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Predicting development preferences for fishing sites among diverse anglers

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Abstract

Shifting demographics among angling communities mean that managers may need different amenities at fishing sites to satisfy new constituents. Anglers approach recreational fishing from diverse demographic and cultural perspectives which influence the sites they access and utilize. Understanding linkages between landscape preferences at fishing sites and demographics in shaping those preferences can improve plans for providing better fishing experiences for diverse constituents. We began addressing this need with a survey of 811 resident anglers in North Carolina. Respondents were asked to state their preference for development at fishing locations, and choose between pictures of streams, rivers, and lakes with and without visible docks and walkways. We used logistic regression analysis to model preference for development in each of the four contexts, with demographics and fishing practices as independent variables. Anglers who stated a preference for developed fishing sites and chose pictures with docks and walkways tended to be non-White minorities, female, older than average, and fish more frequently. Consumptive anglers, however, preferred the less developed site. These results suggest that should the current angling population continue to age and diversify, more individuals will desire development of user amenities at fishing sites. Development of family oriented sites may successfully attract and maintain key groups of anglers and encourage intergenerational transfer of fishing as a cultural practice.

Keywords Site preference · Landscape design · Recreational fishing · Anglers · Visual preference survey

Introduction

Shifting demographics in the United States portend changes in the angling community, and fisheries conservation agencies must adapt to these changes to serve their constituency and maintain conservation funding. The first decade of the twenty-first century saw the percentage of minority anglers in the United States double from 7 to 14%, reflecting a broader demographic shift nationally (USFWS 2011). Similarly, 89% of anglers now reside within municipalities containing at least 50,000 residents (USFWS 2011). Average angler age has also increased over the last several decades, following general population trends (USFWS 2011). Planning efforts attempting to meet the needs of this growing and diversifying constituency of anglers are essential for fisheries conservation because fisheries management agencies often rely heavily on license sales and an excise tax on fishing equipment (e.g., Federal Aid in Sport Fish Restoration Act funding in the United States) for operating budgets (Radonski 1984; Fedler et al. 1998). License fees generate valuable tax funds in Canada and countries in Europe

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(Arlinghaus 2006; Sharp and Wollscheid 2009), and recreational fishing expenditures support economies in some rural communities (Bergstrom et al. 1990; Arlinghaus et al. 2002). Assuming fishing provides social goods, extending the opportunity to more diverse user groups is morally justified (Hunt et al. 2007). Fostering inclusion of diverse demographic groups will require planners to provide services that meet the new and evolving demands on fishery resources (Arlinghaus et al. 2015).

Anglers approach recreational fishing from diverse cultural frameworks which influence the sites they access and utilize (Campbell 1989). Therefore, recognizing these distinct perspectives and determining what type of fishing landscapes diverse anglers prefer is a critical step towards developing fishery resources that cater to shifting angler constituencies (USFWS 2011; Arlinghaus et al. 2016; Lee et al. 2016). Dustin et al. (1991) suggest that minority anglers may differ in site preferences, angling behaviors displayed, and their general perspectives of nature. Previous studies indicate that Black anglers place more emphasis on consuming fish they catch when compared to White anglers (Hunt et al. 2007; West et al. 1992), and, thus, prefer sites in which they may do so. Research on recreational site preferences in non-angling contexts suggests people with greater familiarity with undeveloped recreational sites tend to view them more positively (Dearden 1984). Based on this familiarity-preference logic, Black and Hispanic anglers may prefer developed fishing sites (e.g., with docks, decks, etc.) because they are more likely than White anglers to fish within urban boundaries where such amenities are available (Ditton and Hunt 1996). Limited access to transportation or perceived barriers to accessing transportation may also limit Blacks and Hispanics from visiting more distant outdoor recreation sites that they may otherwise prefer (e.g., Xiao et al. 2017). Although familiarity may partially explain differential use of urban and rural fishing sites, researchers have not explicitly evaluated fishing landscape preferences.

Hypotheses about how demographic attributes of anglers predict fishing landscape preferences can be drawn from studies investigating general landscape preferences. In the United States, Black individuals tend to prefer developed landscapes over undeveloped landscapes (Elmendorf et al. 2005). Specifically, they have shown preferences for public areas with walkways and benches (Kaplan and Talbot 1988), an affinity for facilities and maintenance in urban parks (Gobster 2002), and were more likely to prefer turf grass over native plant landscaping (Peterson et al. 2012). Similarly, Buijs et al. (2009) found that when compared to native Dutch citizens, Middle Eastern immigrants preferred developed over wilderness landscapes. In this case, stronger anthropocentric views among Middle Eastern immigrants may have driven preferences for developed landscapes. Multiple theories have been formulated to explain these preferences, including a history of marginalization from undeveloped wilderness areas, subculture/ethnicity theories, and discrimination theories linked to prejudice and discrimination that have historically suppressed minority use of recreational spaces and undeveloped areas (Washburne 1978; Floyd 1999; Gobster 2002; Elmendorf et al. 2005). In the United States, Blacks have historically been excluded from outdoor recreational sites and are still subject to discrimination at recreations sites (Elmendorf et al. 2005; Stodolska et al. 2013). Social norms related to ethnicity may predict preferences for outdoor recreation locations and preferred levels of crowding at those sites (Manning and Krymkowski 2014).

Socio-economic status, age, and gender also predict landscape preferences. In a study of residential support for floodplain restoration along the Rhine River in the Netherlands, respondents with higher levels of formal education placed greater emphasis on the scenic and natural value of the river (Buijs 2009). Similarly, Van den Berg et al. (1998) reported that individuals with higher levels of formal education showed a greater preference for the aesthetics of undeveloped landscapes. Van den Berg and Koole (2006) noted that older individuals (≥50 years of age) preferred developed landscapes over completely undeveloped landscapes. They explained that higher physical and psychological vulnerability among the elderly, can make them more susceptible to the perceived dangers of undeveloped wilderness areas. Conversely, Howley et al. (2012) stated that older respondents preferred less developed agricultural landscapes and suggested their findings may relate to generational differences and upbringing, as older respondents may have more familiarity with agricultural landscapes. In the same study, female respondents were more likely to prefer undeveloped agricultural landscapes compared to male respondents. These findings highlight key variables that may predict landscape preferences among diverse anglers.

We began addressing the need for research on fishing landscape preferences with a study of anglers in North Carolina. North Carolina, like much of the United States, is experiencing rapid urbanization and shifting demographics towards an older and more racially diverse population. In 2010, 66.1% of North Carolinians lived in urban communities, which includes urban areas (communities with more than 50,000 people) and urban clusters (communities with 2500 to 50,000 people) (U.S. Census Bureau 2011). In 2010, minority groups embodied 34.7% of the population in North Carolina, an increase of 4.9% since 2000 (U.S. Census Bureau 2011). In North Carolina, the total number of anglers has nearly doubled in ten years, from approximately 894,000 in 2000 to 1,307,000 in 2010, with the percent of minority anglers growing faster than the total angling population. During 2000–2010, the total angling population increased by 46% while the minority angling population increased by 78% (USFWS 2001; USFWS 2011). With this transitioning population in mind, we broaden the landscape preference research by investigating fishing landscape preferences. We used a visual preference survey to determine if anglers prefer developed or undeveloped fishing

landscapes. We tested five hypotheses about fishing landscape preferences among anglers:

1. Age will be positively related to preference for developed fishing sites;
2. Education will be negatively related to preference for developed fishing sites;
3. Non-White anglers will prefer developed fishing sites more than White anglers;
4. Female anglers will prefer non-developed fishing sites compared to male anglers; and
5. Anglers with urban backgrounds will prefer developed sites compared to anglers with rural upbringing.

This approach allows us to measure fishing site preferences among underrepresented angler populations, including women, Black, Hispanic, and Asian anglers, and growing populations of older anglers (Dann et al. 2008), and urban anglers (USFWS 2016). A better understanding of their preferences may help managers provide angling opportunities in a manner that contributes to recruiting and retaining anglers from these populations.

Methods

Sampling

We created a sampling frame from the North Carolina Wildlife Resources Commission Automated License & Vessel Information Network database. The sampling frame comprised of North Carolina residents who held valid licenses that included a fishing privilege between January 1, 2010 and December 31, 2014. To legally fish in North Carolina, residents 16 years or older must have a valid fishing license. We wanted to survey residents with angling experience and chose this database because it has full coverage of licensed anglers in the state. We employed stratified random sampling to sample a high percent of minority anglers. Minority anglers were those who self-identified as Black, Asian, Hispanic, Native American, or Other when purchasing a license. These designations were confirmed by cross-checking with subject survey responses before analysis and deferring to survey responses where there were discrepancies. Non-minorities were identified within the database as White. Licensees who were 17 or younger on 31 December 2014 were excluded. Records returning Duplicate, Mail Return, Deceased, and No Future Mailings notifications were also deleted from the sampling frame.

Data collection

We invited anglers to participate in a self-administered web survey (Qualtrics, Provo, UT, USA). The survey was conducted over five weeks during March and April 2015. We emailed the questionnaire invitation to potential participants with a brief letter explaining the purpose of the survey. Two reminder emails were sent to non-respondents in the first week after the initial contact, the third reminder was sent a week later, and the final reminder was sent two weeks after that (Dillman et al. 2014). All notifications contained a web link that directed participants to the survey. E-mails were initially sent to 6490 license holders statewide.

Questionnaire development

We developed a questionnaire using Dillman et al.'s (2014) Tailored Design Method to measure North Carolina angler site preference. To measure fishing landscape preference, we presented respondents with pairs of fishing sites, and asked them to choose which site they prefer. For each pair of photographs, one fishing site contained no human development and the other contained a developed fishing amenity. Three pairs of photographs were used to examine landscape preference differences for stream, river, and lake-based fishing locations (Fig. 1). Similar visual preference survey methodology has been used to assess development preferences across diverse landscapes including parks, forests, and lawns (Kaplan 1985; Van den Berg and Koole 2006; Kearney and Bradley 2011; Peterson et al. 2012). To decrease the possibility of color imagery biasing the perception of the fishing locations, all images were displayed in black and white. We included a stated amenity question, "Would you rather fish in an area with no human influence or one with fishing related amenities such as a fishing dock?" to compare with the visual survey responses.

We also measured fishing behaviors and preferences to determine their potential role in predicting fishing landscape preferences. The number of days spent fishing per year has been used as an indicator for fishing specialization, which predicts differences in angling satisfaction and motivations (Ditton et al. 1992). We asked respondents, "How often did you go fishing during the past 12 months? (in days)". In a study of hunters in Denmark, hunters who began hunting later in life reported lower hunting commitment and importance as adults (Hansen et al. 2012). To similarly measure fishing commitment, we asked respondents, "Approximately how old were you when you had your first fishing experience?". The importance of eating caught fish can differ between angler groups (Hunt et al. 2007). To measure the importance of eating fish caught we asked respondents, "Do you typically eat the fish that you catch? (Yes/No)". We pre-tested the questionnaire with a convenience sample of 50 fisheries and wildlife undergraduates at North Carolina State University to assess and improve questionnaire validity. The North Carolina State University institutional review board ruled this study exempt (IRB #5475).

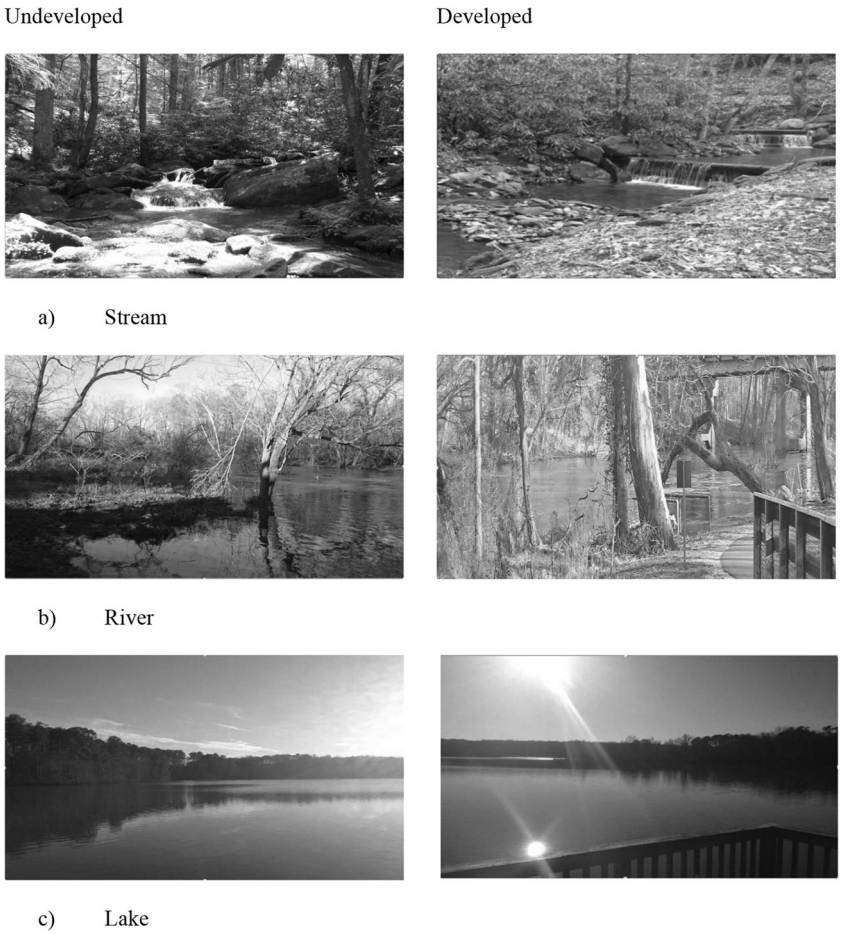

Fig. 1 Image pairs of undeveloped (left) and developed (right) fishing sites used to measure landscape preference

Data analysis

Because we received 811 responses to our online survey, for an overall response rate of 12.5%, we surveyed ($n = 238$, response rate = 76%) non-respondents by telephone to explore the possibility for non-response bias. We found that non-respondents were more likely to have a college degree than respondents and began fishing at an older age, but did not differ with regard to fishing frequency, having a rural background, or using fish to feed their family (Table 2). We applied a sample weighting adjustment to data within our model to correct for increased frequencies of degree holders and higher first age of angling within our sample relative to the population. In this weighting procedure, survey responses are scaled by the inverse frequency to which they are overrepresented in the online survey compared to the non-response survey (Kalton 1983).

We evaluated landscape preference responses to our three fishing locations, stream, river, and lake, to determine if a composite scale was possible, but internal consistency was low (Cronbach's alpha = 0.35). Therefore, we analyzed each response with a separate model. We constructed identical logistic regression models with stream, river, and lake development preference as the dependent variables. We also constructed a stated preference model to compare to the visual preference responses. We used logistic regression models because the dependent variables are binary (0 = prefer undeveloped landscape, 1 = prefer developed landscape). For each independent variable, we report coefficients and odds ratios. Odds ratios have been reported to compare the relative importance of demographic variables for predicting fishing participation rates (Lee et al. 2016). Because our models incorporate binary and continuous independent variables, we also report standardized odds ratios to facilitate direct comparisons between independent variables. All models incorporated eight independent variables: education, age, ethnicity, gender, rural background, fishing frequency, age of first fishing experience, and consumption of fish caught. We transformed several demographic variables to aid in model construction. We created a binary variable for education, reflecting whether or not the respondent possessed a four-year college degree (Hayes et al. 2015). Age was treated as a continuous variable. A variable of fishing frequency was created by using the numeric midpoint of each response option (e.g., the 6–10-day category was assigned a value of 8) (Franzini et al. 2005). Respondents were classified as having a rural background if they indicated that they lived on a farm, ranch, or rural area before the age of 18. We used self-reports regarding ethnicity and gender in our analyses. We included ethnicity as a nominal variable when

reporting odds ratios; each ethnicity was independently compared to a single reference category (White anglers). We also collapsed ethnicity into a binary (White/non-White) variable to calculate standardized odds ratios and compare the relative importance of all independent variables for predicting preference for development. We conducted all analysis with JMP ® Version 11 (SAS Institute Inc., Cary, North Carolina, USA).

Results

Among respondents, 59.3% identified as White, 14.5% as Black, 6.5% as Asian, 5.6% as Hispanic, 6.7% as Native American and 7.4% as multi-racial or other (Table 1). Most (85.8%) respondents were male. The mean age of respondents was 47.4 years (SD = 14.9). Approximately half (53.4%) of respondents possessed a Bachelor's degree or higher. Half (52.7%) of the respondents lived in a rural environment before the age of 18. The respondents spent an average of 20 days (SD = 16.0) fishing in the last year, began fishing at an average age of 6.7 years (SD = 5.0), and 64.2% of respondents reported that they eat the fish they catch (Tables 1 and 2). We tested for associations between ethnicity and fishing frequency, fish consumption, and age when they began fishing. Results indicated that white anglers began fishing at an earlier age ($\overline{x}$ = 5.83 years, SD = 4.2 years) compared to non-white anglers ($\overline{x}$ = 7.77 years, SD = 4.9 years; $t = 5.416$, $p < .001$).

Anglers preferred undeveloped fishing sites over developed fishing sites. Most (68.5%) indicated they would rather fish at a site with no fishing amenities. This stated amenity preference was mirrored by river and lake sites preferences, where over three fourths preferred the undeveloped sites (79.2 and 77.1%, respectively). Responses were evenly split on their preference for the stream site with half (50.3%) preferring the undeveloped site.

Table 1 Descriptive statistics, including demographics and fishing practices of survey respondents in North Carolina, USA

Demographic variables and fishing practices	% / $\overline{x}$
Age (±SD)	47.4 ± 14.9
Education	53.4%
White	59.3%
African American	14.5%
Asian	7.0%
Hispanic	5.1%
Native American	6.7%
Other	7.4%
Gender (male)	85.8%
Non-rural background	52.7%
Fishing frequency (±SD)	19.6 ± 16.0
Age of first fishing experience (±SD)	6.7 ± 5.0
Fish consumption	64.2%

Our modeling results supported Hypotheses 1, 2, and 3, as older anglers, anglers with less formal education, and Black anglers preferred developed fishing sites (Table 3). Our results refuted Hypothesis 4 by suggesting female gender predicted preference for more developed fishing locations. Female anglers preferred sites with amenities and development at the stream and river sites, and gender was the strongest predictor for development preference at the river site (Table 3). We detected no evidence for Hypothesis 5, as urban versus rural background was not related to preference for any fishing sites. Older anglers preferred the developed stream and river sites (Table 3). Anglers with lower formal education preferred the developed stream and lake sites (Table 3), and lower formal education was the strongest predictor of preference at the stream site.

In every model, except the river sites, ethnicity was the strongest predictor of development preference (Table 3). Compared to White anglers, Black anglers preferred development in all models (Table 3). Additionally, Native American anglers preferred sites with amenities and development at the lake site (Table 3). Asian anglers preferred development at the river and lake sites (Table 3).

Fishing behaviors and preferences were significant predictors for the lake sites. Fishing frequency predicted preference for amenities and development at the lake site (Table 3). First age of fishing predicted development preference at the river and lake sites (Table 3), and respondents who began fishing at an earlier age were more likely to prefer development at these sites. Consuming caught fish was not a consistent predictor of development preference, although these anglers preferred the undeveloped lake site (Table 3).

Discussion

Most anglers in our sample preferred undeveloped sites, supporting previous research on anglers' preferences indicating that a desire to "be in nature" is an important component of recreation fishing. Anglers in the U.S. go fishing for a variety of reasons, and spending time in nature is an important non-catch motivation (Toth and Brown 1997; Kuehn et al. 2013). Undeveloped sites reflect a natural aesthetic that satisfies a desire to spend time in nature. But preference for undeveloped sites was not ubiquitous among anglers. For some anglers, developed amenities may be more familiar or may satisfy other motivations including increased chances of catching fish, comfort, or safety.

There are several possible explanations for why minority anglers preferred developed fishing landscapes. In North Carolina, Black and Asian residents are more likely to live in urban areas compared to White residents (Carolina Demography University of North Carolina 2014). These groups may prefer development at fishing sites because they are more familiar with urban areas and developed sites (Dearden 1984). Differences between fishing motivations may also drive development preferences because structures

Table 2 Comparison of demographics and fishing behavior for survey respondents and non-respondent sample in North Carolina, USA

	Respondent sample ($N = 811$)	Non-respondent sample (N = 238)	T/χ^2 ([a] = χ^2)	Df	*P*
Mean days spent fishing in the last 12 Months (±SD)	19.6 ± 16.0	17.2 ± 16.6	1.8	274.7	.07
% With a 4 year degree	53.4%	29.0%	38.5[a]	1	<.001
% From a rural background	52.7%	54.8%	.224[a]	1	.64
% That eats the fish that THEY catch	64.2%	61.4%	.742[a]	1	.39
Age of first fishing experience (±SD)	6.7 ± 5.0	10.1 ± 6.3	−6.7	233.3	<.001

such as docks may align with catch-related motives (e.g. catching more or specific types of fish) or non-catch-related motives (e.g., ease of spending time with friends or family) (Fedler and Ditton 1994). White anglers are more likely to report fishing as a way to spend time in nature, and less developed sites fulfill this underlying interest (Toth and Brown 1997). Although our models controlled for whether respondents consumed fish they caught, we did not address the importance of consuming fish among respondents. Research suggests consuming caught fish is more important to Black than White anglers (Burger et al. 1999). Differential importance of fish consumption is worth addressing in future research on fishing site preferences. A similar trend may exist for Asian-Americans. Groups, such as Hmong Americans, consume fish they catch at higher rates than other cultural groups (Hutchison 1993), and Asian-Americans may prefer fishing at more developed sites (Blahna 1992, this study). Finally, undeveloped fishing areas may require special equipment (e.g., boats), which may be less prevalent or available to minorities (Hunt and Ditton 2002). Future research may further contextualize catch and non-catch motives and the use of specialized equipment to determine how amenities are being

Table 3 Angler demographics and fishing behavior predicting preference for developed fishing sites

	Stated amenity model			Stream model			River model			Lake model		
Variable	Coeff.	Odds ratio	Std. odds ratio	Coeff.	Odds ratio	Std. odds ratio	Coeff.	Odds ratio	Std. odds ratio	Coeff.	Odds ratio	Std. odds ratio
Intercept	0.44	–	–	0.86	–	–	1.55	–	–	−0.18	–	–
Age	0.01	1.57	1.09	0.02**	1.12	1.08	0.02**	2.24	1.41	0.01	1.36	1.18
Education[a]	−0.19	0.69	0.79	−0.31**	0.55	0.70	0.05	1.11	1.07	−0.35**	0.50	0.70
Ethnicity[b]	–	–	1.61	–	–	1.34	–	–	1.41	–	–	1.97
African American[c]	0.47**	3.31	–	0.53**	2.57	–	0.26**	2.25	–	0.55**	4.98	–
Asian[c]	0.35	1.41	–	−0.44	0.81	–	0.84*	3.61	–	0.49**	4.48	–
Hispanic[c]	0.04	2.04	–	0.38	1.98	–	0.44	1.15	–	0.51	1.74	–
Native American[c]	0.60**	3.66	–	0.03	1.52	–	0.14	1.48	–	0.50**	4.70	–
Gender[d]	0.26**	1.70	1.19	−0.43**	0.42	0.75	0.59**	3.23	1.47	0.20	1.50	1.14
Non-rural background[e]	−0.10	0.81	0.89	−0.03	0.89	0.94	0.14	1.30	1.17	0.12	1.25	1.12
Fishing frequency	0.02**	1.02	1.44	−0.01	0.99	0.92	−0.01	0.99	0.86	0.03**	1.03	1.55
Age of first fishing experience	−0.02	0.98	0.92	0.02	1.01	1.06	0.04**	1.04	1.21	0.07**	1.07	1.40
Fish consumption[f]	0.04	1.07	1.03	−0.02	0.98	.099	0.04	1.09	1.02	−0.26**	0.60	0.76

Odds ratios and *p*-values were calculated using logistic regression. Standardized odds ratios were calculated after reducing ethnicity into a binary category (*White and non-White*) as no underlying continuous variable could be expected across all ethnicities

[a] Formal education (0 = no bachelor's degree, 1 = bachelor's degree or higher)

[b] Ethnicity (0 = white, 1 = non-white)

[c] Ethnicity (0 = white as reference, 1 = ethnicity)

[d] Gender (0 = male, 1 = female)

[e] Non-rural background (0 = rural background, 1 = non-rural background)

[f] Eats fish (0 = does not eat fish, 1 = eats fish)

(* $p < .05$, ** $p < .01$)

used by various angling communities. Our results indicate a need to further explore the cultural contexts of fishing with respect to ethnicity.

Perceived risk associated with different sites may explain why female anglers preferred development at the river site and preferred no development at the stream site. A meta-analysis of 150 risk perception studies conducted by Byrnes et al. (1999) indicated that women tend to be more risk-averse than men. Similarly, women tend to be more concerned about safety during outdoor recreation (Johnson et al. 2001), set rules for family safety (Allen and Hawkins 1999), and fish more often in groups or with family and friends (Ditton and Hunt 1996; Toth and Brown 1997). In our study, physical aspects of the undeveloped river site, which contained a large moving body of water and lacked a visible riverbank, may have been perceived by female anglers as an unsafe site or less suitable for fishing with children and social groups. For the stream site, where shallow water and low water volume may pose fewer safety concerns, our results affirmed prior research findings as female anglers preferred the less developed sites than male anglers (Howley et al. 2012).

Older anglers may have preferred developed fishing sites because development can alleviate physical access challenges, which may lead to lower perceptions of risk. Van den Berg and Koole (2006) suggested that older respondents prefer developed landscapes due to their greater physical and psychological vulnerability. As proposed in our discussion of gender, the non-developed river site may present the highest perceptions of risk due to the lack of a visible bank and large volume of moving water. Further, the image provides no clear access, other than by boat, for someone with limited mobility. Issues concerning access may explain why older respondents were likely to support development of fishing sites when considered in abstract without associated images. Our findings, however, differ from Howley et al. (2012), who claimed that older individuals preferred less developed or traditional landscapes. They explained their results by appealing to age-based differences related to culture and upbringing, with older individuals more likely to grow up and be familiar with rural or less developed areas. Our findings, however, suggest that rural background was not related to any fishing landscape preferences in North Carolina, USA. Future research is needed to determine if cultural differences rooted in aging and rural background were fundamentally different in our case study, or if the utilitarian aspects of fishing flipped age related preferences relative to those associated primarily with aesthetic appreciation. Although our data do not provide a clear explanation for why anglers who began fishing later in life preferred development at the river and lake sites, they do suggest that when recruitment ages rise (e.g., Hansen et al. 2012) there may be increased preferences for development of amenities at fishing sites.

Fishing behaviors and preferences do not appear to be particularly strong predictors of development preferences for fishing sites, except for lake sites where a weak positive relationship existed between fishing frequency and respondents stating a preference for development at fishing sites. Behaviors and preferences are complex and may be influenced by a number of several factors including familiarity with fishing sites (Dearden 1984), expectations related to catch opportunity, and social norms related to site crowding (Dearden 1984; Hunt 2005; Hutt and Neal 2010). Anglers who fish many times every month may fish more often in peri-urban locations with some form of development (Hutt and Neal 2010), whereas anglers who fish rarely may do so more often in less developed settings. The negative relationship between fishing for food and preference for development at lakes may reflect perceptions that lake areas with fishing amenities face more fishing pressure and thus provide limited opportunities for catching fish (Hunt 2005).

Future research exploring drivers of fishing site preferences could address several limitations of this study. First, future research should consider using sample frames that move beyond licenses databases such as ones generated through snowball sampling, market research and market segmentation (Balsman and Shoup 2008). This would overcome biases associated with some demographic groups choosing not to purchase licenses, such as Hmong immigrants that cannot afford license fees (Bengston et al. 2008). Further, studies using licenses databases as sampling frames could include anglers with expired licenses to avoid oversampling the most avid anglers relative to those who allow their licenses to expire occasionally. A better understanding of site preferences among these groups would help managers address the interests of underserved anglers and improve recruitment and reactivation among the same populations (Balsman and Shoup 2008). Including variables not addressed in this study such as value orientations (Vaske and Donnelly 1999) may also contribute to understanding how diverse angler groups perceive development at fishing sites. Active anglers may have more utilitarian orientations because fishing is strongly associated with utilitarian values (Fulton et al. 1996), and these orientations may shape fishing site preferences. Qualitative research exploring the historical and cultural context of fishing site preferences and experimental approaches able to tease out causal mechanisms for preferences would also provide important steps forward in this research area.

This study suggests strategic development at fishing sites may help fisheries managers better meet interests of growing and underrepresented angling communities (e.g., minorities, women, the elderly). Development may be particularly beneficial in rural areas near urban centers to provide more sites that comfortably accommodate urban anglers who typically fish near their home (Hutt and Neal 2010). Our findings support previous landscape preference and fishing site preference research and suggest development at fishing sites may help fisheries management agencies engage and retain growing

populations of elderly and minority anglers, and perhaps facilitate family use of fishing sites that are otherwise deemed too risky by female anglers. Women only represent 27% of the US angling population (USFWS 2011) and their inclusion may be hastened by developing "family-oriented" sites (Hunt and Ditton 1997) or sites with cues to safety (e.g., railings). Such changes may be important for meeting interests of female anglers as women, who preferred development at fishing sites, typically take a larger role than men in ensuring family safety (Allen and Hawkins 1999). Programs designed to recruit and retain anglers, such as urban fishing programs, may be improved by developing safety and user related amenities at fishing sites, or advertising amenities in outreach regarding urban fishing programs (Balsman and Shoup 2008). This study suggests programs aimed at recruiting non-white minorities at young ages may be especially important because their first fishing experiences are later than white anglers. This study also highlights the potential value of applying visual survey preference methodology for testing fisheries management strategies. This methodology can be further adapted to measure the landscape preferences of different outdoor recreational users (e.g. hikers, park and greenway users) and can be adapted to measure preferences for specific amenities (e.g. docks, park benches). This methodology can also be used to evaluate urban fishing programs, to determine how well anglers' preferences for developed amenities match available on-site amenities.

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