for each manifest variable, and the letter C represents correlations between the latent variables. Maximum likelihood estimation was employed to estimate the three dimensional measurement model of birding specialization.

The covariance matrix analyzed for testing the measurement model and the goodness of fit indices of the model are shown in Table 3. The matrix was based on 469 complete cases. Among the 642 usable cases, 173 cases were skipped because one or more variables were missing. Overall, the goodness of fit supported the measurement model. The X²/df ratio value was less than 3, CFI and NNFI were all larger than .95, and SRMR was smaller than .05.

Figure 3 summarizes the standardized estimates of each parameter in the measurement model. The figure shows correlations among the three latent factors of birding specialization are low to modest (i.e., .27 to .49), and that each indicator of a dimension of birding specialization represented its respective latent factor. Because the goodness of fit indices and standardized estimates do not show specific information about the reliabilities and validities of the scales in detail, other statistics were also used to validate the model. First of all, the R squared value (i.e., the variance in a manifest variable explained by its latent factor) for each indicator was examined to see if the indicator was a reliable measure of a certain dimension of specialization (Hatcher, 1994). Every manifest variable except for three items measuring commitment had reliability scores higher than .6.

To determine if all three scales had reliability as a group or composite score, the composite reliability of each scale was also estimated. The composite reliability is analogous to coefficient alpha, and reflects the consistency of the indicators in measuring respective latent variable (Hatcher, 1994). As shown in Table 4, all three scales assessing birding specialization had acceptable reliability (i.e., ≥.60). This finding justified the creation of
TABLE 3 Covariance Matrix of Eight Indicators Measuring Birding Specialization and Goodness of Fit Indices of the Measurement Model (N = 469)

<table>
<thead>
<tr>
<th></th>
<th>V1</th>
<th>V2</th>
<th>V3</th>
<th>V4</th>
<th>V5</th>
<th>V6</th>
<th>V7</th>
<th>V8</th>
<th>V9</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>.312</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2</td>
<td>.191</td>
<td>.259</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V3</td>
<td>.065</td>
<td>.066</td>
<td>.137</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V4</td>
<td>.098</td>
<td>.084</td>
<td>.141</td>
<td>.284</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V5</td>
<td>.194</td>
<td>.171</td>
<td>.257</td>
<td>.358</td>
<td>1.096</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V6</td>
<td>.103</td>
<td>.122</td>
<td>.116</td>
<td>.169</td>
<td>.268</td>
<td>3.440</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V7</td>
<td>.087</td>
<td>.089</td>
<td>.065</td>
<td>.139</td>
<td>.275</td>
<td>1.400</td>
<td>3.195</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V8</td>
<td>.220</td>
<td>.140</td>
<td>.128</td>
<td>.205</td>
<td>.302</td>
<td>1.062</td>
<td>1.466</td>
<td>3.625</td>
<td></td>
</tr>
<tr>
<td>V9</td>
<td>.219</td>
<td>.178</td>
<td>.142</td>
<td>.204</td>
<td>.358</td>
<td>2.158</td>
<td>1.515</td>
<td>1.343</td>
<td>3.276</td>
</tr>
</tbody>
</table>

Model   | X^2  | df  | p    | CFI  | NNFI | SRMR |
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>58.70</td>
<td>24</td>
<td>.001</td>
<td>.98</td>
<td>.98</td>
<td>.04</td>
</tr>
</tbody>
</table>

Keys:
V1 = How many trips have you taken that included birdwatching as an activity in 2001?
V2 = How many days have you spent on birding trips in 2001?
V3 = How many birds can you identify by sight without a field guide?
V4 = How many birds can you identify by sound?
V5 = Subjective level of skill.
V6 = Other leisure activities don’t interest me as much as birding.
V7 = If I couldn’t go birding, I am not sure what I would do.
V8 = If I stopped birding, I would probably lose touch with a lot of my friends.
V9 = I would rather go birding than do most anything else.

FIGURE 3 A first order CFA of three-dimensional model of birding specialization and the standardized solution.
Measuring Birding Specialization

TABLE 4 Reliability Scores of the Scales (n = 469)

<table>
<thead>
<tr>
<th>Variables</th>
<th>R-squared</th>
<th>Composite reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
<td></td>
<td>.81</td>
</tr>
<tr>
<td>Numbers of trips taken in 2002</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>Numbers of days spent for birding in 2002</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>Skill and knowledge</td>
<td></td>
<td>.86</td>
</tr>
<tr>
<td>Numbers of birds can be identified by sight</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>without field guide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbers of birds can be identified by sound</td>
<td>.69</td>
<td></td>
</tr>
<tr>
<td>Subjective level of skill</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>Commitment</td>
<td></td>
<td>.77</td>
</tr>
<tr>
<td>Other leisure activities don’t interest me as</td>
<td>.54</td>
<td></td>
</tr>
<tr>
<td>much as birding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I couldn’t go birding, I am not sure what I</td>
<td>.34</td>
<td></td>
</tr>
<tr>
<td>would do</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I stopped birding, I would probably lose</td>
<td>.24</td>
<td></td>
</tr>
<tr>
<td>touch with a lot of my friends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would rather go birding than do most anything</td>
<td>.71</td>
<td></td>
</tr>
<tr>
<td>else</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Two different validities of the scales and indicators were estimated to test the construct validity of the indicators and scales (i.e., if the indicators and scales measure what they are hypothesized to measure). First, the convergent validity of each scale was assessed. Convergent validity was defined as the agreement among indicators of a scale (Bagozzi, Yi, & Phillips, 1991). It was assessed by inspecting whether or not the factor loadings of the indicators of each scale were statistically significant. T values of all factor loadings for each scale were statistically significant at a .05 level, indicating each scale achieved convergent validity. Secondly, we assessed each scale in terms of discriminant validity, defined here as the degree to which measures of different construct are unique (Campbell & Fiske, 1959). It is achieved when the correlations between the indicators used to measure different constructs are relatively weak. The discriminant validity of each scale was assessed by testing whether or not the square root of the average variance extracted for each of the factors was greater than the square of the correlations of the constructs (Hatcher, 1994; Petrick, 2002). Table 5 shows all three factors for measuring birding specialization achieved discriminant validity, and the three dimensions of birding specialization were distinct.

Figure 4 is a second-order confirmatory factor analysis of birding specialization, which is an extension of the first-order CFA model (Kline, 1998). This model is different from the first order confirmatory factor analysis in two ways. First, in the second-order model, birding specialization acts as a second order factor (i.e., a more abstract construct that is not directly measured) comprised of the three dimensions of birding specialization as first order factors. In addition, the second order model shows the relative weight of each of the three dimensions in representing birding specialization. The overall goodness of fit of the second order confirmatory factor analysis was as satisfactory as the first order model. The goodness of fit indices were identical to those of the first order confirmatory factor analysis ($X_2 = 58.70$, df = 23, $p = .001$, CFI = .98, NNFI = .96, SRMR = .04). In addition, Figure 4
TABLE 5  Discriminant Validity of the Three Dimensions of Recreational Specialization

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<th>1</th>
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<th>3</th>
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<tbody>
<tr>
<td>1. Behaviors</td>
<td>.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Skill and knowledge</td>
<td>.23</td>
<td>.54</td>
<td></td>
</tr>
<tr>
<td>3. Commitment</td>
<td>.07</td>
<td>.08</td>
<td>.39</td>
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</tbody>
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Note: In Table 5, the bold diagonal elements are the square root of the variance shared between the three dimensions of recreational specialization and their manifest variables (average variance extracted). Off diagonals are the squares of the correlations between the three dimensions. For discriminant validity, the diagonal elements should be larger than any other corresponding row or column entry.

shows the skill and knowledge dimension represented birding specialization better than the other two dimensions.

Finally, to see if the traditional additive approach (e.g., Virden & Schreyer, 1988; Wellman et al., 1988) also fits the data, the goodness of fit of the single factor model of birding specialization (Figure 5) was tested. As shown in Figure 5, the single factor model has a poor fit to the data compared to the three-dimensional first order and second order measurement models. CFI and NNFI were also much lower than .90 and SRMR

FIGURE 4  A second order CFA of a three-dimensional measurement model of birding specialization and the standardized solution.
was much higher than .10. A Chi-square difference test indicated the additive model was significantly poorer than the three dimensional model, $X^2_{\text{diff}} (3, N = 469) = 625.77, p < .001$. Figure 5 also shows the composite reliability score of the single factor measurement model of birding specialization is acceptable (.76). The reliability was lower, however, than the three scales used for measuring three different dimensions of birding specialization even though the model used more items. This reliability score suggests an additive model to measure recreational specialization may be inappropriate.

**Discussion**

In this study, we tested whether or not Scott and Shafer’s (2001a) recent three-dimensional measurement model of recreational specialization fits the data of a sample of serious or avid American birders. They defined specialization as a process involving a progression in behavior, skill, and commitment. Results showed the correlations among the three dimensions were moderate (i.e., .27 to .48). [Some researchers argue a correlation below .39 is low and one between .49 to .69 is modest (Bryman & Cramer, 1990).] Discriminant validity tests also suggested the three dimensions of birding specialization were distinct. This finding suggests progression in behavior, skill, and commitment may not happen in a “lock step” fashion (Scott & Shafer, 2001a). In other words, behavior, skill and knowledge, and commitment are moderately related but are not always iterative and mutually reinforcing (Kuentzel & McDonald, 1992). For example, some individuals may participate in birdwatching on a regular basis but demonstrate little skill and knowledge, while other individuals may participate infrequently but have high skill and knowledge. Another possibility is that some birders (e.g., somebody with health problems) may measure high on commitment and skill and knowledge but low on behavioral involvement.
From a managerial point of view, this finding suggests recreation researchers and practitioners should collect information on all three dimensions of recreational specialization. Not doing so would potentially undermine their ability to identify distinct segments or types of activity participants. Because the three-dimensional model was a better fit to the data than a traditional additive approach, the creation of a single index to measure recreational specialization would be unwise. Such an approach has been criticized because research indicates different dimensions of recreational specialization are more or less related to others facets of involvement, including preferences for physical and social setting attributes (Kuentzel & Heberlein, 1992) and attitudes toward management actions (Kuentzel & McDonald, 1992).

Future studies need to explore how the three dimensions of recreational specialization are individually related to other facets of involvement, including motivations to participate in the activity, preferences for physical and social settings, use of information in making trip decisions, attitudes toward resource management and development, and so on. Such a program of research may provide practitioners information that will assist them in dealing with management or planning issues. For example, if skill and knowledge are found to be the most important dimension in determining birders’ preferences for physical and social settings, programs and services will need to be created to accommodate birders with varying levels of skill.

Researchers have paid little attention to whether or not individual dimensions characterize recreational specialization equally. A second-order factor analysis revealed skill and knowledge represented birding specialization better than behavior and commitment. Thus, specialization among birders must be understood, first and foremost, as a developmental process entailing a progression in skill and knowledge. Among elite birders, an individual’s identity or status is evaluated chiefly in terms of his or her ability to identify birds (Cocker, 2002; Donnelly, 1994). Frequency of participation and commitment may mean little until individuals “prove” they are skilled birders. A recreationist’s level of skill and knowledge may be essential information recreation professionals need to collect for resource development and management.

Results also revealed all of the scales had convergent validity. Each of the indicators was found to uniquely load on its respective latent factor. The items seem to be good indicators of the recreational specialization dimensions they were intended to measure. Future research, however, should focus on developing a scale to better measure behavioral dimension. We measured behavior using two traditional items (i.e., number of birding trips and number of days spent for birding trips). Behavior was not measured in light of birders’ participation in other leisure activities, which according to Scott and Shafer (2001a) is key to understanding behavioral involvement. Those individuals who are truly specialized are unlikely to have either time or resources to intensely participate in other activities. Future research is required to explore the extent to which this premise is true.

More research may need to be done to determine whether or not the scales are reliable and valid in measuring other populations of birders. The birders in this study comprised a rather elite and skilled group of recreationists. By employing Multitrait-Multimethod (Kline, 1998) confirmatory factor analysis, we may test if the scales can be applied to different populations of birders. Researchers may also want to determine if the scales can be used to measure recreational specialization among other groups of recreationists (e.g., anglers, hunters, mountain climbers).

References
Measuring Birding Specialization


