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Research Article

Racial, ethnic, and social patterns in the recreation specialization of birdwatchers: An analysis of United States eBird registrants

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ABSTRACT

Although birdwatchers comprise a large and growing proportion of the American public, there is a lack of racial and ethnic diversity in the birdwatching community. Previous research suggests that this homogeneity is self-perpetuating, as Black, Indigenous, and/or people of color (BIPOC) are less likely to pursue activities in which no one they know participates. However, it is unclear whether this trend in birdwatching participation also applies to degree of subsequent participant involvement. Using a national online survey of US birdwatchers, we measured the degree of recreation specialization among birdwatchers along affective, cognitive, and behavioral dimensions. We also determined whether respondents had social connections (acquaintances, close friends, or relatives) who birdwatch. We then used logistic regression to determine which ethno-racial groups were more likely to have birdwatcher social connections, and multiple linear regression to investigate how our measures of recreation specialization varied by ethno-racial group. As expected, the ethno-racial composition of the birdwatchers we studied was significantly less diverse than that of the American public. Of the 29,380 respondents who reported their ethno-racial group, 5.2% were BIPOC (including Native American, Black, Asian, Pacific Islander, Hispanic/Latino, or multiracial), while 94.8% were non-Hispanic White. However, we observed no statistically significant ethno-racial patterns in overall degree of recreation specialization, even when controlling for social connection and demographic characteristics. Considering the three dimensions of specialization individually, we found that some ethno-racial predictors were statistically significant, but coefficients were too small to be practically significant. We conclude that while some ethno-racial groups are underrepresented among birdwatchers, there is insufficient evidence that they are also under-specialized.

Management implications: Understanding the racial and ethnic dynamics of outdoor recreation is crucial as wildlife agencies and organizations seek to diversify wildlife-related recreation and serve the breadth of their public constituencies. We found that although Black, Indigenous, and people of color in the United States are underrepresented in birdwatching, the degree of their involvement (i.e. recreation specialization) does not differ substantially from that of White birdwatchers. Efforts to build a more diverse birdwatching community should therefore focus on increasing participation from, and developing opportunities that are inclusive of, underrepresented ethno-racial groups.

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"Be prepared to be confused with the other black birder. Yes, there are only two of you at the bird festival. Yes, you're wearing a name tag and are six inches taller than he is. Yes, you will be called by his name at least half a dozen times by supposedly observant people who can distinguish gull molts in a blizzard."

– Drew Lanham, "9 Rules for the Black Birdwatcher" (2013)

"This morning there are nineteen people on the birdwalk, all white. This is my first time with this group … but I still feel welcomed. I am white. They are white."

– Oliver Cashman-Brown, "Birds of a Feather: The Whiteness of Birding" (2012, p. 176)

1. Introduction

Birdwatching is one of the most popular outdoor recreation activities in the United States. Today, there are at least 45 million adults who deliberately observe birds outdoors (Carver, 2019), with some estimates as high as 85 million (Cordell, 2013). Yet, despite a rapidly diversifying American population (Vespa, Armstrong, & Medina, 2018), decades of surveys demonstrate that the racial and ethnic composition of birdwatchers is overwhelmingly homogeneous (Cordell & Herbert, 2002; Ellis & Vogelsong, 2004; Eubanks, Stoll, & Ditton, 2004; Kellert, 1985; Robinson, 2005). The 2016 USFWS Survey of Fishing, Hunting, and Wildlife-Associated Recreation found that 91% of birdwatchers were White, 10% were Hispanic, 5% were Black, 1% were Asian, and 4% identified with another race or ethnicity (individuals could identify with more than one group). Only part of this homogeneity could be explained by differences in overall proportions of the American population. Of the entire American public, 21% of the White population were birdwatchers, far exceeding the national participation rates in birdwatching of the Hispanic (10%), Black (6%), and Asian (3%) populations (Carver, 2019).

As the observations of Drew Lanham and Oliver Cashman-Brown illustrate, the underrepresentation of Black, Indigenous, and people of color (BIPOC) in the birdwatching community does not go unnoticed by birdwatchers. Discussions about the importance of diversifying the community are ongoing. For example, more than 55 organizations, government entities, and nature-related businesses – including the National Audubon Society, the American Birding Association, and the Cornell Lab of Ornithology – participated in a series of a conferences titled "Focus on Diversity: Changing the Face of American Birding," organized by the Fledging Birders Institute (FBI, 2013). The conferences were designed "to promote a societal conservation ethic by proactively engaging new audiences with birding/nature activities" (p. 7), a goal based on the notion that participating in birdwatching fosters an appreciation for birds and bird conservation (Cooper, Larson, Dayer, Stedman, & Decker, 2015; Cordell & Herbert, 2002; Robinson, 2007). Beyond its implications for conservation, increasing ethno-racial diversity in the birdwatching community may also allow the benefits of birdwatching, including personal fulfillment and intellectual stimulation, to be more widely enjoyed (Robinson, 2007).

Despite widespread acknowledgement of the need to better understand the underrepresentation of BIPOC in birdwatching, very few studies have addressed the mechanisms underlying these groups' low birdwatching participation rates. Robinson's (2005) research into Black birdwatchers suggests that social connections are important for gaining exposure to and maintaining interest in birdwatching. Through a national survey of participants and non-participants, he found that two-thirds of Black people do not know a birdwatcher. This paucity of connections sustains a self-perpetuating "Don't Loop" – "If you don't meet others who are engaged in a particular activity, the odds are you will not take interest in that activity yourself" (p. 1292). The result is that the average birdwatcher meets only 2–3 Black birdwatchers every 20 years (Robinson, 2005). Robinson also suggests that ethnic boundary maintenance (Floyd, 1999; Stodolska, Shinew, Floyd, & Walker, 2013; Washburne & Wall, 1980) could play a role in birdwatching patterns: as one birdwatcher stated, "… once a Black … person admits to being a 'birder,' they have broken with the image they are expected to maintain to belong to the Black [subculture], and have instead aligned themselves with the white majority. Being unique in a group you are otherwise expected to belong to is very difficult" (Robinson, 2005, p. 1292).

Though not specific to birdwatching, ample literature exists about the ethno-racial dynamics of outdoor recreation in general. Many studies show that BIPOC participate in outdoor recreation – particularly in local and national parks – less often than White people do (e.g. Dwyer, 2000, pp. 98–105; Floyd, Bocarro, & Thompson, 2008; Krymkowski, Manning, & Valliere, 2014; Shores, Scott, & Floyd, 2007; Solop, Hagen, & Ostergren, 2003, pp. 1–13; Stodolska et al., 2013; Washburne, 1978). Floyd (1999) outlined four widely cited reasons for this pattern. First, BIPOC may be limited from park visitation because they are at a socioeconomic disadvantage, and thus more likely to identify high costs and travel distance as barriers (Solop et al., 2003, pp. 1–13). Second, there may be cultural reasons for differences in park visitation, such as the perception that national parks are "White spaces" (Finney, 2014). Third, BIPOC may visit parks more as they assimilate into the majority culture, which may explain why Latino park visitation is correlated with English ability (Fernandez, Shinew, & Stodolska, 2015). Finally, experiences with discrimination may leave BIPOC feeling unwelcome or unsafe in parks (Finney, 2014; Krymkowski et al., 2014).

These same factors may prevent or discourage some BIPOC from initiating participation in birdwatching (Robinson, 2005). However, constraints to recreation participation continue to be important even after a non-participant becomes a participant (Godbey, Crawford, & Shen, 2010; Wright & Goodale, 1991). Indeed, binary measures of birdwatching participation, while useful for showing underrepresentation of BIPOC, do not consider the variations in engagement and commitment that exist among participants themselves. Recreation specialization offers a useful framework through which to study such variations, especially considering its frequent application to birdwatchers (e.g. Cole & Scott, 1999; De Salvo, Cucuzza, Ientile, & Signorello, 2020; Hvenegaard, 2002; Lee & Scott, 2004; McFarlane, 1994, 1996; McFarlane & Boxall, 1996; Scott & Lee, 2010). Conceptualized by Bryan (1977), recreation specialization is both the process of reaching different levels of involvement in an activity, and the continuum that measures this involvement. Ditton, Loomis, and Choi (1992) reframed this definition, describing recreation specialization as the dynamic arrangement of "social worlds" within a larger community of recreationists (e.g. the birdwatching community). Furthermore, it is now widely understood that the process of recreation specialization is neither unidirectional nor unidimensional (Scott & Shafer, 2001). For the purposes of this study, we consider recreation specialization along three dimensions (Lee & Scott, 2004; McIntyre & Pigram, 1992). The *affective* dimension incorporates the centrality that an activity holds in a person's life, and how enjoyable it is relative to other activities; the *cognitive* dimension accounts for skill and knowledge levels, as in bird identification; and the *behavioral* dimension refers to avidity, which includes frequency of participation and equipment purchase decisions.

It is unclear to what extent our current understanding of recreation specialization applies to BIPOC recreationists. Research on ethno-racial patterns in specialization is limited, and findings have been inconsistent. Hunt and Ditton (2002) found that White anglers were typically more specialized than Black and Mexican American anglers, although their frequency of participation was no different. Conversely, Oh and Ditton (2008) found that Hispanic anglers were more specialized than White anglers while controlling for demographic characteristics. In another study of multiple recreation activities, frequency of participation (one measure of the behavioral dimension of recreation specialization) did vary among ethno-racial groups, but there were entirely different patterns in *percent* participation of these groups in each activity (Dwyer, 2000, pp. 98–105). To our knowledge, the recreation specialization of birdwatchers has not been studied in the context of race and ethnicity,

except along the behavioral dimension. White birdwatchers have been found to participate more frequently (i.e. for more days per year on average) than Black and Hispanic birdwatchers (Cordell et al., 2008).

Research on the sociological mechanisms behind the process of recreation specialization may help explain why these studies observed specialization differences among ethno-racial groups. Scott and Shafer (2001) identified socioeconomic status, cultural expectations of gender, and lack of social support as potential constraints to progression along the recreation specialization continuum. They also speculated that fear of discrimination may discourage Black recreationists from becoming more specialized. For birdwatchers in particular, social support from family members, role models, and peers – especially those who are already part of the birdwatching "social world" – plays an important role in specialization progression (McFarlane, 1996; Scott & Lee, 2010). Because these studies measured change in recreation specialization over time, and did not consider race, they are not directly comparable to literature on BIPOC underrepresentation in outdoor recreation (see Stodolska et al., 2013). Nevertheless, important parallels exist between the two bodies of literature. As with specialization progression, initial participation in outdoor recreation may be constrained by marginal socioeconomic status, cultural factors, and discrimination (Krymkowski et al., 2014). Moreover, as Robinson's "Don't Loop" describes (2005), a lack of social connection to other birdwatchers, especially those who serve as role models, likely constrains would-be Black birdwatchers from initiating participation.

These parallels raise the question of whether BIPOC birdwatchers in the United States are not only underrepresented, but under-*specialized*. Our study investigated whether there were ethno-racial patterns across all dimensions of the birdwatcher specialization continuum, and how these potential patterns related to social connections to other birdwatchers. Our research objectives and hypotheses are summarized as follows:

1. Compare the ethno-racial composition of the US birdwatching community with that of the general US public. We hypothesize that BIPOC are underrepresented in the birdwatching community.
2. Investigate the relative likelihood of US birdwatchers having social connections to other birdwatchers, based on their ethno-racial group. We hypothesize that White birdwatchers are more likely to have acquaintances, close friends, and relatives who also birdwatch.
3. Compare the recreation specialization levels of different ethno-racial groups of US birdwatchers, with and without consideration of social connections and demographic characteristics. We hypothesize that average recreation specialization levels are lower for BIPOC, both (3.1) overall and (3.2) within each dimension. However, given the role of social connections (Robinson, 2005) and socioeconomics (Krymkowski et al., 2014) in BIPOC recreation participation, we hypothesize that this relationship is weaker when controlling for these other variables.

Table 1
Recreation specialization questions from survey of US birdwatchers. Unless otherwise indicated, responses were measured on a 5-point scale from strongly disagree (1) - strongly agree (5).

Dimension	Question Text
Affective Dimension	Birdwatching is one of the most enjoyable activities I do.
	Birdwatching has a central role in my life.
	A lot of my life is organized around birdwatching.
	If I couldn't go birdwatching I am not sure what I would do instead.
Cognitive Dimension	How would you rate your own ability to observe and identify birds? (7-point scale: novice [1] - expert [7].)
	I can identify most birds I see in the field.
	I can readily identify many birds in the field by sound.
Behavioral Dimension	In the past 12 months, about how many trips at least 1.6 km (1 mile) from your home did you take primarily for birdwatching? (This variable was standardized.)
	Do you have any of the following equipment that you own primarily for birdwatching? (3 items: binoculars, cameras, spotting scopes. Summative variable created.)
	I tend to just watch birds without using any special equipment.

2. Methods

2.1. Survey design

As members of the North American Waterfowl Management Plan's (NAWMP) Human Dimensions Working Group, we designed an anonymous web-based survey of United States and Canadian birdwatchers that included questions intended to measure demographic characteristics, degree of specialization, organizational involvement, motivations, social connections, and conservation behavior. Because we did not measure the ethno-racial identity of Canadian respondents, we considered only United States respondents in this study. We developed the survey in cooperation with the National Flyway Council and affiliated governmental and non-governmental agencies (see Slagle & Dietsch, 2018). The University of Minnesota Institutional Review Board determined that the survey did not meet the definition of human subjects research, and thus did not require approval.

Our survey sample included individuals who had previously registered for eBird, a globally accessible online database of bird observations, whose network of observers puts it at the forefront of public participation in science (Sullivan et al., 2009). After receiving a complete list of eBird members from the Cornell Lab of Ornithology on October 24, 2016, we selected only those who were United States residents with a valid email address and at least one eBird login since January 1, 2012. On November 16, 2016, we used the University of Minnesota's mass e-mail program to distribute the survey link to 134,111 email addresses of United States eBird registrants; 126,083 of these were valid. We sent up to four additional emails to recipients who did not complete the survey, until closing data collection on January 6, 2017. Having received an insufficient number of responses from Arkansas residents, we reopened the survey from February 13 through March 23, 2017. During this time, we sent up to three email contacts to eBird registrants in Arkansas, and we also mailed up to two letters containing the web address of the survey to all Arkansas non-respondents (see Slagle & Dietsch, 2018).

We ultimately received 33,071 survey responses. Of these, 32,570 were at least 18 years old and answered "Yes" to the screening question "Do you ever participate in birdwatching or birding?" yielding an adjusted response rate of 25.8%. For the purposes of this study, 29,380 (90.2%) reported their race, 28,568 (87.7%) reported their ethnicity, and 27,916 (85.7%) answered all questions related to race, ethnicity, and recreation specialization.

To determine the representativeness of our sample, we conducted a non-response assessment with a proportional random sample of 16,000 non-respondents. They received a shortened version of our original

Table 2
Descriptive statistics of recreation specialization scores (by dimension and overall) of US birdwatchers in 2016–2017.

Recreation Specialization Measure	n	Min.	Max.	Mean	SD	SE	Median
Affective dimension	30,163	2.41	12.03	7.96	2.05	0.01	7.98
Cognitive dimension	30,163	1.68	9.62	6.43	1.61	0.01	6.71
Behavioral dimension	30,163	0.27	7.29	2.62	1.17	0.01	2.51
Recreation specialization – continuous measurement	30,163	4.35	28.95	17.01	3.95	0.02	17.02

survey in April 2017, and 23.3% (n = 3729) responded by May 2017 (Slagle & Dietsch, 2018). Compared to respondents, a higher percentage of non-respondents were female (63% vs. 55%) and were slightly older (60.3 vs. 58.5 years). Although a slightly larger percentage of non-respondents (98.6%) than respondents (95.0%) self-identified as White, there were no other substantive differences in ethno-racial self-identification. Non-respondents were less likely to rate themselves at the "expert" end of the scale in their ability to observe and identify birds, and slightly fewer non-respondents (70.1%) than respondents (76.1%) indicated that they had taken at least one trip of one mile or more from their home primarily to view birds. There were no substantive differences in income or education levels between non-respondents and respondents. Although we acknowledge that fewer older, White, less specialized, and female birdwatchers responded to our survey compared to the nonresponse survey, we did not weight our data for three reasons. First, because only 23.3% of non-respondents returned a survey, these data could not be assumed to be an unbiased estimate of all non-respondents' characteristics. Second, the number of BIPOC respondents from certain states was too low to weight our data at the state level. Third, we could not weight by population proportions because eBird does not record the demographic characteristics of its United States registrants.

We further assessed the representativeness of our sample by comparing the demographic characteristics of our respondents with those of birdwatchers in the 2016 US Fish and Wildlife Service (USFWS) Survey of Fishing, Hunting, and Wildlife-Associated Recreation. This survey had a wider sampling frame than ours, as it involved detailed interviews of people in households across the United States regardless of their participation in birdwatching (Carver, 2019). The demographic composition of our sample was generally consistent with the USFWS sample, as the average respondent was older than 55, made over $75,000 in personal income per year, had attended college, was White, and lived in a metropolitan statistical area with a population over 250,000. However, unlike the USFWS sample, the majority of birdwatchers in our sample were female (56% vs. 44%). Additionally, our respondents tended to be older (69% vs. 49% older than 55) and to have higher levels of education (86% vs. 41% finished college) than those surveyed by the USFWS. Our sample was also composed of a slightly higher proportion of White (96% vs. 91%), a similar proportion of Asian (1%), 1/5 the proportion of Hispanic (2% vs. 10%), and less than 1/5 the proportion of Black (<1% vs. 5%) respondents. Finally, compared to the USFWS sample, our sample included over twice as many birdwatchers who had taken at least one trip away from home to watch birds (76% vs. 36%), which suggested greater avidity and thus possibly higher degrees of recreation specialization. Details of this survey comparison are included in Appendix 1.

2.2. Key variables

We focused on three key variables in this study: ethno-racial group (independent), social connections (independent), and recreation specialization (dependent). Because of the socially constructed nature of race and ethnicity (Kivel, Johnson, & Scraton, 2009; Krymkowski et al., 2014), we do not make any distinction between the two in our analysis, despite their separation within the survey. We determined race with the survey question, "From what racial origin(s) do you consider yourself? (*Please check all that apply*)," with respondents able to check the categories of "American Indian or Alaskan Native" (abbr. "Native American"), "Asian," "Black or African American" (abbr. "Black"), "Native Hawaiian or other Pacific Islander" (abbr. "Pacific Islander"), and "White." Consistent with the US Census Bureau (USCB, 2015), we considered ethnicity separately from race with the question, "What ethnicity do you consider yourself? (*Check one*)," with a choice between "Hispanic or Latino" (abbr. "Hispanic") and "Not Hispanic or Latino." These categories were not mutually exclusive, and many of our respondents were multiracial. Thus, we included "ethno-racial group" in

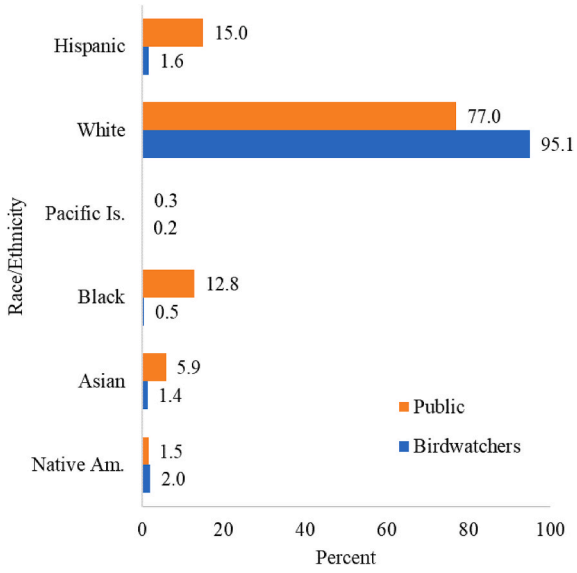

Fig. 1. Ethno-racial composition of US birdwatching population (18 years or older) in 2016–2017 (Birdwatchers; n = 29380), compared to that of the total US population from the 2011–2015 American Community Survey (Public; n = 242.8 million). The proportion of each ethno-racial group of birdwatchers differed significantly from that of the United States as a whole (Table 3).

statistical models as six individual dummy variables. We use the term "Black, Indigenous, and/or people of color" (BIPOC) to refer to people who identify with a non-White race and/or as Hispanic; this term can be considered synonymous with the term "racial/ethnic minority" that is often used in the literature.

We determined social connections to other birdwatchers with the survey question, "Among your relatives, close friends, or acquaintances, are there people who participate in birdwatching?" with respondents making any applicable selections from the categories "Acquaintance," "Close Friend," and "Relative." As with race, we included these responses in statistical models as three individual dummy variables.

Following McFarlane (1994), Needham, Sprouse, and Grimm (2009), and Schroeder, Fulton, Lawrence, and Cordts (2013), we used the recreation specialization framework to explore respondents' involvement in birdwatching. Survey items measured the three dimensions of recreation specialization: affective, cognitive, and behavioral (Table 1); we used second-order confirmatory factor analysis (CFA) to test whether these three dimensions were present among birdwatchers (Hu & Bentler, 1999). Having compared several CFA models, we selected one with ten component variables that was superior based on item loadings, model fit indices, and parsimony. We used the first- and second-order CFA coefficients to create weighted scores for each dimension of recreation specialization for each respondent. We then added these scores together into a continuous measurement of overall recreation specialization, which we tested against a three-cluster solution of recreation specialization and found to be consistent. Descriptive statistics for the three constituent dimension scores and one overall score of recreation specialization are included in Table 2; these statistics served to contextualize the units of specialization in subsequent analyses. We further describe the methodology for creating these recreation specialization variables in Harshaw et al. (2020).

Other demographic variables in our analysis included age, gender, education, and income. We measured education level on a six-level ordinal scale, which we consolidated into three levels (No College Degree, Bachelor's Degree, and Advanced Degree), the highest two of which we made into dummy variables. We measured income on a seven-point ordinal scale, which we also consolidated into three levels (<$50,000, $50,000-$150,000, $150,000+), the highest two of which became dummy variables. We controlled for these variables in some of

Table 3
Demographic comparison of US birdwatchers in 2016–2017 to the US public in 2011–2015. Relative proportions of demographic groups are organized by ethno-racial group and survey, with test statistics of chi-square goodness-of-fit tests for each ethno-racial/demographic group shown.

	Native American		Asian		Black		Pacific Islander		White		Hispanic	
	Birders[a] n = 582	Public[b] n = 3.7m	Birders n = 405	Public n = 14.4m	Birders n = 159	Public n = 31.0m	Birders n = 52	Public n = 844.5k	Birders n = 27929	Public n = 187.1m	Birders n = 460	Public n = 36.5m
Race	$\chi^2 = 46.0$*		$\chi^2 = 1018.1$*		$\chi^2 = 3955.7$*		$\chi^2 = 14.9$*		$\chi^2 = 5411.7$*		$\chi^2 = 4158.8$*	
Overall %	2.0	1.5	1.4	5.9	0.5	12.8	0.2	0.3	95.1	77.0	1.6	15.0
Age	$\chi^2 = 489.7$*		$\chi^2 = 54.3$*		$\chi^2 = 94.0$*		$\chi^2 = 18.7$		$\chi^2 = 18293.3$*		$\chi^2 = 174.3$*	
18–19	0.0	5.0	2.0	3.8	1.9	4.8	4.1	5.5	0.3	3.4	1.5	5.1
20–24	3.3	11.7	6.9	10.2	2.6	12.1	4.1	13.7	1.3	8.7	3.9	12.8
25–29	3.3	10.0	9.6	11.0	4.5	10.2	6.1	12.6	2.6	8.4	8.6	12.0
30–34	5.3	9.7	8.6	11.0	4.5	9.5	6.1	11.8	3.3	8.2	8.7	11.9
35–44	7.9	17.8	15.7	20.8	11.5	17.7	20.4	19.4	8.3	15.9	16.0	21.6
45–54	17.7	18.4	21.3	17.1	23.1	18.2	18.4	16.2	15.1	18.1	22.8	16.8
55–64	31.2	15.0	21.3	13.4	26.3	14.6	22.5	5.5	30.9	17.0	23.7	10.6
65–74	26.1	8.0	11.9	7.7	22.4	7.7	12.2	2.7	30.4	11.3	11.8	5.5
75–84	5.3	3.3	2.5	3.8	3.2	3.7	6.1	1.1	7.0	6.2	2.6	2.7
85+	0.0	1.1	0.0	1.3	0.0	1.4	0.0	0.3	0.7	2.8	0.2	1.0
Gender	$\chi^2 = 17.8$*		$\chi^2 < 0.1$		$\chi^2 = 1.3$		$\chi^2 = 0.9$		$\chi^2 = 252.2$*		$\chi^2 = 2.2$	
Male	40.0	48.8	47.7	46.9	42.1	46.7	42.3	48.7	44.2	48.9	46.9	50.4
Female	60.0	51.2	52.4	53.1	57.9	53.3	57.7	51.3	55.9	51.1	53.0	49.6
Education[c]	$\chi^2 = 1213.7$*		$\chi^2 = 387.3$*		$\chi^2 = 399.3$*		$\chi^2 = 241.4$*		$\chi^2 = 44192.8$*		$\chi^2 = 2242.9$*	
Some HS or less	0.4	17.7	0.0	13.5	0.7	16.1	0.0	11.9	0.1	11.4	0.7	35.1
HS grad	6.0	28.2	1.1	15.6	2.7	30.8	4.4	32.1	3.2	28.1	2.8	27.0
College, no degree	15.8	27.1	6.1	13.4	13.5	25.3	13.3	25.8	10.2	21.2	7.7	17.7
Associate's degree	9.6	8.9	3.3	6.9	8.1	8.0	4.4	9.2	6.2	8.3	6.5	5.9
Bachelor's degree	31.3	11.7	29.5	29.3	30.4	12.6	17.8	14.5	32.3	19.4	37.0	9.8
Advanced degree	37	6.5	59.9	21.2	44.6	7.3	60.0	6.4	48.0	11.7	45.4	4.5
Income[d]	$\chi^2 = 7.71$		$\chi^2 = 116.8$*		$\chi^2 = 21.0$		$\chi^2 = 5.4$		$\chi^2 = 492.8$*		$\chi^2 = 47.0$*	
Less than $25,000	26.5	26.0	29.7	12.8	30.3	29.6	16.7	18.2	12.9	13.1	17.6	26.1
$25,000–49,999	25.1	25.6	17.0	16.5	17.2	26.2	25.0	22.0	22.1	20.8	25.5	29.0
$50,000-$74,999	16.4	18.4	15.4	15.6	18.6	17.3	16.7	18.7	21.9	19.2	18.8	18.4
$75,000-$99,999	14.3	11.8	14.3	13.3	10.3	10.7	12.5	13.8	16.5	14.9	14.4	10.8
$100,000-$149,999	12.6	11.4	13.2	19.3	14.5	10.4	20.8	16.1	16.2	17.5	12.3	9.9
$150,000-$200,000	2.5	3.9	3.8	10.2	2.1	3.5	0.0	6.4	4.7	7.1	6.3	3.2
$200,000 or more	2.5	2.9	6.5	12.3	6.9	2.3	8.3	4.8	5.7	7.5	5.1	2.4

*$p < 0.0017$ (Bonferroni correction).

[a] Birders refers to the US birdwatchers we surveyed in 2016–2017 (n = 29380).

[b] Public refers to the general US public (age > 18) according to the 2011–2015 American Community Survey (ACS; n = 242.8 million; USCB, 2015).

[c] The ACS recorded education levels for people over age 25 (n = 211.5 million).

[d] The ACS recorded household income (n = 116.9 million); our birdwatcher survey recorded personal income.

our statistical analyses (see section 2.4) to determine whether they explained any observed ethno-racial differences in recreation specialization, and to help contextualize the magnitude of these differences.

2.3. Ethno-racial composition of birdwatchers

We used the 2011–2015 American Community Survey (ACS) Selected Population Tables (USCB, 2015) to compare the demographic characteristics of our eBird sample to those of the American public (Objective 1). We accessed tables of population, age, gender, education, and income, and filtered them to reflect data from a single ethno-racial group. ACS survey data were collected between January 1, 2011 and December 31, 2015. The US Census American Factfinder website allowed for the constituent tables of the ACS survey to be displayed by racial/ethnic group. In order to include multiracial/ethnic respondents in statistics for each group, we selected groups titled "[Race] alone or in combination with one or more other races", or in the case of Hispanic/Latino, "Hispanic or Latino (of any race)". Thus, races/ethnicities were not mutually exclusive. If respondents did not identify as belonging to any of the six ethno-racial categories, we did not include them in our

analysis. However, we did include them in both birdwatcher and general population totals. We also limited analysis to respondents 18 years or older, with two exceptions. First, we recorded education levels for all birdwatchers 18 years or older; the ACS recorded education levels for US residents 25 years or older. Second, we recorded birdwatchers' personal income; the ACS recorded family income with no indication of age. For these reasons, education and income levels for the US public would have been lower on average if they had been recorded with the same approach as our survey.

We used 30 chi-square goodness-of-fit tests to compare the ethno-racial composition of our respondents to those of the ACS, and to compare the demographic characteristics of each ethno-racial group of birdwatchers to their counterparts in the general public. We conducted a Bonferroni correction to protect from Type I error, which prompted us to set significance at $\alpha = 0.05/30 = 0.0017$. To further protect from Type I error, and because the focus of this analysis was to compare the demographic composition of our sample to that of the US public, we did not test for within-sample demographic differences among ethno-racial groups of birdwatchers.

2.4. Statistical analyses

We examined how birdwatchers' ethno-racial groups predicted the likelihood of having social connections to other birdwatchers (Objective 2) by performing binomial logistic regression, with ethno-racial groups (6 dummy variables) as independent variables and social connections (3 dummy variables) as dependent variables. Because our objective was not to study the role of socioeconomics in this relationship, we did not control for other demographic characteristics in these models.

To compare the recreation specialization levels of different ethno-racial groups of birdwatchers (Objective 3), we used a hierarchical regression procedure in which we developed a series of progressively complex linear regression models (Cohen, Cohen, West, & Aiken, 2013). Our first three models predicted birdwatchers' overall recreation specialization scores (Objective 3.1). Independent variables consisted of (1) ethno-racial group (6 dummy variables); (2) ethno-racial group and social connections (3 dummy variables); and (3) ethno-racial group, social connections, age, gender (1 dummy variable), education (2 dummy variables), and income (2 dummy variables).

We developed three more models with the same initial independent variables as the third model (above), with each predicting a different dimension of recreation specialization (affective, cognitive, behavioral; Objective 3.2). All six models met assumptions of independent observations, linearity, homoscedasticity, no multicollinearity, and normality of residuals. We did not include interaction terms in any of our regression models because our research objectives did not necessitate their inclusion (Cohen et al., 2013), and because the quantity of potential interactions would have complicated interpretation of our findings (Mikucka, Sarracino, & Dubrow, 2015).

3. Results

3.1. Ethno-racial composition of birdwatchers (Objective 1)

Our sample of United States birdwatchers consisted of 29,380 respondents 18 years or older who reported their race and ethnicity, including 460 Hispanic, 582 Native American, 405 Asian, 159 Black, 52 Pacific Islander, and 27,929 White respondents (997 identified with more than one ethno-racial group). The proportion of each ethno-racial group of birdwatchers differed significantly from that of the United States as a whole (Fig. 1; Table 3). Ninety-five percent of birdwatchers identified as at least partially White, compared to 77.0% of the general population. In contrast, birdwatchers who identified as Asian (1.4%), Black (0.5%), Pacific Islander (0.2%), or Hispanic (1.6%) were all underrepresented compared to the general adult population (5.9%, 12.8%, 0.3%, and 15.0% respectively). Among non-White birdwatchers, only Native Americans were more represented than within the general population (2.0% vs 1.5%).

Comparisons of other demographic characteristics found that birdwatchers of all ethno-racial groups tended to have significantly higher levels of education than the general public, despite the lack of 18–24-year-olds in ACS sample. Except for Pacific Islanders, birdwatchers were also significantly older. The degree of these relationships varied only slightly among different ethno-racial groups (Table 3). For example, Pacific Islander and Hispanic birdwatchers had particularly high education levels relative to their national populations. In addition, Native American birdwatchers had a slightly higher proportion of females than other ethno-racial groups. Native American and White birdwatchers – the two groups overrepresented in our sample compared to the public – were also older than their general public counterparts. The distribution of income for most ethno-racial groups was similar between both surveys, although respondents to the ACS reported family income rather than personal income.

3.2. Social connection (Objective 2)

Of the birdwatchers in our sample, 51.8% had a birdwatcher acquaintance, 55.0% had a close birdwatcher friend, 48.0% had a birdwatcher relative, and 84.9% had at least one of these types of social connections to another birdwatcher. White birdwatchers were significantly more likely than non-White birdwatchers to have close friends and/or relatives who birdwatch (Table 4). In particular, the odds of having a birdwatcher relative were 42% higher for White compared to non-White birdwatchers (OR = 1.417, $p < 0.001$). Some other ethno-racial groups also significantly predicted social connection to other birdwatchers. Hispanic birdwatchers had a 29% lower odds of having a birdwatcher relative, while Asian birdwatchers had a 37% higher odds of having a birdwatcher acquaintance. Furthermore, the odds of having a close birdwatcher friend were 19% lower for Native American birdwatchers, but 88% higher for Pacific Islander birdwatchers. Collectively,

Table 4
Parameter estimates, standard errors, and odds ratios (OR) from binary logistic regression models examining ethno-racial predictors of whether US birdwatchers surveyed in 2016–2017 have at least one (1) acquaintance, (2) close friend, or (3) relative who is also a birdwatcher.

	(1) Acquaintance			(2) Close Friend			(3) Relative		
	Nagelkerke $R^2 = 0.001$ % Correct = 52.5% n = 28568			Nagelkerke $R^2 = 0.001$ % Correct = 55.6% n = 28568			Nagelkerke $R^2 = 0.003$ % Correct = 51.6% n = 28568		
	β	SE	OR	β	SE	OR	β	SE	OR
Constant	−0.064	0.085	0.938	0.056	0.085	1.058	−0.395***	0.087	0.673
Race: Native Am.	−0.152	0.086	0.859	−0.206*	0.086	0.813	0.149	0.086	1.161
Race: Asian	0.317**	0.118	1.373	0.031	0.118	1.031	−0.182	0.120	0.833
Race: Black	−0.303	0.173	0.738	−0.183	0.171	0.833	−0.307	0.178	0.735
Race: Pacific Is.	0.382	0.294	1.465	0.629*	0.305	1.876	−0.151	0.295	0.860
Race: White	0.166	0.085	1.181	0.172*	0.085	1.058	0.349***	0.087	1.417
Ethnicity: Hispanic	0.026	0.095	1.027	−0.099	0.095	0.906	−0.350***	0.098	0.705

Table 5
Unstandardized coefficients, standard errors, coefficients of determination (R^2), and effect sizes (f^2) from linear regression models examining factors predicting the continuous recreation specialization scores of US birdwatchers surveyed in 2016–2017.

	(1) Race/Ethnicity		(2) Race and Social		(3) All	
	Adj $R^2 < 0.001$ $f^2 < 0.001$ AIC = 76652.7 n = 27916		Adj $R^2 = 0.099$ $f^2 = 0.110$ AIC = 73756.1 n = 27916		Adj $R^2 = 0.129$ $f^2 = 0.148$ AIC = 64271.4 n = 24616	
	β	SE	β	SE	β	SE
Constant	16.763***	0.169	15.159***	0.163	15.779***	0.217
Race: Native Am.	0.173	0.171	0.316	0.163	0.270	0.170
Race: Asian	0.321	0.233	0.229	0.222	0.219	0.234
Race: Black	−0.587	0.343	−0.419	0.326	−0.494	0.335
Race: Pacific Is.	−0.441	0.584	−0.888	0.555	−0.921	0.570
Race: White	0.322	0.169	0.186	0.161	0.092	0.184
Ethnicity: Hispanic	−0.126	0.189	−0.077	0.180	−0.135	0.184
SC: Acquaintance			1.139***	0.046	1.061***	0.049
SC: Close Friend			1.929***	0.047	1.920***	0.049
SC: Relative			0.128**	0.045	0.192***	0.048
Age					0.012***	0.002
Gender (Female)					−1.376***	0.048
Bachelor's Degree					−0.309***	0.068
Advanced Degree					−0.321***	0.065
Income $50-150k					−0.177**	0.053
Income $150k +					−0.212*	0.086

*p < 0.05, **p < 0.01, ***p < 0.001.

however, race and ethnicity explained less than 0.3% (Nagelkerke R^2) of the variation in each of the three types of birdwatchers' social connections.

3.3. Recreation specialization (Objective 3.1)

The first multiple regression model included respondents' recreation specialization score as the dependent variable, and the six ethno-racial groups as independent variables. We found none of these variables to be significant predictors (Table 5.1), which suggest that ethno-racial group alone does not explain variation in recreation specialization (adj $R^2 < 0.001$, $f^2 < 0.001$).

When we included social connection variables in the regression model, the fit of the model improved (adj $R^2 = 0.099$, $f^2 = 0.110$, AIC = 73756.1), but ethno-racial predictors remained statistically insignificant. Having a birdwatcher acquaintance (β = 1.139) or close friend (β = 1.929) was associated with a larger difference in specialization than having a birdwatcher relative (β = 0.128, Table 5.1). These relationships stayed roughly consistent when we added demographic variables to the model ($\beta_{Acquaintance} = 1.061$, $\beta_{Close\ Friend} = 1.920$, $\beta_{Relative} = 0.192$, Table 5.3). Ethno-racial variables were again insignificant predictors. We found specialization to be negatively correlated with being female ($\beta_{Female} = -1.376$), having a higher education ($\beta_{Bachelor's} = -0.309$, $\beta_{Advanced} = -0.321$), and having a higher income ($\beta_{50\text{-}150} = -0.177$, $\beta_{150+} = -0.212$). The inclusion of these demographic variables yielded a regression model stronger than the two simpler models (adj $R^2 = 0.129$,

Table 6
Unstandardized coefficients, standard errors, coefficients of determination (R^2), and effect sizes (f^2) from linear regression models examining factors predicting scores for the three dimensions of recreation specialization (affective, cognitive, behavioral) of US birdwatchers surveyed in 2016–2017.

	(4) Affective		(5) Cognitive		(6) Behavioral (ln *y*)	
	Adj $R^2 = 0.067$ $f^2 = 0.072$ n = 24616		Adj $R^2 = 0.127$ $f^2 = 0.145$ n = 24616		Adj $R^2 = 0.141$ $f^2 = 0.164$ n = 24616	
	β	SE	β	SE	β	SE
Constant	7.025***	0.117	6.462***	0.088	2.292***	0.064
Race: Native Am.	0.061	0.091	0.278***	0.069	−0.069	0.050
Race: Asian	0.292*	0.126	−0.260**	0.095	0.186**	0.069
Race: Black	−0.088	0.180	−0.156	0.136	−0.250*	0.099
Race: Pacific Is.	−0.343	0.306	−0.262	0.232	−0.316	0.168
Race: White	−0.075	0.099	0.184*	0.075	−0.018	0.054
Ethnicity: Hispanic	−0.048	0.099	−0.122	0.075	0.035	0.054
SC: Acquaintance	0.417***	0.026	0.306***	0.020	0.338***	0.015
SC: Close Friend	0.795***	0.027	0.642***	0.020	0.482***	0.015
SC: Relative	0.106***	0.026	0.128***	0.019	−0.041**	0.014
Age	0.013***	0.001	−0.005***	0.001	0.004***	0.001
Gender (Female)	−0.069**	0.026	−0.765***	0.019	−0.541***	0.014
Bachelor's Degree	−0.277***	0.036	0.010	0.037	−0.043*	0.020
Advanced Degree	−0.347***	0.035	0.063*	0.026	−0.037	0.019
Income $50-150k	−0.170***	0.028	−0.067**	0.022	0.059***	0.016
Income $150k +	−0.209***	0.046	−0.115**	0.035	0.113***	0.025

*p < 0.05, **p < 0.01, ***p < 0.001.

$f^2 = 0.148$, AIC = 64271.4).

Because all independent variables (except age) included in the regression analyses were dummy variables, coefficients represented mean differences in recreation specialization between members and non-members of different ethno-racial groups, or between birdwatchers with and without social connections to other birdwatchers. To calibrate the units of these coefficients, we note that the mean recreation specialization measurement was 17.01 units, with a standard deviation of 3.95 (Table 2).

3.4. Dimensions of recreation specialization (Objective 3.2)

We found that ethno-racial differences in recreation specialization varied among its constituent dimensions, and were thus more complex than our first three models suggested. Our regression model for the affective (centrality) dimension of birdwatcher specialization (mean = 12.03, SD = 2.05; Table 2) showed that identifying as Asian was a significant, positive ethno-racial predictor with a small coefficient (β = 0.292). Affective dimension scores were also significantly higher among respondents with a birdwatcher acquaintance (β = 0.417), close friend (β = 0.795), or relative (β = 0.106), though all social connection variables had relatively small β coefficients. Combined with similarly small coefficients for age, gender, income, and education, these variables explained 6.7% of the variability in how central birdwatching was to respondents' lives (Table 6.4).

Our model for the cognitive (skill) dimension of birdwatcher specialization (mean = 6.43, SD = 1.61, Table 2) had considerably better fit (adj $R^2 = 0.127$, $f^2 = 0.145$), in part because Native American (β = 0.278), Asian (β = −0.260), and White (β = 0.184) ethno-racial groups were all significant predictors (Table 6.5). Although belonging to any of these groups was not associated with large differences in skill, we note that Asian birdwatchers tended to have lower specialization scores along the cognitive dimension, yet higher scores along the affective dimension. Social connections showed similar patterns along both dimensions, as did income. Conversely, gender had a stronger correlation with skill ($\beta_{Female} = -0.765$), and education had a positive correlation ($\beta_{Advanced} = 0.063$).

Finally, along the behavioral (avidity) dimension of birdwatcher specialization (mean = 2.62 SD = 1.17; Table 2), as with the affective dimension, Asian birdwatchers showed a slightly higher degree of specialization than non-Asian birdwatchers (β = 0.186). In contrast, Black birdwatchers had lower average scores in this dimension (β = −0.250). Social connections were also significant predictors of avidity – having a birdwatcher acquaintance or close friend was associated with higher avidity ($\beta_{Acquaintance} = 0.338$, $\beta_{Close\ Friend} = 0.482$), while having a birdwatcher relative was unexpectedly associated with lower avidity (β = −0.041). All demographic variables except those for education were also significant. Of these, gender had the largest coefficient (β_{Female} = −0.541). These variables explained 14.1% of the variability in avidity score, resulting in a model with a larger effect size than the overall recreation specialization model ($f^2 = 0.164$).

4. Discussion

We documented striking differences between the ethno-racial composition of the general public of the United States and the birdwatching community, reflecting underrepresentation in birdwatching among Black, Indigenous, and people of color compared to non-Hispanic White birdwatchers. In contrast, we unexpectedly found no statistically significant ethno-racial patterns in birdwatchers' overall degree of recreation specialization. Some ethno-racial groups were more likely to have social connections to other birdwatchers, and there were some ethno-racial differences in the centrality, skill, and avidity dimensions of recreation specialization. However, the magnitudes of these differences were small, suggesting that ethno-racial patterns in birdwatcher specialization are weaker than ethno-racial patterns in birdwatcher (non)participation. Future efforts to diversify the birdwatching community, therefore, may be most effective if focused on increasing initial participation rates of underrepresented groups.

Our comparison of birdwatcher demographic characteristics to those of the general public supports the ample body of literature that demonstrates underrepresentation of BIPOC in birdwatching (Adams, Leifester, & Herron, 1997; Carver, 2019; Cordell & Herbert, 2002; Eubanks et al., 2004; Kellert, 1985; Lee & Scott, 2011; Robinson, 2005) and outdoor recreation (Floyd, 1999; Floyd et al., 2008; Stodolska et al., 2013). Even relative to other national surveys of birdwatchers (Carver, 2019; Cordell & Herbert, 2002), Hispanic and Black respondents had extremely low participation rates. Only Native American and White respondents had higher representation in our birdwatching sample than in the general public. This finding is important because Native Americans are sometimes not included in birdwatcher surveys, or are relegated to an "Other" category (e.g. Adams et al., 1997; Carver, 2019; Kellert, 1985). Our results are congruent with literature that has shown Native Americans to birdwatch at a rate consistent with their proportion in the national population (Cordell & Herbert, 2002), and at a far higher rate than Hispanic and Asian people (Cordell et al., 1999, p. 449).

We expected the degree of specialization of BIPOC birdwatchers to follow a similar pattern to their participation rates. The process of specialization is influenced by socioeconomic status and social support (McFarlane, 1996; Scott & Lee, 2010; Scott & Shafer, 2001); such sociological mechanisms resemble the theoretical explanations for BIPOC underrepresentation in outdoor recreation (Floyd, 1999; Floyd et al., 2008; Stodolska et al., 2013). Accordingly, we hypothesized that birdwatcher specialization levels, like participation rates, would be lower in these ethno-racial groups. Our results did not support this hypothesis. Even as we observed a wide range of degrees of overall recreation specialization, we could not attribute this variability to differences in race or ethnicity. Controlling for demographic characteristics and social connections to other birdwatchers improved the fit of our model, but did not confer statistical significance to any ethno-racial predictor.

Ethno-racial differences among birdwatchers were more apparent when considering the affective (centrality), cognitive (skill), and behavioral (avidity) dimensions of recreation specialization individually. Asian birdwatchers indicated higher levels of centrality and avidity but lower levels of skill than other birdwatchers; this distinction was undetectable from our summative measure of overall specialization. In contrast, Native American and White birdwatchers' self-reported skill levels were higher than those of other ethno-racial groups. Black birdwatchers were less avid than other groups, a finding that aligns with literature showing that they leave home to watch birds less frequently than White birdwatchers (Cordell et al., 2008; Cordell & Herbert, 2002). Given that centrality, skill, and avidity do not always covary in birdwatchers (Lee & Scott, 2004), our findings suggest that race and ethnicity may explain some of the variation among the dimensions of recreation specialization. However, although these ethno-racial differences were statistically significant, they were small enough in magnitude to suggest only minimal practical significance (Vaske, 2002). For example, respondents' scores for the affective dimension of recreation specialization ranged from 2.41 to 12.03 with a standard deviation of 2.05 (Table 2); yet on this scale, Asian birdwatchers were only 0.29 units more specialized than non-Asian birdwatchers (Table 6). The statistical significance of these small differences was likely due to our large sample size (27,916 birdwatchers answered ethno-racial group and recreation specialization questions), though we note that our sample sizes of BIPOC birdwatchers were relatively small.

When we included social connections and other demographic variables in the regression models, they collectively accounted for far more of the variation in recreation specialization than did race and ethnicity alone. In all six models, the three independent variables for social connection (having a birdwatcher acquaintance, close friend, or relative) were significant predictors of recreation specialization. Although we did not measure changes in specialization over time, this finding may

support past research that shows both early exposure to birdwatching (Jones, Corin, Andre, Childers, & Stevens, 2017; McFarlane, 1996) and social support (McFarlane, 1996; Scott & Lee, 2010) to be drivers of progression along the recreation specialization continuum. In contrast, other demographic predictors had generally negative relationships with birdwatcher specialization, despite simultaneously positive relationships with birdwatcher participation. For example, although birdwatchers in our sample had higher average education levels than the general public as expected (Carver, 2019; Eubanks et al., 2004; Walther & White, 2018), we observed a negative association between higher education and recreation specialization. Similarly, while we had a female bias in our survey responses, we found that female birdwatchers were less specialized than males along all three dimensions of recreation specialization. These patterns suggest that, as with race and ethnicity, other demographic patterns in initial participation in birdwatching have little bearing on the degree of specialization among established birdwatchers.

Altogether, while our data confirmed substantial differences in ethno-racial representation among birdwatchers, we unexpectedly found only small or insignificant ethno-racial differences in recreation specialization. Such a distinction has not been previously made in the context of birdwatching, although Dwyer (2000, pp. 98–105) found little consistency between racial patterns in average days of participation, compared to percent participation, for a variety of other outdoor leisure activities. We propose two possible explanations. First, our study was cross-sectional; thus, we could not consider birdwatchers' specialization trajectories over time. Many birdwatchers never progress beyond a casual degree of recreation specialization (Scott & Lee, 2010), whereas other birdwatchers progress to advanced levels of involvement. Researchers have been able to explain only some of this variation in trajectories through sociological mechanisms (McFarlane, 1996; Scott & Lee, 2010). This same variation may have diluted the effects of demographic characteristics, including race and ethnicity, on our "snapshot" of recreation specialization. A second, related explanation may be found in the literature on hierarchical leisure constraints theory (Godbey et al., 2010). We cannot say that the theoretical constraints to BIPOC recreation participation (e.g., socioeconomic marginality, cultural expectations, discrimination; Floyd, 1999; Stodolska et al., 2013) disappear when a member of one of these groups becomes a participant. However, the relative importance and subsequent negotiation of those constraints may change as non-participants begin participating and (later) specializing (Crawford, Jackson, & Godbey, 1991; Godbey et al., 2010; Lewis & Moital, 2013). We suggest that race and ethnicity may play a greater role in constraining initial participation than continued participation of BIPOC, resulting in relatively weak ethno-racial patterns in recreation specialization.

A lack of social connection, described by Robinson's (2005) "Don't Loop" as a key reason why BIPOC are underrepresented in birdwatching, is one example of a constraint that likely differs in importance between non-participants and participants. Through logistic regression analysis, we found that White birdwatchers had a 42% higher odds than non-White birdwatchers of having close friends or relatives who also birdwatched. Although we expected this finding, we do not consider our hypothesis to be fully supported because (1) the logistic regression models explained very little variation in likelihood of social connection, and (2) BIPOC identity did not consistently predict lower likelihood of social connection. Indeed, only Native American birdwatchers were significantly less likely to have any type of social connection; conversely, Pacific Islander birdwatchers had an 88% higher odds of having a close birdwatcher friend (although we note that only 52 of them responded to our survey). Part of the reason for the weakness of our models may lie in the fact that our respondents were all participants, meaning they already belonged to the birdwatching "social world" (see Ditton et al., 1992). This fact likely explains why 85% of our respondents had at least one social connection to another birdwatcher. With social connections this common among participants, we conclude that the "Don't Loop," as the name suggests, may be a more important constraint for BIPOC who "don't" birdwatch than for those who already do.

4.1. Limitations and future research

Birdwatching has a unique definition in the context of eBird, the online platform from which we drew our respondents. Our sample considered people who not only deliberately watch birds at or away from home (Carver, 2019; Cordell, 2013), but also have previously created an account and logged into eBird. This likely favored birdwatchers who have greater access to the internet, which in turn could have affected the ethno-racial composition of our sample (Robinson et al., 2015). Additionally, it is unclear how eBird registrants' degrees of recreation specialization compare to those of other birdwatchers. Considering the importance of birding checklists to eBird, and the high proportion of away-from-home birdwatchers among our respondents (Appendix 1), we acknowledge a potential bias in our sample towards higher degrees of specialization. However, many eBird registrants do not regularly contribute to the database (Rosenblatt et al., in review), and only a small proportion submit the majority of checklists (Wood, Sullivan, Iliff, Fink, & Kelling, 2011). Moreover, our own sample showed considerable variation in birdwatching specialization levels. Thus, we emphasize that eBird registrants still represent a wide breadth of involvement in birdwatching.

We also recognize that members of an ethno-racial group are not homogeneous, as general terms such as "Native American," "Hispanic," and "Asian" conceal the diversity among individuals and cultures (Stodolska et al., 2013; Winter, Jeong, & Godbey, 2004). We avoided oversimplification of our respondents by treating ethno-racial categories as dummy variables, rather than consolidating multiracial respondents into a single category. We also included all six major ethno-racial groups recognized by the US Census Bureau in our analysis. Nevertheless, the comparative nature of our study reduces respondents' political, economic, and cultural backgrounds to a one-dimensional label, making it difficult to fully interpret how the experience of birdwatching is mediated by racial and ethnic identity (Kivel et al., 2009). Future research is necessary to better understand these nuances.

Our analysis left several other unanswered questions that could be addressed in future studies. For example, although we studied how birdwatchers' social connections related to their race, ethnicity, and specialization levels, we did not measure the quantity or ethno-racial identity of those connections, nor did we analyze their role in birdwatching socialization (see McFarlane, 1996). Similarly, although we controlled for several demographic characteristics in our analyses, we did not consider how ethno-racial patterns in birdwatcher participation and specialization vary across space (see Byrne & Wolch, 2009; Carver, 2019). Future research could use path analysis, social network analysis, and/or geospatial analysis to pursue these lines of inquiry. More generally, we suggest that future studies might investigate why BIPOC have been historically less likely than non-Hispanic White people to birdwatch, following decades of equivalent studies of underrepresentation in park visitation (e.g. Krymkowski et al., 2014; Solop et al., 2003, pp. 1–13; Washburne, 1978). These studies could further examine how some members of these underrepresented groups have successfully negotiated constraints to participation (see Godbey et al., 2010). Finally, whereas our examination of recreation specialization considered participants only, we recommend that future research also involve non-participants, and follow participants longitudinally as they are initially engaged and become (no) further involved in birdwatching.

4.2. Management implications

Our study has important implications for efforts to make the birdwatching community more diverse. We found that underrepresentation of BIPOC in birdwatching does not translate to under-*specialization* among these groups, as we had hypothesized. These results should be

encouraging for managers whose diversity efforts prioritize increasing BIPOC participation rates, as they show that BIPOC who already birdwatch are on average no less committed, skilled, or avid than White birdwatchers. This is not to say that promoting characteristics and behaviors that support recreation specialization in birdwatching is unimportant; on the contrary, higher levels of specialization are positively associated with conservation behaviors and attitudes (Lessard, Morse, Lepczyk, & Seekamp, 2018; McFarlane & Boxall, 1996). Nor should we overlook that race and ethnicity play a role in the birdwatching experience, as many birdwatchers have documented anecdotally (e.g. Cashman-Brown, 2012; Lanham, 2017). Rather, we emphasize that some ethno-racial groups will continue to be underrepresented among birdwatchers without a focus on increasing BIPOC participation rates, through both initial engagement and ongoing support of prospective first-time birdwatchers.

To this end, several studies (e.g. Hunt & Ditton, 2002; Krymkowski et al., 2014; Metcalf, Burns, & Graefe, 2013; Robinson, 2005; Solop et al., 2003, pp. 1–13; Stodolska et al., 2013) point to targeted outreach as an important means of encouraging new constituencies to engage in outdoor recreation. Nature-based outreach to BIPOC is central to the work of outdoor organizations such as Outdoor Afro (Meraji, 2015), Latino Outdoors (Flores & Kuhn, 2018), Christodora (Christodora, 2015), and Wild Indigo Nature Explorations (Rodriguez, 2018). Latino Outdoors, for example, organizes storytelling-based outings (including bird walks) in 14 states in order to engage Latino participants with their local environments (Flores & Kuhn, 2018). In another example of birdwatching-related outreach, the first Black Birders Week took place over social media in June 2020. Organized in response to a widely-reported racist incident in Central Park the month prior, in which a White woman called the police on a Black birdwatcher (Nir, 2020), the event celebrated Black birdwatchers and discussed the challenges they face in pursuing the activity (Mock, 2020).

These examples demonstrate the potential of outreach to promote birdwatching participation among BIPOC by leveraging social connections, thereby breaking Robinson's "Don't Loop" (2005). However, we note that outreach to these populations may be only part of a comprehensive approach to diversifying the birdwatching community. Finney (2014) argues that the lack of diversity in outdoor recreation reflects deeper issues of equity in the environmental movement as a whole. Therefore, other strategies to increase diversity may include more representative hiring practices in environmental organizations (Taylor, 2015), more deliberate efforts to reduce ethno-racial inequities in access to greenspace (Byrne & Wolch, 2009), more emphasis on including BIPOC in environmental imagery (Frazer & Anderson, 2018), and more institutional acknowledgement of the complex racialized histories of outdoor spaces (Finney, 2014).

As managers consider implementing such strategies in the context of birdwatching, it is crucial that the ethno-racial dynamics of the activity are well understood. By integrating analyses of participation rates, social connections, and recreation specialization with a specific focus on Black, Indigenous, and people of color, our study provides an important foundation for this understanding. Future research and management can thus apply our findings to help reduce constraints to participation, increase diversity among birdwatchers, and promote inclusion and belonging in the birdwatching community.

USGS disclaimer statement

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

CRediT authorship contribution statement

Jonathan D. Rutter: Conceptualization, Data curation, Formal analysis, Methodology, Visualization, Writing – original draft. **Ashley A. Dayer:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Writing – review & editing. **Howard W. Harshaw:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Writing – review & editing. **Nicholas W. Cole:** Data curation, Formal analysis, Writing – review & editing. **Jennifer N. Duberstein:** Conceptualization, Investigation, Methodology, Project administration, Writing – review & editing. **David C. Fulton:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Writing – review & editing. **Andrew H. Raedeke:** Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Writing – review & editing. **Rudy M. Schuster:** Conceptualization, Investigation, Methodology, Project administration, Writing – review & editing.

Declaration of competing interest

The authors declare that representatives of the National Flyway Council who are not named authors contributed to study design, but not to data collection/analysis, decision to publish, nor preparation of the manuscript.

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Appendix A. Supplementary data

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