Wildlife-related Recreation Participation and Conservation Attitudes: Differences between Mail and Online Respondents in a Mixed-mode Survey

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Abstract

This study reports a comparison of demographics, outdoor recreation activity patterns, and attitudes towards conservation issues collected via mail and online survey methods within a mixed-mode survey. Pennsylvania residents, randomly sampled by Survey Sampling, Inc., were invited in a pre-survey letter to complete the survey online, or through a paper survey mailed to their homes. Differences in outdoor recreation participation were generally small for wildlife related activities, and were greater among non-wildlife related outdoor recreation activities, with the internet respondents generally reporting higher rates of participation. Analyses controlling for demographic variables showed a confounding influence on the relationships examined. Internet respondents tended to be younger, better educated, and more affluent. Conservation related attitudes did not differ between the mail and online survey respondents and were more weakly related to demographic factors. Results suggest that online surveys can yield valid results when using appropriate sampling designs and implementing quality control procedures.

Key words: mail and online surveying, outdoor recreation, demographics, funding priorities, non-response bias

Introduction

Internet surveys have grown in popularity as resource managers and researchers alike seek to realize the cost savings available through online data collection. While some have suggested that internet surveys provide unrepresentative data (e.g., Duda & Nobile, 2010), previous studies using online methods suggest that such methods have appropriate uses in human dimensions research (e.g., Lesser, Yang, & Newton, 2011; Sexton, Miller, & Dietsch, 2011; Trouthead, 2004). For example, when used to supplement random/probability-based data that can be generalized to a known population, web-based surveys can obtain a larger audience than may be possible through other methods, and can instill a sense of inclusiveness from participants that may aid in implementing subsequent management regulations or programs (Cornicelli & Grund, 2011). They also may be appropriate for surveying specialized populations and offer advantages over alternative survey modes for complicated surveys involving branching question patterns (Sexton et al., 2011).

As in all types of surveys, the potential and likely effectiveness of online surveying depend on many factors. First among these is the type of online protocol used. Some types of online surveys involve e-mail messages inviting participation while others have no corresponding e-mail request for participation and are open to anyone with internet access. Each of the methods available has its associated strengths and weaknesses, and choosing a survey delivery mode is dependent on several factors including the study objectives, sampling plan, survey instrument design, and data analysis plan (Couper & Miller, 2008; Dillman, Smyth, & Christian, 2009; Witte, 2009). Online surveys using probability samples have fewer weaknesses than those with open access and corresponding convenience samples. This is because probability samples avoid or minimize biases that threaten the representativeness of other types of samples (Vaske, 2008).

This study reports a comparison of measures of outdoor recreation activity patterns and attitudes towards conservation issues collected via mail and online survey methods within a mixed-mode survey. It is intended to contribute to our growing understanding of ways of combining various survey approaches to achieve better outcomes when using a common probability sample to represent a general population. The data presented compare the survey modes directly and examine the potential confounding effects of demographic variables that have been shown to be related to survey responses. More specifically, the paper addressed the following five research questions:

1. How do mail and internet survey respondents differ in demographic characteristics?
2. How do mail and internet survey respondents differ in recreation activity participation?
3. How do mail and internet survey respondents' recreation activity participation patterns differ, controlling for demographic variables?
4. How do mail and internet survey respondents differ in conservation-related attitudes and funding priorities?
5. How do mail and internet survey respondents' conservation-related attitudes and funding priorities differ, controlling for demographic variables?

Literature Review

Understanding of the methodological issues related to online surveying has grown over the past 10-15 years through contributions by numerous authors. For example, as in other types of surveying, response rates in online surveys can be influenced by the degree of personalization in the messages (Heerwegh, Vanhove, Matthijs, & Loosveldt, 2005; Johnson & Reips, 2007); use of an initial postcard introducing the study (Kaplowitz, Hadlock, & Levine, 2004); use of various subject lines in the corresponding e-mail (Porter & Whitcomb, 2005; Trouthead, 2004); and timing considerations, including time between contacts, time of delivery –weekend or end of day (Dillman, et al. 2009; Schillewaert, Langerak, & Duhamel, 1998).

Many studies have documented differences in the characteristics of respondents to various types of surveys. One consistent finding is that people responding to online surveys are younger on average than those responding to mail surveys (Forsman & Varedian, 2002; Kaplowitz, Hadlock, & Levine, 2004). Previous research also shows that people with more education and higher incomes are more likely to participate in online surveys, as they more likely to use the internet (Sexton et al., 2011; The Pew Internet & American Life Project, 2010). Studies comparing responses to different survey modes have found varying degrees of differences between the modes. Lesser et al. (2011) and Sexton et al. (2011) found responses to questions in a mail versus an online survey were quite similar. Gigliotti (2011) found statistically significant differences for 25% of variables examined while Penkala (2004) found 60% of responses to survey questions were significantly different between mail and internet responders. Cole (2005) looked at indicators of data quality and found that internet respondents had more missing values than respondents using a paper mail survey.

Non-response bias is one of the greatest threats to validity in any survey, and is becoming increasingly important as response rates to all types of surveys have shown a declining trend (Connelly, Brown & Decker, 2003; Cook, Heath & Thompson, 2000; Tuckel & O'Neill, 2002). Unfortunately, little is known about non-response bias in web-based surveys (Couper, 2000). In many cases (especially open-access surveys posted on websites), response rates to online surveys cannot be determined, much less assessed for their impact on sample validity. When they can be determined, response rates to online surveys are generally lower than those of mail and telephone surveys (Lozar Manfreda, Bosnjak, Haas, & Vehovar, 2008; Miller & Rogers, 2010; Shih & Fan, 2008). One reason for this is that surveys embedded in e-mails may be "filtered out" or, if received, ignored or quickly deleted by disinterested recipients (Duda & Nobile, 2010).

While non-response bias can result in unrepresentative samples, other types of bias can also make samples unrepresentative of the population they were intended to represent. For

example, stakeholder bias occurs when people with a vested interest in a survey's results complete a survey multiple times and/or urge others to complete the survey (Duda & Nobile, 2010). While safeguards can be included to minimize the risk of this type of bias, computer literate individuals can often find ways to defeat the safeguards and introduce bias via multiple survey entries. This type of bias may also occur when incentives are offered for completing online surveys.

Duda and Nobile (2010) recently questioned the use of online surveys for fish and wildlife related efforts, going so far as to state in their title that "no data are better than bad data." They describe and then document four problems that undermine the scientific validity of data gathered through online surveys: sample validity, non-response bias, stakeholder bias, and unverified respondents. All of these problems are related to or result from the fact that it is generally impossible to obtain a true probability sample of the population being studied through an internet survey. Although legitimate sampling frames may be available for some populations like students at a university, a "master list" of e-mail addresses does not exist for most relevant populations in human dimensions research because not all members of the population in question have e-mail addresses or even internet access. This problem also applies to telephone surveys, however, in that some members of the population may not have telephone access and thus could be excluded from a survey. In cases where a legitimate probability sample can be drawn, mixed-mode surveys in which individuals within a valid sample are offered different options for responding to the survey offer several potential advantages and are becoming increasingly popular (e.g., Lesser et al. 2011; Miller & Rogers, 2010; Sexton et al., 2011).

Duda and Nobile (2010) documented problems with online surveys using three recent empirical studies. In the first example, North Carolina residents' opinions about legalization of hunting on Sundays were measured through both an online poll and scientific telephone survey. The online poll was available to anyone on the state agency's website and thus involved a non-

probability sample, while the telephone survey used a random sample of state residents to achieve a representative sample. Results showed very different opinions about hunting on Sundays in North Carolina. The majority (55%) of online poll respondents supported Sunday hunting, compared to just 25% of telephone respondents. "No opinion" responses were far more common among telephone respondents (10% versus 2% in the online poll), suggesting that people with a vested interest (i.e., Sunday hunting proponents) were more likely to complete the online poll.

The second empirical example reported by Duda and Nobile (2010) involved a comparison of online survey respondents with a telephone survey of non-respondents to the online poll. In this case, the web-based survey was distributed via e-mail to individuals who provided an e-mail address when applying for an Arizona big game hunting permit. Statistically significant differences between the online and telephone samples were found for 41% of the variables in the study. The telephone respondents were older than the online respondents and differed on many attitudinal and behavioral variables, such as the importance of various permit/tag regulations and membership in or donation of money to hunting or conservation organizations.

Duda and Nobile's (2010) final empirical example involved a comparison of telephone and online surveys of South Carolina saltwater recreational fishing license holders. This study involved a finite and known population of license holders against which results of both surveys could be compared. The telephone survey used a probability sample drawn from the entire saltwater fishing license database, while the online survey used a sample drawn from those license holders who provided an e-mail address when purchasing their licenses (i.e., a non-probability sample). Results of both surveys were compared with data for the entire population for several demographic and geographic variables. The online responders were better educated, more affluent, and more likely to be male. Telephone survey results were generally consistent

with corresponding population data within an acceptable margin of error. In particular, the telephone survey much more closely represented the true proportion of females in the total population of saltwater anglers, while the online participants included more avid and disgruntled anglers.

Other researchers have also examined the differential effects of online versus other survey methods in different contexts. Sexton et al. (2011) conducted a mixed mode survey (mail and online) of visitors to National Wildlife refuges. Visitors at 52 refuges nationwide were sampled onsite and asked whether they were willing to participate in a follow-up survey. Information collected during the onsite intercept included the visitor's name and mailing address along with language preference and survey mode preference (mail or online). Although visitors were asked whether they preferred to complete the survey online or through the mail, all contacts with sampled individuals were by mail (e-mail addresses were not collected). The overall response rate was high (72%) and almost evenly divided between the two survey modes (49% of responses online and 51% via mail). Interestingly, however, about one-third of each preference group did not use their preferred survey mode. Sexton et al. (2011) found small differences in the demographics of online versus mail survey respondents; the online respondents were two years younger on average and reported higher education and income levels. Based on the effect sizes for the different variables, the authors suggested education and income may influence mode selection more than age. They argued that maintaining both survey options throughout the entire survey process contributed to a higher response rate and was necessary given the tendency of many respondents to deviate from their stated preference.

Miller and Rogers (2010) compared online and mail survey responses to public perceptions of Georgia's coastal resources. Like Sexton et al.'s study, Miller and Rogers began with an onsite sample of coastal recreationists and offered willing participants a choice between a mail and online follow-up to an intercept survey. Unlike Sexton et al., Miller and Rogers' study

implemented each respondent's preferred method for receiving the follow-up survey. They found people more likely to choose the online alternative, but received a lower response rate among those selecting the online option. This difference is consistent with other literature documenting lower response rates for online surveys and was attributed to factors such as potential loss of e-mail messages through spam filters and ease of ignoring e-mail messages containing the survey protocol.

Lesser et al. (2011) examined differences in hunter characteristics and opinions gathered through a mixed-mode survey versus a traditional mail survey. They surveyed a probability sample of Oregon hunters but did not offer subjects a choice of survey options. Half of their sample received a traditional mail survey while the other half received a mixed-mode survey in which they were first asked to complete the questionnaire on the internet and then sent a printed version if they did not respond to the internet questionnaire. The hunters receiving all contacts by mail had the highest response rate. Lesser et al.'s (2011) results showed similar levels of item non-response and generally similar responses across the two survey modes. Their study demonstrated that a mixed-mode survey can provide an advantage over single mode internet surveys by offering an opportunity for people less likely to have or use internet access, such as older and less affluent individuals, a means to participate in the survey. From a cost comparison perspective, however, the estimated cost per completed questionnaire was lowest for the mail only approach due to its higher rate of response.

Cornicelli and Grund (2011) compared hunters' attitudes towards regulatory change across three modes of data collection (a random mail survey, public input meetings, and an internet survey). The mail survey used a stratified random sample while participants in the public input meetings and internet survey were self-selected. Findings showed both groups of self-selected respondents were not representative of the overall deer hunter population demographically, but attitudinal differences were minimal. Cornicelli and Grund (2011) make a

case for using non-representative data such as input from public meetings and internet surveys with convenience samples as a supplement to probability-based user data.

Gigliotti (2011) compared a traditional mail survey of South Dakota spring turkey hunters with one using an e-mail with a link to a web-based survey. Like most similar studies, the mail survey received a higher response rate (75%) than the internet survey (44%). Comparison of responses to the two surveys found nine significant differences in 36 statistical tests, although the differences were relatively small. Gigliotti warned against use of internet-only surveys because of problems with sample validity and non-response bias. He suggested using a mixed-mode design to compensate for the shortcomings of each individual approach.

Vaske, Jacobs, Sijtsma, and Beaman (2011) investigated weighting strategies as a means to compensate for sampling issues in internet surveys. They used census demographic data (sex, age, and current residence) to adjust responses to a traditional random mail survey and an identical internet questionnaire. Results showed that the mail sample differed from the internet sample in terms of education and wildlife value orientations. The internet survey overrepresented highly educated people and those who are ambivalent towards wildlife. The weighting strategy successfully forced the mail sample to be statistically equivalent to the Dutch population, but could not be used to compensate for the internet convenience sample. The authors urged that caution should be used when generalizing the results from internet surveys.

In summary, previous studies have examined many issues associated with internet surveys. Some clear patterns emerge, such as the lower response rates and unrepresentative (e.g., younger, more affluent) samples associated with many internet-based surveys. Collectively the literature suggests that internet surveys may be appropriate in situations where threats to validity can be controlled and especially in combination with other approaches in mixed-mode surveys. This paper contributes to this literature by reporting a comparison of demographic

characteristics, recreation activity patterns, and attitudes towards conservation issues of online versus mail survey respondents in a mixed-mode survey.

Methods

Data were from a 2009 statewide resident survey conducted in support of Pennsylvania's Statewide Outdoor Recreation Plan. The survey instrument was a 12-page questionnaire with sections on outdoor recreation activities and interests, area and facility needs, and other current issues and priorities such as recreation and physical activity and people's connection with the outdoors. A random sample of Pennsylvania residents was purchased from Survey Sampling, Inc. The sample was designed to provide even representation for six state planning regions and the two urban areas of Philadelphia and Pittsburgh. The goal of the sample design was to achieve statistically valid data, defined as a 5% margin of error with 95% confidence, at a regional level. This goal required a target sample size of about 350 completed responses per region. The sample included 1,600 residents in each region to achieve this target, based on an expected response rate of about 20-25%.

The survey protocol followed the Dillman Tailored Design Method and included a total of five mailings (pre-survey letter, full survey mailing with postage-paid return envelope, post card reminder, second full mailing, and final post card reminder). In a deviation from previous statewide recreation surveys, individuals within the sample were invited in the pre-survey letter to complete the survey online, or through a traditional paper survey to be mailed to their homes. The risk of multiple entries was controlled, as respondents were required to enter a unique identification number when accessing the online survey. A total of 2,648 online and mail surveys were received, representing a response rate of about 21%. Surprisingly, relatively few people (about 14% of total respondents) selected the online option. Although each of the mailings reminded respondents about the online opportunity, most of those responding to the survey inquiry completed the paper questionnaire.

To check for non-response bias, or the possibility the responding households differed from the population they were intended to represent, 200 non-responding households were called and administered a brief interview with selected questions from the larger survey. Results of the telephone calls showed that respondents were somewhat more committed outdoor recreationists. For use in the state recreation plan, the survey data were weighted for non-response bias and for region and gender to provide better representation of the overall state population. The unweighted data were used in this paper to highlight the effects of the variables included in the analyses.

This paper focuses on a comparison of those choosing to complete the online version of the survey (n = 361) and those completing the traditional paper questionnaires (n = 2,287). All respondents are from the same sampling frame (i.e., a random sample of Pennsylvania households). Sampled individuals were allowed to select their preferred mode of survey and this paper compares the resulting two groups' demographic profiles and their responses to questions on recreation activity participation and conservation related attitudes and funding priorities. The initial bivariate comparisons of groups are followed by multiple regression analyses that examine the effect of survey mode while controlling for the demographic variables of age, gender, education, income, and area of residence (rural/urban).

Results

Research Question 1: How do mail and internet survey respondents differ in demographic characteristics?

The demographic characteristics of respondents to the mail survey were compared with those choosing the internet survey (Table 1). Three of five variables examined differed significantly between the two groups, with the difference in age between the two sub-samples being the most striking. Internet respondents were much younger, averaging 47 years old compared to 57 for mail survey respondents. The age categories in Table 1 compare baby

boomers (ages 44-62) with older individuals (pre-boomers over 62 years old) and younger people (post-boomers under the age of 44). Internet survey participation dropped off sharply among the oldest group and was much higher among the youngest group (41% of the internet respondents vs. 19% of mail survey respondents). Internet survey respondents also tended to have more formal education and higher income levels than the mail survey respondents. There was no difference between the two groups in terms of gender or place of residence (rural vs. urban).

Table 1 about here

Research Question 2: How do mail and internet survey respondents differ in recreation activity participation?

Rates of participation were compared across mail survey versus internet survey respondents for several wildlife related and non-wildlife related activities (Table 2). The activities examined included a variety of land and water based recreational pursuits, ranging from relatively common activities like wildlife viewing and hiking to less common (e.g., rock climbing) or "new" (e.g., geocaching) activities. The differences were generally small and non-significant for the wildlife related activities. Only bird watching differed significantly, with mail survey respondents slightly more likely to participate (31%) than internet respondents (26%).

Among the non-wildlife related activities, the differences were greater and showed a consistent pattern (Table 2). The online respondents generally reported higher rates of participation. This pattern held true for relatively popular activities like hiking and biking as well as less common activities like skiing, rock climbing, and geocaching. One notable exception was the activity of dog walking, which was far more common among the mail survey respondents. Over one-third of them (36%) reported participating in dog walking, compared to just 4% of the internet respondents. These differences are not surprising given the tendency of mail survey respondents to be older individuals who generally prefer more passive or low impact activities.

Table 2 about here

Research Question 3: How do mail and internet survey respondents' recreation activity participation patterns differ, controlling for demographic variables?

Logistic regression was used to examine the effects of survey mode along with five demographic variables (age, gender, education level, income, and place of residence) on participation in recreation activities (Table 3). The dependent variables were dichotomous (participation/no participation) and the independent variables were dichotomous with the exception of age, which was continuous (actual reported age). Test statistics shown for each activity include the Nagelkerke R^2, showing the relative strength or degree of explanation of activity participation; the Wald statistic, indicating the test of significance of each variable; and the Exp (B) or odds ratios, providing the most useful interpretation of the relationships. For the odds ratios, values above 1 indicate an increasing probability of participation per unit increase in the independent variable; values less than 1 indicate an inverse relationship or decreasing odds of participating per unit gain in the independent variable. For example, an Exp (B) value of 3.2 for gender on participation in fishing would indicate that the odds of men participating in fishing are 3.2 times higher than they are for women.

Table 3 about here

The effect of survey mode was generally not significant or a weak predictor of participation with other demographics included in the analysis (Table 3). The effect was significant for only 5 of the 14 activities examined, and was quite weak for most of those. The exception was dog walking, where survey mode was the strongest predictor of participation. Internet respondents were far less likely (odds ratio = .076) than mail survey respondents to report participating in dog walking. This remains a true anomaly in the findings, as the internet respondents were generally more likely to participate in most of the outdoor activities. This effect was greater than the effect of age, which was the only other significant predictor for that

activity. Accounting for the survey mode, younger people were more likely to report participating in dog walking, reflecting the normal inverse relationship between age and participation.

Age was generally one of the strongest predictors of activity participation and tended to show a predictable inverse relationship. The odds ratios are consistently below 1, reflecting decreasing participation with increasing age (the closeness to1 depicts the relative influence of each additional year of age on activity participation). Age was the strongest correlate of participation for hiking, biking, and canoeing. Among the wildlife-related activities, age showed the greatest effect on fishing, hunting, and bird watching. Fishing and hunting were inversely related to age, while bird watching was the only activity that showed increasing participation among older respondents.

Gender differences were greatest among the consumptive activities of hunting and fishing. The odds of hunting were 11.9 times higher for men than women, while the odds of fishing and ice fishing were 3.2 and 3.9 times higher for men than women, respectively. Gender showed a consistent but weaker pattern among many of the other activities, reflecting higher levels of participation among men than women. Notably, gender was not a significant factor related to participation in bird watching, rock climbing, geocaching, and dog walking. Among the water-based activities, men were more likely to participate in canoeing, but men and women participated equally in kayaking, reflecting recent growth in popularity of kayaking among women (Pennsylvania Department of Conservation and Natural Resources, 2009).

The influence of education on recreation participation was generally weaker and less consistent than the other demographic predictors. Level of education was inversely related to participation in the consumptive wildlife related activities, especially hunting, while it showed a slight positive influence on hiking, biking, kayaking, and downhill skiing. Income was also a relatively weak predictor, but showed its greatest effect on biking, kayaking, and especially

downhill skiing. Given the cost of downhill skiing, it is not surprising that income was a strong predictor of participation. Age was another relatively strong predictor of downhill skiing, reflecting the fact that skiing is dominated by younger participants.

Place of residence (rurality) was positively associated with participation in many of the activities examined. Among the wildlife related activities, it showed the greatest effect on hunting, with much higher rates of participation among rural residents. It is notable that this pattern held true among the non-consumptive wildlife activities of bird watching and wildlife viewing as well. The effect of place of residence was generally very small for the non-wildlife related activities, and less consistent. For example, people in more rural areas were more likely than urbanites to participate in canoeing, but less likely to report participating in bicycling.

The survey mode and demographic variables account for varying levels of explanation of participation in the recreation activities examined in Table 3, ranging from about 3% for bird watching and wildlife viewing to almost 30% for hunting. Although these pseudo R^2 values do not truly measure the amount of variance explained in these analyses, they are useful in showing the relative degree of explanation for different activities and strength/effect size and significance of the various predictor variables.

Research Question 4: How do mail and internet survey respondents differ in conservation-related attitudes and funding priorities?

A similar analysis was conducted to examine the effects of survey mode on conservation related attitudes and priorities for funding of conservation related programs. In the initial bivariate comparison of mail and internet respondents, none of the attitudinal variables differed significantly between the internet and mail survey groups (Table 4). For both groups, most of the respondents agreed that they *do their part to conserve natural resources*, and most felt that *the general environmental quality of public recreation areas near where I live is good*. They were more likely to disagree with the statements that *streams and rivers near where I live are in poor*

condition, and that *local waterways for boating and fishing opportunities are inaccessible*. Relative to funding priorities, both groups placed the highest priority on *protecting wildlife habitat and conserving wild resources* and *restoring damaged rivers and streams*, and placed slightly less importance on *providing environmental and conservation programs* and *acquiring and protecting open space as undeveloped recreation land*.

Table 4 about here

Research Question 5: How do mail and internet survey respondents' conservation attitudes and funding priorities differ, controlling for demographic variables?

Although mail and online survey respondents did not differ in their conservation-related attitudes and funding priorities, it is possible that survey mode could affect these responses when combined with other demographic variables. Thus, multiple regression was used to examine the effects of survey mode along with five demographic variables (age, gender, education level, income, and place of residence) on conservation attitudes and funding priorities (Table 5). In this case, the dependent variables were continuous (5-point scales) and the independent variables were dichotomous or continuous (age), as in the previous logistic regression analyses. Test statistics shown for each statement include the R^2 values, showing the relative strength or degree of explanation of the attitudinal variables, the *t* statistic, indicating the test of significance of each variable, and the Beta coefficients, showing the relative strength of each variable while controlling for the other predictor variables.

Table 5 about here

As in the previous analyses, survey mode remained a not significant predictor of conservation attitudes and funding priorities (Table 5). Several significant predictors were found for the various attitudinal measures, but the relationships were much weaker than those shown earlier for the activity participation variables. Age was positively related to the perception that the *environmental quality of public recreation areas near where I live is good,* and the statement,

I do my part to conserve our natural resources. Gender was related to two funding priorities, with females more supportive of *providing environmental and conservation programs* and *protecting wildlife habitat and conserving wild resources.* Education showed only one significant effect, with less educated respondents more likely to indicate that *local waterways for boating and fishing opportunities are inaccessible*. A similar effect was found for income, which also showed an inverse relationship with the perception that *streams and rivers near where I live are in poor condition*. Conversely, income was positively associated with the view that *the general environmental quality of public recreation areas near where I live is good.* Place of residence was the demographic variable most frequently contributing to the conservation-related attitudes and funding priorities. Those living in rural areas were more likely to indicate they *do their part to conserve natural resources*, and also placed less priority on *acquiring open space as undeveloped recreation land* and *restoring damaged rivers and streams*. All of the effects noted, however, were relatively weak and accounted for just 1-2% of the variance in the attitudinal and funding related variables.

Discussion

This paper examined differences between mail and online survey responses to a series of demographic, behavioral, and attitudinal questions. Although all respondents were members of the same probability sample of Pennsylvania residents, the mail and internet respondents differed with respect to key demographic variables. These differences in turn were reflected in the recreation activity participation of survey respondents but had little to do with their conservation-related attitudes. Age was the strongest factor distinguishing the two samples. Consistent with most previous studies (Duda & Nobile, 2010; Kaplowitz et al., 2004: Sexton et al., 2011), the internet respondents were younger and had higher levels of education and income. While Sexton et al. (2011) suggested that choice of survey mode may be more strongly affected by education and income than age, this study showed that age had a stronger effect. When combined with

other variables, age was frequently the strongest predictor of recreation activity participation. The effect of survey mode was either greatly reduced or eliminated when age was included in the equation. Conversely, other demographic variables often contributed additional explanation above and beyond the influence of age on participation in various activities. For example, along with age, education and income were related to participation in hiking, biking, and kayaking, while place of residence contributed strongly to understanding participation in wildlife related activities.

Both survey mode and demographic variables were much more strongly related to recreation activity participation than they were to conservation attitudes and funding priorities. These findings are generally consistent with existing understanding of demographic differences in outdoor activity participation. Rates of participation in most outdoor recreation activities decline with age and increase with higher levels of education and income. These differences were much greater and more consistent for the non-wildlife related activities. Given that online respondents were more likely to participate in many outdoor activities, conducting this type of survey online (or offering an online option as in the case of this study) may exacerbate the non-response biases inherent in other survey methods, such as the tendency for those more interested in the topic to complete the survey (Duda & Nobile, 2010). In this study, non-response bias was a factor in both the mail and online protocols and was possibly greater for the internet respondents as a result of their lower ages and corresponding more active outdoor recreation lifestyles.

It is interesting that results for the wildlife related activities differed from those for the non-wildlife related outdoor recreation activities. While the patterns of relationships between variables were consistent across many non-wildlife related activities, the findings for different wildlife-related activities were more unique and specific. For example, rather than the general inverse relationship between age and participation, age was a less powerful predictor of

participation in wildlife related activities and actually showed a positive relationship with bird watching. Gender showed an unusually large effect on hunting participation, while place of residence showed relatively strong effects on participation in hunting, wildlife viewing, and bird watching. Designers of wildlife related surveys should carefully consider their target population prior to selecting any alternative survey protocol, and examine the potential biases that each option may have on survey results.

In this study, differences in conservation related attitudes and priorities by survey mode were not significant and the effects of demographic factors on these measures were negligible. Cornicelli and Grund (2011) also found attitudinal differences to be minimal compared to differences in demographics across survey modes. Perhaps such attitudes are more stable across survey methods compared with demographics and behavioral variables like outdoor recreation participation. If so, choice of survey method may not be as critical for these types of variables. More research is needed to identify what predicts these types of attitudinal variables and the methodological implications for designing appropriate survey protocols.

What do the findings of this study mean in relation to Duda and Nobile's (2010) assertion that online surveys may yield invalid or wrong results? Our study compared online and mail survey respondents within the same probability sample, while Duda and Nobile's (2010) examples compared online results with telephone surveys using different sampling designs. The differences noted between our online and mail survey respondents were certainly smaller and generally accounted for by factors other than survey mode. One might consider Duda and Nobile's examples "worst case scenarios" where the results compared could not reasonably be expected to be similar. These differences might be attributed to sampling issues rather than resulting from different modes of data collection. Mixed-mode surveys such as ours and those reported by Sexton et al. (2011), Lesser et al. (2011), and Miller and Rogers (2010) showed smaller effects of alternative survey procedures. Thus, online methods may be a reasonable

component of a larger, mixed mode approach to surveying a clearly defined population with a valid probability sample.

Was it worth it to include the online option within our survey of state residents' outdoor recreation behaviors and related attitudes? Sexton et al. (2011) claimed an improved response rate and a substantial savings in costs by offering an online alternative. In contrast, Lesser et al. (2011) found that the *cost per completed survey* in their study of Oregon hunters was lowest for the traditional mail survey approach, followed by the internet only and web/mail hybrid options; the web/mail approach had a 64% higher cost per completed questionnaire compared to the mail only approach. Our rationale for offering the online option included the hope for reduced printing and mailing costs along with the potential for an improved response rate. Although some mailing costs were realized, the benefits were minimal, as only 14% of those responding to the survey chose the online alternative. In retrospect, we would not be likely to repeat this protocol if we conducted a similar survey in the future. From our experience along with the findings of other papers included in this special issue, we would more likely follow Vaske et al.'s (2011) recommendation to avoid offering respondents a choice of whether to respond via the internet or through the mail, as such approaches have tended to achieve lower response rates than traditional mail surveys.

In conclusion, while online surveying is far from a panacea and is plagued by numerous pitfalls that can lead to potentially disastrous results, there is clearly an appropriate and legitimate role for online surveys in human dimensions studies. Results do not always produce data that is "worse than no data" (Duda & Nobile, 2010). This study, along with the growing number of surveys using various online protocols and combinations of approaches, demonstrates that valid results are possible when using an appropriate sampling design and quality control procedures for implementation.

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Table 1.
Characteristics of respondents by survey mode.

	Internet (%)	Mail (%)	Chi Square	Cramer's *V*
Age				
< 44	41.2	19.1	94.393***	.199
44 - 62	47.9	46.9		
> 62	10.9	34.1		
Gender				
Male	69.4	66.9	0.707	.017
Female	30.6	33.1		
Education				
High school or less	18.9	30.4	29.021***	.109
Technical/vocational school	7.9	11.2		
Some college	17.1	18.2		
College graduate	33.6	23.2		
Post graduate	22.5	17.1		
Income				
Less than $20,000	4.6	13.0	35.805***	.108
$20,000 - $39,999	15.0	22.5		
$40,000 - $59,999	22.9	22.2		
$60,000 - $79,999	19.2	16.7		
$80,000 - $99,999	12.1	10.4		
$100,000 or more	26.3	15.1		
Place of Residence				
City	19.8	16.2	6.783	.053
Suburb	28.0	24.9		
Town	22.8	21.7		
Rural area	29.5	37.2		

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 2.

Recreation activity participation by survey mode.

Activity	Internet (%)	Mail (%)	Chi Square	Cramer's *V*
Wildlife-Related Activities				
Ice Fishing	5.9	7.0	0.6	.015
Fishing	39.9	38.8	0.2	.008
Hunting	25.2	28.4	1.6	.025
Bird Watching	25.5	30.8	4.3*	.041
Wildlife Viewing	51.7	46.6	3.3	.036
Fish Viewing	16.9	16.9	0.0	.000
Non-Wildlife-Related Activities				
Hiking/Backpacking	43.2	29.7	28.0***	.104
Biking	41.8	31.9	14.0***	.073
Canoeing	20.1	14.2	8.7**	.058
Kayaking	13.1	7.9	10.9**	.065
Downhill Skiing	14.2	7.8	16.5***	.080
Rock climbing	5.6	2.8	8.1**	.056
Geocaching	6.4	2.0	24.2***	.096
Dog walking	3.8	35.6	151.6***	.241

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 3.

Logistic regression analysis of activity participation by survey mode and demographic variables.

Activity	Test Statistic	Independent Variables					
		Survey Mode[1]	Age[2]	Gender[3]	Education[4]	Income[5]	Residence[6]
Wildlife Related Activities							
Ice Fishing (Nagelkerke R^2=.068)	Wald	0.03	2.61	27.5***	10.5***	0.01	4.9*
	Exp(B)	.955	.990	3.913	.528	1.007	1.463
Fishing (Nagelkerke R^2=.124)	Wald	0.1	43.6***	114.0***	8.8**	3.5	11.8***
	Exp(B)	.958	.977	3.266	.737	1.214	1.398
Hunting (Nagelkerke R^2=.291)	Wald	0.5	17.3***	195.1***	24.1***	1.6	95.1***
	Exp(B)	.879	.983	11.869	.499	1.160	2.927
Bird Watching (Nagelkerke R^2=.026)	Wald	0.4	18.1***	1.0	1.5	1.7	10.7***
	Exp(B)	.896	1.015	.901	1.138	.869	1.385
Wildlife Viewing (Nagelkerke R^2=.035)	Wald	4.6*	6.2**	10.6***	3.5	4.6*	18.5***
	Exp(B)	1.374	.992	1.378	.834	1.236	1.495
Non-Wildlife Related Activities							
Hiking/Backpacking (Nagelkerke R^2=.128)	Wald	4.8*	92.6***	11.0**	12.6***	7.4*	1.4
	Exp(B)	1.392	.964	1.442	1.447	1.331	1.127
Biking (Nagelkerke R^2=.122)	Wald	0.2	74.8***	17.4***	5.3*	20.1***	15.7***
	Exp(B)	1.078	.969	1.585	1.269	1.598	.663
Canoeing (Nagelkerke R^2=.073)	Wald	0.7	48.5***	11.3***	0.1	4.1*	10.6***
	Exp(B)	1.170	.967	1.633	1.038	1.312	1.515
Kayaking (Nagelkerke R^2=.070)	Wald	0.6	7.3**	0.8	10.7***	17.7***	0.5
	Exp(B)	1.189	.983	1.172	1.756	2.135	1.120

Table 3, continued.

Activity	Test Statistic	Independent Variables					
		Survey Mode	Age	Gender	Education	Income	Residence
Downhill Skiing (Nagelkerke R^2=.111)	Wald	0.5	30.5***	4.1*	6.3*	22.4***	1.4
	Exp(B)	1.177	.966	1.458	1.534	2.354	.816
Rock Climbing (Nagelkerke R^2=.047)	Wald	5.4	13.2***	1.3	1.7	0.1	0.2
	Exp(B)	2.032	.966	1.381	.701	1.103	.897
Geocaching (Nagelkerke R^2=.077)	Wald	10.8***	13.6***	0.8	2.0	0.2	0.3
	Exp(B)	2.733	.962	1.319	1.511	.962	1.176
Dog Walking (Nagelkerke R^2=.113)	Wald	76.6***	40.8***	1.2	1.0	3.0	0.1
	Exp(B)	.076	.978	.893	1.107	1.201	1.015

[1] Survey mode coded as mail = 0 and internet = 1.

[2] Age coded as continuous variable, actual age in years.

[3] Gender coded as female = 0 and male = 1.

[4] Education coded as high school through some college =0 and college graduate or post graduate = 1.

[5] Income coded as less than $60,000 = 0, more than $60,000 = 1.

[6] Place of residence coded as urban, suburb, or town = 0 and rural = 1.

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 4.

Conservation attitudes and funding priorities by survey mode.

	Internet	Mail	*t* Value	*eta*
Conservation Attitudes[1]				
The general environmental quality of public recreation areas near where I live is good	3.61	3.65	0.69	.015
Streams and rivers near where I live are in poor condition	2.87	`2.81	0.76	.017
I do my part to conserve our natural resources	4.07	4.17	1.94	.038
Local waterways for boating and fishing opportunities are inaccessible near where I live	2.37	2.44	0.82	.018
Funding Priorities[2]				
Acquire and protect open space (as undeveloped recreation land)	3.84	3.92	1.02	.022
Provide environmental and conservation programs	3.91	4.00	1.25	.027
Protect wildlife habitat and conserve wild resources	4.37	4.35	0.33	.007
Restore damaged rivers and streams	4.38	4.32	1.01	.023

[1] Scale: 1 = strongly disagree to 5 = strongly agree

[2] Scale: 1 = not at all important to 5 = extremely important

All *t*-tests not significant at $p < .05$

Table 5.

Multiple regression analysis of conservation attitudes and funding priorities by survey mode and demographic variables.

	Test Statistic	Independent Variables					
		Survey Mode	Age	Gender	Education	Income	Residence
Conservation Attitudes							
The general environmental quality of public recreation areas near where I live is good (R^2=.011)	*t*	-0.0	2.7**	1.7	1.1	2.0*	1.1
	Beta	-.004	.069	.043	.029	.052	.026
Streams and rivers near where I live are in poor condition (R^2=.013)	*t*	0.7	-0.2	-1.6	-1.1	-1.8	-3.6***
	Beta	.017	-.004	-.040	-.028	-.047	-.089
I do my part to conserve our natural resources (R^2=.020)	*t*	-0.2	4.4***	0.9	-0.1	0.1	3.3***
	Beta	-.006	.106	.022	-.002	.002	.076
Local waterways for boating and fishing opportunities are inaccessible near where I live (R^2=.007)	*t*	-0.3	0.3	-0.1	-1.1	-2.2*	-1.7
	Beta	-.009	.007	-.003	-.029	-.058	-.043
Funding Priorities							
Acquire and protect open space (as undeveloped recreation land) (R^2=.014)	*t*	-1.0	-0.9	-1.0	1.6	1.2	-3.8***
	Beta	-.023	-.020	-.023	.039	.031	-.089
Provide environmental and conservation programs (R^2=.007)	*t*	-0.7	-0.4	-2.9**	-0.2	-0.7	-1.5
	Beta	-.016	-.010	-.069	-.006	-.017	-.035
Protect wildlife habitat and conserve wild resources (R^2=.007)	*t*	1.2	-0.7	-2.6*	-1.9	0.0	0.1
	Beta	.029	-.018	-.061	-.047	.001	.002
Restore damaged rivers and streams (R^2=.009)	*t*	1.8	0.7	-1.8	-2.0*	1.9	-2.6*
	Beta	.042	.018	-.043	-.049	.048	-.061

* $p < .05$ ** $p < .01$ *** $p < .001$