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Gender differences in wildlife-dependent recreation on public lands

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Different groups of people may desire and respond to social and ecological conditions in myriad ways (e.g., increased engagement, avoidance). Thus, managers of nature-based recreation sites open for public use (i.e., “public lands”) would benefit from understanding how people with different lived experiences respond under new conditions brought about by regulatory changes (e.g., infrastructural improvements, reduction of access) or environmental changes (e.g., drought, population declines). From a survey of visitors to public lands, specifically National Wildlife Refuges (i.e., refuges) in the United States, we examine gender differences in (a) participation in wildlife-dependent recreation, (b) visitor experiences, and (c) the effect of regulatory and environmental changes on future participation in preferred activities. Our sample ($n = 9,918$; 40% who self-selected female) included visitors to 69 refuges during 2018 and 2019. Results indicated that people who self-selected female were more likely to indicate that they don't like being in nature by themselves, and that people close to them enjoy nature-based recreation. People who self-selected female were less likely to engage in hunting or fishing as their primary activity and noted that regulatory changes supporting these activities (specifically, fewer regulations on fishing, fewer regulations on hunting, and more acreage open to fishing/hunting) could decrease their future participation in their primary activity. Thus, respondents who self-selected female may be displaced or alienated from visiting a site if consumptive activities (e.g., hunting) are prioritized as regulatory mechanisms (e.g., for controlling abundant wildlife populations). Adaptive processes that anticipate - in advance of decisions being made - the potential ramifications of regulations on different subgroups of visitors to public lands can identify differential and inequitable impacts, and thus lead to inclusive management decisions when those impacts are preemptively addressed.

KEYWORDS

women, consumptive, wildlife refuge, hunting, fishing, inclusion, participation, adaptive management

1 Introduction

Managers of public lands and natural resources are facing numerous ecological and social changes that challenge traditional approaches. Example ecological challenges include shifts in species ranges, biodiversity loss, increased habitat fragmentation, changing climate conditions (e.g., prolonged drought, increased temperatures), catastrophic flooding and fires, and more, all of

which may be hard to detect at the frequency and geographic scale in which decisions are typically made (Burns et al., 2003; Davis and Hansen, 2011; Monahan and Fisichelli, 2014). Additionally, social changes such as demographic shifts, increased desire for participatory processes, and conflict over management decisions have challenged the decision authority of experts (e.g., scientists, public land managers) and raised questions as to who should have a voice in decision-making processes – given those processes inequitably impacts groups of people – and whether those voices are respected when heard (Manfredo et al., 2019; Manfredo et al., 2020; Manfredo et al., 2021). For example, governing authorities may bar access to protected areas or prohibit local people from engaging in traditional practices of take (e.g., hunting for sustenance), ostensibly to protect site resources or threatened and endangered species; however, these decisions can also disrupt people's daily lives and livelihoods without leading to conservation successes (Stevens, 2014). In other contexts, lands remain open to the public for purposes of wildlife-dependent recreation (e.g., hunting, fishing, observation of wildlife and birds, environmental education), and management approaches that allow specific recreation activities (e.g., hunting) can reinforce expectations of who belongs – or not – in these public spaces (Byrne, 2012). As an illustration, protected areas in the United States (U.S.) often depict western European-descendent (white) males as noted explorers who “discovered” an area or a resource, often ignoring the diversity of people who have lived in these lands – and the relationships they have cultivated and maintained with flora and fauna – long before such explorers arrived (Colchester, 2004; Kantor, 2007; Taylor, 2018). Therefore, a deeper understanding of how people are differentially impacted by public lands decision-making (i.e., what conservation and policy actions to prioritize) is necessary for arriving at equitable solutions to ecological and social changes.

Understanding recreational participation in response to regulation is important for public land management approaches. For example, fishers who identified as women from Minnesota, U.S. reported wanting to keep all the legal fish they caught whereas men were more likely to practice catch-and-release; in terms of motivations to fish, women were more motivated to catch fish for food, whereas men were more motivated to fish to develop skills and catch “trophy” fish (Schroeder et al., 2006). These decisions could be reflective of societally reinforced gender differences¹ in which species are viewed as “valuable” (and for what reasons) which can lead women to target different habitats or animals. For example, in Samoa, women were more likely than men to rank shellfish (a staple subsistence resource in the region) as an important species to catch (Purcell et al., 2020). Thus, regulatory changes regarding fishing behaviors can shape who has access to these

sites and who accrues benefits from the associated activities. Specifically, if managers limit the activity of fishing only to catch-and-release (and disallow the consumption of fish or other marine species for food), that decision may prioritize the interests and behaviors of men at the expense of women's needs and interests. Alternatively, managers could close a site altogether to reduce fishing pressure on a population, which would seemingly bar access equally; however, some people may be able to substitute a similar site elsewhere to engage in the same activity while others may be constrained by travel distances and associated time or financial burdens of that travel.

In addition to differences in recreational activity, research has shown that women generally differ from men concerning preferences for wildlife management strategies and regulations (Anthony et al., 2004; Schroeder et al., 2006; Loyd and Miller, 2010). For example, women typically favor wildlife reintroduction efforts (Hermann et al., 2013) and find lethal control of wildlife less acceptable than men do (Dougherty et al., 2003; Agee and Miller, 2009; Loyd and Miller, 2010; Draheim et al., 2019). These preferences may stem from wildlife value orientations, where women tend to score higher on mutualism (related to a higher protective intention) and men score higher on domination (which prioritizes human uses of wildlife) (Liordos et al., 2021). If true, this could also explain why women place more importance on unbiased facilitation and open exchange of ideas in wildlife management decision-making compared to men (Anthony et al., 2004), and why women support funding measures that contribute to conservation; for example, in Michigan, U.S., women were more likely to favor dedicating a portion of state lottery proceeds to conservation (Henderson et al., 2021). However, that same study indicated women were less likely than men to support a “backpack tax” on outdoor gear (e.g., hiking boots, packs, tents). This finding may be due in part to such a tax placing an inordinate burden on recreationists with lower incomes or those financially responsible for family members unable to purchase items themselves (e.g., children, siblings, elders without income). In this example as well as others globally (e.g., Keane et al., 2016), women regularly support conservation efforts in creative ways while attempting to mitigate economic losses, highlighting the importance of understanding the ways in which women think about decision-making and how the decision-making of others (whether about conservation, restoration, or recreation and environmental policy) can differentially affect women.

Women and their experiences on public lands also remains underrepresented, particularly in the context of wildlife-based recreation. For example, women in Brazil and the U.S. – despite indicating a stronger connection to nature and tending to prefer outdoor recreation more than men do – were less likely to actually engage in nature-based recreation (Rosa et al., 2020). This lower engagement levels can result in men's interests being more accounted for in recreation planning and policy, as managers attempt to meet the needs of the group of recreationists they more often seen using recreation sites (Chakrabarti, 2020). In addition, many natural resource agencies, including those that manage wildlife, are predominantly led by men, which can further reinforce beliefs about what recreation should look like; such beliefs are reinforced by survey research that tends to be dominated by male perspectives or through oversampling of male recreationists (Jacobson et al., 2007). Since women are particularly

¹ We understand the distinction between biological assignment of sex at birth (e.g., female, male) and gender identification (e.g., woman, man, nonbinary, two-spirit, non-conforming). However, our own survey measurement only offered ‘female’ and ‘male’ as categories that people could self-select or opt to skip. Because of this self-selection, we focus throughout our writing on gender identification as a socialization process and do not assume any differences found are due to biological sex. Regardless, we regret reinforcing inadequate use of terms to represent core aspects of one's identity and encourage the research and practitioner community to learn and apply these important distinctions going forward.

underrepresented in consumptive forms of wildlife activities, such as hunting and fishing (Anthony et al., 2004), the distinction between consumptive and non-consumptive (e.g., wildlife observation, photography) activity participation is of special pertinence in the framework of gender. As another example, funding for conservation in the U.S. commonly stems from license and equipment sales for activities such as hunting and fishing (Arnett and Southwick, 2015), which not only strengthens how agencies perceive their stakeholders (e.g., “hunters pay our bills”), but also socializes people (e.g., agency employees, members of the public) into who is perceived as experts and who can engage in recreation activities (Bilgic et al., 2008). This funding structure replicates a system in which authorities govern access to public lands in ways that facilitate use by certain groups (e.g., hunters) and excludes participation (purposefully or not) from other segments of the population, such as women (Stedman and Heberlein, 2001). There is also continued pressure on this funding structure because of consistent declines in hunting license sales (Robison and Ridenour, 2012). Therefore, integrating perspectives and preferences of groups historically excluded from decision-making processes is more important than ever for inclusive wildlife management practices, as well as for state and federal agencies seeking to secure alternative funding mechanisms for conservation (Winkler and Warnke, 2013; Larson et al., 2014; Price Tack et al., 2018).

In this paper, we approach differences in experiences associated with gender (as well as other demographic variables) as reflections of socialization (and/or institutionally based bias, whether explicit or not) rather than inherent biological differences. One of the key ways in which outcomes (e.g., recreation participation) gets reinforced is through socialization by others and society more broadly. Gender can interact with beliefs about who belongs on public lands, what activities are allowed (e.g., the expansion of hunting over non-consumptive recreation), and who has a voice – and a voice that is respected – in decision-making processes. Such socialization can lead certain groups to avoid participating in opportunities on public lands (Evans et al., 2020), or to only engage in certain forms of recreation. Additionally, socialization around intersectional identities often marginalized (e.g., a woman who is also racialized as Black) can further impact how people perceive access and opportunity. For example, Powers et al. (2020) found increased identification with a number of marginalized groups resulted in people being less likely to visit parks and to perceive park-based recreation activities as being close to their home, even if recreation opportunities were nearby. Thus, an understanding of how these demographic characteristics are related to public land experiences is needed.

In addition, the inclusivity of a wide range of recreationists is essentially linked to adaptive management of public lands. Adaptive management simultaneously incorporates *managing* and *learning* about (e.g., through visitor feedback) natural resources. Applications of adaptive management typically involve a system that is dynamic, that responds to social and environmental conditions and management choices, and which is characterized by variation that is only partially predictable (Williams, 2011).

Under these conditions, adaptive management provides an opportunity to incorporate uncertainty and complexity into management, continuously monitor the system, and evolve along with the system through iterative decision-making. The anticipation of the responses of diverse stakeholders is beneficial to avoiding “surprises” that can undermine wildlife management planning and strategies. For example, a crucial feedback component of adaptive management is overlooked when wildlife or fisheries management is insensitive to how people are differentially impacted across demographic groups (Fröcklin et al., 2013). Due to the substantial role gender can play on preferences for wildlife management strategies and regulations, there have been increased calls for gender inclusiveness in nature-based recreation (Rosa et al., 2020) and management (Staples and Natcher, 2015; Gharis et al., 2017; Seager et al., 2021). In addition, there is a particular need to examine how both gender and other demographic variables such as race influence opportunities for outdoor recreation outside of cities, as much of this literature tends to focus on urban parks and green spaces (Gentin, 2011).

Our objectives in this paper were to examine how gender and other demographic variables relate to (a) wildlife-dependent recreation participation, (b) the visitor experience, such as feeling safe and welcome, and satisfaction with one’s visit, and (c) intended (future) participation in preferred activities given regulatory or environmental changes on public lands.

2 Methods

We analyzed data collected from visitors to 69 refuges during 2018 and 2019 as part of a nationwide survey of visitors to U.S. National Wildlife Refuges (i.e., refuges). Participating refuges had at least 50,000 annual visits and were selected for participation in the overall study by the Human Dimensions Branch of the U.S. Fish and Wildlife Service (FWS). The methodological approach and survey instrument were approved by the Office of Responsible Research Practices at The Ohio State University (OSU) as study number 2018E0221, deemed exempt with limited IRB review, according to 45 CFR 46.104.

2.1 Sampling

Sampling occurred over two time periods (e.g., spring, autumn) of two consecutive weeks per period with a goal of inviting approximately 400 total visitors at every refuge to complete a survey. OSU staff developed (in consultation with FWS staff) and provided a sampling protocol to the onsite survey recruiters employed by American Conservation Experience, which detailed a script for inviting one visitor per group to participate in the survey and to select every n^{th} group depending on visitation levels (e.g., higher levels of visitation may have equated to every 5th group whereas lower levels of visitation may have resulted in contacting every group). Visitors who agreed to participate provided their

name and address and subsequently received up to four postal mailings (postcard, survey package, reminder postcard, and second survey package) in either English or Spanish (self-selected during onsite contacts). The invitation encouraged completion of the survey online through Qualtrics (a web-based survey platform) or by paper, and all responses were password-protected. Additional description of the overall methodology and final reports for individual refuges are accessible at go.osu.edu/NVSresults.

2.2 Measurement

The survey asked visitors about their experience at “this refuge” - the refuge where they were contacted - in numerous domains, including recreation activities, transportation and other infrastructure features, economic expenditures, information sources, and more. This paper specifically focuses on questions related to demographics and recreational experience (Appendix 1).

For demographics, we focused on gender, education, self-identified distance from the refuge (i.e., local or nonlocal), age, and race (Appendix 1). The survey measured gender as a dichotomous variable (“Are you...? Selection options: “male” or “female”). Due to our survey methodology, we only know that respondents self-selected either male or female (or they could skip the question). Therefore, we do not distinguish between sex assigned at birth and gender identity and did not at the time of data collection accommodate non-binary, two-spirit, or other diverse identities. The survey also asked respondents to self-identify their race/ethnicity from several listed categories consistent with how the U.S. Census Bureau (2020) measured race and ethnicity (Appendix 1). Respondents could select more than one race/ethnic category. Respondents also self-selected “local” or “non-local” based on living within a 50-mile radius of the refuge, and being “local” to this refuge was analyzed as a control variable since local visitors tend to have different preferences and levels of satisfaction with recreation than nonlocal visitors (Palso et al., 2009; Lindberg and Veisten, 2012). Education and age were both measured on a continuous scale in terms of years (e.g., 12 years of schooling typically represents completion of high school and 16 years of schooling typically equates to having a bachelor’s degree in the U.S., though variation exists in educational experiences).

Regarding recreation-related variables, respondents wrote one primary activity they participated in during their most recent visit to “this refuge” following a list of 21 activities from a preceding question about recreation participation at this refuge during the last 12 months. This write-in response represented an individual’s primary activity (Appendix 1). Aspects of visitors’ experiences at this refuge included variables measured on a Likert scale related to satisfaction with opportunities related to one’s primary activity, or a three-point scale (agree/disagree/neither) measuring feelings of safety and being welcomed, and perceptions of treatment by others while onsite (Appendix 1). Additionally, general preferences related to group dynamics (e.g., being alone in nature, having other close contacts who engage in nature-based recreation) were measured on a three-point scale (agree/disagree/neither), see Appendix 1.

2.3 Analysis

To begin our analysis, we linked responses of primary activity (e.g., hunting) to satisfaction with opportunities related to that specific activity (e.g., “to what extent are you satisfied with the hunting opportunities at this refuge?”). Respondents who did not indicate a primary activity or answer the related satisfaction question did not receive a recreation satisfaction score and thus were excluded. We also excluded from our analysis any primary activity in which less than 150 respondents participated (e.g., trapping, which had an n of 2). This criterion allowed for adequate statistical power - a hypothetical distribution of at least 50 respondents per dependent variable category (future recreation activity will 1) decrease, 2) remain the same, or 3) increase) in the multinomial regression models. We excluded primary activities that did not have a related satisfaction variable and/or were not overtly wildlife-dependent, including art, miscellaneous water activities (e.g., swimming), general observation (e.g., of a lighthouse or mountain scene), activities with dog, picnicking, camping, and more. This approach yielded the exclusion of 688 participants (or 6% of the original sample). The final sample included 12 primary activities that had a direct match to a satisfaction variable (Appendix 1), including the “Big Six” wildlife-dependent activities (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation) that have traditionally been acknowledged as being of primary importance to wildlife conservation on public lands (Keatinge, 2017; Arnett, 2020).

Since the sample was predominantly white (86.6%), in our regression models we classified people as either white or a person of color (which included biracial individuals); this prevented the generalization of results based on too-small sample sizes of each racial category, yet has limitations given that the lived experiences of people with racialized identities can significantly differ.

Analysis (of data aggregated across all sampled refuges) proceeded in three stages using SPSS 27.0. In the first stage (Table 1), we used binary regression models to analyze how gender, race, age, and other demographic variables affected the odds of a respondent *selecting a particular activity as their primary form of recreation*. In the second stage, we used regression models to analyze how gender, race, age, and other demographic and recreation variables influence *aspects of the visitor experience* (Table 2), specifically 1) satisfaction with primary recreation activity, 2) dislike of being in nature by oneself, 3) feeling that people closest to oneself enjoy participating in nature-based recreation, 4) feeling welcomed and safe while at the refuge, and 5) thinking that people who look like you are treated differently when participating in nature-based recreation. We used linear regression to analyze satisfaction with primary recreation activity and binary logistic regression to model the other dependent variables.

In the third stage, we used multinomial logistic regressions to examine how gender, race, age, and other demographic and recreation variables affect the *relationships between intended participation in a primary activity on a refuge given a regulatory or environmental change* (Table 3). We ran eight models, one for regulatory change and one for environmental change. For each

TABLE 1 Odds ratios from separate binary logistic models of primary activity participation on wildlife refuges (n = 9,125).

	Demographics					Nagelkerke R-squared
	Female	Age	Education	Local	White	
Consumptive recreation activities						
Hunting	0.03*	0.96*	0.53*	0.62*	1.64	0.22
Fishing	0.21*	1.00	0.38*	2.01*	0.70	0.19
Nonconsumptive recreation activities						
Bird watching	1.79*	1.03*	1.63*	0.59*	1.20	0.09
Bicycling	0.84	1.01	1.29	1.54*	1.39	0.01
Driving	1.18	1.01	0.75*	0.80	0.91	0.01
Education	2.35*	1.00	1.46	1.16	0.65	0.03
Hiking	1.83*	0.99*	1.49*	1.84*	0.95	0.07
Jogging	1.13	0.96*	1.76*	4.05*	0.76	0.08
Motorized boating	0.88	0.99	0.80	1.71*	2.23	0.02
Nonmotorized boating	1.11	0.99	1.44*	0.65*	1.72	0.02
Photography	0.91	1.02*	0.99	0.76*	0.82	0.02
Wildlife observation	1.28*	1.00	0.91	0.57*	1.03	0.02

*Bold values are statistically significant at the $p < 0.001$ level.

Values are Exp(B) values; values greater than 1 indicate increased odds and values lower than 1 indicate decreased odds.

model, “participation remains the same” was the reference category, and we compared this category with the other two (“participation increases” and “participation decreases”). These multinomial logistic models produced two sets of coefficients (one for participation increases and one for decreases). We also controlled for demographic variables and participation in various primary activities. In these models, exp(B) values of less than 1 indicated decreased odds, whereas values greater than 1 indicated increased odds.

3 Results

3.1 Sample

Our sample consisted of 9,918 respondents (40% of whom self-selected as female) from 69 refuges, including sites from all the regions managed by the Refuge System. Nearly 58% of the sample consisted of locals living within 50 miles of a refuge. The mean age of respondents was 56.5 years and the mean years of school completed was 16 (typically equating to a 4-year college degree). 86.6% of the sample identified as white, 2.3% as Hispanic, 1.3% as Asian, and 1.2% as African American (other racial/ethnic groups each constituted less than 1% of the sample). Of the 12 primary activities examined, the most common were hiking (23.7% of the sample), bird watching (17.6%), wildlife observation (14.8%), and fishing (11.4%). Less common primary activities included photography (6.6% of the sample), hunting (6.5%), driving

(3.9%), bicycling (3%), nonmotorized boating (2.8%), motorized boating (2.2%), jogging (2.1%), and education (1.8%).

3.2 Recreation participation

Respondents who self-selected female were less likely to indicate consumptive recreation (hunting or fishing) as their primary activity; however, self-selecting female increased the odds that a respondent engaged in birdwatching, wildlife observation, education, and hiking as a primary activity (Table 1). Increased age lowered the odds of hunting, hiking, or jogging as a primary activity, but increased the odds of bird watching and photography as a primary activity. Visitors with increased levels of education were more likely to select bird watching, hiking, jogging, and nonmotorized boating, and less likely to select driving, hunting, or fishing as a primary activity. Local respondents were more likely to indicate that fishing, bicycling, hiking, jogging, or motorized boating was their primary activity, and less likely to choose hunting, bird watching, nonmotorized boating, photography, or wildlife observation. There were no statistically significant differences between white respondents and people of color in terms of primary recreation.

3.3 Visitor experience

In the model of recreation satisfaction (not displayed), self-selecting as female increased satisfaction with one’s primary activity

TABLE 2 Odds ratios from separate binary logistic regression models of visitor experience on wildlife refuges (n = 9,125).

	Felt welcomed during visit	Felt safe during visit	I do not like being in nature by myself	People close to me enjoy nature-based recreation	People who look like me are treated differently during nature-based recreation
Demographics					
Female	0.93	0.81	3.74*	1.31*	0.77
Age	0.99	0.99	1.01	0.99*	0.98*
Education	0.99	1.13	0.77*	1.17*	1.05
Local	0.77*	0.72	0.99	0.76*	1.03
White	0.97	1.23	0.73	1.31	0.39*
Primary Activity					
Hunting	1.11	0.91	0.83	1.91	1.46
Fishing	0.96	0.91	1.09	1.29	0.87
Bird watching	1.82*	2.81*	0.62	2.32*	0.95
Bicycling	2.26*	1.60	0.87	1.17	1.47
Driving	1.35	1.48	1.25	1.37	1.02
Education	6.85*	2.57	1.19	1.35	0.59
Hiking	1.92*	1.58	1.01	1.51	0.85
Jogging	1.19	1.30	1.03	1.02	0.72
Motorized boating	1.06	1.05	0.95	2.34	0.81
Nonmotorized boating	2.04	1.24	1.40	2.26	0.92
Photography	1.33	2.29	0.63	0.89	1.20
Wildlife observation	2.73*	2.58*	1.03	1.69	1.08
Nagelkerke R-squared	0.03	0.03	0.08	0.03	0.03

*Bold values are statistically significant at the $p < .001$ level.

Values are Exp(B) values; values greater than 1 indicate increased odds and values lower than 1 indicate decreased odds.

($B = 0.10$, $t = 4.91$, $p < .001$), as did selecting bird watching ($B = 0.13$, $t = 4.37$, $p < .001$). Respondents who reported hunting ($B = -0.19$, $t = -4.28$, $p < .001$), driving on an auto-tour route ($B = -0.54$, $t = -10.72$, $p < .001$), or wildlife observation ($B = -0.23$, $t = -7.19$, $p < .001$) as their primary activity had decreased satisfaction. Respondents who self-selected female were more likely than those who self-selected male to indicate that they don't like being in nature by themselves, and that people close to them enjoy nature-based recreation (Table 2). Increased age lowered the odds that a respondent didn't like being in nature by themselves and also lowered the odds that a respondent felt that people who look like them are treated differently while they participated in nature-based recreation. Respondents who self-selected white were less likely than people self-selecting a race or ethnicity other than white (i.e., people of color) to indicate that "people who look like me are treated differently during nature-based recreation." Local respondents were less likely to feel welcomed during their visit and to have people close to them who enjoy nature-based recreation.

3.4 Impacts of regulatory and environmental change on future activity participation

Regulatory changes focused on consumptive activities (i.e., fewer regulations on hunting, fewer regulations on fishing, and more acreage open to both these activities) differentially affected visitors' expected future participation. For example, visitors who self-selected female were more likely than those who self-selected male to report that the three regulatory changes would decrease their participation in their primary activity at this refuge (Table 3). Older visitors were less likely to indicate that the three regulatory changes would increase their participation in their primary activity at this refuge. Visitors whose primary activity was photography also reported that more acreage open to hunting and fishing would lead to their decreased participation. In contrast, visitors who engaged in hunting or fishing as their primary activity indicated that

TABLE 3 Odds ratios from separate multinomial logistic regressions exploring impacts of environmental and regulatory changes on different visitor groups' self-expressed future recreation compared to no recreational changes (i.e., referent group).

Outcome Category Explanatory variable	Environmental changes					Regulatory changes		
	Wetlands improve	Other habitat improves	Biodiversity increases	Preferred species decreases	Less water	Less hunting regulations	Less fishing regulations	More acreage open to hunt/fish
Increase in future recreation activity due to changes based on...								
<i>Demographics</i>								
Female	0.92	0.90	0.99	0.87	0.67	0.38*	0.67*	0.41*
Age	0.99*	0.99*	0.98*	0.99	1.01	0.97*	0.98*	0.98*
Education	1.37*	1.36*	1.39*	0.85	0.84	1.04	0.90	0.89
Local	1.01	0.98	0.88	1.12	0.95	1.39*	1.20	1.56*
White	1.05	1.05	0.93	0.76	0.72	0.85	0.70	0.90
<i>Primary Activity</i>								
Hunting	1.90*	1.62	0.67	1.37	2.09	4.18*	1.76	7.48*
Fishing	0.94	0.78	0.59*	1.43	2.67	1.43	3.18*	2.82*
Bird watching	3.47*	2.86*	3.70*	1.06	0.75	0.72	0.65	0.34*
Bicycling	0.52*	0.56	0.79	0.42	0.85	0.58	1.18	0.35*
Driving	1.15	1.14	1.23	0.63	0.73	1.08	2.14	0.83
Education	1.22	1.09	1.22	0.40	0.17	0.53	1.55	0.34
Hiking	1.03	1.06	1.22	0.61	0.59	0.60	0.90	0.36*
Jogging	0.39*	0.38*	0.67	0.93	0.12	0.67	0.57	0.34*
Motorized boating	0.65	0.58	0.49*	0.49	1.95	0.83	1.89	0.78
Nonmotorized boating	1.26	0.98	0.98	0.45	0.72	0.57	0.94	0.38*
Photography	2.38*	2.23*	3.54*	0.91	0.89	0.49	0.58	0.32*
Wildlife observation	1.35	1.39	1.94*	1.48	0.86	1.26	1.38	0.74
Decrease in future recreation activity due to changes based on...								
<i>Demographics</i>								
Female	0.53	0.72	0.65	0.91	0.83*	1.29*	1.24*	1.53*
Age	1.01	1.03	1.01	0.99	0.99	1.00	0.99	1.01*
Education	0.67	0.79	0.93	1.22*	1.25*	1.35*	1.32*	1.44*
Local	1.20	0.89	0.88	0.89	1.02	1.18*	1.11	1.13
White	0.79	0.53	0.69	1.06	1.03	1.05	0.91	1.02
<i>Primary Activity</i>								
Hunting	2.00	2.20	0.65	2.25*	2.08*	0.71	0.48	0.23*
Fishing	1.15	1.72	1.16	2.00*	3.14*	0.36*	0.75	0.11*
Bird watching	0.51	0.94	1.18	1.84*	1.43	2.07*	1.79	2.12*
Bicycling	0.56	0.44	0.92	0.68	0.45*	0.83	0.42	0.79
Driving	0.96	1.07	0.56	0.96	0.87	0.68	0.72	0.61
Education	1.43	1.89	<.001	0.84	1.17	0.95	1.01	0.82

(Continued)

TABLE 3 Continued

Outcome Category Explanatory variable	Environmental changes					Regulatory changes		
	Wetlands improve	Other habitat improves	Biodiversity increases	Preferred species decreases	Less water	Less hunting regulations	Less fishing regulations	More acreage open to hunt/fish
Hiking	0.72	0.82	0.48	0.71	0.75	1.41	0.99	1.33
Jogging	0.41	<.001	<.001	0.41	0.36*	1.46	1.09	1.26
Motorized boating	0.67	1.69	0.97	0.89	4.13*	0.28*	0.41	0.13*
Nonmotorized boating	0.44	0.61	<.001	0.85	5.03*	0.91	0.59	0.62
Photography	0.86	1.23	1.04	1.99*	1.53	1.62	1.48	1.95*
Wildlife observation	0.84	0.82	0.89	1.53	1.14	1.15	1.11	1.14
N	8,633	8,638	8,637	8,506	8,657	8,546	8,578	8,636
Nagelkerke R-squared**	0.11	0.09	0.15	0.06	0.11	0.18	0.10	0.37

*Bold values are statistically significant at the $p < .001$ level.

**This refers to the model as a whole, which includes values related to both increased and decreased participation.

Values are Exp(B) values; values greater than 1 indicate increased odds and values lower than 1 indicate decreased odds.

regulations to expand consumptive activities would increase their participation (Table 3). Local visitors indicated that less hunting regulations and more acreage open to consumptive recreation would increase their participation.

Environmental changes (i.e., wetland and habitat improvement, increased biodiversity, decrease in preferred species, and less water in lakes, rivers, or streams available for recreation) also differentially affected views about future activity participation. For example, visitors who primarily participated in water-based activities (fishing, motorized boating, and nonmotorized boating) reported that less water would dampen their participation; however, visitors who self-selected female were less likely than those self-selecting as male to note that less water would decrease their participation (Table 3). People who identified bird watching or photography as their primary recreation activity noted that three environmental improvements (wetland improvement, habitat improvement, and increased biodiversity) would amplify their primary activity participation (Table 3). As levels of education increased, so did the likelihood that three of the five environmental changes (wetland and habitat improvement, and increased biodiversity) would increase their future participation in primary activities.

4 Discussion

Our results have several implications for gender-inclusive adaptive management related to wildlife-based recreation on public lands. First, our results suggest that there is no “generic” visitor to U.S. wildlife refuges, meaning a “one size fits all” approach to management could lead to differential impacts on visitor subgroups. How visitors participate in and experience recreational activities on public lands is influenced by their lived experiences, which we explored as differences among gender, racial, educational,

locality- and age-based groups. Thus, decision-makers who (intentionally or not) view the typical visitor as synonymous with a traditional wildlife user (e.g., a white man who hunts/fishes) may miss key elements of the full social-ecological system in which people interact with wildlife on public lands. For example, our finding that people who self-selected female preferred non-consumptive activities (e.g., bird watching, hiking, and wildlife observation) more often than those who self-selected male comports with other research; for example, Heberlin et al. (2008), found that across 50 U.S. states, 13 European countries, and 6 Canadian provinces/territories, only 8% of hunters self-selected female. However, even certain nonconsumptive activities, such as competitive birding (Cooper and Smith, 2010) and thru-hiking (Howard and Goldenberg, 2020), can be dominated by a masculine culture that is further reinforced in media (McNiel et al., 2012) in ways that can (whether purposefully or not) alienate women. Even when women are more likely (based on count) to participate in a particular activity, the culture and decision-making processes surrounding such an activity can still be dominated by men (e.g., the masculine “hiking trail culture” discussed in Howard and Goldenberg, 2020), which may affect the interest and participation in recreation opportunities of people identifying as a woman, non-binary, non-confirming, two-spirit, or otherwise.

Second, our finding that visitors who self-selected female are less comfortable engaging in recreation alone yet have close confidantes who enjoy nature is consistent with other studies that reinforce the safety and security of group-based recreation for people of marginalized identities. For example, women-only outdoor groups can increase social bonding and confidence in one’s physical abilities (Bosteder and Appleby, 2015), improving recreation satisfaction. Preference for group recreation may also be partly due to women being socialized toward “other-oriented” care (e.g., to plan trips around the activity interest of children and/or

elders) while men are often socialized to outdoor activities that emphasize rugged individualism (McNiell et al., 2012; Warren, 2015). Alternatively, the discomfort of some women with solo wildlife-dependent recreation may be reinforced by perceptions about violence occurring in outdoor settings, which in part results from societal expressions of the outdoors as primarily a male space in which female competence is undervalued and socially-reinforced stories that women “need” to be “protected” (Wesely and Gaarder, 2004; McNiel et al., 2012; Ouellet and Laberge, 2021). Even if women are equal or majority participants in nature-based recreation, tourism promotion is typically infused with the “male gaze” (or a male-oriented perspective, Pritchard and Morgan, 2000; McNiel et al., 2012). For this reason, our findings that people who self-selected female are *more likely* than those who self-selected male to participate in wildlife-dependent, non-consumptive activities (e.g., wildlife observation) has significant implications for nature-based tourism promotion. Publicizing high levels of involvement by women in these activities challenges the prevalent narrative that men are the primary participants in and audience for solo or physically-rigorous recreation opportunities.

Third, our findings regarding racial differences in how visitors experienced wildlife refuges is congruent with historically entrenched patterns of discrimination and oppression that has shaped racial disparities within nature-based recreation (Taylor, 2018; Dietsch et al., 2021). The white respondents in our study being less likely than people of color to feel that people who looked like them were treated differently while participating in nature-based recreation is consistent with other research that found, even among non-consumptive users, that members of minority ethnicities often experience more constraints to nature-based recreation (Metcalf et al., 2013). Specifically, self-identified Black recreationists may be both ostracized by family and friends for engaging in what is often perceived as Eurocentric activities while also being marginalized or stereotyped by other public lands visitors (e.g., Dietsch et al., 2021).

Fourth, our results highlight differentials in consumptive recreation. Not only are people who self-selected female less likely to participate in fishing and hunting as their primary activity (as other studies have found, see Stedman and Heberlein, 2001) than people self-selecting male, but our regression models suggest that the expansion of consumptive recreation (fewer regulations on fishing, fewer regulations on hunting, more acreage open to hunting/fishing) could lead to *decreased participation* of females in the activities they already engage in. Therefore, an overemphasis on these activities in wildlife management might alienate women from participating in outdoor recreation and accessing public lands. The expansion of consumptive recreation could (based on self-reports) also decrease the future participation of other non-consumptive recreationists (specifically those who engaged in bird watching and wildlife observation). To promote gender-inclusive adaptive management and accurate measurement of stakeholder preferences (e.g., cumulatively, people who participate in bird watching and wildlife observation make up a third of our total sample), it is important to expand wildlife management decisions beyond traditional consumptive recreational uses. Adaptive management processes can benefit from anticipating how the regulations aimed at one group (e.g., people who participate in hunting or fishing) might affect other stakeholders; this analysis is

essential for adaptive management of public lands where visitors have diverse environmental values and where their perceptions of other recreationists impact the quality of their own visitor experience (Rossi et al., 2015; Hunt et al., 2016). However, it is important to note that both the prevalence of consumptive recreation and the associations between gender and consumptive recreation differ between countries (see Heberlein et al., 2008), so our results may not generalize outside of the United States.

Further, our work found that gender had a more significant impact in scenarios of regulatory change than in those of environmental change. This result requires further research, as other scholars have found that certain forms of environmental change, such as climate change, are gendered in their impacts (Pearse, 2017). However, prior research has also found high levels of visitor flexibility to non-ideal recreation settings in a sample that was primarily (65%) female (Parry and Gollob, 2018). Although the link between flexibility and gender requires further examination, it may be that the broader experiences of women with various constraints in recreation (e.g., physical restraints or microaggressions; McAnirlin and Maddox, 2020) has forced them to be more “realistic” or to adapt to various hurdles (such as environmental change) in order to participate.

Our emphasis in this work reflects the importance of visitor participation in wildlife and public lands management and to social-ecological systems more broadly. People who engage in wildlife-dependent recreation may have a more complete view of or influence on the social-ecological system (e.g., in the context of fishers, see Hunt et al., 2016), which could lead to a range of benefits, including:

- Reduced uncertainty related to changing conditions in the environmental or social milieu if understanding is shared (Berkes, 1999; Olsson et al., 2004)
- Sharing of novel social, ethical, and political insights about the system under scrutiny (Briggs and Sharp, 2004);
- Increased legitimacy of the adaptive management process among included community member (Colfer, 2005)
- Empowerment of previously marginalized groups (Henderson, 2000); and
- Increased social learning, which can foster new ideas, solutions, and directions (Stringer et al., 2006).

Despite these important benefits, increased participation in wildlife-dependent recreation can also yield more complexity and challenges for wildlife management. For example, increased participation of diverse recreationists can amplify social conflict between stakeholders over wildlife practices (such as culling), requiring wildlife managers to explore alternative ways to address overpopulation of wildlife (if that’s why culling is needed) and find a way to resolve social conflict in a constructive manner (Chase et al., 2004).

There are also numerous forms of participation that have different implications for wildlife and public lands decision-making. These forms of participation include nominal participation (membership in a group), passive participation (being informed of decisions after the fact or listening in on a decision-making process without speaking up), consultive participation (being asked one’s opinion on a matter without a guarantee that one’s opinion will influence decisions), active participation (expressing opinions or taking initiatives of other sorts),

and interactive/empowering participation (having voice and influence in the decision) (Agarwal, 2001). This typology of participation is important because it differentiates between recreationists as users of public lands versus influencers of public land use policies. For example, people who occasionally participate in birdwatching might be different from people who seek to impact policies related to bird reintroduction or which acres are open for bird hunting; while both are forms of participation, the priorities of each group can have differential impacts on decision-making related to wildlife.

Even if exclusion is not the goal, management that ignores or marginalizes the perspectives of particular recreationists can dampen their participation (Byrne, 2012; Sánchez et al., 2020). Thus, an overemphasis on consumptive activities can overlook visitors who primarily engage in non-consumptive activities of various forms and perhaps overly ignore women or other gender non-confirming identities, which could be detrimental to adaptive management – an important tool for reducing uncertainty around environmental changes and identifying opportunities for equitable access to natural resources.

5 Conclusion

This paper provides insights into the gendered nature of wildlife-dependent recreation experiences across the Refuge System, an important public lands system in the U.S. We have demonstrated gender differences in recreation participation as well as gender variation in how regulatory and environmental changes may affect intended participation in nature-based activities. There are several mechanisms to promote gender-inclusive adaptive management (and gender-inclusive engagement with public lands more broadly) such as including people of diverse gender identities in recreation decision-making, increasing recreation opportunities favored by women, and surveying diverse groups of people about the obstacles they encounter to involvement in recreation. Accounting for and respecting non-traditional stakeholders in decision-making will improve understanding of public lands and provide more complete, accurate data about how visitors engage with the myriad activities available on these sites. There is also a need to examine gender alongside other demographic variables because experiences in nature-based recreation can be influenced by race, age, education, and geographic location, as well as the intersection of these identities. Considering gender as a construct in adaptive management will not only engage a wider range of recreationists to participate in activities on public lands but will help wildlife management reflect on the diversity of its stakeholders.

Data availability statement

All relevant data is contained within the article. The original contributions presented in the study are included in the article/supplementary files. Requests to access the data that underlie this study should be directed to AD.

Ethics statement

The Federal Lands Transportation Generic Clearance approved all survey and administration procedures (OMB Control # 0596-

0236). In addition, the Office of Responsible Research Practices at The Ohio State University approved the methodological approach and survey instrument as study number 2018E0221, deemed exempt with limited IRB review, according to 45 CFR 46.104. Respondents provided their informed consent to participate in this study by completing a survey online or by mail.

Author contributions

AD oversaw data collection. JR wrote the first draft of the manuscript. All authors edited the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcosc.2023.1006150/full#supplementary-material>

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