12-2021

Constraints to Waterfowl Hunting by Hunters and Anglers in the Central United States

Matthew P. Hinrichs
University of Nebraska-Lincoln, matthewphinrichs@gmail.com

Matthew P. Gruntorad
University of Nebraska-Lincoln, mgruntorad2@unl.edu

Julia A. Nawrocki
University of Nebraska-Lincoln

Mark P. Vrtiska
Nebraska Game and Parks Commission, mvrtiska3@unl.edu

Mark A. Pegg
University of Nebraska-Lincoln, mpegg2@unl.edu

See next page for additional authors

Published in *Wildlife Society Bulletin* 45:4 (December 2021), pp. 638–646; doi: 10.1002/wsb.1241

Submitted November 18, 2019; accepted July 13, 2021; published December 20, 2021.

Supplemental material follows the references.

Constraints to Waterfowl Hunting by Hunters and Anglers in the Central United States

Matthew P. Hinrichs,[1] Matthew P. Gruntorad,[1] Julia A. Nawrocki,[1]

Mark P. Vrtiska,[2]* Mark A. Pegg,[1] and Christopher J. Chizinski[1]

1. School of Natural Resources, University of Nebraska–Lincoln, Lincoln, Nebraska, USA
2. Nebraska Game and Parks Commission, Lincoln, Nebraska, USA

**Current address* – School of Natural Resources, University of Nebraska–Lincoln, Lincoln, Nebraska, USA

Corresponding author – Matthew P. Hinrichs, email matthewphinrichs@gmail.com

Abstract

Waterfowl hunting participation has been on the decline since the mid-1980s. We used a web-based survey to better understand waterfowl hunting constraints (i.e., factors that limit or prohibit participation and enjoyment in leisure activities) among hunters and anglers that hunted or did not hunt waterfowl in the central United States. Forty-eight constraint items were condensed into 10 constraint factors: Rules and Regulations, Waterfowl Identification, Cost, Waterfowl Hunting Skills, Land Access and Permissions, Interference by Other Hunters, Travel, Social, Waterfowl Populations, and Views of Others. We observed significant effects of both state of residence and activity type (i.e., frequent waterfowl hunters, sporadic waterfowl hunters, dissociated waterfowl hunters, non-waterfowl hunters, and anglers) but the effect sizes were mostly small. There were few meaningful differences between constraints based on state of residence, indicating that the perception of constraints was largely consistent among the states included in our study. However, Social, Waterfowl Identification, and Waterfowl Hunting Skills constraints had greater differences, particularly between frequent waterfowl hunters and non-waterfowl hunters. Our assessment of waterfowl constraints did not indicate a single constraint that was inhibiting (or prohibiting) participation of waterfowl hunting among waterfowl hunters or non-waterfowl hunters. However, there were numerous constraints that were slightly to moderately limiting across all activity groups similarly, which suggests that

constraints may act collectively to create a perception of an insurmountable impediment to participation to the individual.

Keywords: constraints, reactivation, recruitment, retention, waterfowl hunting, web-survey

Participation in waterfowl hunting has experienced some of the sharpest declines among the various types of hunting in the United States (U.S. Fish and Wildlife Service et al. 2012). There are several overarching consequences to waterfowl conservation due to decreased participation, including the loss of revenue to support conservation and management of wetlands and waterfowl (Vrtiska et al. 2013), loss of cultural tradition (Arnett and Southwick 2015), political support for hunting and conservation efforts (Enck et al. 2000), and connection to nature (Peterson et al. 2011). To address the loss of hunters and to minimize the associated negative consequences, the North American Waterfowl Management Plan (NAWMP; U.S. Fish and Wildlife Service et al. 2012) was revised in 2012 to include a specific goal to increase participation among waterfowl hunters and gain support of waterfowl and wetland conservation among waterfowl viewers and the public (U.S. Fish and Wildlife Service et al. 2012). Although the goal provided little direction in regard to the means, extent, or timeframe of the increase needed, it was unique and important in highlighting the need for growing the stakeholder base in a wildlife management plan. To help inform the NAWMP goal, research into factors that inhibit participation among current waterfowl hunters and potential waterfowl hunters is necessary.

Constraints are factors that limit or prohibit participation and enjoyment in leisure activities (Jackson 1991). Identifying constraining factors is an important step in developing management scenarios that can be implemented to help individuals negotiate constraints and ultimately increase participation in wildlife-based recreation. Crawford et al. (1991) outlined a model of intrapersonal, interpersonal, and structural constraints. Intrapersonal constraints depict an individual's psychological state and guide leisure preferences and include factors like family attitudes and perception of skills. Interpersonal constraints depict factors that are focused on other individuals and include familial obligations or the lack of a social hunting circle. Lastly, structural constraints depict resource factors and encompass factors such as finances, climate, and access opportunities. Constraints to hunting activities have been identified to include factors such as overcrowding, lack of accessible land, equipment and travel costs, work and family obligations, and skills (Enck et al. 1993, Schroeder et al. 2006, Metcalf et al. 2015, Gruntorad and Chizinski 2020).

Constraints are involved in all leisure activities, but participation can be achieved through negotiation strategies (Hubbard and Mannell 2001). Negotiation of constraints include both cognitive and behavioral approaches, which requires an active investment of time and effort by potential participants (Jackson et al. 1993, Jackson 2000, Wright et al. 2001). Although the constraints must be negotiated by the individual, state and federal fish and wildlife agencies (hereafter agencies) and nongovernmental organizations (NGOs) cannot solely depend on individuals to negotiate them on their own. Agencies and NGOs can facilitate the negotiation process through targeted programming and management efforts, which may include providing sponsored mentor programs and family events (Responsive Management and National Shooting Sports Foundation 2017) or opening up more private

land for public access through programs that encourage landowners to make their land publicly accessible (Wszola et al. 2020a).

Understanding how constraints to waterfowl hunting may vary among states and wildlife recreation groups (hunters and anglers, hereafter activity types) can provide valuable insight for the creation and revisions of regulations and programs as well as to draw relevancy between hunting and fishing activities among participants. Ultimately, research identifying and quantifying constraints will inform recruitment, retention, and reactivation (R3) objectives and efforts. Our study builds on previous research on constraints to waterfowl hunting among current and former waterfowl hunters (Enck et al. 1993, Schroeder et al. 2006) but also extends to those who never participated in waterfowl hunting (though engage in other hunting and fishing activities). We predicted that constraints to waterfowl hunting might vary across states within the central U.S. due to differences in opportunities for waterfowl hunting. Further, we predicted that constraints to waterfowl hunting would be different among those who have participated (i.e., frequent and sporadic waterfowl hunters) from those that have disengaged or never engaged in waterfowl hunting (non-waterfowl hunters and anglers). Thus, our objectives were to (1) identify and quantify intrapersonal, interpersonal, and structural constraints to waterfowl hunting, (2) use exploratory factor analysis to identify the underlying relationships among constraint items, and (3) identify and compare the influence of state of residence and activity types on the strength of constraint factors.

Methods

Study System

We surveyed hunters and anglers in Kansas, Michigan, Missouri, Montana, Nebraska, Oklahoma, South Dakota, and Wyoming, USA. Each state had electronic license systems (ELS) that contained email addresses, permit and stamp types, permit year, and birth year. Permit type and purchase year were required to develop purchase histories, and birth year was needed to comply with the University of Nebraska–Lincoln Institution Review Board (IRB) age requirements. Each participating state and the University of Nebraska–Lincoln signed data-sharing agreements to ensure data security and appropriate use of data. All protocols and survey instruments were approved by the University of Nebraska–Lincoln Institutional Review Board (IRB Approval #: 20160215880 EX).

To build our sampling frame, we developed 6 initial *a priori* activity categories based on permits and stamp purchase histories from 2012 to 2016 for each state. We wanted to compare scenarios intended to increase waterfowl hunting participation across different types of hunters and anglers, not just current and former waterfowl hunters. The *a priori* activity types consisted of anglers, big game hunters, small game hunters, combination users (purchased a combination of hunting and fishing permits), and waterfowl hunters (purchased the required combination of permits and state stamps). Using stamp purchase histories from the waterfowl groups and responses from our survey questionnaire, we categorized waterfowl hunters into the following 3 groups: frequent (purchased the appropriate permits and stamps ≥ 4 times from 2012 to 2016), sporadic (purchased the appropriate permits and stamps 1–3 times from 2012 to 2016), or dissociated (did not purchase the

appropriate permits and stamps between 2012–2016 but self-identified as previously participating in waterfowl hunting in our survey questionnaire). Purchase of federal waterfowl stamps was not considered in our grouping effort because this information was not available in state ELS.

Data Collection

Survey

Hunters and anglers among the participating states were sent an email invitation to an online survey created with Qualtrics® online survey software (Qualtrics® XM, Provo, Utah, USA). We used a tailored design method of invitation letter and reminders to maximize the number of responses (Dillman et al. 2014). The survey link was active from 05 May to 05 June, 2018, and again from 27 August to 07 September, 2018. Email reminders were sent on Monday and Wednesday to all nonrespondents starting one week after initial invitation. Four reminders were sent between May and June, 2018, and three reminders were sent between August and September, 2018; for the latter interval we sent only 3 reminders due to the survey being sent on a Monday and closed 2 weeks later. Recipients were able to opt out of the survey by clicking a link in the invitation letter or answering no to the first question on the questionnaire (Do you wish to participate in this survey). The first question provided an indication of consent to take the survey and ensured that those who did not want to participate did not receive subsequent reminders. In addition to a section on Potential Barriers to Waterfowl Hunting, the questionnaire also collected information on current and past hunting and fishing participation, activity preferences, motivations, scenarios to increase waterfowl hunting, mentorship, and demographics. We used responses from the later round of the survey mailing to gauge nonresponse bias. The use of the second or final wave to measure nonresponse bias reflects extrapolation methods, which are based on the assumption that individuals that respond after reminders are more likely to be similar to nonrespondents (Filion 1975, Armstrong and Overton 1977).

Constraints

Constraints were adapted from the 2005 National Survey of Waterfowl Hunters (National Flyway Council and Wildlife Management Institute 2006), and input from waterfowl managers in the Central and Mississippi flyways. Constraint questions were grouped into 6 categories: access ($n = 11$), cost ($n = 7$), rules and regulations ($n = 11$), social ($n = 4$), waterfowl hunting knowledge and skills ($n = 6$), and waterfowl identification and population ($n = 9$) (Table 1). Each constraint question asked the respondent to identify the strength of the limitation on a five-point scale from not at all limiting (scaled to 0) to very limiting (scaled to 4).

Table 1. The constraint items and type of constraints assessed in our study of waterfowl and non-waterfowl hunters in the central United States during 2018 in the states of Kansas, Michigan, Missouri, Montana, Nebraska, Oklahoma, South Dakota, and Wyoming

Constraint	Constraint type
Amount/availability of public hunting land in my area	Structural
Asking for private hunting land access	Intrapersonal
Crowding on public hunting land	Interpersonal
Duck species–specific bag limits (i.e., Mallard or Canvasback)	Structural
Encounters with other hunters	Interpersonal
Fear of not complying with rules and regulations	Intrapersonal
Finding information on rules and regulations	Structural
Finding resources to aid in waterfowl identification	Structural
Frequency of rules and regulation changes	Structural
Having time to scout	Intrapersonal
Interference by other hunters (i.e., setting up too close)	Interpersonal
Knowing how to scout	Intrapersonal or Structural
Knowing how to use a shotgun	Intrapersonal or Structural
Knowing how to use duck or goose decoys	Intrapersonal or Structural
Knowing the dates in specific areas (zones) within the state	Intrapersonal or Structural
Knowing the location of public hunting land	Intrapersonal or Structural
Knowing what equipment that I need to hunt waterfowl	Intrapersonal or Structural
Knowing what license/permits/stamps I need	Intrapersonal or Structural
Knowing where zone boundaries are	Intrapersonal or Structural
Knowing who to ask for private hunting land access	Intrapersonal or Structural
Knowing when seasons open and close	Intrapersonal or Structural
My ability to identify male versus female ducks	Intrapersonal
My ability to identify waterfowl in flight	Intrapersonal
My ability to identify waterfowl in hand	Intrapersonal
My ability to identify female species of duck	Intrapersonal
My community's view toward waterfowl hunting	Interpersonal
Not having a friend that hunts waterfowl	Interpersonal
Not having a family member that hunts waterfowl	Interpersonal
Obtaining permission for private hunting land access	Structural
Required use of non-toxic shot	Structural
Requirement to identify waterfowl	Structural
The cost of a shotgun	Structural
The cost of decoys	Structural
The cost of hunting blinds	Structural
The cost of license/permits/stamps	Structural
The cost of other equipment (i.e., waders, duck or goose calls, shotgun shells)	Structural
The cost of travel (i.e., gas, lodging)	Structural
The cost to lease private land	Structural
The number of required licenses/permits and stamps	Structural
The number of waterfowl I see	Structural
The physical demands of waterfowl hunting	Intrapersonal
The population number of the duck species that I am interested in where I hunt	Structural
The timing of waterfowl competes with other activities	Structural
The views about waterfowl hunting by an important person in my life	Interpersonal
Travel distance to a hunting area	Structural
Travel time to a hunting area	Structural
Understanding the rules and regulations	Intrapersonal

Defining Activity Types

Although we sampled from the 6 *a priori* activity types, we based analyses on an individual's stated participation rather than their revealed preferences (i.e., permit sales), following methods described in Hinrichs et al. (2021). Briefly, we grouped individuals into 5 exclusive groups based on responses to survey questions. The groups were as follows: frequent waterfowl hunters (indicated they hunted waterfowl and hunted waterfowl in most years between 2012–2016), sporadic waterfowl hunters (indicated they hunted waterfowl and hunted waterfowl only a couple of years between 2012–2016), dissociated waterfowl hunters (indicated they had hunted waterfowl previously but had not hunted waterfowl during 2012–2016), non-waterfowl hunters (indicated that they had never hunted waterfowl but had engaged in big game, small game, upland game, or non-waterfowl migratory bird hunting), and nonhunters (indicated they never hunted waterfowl and engaged only in angling during 2012–2016).

Data Analyses

We used an exploratory factor analysis (EFA) with the parallel method and Promax rotation (Hayton et al. 2004) to explore relationships among constraint items. It was necessary to take an exploratory rather than confirmatory approach because the constraints had been divided into 6 categories for organizational purposes and did not represent a hypothesized factor structure. We then used factor analysis to group and reduce the dimensions of the 48 constraint items (questions) into constraint factors (i.e., domains or constructs). For factors with eigenvalues > 1.0 and factor loadings > |0.3|, a reliability analysis using the McDonald's omega (ω) criterion was calculated (DeVellis 2016). McDonald's omega was used over the more ubiquitous Cronbach's alpha because of the numerous deficiencies that Cronbach's alpha has been documented with in the psychometric literature (Dunn et al. 2014, Trizano-Hermosilla and Alvarado 2016). Items were combined into factors if reliability (ω) was ≥ 0.6 and the mean values from the items within a factor provided indices of motivation importance for each factor (Nunnally and Bernstein 1994). All analyses were conducted in R (R Core Team 2018). Factor analysis and McDonald's omega were calculated using the psych package (Revelle 2019). We compared motivation factors as a function of activity and state of residence using an analysis of variance. For each statistically significant main effect ($P < 0.05$), we calculated the effect sizes using the effect-size package (Ben-Shachar et al. 2020). Effect sizes were important because with large sample sizes ($n > 1000$), as in our study, significant P-values ($P \leq 0.05$) are likely even when the differences among groups are very small (Sullivan and Feinn 2012). Effect sizes are often categorized as small, medium, and large (although finer categories exist depending on the metric) and describe the differences between means in terms of differences relative to the standard deviation, such that a large effect size represents a greater proportion of the standard deviation than would a small effect size. We categorized our effect sizes into small if the effect size was small or less than small. In addition, for each statistically significant main effect, we conducted a post hoc multiple comparison of estimated marginal means to identify difference among levels of the factor (i.e., state of residence or activity type) using the emmeans package (Lenth 2020). The effect size of Cohen's d (transformed from t ratio) was interpreted using criteria from Funder and Ozer (2019) and the effect size of ω^2 was

interpreted using criteria from Field (2013). We used the Tucker Lewis index (TLI) and the Root Mean Square Error of Approximation (RMSEA) to assess fit.

Results

Survey Response

We received 7,875 completed surveys. After adjusting for undeliverable surveys, invalid respondents, and individuals that chose to opt out of the survey, the response rate (minimum response rate; The American Association for Public Opinion Research 2016) was 10%. Overall, there were no large differences between responses from early and late respondents. Because of the similarity between early and late respondents in our measures and no indication of non-response bias, the later responses to the survey were included in the analyses (Hinrichs et al. 2021).

Exploratory Factor Analysis

Our initial EFA revealed a 10-factor solution for constraints. Five constraint items (physical demands, private land access cost, travel cost, time to scout, and using a gun) occurred on several factors (loadings > |0.30|) and thus dropped from further analyses. After dropping those 5 items, a 10-factor solution was maintained, and the resulting model fit was satisfactory ($\chi^2_{(585)} = 1822.75$; TLI = 0.957; RMSEA = 0.037; Table 2).

Table 2. Results of an Exploratory Factor Analysis of constraint items toward waterfowl hunting assessed in our study of waterfowl and non-waterfowl hunters in the central United States during 2018 in the states of Kansas, Michigan, Missouri, Montana, Nebraska, Oklahoma, South Dakota, and Wyoming

Barriers	Factor loading	Variance explained (%)	Omega
Rules and Regulations		16%	0.98
Rule changes	0.85		
Species bag limits	0.61		
Number of permits	0.78		
What kind of permit	0.84		
Knowledge of zone season dates	0.91		
Knowledge of zones	0.76		
Knowledge of season dates	0.88		
Finding information	0.86		
Understanding Rules	0.87		
Fear of not complying	0.78		
Use of steel shot	0.55		
Waterfowl Identification		10%	0.93
Identification of flying ducks	0.82		
Identification of female ducks	0.99		
Identification of males vs. females	0.98		
Identification of waterfowl in hand	0.80		
Identification requirements	0.81		
Finding identification resources	0.56		

Continued next page

Table 2. *Continued*

Barriers	Factor loading	Variance explained (%)	Omega
Cost		8%	0.89
Decoy costs	0.89		
Cost of blinds	0.83		
Shotgun cost	0.68		
Other equipment costs	0.90		
Permit cost	0.62		
Travel cost	0.61		
Land Access/Permissions		7%	0.87
Who to ask for permission	0.90		
Asking for permission	0.95		
Obtaining permission	0.94		
Knowing public land location	0.40		
Amount of public land	0.43		
Waterfowl Hunting Skills		7%	0.87
Using decoys	0.94		
Using calls	0.80		
What equipment to use	0.77		
How to scout	0.80		
Travel		5%	0.91
Travel distance	0.95		
Travel time	0.95		
Other Hunters		5%	0.83
Crowding	0.97		
Encounters	0.81		
Interference	0.95		
Social		3%	.85
Lack of family who hunt	0.88		
Lack of friends who hunt	0.82		
Waterfowl Populations		3%	0.72
Low population numbers	0.68		
Number of waterfowl I see	0.84		
Timing of migration	0.42		
Views of Others		3%	0.67
Community views	0.70		
Important person views	0.74		

Comparing Constraints Among States

The strength of each constraint factor varied by the state of residence (Table 3). However, the effect size of state of residence was small for each constraint factor. Further, multiple comparisons of the estimated marginal means indicated small effect sizes for each comparison (Table S1), which indicated that although statistically significant ($P < 0.05$), actual differences in constraints toward waterfowl hunting were small among the states in this study.

Comparing Constraints among Activity Type

The strength of each constraint factor varied by activity type (Table 3). Effect sizes for activity type varied on the constraint factors, ranging from medium to small. Social (i.e., lack

of family and friends who hunt; $\omega^2 = 0.08$), waterfowl identification (i.e., identifying flying ducks; $\omega^2 = 0.09$), and waterfowl hunting skills (i.e., using calls and decoys; $\omega^2 = 0.10$) had medium effect size values, with the remaining factors (cost, land access, other hunters, rules and regulations, travel, waterfowl population and views; $\omega^2 < 0.03$) having small effect sizes.

Table 3. Means (± SD), F-value, and partial omega squared for each constraint factor across different stated activity participation types assessed in our study of waterfowl and non-waterfowl hunters in the central United States during 2018 in the states of Kansas, Michigan, Missouri, Montana, Nebraska, Oklahoma, South Dakota, and Wyoming. Constraint factors are ordered by the variance explained (proportion of total variance that is accounted for by that factor) obtained from exploratory factor analysis (Table 2).

	Mean values ± SD							
	Waterfowl			Non-waterfowl				
Constraint	Frequent	Sporadic	Dissociated	Hunter	Angler	F-value	Partial omega^2	Variance explained
Rules and Regulations	0.65 ± 0.99	0.92 ± 1.13	1.02 ± 1.19	1.04 ± 1.22	0.90 ± 1.18	480.55	0.023	16
Waterfowl Identification	0.57 ± 0.88	0.98 ± 1.10	1.06 ± 1.14	1.42 ± 1.34	1.32 ± 1.40	1073.74	0.089	10
Cost	1.12 ± 1.14	1.37 ± 1.23	1.42 ± 1.27	1.47 ± 1.34	1.32 ± 1.35	156.16	0.014	8
Waterfowl Hunting Skills	0.53 ± 0.88	0.93 ± 1.08	0.92 ± 1.09	1.39 ± 1.31	1.51 ± 1.46	818.10	0.100	7
Land Access/Permissions	2.01 ± 1.40	2.16 ± 1.37	2.08 ± 1.42	1.91 ± 1.46	1.53 ± 1.48	81.01	0.009	7
Other Hunters	2.11 ± 1.29	1.99 ± 1.29	1.93 ± 1.33	1.68 ± 1.38	1.34 ± 1.39	144.24	0.025	5
Travel	1.65 ± 1.20	1.80 ± 1.22	1.83 ± 1.29	1.50 ± 1.30	1.12 ± 1.28	65.72	0.017	5
Social	0.69 ± 1.06	1.10 ± 1.27	1.36 ± 1.39	1.62 ± 1.50	1.41 ± 1.51	328.09	0.082	3
Waterfowl Populations	1.23 ± 1.17	1.41 ± 1.21	1.32 ± 1.22	1.36 ± 1.30	1.19 ± 1.33	21.93	0.004	3
Views of Others	0.22 ± 0.62	0.24 ± 0.64	0.27 ± 0.72	0.34 ± 0.83	0.48 ± 1.02	30.72	0.008	3

Comparison among the activity type on waterfowl hunting constraints indicated that most of the comparisons were either not statistically significant or had small effect sizes (Table S2). However, there were 3 comparisons between frequent waterfowl hunters and the non-waterfowl hunters that indicated greater differences. The differences indicated that non-waterfowl hunters indicated a greater limitation imposed by social factors, waterfowl identification, and waterfowl hunting skills than frequent waterfowl hunters.

Discussion

We identified significant differences in the strength of constraints to waterfowl hunting between activity types and state of residence. However, based on calculation of effect sizes, most were small with a few exceptions. The perception of constraints among the 8 states included in our study were largely consistent and showed little differences. We expected that with different management strategies and resources in each state there would be some differences in the intensity of constraints to waterfowl hunting. However, we may have had unfounded expectations given the cross-boundary governance and the relative importance of human dimensions in waterfowl management that is employed in the NAWMP. The collaborative management across many states and provinces may have had the effect of minimizing differences (especially those constraints that agencies could influence) that may have existed if agencies managed waterfowl on an individual basis. Another potential

explanation for the similarity in the perceptions of constraints in our study is the geographic extent of our sample. Although our sample stretched across 2 flyways, it may not have been large enough to witness differences in perceptions of constraints, particularly those associated with land access that might be expected to vary more on the coasts.

Our results suggested that land access and conflict with other hunters were generally some of the relatively stronger constraints, with waterfowl hunters rating them as more limiting. Waterfowl hunters (current and former) and non-waterfowl hunters and anglers tended to view (1) asking for permission, (2) crowding, (3) knowing who to ask for permission, and (4) obtaining permission as impediments to hunting waterfowl, which is consistent with previous research of hunters (Backman and Wright 1993, Montgomery and Blalock 2010, Metcalf et al. 2015, Gruntorad and Chizinski 2020). Further, frequent and sporadic waterfowl hunters viewed these as relatively stronger constraints, but it did not prohibit them from participating in their activity, which suggests that they have successfully negotiated these impediments (Kay and Jackson 1991, Shaw et al. 1991) or had the motivations to do so (Jackson et al. 1993). In addition, increased leisure involvement has been theorized to lead to increases in subtleties of activity attributes (e.g., skills and equipment, geographical locations), activity importance, and managerial elements of an activity (Havitz and Dimanche 1999, Kyle et al. 2003). More engaged waterfowl hunters may be more sensitive to hunters on the landscape than less engaged or nonparticipants of waterfowl hunting. However, the interference by other hunter constraint indicates that with potential increases in participation, crowding could cause individuals to minimize participation or completely dissociate from the activity (Enck et al. 1993). Further, the similar perception of land access and interference by other hunters indicates that these constraints may not be distinct to only waterfowl hunters. By increasing public or private land availability, agencies can provide more areas to hunt and indirectly decrease conflicts among waterfowl hunters (Fontaine et al. 2019, Wszola et al. 2020b). Yet, increasing public land access is challenging and not easily accomplished by agencies. Alternatives to purchasing more land such as leasing or obtaining permission on private property to disperse hunters on the landscape is needed (Gruntorad and Chizinski 2020, Wszola et al. 2020b).

Our study faced limitations common to survey research, in particular with the use of web surveys, that should be noted. Our overall response rate was 10% suggesting the potential for nonresponse bias (Manfreda et al. 2008). Although we observed no difference between the 2 waves of respondents in the survey, those included in our study might not wholly represent waterfowl hunters and non-waterfowl hunters in the Central and Mississippi flyways. Further, we evaluated 48 potential constraints faced by waterfowl hunters. This may not fully reflect all potential intraspecific, interspecific, and structural constraints faced by waterfowl hunters. Lastly, we did not assess negotiation strategies that hunters might employ to maintain or start participation in waterfowl hunting, which may have helped set the context for the constraint factors identified in this study.

Our expectation that there would be a gradient in the expected or perceived constraints was partially supported by our results. Frequent waterfowl hunters were largely less constrained to hunt waterfowl, with the largest constraints coming from factors that directly interfered with their participation (e.g., interference by others, finding access). The perception of constraints by frequent waterfowl hunters is not surprising, as research has

indicated that those individuals who already participate may have established negotiation strategies (Schroeder et al. 2012). The sporadic and dissociated waterfowl hunters indicated a relatively greater level of constraint among those associated with cost, social, and land access. With the non-waterfowl hunters, we observed a general increase in the intensity of all the constraints associated with waterfowl hunting, especially those concerned with understanding and knowing the rules and regulations, waterfowl hunting skills, and identification. Waterfowl hunting requires highly specialized skills and equipment compared to other leisure activities (Schroeder et al. 2012). The transition in our continuum between waterfowl hunters and non-waterfowl hunters also represents a shift in a transition of realized and perceived constraints (non-waterfowl hunters have never had to establish negation strategies directly associated with waterfowl hunting). However, non-waterfowl hunters may have a greater perception and experience with a similar suite of the constraints than anglers, as they have had to use negotiation strategies to acquire land access and skills in other hunting situations. The greatest difference observed in constraints was observed between frequent waterfowl hunters and non-waterfowl hunters but not between frequent waterfowl hunters and anglers. This discrepancy suggests that anglers may not fully conceptualize (or perceive) the extent that some of these constraint groups and the limitations they may impose, which suggests an area for further research.

Motivations may interact with constraints to influence participation in leisure activities (Lee and Scott 2009). Highly motivated individuals may be more willing to put increased effort into negotiation strategies or may perceive constraints as less limiting; however, support for this hypothesis has been mixed (Hubbard and Mannell 2001, Alexandris et al. 2002, Schroeder et al. 2012). In particular, waterfowl hunting motivations have been indicated as a positive precursor to predicting future waterfowl hunting participation, but it was not negatively associated with perceived constraints (Schroeder et al. 2012). Although we did not directly assess the relationship between motivations and constraints in our study, we did observe differences along our gradient of activity types to participate in waterfowl hunting. Motivation factors were generally consistent between the types of waterfowl hunters and non-waterfowl hunters (Hinrichs et al. 2021), with the notable exception being a greater food-oriented motivation among the latter. There was, however, a strong difference in the importance of the activity among waterfowl hunters and likelihood of engaging in the activity among non-waterfowl hunters (Hinrichs et al. 2021). The association between the importance and willingness to engage in an activity, the negotiation strategies employed, and the interaction with realized and perceived constraints along a gradient of recreationists, as described here, warrants further exploration and study.

Our assessment of waterfowl constraints did not indicate a single smoking gun that was inhibiting (or prohibiting) participation of waterfowl hunting among waterfowl hunters or non-waterfowl hunters. However, there were numerous constraints that were indicated to be slightly to moderately limiting to participation across all activity groups similarly. The number of limiting factors was large, which suggests that constraints may not act on their own but may act collectively to create a perception of an insurmountable barrier to participation (Jackson et al. 1993, White 2008). The perception of the accumulation of multiple small constraints acting to limit participation has support from an assessment of negotiating strategies to increase participation in waterfowl hunting. Although

hunters identified the lack of family or friends who hunt waterfowl as a slightly limiting constraint, hunters also indicated that someone to take me hunting would increase their level of participation. There are likely multiple reasons why this is important, including appealing to hunting-related motivations (Hinrichs et al. 2021). Having someone taking you hunting also allows the individual to navigate and negotiate many constraints at once (e.g., access issues, driving to locations; Kay and Jackson 1991) as well as influence social identity factors associated with negotiation (Jun and Kyle 2011, Mueller et al. 2019). While having someone take you hunting appears to be an important negotiating option to minimize waterfowl-hunting constraints, it is an interpersonal constraint that is not easy to address by management agencies. However, this may be an important opportunity to work with NGOs (e.g., Ducks Unlimited, Delta Waterfowl) to help develop or enhance social efforts to bring together waterfowl hunters and those interested in waterfowl. The development of a social habitat for hunting (Larson et al. 2014) has been shown to be an important factor in the retention and frequency of permit purchases by waterfowl hunters (Schroeder et al. 2013).

Management Implications

Building public support for waterfowl and wetlands conservation is an explicit goal in the NAWMP Action Plan and will require agencies and NGOs to develop programs that meet the waterfowl, habitat and participant needs. We identified several constraints, particularly locations to waterfowl hunt and hunter-hunter conflict that highlight the need for quality public access, which should continue to be an agency objective. Providing more access is a difficult and expensive management action, but simply adding hunting locations in the landscape may not be the only option available to agencies and NGOs. Managing locations at a landscape scale by drawing on knowledge of hunter preferences and substitute sites may help disperse hunters without adding additional properties that require management or tax burdens. In addition, technological solutions may exist to highlight less used sites and draw waterfowl hunters to specific locations. Further, understanding the factors involved in hunter-hunter conflict is important (Vrtiska et al. 2010) and may help diminish the perception of overcrowding. Finally, constraints may fluctuate over time in response to game populations, hunter demographics, and regulations. Thus, monitoring perception of constraints to hunting on a semiregular basis, across larger spatial scales, and other activity types will be important for fish and wildlife management agencies to better meet the needs of current and incoming hunters.

Increasingly, research suggest that R3 efforts that focus only on low-hanging fruit (i.e., providing equipment or basic hunting education classes) may not effectively increase hunter participation. Rather, management agencies and NGOs should begin trying big shifts that expand or alter traditional management approaches to be more proactive in hunter and angler management (Larson et al. 2014, Graham et al. 2021, Gruntorad and Chizinski 2021). As an example, many R3 efforts continue to focus on traditional stakeholders, but it is becoming increasingly apparent from results of these efforts that this demographic will not sustain future waterfowl and wetlands management needs. The foundation of stakeholders needs to be enhanced by increasing the relevancy of waterfowl and wetlands to

more, and a diversity of, stakeholders. Increasing the relevancy among individuals will be critical for continued conservation of wetlands and waterfowl and in meeting the third goal of NAWMP of increasing participation among waterfowl hunters.

Acknowledgments – We thank all the managers from the participating states: T. Bidrowski from Kansas Department of Wildlife, Parks, and Tourism; B. Avers from Michigan Department of Natural Resources; A. Raedeke from Missouri Department of Conservation; J. Hanson from Montana Fish, Wildlife & Parks; C. Jager from Oklahoma Department of Wildlife Conservation, R. Murano from South Dakota Game, Fish, and Parks; N. Huck from Wyoming Game and Fish; and all respondents to our surveys. We thank B. Davis (Associate Editor), A. Knipps (Editorial Assistant), J. Levengood (Content Editor), and two anonymous reviewers for their excellent comments and suggestions that greatly improved this manuscript. This project was funded by Federal Aid in Wildlife Restoration Projects W-123-R, administered by the Nebraska Game and Parks Commission (NGPC). Support for C. Chizinski was made possible by Hatch funds through the Agricultural Research Division at the University of Nebraska–Lincoln and from Federal Aid in Wildlife Restoration project W-120-T, administered by the NGPC.

Literature Cited

Alexandris, K., C. Tsorbatzoudis, and G. Grouios. 2002. Perceived constraints on recreational sport participation: investigating their relationship with intrinsic motivation, extrinsic motivation and amotivation. Journal of Leisure Research 34:233–252.

Armstrong, J. S., and T. S. Overton. 1977. Estimating nonresponse bias in mail surveys. Journal of Marketing Research 14:396–402.

Arnett, E. B., and R. Southwick. 2015. Economic and social benefits of hunting in North America. International Journal of Environmental Studies 72:734–745.

Backman, S. J., and B. A. Wright. 1993. An exploratory study of the relationship of attitude and the perception of constraints to hunting. Journal of Park and Recreation Administration 11:1–16.

Ben-Shachar, M. S., D. Makowski, and D. Lüdecke. 2020. Compute and interpret indices of effect size. CRAN. <https://github.com/easystats/effectsize>. Accessed 28 Jun 2021.

Crawford, D. W., E. L. Jackson, and G. Godbey. 1991. A hierarchical model of leisure constraints. Leisure Sciences 13:309–320.

DeVellis, R. F. 2016. Scale development: theory and applications. Volume 26. Sage Publications, Los Angelos, California, USA.

Dillman, D. A., J. D. Smyth, and L. M. Christian. 2014. Internet, Phone, Mail, and Mixed-mode Surveys: the Tailored Design Method. John Wiley and Sons, Hoboken, New Jersey, USA.

Dunn, T. J., T. Baguley, and V. Brunsden. 2014. From alpha to omega: a practical solution to the pervasive problem of internal consistency estimation. British Journal of Psychology 105:399–412.

Enck, J. W., D. J. Decker, and T. L. Brown. 2000. Status of hunter recruitment and retention in the United States. Wildlife Society Bulletin 28:817–824.

Enck, J. W., B. L. Swift, and D. J. Decker. 1993. Reasons for decline in duck hunting: insights from New York. Wildlife Society Bulletin 21:10–21.

Field, A. 2013. Discovering Statistics Using IBM SPSS Statistics. Sage, London, United Kingdom.

Filion, F. 1975. Estimating bias due to nonresponse in mail surveys. Public Opinion Quarterly 39:482–492.

Fontaine, J. J., A. D. Fedele, L. S. Wszola, L. N. Messinger, C. J. Chizinski, J. J. Lusk, K. L. Decker, J. S. Taylor, and E. F. Stuber. 2019. Hunters and their perceptions of public access: a view from afield. Journal of Fish and Wildlife Management 10:589–601.

Funder, D. C., and D. J. Ozer. 2019. Evaluating effect size in psychological research: sense and nonsense. Advances in Methods and Practices in Psychological Science 2:156–168.

Graham, K. A., N. B. Price, V. K. Jones, J. J. Fontaine, and C. J. Chizinski. 2021. Marketing and ecological models to predict permit purchasing behavior of sportspersons. Pages 87–97 in K. L. Pope and L. A. Powell, editors. Harvest of Fish and Wildlife: New Paradigms for Sustainable Management. CRC Press, Boca Raton, Florida, USA.

Gruntorad, M. P., and C. J. Chizinski. 2020. Constraints to hunting and harvesting elk in a landscape dominated by private land. Wildlife Biology 2020(1).

Gruntorad, M. P., and C. J. Chizinski. 2021. Hunter and angler behavior in harvest management. Pages 55–68 in K. L. Pope and L. A. Powell, editors. Harvest of Fish and Wildlife: New Paradigms for Sustainable Management. CRC Press, Boca Raton, Florida, USA.

Havitz, M. E., and F. Dimanche. 1999. Leisure involvement revisited: Drive properties and paradoxes. Journal of Leisure Research 31:122–149.

Hayton, J. C., D. G. Allen, and V. Scarpello. 2004. Factor retention decisions in exploratory factor analysis: a tutorial on parallel analysis. Organizational Research Methods 7:191–205.

Hinrichs, M. P., M. P. Vrtiska, M. A. Pegg, and C. J. Chizinski. 2021. Motivations to participate in hunting and angling: a comparison among preferred activities and state of residence. Human Dimensions of Wildlife 26:576–595.

Hubbard, J., and R. C. Mannell. 2001. Testing competing models of the leisure constraint negotiation process in a corporate employee recreation setting. Leisure Sciences 23:145–163.

Jackson, E. L. 1991. Leisure constraints/constrained leisure: special issue introduction. Journal of Leisure Research 23:279–285.

Jackson, E. L. 2000. Will research on leisure constraints still be relevant in the twenty-first century? Journal of Leisure Research 32:62–68.

Jackson, E. L., D. W. Crawford, and G. Godbey. 1993. Negotiation of leisure constraints. Leisure Sciences 15:1–11.

Jun, J., and G. T. Kyle. 2011. Understanding the role of identity in the constraint negotiation process. Leisure Sciences 33:309–331.

Kay, T., and G. Jackson. 1991. Leisure despite constraint: the impact of leisure constraints on leisure participation. Journal of Leisure Research 23:301–313.

Kyle, G., A. Graefe, R. Manning, and J. Bacon. 2003. An examination of the relationship between leisure activity involvement and place attachment among hikers along the Appalachian Trail. Journal of Leisure Research 35:249–273.

Larson, L. R., R. C. Stedman, D. J. Decker, W. F. Siemer, and M. S. Baumer. 2014. Exploring the social habitat for hunting: toward a comprehensive framework for understanding hunter recruitment and retention. Human Dimensions of Wildlife 19:105–122.

Lee, S., and D. Scott. 2009. The process of celebrity fan's constraint negotiation. Journal of Leisure Research 41:137–156.

Lenth, R. 2020. emmeans: estimated marginal means, aka least-squares means. manual. <https://CRAN.R-project.org/package=emmeans>. Accessed 28 Jun 2021.

Manfreda, K. L., M. Bosnjak, J. Berzelak, I. Haas, and V. Vehovar. 2008. Web surveys versus other survey modes: a meta-analysis comparing response rates. International Journal of Market Research 50:79–104.

Metcalf, E. C., A. R. Graefe, N. E. Trauntvein, and R. C. Burns. 2015. Understanding hunting constraints and negotiation strategies: a typology of female hunters. Human Dimensions of Wildlife 20:30–46.

Montgomery, R., and M. G. Blalock. 2010. The impact of access, cost, demographics, and individual constraints, on hunting frequency and future participation. Academy of Marketing Studies Journal 14:115.

Mueller, J. T., A. C. Landon, and A. R. Graefe. 2019. Modeling the role of social identity in constraint negotiation for ultra-endurance gravel cycling. Journal of Leisure Research 50:81–106.

National Flyway Council and Wildlife Management Institute. 2006. National Duck Hunter Survey 2005 National Report. Minnewaska, Indiana, USA. <https://www.fws.gov/migratorybirds/pdf/surveys-and-data/ HarvestSurveys/ducksurvey_national.pdf>. Accessed 1 Feb 2020.

Nunnally, J. C., and I. Bernstein. 1994. Psychometric theory. Volume 3. McGraw-Hill, New York, New York, USA.

Peterson, M. N., H. P. Hansen, M. J. Peterson, and T. R. Peterson. 2011. How hunting strengthens social awareness of coupled human-natural systems. Wildlife Biology in Practice 6:127–143.

R Core Team. 2018. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>. Accessed 28 Jun 2021.

Responsive Management and National Shooting Sports Foundation. 2017. Hunting, Fishing, Sport Shooting, and Archery Recruitment, Retention, and Reactivation: A Practitioner's Guide. Harrisburg, Virginia, USA.

Revelle, W. 2019. psych: Procedures for psychological, psychometric, and personality research. Evanston, Illinois. <https://CRAN.R-project.org/package=psych>. Accessed (date).

Schroeder, S. A., D. C. Fulton, and J. S. Lawrence. 2006. Managing for preferred hunting experiences: a typology of Minnesota waterfowl hunters. Wildlife Society Bulletin 34:380–387.

Schroeder, S. A., D. C. Fulton, J. S. Lawrence, and S. D. Cordts. 2012. An application and extension of the constraints-effects-mitigation model to Minnesota waterfowl hunting. Human Dimensions of Wildlife 17:174–192.

Schroeder, S. A., D. C. Fulton, J. S. Lawrence, and S. D. Cordts. 2013. Identity and specialization as a waterfowl hunter. Leisure Sciences 35:218–234.

Shaw, S. M., A. Bonen, and J. F. McCabe. 1991. Do more constraints mean less leisure? Examining the relationship between constraints and participation. Journal of Leisure Research 23:286–300.

Sullivan, G. M., and R. Feinn. 2012. Using effect size—or why the P value is not enough. Journal of Graduate Medical Education 4:279–282.

The American Association for Public Opinion Research. 2016. Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys. 9th edition. AAPOR, Lenexa, Kansas, USA.

Trizano-Hermosilla, I., and J. M. Alvarado. 2016. Best alternatives to Cronbach's alpha reliability in realistic conditions: congeneric and asymmetrical measurements. Frontiers in Psychology 7:769.

U.S. Fish and Wildlife Service, Canadian Wildlife Service, and Secretaria de Medio Amiente y Recursos Naturales. 2012. North American Waterfowl Management Plan 2012: People Conserving Waterfowl and Wetlands. Washington, D.C., USA.

Vrtiska, M. P., J. H. Gammonley, L. W. Naylor, and A. H. Raedeke. 2013. Economic and conservation ramifications from the decline of waterfowl hunters. Wildlife Society Bulletin 37:380–388.

Vrtiska, M. P., A. N. Hardin, and L. M. Gigliotti. 2010. Waterfowl hunter crowding and dissatisfaction: a tale of two surveys. Human Dimensions of Wildlife 15:65–66.

White, D. D. 2008. A structural model of leisure constraints negotiation in outdoor recreation. Leisure Sciences 30:342–359.

Wright, B. A., E. B. D. Rodgers, and K. F. Backman. 2001. Assessing the temporal stability of hunting participation and the structure and intensity of constraints: a panel study. Journal of Leisure Research 33:450–469.

Wszola, L. S., L. F. Gruber, E. F. Stuber, L. N. Messinger, C. J. Chizinski, and J. J. Fontaine. 2020a. Use and expenditures on public access hunting lands. Journal of Outdoor Recreation and Tourism 29:100256.

Wszola, L. S., A. E. Madsen, E. F. Stuber, C. J. Chizinski, J. J. Lusk, J. S. Taylor, K. L. Pope, and J. J. Fontaine. 2020b. Public access for pheasant hunters: Understanding an emerging need. Journal of Wildlife Management 84:45–55.

Supporting Information

21 November 2021

Hinrichs, M. P., M. P. Gruntorad, J. Nawrocki, M. P. Vrtiska, M. A. Pegg, and C. J. Chizinski. 2021. Constraints to waterfowl hunting by hunters and anglers in the central United States. Wildlife Society Bulletin.

Table S1. Multiple comparisons of the estimated marginal means by states from the ANOVA assessing the strength of the constraints among waterfowl and non-waterfowl hunters during 2018 in the states of Kansas, Michigan, Missouri, Montana, Nebraska, Oklahoma, South Dakota, and Wyoming, USA. Abbreviations are used for the states (KS = Kansas, MI = Michigan, MO = Missouri, MT = Montana, NE = Nebraska, OK = Oklahoma, SD = South Dakota, and WY = Wyoming). P values were adjusted Tukey p-values. Effect size of Cohen's d were interpreted based on guidelines by Cohen (2013).

State contrast	Estimate	Sd. Error	df	T statistic	Adjusted p value	Cohen's *d*	Effect size
Regulations							
KS - MI	0.057	0.015	80948	3.707	0.005	0.026	very small
KS - MO	0.152	0.015	80948	10.413	< 0.001	0.073	very small
KS - MT	0.203	0.015	80948	13.944	< 0.001	0.098	very small
KS - NE	0.038	0.014	80948	2.658	0.136	0.019	very small
KS - OK	0.107	0.016	80948	6.631	< 0.001	0.047	very small
KS - SD	0.136	0.015	80948	9.338	< 0.001	0.066	very small
KS - WY	0.056	0.016	80948	3.561	0.009	0.025	very small
MI - MO	0.095	0.016	80948	5.873	< 0.001	0.041	very small
MI - MT	0.146	0.016	80948	9.044	< 0.001	0.064	very small
MI - NE	–0.019	0.016	80948	–1.180	0.938	–0.008	very small
MI - OK	0.050	0.018	80948	2.872	0.078	0.020	very small
MI - SD	0.079	0.016	80948	4.914	< 0.001	0.035	very small
MI - WY	–0.001	0.017	80948	–0.039	1.000	< 0.001	very small
MO - MT	0.051	0.015	80948	3.313	0.021	0.023	very small
MO - NE	–0.114	0.015	80948	–7.449	< 0.001	–0.052	very small
MO - OK	–0.045	0.017	80948	–2.641	0.141	–0.019	very small
MO - SD	–0.015	0.016	80948	–0.992	0.976	–0.007	very small
MO - WY	–0.096	0.017	80948	–5.734	< 0.001	–0.040	very small
MT - NE	–0.165	0.015	80948	–10.806	< 0.001	–0.076	very small
MT - OK	–0.096	0.017	80948	–5.666	< 0.001	–0.040	very small
MT - SD	–0.067	0.016	80948	–4.296	< 0.001	–0.030	very small
MT - WY	–0.147	0.017	80948	–8.812	< 0.001	–0.062	very small
NE - OK	0.069	0.017	80948	4.132	0.001	0.029	very small
NE - SD	0.098	0.015	80948	6.439	< 0.001	0.045	very small
NE - WY	0.018	0.016	80948	1.106	0.956	0.008	very small

OK - SD	0.029	0.017	80948	1.728	0.669	0.012	very small
OK - WY	–0.051	0.018	80948	–2.827	0.088	–0.020	very small
SD - WY	–0.080	0.017	80948	–4.809	< 0.001	–0.034	very small
Waterfowl identification							
KS - MI	–0.193	0.021	44148	–9.245	< 0.001	–0.088	very small
KS - MO	–0.076	0.020	44148	–3.819	0.003	–0.036	very small
KS - MT	0.134	0.020	44148	6.791	< 0.001	0.065	very small
KS - NE	0.018	0.019	44148	0.929	0.983	0.009	very small
KS - OK	–0.069	0.022	44148	–3.123	0.038	–0.030	very small
KS - SD	0.082	0.020	44148	4.117	0.001	0.039	very small
KS - WY	0.061	0.021	44148	2.831	0.088	0.027	very small
MI - MO	0.117	0.022	44148	5.331	< 0.001	0.051	very small
MI - MT	0.327	0.022	44148	14.892	< 0.001	0.142	very small
MI - NE	0.211	0.022	44148	9.715	< 0.001	0.092	very small
MI - OK	0.124	0.024	44148	5.216	< 0.001	0.050	very small
MI - SD	0.274	0.022	44148	12.476	< 0.001	0.119	very small
MI - WY	0.253	0.023	44148	10.774	< 0.001	0.103	very small
MO - MT	0.210	0.021	44148	9.987	< 0.001	0.095	very small
MO - NE	0.094	0.021	44148	4.516	< 0.001	0.043	very small
MO - OK	0.007	0.023	44148	0.308	1.000	0.003	very small
MO - SD	0.157	0.021	44148	7.465	< 0.001	0.071	very small
MO - WY	0.136	0.023	44148	6.019	< 0.001	0.057	very small
MT - NE	–0.116	0.021	44148	–5.605	< 0.001	–0.053	very small
MT - OK	–0.203	0.023	44148	–8.824	< 0.001	–0.084	very small
MT - SD	–0.053	0.021	44148	–2.498	0.196	–0.024	very small
MT - WY	–0.074	0.023	44148	–3.254	0.025	–0.031	very small
NE - OK	–0.087	0.023	44148	–3.811	0.003	–0.036	very small
NE - SD	0.064	0.021	44148	3.066	0.045	0.029	very small
NE - WY	0.043	0.022	44148	1.909	0.544	0.018	very small
OK - SD	0.150	0.023	44148	6.534	< 0.001	0.062	very small
OK - WY	0.129	0.024	44148	5.276	< 0.001	0.050	very small
SD - WY	–0.021	0.023	44148	–0.927	0.983	–0.009	very small
Costs							
KS - MI	0.114	0.023	44148	4.971	< 0.001	0.047	very small
KS - MO	–0.005	0.022	44148	–0.225	1.000	–0.002	very small
KS - MT	0.151	0.022	44148	6.898	< 0.001	0.066	very small
KS - NE	–0.128	0.021	44148	–5.977	< 0.001	–0.057	very small
KS - OK	0.025	0.024	44148	1.025	0.971	0.010	very small
KS - SD	0.061	0.022	44148	2.765	0.104	0.026	very small
KS - WY	0.081	0.024	44148	3.421	0.014	0.033	very small

MI - MO	–0.119	0.024	44148	–4.921	< 0.001	–0.047	very small
MI - MT	0.036	0.024	44148	1.497	0.809	0.014	very small
MI - NE	–0.243	0.024	44148	–10.130	< 0.001	–0.096	very small
MI - OK	–0.090	0.026	44148	–3.409	0.015	–0.032	very small
MI - SD	–0.054	0.024	44148	–2.216	0.342	–0.021	very small
MI - WY	–0.033	0.026	44148	–1.287	0.904	–0.012	very small
MO - MT	0.156	0.023	44148	6.703	< 0.001	0.064	very small
MO - NE	–0.123	0.023	44148	–5.384	< 0.001	–0.051	very small
MO - OK	0.030	0.025	44148	1.174	0.939	0.011	very small
MO - SD	0.065	0.023	44148	2.814	0.091	0.027	very small
MO - WY	0.086	0.025	44148	3.435	0.014	0.033	very small
MT - NE	–0.279	0.023	44148	–12.174	< 0.001	–0.116	very small
MT - OK	–0.126	0.025	44148	–4.956	< 0.001	–0.047	very small
MT - SD	–0.090	0.023	44148	–3.871	0.003	–0.037	very small
MT - WY	–0.070	0.025	44148	–2.788	0.098	–0.027	very small
NE - OK	0.153	0.025	44148	6.099	< 0.001	0.058	very small
NE - SD	0.189	0.023	44148	8.238	< 0.001	0.078	very small
NE - WY	0.209	0.025	44148	8.488	< 0.001	0.081	very small
OK - SD	0.036	0.025	44148	1.407	0.854	0.013	very small
OK - WY	0.056	0.027	44148	2.076	0.431	0.020	very small
SD - WY	0.020	0.025	44148	0.815	0.992	0.008	very small
Waterfowl hunting skills							
KS - MI	–0.066	0.025	29428	–2.635	0.143	–0.031	very small
KS - MO	–0.061	0.024	29428	–2.562	0.170	–0.030	very small
KS - MT	0.096	0.024	29428	4.014	0.002	0.047	very small
KS - NE	–0.059	0.024	29428	–2.517	0.188	–0.029	very small
KS - OK	–0.086	0.027	29428	–3.248	0.026	–0.038	very small
KS - SD	0.051	0.024	29428	2.110	0.408	0.025	very small
KS - WY	0.030	0.026	29428	1.158	0.944	0.013	very small
MI - MO	0.005	0.027	29428	0.190	1.000	0.002	very small
MI - MT	0.163	0.027	29428	6.117	< 0.001	0.071	very small
MI - NE	0.007	0.026	29428	0.276	1.000	0.003	very small
MI - OK	–0.020	0.029	29428	–0.689	0.997	–0.008	very small
MI - SD	0.117	0.027	29428	4.402	< 0.001	0.051	very small
MI - WY	0.096	0.028	29428	3.391	0.016	0.040	very small
MO - MT	0.157	0.025	29428	6.190	< 0.001	0.072	very small
MO - NE	0.002	0.025	29428	0.088	1.000	0.001	very small
MO - OK	–0.025	0.028	29428	–0.896	0.987	–0.010	very small
MO - SD	0.112	0.025	29428	4.395	< 0.001	0.051	very small
MO - WY	0.091	0.027	29428	3.336	0.019	0.039	very small

MT - NE	–0.155	0.025	29428	–6.185	< 0.001	–0.072	very small
MT - OK	–0.182	0.028	29428	–6.554	< 0.001	–0.076	very small
MT - SD	–0.045	0.026	29428	–1.780	0.634	–0.021	very small
MT - WY	–0.066	0.027	29428	–2.411	0.236	–0.028	very small
NE - OK	–0.027	0.027	29428	–0.985	0.977	–0.011	very small
NE - SD	0.110	0.025	29428	4.374	< 0.001	0.051	very small
NE - WY	0.089	0.027	29428	3.303	0.021	0.039	very small
OK - SD	0.137	0.028	29428	4.921	< 0.001	0.057	very small
OK - WY	0.116	0.030	29428	3.924	0.002	0.046	very small
SD - WY	–0.021	0.027	29428	–0.753	0.995	–0.009	very small
Land access							
KS - MI	–0.027	0.029	36788	–0.933	0.983	–0.010	very small
KS - MO	–0.214	0.027	36788	–7.828	< 0.001	–0.082	very small
KS - MT	–0.032	0.027	36788	–1.163	0.942	–0.012	very small
KS - NE	–0.216	0.027	36788	–8.059	< 0.001	–0.084	very small
KS - OK	–0.243	0.030	36788	–8.028	< 0.001	–0.084	very small
KS - SD	0.045	0.027	36788	1.645	0.723	0.017	very small
KS - WY	–0.158	0.030	36788	–5.353	< 0.001	–0.056	very small
MI - MO	–0.187	0.030	36788	–6.174	< 0.001	–0.064	very small
MI - MT	–0.005	0.030	36788	–0.162	1.000	–0.002	very small
MI - NE	–0.189	0.030	36788	–6.324	< 0.001	–0.066	very small
MI - OK	–0.216	0.033	36788	–6.590	< 0.001	–0.069	very small
MI - SD	0.072	0.030	36788	2.369	0.257	0.025	very small
MI - WY	–0.131	0.032	36788	–4.053	0.001	–0.042	very small
MO - MT	0.182	0.029	36788	6.279	< 0.001	0.065	very small
MO - NE	–0.002	0.029	36788	–0.077	1.000	–0.001	very small
MO - OK	–0.029	0.032	36788	–0.924	0.984	–0.010	very small
MO - SD	0.259	0.029	36788	8.904	< 0.001	0.093	very small
MO - WY	0.055	0.031	36788	1.778	0.635	0.019	very small
MT - NE	–0.184	0.029	36788	–6.439	< 0.001	–0.067	very small
MT - OK	–0.211	0.032	36788	–6.664	< 0.001	–0.069	very small
MT - SD	0.077	0.029	36788	2.639	0.142	0.028	very small
MT - WY	–0.126	0.031	36788	–4.051	0.001	–0.042	very small
NE - OK	–0.027	0.031	36788	–0.863	0.989	–0.009	very small
NE - SD	0.261	0.029	36788	9.118	< 0.001	0.095	very small
NE - WY	0.058	0.031	36788	1.876	0.568	0.020	very small
OK - SD	0.288	0.032	36788	9.083	< 0.001	0.095	very small
OK - WY	0.085	0.034	36788	2.510	0.191	0.026	very small
SD - WY	–0.203	0.031	36788	–6.504	< 0.001	–0.068	very small

Other hunters							
KS - MI	–0.049	0.035	22068	–1.422	0.848	–0.019	very small
KS - MO	–0.161	0.033	22068	–4.900	< 0.001	–0.066	very small
KS - MT	0.180	0.033	22068	5.485	< 0.001	0.074	very small
KS - NE	–0.080	0.032	22068	–2.473	0.207	–0.033	very small
KS - OK	–0.080	0.036	22068	–2.203	0.350	–0.030	very small
KS - SD	0.103	0.033	22068	3.130	0.037	0.042	very small
KS - WY	0.091	0.036	22068	2.550	0.175	0.034	very small
MI - MO	–0.112	0.036	22068	–3.069	0.045	–0.041	very small
MI - MT	0.230	0.036	22068	6.291	< 0.001	0.085	very small
MI - NE	–0.031	0.036	22068	–0.849	0.990	–0.011	very small
MI - OK	–0.031	0.040	22068	–0.788	0.994	–0.011	very small
MI - SD	0.152	0.037	22068	4.172	0.001	0.056	very small
MI - WY	0.140	0.039	22068	3.585	0.008	0.048	very small
MO - MT	0.342	0.035	22068	9.776	< 0.001	0.132	very small
MO - NE	0.081	0.034	22068	2.360	0.261	0.032	very small
MO - OK	0.081	0.038	22068	2.119	0.402	0.029	very small
MO - SD	0.264	0.035	22068	7.551	< 0.001	0.102	very small
MO - WY	0.252	0.038	22068	6.698	< 0.001	0.090	very small
MT - NE	–0.260	0.034	22068	–7.546	< 0.001	–0.102	very small
MT - OK	–0.261	0.038	22068	–6.822	< 0.001	–0.092	very small
MT - SD	–0.077	0.035	22068	–2.201	0.351	–0.030	very small
MT - WY	–0.089	0.038	22068	–2.378	0.252	–0.032	very small
NE - OK	–0.001	0.038	22068	–0.014	1.000	< 0.001	very small
NE - SD	0.183	0.034	22068	5.307	< 0.001	0.071	very small
NE - WY	0.171	0.037	22068	4.602	< 0.001	0.062	very small
OK - SD	0.184	0.038	22068	4.804	< 0.001	0.065	very small
OK - WY	0.171	0.041	22068	4.206	0.001	0.057	very small
SD - WY	–0.012	0.038	22068	–0.328	1.000	–0.004	very small
Travel							
KS - MI	0.102	0.040	14708	2.556	0.172	0.042	very small
KS - MO	–0.323	0.038	14708	–8.553	< 0.001	–0.141	very small
KS - MT	0.160	0.038	14708	4.231	0.001	0.070	very small
KS - NE	–0.116	0.037	14708	–3.123	0.038	–0.051	very small
KS - OK	–0.058	0.042	14708	–1.387	0.864	–0.023	very small
KS - SD	0.058	0.038	14708	1.529	0.792	0.025	very small
KS - WY	0.041	0.041	14708	0.993	0.976	0.016	very small
MI - MO	–0.425	0.042	14708	–10.140	< 0.001	–0.167	very small
MI - MT	0.058	0.042	14708	1.386	0.864	0.023	very small
MI - NE	–0.217	0.041	14708	–5.254	< 0.001	–0.087	very small

MI - OK	–0.160	0.045	14708	–3.519	0.010	–0.058	very small
MI - SD	–0.044	0.042	14708	–1.043	0.968	–0.017	very small
MI - WY	–0.061	0.045	14708	–1.360	0.875	–0.022	very small
MO - MT	0.483	0.040	14708	12.036	< 0.001	0.198	very small
MO - NE	0.207	0.040	14708	5.239	< 0.001	0.086	very small
MO - OK	0.265	0.044	14708	6.051	< 0.001	0.100	very small
MO - SD	0.381	0.040	14708	9.476	< 0.001	0.156	very small
MO - WY	0.364	0.043	14708	8.419	< 0.001	0.139	very small
MT - NE	–0.275	0.040	14708	–6.958	< 0.001	–0.115	very small
MT - OK	–0.218	0.044	14708	–4.963	< 0.001	–0.082	very small
MT - SD	–0.102	0.040	14708	–2.531	0.182	–0.042	very small
MT - WY	–0.119	0.043	14708	–2.756	0.106	–0.045	very small
NE - OK	0.058	0.043	14708	1.331	0.887	0.022	very small
NE - SD	0.174	0.040	14708	4.385	< 0.001	0.072	very small
NE - WY	0.156	0.043	14708	3.672	0.006	0.061	very small
OK - SD	0.116	0.044	14708	2.643	0.141	0.044	very small
OK - WY	0.099	0.047	14708	2.112	0.407	0.035	very small
SD - WY	–0.017	0.043	14708	–0.399	1.000	–0.007	very small
No other hunters							
KS - MI	–0.259	0.042	14708	–6.208	< 0.001	–0.102	very small
KS - MO	–0.068	0.040	14708	–1.719	0.675	–0.028	very small
KS - MT	–0.017	0.040	14708	–0.418	1.000	–0.007	very small
KS - NE	–0.063	0.039	14708	–1.630	0.732	–0.027	very small
KS - OK	–0.064	0.044	14708	–1.452	0.832	–0.024	very small
KS - SD	0.006	0.040	14708	0.145	1.000	0.002	very small
KS - WY	0.058	0.043	14708	1.361	0.875	0.022	very small
MI - MO	0.191	0.044	14708	4.342	< 0.001	0.072	very small
MI - MT	0.242	0.044	14708	5.515	< 0.001	0.091	very small
MI - NE	0.196	0.043	14708	4.504	< 0.001	0.074	very small
MI - OK	0.195	0.048	14708	4.098	0.001	0.068	very small
MI - SD	0.265	0.044	14708	6.014	< 0.001	0.099	very small
MI - WY	0.317	0.047	14708	6.742	< 0.001	0.111	very small
MO - MT	0.052	0.042	14708	1.226	0.924	0.020	very small
MO - NE	0.005	0.042	14708	0.114	1.000	0.002	very small
MO - OK	0.004	0.046	14708	0.094	1.000	0.002	very small
MO - SD	0.074	0.042	14708	1.752	0.653	0.029	very small
MO - WY	0.127	0.045	14708	2.791	0.097	0.046	very small
MT - NE	–0.047	0.042	14708	–1.128	0.951	–0.019	very small
MT - OK	–0.047	0.046	14708	–1.027	0.970	–0.017	very small
MT - SD	0.022	0.042	14708	0.529	1.000	0.009	very small

MT - WY	0.075	0.045	14708	1.653	0.718	0.027	very small
NE - OK	< 0.001	0.046	14708	–0.009	1.000	< 0.001	very small
NE - SD	0.069	0.042	14708	1.665	0.710	0.027	very small
NE - WY	0.122	0.045	14708	2.726	0.115	0.045	very small
OK - SD	0.070	0.046	14708	1.512	0.801	0.025	very small
OK - WY	0.122	0.049	14708	2.493	0.198	0.041	very small
SD - WY	0.053	0.045	14708	1.160	0.943	0.019	very small
Waterfowl populations							
KS - MI	–0.160	0.032	22068	–4.994	< 0.001	–0.067	very small
KS - MO	–0.063	0.031	22068	–2.055	0.444	–0.028	very small
KS - MT	0.167	0.030	22068	5.485	< 0.001	0.074	very small
KS - NE	–0.030	0.030	22068	–1.006	0.974	–0.014	very small
KS - OK	–0.090	0.034	22068	–2.669	0.132	–0.036	very small
KS - SD	0.103	0.031	22068	3.380	0.017	0.046	very small
KS - WY	0.024	0.033	22068	0.731	0.996	0.010	very small
MI - MO	0.098	0.034	22068	2.886	0.075	0.039	very small
MI - MT	0.328	0.034	22068	9.681	< 0.001	0.130	very small
MI - NE	0.130	0.033	22068	3.896	0.002	0.052	very small
MI - OK	0.070	0.037	22068	1.912	0.543	0.026	very small
MI - SD	0.264	0.034	22068	7.782	< 0.001	0.105	very small
MI - WY	0.184	0.036	22068	5.092	< 0.001	0.069	very small
MO - MT	0.230	0.032	22068	7.097	< 0.001	0.096	very small
MO - NE	0.033	0.032	22068	1.019	0.972	0.014	very small
MO - OK	–0.028	0.035	22068	–0.779	0.994	–0.010	very small
MO - SD	0.166	0.032	22068	5.114	< 0.001	0.069	very small
MO - WY	0.087	0.035	22068	2.489	0.200	0.034	very small
MT - NE	–0.197	0.032	22068	–6.173	< 0.001	–0.083	very small
MT - OK	–0.257	0.035	22068	–7.267	< 0.001	–0.098	very small
MT - SD	–0.064	0.032	22068	–1.966	0.505	–0.026	very small
MT - WY	–0.143	0.035	22068	–4.101	0.001	–0.055	very small
NE - OK	–0.060	0.035	22068	–1.717	0.676	–0.023	very small
NE - SD	0.133	0.032	22068	4.173	0.001	0.056	very small
NE - WY	0.054	0.034	22068	1.578	0.764	0.021	very small
OK - SD	0.194	0.035	22068	5.463	< 0.001	0.074	very small
OK - WY	0.114	0.038	22068	3.031	0.050	0.041	very small
SD - WY	–0.079	0.035	22068	–2.268	0.311	–0.031	very small
Views of others							
KS - MI	–0.075	0.023	14708	–3.236	0.027	–0.053	very small
KS - MO	–0.006	0.022	14708	–0.249	1.000	–0.004	very small
KS - MT	0.004	0.022	14708	0.162	1.000	0.003	very small

KS - NE	–0.016	0.022	14708	–0.745	0.996	–0.012	very small
KS - OK	0.013	0.024	14708	0.526	1.000	0.009	very small
KS - SD	0.023	0.022	14708	1.057	0.965	0.017	very small
KS - WY	0.028	0.024	14708	1.182	0.937	0.019	very small
MI - MO	0.070	0.024	14708	2.847	0.084	0.047	very small
MI - MT	0.079	0.024	14708	3.217	0.028	0.053	very small
MI - NE	0.059	0.024	14708	2.441	0.221	0.040	very small
MI - OK	0.088	0.027	14708	3.320	0.020	0.055	very small
MI - SD	0.099	0.025	14708	4.021	0.002	0.066	very small
MI - WY	0.103	0.026	14708	3.946	0.002	0.065	very small
MO - MT	0.009	0.023	14708	0.387	1.000	0.006	very small
MO - NE	–0.011	0.023	14708	–0.460	1.000	–0.008	very small
MO - OK	0.018	0.026	14708	0.718	0.996	0.012	very small
MO - SD	0.029	0.023	14708	1.230	0.923	0.020	very small
MO - WY	0.034	0.025	14708	1.337	0.885	0.022	very small
MT - NE	–0.020	0.023	14708	–0.853	0.990	–0.014	very small
MT - OK	0.009	0.026	14708	0.363	1.000	0.006	very small
MT - SD	0.020	0.024	14708	0.843	0.991	0.014	very small
MT - WY	0.025	0.025	14708	0.978	0.978	0.016	very small
NE - OK	0.029	0.025	14708	1.146	0.947	0.019	very small
NE - SD	0.040	0.023	14708	1.709	0.682	0.028	very small
NE - WY	0.044	0.025	14708	1.784	0.631	0.029	very small
OK - SD	0.011	0.026	14708	0.410	1.000	0.007	very small
OK - WY	0.015	0.027	14708	0.563	0.999	0.009	very small
SD - WY	0.005	0.025	14708	0.193	1.000	0.003	very small

Table S2. Multiple comparisons of the estimated marginal means from the ANOVA assessing the strength of the constraints by activity type among waterfowl and non-waterfowl hunters 2018 in the states of Kansas, Michigan, Missouri, Montana, Nebraska, Oklahoma, South Dakota, and Wyoming, USA. Activity contrasts are designated using abbreviations (dissWF = Dissociated waterfowl hunter, nonWFfish = Angler, nonWFhunter = Non-Waterfowl hunter, freqWF = Frequent waterfowl hunter, and sporadicWF = Sporadic waterfowl hunter). P values were adjusted Tukey p-values. Effect size of Cohen's d were interpreted based on guidelines by Cohen (2013)

Activity contrast	Estimate	Sd. Error	df	T statistic	Adjusted p value	Cohen's *d*	Effect size
Regulations							
dissWF - nonWFfish	0.100	0.022	80948	4.514	< 0.001	0.032	very small
dissWF - nonWFhunter	–0.030	0.014	80948	–2.219	0.172	–0.016	very small
freqWF - dissWF	–0.356	0.013	80948	–26.536	< 0.001	–0.187	very small
freqWF - nonWFfish	–0.257	0.020	80948	–12.933	< 0.001	–0.091	very small
freqWF - nonWFhunter	–0.387	0.010	80948	–39.238	< 0.001	–0.276	small
freqWF - sporadicWF	–0.257	0.011	80948	–22.588	< 0.001	–0.159	very small
nonWFhunter - nonWFfish	0.130	0.020	80948	6.468	< 0.001	0.045	very small
sporadicWF - dissWF	–0.100	0.015	80948	–6.729	< 0.001	–0.047	very small
sporadicWF - nonWFfish	0.000	0.021	80948	–0.006	1.000	0.000	very small
sporadicWF - nonWFhunter	–0.130	0.012	80948	–11.075	< 0.001	–0.078	very small
Waterfowl identification							
dissWF - nonWFfish	–0.254	0.030	44148	–8.483	< 0.001	–0.081	very small
dissWF - nonWFhunter	–0.357	0.019	44148	–19.234	< 0.001	–0.183	very small
freqWF - dissWF	–0.501	0.018	44148	–27.485	< 0.001	–0.262	small
freqWF - nonWFfish	–0.755	0.027	44148	–28.007	< 0.001	–0.267	small
freqWF - nonWFhunter	–0.858	0.013	44148	–64.101	< 0.001	–0.610	medium
freqWF - sporadicWF	–0.411	0.015	44148	–26.608	< 0.001	–0.253	small
nonWFhunter - nonWFfish	0.103	0.027	44148	3.761	0.002	0.036	very small
sporadicWF - dissWF	–0.091	0.020	44148	–4.505	< 0.001	–0.043	very small
sporadicWF - nonWFfish	–0.345	0.028	44148	–12.154	< 0.001	–0.116	very small
sporadicWF - nonWFhunter	–0.447	0.016	44148	–28.058	< 0.001	–0.267	small
Costs							
dissWF - nonWFfish	0.071	0.033	44148	2.152	0.198	0.020	very small
dissWF - nonWFhunter	–0.060	0.020	44148	–2.925	0.028	–0.028	very small
freqWF - dissWF	–0.280	0.020	44148	–13.883	< 0.001	–0.132	very small
freqWF - nonWFfish	–0.208	0.030	44148	–6.999	< 0.001	–0.067	very small
freqWF - nonWFhunter	–0.339	0.015	44148	–22.971	< 0.001	–0.219	small

freqWF - sporadicWF	–0.243	0.017	44148	–14.285	< 0.001	–0.136	very small
nonWFhunter - nonWFfish	0.131	0.030	44148	4.353	< 0.001	0.041	very small
sporadicWF - dissWF	–0.036	0.022	44148	–1.627	0.480	–0.015	very small
sporadicWF - nonWFfish	0.035	0.031	44148	1.119	0.797	0.011	very small
sporadicWF - nonWFhunter	–0.096	0.018	44148	–5.456	< 0.001	–0.052	very small
Waterfowl hunting skills							
dissWF - nonWFfish	–0.594	0.036	29428	–16.392	< 0.001	–0.191	very small
dissWF - nonWFhunter	–0.474	0.022	29428	–21.128	< 0.001	–0.246	small
freqWF - dissWF	–0.401	0.022	29428	–18.161	< 0.001	–0.212	small
freqWF - nonWFfish	–0.995	0.033	29428	–30.484	< 0.001	–0.355	small
freqWF - nonWFhunter	–0.875	0.016	29428	–54.018	< 0.001	–0.630	medium
freqWF - sporadicWF	–0.414	0.019	29428	–22.141	< 0.001	–0.258	small
nonWFhunter - nonWFfish	–0.120	0.033	29428	–3.639	0.003	–0.042	very small
sporadicWF - dissWF	0.013	0.024	29428	0.521	0.985	0.006	very small
sporadicWF - nonWFfish	–0.582	0.034	29428	–16.942	< 0.001	–0.198	very small
sporadicWF - nonWFhunter	–0.461	0.019	29428	–23.918	< 0.001	–0.279	small
Land access/Permissions							
dissWF - nonWFfish	0.555	0.041	36788	13.445	< 0.001	0.140	very small
dissWF - nonWFhunter	0.175	0.026	36788	6.863	< 0.001	0.072	very small
freqWF - dissWF	–0.090	0.025	36788	–3.596	0.003	–0.037	very small
freqWF - nonWFfish	0.465	0.037	36788	12.498	< 0.001	0.130	very small
freqWF - nonWFhunter	0.085	0.018	36788	4.606	< 0.001	0.048	very small
freqWF - sporadicWF	–0.154	0.021	36788	–7.231	< 0.001	–0.075	very small
nonWFhunter - nonWFfish	0.380	0.038	36788	10.103	< 0.001	0.105	very small
sporadicWF - dissWF	0.063	0.028	36788	2.288	0.149	0.024	very small
sporadicWF - nonWFfish	0.619	0.039	36788	15.822	< 0.001	0.165	very small
sporadicWF - nonWFhunter	0.239	0.022	36788	10.870	< 0.001	0.113	very small
Other hunters							
dissWF - nonWFfish	0.584	0.050	22068	11.724	< 0.001	0.158	very small
dissWF - nonWFhunter	0.255	0.031	22068	8.256	< 0.001	0.111	very small
freqWF - dissWF	0.169	0.030	22068	5.564	< 0.001	0.075	very small
freqWF - nonWFfish	0.753	0.045	22068	16.782	< 0.001	0.226	small
freqWF - nonWFhunter	0.423	0.022	22068	19.019	< 0.001	0.256	small
freqWF - sporadicWF	0.119	0.026	22068	4.627	< 0.001	0.062	very small

nonWFhunter - nonWFfish	0.329	0.045	22068	7.265	< 0.001	0.098	very small
sporadicWF - dissWF	0.050	0.033	22068	1.494	0.566	0.020	very small
sporadicWF - nonWFfish	0.634	0.047	22068	13.442	< 0.001	0.181	very small
sporadicWF - nonWFhunter	0.304	0.027	22068	11.489	< 0.001	0.155	very small
Travel							
dissWF - nonWFfish	0.696	0.057	14708	12.180	< 0.001	0.201	small
dissWF - nonWFhunter	0.345	0.035	14708	9.756	< 0.001	0.161	very small
freqWF - dissWF	–0.187	0.035	14708	–5.373	< 0.001	–0.089	very small
freqWF - nonWFfish	0.509	0.051	14708	9.892	< 0.001	0.163	very small
freqWF - nonWFhunter	0.158	0.026	14708	6.192	< 0.001	0.102	very small
freqWF - sporadicWF	–0.154	0.029	14708	–5.242	< 0.001	–0.086	very small
nonWFhunter - nonWFfish	0.351	0.052	14708	6.746	< 0.001	0.111	very small
sporadicWF - dissWF	–0.033	0.038	14708	–0.850	0.915	–0.014	very small
sporadicWF - nonWFfish	0.664	0.054	14708	12.260	< 0.001	0.202	small
sporadicWF - nonWFhunter	0.313	0.030	14708	10.275	< 0.001	0.169	very small
Social							
dissWF - nonWFfish	–0.022	0.060	14708	–0.367	0.996	–0.006	very small
dissWF - nonWFhunter	–0.247	0.037	14708	–6.641	< 0.001	–0.110	very small
freqWF - dissWF	–0.698	0.037	14708	–19.093	< 0.001	–0.315	small
freqWF - nonWFfish	–0.720	0.054	14708	–13.319	< 0.001	–0.220	small
freqWF - nonWFhunter	–0.944	0.027	14708	–35.219	< 0.001	–0.581	medium
freqWF - sporadicWF	–0.428	0.031	14708	–13.848	< 0.001	–0.228	small
nonWFhunter - nonWFfish	0.225	0.055	14708	4.113	< 0.001	0.068	very small
sporadicWF - dissWF	–0.269	0.040	14708	–6.686	< 0.001	–0.110	very small
sporadicWF - nonWFfish	–0.291	0.057	14708	–5.130	< 0.001	–0.085	very small
sporadicWF - nonWFhunter	–0.516	0.032	14708	–16.163	< 0.001	–0.267	small
Waterfowl population							
dissWF - nonWFfish	0.128	0.046	22068	2.780	0.043	0.037	very small
dissWF - nonWFhunter	–0.036	0.029	22068	–1.253	0.720	–0.017	very small
freqWF - dissWF	–0.111	0.028	22068	–3.940	0.001	–0.053	very small
freqWF - nonWFfish	0.018	0.042	22068	0.422	0.993	0.006	very small
freqWF - nonWFhunter	–0.147	0.021	22068	–7.104	< 0.001	–0.096	very small
freqWF - sporadicWF	–0.193	0.024	22068	–8.100	< 0.001	–0.109	very small
nonWFhunter - nonWFfish	0.164	0.042	22068	3.905	0.001	0.053	very small

sporadicWF - dissWF	0.082	0.031	22068	2.643	0.063	0.036	very small
sporadicWF - nonWFfish	0.210	0.044	22068	4.810	< 0.001	0.065	very small
sporadicWF - nonWFhunter	0.046	0.025	22068	1.878	0.329	0.025	very small
Views of others							
dissWF - nonWFfish	–0.211	0.033	14708	–6.313	< 0.001	–0.104	very small
dissWF - nonWFhunter	–0.066	0.021	14708	–3.210	0.012	–0.053	very small
freqWF - dissWF	–0.051	0.020	14708	–2.487	0.094	–0.041	very small
freqWF - nonWFfish	–0.262	0.030	14708	–8.692	< 0.001	–0.143	very small
freqWF - nonWFhunter	–0.117	0.015	14708	–7.835	< 0.001	–0.129	very small
freqWF - sporadicWF	–0.018	0.017	14708	–1.023	0.845	–0.017	very small
nonWFhunter - nonWFfish	–0.145	0.030	14708	–4.752	< 0.001	–0.078	very small
sporadicWF - dissWF	–0.033	0.022	14708	–1.469	0.583	–0.024	very small
sporadicWF - nonWFfish	–0.244	0.032	14708	–7.709	< 0.001	–0.127	very small
sporadicWF - nonWFhunter	–0.099	0.018	14708	–5.588	< 0.001	–0.092	very small

Literature Cited

Cohen, J. 2013. Statistical Power Analysis for the Behavioral Sciences. Academic Press, New York, New York, USA.