CHARACTERISTICS OF ANGLERS AND ANGLING PREFERENCES IN UTAH: RESULTS FROM THE 2021-2022 UTAH ANGLER SURVEY

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The **Institute of Outdoor Recreation and Tourism at Utah State University** does research, outreach, and teaching focused on outdoor recreation and tourism management — inside Utah and beyond its borders. Our work focuses on the social and economic trade-offs associated with providing outdoor recreation opportunities on public lands.

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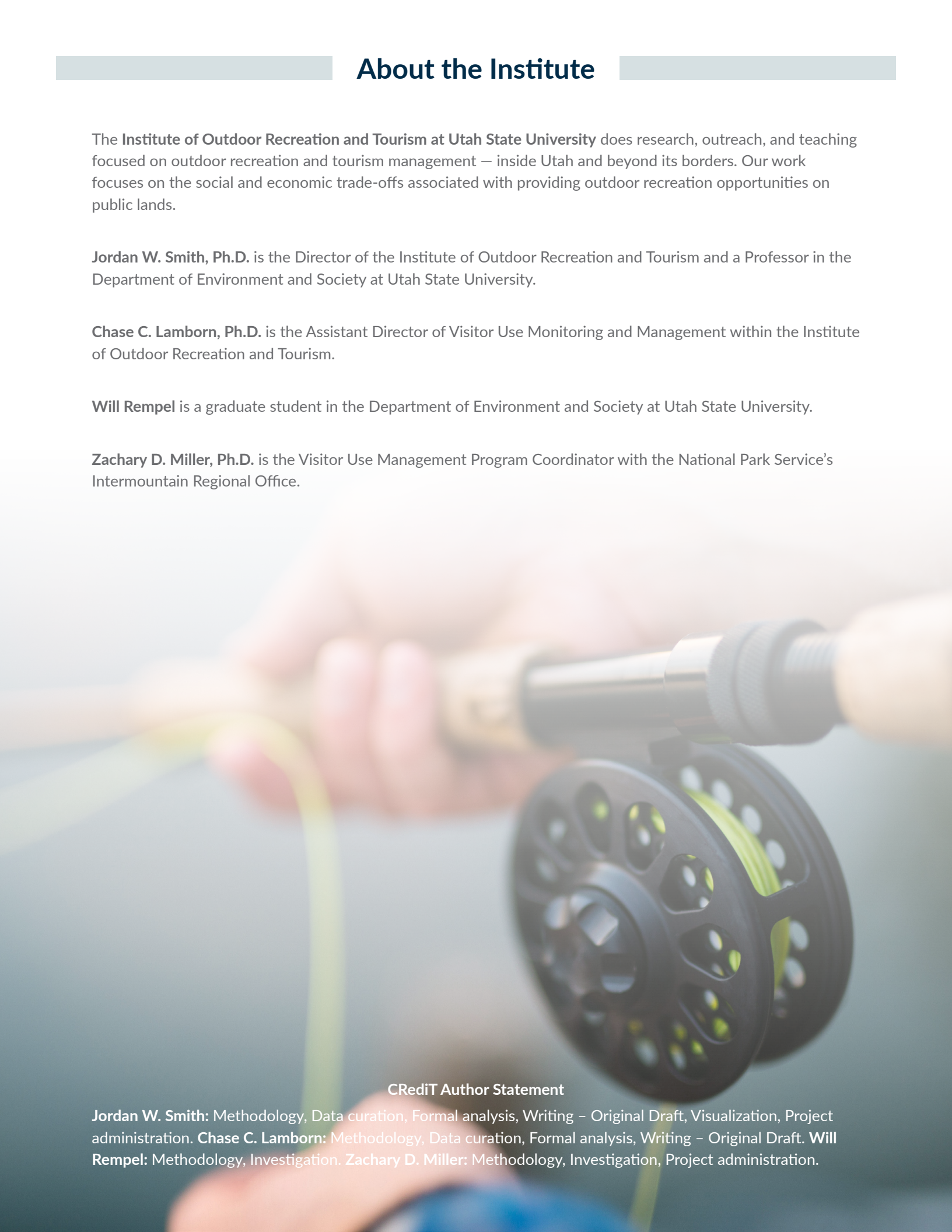

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Characteristics of Anglers and Angling Preferences in Utah: Results from the 2021-2022 Utah Angler Survey

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Executive Summary

In the face of a diminishing resource base and increased demand from anglers, the state of Utah is looking for biologically feasible, economical, and publicly supported solutions to address the angling supply and demand mismatch. This study was conducted to gather information about the characteristics, behaviors, and preferences of Utah anglers to help explore the potential for new angling opportunities. Notable findings include:

- **The primary motivations to fish within the state are to get away from crowds, to be in natural settings, and to mentally and physically relax.** Many anglers also seek opportunities to catch fish and improve their skills. When communicating to anglers in the state of Utah as a whole, it may be prudent for state wildlife managers to present experiences that resonate with these very common motivations. Specifically, imagery and messages that depict natural settings, escaping crowds, and relaxation, are most likely to resonate with the state's anglers.

- **The most common species Utah anglers target is Rainbow Trout; however, anglers are seeking more opportunities to fish for a wider diversity of trout species in addition to Kokanee, Bass, Walleye, and Wipers.** New angling opportunities in Utah for these species will need to align with anglers' motivations. Simply put, the characteristics of angling experiences need to satisfy the motivations driving Utah anglers to fish—nature, solitude, catch, and opportunities for relaxation. Within these confines, there are likely alternatives for new assemblages that can still provide satisfying experiences for Utah anglers.

- **Anglers can be classified by their motivations into five relatively distinct groups – Explorers, Social anglers, Catch Focused anglers, Ambivalent anglers, and Catch & Consume anglers.** Explorers and Social anglers are the most receptive to new experiences, although the preferences, behaviors, and motivations of the two types of anglers differ. Ambivalent and Catch & Consume anglers are the least likely to seek new experiences.

- **Anglers with different motivations use the same fisheries to achieve desirable fishing experiences, although they use them in different ways.** Given the unique motivations defining the five angler classifications, we assumed there would be geographic differences in where these anglers fish, and those differences could be used to pair fisheries with anglers who are receptive to new angling experiences that are more biologically and economically sustainable. However, the analysis failed to show any geographic differences across the angler classifications. This suggests anglers with different motivations use the same fisheries to achieve desirable fishing experiences, although they use them in different ways. This emphasizes the need for fisheries to provide a diverse spectrum of opportunities.

  For example, a single reservoir can provide a spectrum of experiences—one for each of the five angler classifications noted above. The more remote, secluded, and natural areas of a reservoir will be more appealing to Explorers. Social anglers are likely looking for easier access, and places where they can take friends and family fishing (Ambivalent anglers). Catch Focused anglers may target the tailwaters of the reservoir and be focused on catching several fish, including large fish. Catch & Consume anglers would likely seek areas with easy access but with good water quality so they know the fish are safe to eat. They likely fish places that they are familiar with and know they have a high likelihood of catching fish to take home.

Taken together, the information in this report provides some insights into Utah anglers and their angling experiences. We have identified types of motivations that are fundamental to the Utah fishing experience and should be preserved and/or enhanced. Maintaining angler satisfaction can be achieved if the key motivations of anglers are met. Managers are now tasked with using this information to devise biologically feasible solutions that not only enhance the sustainability of Utah's fisheries, but also meet the fundamental motivations of the angling public.

Introduction

Since 1967, the Utah Division of Wildlife Resources (DWR) has surveyed anglers approximately every 5-years to assess the characteristics, preferences, and behaviors of individuals who fish in Utah. Data generated from the survey effort facilitate a better understanding of the needs and desires of anglers, ultimately allowing the DWR to make decisions that improve fishing experiences within the state.

The 2021-2022 survey effort was guided, in part, by fisheries managers interest in developing a classification of anglers and angling experiences within the state. This goal, along with several others, was identified through meetings between Utah State University's research team and DWR staff in the fall of 2020. Consequently, the 2021-2022 survey effort included many of the same types of questions as previous rounds of the periodic survey (e.g., angler sociodemographics, species preferences, etc.), but also included several other sets of questions (e.g., anglers' motivations for fishing), that could be used to develop a robust classification of anglers and angling experiences within the state. **The purposes of this report are to:**

1. **Provide a descriptive review of all data collected as part of the 2021-2022 survey effort;** and to
2. **Generate a classification of anglers and angling experiences in the state.**

Angler Classification as a Tool to Guide Management Actions

In the face of a shrinking resource base and increased demand from anglers, the state of Utah is looking for biologically feasible, economical, and publicly supported solutions to address the angling supply and demand mismatch. This study is intended to help managers better understand Utah anglers by exploring their unique motivations, preferences, and behaviors within relatively distinct angler classifications. The goal is to identify the characteristics of the angling experience that define each angler classification, then use this information to explore new angling opportunities which resonate with a particular classification of anglers. With this information, managers can more effectively identify satisfying angling experiences and market those experiences to targeted segments of the angling population. This study is not intended to explore the biological and economic feasibility of these new opportunities, but rather to help managers identify publicly supported alternatives that may be more biologically and economically sustainable.

Methods

The Utah State University research team met with DWR fisheries managers to develop research questions that could address management needs. These questions were used to guide the scope of work for the project (Appendix A). Relevant areas of interest included motivations, preferences, willingness to travel, group differences, native species knowledge and management, and lapsed angler assessments.

Instrument Development

Research questions were operationalized into two survey instruments with the first focusing on all currently licensed anglers within the state (the periodic survey) and the second focusing more specifically on the constraints and barriers that lead to lapses in fishing license renewal (the lapsed angler survey). Data collected from the periodic survey are reported in this report while data collected from the lapsed angler survey are in Rempel et al. (2023). An outline of the types of questions asked in the periodic survey instrument is provided in Table 1. Questions within the survey instrument were rooted in existing applied social science literature when possible. Survey questions from previous 5-year Statewide Utah Angler Surveys were also used when applicable. Drafts of the survey instrument were shared with DWR staff to ensure conceptual accuracy and solicit comments. The final survey instrument is provided in Appendix B.

Table 1

Types of Questions Asked in the Periodic Angler Survey

Type of question
Sociodemographic characteristics[a]
License information
License type
Resident
Trip characteristics
Group size on most recent trip
Location of most recent trip
Month, day, and year of most recent trip
Travel time to destination on most recent trip
Time spent on site on most recent trip
Trip frequency
Trip type (day trip or overnight trip)
Use of guide in past 12 months
Trip expenditures
Access and fishing methods
Access methods used in last 12 months
Access method used on most recent trip
Fishing methods used in last 12 months
Fishing methods used on most recent trip
Primary method used in last 12 months
Primary method used on most recent trip
Setting preferences
Times fished at different types of waterbodies in past 12 months
Types of waterbodies preferred
Types of amenities and services used
Types of amenities and services preferred, if not used
Adequacy of boat facilities and access
Perceived availability of accessible fishing
Motivations for fishing
General motivations
Preferences for fishing-specific opportunities
Species preferences
Knowledge of native species
Most preferred species to catch
Most targeted species
Number of fish caught on most recent trip
Perceptions of native species
Species expecting to catch on most recent trip
Species caught on most recent trip
Perceptions of crowding on most recent trip
Other recreation activities
Importance of other activities relative to fishing
Interest in combining other activities with fishing
Other activities participated in during the past 12 months

[a] Variables included: age; education; gender; Hispanic, Latino, or Spanish origin; home zip code; income; self-described race; and use of English as preferred language.

Sampling Design and Data Collection

The periodic angler survey instrument was emailed to four randomly selected samples of nearly 15,000 licensed anglers (total sample = 59,994). The random samples were drawn from the DWR's records of individuals who held an active fishing license within the state in mid-July 2021; these records were also used to obtain the email addresses of license holders. Each of the four random samples received the survey instrument in either summer (August 2021), late fall (November 2021), winter (February 2022), or spring (May 2022) to gain a representative sample of angling experiences throughout the year. The survey instrument solicited information about respondents' most recent fishing trip to minimize the potential for recall error (Shonkwiler & Barfield, 2015).

The total sample size was determined to ensure results could be reported state-wide and for each of the DWR's administrative regions (Figure 1). The target sample size for each region was 400 completed surveys. The total number of surveys distributed was calculated using the anticipated response rate. A sample of 400 is large enough to be representative of all anglers within each region, assuming no systematic non-response bias exists. Participants were connected to a DWR region by one of two variables: either their residential zip code or the location of their most recent fishing trip. The variable chosen to separate respondents into groups was based on the objective of each analysis. For example, some analyses required a comparison between where anglers live, and others required where anglers fished. Anglers' zip codes and the location of their most recent fishing trip were both obtained through the survey.

Analysis

Descriptive Statistics and Regional Comparisons

Univariate descriptive statistics are used to present all survey data. To allow the DWR to use the data to make decisions both within individual regions as well as across the entire state, descriptive statistics are presented at both administrative/geographic levels. Comparative statistics (i.e., Wald chi-square tests, ANOVAs, and post-hoc tests) were also used where appropriate to identify statistically significant differences across DWR regions.

Angler Classification

Following a long-standing body of research on the human dimensions of recreational fisheries management, we used anglers' motivations to classify them into distinct groups (Fedler & Ditton, 1994; Finn & Loomis, 2001). The underlying

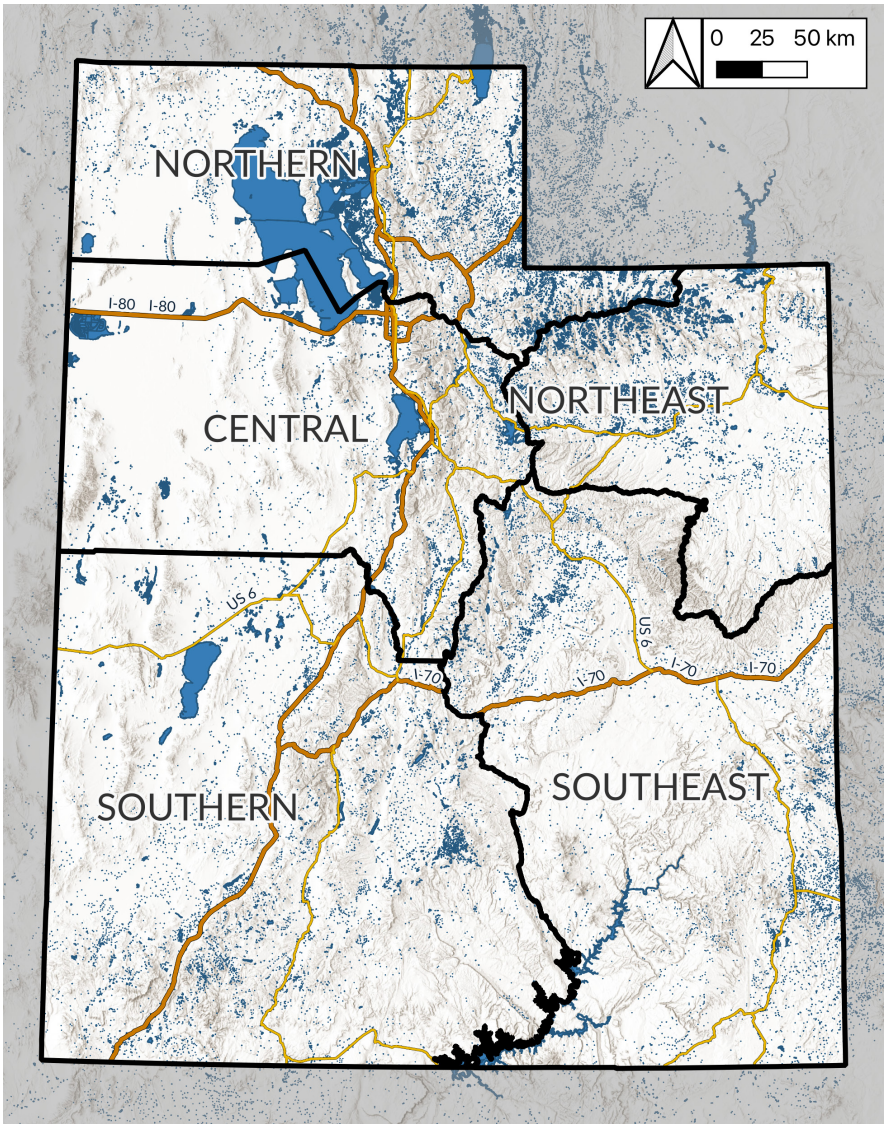

Figure 1

Division of Wildlife Resources Management Regions

assumption with this approach is that providing high-quality fishing experiences requires an understanding of what anglers believe is important. Recreational motivations can be classified into those that are activity-general (i.e., common across all outdoor recreation activities) and those that are activity-specific (i.e., they are unique to that particular activity) (Fisher, 1997).

The survey instrument developed for the periodic survey solicited information on both types of motivations. Activity-general motivations were solicited from the Recreation Experience Preference (REP) scale, which is the standard battery of potential motivations used within the fields of recreation resource management and human dimensions of wildlife (Driver, 2008). Activity-specific motivations were assessed with a set of statement items derived from the literature on recreational angling motivations (e.g., Arlinghaus, 2006; Beardmore et al., 2011). Exploratory factor analyses were used to reduce the data generated from the two sets of motivation questions into their common factors, as defined by their linear relationships. Following the standard within the recreation resource management and human dimensions of wildlife literatures, extracted factors were rotated using the Varimax rotation method, yielding orthogonal factor scores.

Factors with an Eigenvalue > 1 were retained and qualitatively defined by the research team based upon the statement items loading highly on them.

A k-means cluster analysis was subsequently conducted on the extracted and rotated factor scores to segment the state's anglers into the most homogenous sub-groups. The k-means clustering algorithm is a well-known partitioning clustering method that allows analysts to explore optimal sub-groupings of their data across any number of groups, k (Hastie et al., 2009) Solutions ranging between 1 and 20 clusters were calculated, and subsequently evaluated using the Weighted Sum of Squares, its logarithm, the η^2 statistic, and the Proportional Reduction in Error (PRE) coefficient (Rokach & Maimon, 2005). The determination of an 'optimal' number or clusters was assesses through a visual inspection of these statistics across the possible solutions ($1 \leq k \leq 20$) following Makles (2012).

Once an optimal number of clusters was identified, these groups of anglers were given qualitative descriptions based on the strength/weakness of the underlying motivational factor scores defining them. The clusters were then used to identify differences across a range of angler characteristics and preferences. These characteristics and preferences were selected based upon their relevance to potential management actions (e.g., stocking certain assemblages of fish most appealing to different types of anglers). Standard comparative statistics (i.e., Wald chi-square tests and ANOVAs) were used to identify significant differences. Where possible, post-hoc tests were used to identify pair-wise differences between clusters. Notable pair-wise differences are discussed in the body of the results with all pair-wise differences presented in tables.

Results

The results are presented in eleven sections. The first section reports on the response rate, the subsequent nine report on specific question sets included in the survey (e.g., sociodemographics), and the final section reports on the classification of anglers and angling experiences within the state.

Response Rates

6,632 surveys were completed, which after accounting for undeliverable emails (1,568), tabulates out to an effective response rate of 11.4% (Table 2). This is lower than the response rate reported for the 2016 survey effort, which used a similar methodology (Lilieholm et al., 2017). The decline in response rates is reflective of a broader issue across survey research (Keeter, 2018).

Separating the sample using the DWR region of respondents' most recent fishing trip (if it was provided), there were 1,385 complete surveys from the Central region, 747 from the Northeast region, 1,107 surveys from the Northern region, 341 from the Southeast region, and 859 from the Southern region. These totals are sufficient to be representative of the total number of anglers recreating in each region (Groves et al., 2009).

Sociodemographic Characteristics

A summary of respondents' sociodemographic information is presented in Table 3. Respondents were, on average, 51 years old, had at least a bachelor's degree, were male, white, and had relatively high personal incomes (> $75k per year).

Table 2
Summary of Sampling and Response Rates

		Undeliverable		Complete responses	
Survey round	Emails sent	*n*	%	*n*	%
Round 1 (Summer 2021)	14,999	372	2.5	1,735	11.9
Round 2 (Late Fall 2021)	14,999	381	2.5	1,634	11.2
Round 3 (Winter 2022)	14,999	401	2.7	1,718	11.8
Round 4 (Spring 2022)	14,997	414	2.8	1,545	10.6
Total	**59,994**	**1,568**	**2.6**	**6,632**	**11.4**

Table 3

Demographic Characteristics of Respondents, by DWR Region Fished

Characteristic	STATEWIDE ($n \geq 2{,}869$)	Central ($n \geq 879$)	Northeast ($n \geq 479$)	Northern ($n \geq 756$)	Southeast ($n \geq 215$)	Southern ($n \geq 540$)	Sig. Diff.
Age							< 0.001††
Mean	51.2	49.8	53.3	48.5	51.8	55.5	
Std. Dev.	15.5	15.6	14.7	15.5	15.2	15.5	
Education (%)							< 0.001†
< High school	1.0	0.8	1.4	0.8	2.3	0.8	
High school	12.7	11.9	13.1	12.8	12.3	12.7	
Some college/ Associate	34.1	31.6	29.3	35.4	39.9	34.1	
Bachelor's	30.8	31.5	30.4	32.0	28.0	30.8	
Graduate	21.4	24.3	25.8	19.1	17.6	21.4	
Gender (%)							0.068†
Male	88.9	90.6	88.6	89.6	85.0	87.4	
Female	11.1	9.4	11.5	10.4	15.0	12.6	
Hispanic (%)							0.579†
No	90.1	88.8	90.8	91.3	90.1	90.1	
Race (%)							0.275†
American Indian	1.2	0.8	1.1	1.1	1.2	2.1	
Asian	1.3	1.4	1.3	1.7	0.0	1.0	
Black	0.3	0.2	0.0	0.2	1.2	0.2	
White	97.9	98.0	97.9	98.0	98.8	97.4	
Native Hawaiian	0.3	0.4	0.6	0.1	0.0	0.5	
Income (%)							< 0.001†
< $25,000	6.0	6.7	4.2	7.4	6.1	4.4	
$25k - $40k	7.7	7.6	7.9	8.1	5.6	8.2	
$40k - $60	15.6	14.9	13.6	15.5	24.2	15.4	
$60k - $75	15.0	12.7	11.5	18.7	13.5	17.4	
$75k - $100k	18.6	17.3	21.3	19.2	14.0	19.4	
$100k - $150k	21.3	21.8	21.1	20.0	21.4	22.6	
> $150k	15.7	18.9	20.5	11.2	15.4	12.6	

Note. †Pearson's chi-square. ††One-way ANOVA.

There were several statistically significant differences between the demographic characteristics of anglers who fish in different DWR regions (Table 3). Anglers in the Northern region tended to be the youngest in the state (48.5 years old) while those in the Southern region tended to be the oldest (55.5 years old). The Northeast region had anglers with the most formal education (56.1% had at least a bachelor's degree) while anglers in the Southeast region had the least amount of formal education (45.6% had at least a bachelor's degree). The Northeast region also had the largest percent of anglers earning over $150,000 (20.5%) while the Northern region had the lowest (11.2%).

Over three-fourths (78.4%) of licensed anglers indicated they were residents of Utah. This is consistent with results from the 2016 survey effort (81.8% residents). However, license sales data show that a slightly higher proportion of anglers within the state are residents than these data represent. This is likely attributed to the sampling design not intending to gain a representative sample of non-resident anglers. Figure 2 shows the proportion of Utah residents and non-residents by the region of their most recent fishing trip. The Northern and Central regions have the greatest proportion of visits by Utah residents, and the Southern, Northeast, and Southeast regions have the highest proportions of visits by non-residents.

License Information

License Type

Most respondents across all regions had purchased a 365-day fishing license (37.7%) or a combination

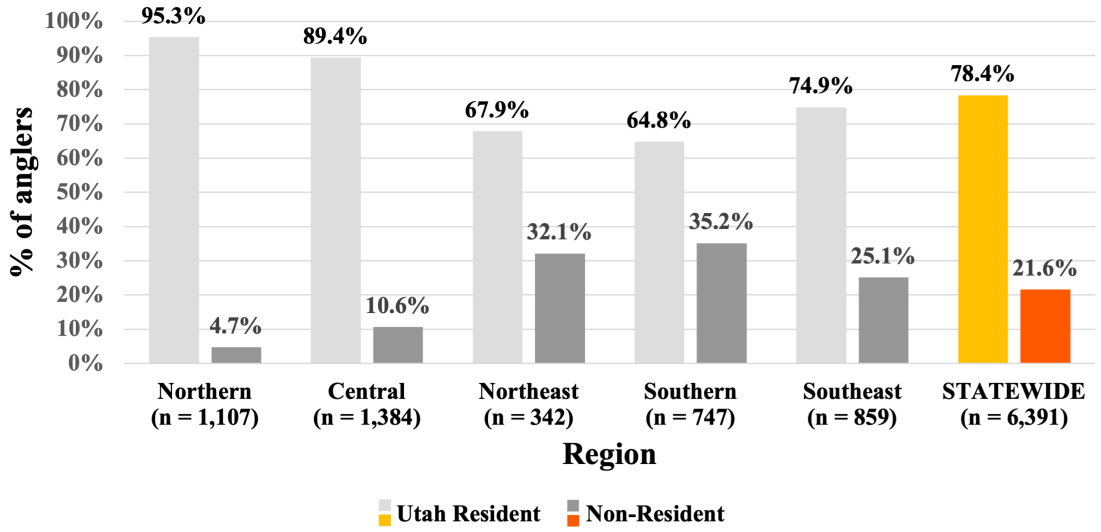

Figure 2

Distribution of Residents and Non-residents, by DWR Region Fished

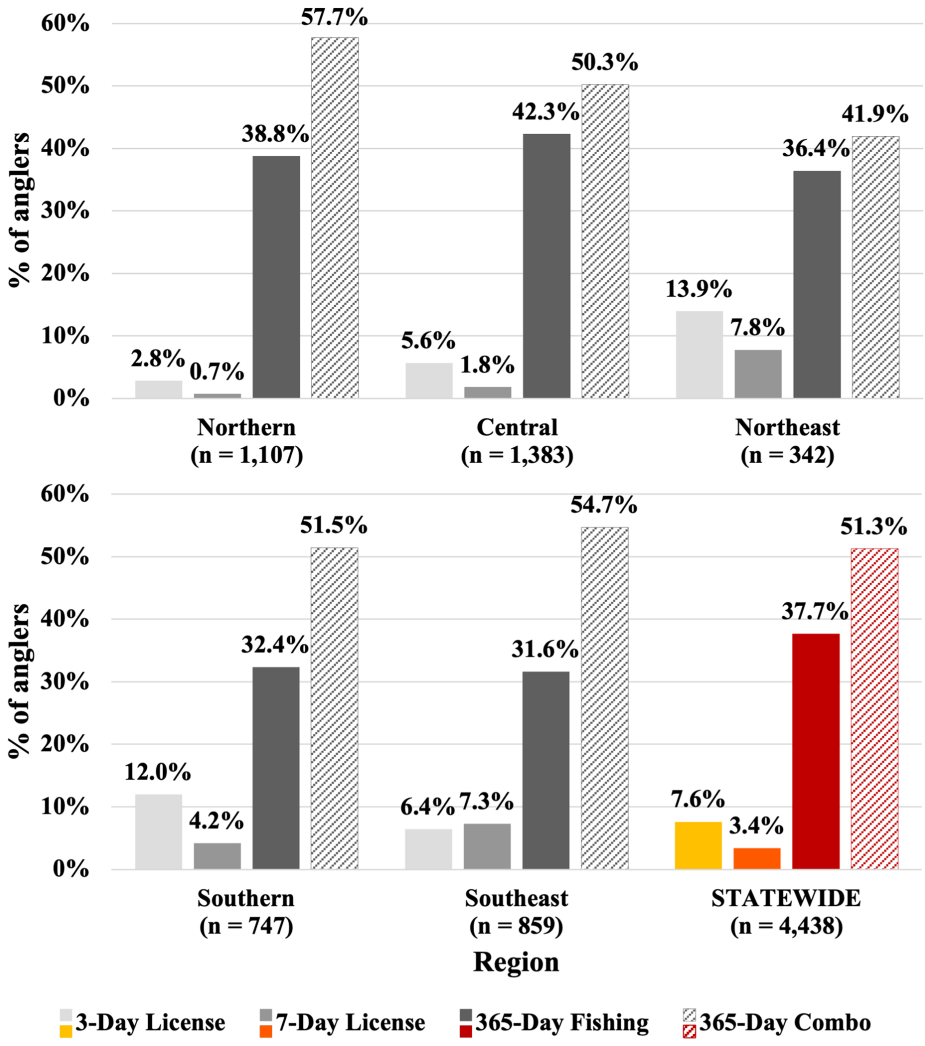

Figure 3

Type of License Purchased, by DWR Region Fished

license (51.3%) (Figure 3). The Northeast and Southern regions had the highest proportion of 3-day fishing licenses, with 13.9% and 12.0% of anglers fishing with these short-term licenses in these regions respectively. This is likely attributed to the higher proportion of non-residents fishing in these regions (Figure 2).

Use of Combination Hunting/fishing License

The state's combination hunting/fishing license allows people to fish and hunt small game. The combination license is also required for everyone applying for big game hunting licenses. Most (56.6%) anglers indicated they are using their combination license to both fish and hunt (Figure 4). Roughly one-third (32.1%) primarily use their combination license to fish and only 11.3% indicated they primarily hunted with their combination license. It is difficult to know if the people who primarily use their combination license to hunt opted out of taking the survey at a higher rate because they had little interest in angling in Utah.

Trip Characteristics

Fishing Effort Throughout the Year

Figure 5 presents the percent of fishing trips by month statewide; Figure 6 presents the number of fishing trips by month by region. The percent of fishing trips shows the expected trend of low winter participation and high summer participation. Figure 6 shows the Central region received the most trips, and the Northern, Northeast, and Southern regions all received a similar number of trips, and the Southeast region received the fewest.

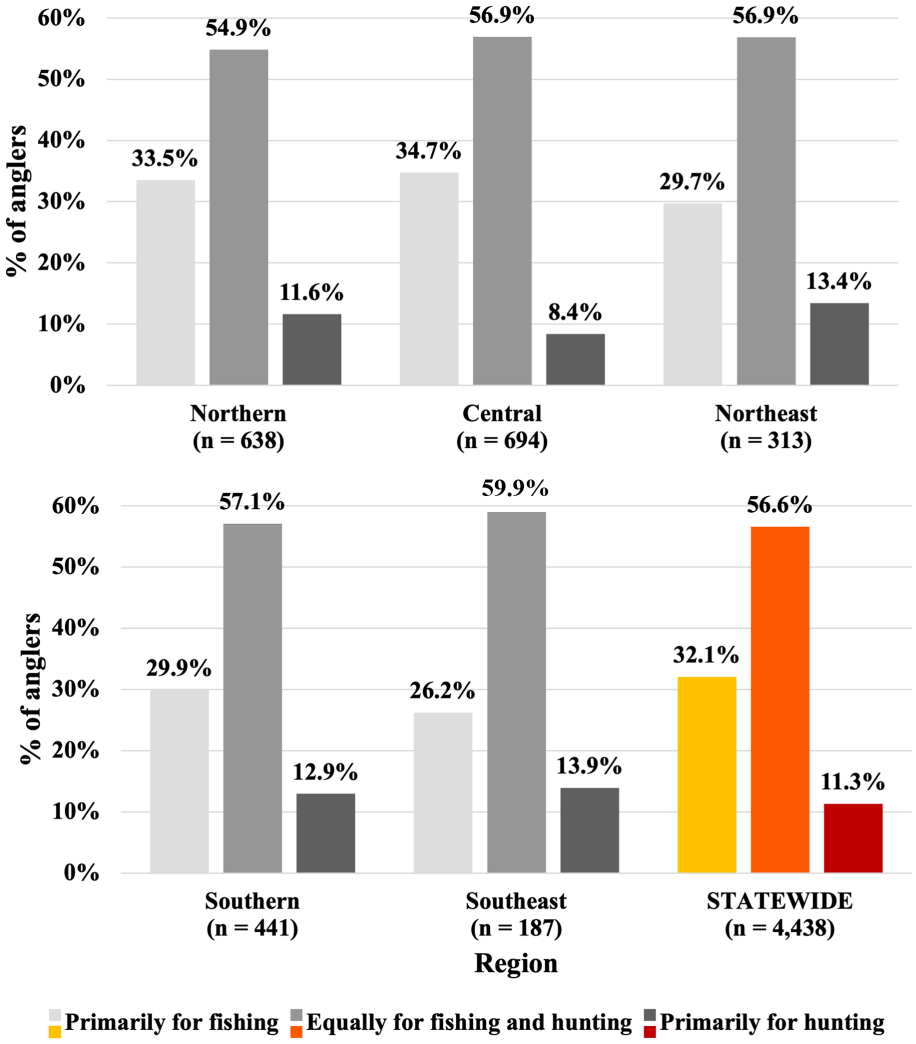

Figure 4

Primary Use of Combination License, by DWR Region Fished

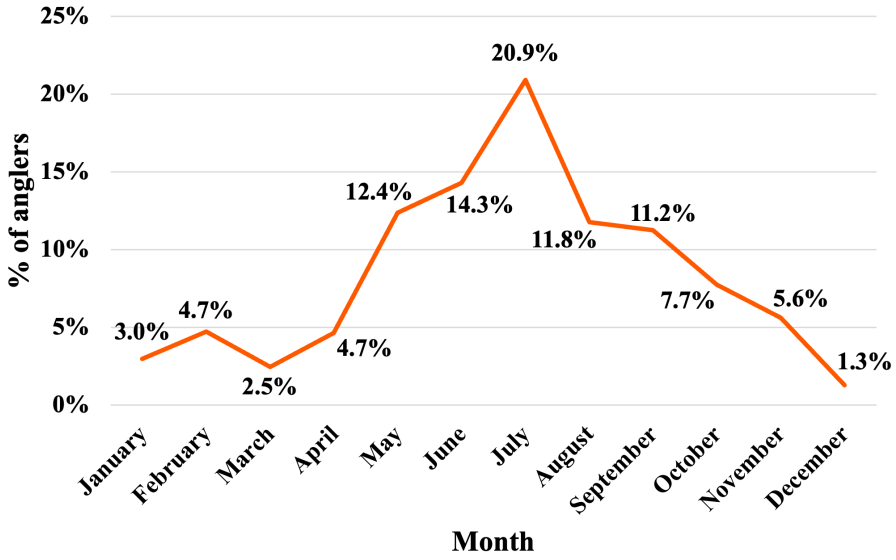

Figure 5

Percent of Fishing Trips by Month by Region

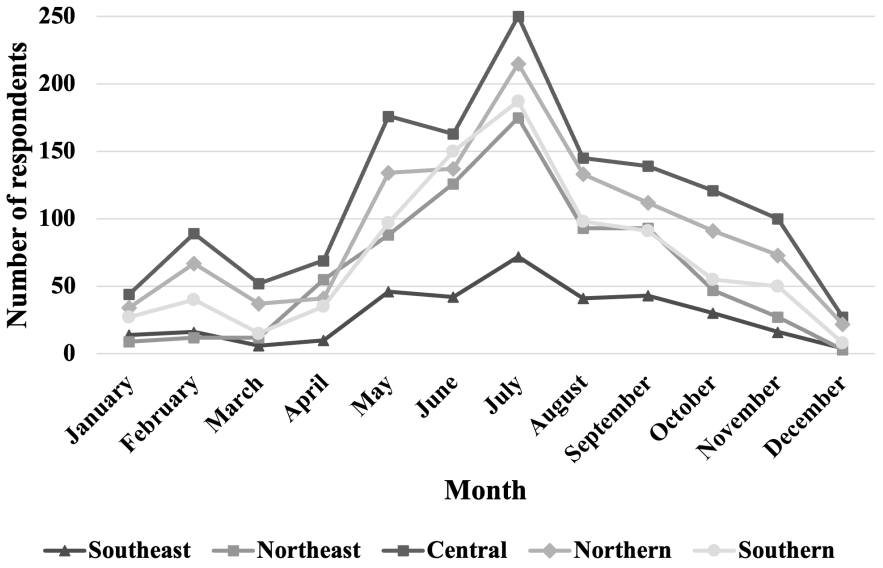

Figure 6

Number of Fishing Trips, by Month and Region

Trips Taken

Using respondents' home zip code to distinguish between DWR regions, the data show anglers living in the Northeastern region tend to fish more within Utah than anglers living in other regions (Figure 7). Notably however, trip frequency is heavily right-skewed, meaning there are a small proportion of anglers who fish very frequently (> 50 times per year). Consequently, the median number of fishing trips is a more realistic representation of trip frequency. The median number of trips across the entire state was 6 trips per year (Figure 7).

Travel Time

The longest travel times to reach fishing destinations were for the Northeast region (mean = 4.5 hours); the shortest travel times were for the Central (mean = 2.1 hours) and Northern regions (mean = 2.3 hours) (Figure 8).

Day Versus Overnight Trips

Regions with the longest travel times also had higher proportions of anglers spending the night (Table 4). For example, anglers traveled the farthest to

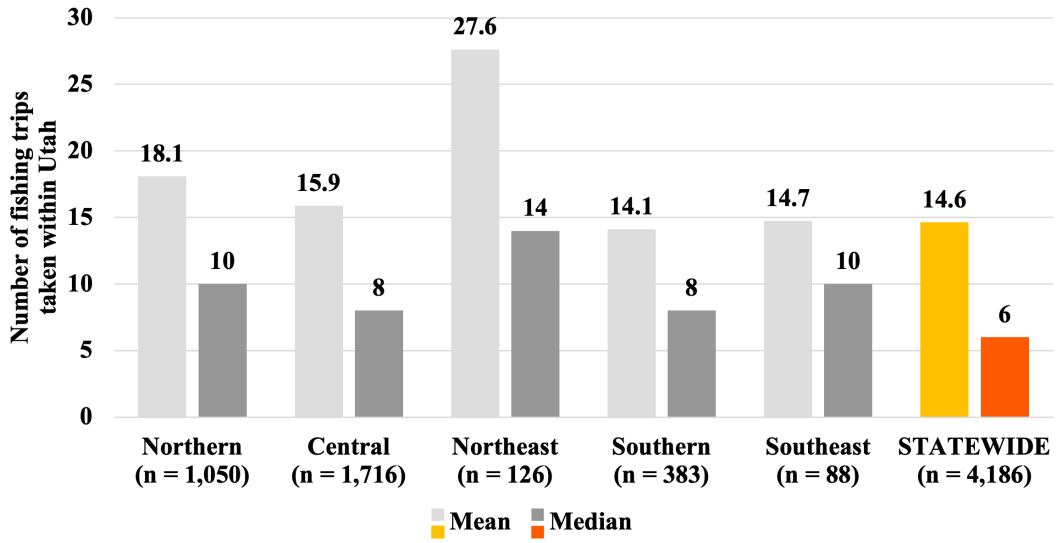

Figure 7

Mean and Median Number of Trips Taken by Residents Living Within Each DWR Region

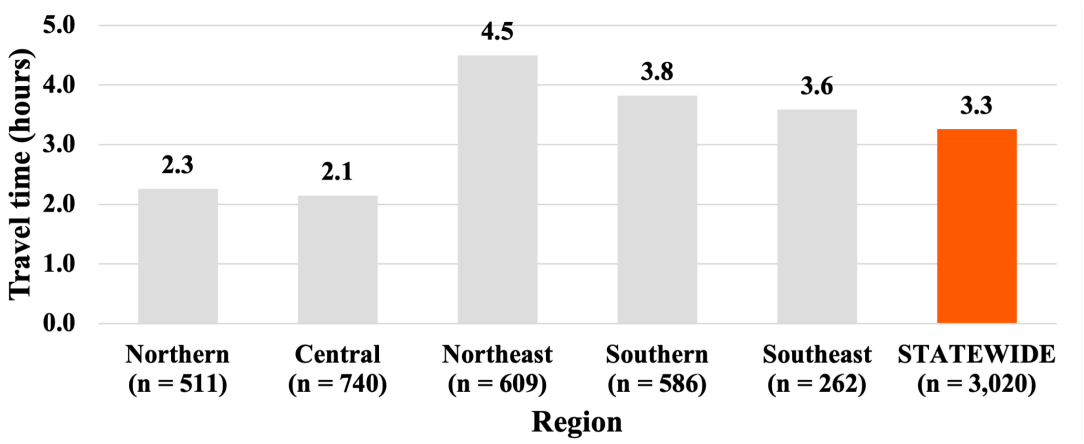

Figure 8

Mean Travel Time in Hours to Reach Fishing Destinations Within Each DWR Region

reach the Northeast region, with 67.4% of them taking overnight trips. Conversely, regions with the shortest travel times—the Central and Northern regions—had 86.3% and 82.0% of their anglers participating in day trips, respectively. The data also show significant differences across DWR regions in the amount of time anglers spend on site (Table 4). Again, the region with the longest travel time—the Northeast region—saw the longest time spent on site during day trips (mean = 5.0 hours).

Table 4

Time Spent On Site For Both Day and Overnight Fishing Trips, by DWR Region Fished

	Day trips Time spent on site (hours)			Overnight trips Time spent on site (days)		
DWR region	% of trips	Mean	Std. Dev.	% of trips	Mean	Std. Dev.
Central	86.3	4.6	2.2	13.7	3.1	2.3
Northern	82.0	3.7	1.6	18.0	4.0	2.6
Southern	49.2	4.3	2.3	50.8	3.3	2.0
Southeast	44.9	3.8	1.6	55.1	4.2	2.4
Northeast	32.6	5.0	2.1	67.4	3.8	2.9
STATEWIDE	**65.9**	**4.2**	**2.0**	**34.2**	**3.8**	**2.6**

Note. One-way ANOVA for time spent on site for day trips across DWR regions: $F(4, 706) = 8.0$, $p \leq 0.001$. One-way ANOVA for time spent on site for overnight trips across DWR regions: $F(4, 1{,}508) = 7.4$, $p \leq 0.001$.

Group Size

Group sizes only varied slightly across all angling regions (Table 5). The average size of a fishing group within the state was 3.6 people. However, there are statistically significant differences across DWR regions. The Southeast, Northeast, and Southern regions of the state tend to see group sizes larger than the statewide average while those in the Central and Northern region tend to be smaller (Table 5).

Methods Used

The primarily method used on anglers' most recent trip is reported in Table 6; differences were significant across DWR regions. The Southern region had the highest percentage of anglers using bait (46.8%), while the Northeast region had the lowest (23.1%). The Northeast region had the highest percentage of anglers using artificial flies (42.1%). Anglers in the Central and Northern regions share proportionally similar fishing methods. Results were similar for the question asking about all methods used (as opposed to just the primary method) on an angler's most recent trip (Table 7).

Table 5
Group Sizes, by DWR Region Fished

DWR Region	Mean	Std. Dev.	Min.	Max.
Southeast	4.1	3.1	1	26
Northeast	4.0	4.0	1	45
Southern	3.9	3.4	1	41
Central	3.3	2.6	1	36
Northern	3.2	2.1	1	21
STATEWIDE	**3.6**	**3.0**	**4**	**3**

Note. One-way ANOVA across DWR regions: $F(4, 2{,}775) = 8.5$, $p \leq 0.001$.

Table 6
Proportion of Anglers with Different Primary Angling Methods, by DWR Region Fished

	Method				
DWR Region	Bait (%)	Artificial flies (%)	Artificial lures (%)	Ice fished (%)	Other (%)
Southern	46.8	15.7	32.3	4.9	0.4
Southeast	36.7	13.0	42.4	7.6	0.3
Central	33.8	30.6	29.0	6.1	0.4
Northern	32.2	33.2	26.4	8.0	0.3
Northeast	23.1	42.1	32.2	1.9	0.7
STATEWIDE	**34.6**	**29.7**	**30.1**	**5.2**	**0.4**

Note. $\chi^2(16) = 256.3$, $p \leq 0.001$.

Table 7
Proportion of Anglers Using Different Angling Methods, by DWR Region Fished

	Method				
DWR Region	Bait (%)	Artificial flies (%)	Artificial lures (%)	Ice fished (%)	Other (%)
Southern	61.9	25.1	52.3	5.7	0.6
Southeast	57.6	18.5	60.3	9.4	0.3
Central	45.9	36.2	44.0	7.0	0.6
Northern	43.3	39.5	43.3	8.9	0.3
Northeast	32.5	50.2	47.6	2.5	0.7
STATEWIDE	**47.1**	**36.9**	**47.1**	**6.1**	**0.6**

Use of Guides

Statewide, only 8% of anglers used a guide in the last 12 months. Anglers in the Northeast region use guides far more frequently (19.5%) than any other region. A moderate number of anglers used guides in the Central region (9.0%), and very few anglers use guides in the Southeast (5.2%), Northern (4.6%), and Southern (4.4%) regions (Table 8).

Trip-related Spending

Respondents were asked how much they spent before they left, on the way, and at their destination on their last fishing trip (Figure 9). The results shown in Figure 9 combine all three spending categories. The two regions with the longest travel times—Northeast and Southeast—also had the highest spending per trip. The regions with the lowest angling-related

Table 8

Proportion of Anglers Who Used a Guide in the Last 12 Months and the Frequency of Guide Use, by DWR Region Fished

DWR Region	% of anglers using a guide
Northeast	19.5%
Central	9.0%
Southeast	5.2%
Northern	4.6%
Southern	4.4%
STATEWIDE	**8.4**

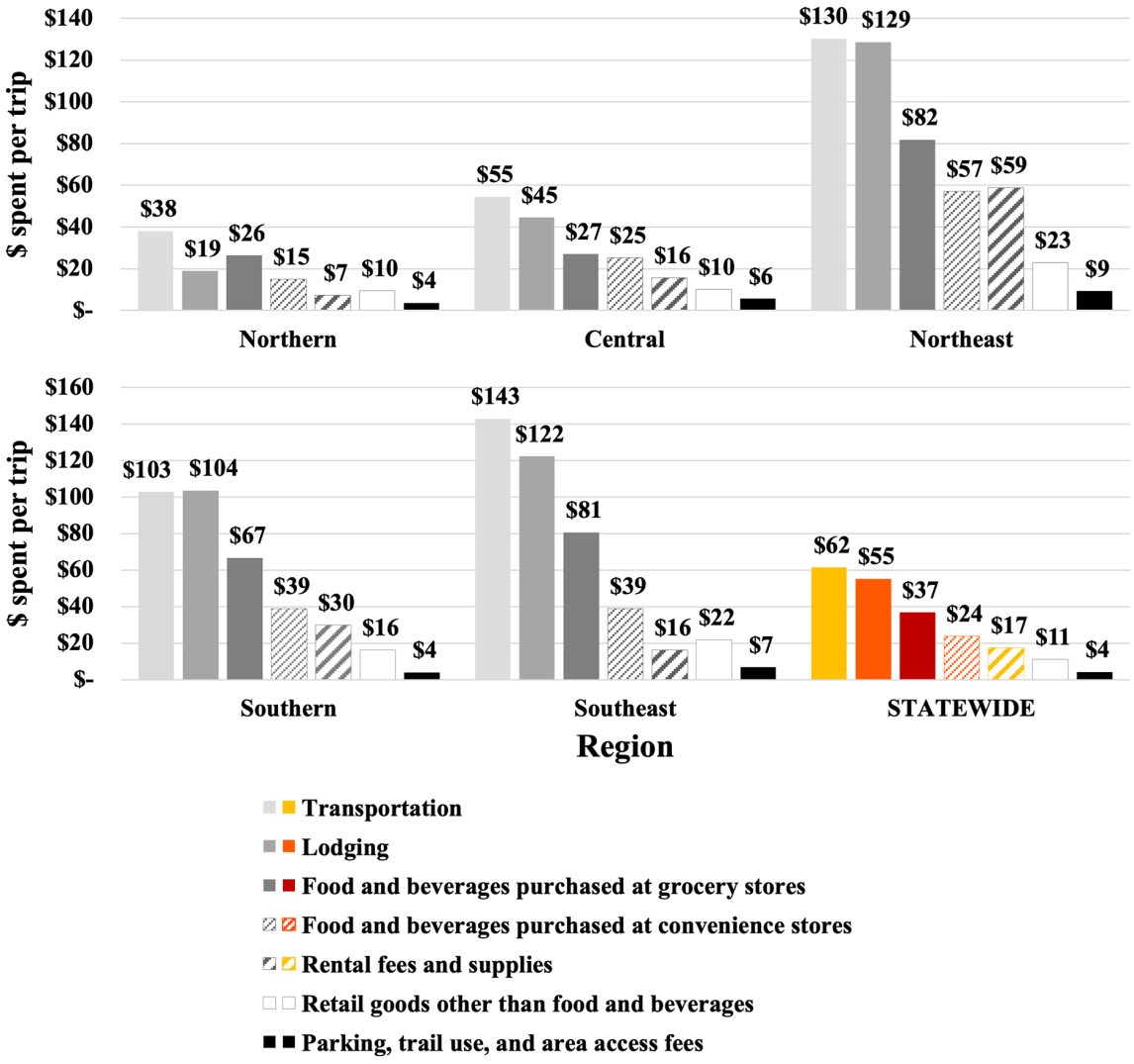

Figure 9

Trip Related Spending by Region

spending were the Central and Northern regions. The top spending categories across all regions were transportation (mean of $61.57 spent per trip), lodging ($55.26), and food ($36.19).

Access and Fishing Methods

Access Methods

The access methods used on anglers' most recent trip are reported in Table 9 and Figure 10. Fishing from shore on a stream or river was the most common access method used across the state as a whole (44.5% of anglers used this method). This was followed by fishing from a boat on a lake or reservoir (28.4%) and wading in a stream or river (19.1%). The other methods asked about were used less frequently. Due to an oversight, the category "fishing from the shore of a lake or reservoir" was not included as a response option. In the 2016 angler survey (Lilieholm et al., 2017), approximately 35-40% of anglers reported using this access method. Subsequent questions in this survey also show the common use of this method (e.g., Table 10).

The Northeast region had the largest percentage of anglers fishing from a boat on a stream or river, while the Northern region had the highest percentage of anglers fishing from the shore of a stream or river. Wading in a stream or river was also a common access method in the Central and Northern regions.

Table 9

Proportion of Anglers Using Different Access Methods, by DWR Region Fished

	Access method						
DWR region	From shore on a stream or river (%)	From a boat on a lake or reservoir (%)	Wading in a stream or river (%)	From a boat on a stream or river (%)	Wading in a lake or reservoir (%)	Ice fishing (%)	Other (%)
Central (*n* = 1,353)	39.8	30.0	24.9	0.7	3.8	7.4	6.4
Northeast (*n* = 729)	39.1	28.7	19.1	26.6	7.5	2.5	5.2
Northern (*n* = 1,094)	50.2	17.2	26.1	0.5	5.8	9.2	8.4
Southeast (*n* = 330)	37.3	37.0	4.5	0.3	7.0	9.4	13.6
Southern (*n* = 844)	42.4	42.5	5.1	0.4	8.6	6.3	10.2
STATEWIDE	**44.5**	**28.4**	**19.1**	**4.5**	**6.4**	**6.4**	**8.1**

Note. The category "fishing from shore or a lake or reservoir" was mistakenly excluded as a response option.

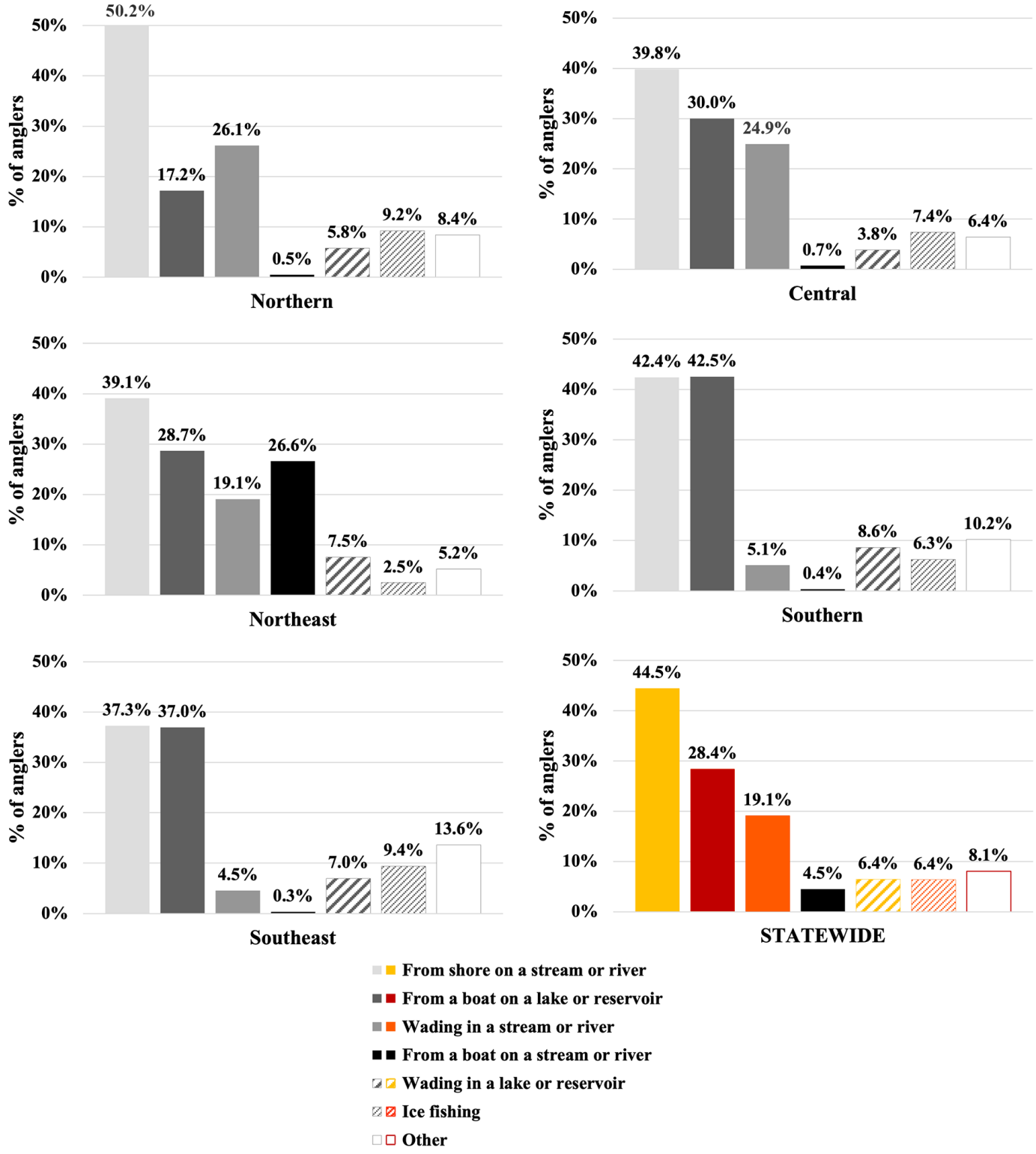

Figure 10

Proportion of Anglers Using Different Access Methods, by DWR Region Fished

Respondents were asked how many times in the last 12 months they used different access methods (Table 10). The primary method across all regions was fishing from shore or a fishing pier/dock on a lake or reservoir (mean = 5.5 times per year). This was followed by wading in a stream or river (mean = 4.9 times per year), from a boat on a lake or reservoir (mean = 4.3 times per year), ice fishing (mean = 1.4 times per year), wading in a lake or reservoir (mean = 1.1 times per year), and fishing from a boat on a stream or river (mean = 0.8 times per year).

Setting Preferences

Types of Waterbodies Used

Respondents were given a list of different types of waterbodies and asked to identify how many times they fished each in the last 12 months (Table 11). Large lakes and reservoirs were fished most often by respondents (mean = 4.9 times per year), followed by small lakes and reservoirs (3.6 times per year). Other types of waterbodies were fished less frequently.

Respondents were then asked what type of waterbody they most prefer. Large and small lakes and reservoirs were the most preferred (32.1% of anglers preferred this type of water body more than all others), followed by smaller lakes or reservoirs (27.2%). Rivers, streams, and community fishing ponds were preferred less so (Table 11).

Amenities

The most common amenities used while on fishing trips within Utah are restrooms (used by 48.2% of anglers), boat ramps (25.5%), and marinas/docks (15.8%) (Table 12). Boat fueling stations were used most frequently in the Southeast region, likely on Lake Powell. The highest proportion of anglers not using any on-site amenities was in the Northern region (45.3%).

In addition to asking anglers what amenities they used during their last fishing trip, we also asked anglers what additional amenities and services they would like available. Overall, 70.5% of anglers said they did not want more amenities or services on-site. Of those who did want additional amenities or services, restrooms (12.3%) were the most common, followed by picnic tables (6.6%) and fishing piers (5.5%).

Table 10

Mean Number of Times Anglers Used Different Access Methods Within the Past 12 Months

Access method	Mean	Std. Dev.	Min.	Max.
From shore or a fishing pier/dock on a lake or reservoir	5.5	11.4	0	250
Wading in a stream or river	4.9	13.7	0	230
From a boat on a lake or reservoir	4.3	10.1	0	180
Ice fishing	1.4	4.5	0	100
Wading in a lake or reservoir	1.1	4.4	0	100
From a boat on a stream or river	0.8	3.8	0	100

Note. $n \geq 3{,}270$.

Table 11

Mean Number of Times Anglers Fished on Different Waterbodies Within the Past 12 Months and Anglers' Preference for Different Waterbody Types

Waterbody type	Mean	Std. Dev.	% of anglers who prefer this type of waterbody over all others
Large lakes or reservoirs	4.9	12.9	32.1
Smaller lakes or reservoirs	3.6	8.1	27.2
Large rivers	2.4	8.0	11.5
Moderately-sized streams	2.2	7.4	16.3
Small streams	1.8	6.8	10.8
Community fishing ponds	1.4	6.1	2.1

Figure 12 illustrates both the proportion of anglers using different amenities on-site as well as anglers' preference for those amenities if they were not present. The figure shows the unique nature of restroom facilities as being both heavily used, and the most preferred in locations where they are not present. Although, it is important to note only 10.9% of anglers wanted additional restroom facilities. This is a consistent trend across all five DWR regions.

Table 12
Proportion of Anglers Using and Preferring Different On-site Amenities, by DWR Region

	Amenities used									
Region	Boat fueling station (%)	Boat ramp (%)	Marina/ dock (%)	Fishing supply store (%)	Rest-rooms (%)	Pier (%)	Non-motor. hard launch (%)	Picnic table (%)	None (%)	Other (%)
Central	1.2	25.3	17.6	7.9	48.6	4.4	3.5	10.3	38.1	4.7
Northeast	4.8	40.2	17.9	27.7	62.9	2.9	14.0	27.0	23.6	5.8
Northern	0.1	15.0	7.8	1.7	37.4	3.2	6.9	10.0	51.1	4.2
Southeast	13.5	31.4	20.6	8.4	50.0	2.0	7.1	11.1	36.8	4.1
Southern	2.0	31.6	22.4	20.0	56.1	6.2	7.6	12.8	30.2	4.2
STATE-WIDE	**3.2**	**25.5**	**15.8**	**11.5**	**48.2**	**4.2**	**6.8**	**13.4**	**39.0**	**4.6**

	Amenities preferred if not present									
Region	Boat fueling station (%)	Boat ramp (%)	Marina/ dock (%)	Fishing supply store (%)	Rest-rooms (%)	Pier (%)	Non-motor. hard launch (%)	Picnic table (%)	None (%)	Other (%)
Central	0.9	1.7	1.7	4.7	13.3	5.7	2.2	6.0	69.8	5.2
Northeast	0.9	2.9	1.8	4.8	10.7	3.9	2.5	6.2	72.4	7.1
Northern	0.7	1.5	2.5	4.7	13.9	4.9	3.4	5.7	72.1	5.2
Southeast	0.7	3.6	2.2	4.4	10.9	5.1	2.2	8.0	67.6	7.3
Southern	1.4	3.3	3.0	6.2	10.3	8.0	2.9	9.5	67.9	5.3
STATE-WIDE	**1.0**	**2.3**	**2.1**	**4.8**	**12.3**	**5.5**	**2.6**	**6.6**	**70.5**	**5.7**

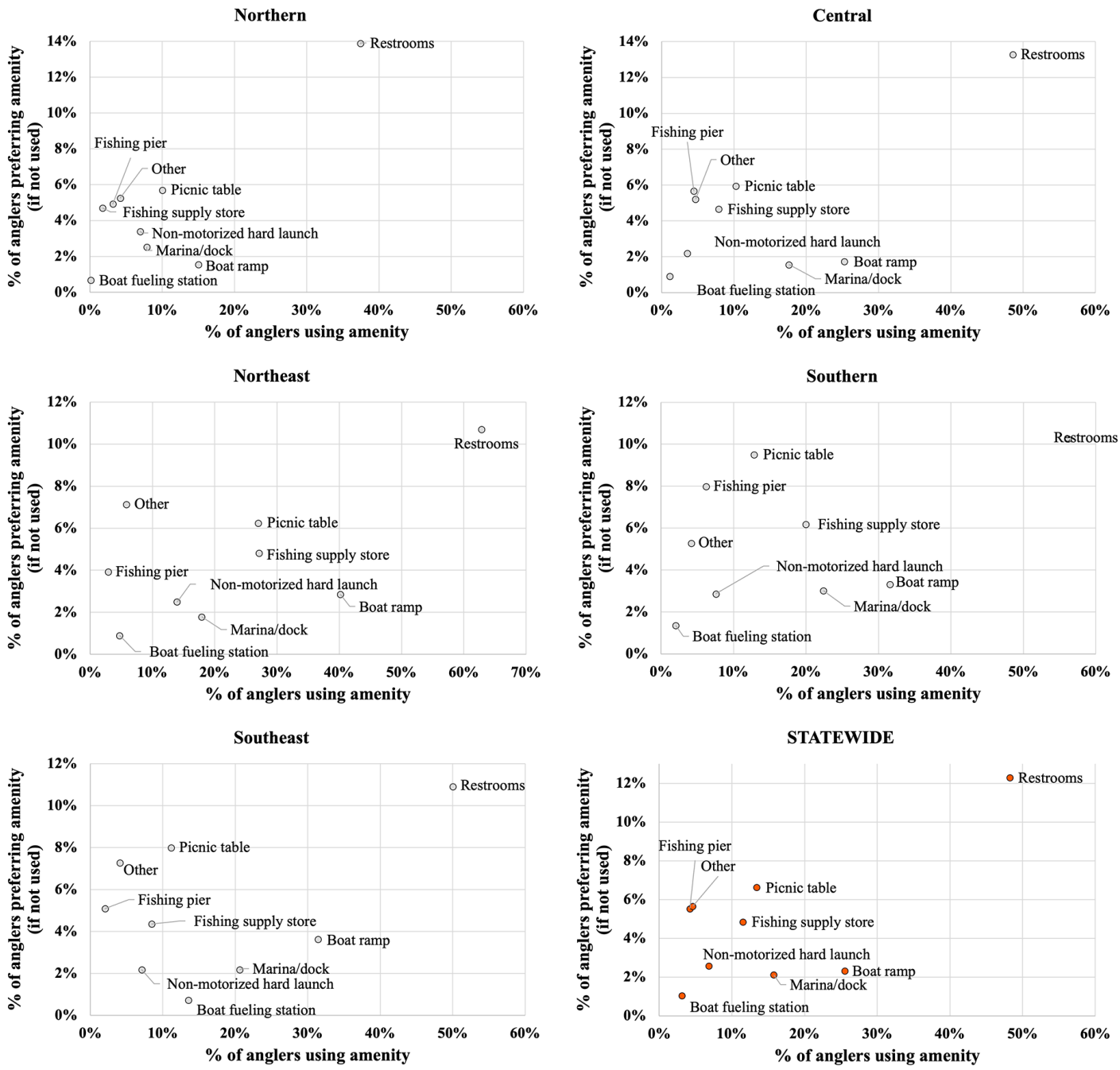

Figure 11

Proportion of Anglers Using Different On-site Amenities, by DWR Region Fished

Motivations

General Motivations for Fishing

Respondents were given a list of common motivations associated with outdoor recreation activities and asked to rate how important each of the motivations are to them while fishing. These data provide insights into the kinds of experiences anglers are seeking. The results presented in Figure 12 show what does, and does not motivate Utah anglers. The top nine motivations can collectively be described as desires to get away from crowds/people, to mentally/physically relax, and to be immersed in nature. In contrast, the eight least motivating factors can collectively be described as the desire to participate in a challenging adventure and tell others about one's abilities/experiences. These data suggest Utah anglers, by and large, are seeking opportunities to get away from people in natural settings for the purposes of mental and physical relaxation. Very few Utah anglers are motivated by showing or telling others about their fishing experience in Utah.

Preferences for Fishing-specific Opportunities in Utah

Respondents were also asked about their preferences for fishing-specific opportunities within Utah. Relative to the general motivation statements above, these statements can provide more specific insights about what anglers want from their fishing experiences within the state. The results, which are shown in Figure 13, show anglers want frequent opportunities to catch fish, find solitude, develop their skills as an angler, and to catch fish in an environment which renders them safe to eat. Anglers, by and large, do not want frequent opportunities to socialize and compete with other anglers.

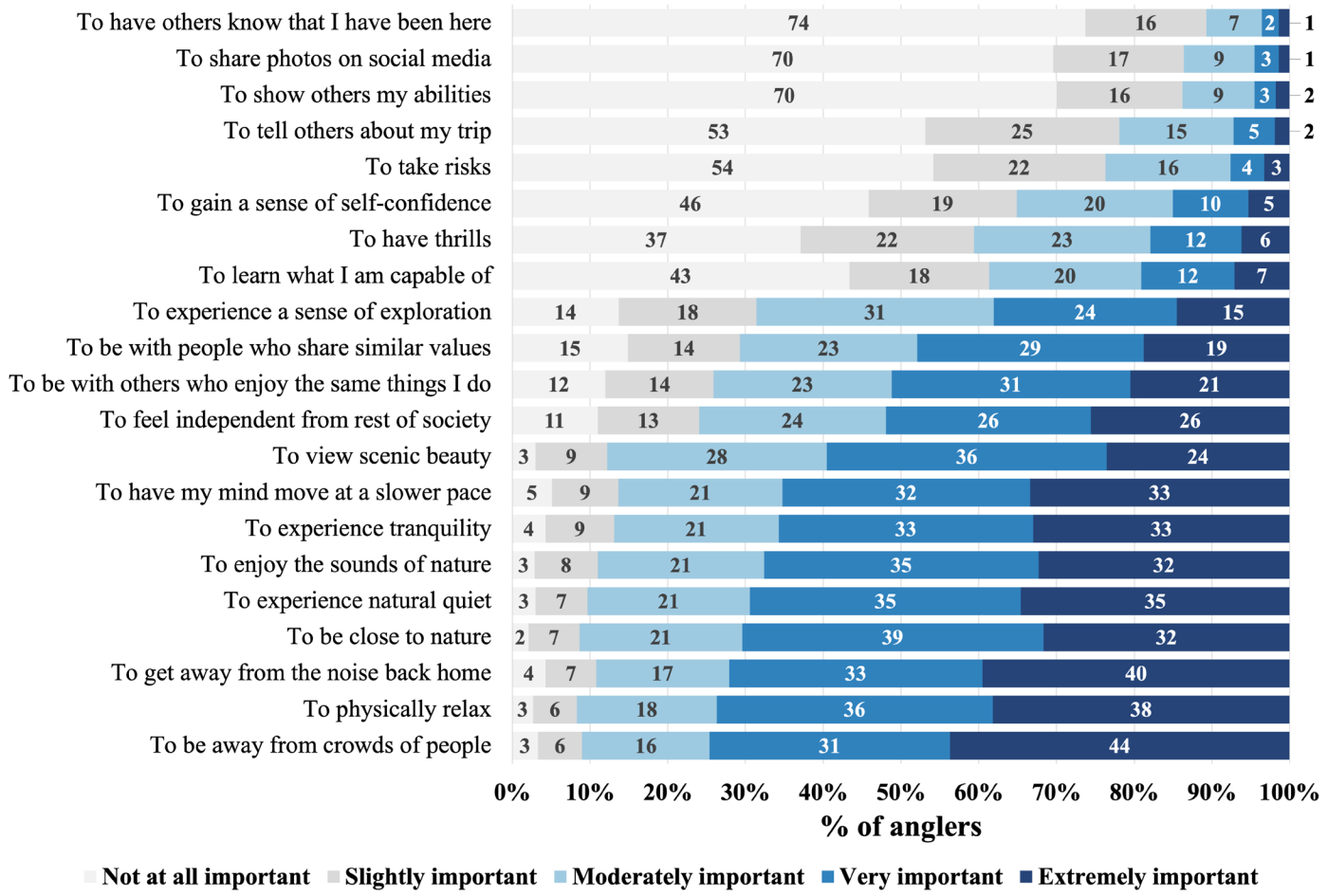

Figure 12

General Motivations for Angling in Utah

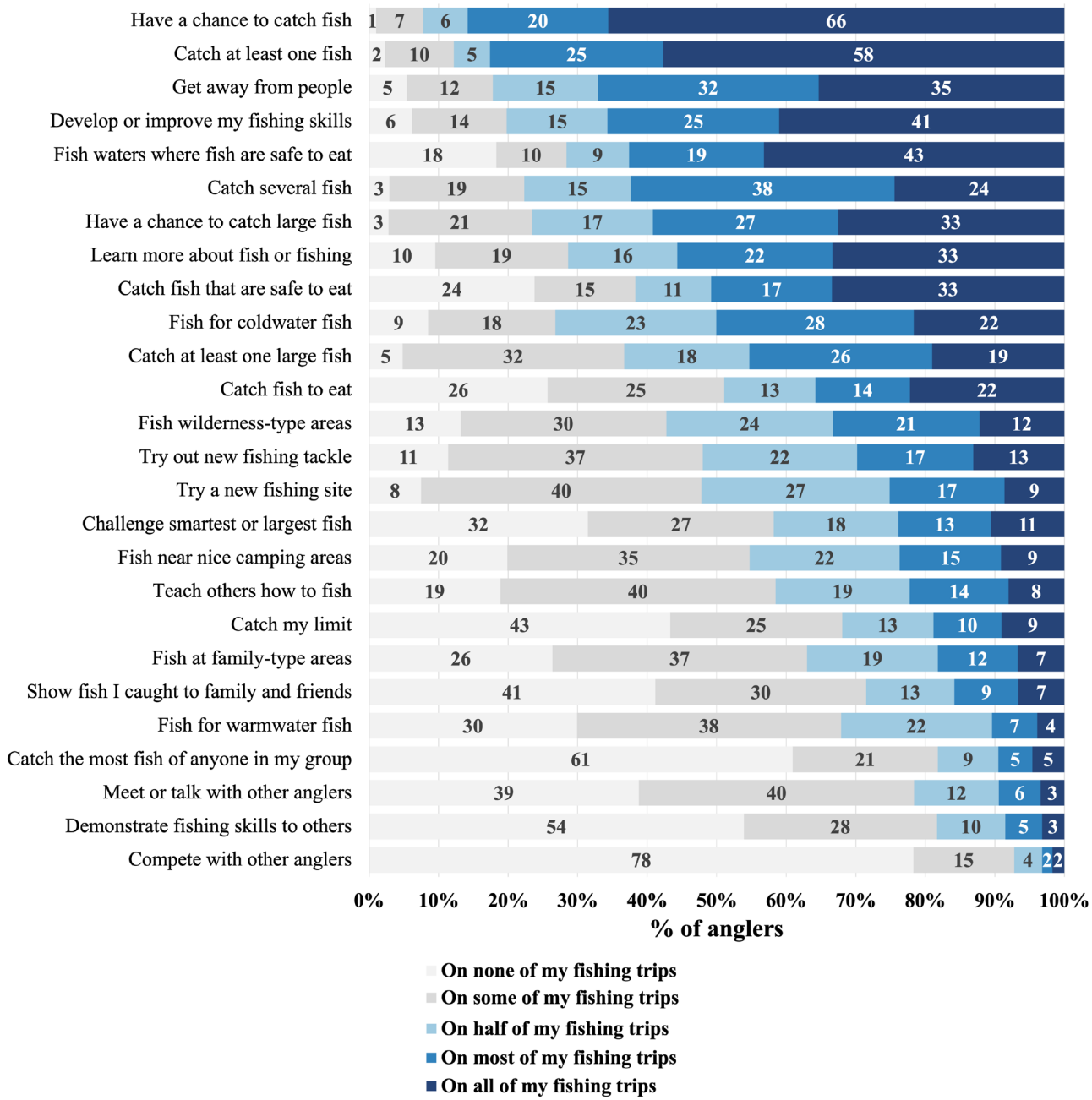

Figure 13

Anglers' Preference for Fishing-specific Opportunities in Utah

Species Preferences

Species Caught Versus Expectations

Anglers were asked which species they expected to catch on their most recent fishing trip in Utah, and what species they actually caught. The results are visualized in Figure 14 and shown in detail in Appendix C. For nearly all species and across all regions, the proportion of anglers expecting to catch a particular species outweighed the number that actually caught it. More explicitly, anglers consistently expected to catch more species than they did. Relatedly, the number of anglers who caught nothing on their last fishing trip varied between a low of 13.7% (the Northeast Region) and a high of 28.6% (the Northern Region); the statewide average was 20.8%.

Number of Fish Caught

Striped Bass were the most abundantly caught species on a per trip basis (mean number caught per trip = 12.2) (Table 13). Given trips to the Southeast region (where the majority of Striped Bass are within the state) tend to be longer, this finding may be skewed upwards for those species, which are predominantly available in this region. Yellow Perch (mean number caught per trip = 8.0) and Smallmouth Bass (7.3) were the next most abundantly caught species on a per trip basis. Poor response to this question prohibited reporting region-specific results.

Table 13

Mean Number of Each Species Caught Per Trip

Species	Mean Number Caught	Median Number Caught	Std. Dev.
Striped Bass	12.2	10	10.9
Yellow Perch	8.0	5	9.8
Smallmouth Bass	7.3	4	8.6
Bluegill/sunfish	6.5	4	7.5
Cutthroat Trout	6.3	4	7.3
Largemouth Bass	6.2	4	7.4
Brown Trout	6.0	4	6.8
Brook Trout	5.4	3	6.4
Rainbow Trout	5.3	3	5.9
Channel Catfish	4.3	3	4.2
Kokanee Salmon	4.2	3	4.9
Tiger Trout	3.9	2	4.5
Mountain Whitefish	3.6	2	3.2
Lake Trout	3.4	2	3.8

Note. n = 3,991

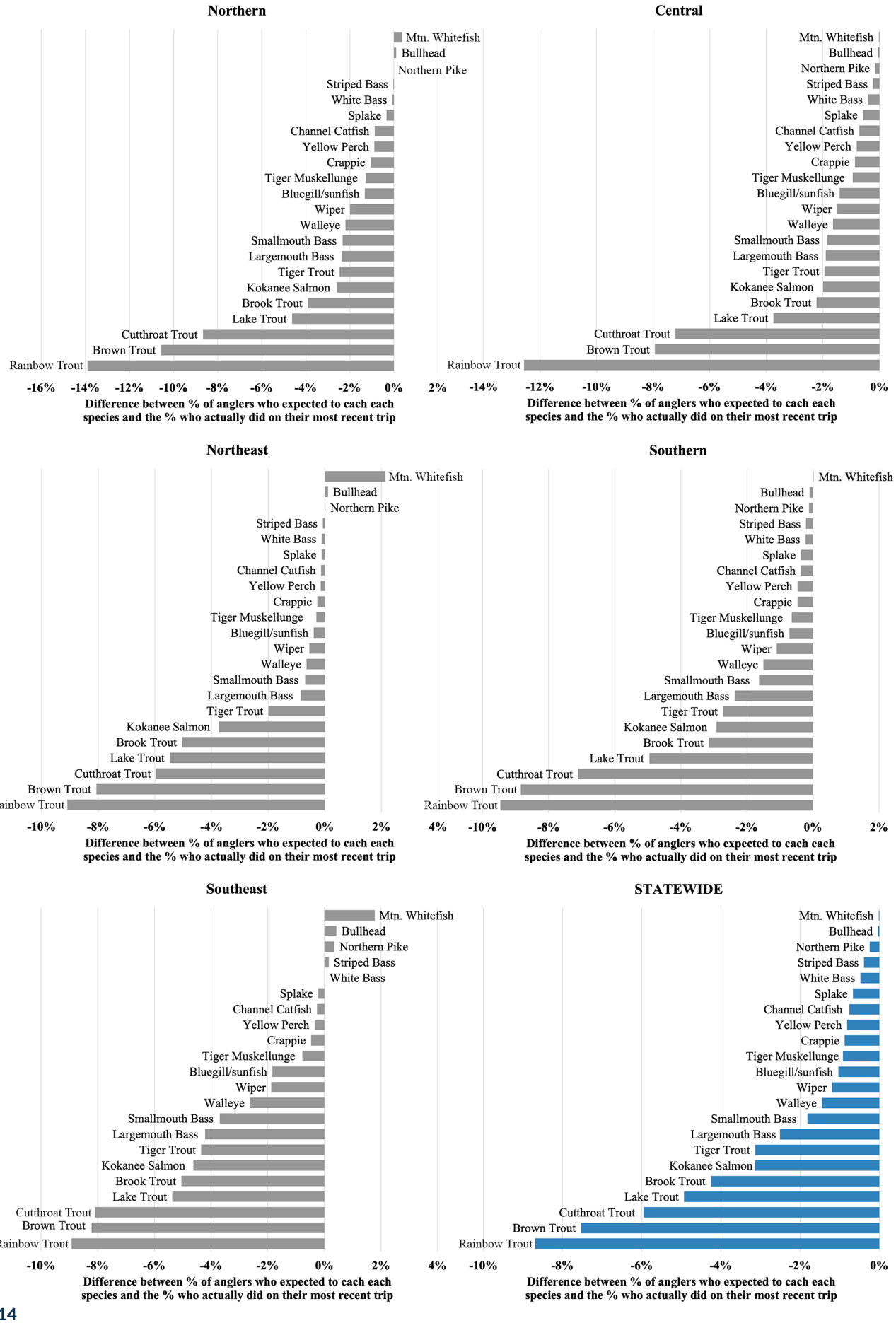

Figure 14

The Percent of Anglers Expecting to Catch Specific Species Minus the Proportion Who Actually Caught that Species, by DWR Region

Most Preferred and Targeted Species

To better understand anglers' preferences for specific species, and potentially find species for which more opportunity could be provided, anglers were asked to identify the top-3 species they prefer to pursue as well as the top-3 species they commonly pursue in Utah. These questions were prefaced by first asking anglers whether or not they had a particular species they prefer to fish for—67.7% of anglers did. Of those with species-specific preferences, Rainbow, Brown, Cutthroat, and Brook Trout were the most preferred and commonly pursued (Figure 15). For half of the species listed—identified by an asterisk on Figure 15—a greater percentage of anglers prefer to fish for the species than the percent of anglers that do. In these cases, the data suggest there is more demand for these species than opportunity.

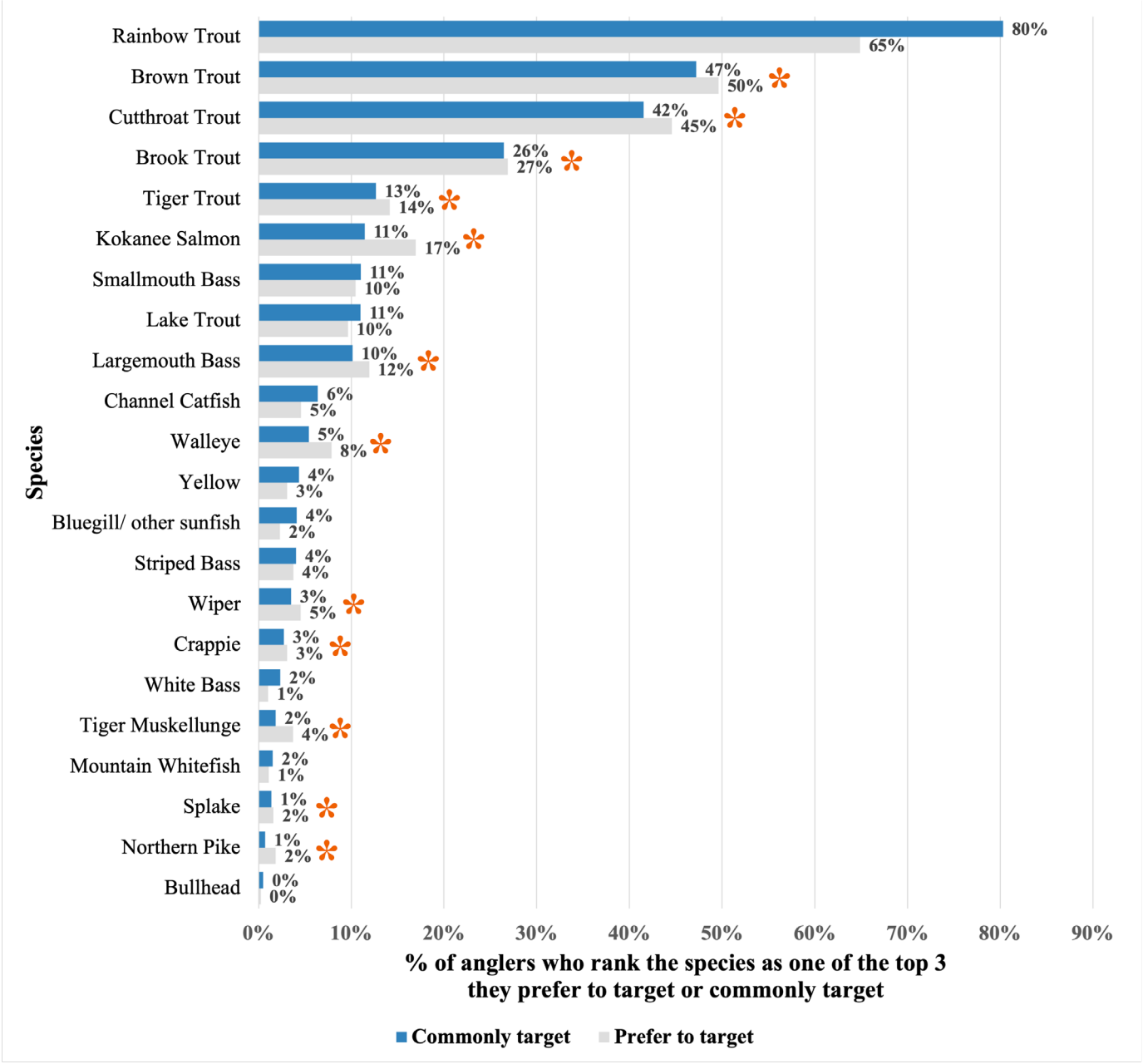

Figure 15

Comparison Between Species Targeted and Species Anglers Prefer to Target

Note. Asterisks indicate where there may be more demand than supply for a particular species.

Perceptions of Native Fish

To gauge Utah anglers' knowledge and perceptions of native fish species, they were asked a series of questions related to native fish and their management. In addition, respondents were given photos and names of fish found in Utah and asked to identify which were native. These data provide information about how Utah anglers feel about native fish and their management, and how well anglers can identify species native to Utah.

Respondents were first asked how much they agreed or disagreed with a series of statements related to native fish species in Utah (Figure 16). Overall, respondents showed high levels of agreement for each of the statements. Respondents disagreed most with the following statements: 1) I am confident in my ability to identify native fish species, 2) I support managing some fisheries so they only contain native fish, and 3) some native species are more important than others. Respondents showed the highest levels of agreement for native fish playing important roles in ecosystems, supporting the recovery of native fish that have sportfishing value, and altering management to help protect sensitive native fish. Overall, respondents showed strong support for these general statements. However, support may waver for management actions that would affect a specific fishery. More targeted questions would be needed to gauge public attitudes regarding specific decisions.

Ability to Identify Native Fish

Respondents were shown pictures of eight different fish species and asked to pick which of them were native to Utah (Figure 17). Most respondents (83.1%) correctly identified Bonneville Cutthroat as a species native to Utah (Table 14). Just over half of respondents (56.0%) also correctly identified Mountain Whitefish. Nearly half of anglers (45.1%) incorrectly identified Rainbow Trout as native to Utah.

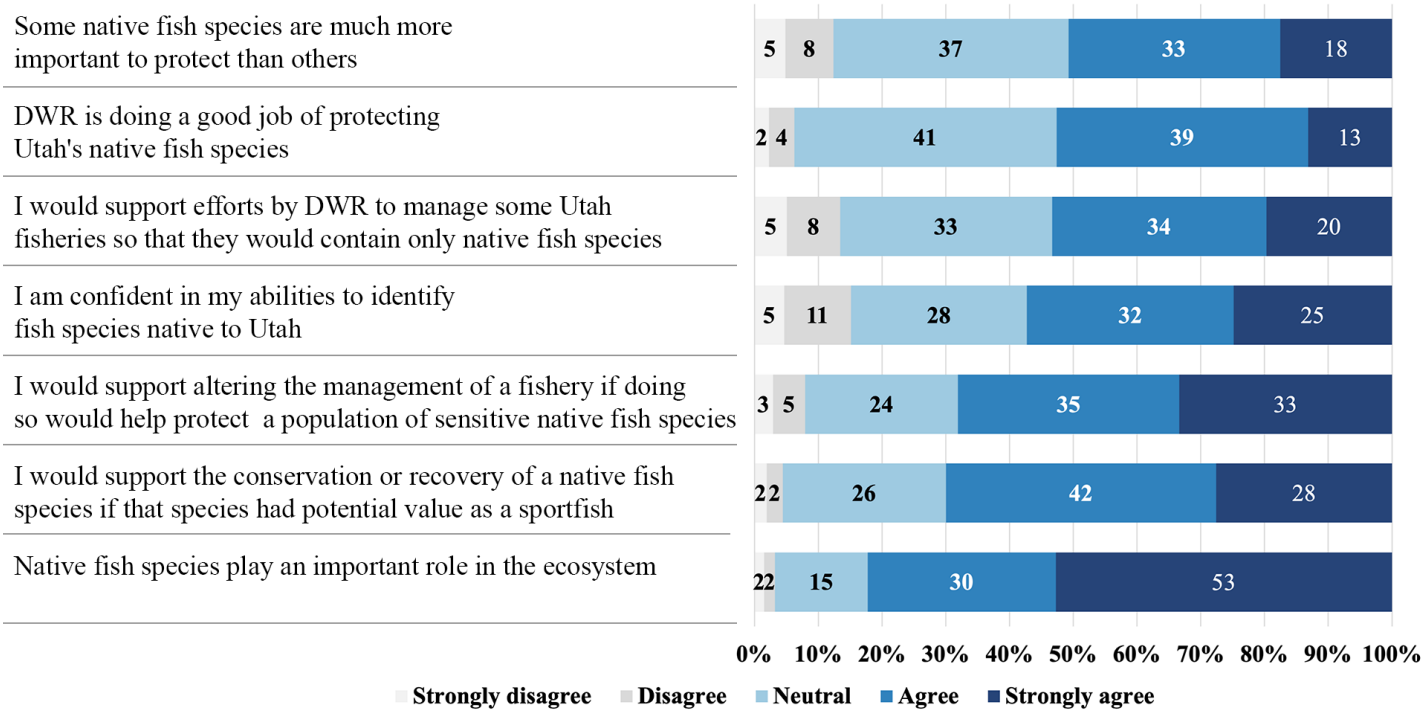

Figure 16

Anglers' Perceptions of Native Fish

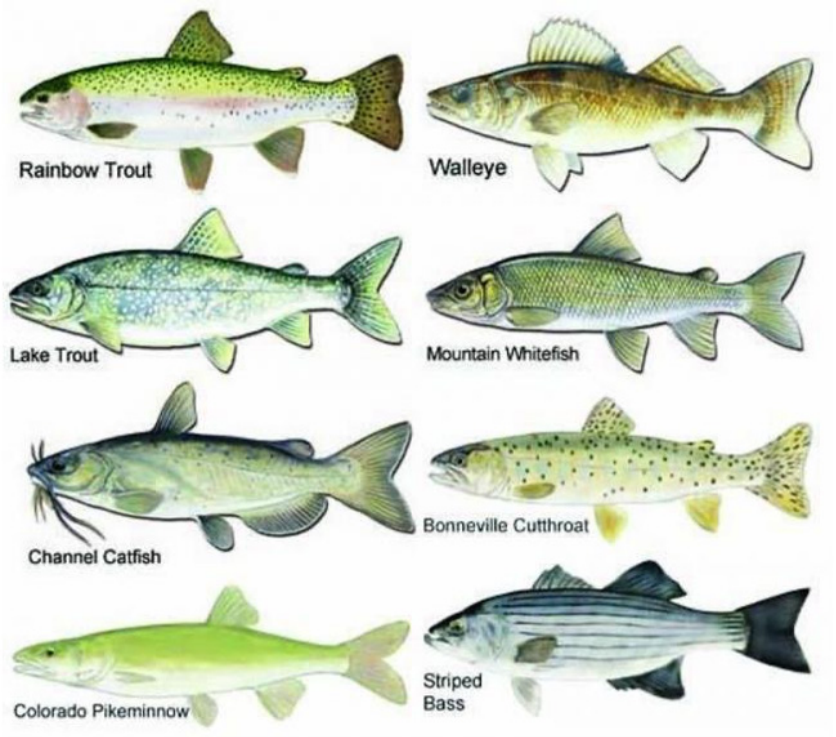

Figure 17

Image of Native and Non-native Fish Species Shown to Survey Respondents

Table 14

Proportion of Anglers Either Correctly, or Incorrectly, Identifying Specific Fish Species as Native

Species	Native/ Non-native	% of anglers identifying species as native	% of anglers identifying species as non-native
Bonneville Cutthroat	Native	83.1	16.9*
Mountain Whitefish	Native	56.0	44.0*
Colorado Pikeminnow	Native	38.7	61.3*
Rainbow Trout	Non-native	45.1*	55.0
Lake Trout	Non-native	33.9*	66.1
Channel Catfish	Non-native	24.2*	75.8
Walleye	Non-native	13.5*	86.6
Striped Bass	Non-native	10.5*	89.5

* Incorrect classifications.

Crowding

Perceptions of Crowding

Respondents were asked a series of statements to help understand how crowding affected them; results are shown in Figure 18. Overall, the effects of crowding in Utah are quite low, with over half of all respondents indicating that all four statements were "not true at all." However, when anglers were affected by crowding, the most common adaptation strategies included changing the timing and/or location of their fishing trip to avoid crowding. When asked their level of agreement with the statement "crowding negatively impacted the quality of my fishing experience", 12.8% of respondents indicated "very true" or "completely true." Given Utah anglers want to find solitude (discussed above), they are likely very sensitive to crowding. These data suggest there are still good opportunities in Utah to get away from people and find solitude while fishing.

An independent samples t-test was used to determine if resident and nonresident anglers

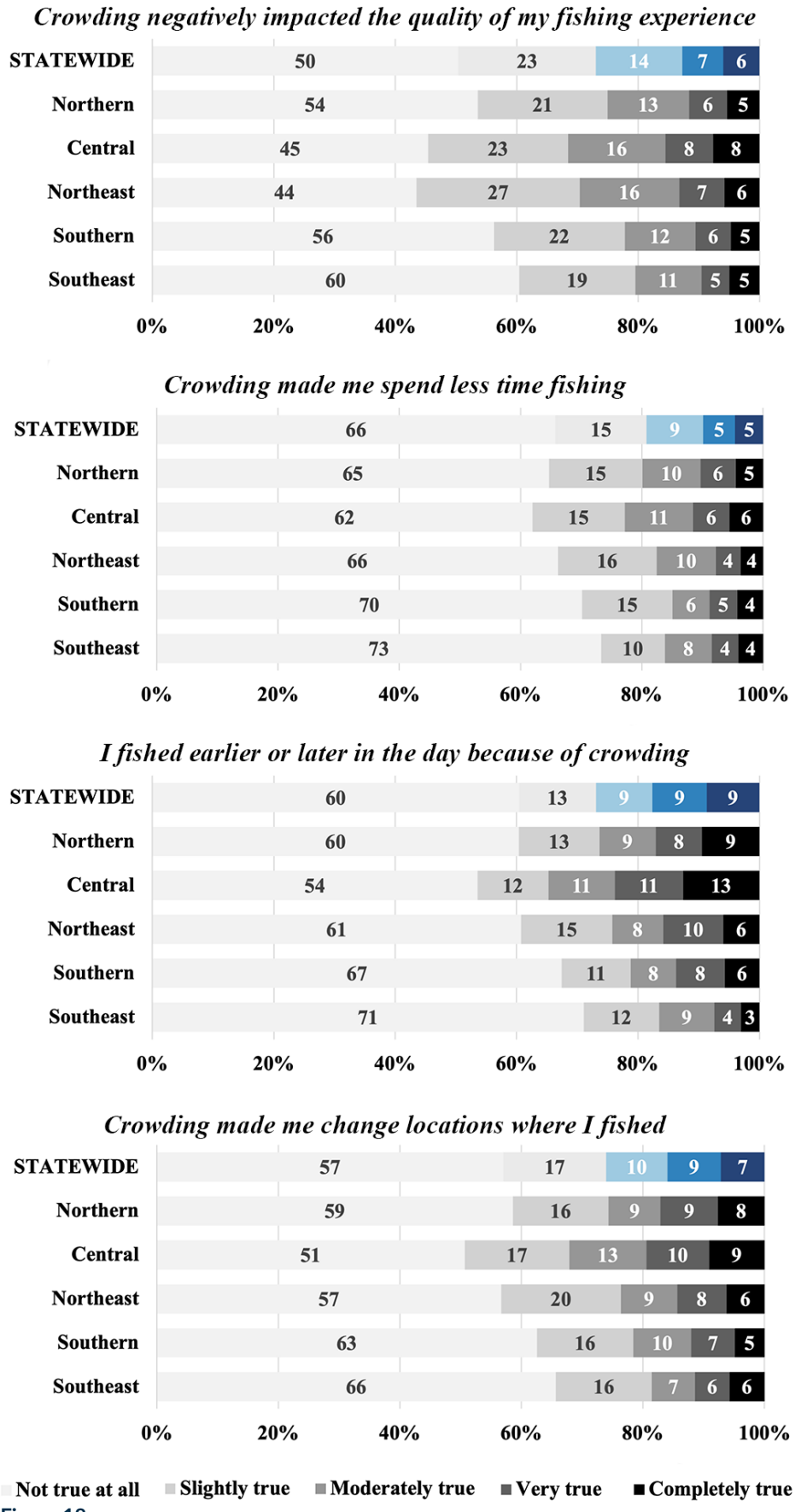

Figure 18

Anglers' Perceptions of Crowding, by Region Fished

perceive crowding differently. This was a possibility raised during initial project meetings between the research team and DWR staff. The results suggest Utah residents do perceive, and were affected by crowding more than non-residents (Table 15).

Complimentary Outdoor Recreation Activities

The DWR was interested to know more about the recreational activities Utah anglers participate in when they are not fishing. The goal was to help better understand Utah anglers and, if possible, create opportunities for Utah anglers to combine other recreational activities with fishing. To do this, respondents were asked three questions. First, to identify the three main recreational activities—excluding fishing—they participated in over the last 12 months. Second, how important those three activities are to them compared to fishing. And third, how much they would like to combine other activities with fishing, if they do not already.

Other Recreational Activities Anglers Participate In

The most common recreational activities Utah anglers participate in, besides fishing, are camping (55.8%), single-day hiking (38.3%), and big game hunting (34.3%). The proportion of anglers participating in other activities is shown in Figure 19.

Table 15

Perceptions of Crowding Between Residents and Non-residents

Statement	Utah Residents ($n \geq 3{,}602$) Mean	Utah Residents ($n \geq 3{,}602$) Std. Dev.	Non-Residents ($n \geq 823$) Mean	Non-Residents ($n \geq 823$) Std. Dev.	Sig. Diff.[†]
Crowding negatively impacted the quality of my fishing experience	2.0	1.2	1.8	1.1	< 0.001
Crowding made me spend less time fishing	1.7	1.2	1.5	1.0	< 0.001
I fished earlier or later in the day because of crowding	2.0	1.4	1.7	1.2	< 0.001
Crowding made me change locations where I fished	1.9	1.3	1.7	1.1	< 0.001

Note. Responses were measured using a 5-point Likert scale where 1 = Not at all true, 2 = Slightly true, 3 = Moderately true, 4 = Very true, 5 = Completely true.

[†]Independent samples t-tests.

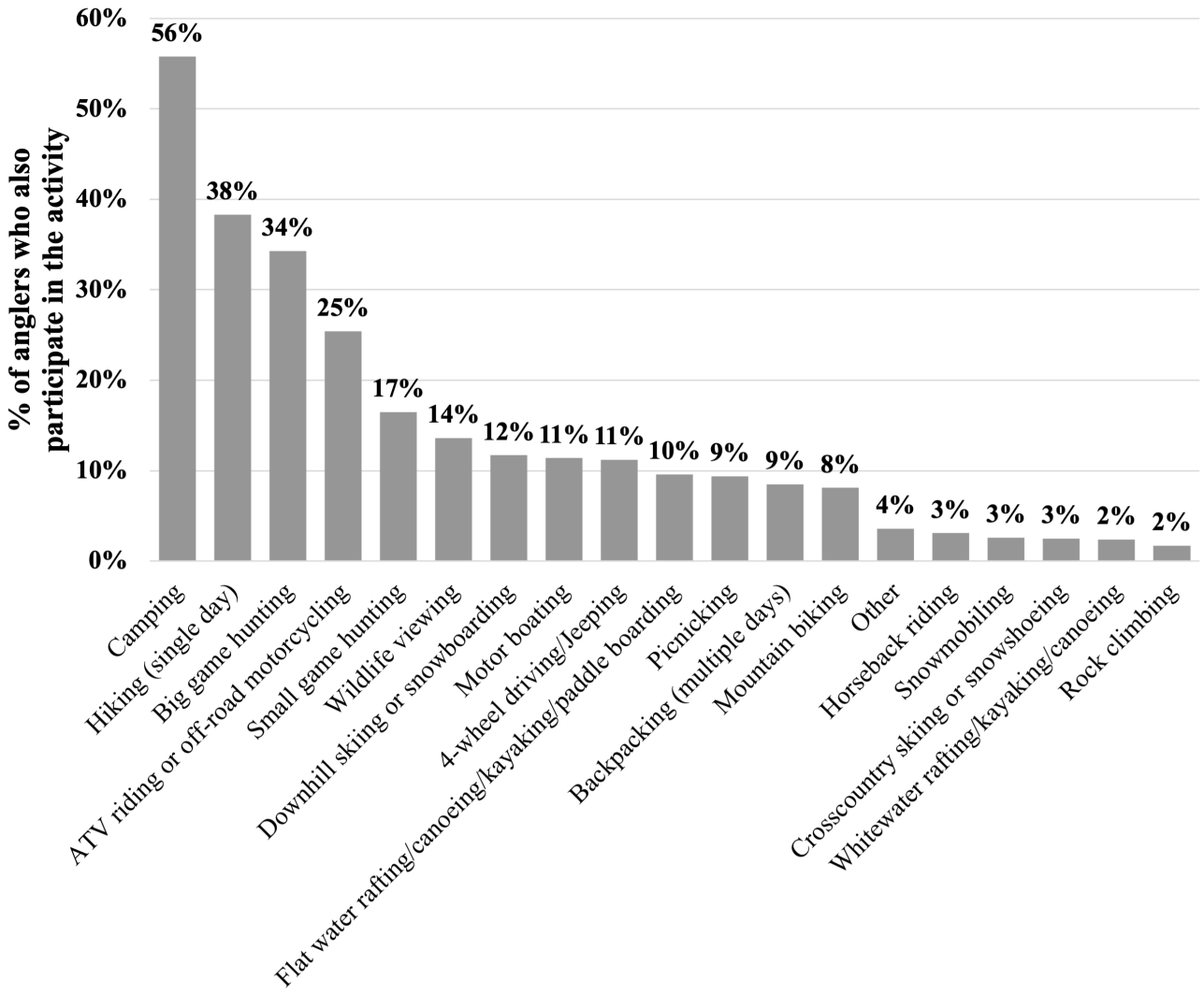

Figure 19

Other Recreational Activities Anglers Participated in Over the Past 12 Months

Importance of Other Recreational Activities Relative to Angling

Respondents were asked how important the other recreational activities they participate in are to them when compared to fishing. Activities like big game hunting, horseback riding, and downhill skiing tend to be more important to Utah anglers than fishing. Most of the activities we asked about were roughly equivalent in importance as fishing. 4-wheel driving/Jeeping, picnicking, wildlife viewing, and several other activities were reported to be less important to Utah anglers than fishing (Figure 20).

Recreational Activities Anglers Do, Or Would Like To, Dombine With Fishing

Respondents were also asked which other recreational activities they already combine with fishing. Results show more than half of anglers combine either backpacking (53.1%), camping (51.4%), or flatwater rafting/canoeing/kayaking/paddleboarding (51.1%) with fishing (Figure 21).

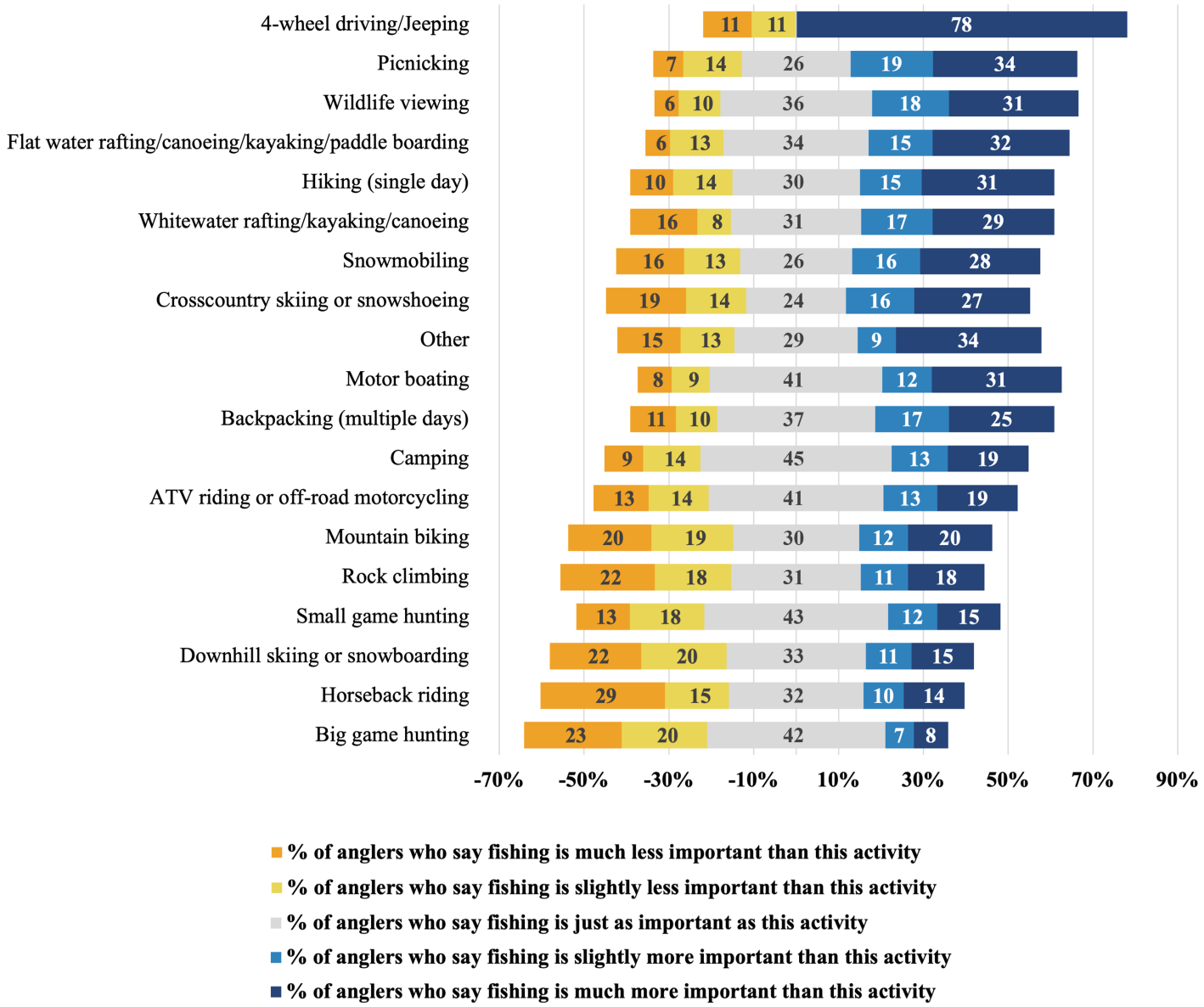

Figure 20

Importance of Other Activities Compared to Fishing

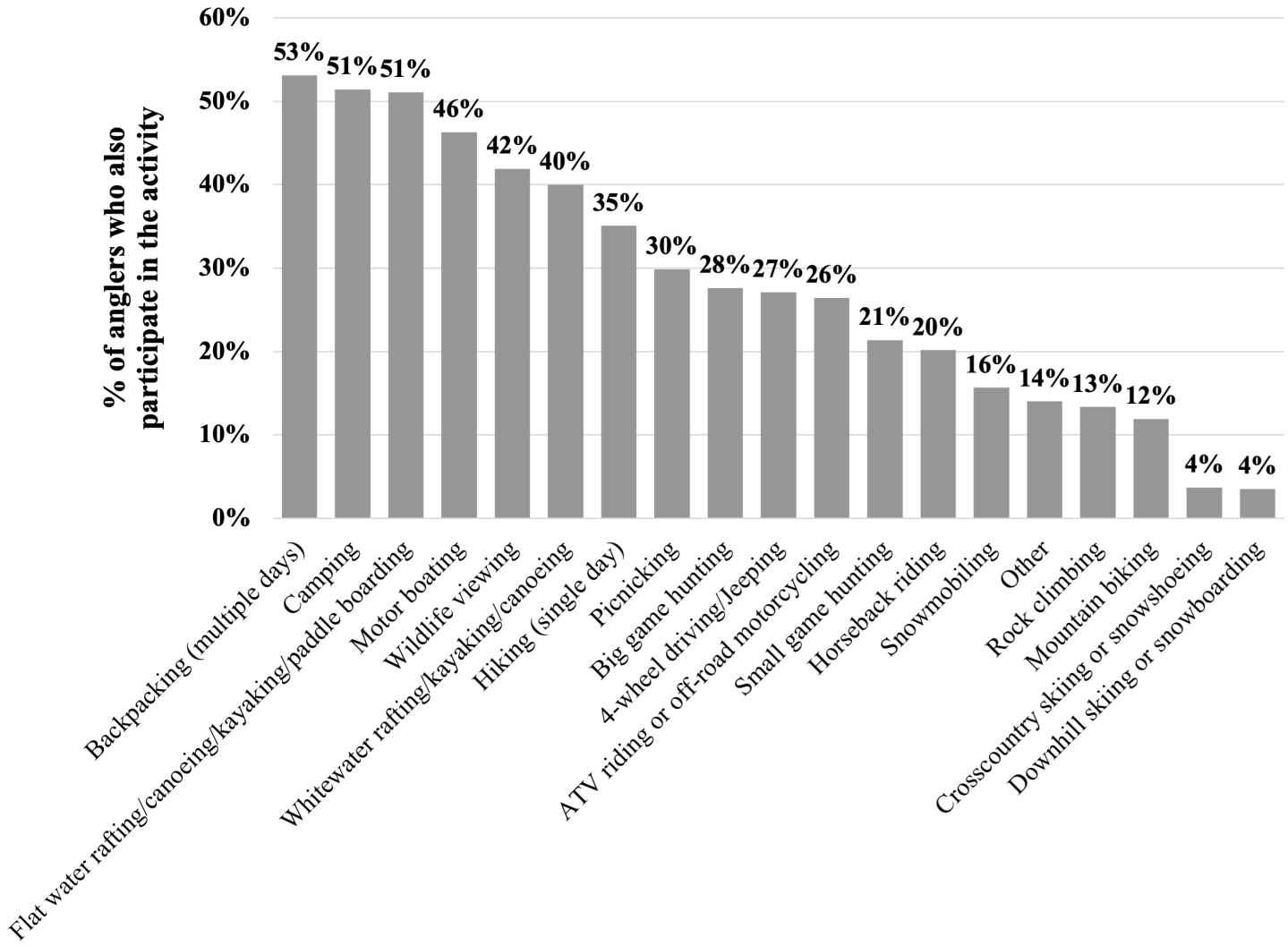

Figure 21

Activities Anglers Already Combine with Fishing

Camping and backpacking were the two most common activities Utah anglers would like to combine with fishing if they did not already (Figure 22). There was also interest in combining fishing with flatwater canoeing/kayaking/paddleboarding and motor boating. Anglers showed moderate interest in combining many activities with angling, such as wildlife viewing, off-roading, picnicking, amongst others. The activities anglers had the least interest in combining with fishing were snow sports like skiing and snowmobiling. Other activities like rock climbing and mountain biking also had low levels of interest.

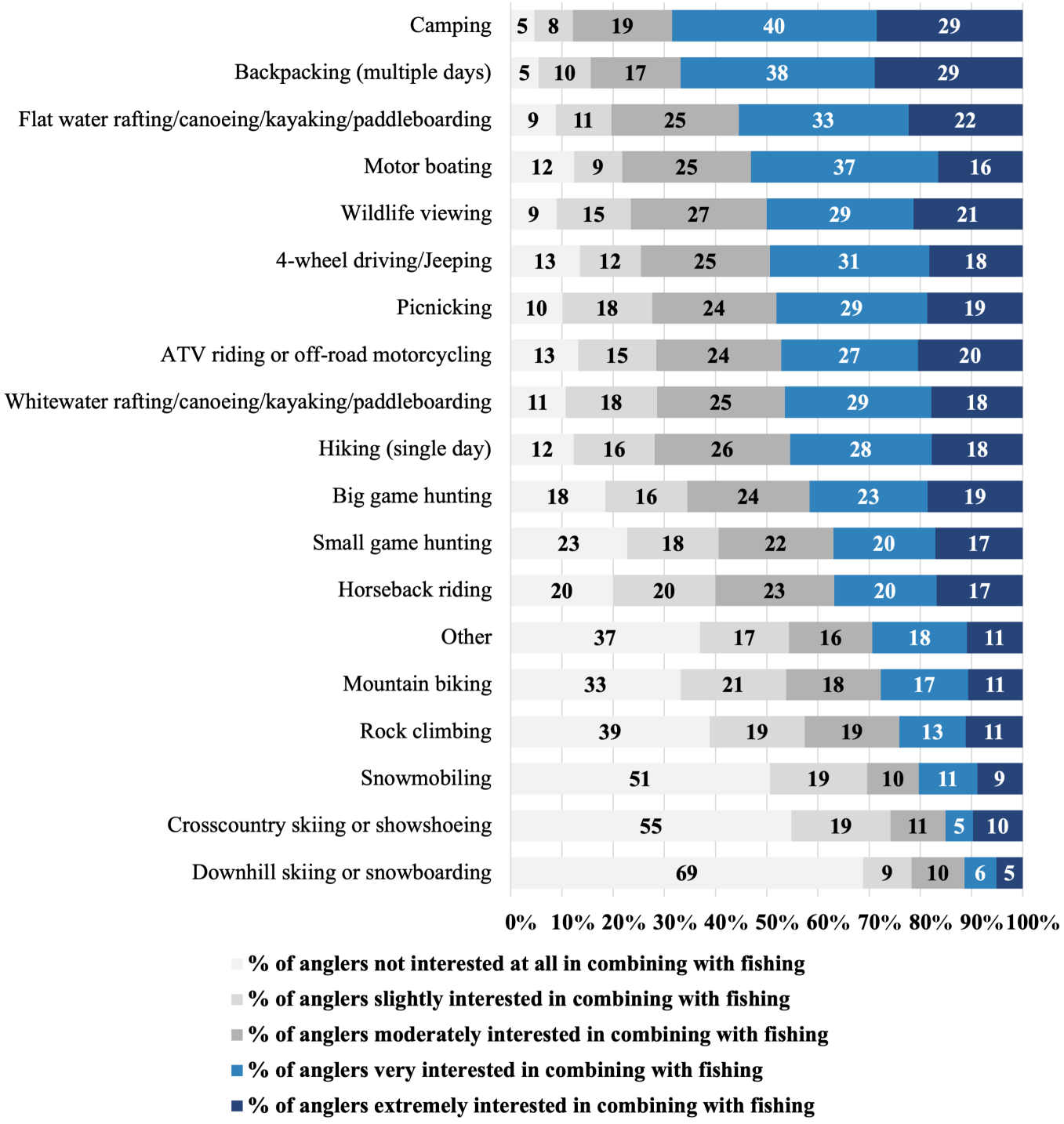

Figure 22

Other Activities Anglers Are Interested in Combination with Fishing, if They Do Not Already

Angler Classification

Exploratory Factor Analysis

Factor analysis of the activity-general statement items revealed a notable 88.5% of the variance across the 21 statement items could be captured within three underlying factors. As defined by the statement items that loaded highly on them, these general motivational factors are defined as: 1) escape/relax/ appreciate nature, 2) social, and 3) learning (Table 16). Of note, a full 53.4% of the variance in Utah anglers' general motivations to go fishing within the state are characterized by the motivation to escape, relax, and appreciate nature.

Factor analysis of the activity specific angler motivations show a full 87.7% of the variance across the 26 statement items is captured in four factors (Table 17). These motivational factors are defined as: 1) catching fish, 2) consuming fish, 3) social motivations, and 4) developing skills and trying out new places and equipment. Each of these factors explained between 20-25% of the variance in Utah anglers' fishing-specific motivations.

Table 16

Rotated Factor Scores for General Motivation Statement Items

Statement item	Factor1: Escape/Relaxation/ Appreciate Nature	Factor2: Social	Factor3: Learning
To view scenic beauty	**0.306**	0.059	0.073
To be close to nature	**0.404**	-0.003	0.107
To be with people who share similar values	0.076	0.086	0.053
To be with others who enjoy the same things I do	0.080	0.103	0.063
To get away from the noise back home	**0.623**	0.004	0.107
To enjoy the sounds of nature	**0.622**	0.049	0.094
To experience natural quiet	**0.708**	0.031	0.081
To physically relax	**0.714**	0.047	0.058
To have my mind move at a slower pace	**0.821**	0.062	0.097
To experience tranquility	**0.817**	0.048	0.099
To feel independent from rest of society	**0.650**	0.079	0.168
To be away from crowds of people	**0.619**	-0.018	0.089
To take risks	0.118	0.189	0.253
To have thrills	0.110	0.150	0.250
To experience a sense of exploration	0.319	0.095	0.320
To share photos on social media	0.040	**0.695**	0.129
To tell others about my trip	0.063	**0.777**	0.190
To have others know that I have been here	0.040	**0.749**	0.218
To gain a sense of self-confidence	0.147	0.276	**0.786**
To learn what I am capable of	0.148	0.198	**0.804**
To show others my abilities	0.034	0.542	0.423
% of Variance Explained	53.7	23.6	11.1
Cumulative Variance Explained	53.7	77.3	88.5

Note. **Bold** values indicate high (> 0.30) factor loadings that are not cross-loaded (i.e., loading highly on more than one factor).

Table 17

Rotated Factor Scores For Fishing-specific Motivation Statement Items

Statement item	Factor1: Catch	Factor2: Consume	Factor3: Social	Factor4: New skills/places/equipment
Catch at least one large fish	**0.667**	0.044	0.130	0.096
Catch several fish	**0.703**	0.070	0.139	0.104
Catch at least one fish	**0.650**	0.106	-0.004	0.177
Have a chance to catch large fish	**0.680**	0.060	0.108	0.152
Have a chance to catch fish	**0.602**	0.107	-0.012	0.245
Develop or improve my fishing skills	0.187	0.017	0.063	**0.808**
Learn more about fish or fishing	0.122	0.014	0.099	**0.828**
Try out new fishing tackle	0.154	0.077	0.253	**0.489**
Try a new fishing site	0.104	0.018	0.145	**0.351**
Teach others how to fish	0.063	0.091	**0.389**	0.158
Meet or talk with other anglers	0.038	0.098	**0.462**	0.234
Compete with other anglers	0.038	0.003	**0.622**	0.072
Catch the most fish of anyone in my group	0.196	0.028	**0.625**	0.060
Demonstrate fishing skills to others	0.057	0.072	**0.666**	0.127
Show fish I caught to family and friends	0.121	0.155	**0.561**	0.147
Catch my limit	0.291	0.456	0.347	0.014
Challenge smartest or largest fish	0.313	0.019	0.357	0.260
Catch fish that are safe to eat	0.071	**0.886**	0.046	0.029
Fish waters where fish are safe to eat	0.043	**0.826**	0.021	0.044
Catch fish to eat	0.033	**0.768**	0.033	-0.026
Fish wilderness-type areas	0.068	0.091	0.023	0.170
Get away from people	0.111	0.064	0.003	0.186
Fish for coldwater fish	0.155	0.072	0.046	0.121
Fish for warmwater fish	0.137	0.154	0.226	0.141
Fish near nice camping areas	0.046	0.183	0.085	0.062
Fish at family-type areas	0.017	0.231	0.184	0.010
% of Variance Explained	23.7	22.7	21.9	19.5
Cumulative Variance Explained	46.3	68.2	68.2	87.7

Note. **Bold** values indicate high (> 0.30) factor loadings that are not cross-loaded (i.e., loading highly on more than one factor).

Cluster Analysis

The k-means cluster analysis on the rotated and extracted factor scores suggest a five-cluster solution best differentiates the Utah anglers with regard to their general and fishing-specific motivations. The optimal cluster solution was particularly evident based upon a slight increase in the PRE coefficient with k = 5 (Appendix D). The mean factor scores for all motivation factors across the five clusters are noted in Table 18; they are also visualized in Figure 23. As would be expected, the clusters differed significantly across each of the general and fishing-specific motivations; the majority of pairwise comparisons (38 out of 50) are also statistically significant. These consistent and significant differences support the ability of the cluster analysis to meaningfully differentiate relatively unique sub-groups within the sample.

The five clusters are characterized as:

- **Cluster 1: Catch Focused anglers** – These anglers do not have any defining general motivations, but are strongly motivated by the opportunity to catch something when they fish. For example, 95.3% of these anglers said they want to "catch at least one fish" on "most" or "all" of their fishing trips within the state. Slightly more (97.8%) of these anglers said they wanted "a chance to catch fish" on "most" or "all" of their fishing trips in Utah. These individuals comprise 22.5% of the licensed anglers who fish in the state.

- **Cluster 2: Social anglers** – These anglers have strong general motivations to fish and also enjoy the social aspects while fishing. Over two-thirds (77.7%) of these anglers said it was at least "moderately important" for them to "tell others about their fishing trips." Nearly the same amount (71.4%) said they wanted the opportunity to "teach others how to fish" on "at least half" of their trips within the state. These individuals comprise 14.8% of the licensed anglers within Utah.

- **Cluster 3: Explorers** – These anglers are highly motivated to fish because it provides the opportunity to get away, physically and mentally relax, and be close to nature. These individuals also hold relatively strong motivations to learn about what they are capable of, to improve their sense of self-confidence, to develop new skills, and to experience new places and types of fishing equipment. Explorers are also more likely to want more frequent opportunities to consume the fish they catch. Of all five clusters, these anglers are the least likely to be motivated for social reasons or the social aspect of fishing. Explorers comprise nearly a quarter (24.7%) of Utah's anglers.

Table 18

Differences in Mean Rotated Factor Scores for General and Activity-specific Fishing Motivations, by Angler Cluster

	Cluster						
Motivation	**Catch Focused** (*n = 835*)	**Social** (*n = 548*)	**Explorers** (*n = 915*)	**Catch & Consume** (*n = 836*)	**Ambivalent** (*n = 569*)	***F*-value**	***p > F***
General							
Escape/relax/ appreciate nature	0.00	0.16	0.49	-0.44	-0.25	146.9	< 0.001
Social	-0.22[a]	1.37	-0.41	-0.19[a]	-0.14[a]	770.3	< 0.001
Learning	-0.13[a]	0.57	0.37	-0.47	-0.23[a]	215.1	< 0.001
Activity-specific							
Catch	0.50	0.06[a]	0.02[a]	0.36	-0.41	777.4	< 0.001
Consume	-1.13	0.16	0.59[a]	0.65[a]	-0.17	1,297.4	< 0.001
Social	-0.19[a]	1.27	-0.28[a,b]	-0.21[a,b,c]	-0.49[a,c]	570.2	< 0.001
New skills/ places/ equipment	0.20[a]	0.28[a]	0.65	-0.74	-0.25	553.6	< 0.001

Note. Values with similar superscripts in the same row are not significantly different at $p \leq 0.05$ based on Tukey's HSD post-hoc tests.

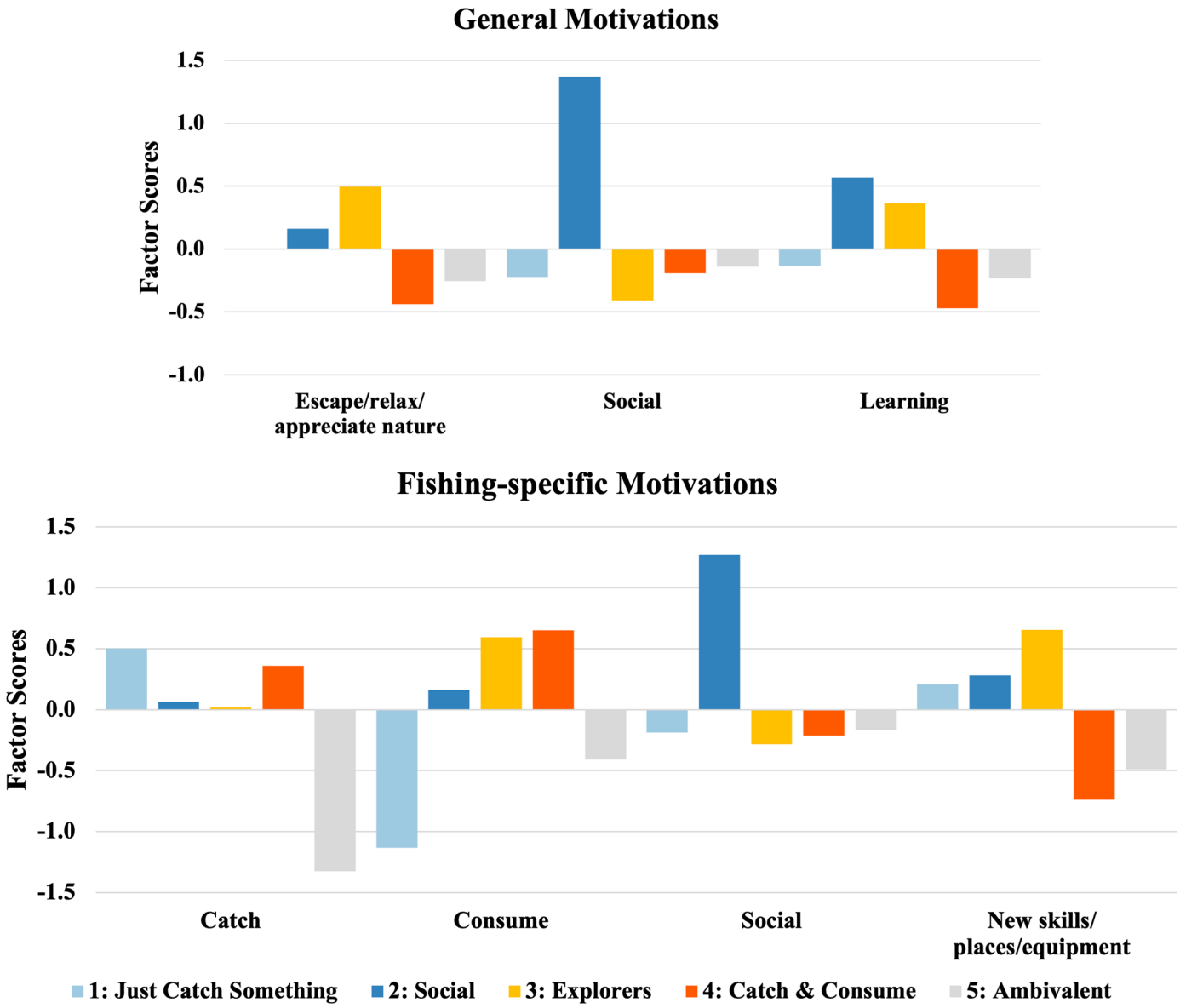

Figure 23

Factor Scores for Angler Clusters

- **Cluster 4: Catch & Consume anglers** – Anglers characterized as catch & consume hold strong motivations to catch fish, second only to the Catch Focused cluster. Most notably, these anglers hold the strongest desire to have frequent opportunities to catch fish to eat. Over three-fourths (76.7%) of these anglers indicated they want the opportunity to "catch fish to eat" on at least half of their fishing trips within the state. These anglers also have the weakest motivations to develop new skills, experience new places, try new equipment, and learn new things. A full 22.6% of the state's anglers fall into the catch & consume cluster.

- **Cluster 5: Ambivalent anglers** – The final cluster identified is best characterized as ambivalent. These anglers tended to hold moderate motivations for most of those identified (i.e., not notably high or low relative to the other clusters). The two exceptions being that ambivalent anglers hold notably weak catch-related motivations;

they also hold the weakest motivations for opportunities to catch fish they can consume. These anglers are relatively non-distinct, and may possibly be incidental anglers (i.e., those who have purchased a license to fish with someone else who has stronger or more specific motivations). These individuals comprise 15.4% of licensed anglers within the state.

Differences in Access and Fishing Methods Used

The five different angler clusters differ significantly in the access methods they use to fish (Table 19). Catch Focused anglers fish significantly more by both wading in streams and rivers (mean = 8.1 times per year) and fishing from a boat on a river or stream (mean = 1.2 times per year) than any of the other clusters. Social anglers, by comparison, fish significantly more frequently from a boat on a lake or reservoir (mean = 5.8 times per year) relative to the other angler clusters. All pair-wise significant differences are noted in Table 19. As mentioned above, an oversight resulted in the category "fish from shore of a lake or reservoir" to be excluded as a response. Fishing from shore on a lake or reservoir is a primary access method for Utah anglers as indicated in past surveys (Lilieholm et al., 2017) and other questions asked in this survey effort.

Angler clusters also differed significantly in their fishing methods (Table 20). Bait is used by the majority of angler clusters, with the exception of Catch Focused anglers. These individuals tend to use artificial flies, with a large majority (76.2%) indicating they have used the method in the past year.

Differences in Types of Waterbodies Preferred

The five distinct angler clusters also exhibited significant differences in the types of waterbodies they fish (Table 21). Social anglers fish significantly more often at large lakes and reservoirs (mean = 7.0 times per year) than any other cluster. Additionally, Catch Focused anglers fish significantly more often at large and moderately-sized rivers (means = 3.8 and 3.4 times per year, respectively). Of note, none of the clusters fish very often at community fishing ponds (mean < 2.0 times per year).

Table 19

Mean Number of Times Anglers Used Different Access Methods Within the Past 12 Months, by Angler Clusters

	Angler cluster						
Access method	Catch Focused (n = 835)	Social (n = 548)	Explorers (n = 915)	Catch & Consume (n = 836)	Ambivalent (n = 569)	F-value	$p > F$
Wading in a stream or river	8.1	$3.5^{a,b}$	$4.0^{a,c}$	$1.8^{b,d}$	$2.8^{b,c,d}$	29.59	< 0.001
From a boat on a lake or reservoir	4.3^{a}	5.8	$2.9^{b,c}$	$3.7^{a,b}$	1.8^{c}	14.78	< 0.001
From a boat on a stream or river	1.2	0.5^{a}	0.3^{a}	0.4^{a}	0.3^{a}	10.35	< 0.001
Ice fishing	1.1^{a}	1.7^{b}	$1.3^{a,b,c}$	$0.9^{a,c}$	$0.7^{a,c}$	5.13	< 0.001
From shore or a fishing pier/dock on a lake or reservoir	4.1^{a}	6.4^{b}	$5.0^{a,b,c}$	$4.8^{a,c,d}$	$4.1^{a,c,d}$	4.88	< 0.001
Wading in a lake or reservoir	1.1^{a}	$0.9^{a,b}$	$0.9^{a,c}$	$0.5^{b,c,d}$	$0.6^{a,d}$	3.23	< 0.050

Note. Values with similar superscripts in the same row are not significantly different at $p \leq 0.05$ based on Tukey's HSD post-hoc tests.

Table 20

Types of Fishing Methods Used, by Angler Cluster

	Angler cluster						
Fishing method	Catch Focused (n = 835)	Social (n = 548)	Explorers (n = 915)	Catch & Consume (n = 836)	Ambivalent (n = 569)	Wald χ^2 (4)	$p < \chi^2$
Bait	$37.7^{(-)}$	$67.7^{(+)}$	$70.4^{(+)}$	$76.9^{(+)}$	65.9	328.2	< 0.001
Artificial flies	$76.2^{(+)}$	$49.3^{(-)}$	59.3	$42.9^{(-)}$	54.3	96.9	< 0.001
Artificial lures	$51.9^{(-)}$	67.7	$70.8^{(+)}$	$71.7^{(+)}$	62.2	209.8	< 0.001
Ice fishing	$18.6^{(-)}$	$29.4^{(+)}$	23.5	23.0	$17.6^{(-)}$	31.0	< 0.001
Other	2.2	2.7	2.8	2.0	2.6	1.8	0.779

Note. Values are the percent of anglers in each cluster who indicated they have used the method in the past 12-months. + and – signs indicate adjusted residuals for the cell are significantly higher or lower than expected at $p < 0.05$.

Table 21

Mean Number of Times Anglers Fished on Different Waterbodies Within the Past 12 Months, by Angler Cluster

	Angler cluster						
Waterbody type	Catch Focused ($n \geq 835$)	Social ($n \geq 548$)	Explorers ($n \geq 915$)	Catch & Consume ($n \geq 836$)	Ambivalent ($n \geq 569$)	*F*-value	$p > F$
Large lakes or reservoirs	4.5[a]	7.0	4.1[a,b]	4.5[a]	2.6[b]	8.89	< 0.001
Smaller lakes or reservoirs	3.5[a]	3.9[a]	3.5[a]	2.8[a,b]	2.2[b]	4.77	< 0.001
Large rivers	3.8	1.9[a]	1.8[a]	1.0[a]	1.4[a]	18.26	< 0.001
Moderately-sized streams	3.4	1.9[a]	1.9[a]	1.1[a]	1.2[a]	13.85	< 0.001
Small streams	2.5[a]	1.2[b]	1.8[a,b]	1.0[b]	1.2[b]	7.02	< 0.001
Community fishing ponds	1.3[a,b,c]	2.0[a]	1.1[b]	0.9[c]	0.8[c]	4.01	0.003

Data on waterbody preferences also suggest significant differences across the five angler clusters (Table 22). Catch Focused anglers have the strongest preferences for large and moderate rivers, as well as small streams. Social anglers tend to prefer large lakes and reservoirs, with 43.4% of these anglers saying they prefer this type of waterbody over all others. Lakes and reservoirs, regardless of size, are also heavily preferred by Catch & Consume anglers; nearly three-fourths (74.8%) of these anglers said they most prefer lakes and reservoirs over all other waterbody types.

Most Preferred and Targeted Species

Angler clusters also have notably different species preferences (Table 23). Catch Focused anglers have strong preferences for Brown and Cutthroat Trout; a significantly larger proportion of these anglers prefer the species than any other cluster. Kokanee Salmon tend to be more preferred by Social anglers, Explorers, and Catch & Consume anglers relative to the other two angler clusters. Similarly, Lake Trout are most preferred by anglers with Social and Catch & Consume motivations; 13.2% of anglers in both these clusters listed the species as one of the top-3 they prefer to target while fishing in Utah. While the differences in the proportion of anglers who prefer warmwater species (e.g., Largemouth and Smallmouth Bass specifically) were statistically significant, they do not appear to be substantial (< 6.7% difference across any pair of clusters).

Interest in Combining Other Activities with Fishing

The differences in motivations that define angler clusters also appear to be related to the other activities they would prefer to pair with fishing (Table 24). Social anglers indicated very strong preferences for pairing fishing with other activities that are also highly social such as camping, hiking, ATV riding, and motor boating. These individuals also exhibited notably low preferences for pairing fishing with backpacking, which is often pursued in

Table 22

Types of Waterbodies Preferred, by Angler Cluster

	Angler cluster				
Waterbody type	Catch Focused (n = 830)	Social (n = 544)	Explorers (n = 913)	Catch & Consume (n = 828)	Ambivalent (n = 560)
Large lakes or reservoirs	20.1[(-)]	43.4[(+)]	31.2	42.3[(+)]	25.2[(-)]
Smaller lakes or reservoirs	18.1[(-)]	24.8	28.7	32.5[(+)]	30.5[(+)]
Large rivers	23.0[(+)]	12.0	9.5[(-)]	5.0[(-)]	8.4[(-)]
Moderately-sized streams	23.6[(+)]	12.1[(-)]	17.1	9.9[(-)]	17.7
Small streams	13.7[(+)]	5.2[(-)]	12.1	8.2	13.9[(+)]
Community fishing ponds	1.5[(-)]	2.6	1.4	2.2	4.3[(+)]

Note. Values are the percent of anglers in each cluster who indicated they prefer that type of waterbody over all others. Wald $\chi^2(20) = 369.07$, $p < 0.001$. + and – signs indicate adjusted residuals for the cell are significantly higher or lower than expected at $p < 0.05$.

Table 23

Species Preferences, by Angler Cluster

	Angler cluster						
Species	**Catch Focused** (*n* = 637)	**Social** (*n* = 363)	**Explorers** (*n* = 635)	**Catch & Consume** (*n* = 575)	**Ambivalent** (*n* = 286)	***F*-value**	***p* > *F***
Brown Trout	67.5	45.7[a]	43.6[a]	37.4[a]	52.4[a]	42.87	< 0.001
Kokanee Salmon	6.6[a]	25.9[b]	21.3[b]	21.4[b]	12.9[a]	21.09	< 0.001
Cutthroat Trout	52.0	33.3[a]	45.4[b]	41.2[a,b]	48.6[a]	16.15	< 0.001
Lake Trout	5.2[a]	13.2[b]	9.1[a,b]	13.2[b]	7.3[a]	7.71	< 0.001
Largemouth Bass	13.5[a]	16.5[a]	12.1[a,b]	9.2[b,c]	7.3[c]	7.58	< 0.001
Smallmouth Bass	12.6[a]	12.4[a,b]	11.3[a,c]	8.5[b,c,d]	5.9[d]	6.58	< 0.001
Rainbow Trout	63.1[a]	63.4[a,b]	63.1[a]	67.0[a]	69.9[b]	6.58	< 0.001
Brook Trout	25.6[a]	18.2[b]	26.9[a,c]	30.1[a,c]	32.9[a,b,c]	4.95	< 0.001
Wiper	3.6[a,b]	7.4[a,c]	3.3[b,d]	6.3[b,d]	2.4[b]	4.82	< 0.001
Yellow Perch	1.1[a]	3.0[a,b,c]	4.9[b]	4.2[a,b]	2.1[a,c]	4.77	< 0.001
Walleye	4.4[a]	8.8[a,b]	9.9[b]	9.9[b]	7.0[a]	4.58	0.001
Bluegill/other sunfish	0.8[a]	2.2[a,b,c]	3.6[b]	3.0[a,b]	1.4[a,c]	3.66	0.006
Mountain Whitefish	1.6[a]	0.3[a]	1.7[a]	0.3[a]	1.4[a]	2.50	0.041
Splake	1.4	2.5	0.8	2.6	1.0	2.36	0.051
Channel Catfish	2.7	5.5	5.5	5.7	4.2	2.24	0.062
Striped Bass	2.2	5.0	3.6	5.0	3.1	2.22	0.065
Tiger Muskellunge	4.7	3.9	3.9	3.0	2.4	2.19	0.067
White Bass	0.5	1.1	0.5	1.9	1.0	2.13	0.075
Northern Pike	2.2	2.8	1.4	1.0	2.4	1.29	0.270
Tiger Trout	12.9	14.0	15.9	13.4	15.4	1.18	0.318
Crappie	2.2	3.9	3.5	3.5	2.4	1.04	0.384
Bullhead	0.2	0.3	0.2	0.2	0.0	0.23	0.922

Note. Values are the percent of anglers who ranked that species as one of the top-3 they prefer to target in Utah. Values with similar superscripts in the same row are not significantly different at $p \leq 0.05$ based on Tukey's HSD post-hoc tests.

Table 24

Interest in Combining Other Activities with Fishing, by Angler Cluster

	Angler cluster						
Species	Catch Focused (n = 217)	Social (n = 142)	Explorers (n = 220)	Catch & Consume (n = 218)	Ambivalent (n = 181)	Wald χ^2 (4)	$p < \chi^2$
Camping	65.1	76.8(+)	80.5(+)	65.2	58.0(-)	30.4	< 0.001
Hiking (single day)	47.9	52.5	58.3(+)	36.6(-)	36.1(-)	27.0	< 0.001
Big game hunting	40.3	53.9(+)	46.3	32.6(-)	39.6	17.6	0.001
ATV riding or off-road motorcycling	42.4	55.7(+)	54.5(+)	41.8	40.5	11.3	0.023
Wildlife viewing	37.9(-)	67.3(+)	58.1	45.9	51.1	11.0	0.027
Picnicking	27.9	48.5	46.7	53.4	56.6	9.2	0.056
Backpacking (multiple days)	80.0	43.5(-)	73.3	72.2	65.4	8.5	0.075
Motor boating	40.0(-)	52.2	70.0(+)	58.3	50.0	6.5	0.165
Small game hunting	32.3	50.0	36.9	33.3	37.3	6.2	0.185
Downhill skiing or snowshoeing	16.2	11.4	11.9	14.5	3.4	6.0	0.198
Rock climbing	8.3	33.3	41.7	33.3	14.3	4.4	0.360
Flat water rafting/canoeing/kayaking/paddleboarding	53.8	61.5	62.2	60.0	41.2(-)	4.1	0.391
Horseback riding	53.8	25.0	42.9	40.0	27.8	3.2	0.521
4-wheel driving/Jeeping	52.7	39.0	50.7	48.3	44.4	2.3	0.690
Whitewater rafting/canoeing/kayaking/paddleboarding	50.0	62.5	55.6	55.6	30.0	2.3	0.677
Mountain biking	29.7	33.3	33.3	23.5	24.3	2.1	0.713
Crosscountry skiing or snowshoeing	23.3	28.6	10.5	13.3	14.3	2.1	0.714
Snowmobiling	11.8	23.1	20.0	26.3	28.6	1.5	0.831

Note. Values are the percent of anglers who indicated they are "very" or "extremely" interested in combining the activity with fishing. + and – signs indicate adjusted residuals for the cell are significantly higher or lower than expected at $p < 0.05$.

small groups. Explorers also had significantly strong preferences for pairing fishing with camping, hiking, ATV riding, and motor boating. Catch Focused, Catch & Consume, and Ambivalent anglers did not exhibit any notable activity preference relative to the other two clusters.

Geographic Distribution of Angler Clusters Across Utah

To see if there were geographic differences in where each of the angler clusters fished on their most recent trip, we mapped them across the state (Figure 24). Given the differences in preferences and behaviors identified above, we assumed anglers would select fishing locations that would match their unique characteristics. However, the analysis revealed very little geographic difference between each of the clusters at the statewide scale, which indicates that anglers of a specific classification are not concentrated in any one region.

Discussion

In the face of diminishing resources and increased demand from anglers, the state of Utah is looking for biologically feasible, economical, and publicly supported solutions to address the angling supply and demand mismatch. This study was conducted to gather information about Utah anglers to help

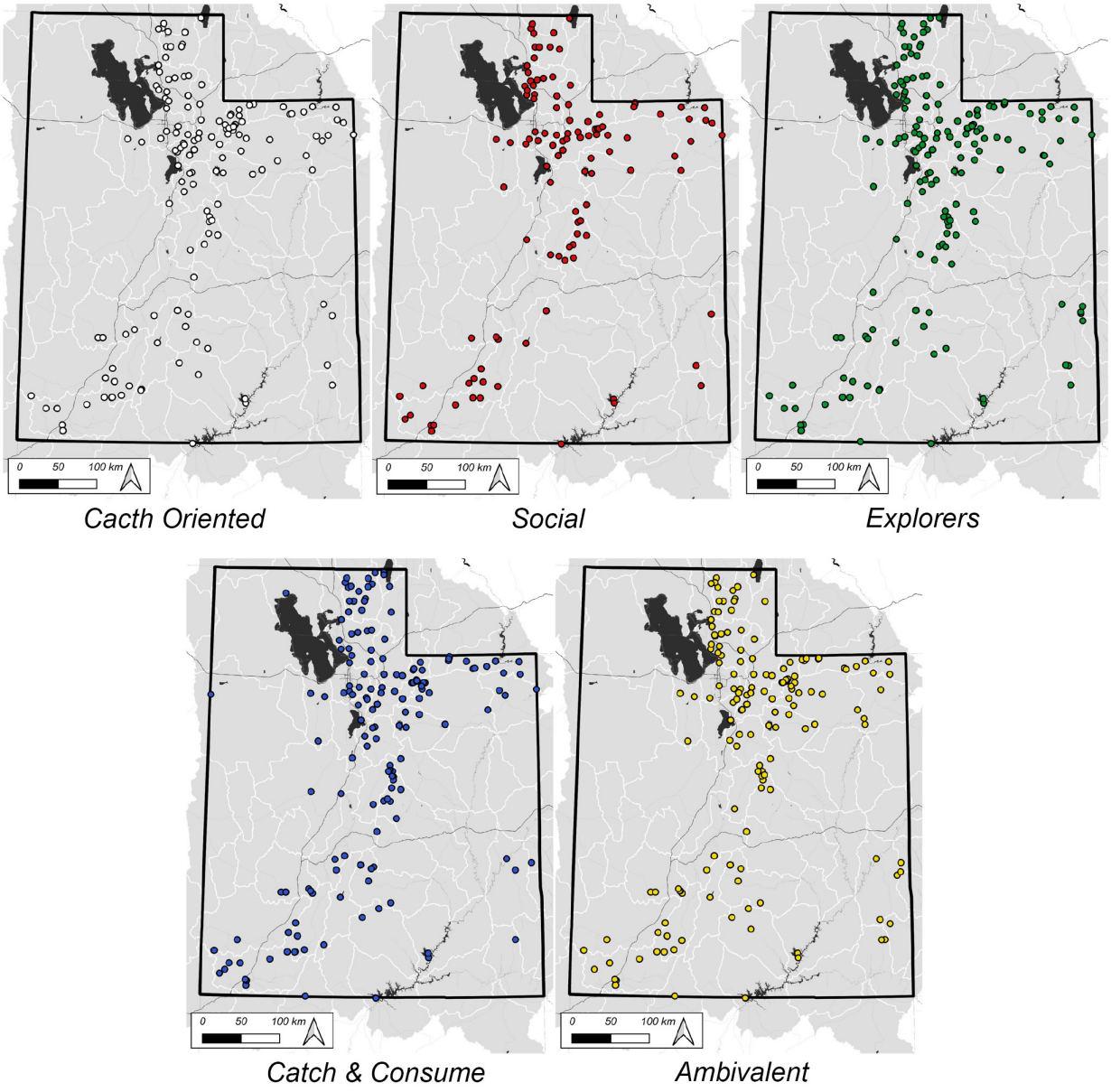

Figure 24

Geographic Distribution of Fishing Trips Across Utah, By Angler Cluster

explore the potential for new angling opportunities. We investigated Utah anglers as a singular group and as subgroups with distinct motivations.

The discussion below first looks at the angling population as a whole and highlights angling preferences that represent the majority. The discussion then identifies where opportunities may exist to market and move distinct types of anglers into new experiences that align with their motivations, behaviors, and preferences.

Characteristics of Utah Anglers

Utah anglers are a demographically homogeneous group; however, in many cases their preferences and behaviors are quite diverse. Here we highlight areas where there is consistency in the preferences and behaviors of Utah anglers, which were in timing, setting, motivation, and species.

Regarding timing, most fishing trips occur between the months of May and September, and 20.9% of all fishing trips occur in July—one of the hottest months of the year.

When looking at the geography of fishing trips across the state, most trips take place in the mountains. Most anglers are fishing during the warmest part of the year and in higher elevations.

The settings anglers most prefer are lakes/reservoirs, but many also frequently fish rivers and streams. Amenities were not commonly used by anglers, and very few anglers wanted more of them at the places they fish. The lack of interest and use of amenities is reflected in anglers' motivations to be in nature and escape crowds.

Anglers are strongly motivated to get away from crowds and people, mentally and physically relax, and be immersed in nature when they go fishing. With regards to fishing-specific motivations, Utah anglers want to catch at least one fish, fish waters where fish are safe to eat, and improve their skills. However, anglers are only slightly motivated by catching fish to eat and catching their limit, which indicates anglers are more concerned about the environmental quality of where they fish than gathering food. Anglers are the least motivated by socialization, competing with other anglers, and fishing for warmwater species.

Lastly, Rainbow Trout is the most preferred, and targeted, species in Utah. However, anglers also expressed strong preferences in targeting a more diverse set of trout species, including Brown, Cutthroat, Brook, and Tiger Trout. Anglers would also like more opportunities to target Kokanee Salmon, Largemouth Bass, Walleye, and Wipers.

Taken together, Utah anglers seek opportunities to get away from crowds, heat, and development, to be immersed in natural settings, and to mentally and physically relax. They are also seeking opportunities to catch fish and improve their skills. Given the geography of Utah and the time of year most anglers are fishing, many of these opportunities exist in the mountains, which happen to be areas predominately inhabited by trout species.

Knowing this about Utah anglers, we also explored the literature to see what promotes angler satisfaction. In a meta-analysis of what drives angler satisfaction, Birdsong et al. (2021) found crowding, reduced access to fishing sites, and a reduction in catch quality often reduce angler satisfaction. These findings reflect ancillary analyses of the periodic angler survey data suggesting population growth (crowding), abnormally warm weather (access), and reductions of coldwater species (catch quality) reduce angler welfare, with anglers paying more to fish in areas that are less populated, cooler, and have coldwater species (Smith & Lamborn, 2023).

If the goal is to maintain or enhance angler satisfaction in ways that are biologically feasible, economical, and publicly supported, this information gives us the fundamental characteristics of what Utah anglers are seeking. To maintain public satisfaction in Utah's fisheries, or in creating publicly supported alternatives, managers will need to preserve and/or enhance the characteristics described above. For example, Rainbow Trout are an excellent gamefish. However, anglers want opportunities to catch a wider diversity of trout species in Utah, in addition to other cool and warmwater species. Therefore, if we assume that Rainbow Trout are an incidental component to the Utah angling experience, it may be possible to replace them as long as the underlying experience is maintained. Naturalness and nature are important for Utah anglers, and almost half of anglers believe the Rainbow Trout is native to Utah. There may be an element in the minds of anglers that even though the water they are fishing is stocked with Rainbow Trout, they feel that naturalness is maintained given their belief about the species. Therefore, species that have characteristics of "native" may be more accepted in the minds of anglers. But if the fundamental experience is not altered and catch quality is good, other less costly and more sustainable species with less "native" characteristics could also likely be used to replace Rainbow Trout and maintain angler satisfaction.

When trying to communicate to anglers in Utah, it would be important to present experiences that resonate with Utah anglers. This includes imagery and messages that depict natural settings and incorporate the elements that motivate anglers, such as catching fish, escaping crowds, and relaxing. In addition, when thinking about what kinds of opportunities may resonate with anglers, it seems anglers are seeking more opportunities to fish for a wider diversity of trout species, in addition to opportunities to fish for Kokanee, Bass, Walleye, and Wipers.

Classifying Anglers by Their Motivations

Our analysis revealed five angler classifications. We reviewed the characteristics of each angler group and ranked them from the most likely to try new opportunities to the least likely. We also summarized each group to provide insights about what kinds of opportunities resonate with them. Explorers and Social anglers are the most likely to try new things, although their core motivations differ. Ambivalent and Catch & Consume anglers are the least likely to seek new experiences.

1. **Explorers** (24.7% of the angler population): These anglers are highly motivated to fish because it provides the opportunity to get away, physically and mentally relax, and be close to nature. These individuals also hold relatively strong motivations to learn what they are capable of, improve their sense of self-confidence, develop new skills, and experience new places and types of fishing equipment. Explorers are also likely, but do not always seek opportunities to consume the fish they catch. Of all five types of anglers, explorers are the least likely to be motivated for social reasons or the social aspect of fishing. This does not mean they always fish by themselves, but it does indicate solitude is an important element of their fishing experience. Explorers frequently use flies, bait, and lures and they primarily fish large and small lakes and reservoirs. They also seek opportunities to fish medium to small streams. Their species preferences are consistent with other angler groups—Rainbow, Cutthroat, and Brown Trout—but they are also quite general; they do not have strong preferences for other species compared to other groups. Proportionally, this is the largest group of anglers in the state.

2. **Social anglers** (14.8% of the angler population): Over two-thirds of these anglers said it was at least "moderately important" for them to "tell others about their fishing trips." Nearly the same amount said they wanted the opportunity to "teach others how to fish" on "at least half" of their trips within the state. Social anglers are also motivated to learn new skills, try new equipment, and experience new places. They are primarily lake anglers (from shore and boat) who use bait and artificial flies. Social anglers mostly prefer Rainbow, Brown, and Cutthroat Trout. They are also more likely to fish for Kokanee, Largemouth Bass, and Wipers relative to the other types of anglers.

3. **Catch Focused anglers** (22.5% of the angler population): These anglers are strongly motivated to catch fish. Their preferred method is to wade in all sizes of streams/rivers and use flies or lures. Their strongest preference is for Brown Trout, but they also prefer to catch Rainbow and Cutthroat Trout. Catch focused anglers are motivated by catching fish in their preferred water type using their preferred method. They are only slightly motivated to acquire new skills and try new places and equipment.

4. **Ambivalent anglers** (15.4% of the angler population): Ambivalent anglers hold notably weak catch-related motivations; they also hold the weakest motivations for opportunities to catch fish they can consume. These anglers are relatively non-distinct, and may possibly be incidental anglers (i.e., those who have purchased a license to fish with someone else who has stronger or more specific motivations). Therefore, marketing efforts directed toward this

group would likely be ineffective because they are the least likely to be fishing for themselves.

5. **Catch & Consume anglers** (22.6% of the angler population): These anglers hold the strongest desire to have frequent opportunities to catch fish to eat. These anglers also have the weakest motivations to escape and relax in natural settings, develop new skills, experience new places, try new equipment, and learn new things. They primarily fish from shore or boat on a lake/reservoir using bait or flies. They prefer the same three species as other anglers—Rainbow, Brown, and Cutthroat Trout.

Given the unique characteristics of the five angler classifications above, we assumed there would be geographic differences in where these anglers fish, and those differences would help identify new experiences that are biologically feasible, economical, and publicly supported. However, the analysis failed to show any geographic differences in where the different types of anglers fish within the state. This suggests anglers with different motivations use the same fisheries to achieve desirable fishing experiences, although they use them in different ways. This emphasizes the need for fisheries to provide a diverse spectrum of opportunities.

For example, a single reservoir can provide a spectrum of experiences—one for each of the five types of anglers described above. The more remote, secluded, and natural areas of a reservoir will be more appealing to Explores. Social anglers are likely looking for easier access, and places where they can take friends and family fishing (Ambivalent anglers). Catch focused anglers may target the tailwaters of the reservoir and be focused on catching several fish, including large fish. Catch & Consume anglers would likely seek areas with easy access but with good water quality so they know the fish are safe to eat. They likely fish places they are familiar with and know they have a high likelihood of catching fish to take home.

Conclusion

This report outlines many of the characteristics that define Utah anglers and the Utah angling experience. We present these characteristics at several levels of resolution (statewide, regionally, and across distinct types of angler motivations) to make the data as useful as possible for fisheries managers within the state.

We have identified types of motivations that are fundamental to the Utah fishing experience and should be preserved and/or enhanced. Managers are now tasked with using this information to devise biologically feasible solutions that not only enhance the sustainability of Utah's fisheries, but also meet the fundamental motivations of the angling public. This is not an easy task, and unique considerations need to be made for each fishery that is being challenged by increased demand and changing biological conditions.

Maintaining angler satisfaction can be achievable if the key motivations of anglers are met. This means fisheries are managed for a diverse set of experiences and the fundamental characteristics that promote angler satisfaction are preserved or enhanced. The information presented in this report can provide guidance for managers seeking to create biologically and economically sustainable fisheries that align with anglers' motivations.

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Appendix A

Research Questions and Sub-questions

Final Research Questions, Sub-questions, and Sampling Frame
December 16, 2020

Research Questions	Potential sub-questions to incorporate into survey
1. What are the major types of anglers and angling experiences in Utah?	• *What are anglers' motivations and preferences for their fishing experience?* • *What indicators of quality are involved in an angler's fishing experience?* • *How do anglers' preferred fishing experiences differ from their actual fishing habits?* • *What limitations or barriers prevent anglers from achieving their preferred fishing experiences?* • *What are anglers' perceptions of crowding?* • *What are anglers' preferences for services?* • *What are anglers' willingness to change their behaviors for their preferred fishing experiences? i.e. via travel, additional investment, education, etc.*
2. What are the travel behaviors of anglers in Utah?	• *How far do anglers typically travel to fish?* • *What indicators are involved in determining an angler's fishing excursion?* • *What is the economic benefit offered by particular types of waterbodies and/or particular types of species?*
3. What are anglers' knowledge and perceptions of native and non-native fish species?	• *What are anglers' knowledge of native fish species?* • *What native and non-native fish species do anglers value?* • *What are anglers' fish identification abilities?* • *What are anglers' attitudes towards maintaining and supporting native fish populations?* • *What communication and outreach tools can be used to expand anglers' knowledge of native fish species?*
4. What are the constraints and barriers that lead to a lapse in fishing license renewal in Utah?	• *How do repeat license (experienced) holders motivations and habits differ from first time (inexperienced) license holders?* • *What are the main constraints and barriers that result in lapsed anglers in Utah?* • *For anglers that are successfully navigating these barriers and constraints, how are they doing so?*

Appendix B

Survey Instrument

2021 Utah General Survey

You are invited to participate in a research study by Jordan Smith, Director of the Institute of Outdoor Recreation and Tourism at Utah State University.

The purpose of this research is to inform fisheries management about angler's resource use and fishing preferences. Specifically, we are interested in learning about your most recent fishing trip, the type of fishing you participate in, what you fish for, how much money you spend to fish, how far you typically travel, and what your preferences for fishing experiences are. You are being asked to participate in this research because you have purchased a Utah State Fishing License within the 2020-2021 fishing season.

Your participation in this study is voluntary and anonymous and you may withdraw your participation at any time for any reason. Your name or fishing license number is not requested in the survey and cannot be connected to your survey responses. For your privacy, you can choose when you take the survey, where you take the survey, and what device you take the survey on. **If possible, we recommend taking the survey on a computer instead of a mobile phone, as the formatting is easier to navigate.**

If you take part in this study, your total estimated participation in this online survey will be approximately 15 minutes.

The possible risks of participating in this study include loss of confidentiality. We cannot guarantee that you will directly benefit from this study, but it has been designed to learn more about the needs and preferences of anglers in Utah, to help fisheries managers better plan for public needs.

We will make every effort to ensure that the information you provide remains confidential. We will not reveal your identity in any publications, presentations, or reports resulting from this research study.

We will collect your information through an online survey. Online activities always carry a risk of a data breach, but we will use systems and processes that minimize breach opportunities. This survey data will be securely stored in a restricted-access folder on a secure storage platform at Utah State University.

You can decline to participate in any part of this study for any reason and can end your participation at any time.

If you have any questions about this study, you can contact our team at Utahfishingsurvey@usu.edu. Thank you again for your time and consideration. If you have any concerns about this study, please contact Utah State University's Human Research Protection Office at (435) 797-0567 or irb@usu.edu. The IRB protocol number for this survey is 12004.

By continuing to the survey you agree that you are 18 years of age or older, and wish to participate. You agree that you understand the risks and benefits of participation, and that you know what you are being asked to do. You also agree that if you have contacted the research team with any questions about your participation and are clear on how to stop your participation in this study if you choose to do so. Please be sure to retain a copy of this form for your records. If you would like a paper copy of this form for your records, please let us know and one will be provided.

Q0 I have read the conditions described above, and agree to participate

- I agree to participate in this survey (1)
- I disagree and will not participate in this survey (2)

Skip To: End of Survey If I have read the conditions described above, and agree to participate = I disagree and will not participate in this survey

Q1c Did you purchase a Utah resident license or a non-resident license?

- Utah Resident (1)
- Non-Resident (2)

Q1a What is the type of Utah fishing license that you purchased in the last 12 months?

- 3-Day license (1)
- 7-Day license (2)
- 365-day fishing or multi-year fishing license (3)
- 365-day or multi-year combination hunting-fishing license (4)

Display This Question:
If What is the type of Utah fishing license that you purchased in the last 12 months? = 365-day or multi-year combination hunting-fishing license

Q1b Which of the following best describes how you use your combination hunting-fishing license?

- I primarily use my combination license to fish (1)
- I use my combination license equally for hunting and fishing (2)
- I primarily use my combination license to hunt (e.g. apply for limited entry hunting opportunities, over the counter tags, etc.) (3)

Q1d Have you **used your purchased Utah license** to fish in the past 12 months?

- Yes (1)
- No (2)

Skip To: End of Survey If Have you used your purchased Utah license to fish in the past 12 months? = No

We would like to learn more about your **most recent fishing trip within Utah where fishing was the primary purpose for taking the trip**. Think back to your most recent trip within the state **where fishing was the primary purpose for taking the trip** and answer the questions below. A trip does not have to be overnight, and does not have to last the whole day.

Q2 What was the approximate month, day and year of your most recent fishing trip within Utah where fishing was the primary purpose for taking the trip?

Month (1)	▼ January (1) ... (150)
Day (2)	▼ January (1) ... (150)
Year (3)	▼ January (1) ... (150)

Q3 What was the name of the stream, river, lake, reservoir, etc. that you fished on your most recent trip in Utah? *Please be as specific as possible*

_____

Q4 What is the closest city or town to the location of your most recent Utah fishing trip? *Please be as specific as possible*

_____

Q5 How long did it take you to travel to the place where you fished? Please estimate just your travel time and exclude incidental stops *(e.g., getting gas, stopping for food, etc.).*

Hours	▼ 0 (1) ... 59 (125)
Minutes	▼ 0 (1) ... 59 (125)

Q6 Was this trip **a day trip** (i.e., you left and returned on the same day) **or an overnight trip?**

- Day trip (1)
- Overnight trip (2)

Display This Question:
If Was this trip a day trip (i.e., you left and returned on the same day) or an overnight trip? = Day trip

Q6a Once you arrived at your fishing destination, how long did you spend at the destination?

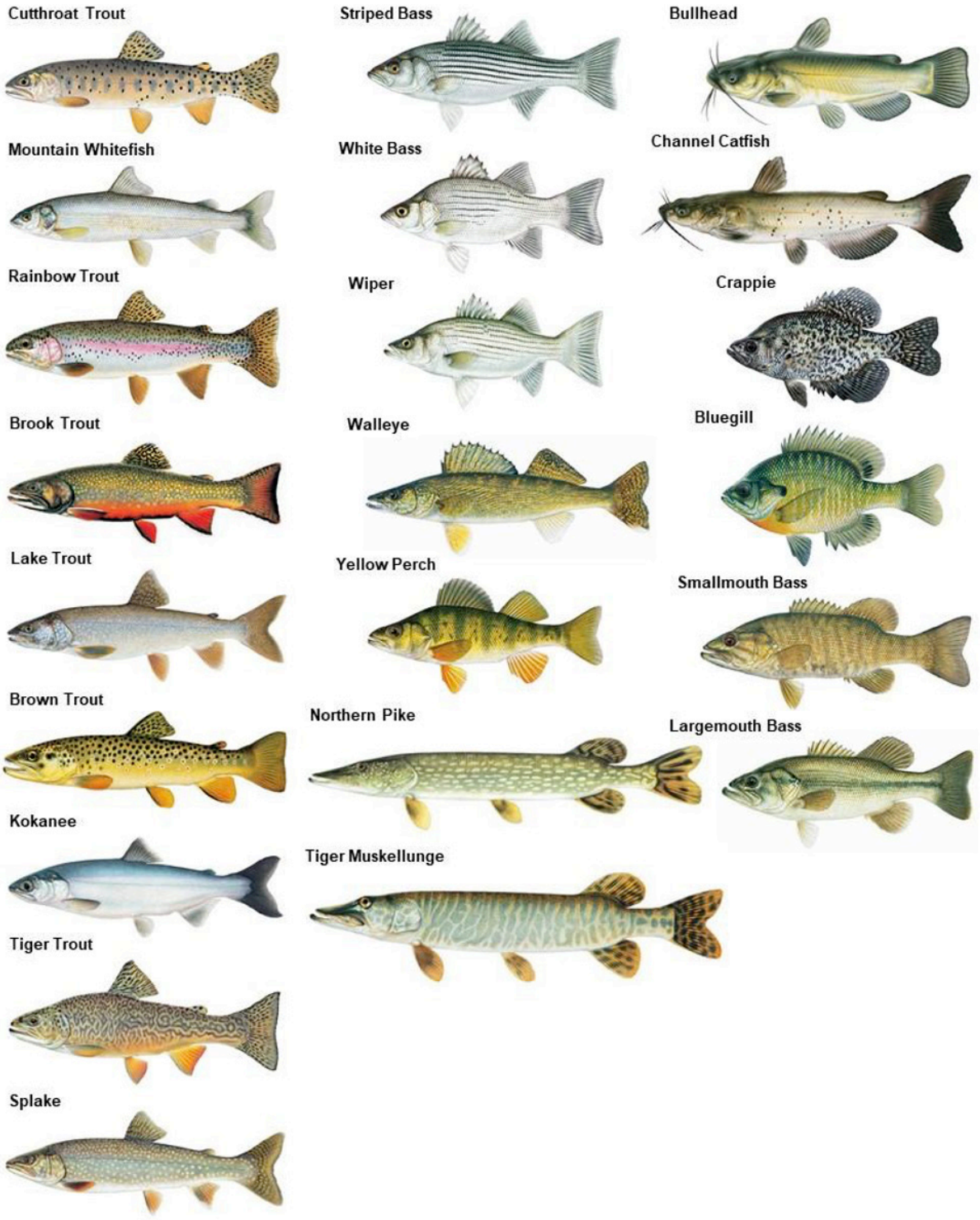
Hours (1)	▼ 0 (1) ... 59 (61)
Minutes (2)	▼ 0 (1) ... 59 (61)

Display This Question:
If Was this trip a day trip (i.e., you left and returned on the same day) or an overnight trip? = Overnight trip

Q6b Once you arrived at your fishing destination, how long did you spend at the destination? Count the day you arrived and the day you departed as two separate days.

Days (1)	▼ 0 (1) ... 24 (83)
Nights (2)	▼ 0 (1) ... 24 (83)

The following image of fish species and their common names can assist you for the following two questions



Q7 What species of fish were you **expecting to catch** on this trip?

- Bluegill / other sunfish (4)
- Brook Trout (5)
- Brown Trout (7)
- Bullhead (8)
- Channel Catfish (9)
- Crappie (10)
- Cutthroat Trout (11)
- Kokanee Salmon (12)
- Lake Trout (13)
- Largemouth Bass (14)
- Northern Pike (15)
- Rainbow Trout (16)
- Smallmouth Bass (17)
- Splake (18)
- Striped Bass (19)
- Tiger Muskellunge (20)
- Tiger Trout (21)
- Walleye (22)
- White Bass (23)
- Mountain Whitefish (24)
- Wiper (25)
- Yellow Perch (26)
- No Expectations (28)

Q8 What species of fish did you **actually catch** on this trip?

- Bluegill/ other sunfish (15)
- Brook Trout (16)
- Brown Trout (17)
- Bullhead (18)
- Channel Catfish (19)
- Crappie (20)
- Cutthroat Trout (21)
- Kokanee Salmon (22)
- Lake Trout (23)
- Largemouth Bass (24)
- Northern Pike (25)
- Rainbow Trout (26)
- Smallmouth Bass (27)
- Splake (28)
- Striped Bass (29)
- Tiger Muskellunge (30)
- Tiger Trout (31)
- Walleye (32)
- White Bass (33)
- Mountain Whitefish (34)
- Wiper (35)
- Yellow Perch (36)
- None (37)

Skip To: Q9 If What species of fish did you actually catch on this trip? = None
Skip To: Q9 If Condition: Selected Count Is Equal to 0. Skip To: Which of the following methods of fis....

Q8b Of the fish you caught on this trip, **how many** of each species did you catch?

	Number of Fish (1)
Bluegill/ other sunfish (x15)	
Brook Trout (x16)	
Brown Trout (x17)	
Bullhead (x18)	
Channel Catfish (x19)	
Crappie (x20)	
Cutthroat Trout (x21)	
Kokanee Salmon (x22)	
Lake Trout (x23)	
Largemouth Bass (x24)	
Northern Pike (x25)	
Rainbow Trout (x26)	
Smallmouth Bass (x27)	
Splake (x28)	
Striped Bass (x29)	
Tiger Muskellunge (x30)	
Tiger Trout (x31)	
Walleye (x32)	
White Bass (x33)	
Mountain Whitefish (x34)	
Wiper (x35)	
Yellow Perch (x36)	
None (x37)	

Q9 Which of the following methods of fishing did you use on this trip? *Please check all that apply.*

- Fished using bait *(e.g., powerbait, worms, minnows, etc.) (1)*
- Fished using artificial flies (2)
- Fished using artificial lures (3)
- Ice fished (4)
- Fished using other techniques *(e.g., spearfishing, archery) (5)*

Q10 Which of the following methods of fishing did you **primarily** use on this trip? *Please check one.*

- Fished using bait *(e.g., powerbait, worms, minnows, etc.) (1)*
- Fished using artificial flies (2)
- Fished using artificial lures (3)
- Ice fished (4)
- Fished using other techniques *(e.g., spearfishing, archery) (5)*

Q11 How did you access the water you fished during this trip? *Please check all that apply*

- From shore on a stream or river (1)
- Wading in a stream or river (2)
- From a boat on a lake or reservoir (3)
- From a boat on a stream or river (4)
- Wading in a lake or reservoir (5)
- Ice fishing (6)
- Other method (7)

Q12 Thinking about your most recent fishing trip where fishing was the primary purpose, **please provide your best estimate of what you personally spent for each kind of item in your home city, along the way, and at the destination**. *If your fishing trip was within your home city, leave the other columns blank*

	In your home city (1)	Along the way (2)	At the destination (3)
Lodging. Includes hotels, motels, bed/breakfasts, cabin or home rentals, public or private campgrounds, tents, and campers (1)			
Food and beverages purchased at grocery stores (2)			
Food and beverages purchased at restaurants and convenience stores (3)			
Transportation. Includes gas for your vehicle, gas for your boat (if your trip included a motorboat), and any other transportation costs (4)			
Parking, trail use, and area access fees. (5)			
Rental fees and supplies. Includes all fishing supplies (tackle, bait, etc.) purchased just for this trip). (6)			
Retail goods other than food and beverages. Includes clothing, gifts, etc. (7)			

Q13 How many other people, excluding yourself, did your expenses cover on this trip? *Enter 0 if you were the only person on the trip*

_____

Display This Question:
If If How many other people, excluding yourself, did your expenses cover on this trip? Enter 0 if you w... Text Response Is Greater Than 0

Q14 How many other people, excluding yourself, participated in fishing on this trip?

_____

Display This Question:
If If How many other people, excluding yourself, did your expenses cover on this trip? Enter 0 if you w... Text Response Is Greater Than 0

Q15 Of the people who participated in fishing on this trip, how many were under the age of 12?

_____

Q16 How true do you find the following statements for **your most recent fishing trip where fishing was the primary purpose?**

	Not at all true	Slightly True	Moderately True	Very True	Completely True
Crowding negatively impacted the quality of my fishing experience (1)					
Crowding made me spend less time fishing (2)					
I fished earlier or later in the day because of crowding (3)					
Crowding made me change locations where I fished (4)					

Display This Question:
If How did you access the water you fished during this trip? Please check all that apply = From a boat on a lake or reservoir
And How did you access the water you fished during this trip? Please check all that apply = From a boat on a stream or river

Q17 How much do you disagree or agree with the following statements about boat facilities and access on **your most recent fishing trip where fishing was the primary purpose?**

	Completely disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Completely agree
There were sufficient boat launching sites and facilities available to access the area (1)							
The boat launching sites and facilities were of acceptable quality (2)							
The boat launching sites and facilities could be better maintained at this site (3)							
Wildlife viewing (x18)							
Other (x20)							

Q18 Over the past 12-months, how many times have you fished at the same location as your most recent trip? *(e.g., the same stream, river, or lake). Please include your most recent trip in your count.*

_____

Q19 While you were there, what **on-site amenities and services** did you use, **if present at this location?**

- Boat fueling station (1)
- Boat Ramp (2)
- Marina/Dock (3)
- Fishing Supply Store (4)
- Restrooms (5)
- Fishing pier (6)
- Non-motorized hand launch *(e.g., kayaks, canoes, etc.) (7)*
- Picnic table (8)
- None / Not Applicable (9)
- Other (10) _____

Q20 **If not present at this location,** what on-site **amenities or services** would you have preferred to be on-site?

- Boat fueling station (1)
- Boat Ramp (4)
- Marina/Dock (5)
- Fishing supply store (6)
- Restrooms (7)
- Fishing pier (8)
- Non-motorized hand launch (e.g., kayaks, canoes, etc.) (9)
- Picnic table (10)
- None / Not Applicable (11)
- Other (12) _____

Q21 Please enter the zip code of your current residence

_____

Q22 Which of the following years have you fished in Utah? *Please check all that apply*

- 2021 (1)
- 2020 (2)
- 2019 (3)
- 2018 (4)
- 2017 (5)

Q23 Besides fishing, which of the following activities have you participated in the most during the past 12 months? Please select your top 3.

- 4-wheel driving/Jeeping (1)
- ATV riding or off-road motorcycling (19)
- Backpacking (multiple days) (2)
- Big game hunting (elk, bear, mule deer, etc.) (3)
- Camping (4)
- Crosscountry skiing or snowshoeing (5)
- Downhill skiing or snowboarding (6)
- Flat water rafting/canoeing/kayaking/paddle boarding (7)
- Hiking (single day) (8)
- Horseback riding (9)
- Picnicking (11)
- Motor boating (12)
- Mountain biking (13)
- Rock climbing (14)
- Small game hunting (upland bird, waterfowl, rabbit, etc.) (15)
- Snowmobiling (16)
- Whitewater rafting/kayaking/canoeing (17)
- Wildlife viewing (18)
- Other (20) _____

Display This Question:
If If Besides fishing, which of the following activities have you participated in the most during the p... q://QID27/SelectedChoicesCount Is Greater Than or Equal to 1
Carry Forward Selected Choices from "Besides fishing, which of the following activities have you participated in the most during the past 12 months? Please select your top 3."

Q24 Compared to the 3 activities you participated in the most during the past 12 months, how much *less or more* important is fishing for you?

	Fishing is much less important than this activity	Fishing is slightly less important than this activity	Fishing is just as important as this activity	Fishing is slightly more important than this activity	Fishing is much more important than this activity
4-wheel driving/Jeeping (x1)					
ATV riding or off-road motorcycling (x19)					
Backpacking (multiple days) (x2)					
Big game hunting (elk, bear, mule deer, etc.) (x3)					
Camping (x4)					
Crosscountry skiing or snowshoeing (x5)					
Downhill skiing or snowboarding (x6)					
Flat water rafting/canoeing/kayaking/paddle boarding (x7)					
Hiking (single day) (x8)					
Horseback riding (x9)					
Picnicking (x11)					
Motor boating (x12)					
Mountain biking (x13)					
Rock climbing (x14)					
Small game hunting (upland bird, waterfowl, rabbit, etc.) (x15)					
Snowmobiling (x16)					
Whitewater rafting/kayaking/canoeing (x17)					
Wildlife viewing (x18)					
Other (x20)					

Display This Question:
If If Besides fishing, which of the following activities have you participated in the most during the p... q://QID27/SelectedChoicesCount Is Greater Than or Equal to 1
Carry Forward Selected Choices from "Besides fishing, which of the following activities have you participated in the most during the past 12 months? Please select your top 3."

Q25 If the opportunity was available in Utah, how interested would you be in combining the 3 activities you participated in the most during the past 12 months with fishing?

	Not at all interested in combining with fishing	Slightly interested in combining with fishing	Moderately interested in combining with fishing	Very interested in combining with fishing	Extremely interested in combining with fishing	I already combine this activity with fishing
4-wheel driving/Jeeping (x1)						
ATV riding or off-road motorcycling (x19)						
Backpacking (multiple days) (x2)						
Big game hunting (elk, bear, mule deer, etc.) (x3)						
Camping (x4)						
Crosscountry skiing or snowshoeing (x5)						
Downhill skiing or snowboarding (x6)						
Flat water rafting/canoeing/kayaking/paddle boarding (x7)						
Hiking (single day) (x8)						
Horseback riding (x9)						
Picnicking (x11)						
Motor boating (x12)						
Mountain biking (x13)						
Rock climbing (x14)						
Small game hunting (upland bird, waterfowl, rabbit, etc.) (x15)						
Snowmobiling (x16)						
Whitewater rafting/kayaking/canoeing (x17)						
Wildlife viewing (x18)						
Other (x20)						

Q26 Approximately how many times have you gone fishing in the state of Utah over the past 12 months?

_____

Q27 Please select all the fishing methods that you've used in the last 12 months within Utah.

- Fished using bait *(e.g., Powerbait, worms, minnows, etc.) (1)*
- Fished using artificial flies (2)
- Fished using artificial lures (3)
- Ice fishing (4)
- Fished using other techniques *(e.g., spearfishing, archery) (5)*

Q28 Of the fishing methods you've used in the last 12 months within Utah, which is your primary method?

- Fished using bait (Powerbait, worms, minnows, etc.) (1)
- Fished using artificial flies (2)
- Fished using artificial lures (3)
- Ice fished (4)
- Fished using other techniques (e.g., spearfishing, archery) (5)

Q29 In the last 12 months within the state of Utah, approximately how many times have you used the following access methods for fishing? *(enter 0 if you did not use the access method)*

	Number of Times Used (1)
From shore or a fishing pier/dock on a lake or reservoir (1)	
From a boat on a lake or reservoir (2)	
Wading in a lake or reservoir (3)	
From a boat on a stream or river (4)	
Wading in a stream or river (5)	
Ice fishing (6)	

Q30 Please indicate how many times you fished in the following types of waterbodies in the last 12 months in Utah *(enter 0 if you did not use fish the type of waterbody)*

	Number of times fished (1)
Large lakes or reservoirs (e.g., Pineview Lake, Strawberry Reservoir, Scofield Reservoir, Flaming Gorge Reservoir, Lake Powell, etc.) (1)	
Smaller lakes or reservoirs (e.g., Newton Reservoir, Grantsville Reservoir, Huntington North Reservoir, Calder Reservoir, Paragonah Reservoir, etc.) (7)	
Large rivers, more than 30 feet in width (e.g., Weber River, Lower Provo, Price River, Green River, Sevier River, etc.) (8)	
Moderately-sized streams, 15 to 30 feet in width (e.g., Logan River, Middle Provo, Huntington Creek, Currant Creek, East Fork Sevier River, etc.) (9)	
Small streams, less than 15 feet in width (e.g., Blacksmith Fork River, Sixth Water Creek, Right Fork Huntington Creek, Sheep Creek, Corn Creek, etc.) (10)	
Community fishing ponds (e.g., Bountiful Lake, Clinton Park Pond, Green River Golf Course, Pioneer Park Pond, Razor Ridge Pond, etc.) (11)	

Q31 You have already told us about the types of waters you typically fish. Now we want to know about **the types of waters you prefer to fish**. Please choose the **one** type of location you **most prefer** as a place to fish in Utah.

- Large lakes or reservoirs (e.g., Pineview Lake, Strawberry Reservoir, Scofield Reservoir, Flaming Gorge Reservoir, Lake Powell, etc.) (1)
- Smaller lakes or reservoirs (e.g., Newton Reservoir, Grantsville Reservoir, Huntington North Reservoir, Calder Reservoir, Paragonah Reservoir, etc.) (22)
- Large rivers, more than 30 feet in width (e.g., Weber River, Lower Provo, Price River, Green River, Sevier River, etc.) (23)
- Moderately-sized streams, 15 to 30 feet in width (e.g., Logan River, Middle Provo, Huntington Creek, Currant Creek, East Fork Sevier River, etc.) (24)
- Small streams, less than 15 feet in width (e.g., Blacksmith Fork River, Sixth Water Creek, Right Fork Huntington Creek, Sheep Creek, Corn Creek, etc.) (25)
- Community fishing ponds (e.g., Bountiful Lake, Clinton Park Pond, Green River Golf Course, Pioneer Park Pond, Razor Ridge Pond, etc.) (26)

Q32 Below are some **common reasons people go fishing**. Please **indicate how important each of these reasons** are in your decision to fish while in Utah.

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
To view scenic beauty (1)					
To be close to nature (2)					
To be with people who share similar values (3)					
To be with others who enjoy the same things I do (4)					
To get away from the noise back home (5)					
To enjoy the sounds of nature (6)					
To experience natural quiet (7)					
To physically relax (8)					
To have my mind move at a slower pace (9)					
To experience tranquility (10)					
To feel independent from rest of society (11)					
To be away from crowds of people (12)					
To take risks (13)					
To have thrills (14)					
To experience a sense of exploration (15)					
To share photos on social media (16)					
To tell others about my trip (17)					
To have others know that I have been here (18)					
To gain a sense of self-confidence (19)					
To learn what I am capable of (20)					
To show others my abilities (21)					

Q33 Please indicate how preferable each of the items below are for your fishing experience based on how often you would like them to occur while fishing in Utah.

	On none of my fishing trips	On some of my fishing trips	On half of my fishing trips	On most of my fishing trips	On all of my fishing trips
Catch at least one large fish (1)					
Catch several fish (2)					
Catch at least one fish (3)					
Have a chance to catch large fish (4)					
Have a chance to catch fish (5)					
Develop or improve my fishing skills (6)					
Learn more about fish or fishing (7)					
Try out new fishing tackle (8)					
Try a new fishing site (9)					
Teach others how to fish (10)					
Meet or talk with other anglers (11)					
Compete with other anglers (12)					
Catch the most fish of anyone in my group (13)					
Demonstrate fishing skills to others (14)					
Show fish I caught to family and friends (15)					
Catch my limit (16)					
Challenge smartest or largest fish (17)					
Catch fish that are safe to eat (18)					
Fish waters where fish are safe to eat (19)					
Catch fish to eat (20)					
Fish wilderness-type areas (21)					
Get away from people (22)					
Fish for coldwater fish (23)					
Fish for warmwater fish (24)					
Fish near nice camping areas (25)					
Fish at family-type areas (26)					

Q34 For places you typically fish in Utah that are publicly accessible (not requiring additional landowner permissions), how would you rate the overall availability of fishing access?

- Availability of accessible fishing is very poor (-2) (1)
- Availability of accessible fishing is poor (-1) (2)
- Availability of accessible fishing is neither poor nor good (0) (3)
- Availability of accessible fishing is good (1) (4)
- Availability of accessible fishing is very good (2) (5)

Q35 In the last 12 months, did you hire a paid guide or outfitter while fishing in Utah?

- No (1)
- Yes (2)

Display This Question:
If In the last 12 months, did you hire a paid guide or outfitter while fishing in Utah? = Yes

Q35a In the last 12 months, how many of your fishing trips involved a paid guide or outfitter?

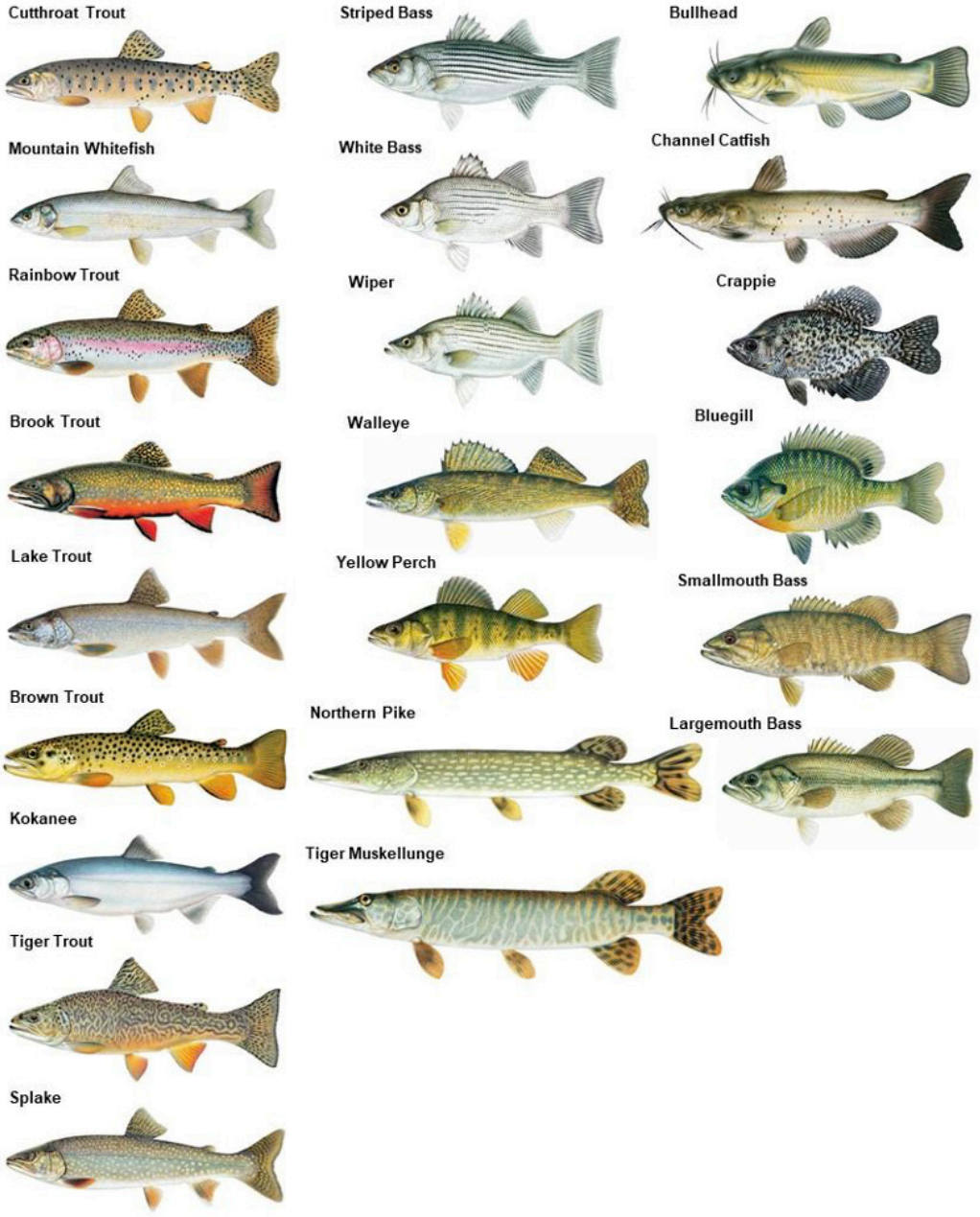
_____

Q36 Are there particular fish species that you prefer to fish for in Utah?

- Yes (1)
- No (2)

Display This Question:
If Are there particular fish species that you prefer to fish for in Utah? = Yes

Please use this reference of common sport fishing species to answer the following 2 questions.



Display This Question:
If Are there particular fish species that you prefer to fish for in Utah? = Yes

Q36a Please select the **top three fish** species **you most prefer** to catch when you have a chance to go fishing in Utah.

- Bluegill/ other sunfish (1)
- Brook Trout (2)
- Brown Trout (3)
- Bullhead (4)
- Channel Catfish (5)
- Crappie (6)
- Cutthroat Trout (7)
- Kokanee Salmon (8)
- Lake Trout (9)
- Largemouth Bass (10)
- Northern Pike (11)
- Rainbow Trout (12)
- Smallmouth Bass (13)
- Splake (14)
- Striped Bass (15)
- Tiger Muskellunge (16)
- Tiger Trout (22)
- Walleye (17)
- White Bass (18)
- Mountain Whitefish (19)
- Wiper (20)
- Yellow Perch (21)

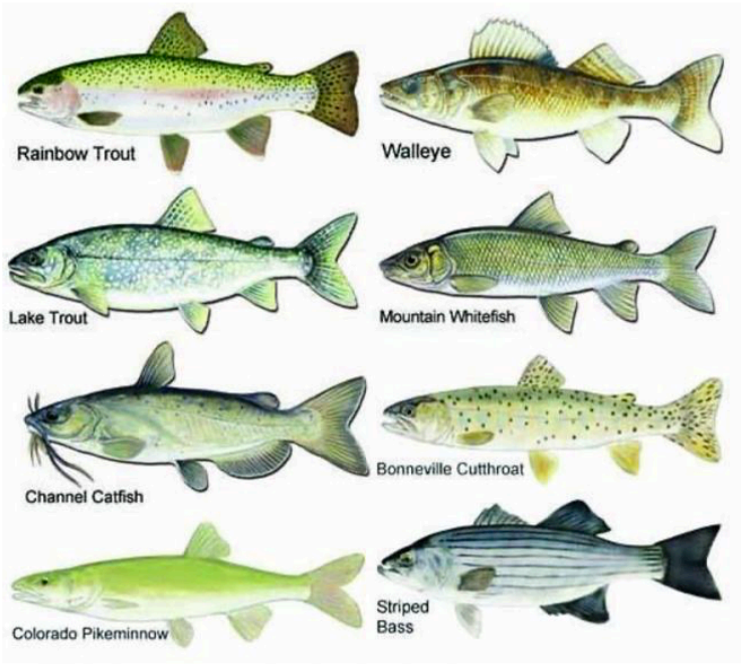
Q36b Looking again at the list blow, please click on the **top three species** you **most commonly fish for** when fishing in Utah.

- Bluegill/ other sunfish (1)
- Brook Trout (4)
- Brown Trout (5)
- Bullhead (6)
- Channel Catfish (7)
- Crappie (8)
- Cutthroat Trout (9)
- Kokanee Salmon (10)
- Lake Trout (11)
- Largemouth Bass (12)
- Northern Pike (13)
- Rainbow Trout (14)
- Smallmouth Bass (15)
- Splake (16)
- Striped Bass (17)
- Tiger Muskellunge (18)
- Tiger Trout (19)
- Walleye (20)
- White Bass (21)
- Mountain Whitefish (22)
- Wiper (23)
- Yellow Perch (24)

Q37 Please indicate your level of agreement or disagreement with each of the following statements regarding native Utah species and their management.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Native fish species play an important role in the ecosystem (1)					
I would support altering the management of a fishery if doing so would help protect a population of sensitive native fish species (2)					
Some native fish species are much more important to protect than others (3)					
DWR is doing a good job of protecting Utah's native fish species (4)					
I would support efforts by DWR to manage some Utah fisheries so that they would contain only native fish species (5)					
I would support the conservation or recovery of a native fish species if that species had potential value as a sportfish (6)					
I am confident in my abilities to identify fish species native to Utah (7)					

Q38 To the best of you knowledge, which of the following are native fish species in Utah? Please look at the following image and then select each choice that you believe is a native species



- Rainbow Trout (1)
- Lake Trout (2)
- Channel Catfish (3)
- Colorado Pikeminnow (4)
- Walleye (5)
- Mountain Whitefish (6)
- Bonneville Cutthroat (7)
- Striped Bass (8)

Finally, we would like to know more about you. As with all of the questions in this survey, your response to these questions is completely voluntary, and any information you provide will remain completely confidential.

Q39 Please enter the year you were born (YYYY)

_____

Q40 Are you of Hispanic, Latino, or of Spanish origin?

- No (1)
- Yes (2)
- Prefer not to answer (3)

Q41 How would you describe yourself?

- American Indian or Alaska Native (1)
- Asian (2)
- Black or African American (3)
- White (4)
- Native Hawaiian or other Pacific Islander (5)
- I prefer not to answer (6)

Q42 Is English your preferred language for communication?

- No (1)
- Yes (2)

Display This Question:
If Is English your preferred language for communication? = No

Q42a What is your preferred language for communication?

_____

Q43 Which of the following best represents your pre-tax annual **personal** income for 2020?

- Under $25,000 (1)
- $25,000 to $39,999 (8)
- $40,000 to $59,999 (2)
- $60,000 to $74,999 (3)
- $75,000 to $99,999 (4)
- $100,000 to $149,999 (5)
- $150,000 or higher (6)
- I prefer not to answer (7)

Q44 Please select your gender

- Male (1)
- Female (2)
- Non-binary / third gender (3)
- I prefer not to say (4)
- I prefer to self-describe (5) _____

Q45 What is the highest level of education you have completed?

- Some high school (1)
- High school graduate/GED (2)
- Some college or Associate's degree (3)
- College graduate (Bachelor's degree) (4)
- Post graduate degree (Master's/PHD) (5)

Q46 Finally, If the Utah Division of Wildlife Resources were to do just one thing that you think would be most effective in improving the quality of your fishing experiences in Utah, what would that be? Please use the space below to provide your suggestion:

_____
_____
_____
_____
_____

Appendix C

Supplementary Tables

Table C1. Proportion of Anglers Expecting to Catch Specific Species Relative to the Proportion who Actually Catch That species, by DWR Region.

	STATEWIDE			Central			Northeast			Northern			Southeast			Southern		
Species	% expect to catch	% catching	Diff.	% expect to catch	% catching	Diff.	% expect to catch	% catching	Diff.	% expect to catch	% catching	Diff.	% expect to catch	% catching	Diff.	% expect to catch	% catching	Diff.
Bluegill/ sunfish	4.8	3.8	-1.0	3.2	1.3	-1.9	1.3	0.6	-0.6	7.8	5.4	-2.4	9.2	8.8	-0.3	4.5	4.3	-0.2
Brook Trout	12.5	8.2	-4.3	7.3	3.6	-3.7	16.4	10.9	-5.5	12.6	8.0	-4.6	5.8	3.2	-2.6	10.9	8.0	-2.9
Brown Trout	31.5	24.0	-7.5	34.6	26.7	-7.9	45.9	39.9	-6.0	35.5	26.8	-8.7	10.7	5.7	-5.0	19.7	12.6	-7.1
Bullhead	1.0	1.0	0.0	1.0	1.0	0.0	0.1	0.0	-0.1	1.5	1.9	0.4	1.8	1.1	-0.8	0.1	0.1	0.0
Channel Catfish	4.4	3.7	-0.8	3.5	1.8	-1.6	1.7	1.4	-0.3	7.4	6.3	-1.1	9.2	11.0	1.8	0.6	0.1	-0.5
Crappie	2.4	1.5	-0.9	0.8	0.4	-0.4	0.4	0.2	-0.3	5.3	4.0	-1.3	7.0	2.8	-4.2	1.3	0.7	-0.6
Cutthroat Trout	26.5	20.5	-6.0	37.7	35.7	-1.9	20.3	11.2	-9.1	23.1	12.5	-10.6	29.4	24.7	-4.6	19.3	14.3	-5.0
Kokanee Salmon	8.0	4.9	-3.1	15.4	8.1	-7.2	13.7	10.0	-3.7	2.2	1.3	-0.9	0.9	0.7	-0.2	6.3	3.6	-2.7
Lake Trout	9.3	4.4	-4.9	3.5	1.5	-2.0	19.8	11.7	-8.1	6.7	2.8	-3.9	5.8	2.1	-3.7	15.0	6.2	-8.8
Largemouth Bass	6.7	4.2	-2.5	3.0	1.1	-1.9	2.4	1.5	-0.8	6.3	3.8	-2.6	19.9	11.0	-8.9	9.2	7.7	-1.5
Mtn. Whitefish	3.8	3.8	0.0	3.4	2.5	-0.9	4.5	6.6	2.1	8.3	8.4	0.1	0.0	0.0	0.0	0.2	0.1	-0.1
Northern Pike	0.6	0.4	-0.2	0.8	0.2	-0.6	0.4	0.3	-0.1	0.0	0.0	0.0	2.8	3.2	0.4	0.4	0.0	-0.4
Rainbow Trout	70.4	61.7	-8.7	76.4	63.8	-12.6	73.9	68.9	-5.0	61.7	47.8	-13.9	54.7	46.6	-8.1	83.0	81.4	-1.6
Smallmouth Bass	7.9	6.1	-1.8	4.8	2.5	-2.2	8.0	8.0	0.0	8.4	6.1	-2.3	22.0	20.1	-1.9	4.9	2.5	-2.4
Splake	2.0	1.4	-0.7	0.2	0.2	-0.1	0.8	0.8	-0.1	0.4	0.4	0.0	1.5	1.1	-0.5	8.3	5.1	-3.1
Striped Bass	3.6	3.2	-0.4	0.7	0.5	-0.2	0.7	0.2	-0.5	0.6	0.2	-0.3	26.0	26.1	0.2	0.8	0.1	-0.7
Tiger Muskellunge	1.2	0.3	-0.9	0.2	0.0	-0.2	0.7	0.3	-0.4	2.5	0.5	-2.0	6.1	1.8	-4.3	0.1	0.0	-0.1
Tiger Trout	10.0	6.9	-3.1	2.2	0.7	-1.5	9.5	7.6	-2.0	7.7	6.8	-0.9	19.9	11.7	-8.2	21.6	12.1	-9.5
Walleye	3.8	2.3	-1.4	2.2	0.8	-1.4	3.9	3.2	-0.7	4.1	1.9	-2.2	17.7	12.4	-5.4	0.4	0.1	-0.2
White Bass	1.5	1.0	-0.5	4.0	3.1	-0.9	0.4	0.3	-0.1	0.2	0.1	-0.1	0.0	0.4	0.4	0.4	0.0	-0.4
Wiper	2.1	0.9	-1.2	1.1	0.4	-0.7	0.3	0.2	-0.1	4.9	2.5	-2.5	1.8	0.0	-1.8	2.1	1.0	-1.1
Yellow Perch	4.1	3.3	-0.8	2.1	1.3	-0.8	1.1	1.2	0.1	8.4	7.2	-1.3	0.6	0.4	-0.3	6.7	6.2	-0.5
Nothing	*4.8*	*20.8*	*16.0*	*4.0*	*19.3*	*15.3*	*4.3*	*13.7*	*9.4*	*5.4*	*28.6*	*23.2*	*4.0*	*19.1*	-0.3	*4.2*	*17.8*	-0.2

Table C2. Other Activities Anglers Participate in, Their Interest in Combining the Activity with Fishing, and the Proportion of Anglers That Already Combine the Activity With Fishing.

Other activity	% of anglers participating in activity within the past 12-months	% of anglers not interested at all in combining with fishing	% of anglers slightly interested in combining with fishing	% of anglers moderately interested in combining with fishing	% of anglers very interested in combining with fishing	% of anglers extremely interested in combining with fishing	% of anglers already combining activity with fishing
Camping	55.8	4.6	7.5	19.4	39.9	28.5	51.4
Hiking (single day)	38.3	12.3	15.8	26.4	27.7	17.7	35.1
Big game hunting (elk, bear, mule deer, etc.)	34.3	18.4	16.1	23.9	23.1	18.5	27.6
ATV riding or off-road motorcycling	25.4	13.2	15.2	24.4	26.7	20.5	26.4
Small game hunting (upland bird, waterfowl, rabbit, etc.)	16.5	22.8	17.8	22.4	19.9	17.1	21.4
Wildlife viewing	13.6	9.0	14.5	26.5	28.7	21.3	41.9
Downhill skiing or snowboarding	11.7	68.8	9.5	10.3	6.2	5.1	3.5
Motor boating	11.4	12.3	9.5	25.1	36.6	16.5	46.3
4-wheel driving/Jeeping	11.2	13.5	12.0	25.1	31.1	18.3	27.1
Flat water rafting/canoeing/kayaking/paddle boarding	9.6	8.8	10.9	24.9	33.2	22.3	51.1
Picnicking	9.4	10.1	17.5	24.3	29.5	18.7	29.9
Backpacking (multiple days)	8.5	5.4	10.2	17.5	38.0	28.9	53.1
Mountain biking	8.1	33.2	20.5	18.5	17.1	10.6	11.9
Other	3.6	37.0	17.4	16.3	18.5	10.9	14.0
Horseback riding	3.1	20.0	20.0	23.2	20.0	16.8	20.1
Snowmobiling	2.6	50.6	19.0	10.1	11.4	8.9	15.7
Cross-country skiing or snowshoeing	2.5	54.8	19.4	10.8	5.4	9.7	3.7
Whitewater rafting/kayaking/canoeing	2.4	10.7	17.9	25.0	28.6	17.9	40.0

Appendix D

Cluster Analysis Criterion

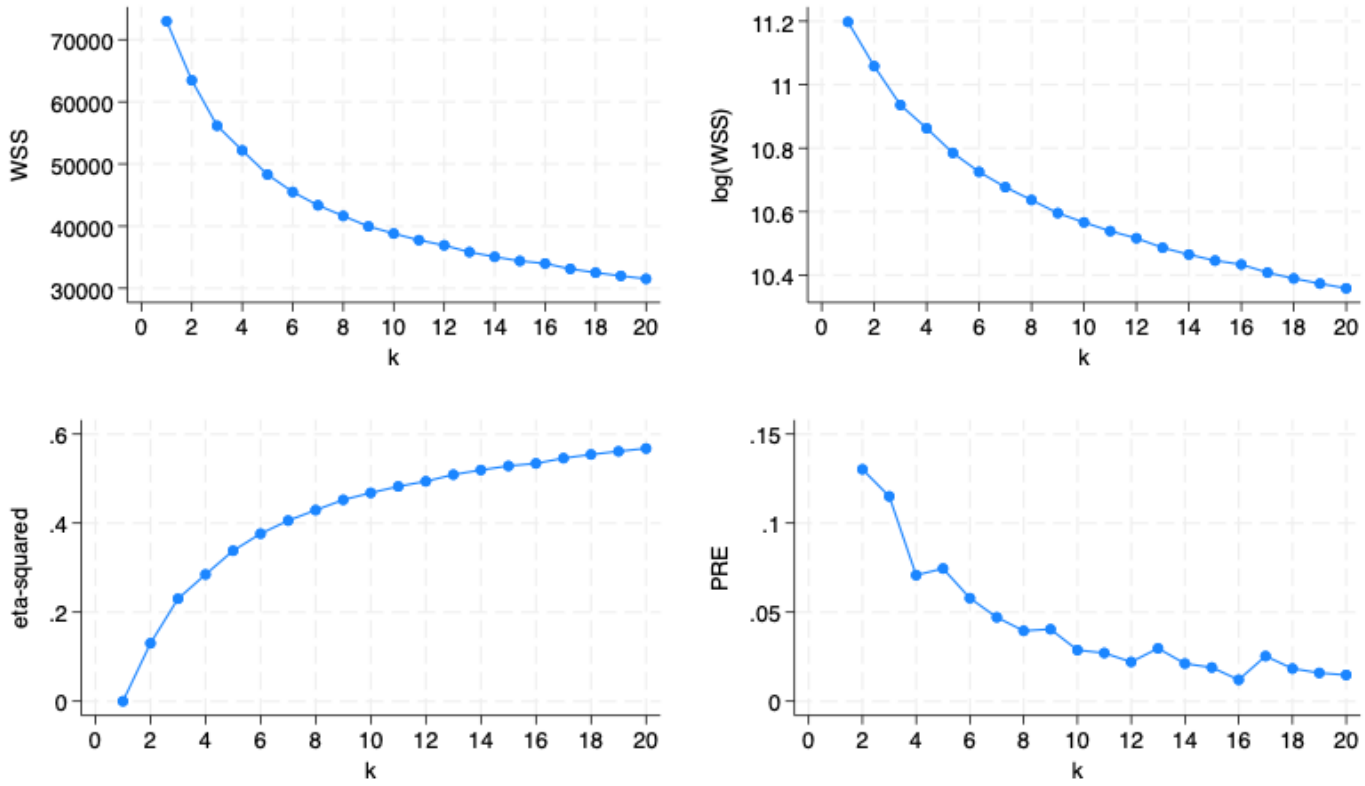


Figure D1

Criterion for Determining Optimal Number of Clusters

Institute of Outdoor Recreation & Tourism
UtahStateUniversity