

# RECREATION USE AND EXPERIENCES ON THE SOVEREIGN LANDS OF THE COLORADO AND GREEN RIVERS IN UTAH

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## ABOUT THE INSTITUTE

**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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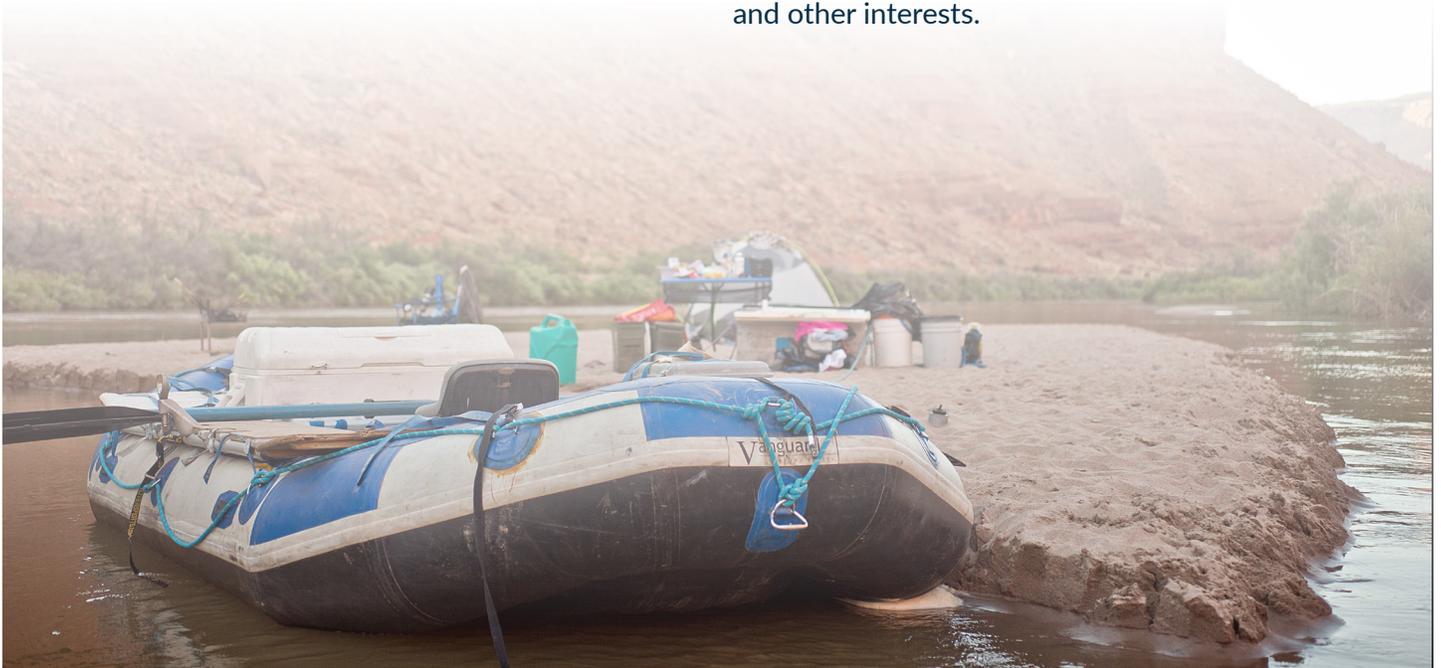
## EXECUTIVE SUMMARY

While the Colorado and Green Rivers both offer a wide variety of experiences, resource managers have very little reliable data to inform them about how recreationists are using the rivers, the types of on-river encounters amongst river users and river users' preferences for how on-river recreation is managed. The objectives of the survey effort were to:

1. Provide an accurate characterization of how recreationists are using the rivers;
2. Characterize the types of on-river encounters amongst river users; and
3. Assess river users' preferences for potential management actions that recreation managers could consider in the future.

We intercepted visitors at 9 river access sites over the course of two seasons (2021 & 2022). Access sites were selected to capture a representative sample of river users who use public access points. In total, we made 358 contacts with river users (291 on the Colorado and 67 on the Green) and received 306 completed surveys (252 on the Colorado and 54 on the Green).

The most notable theme emerging from the survey data was an asymmetrical conflict between non-motorized river users and river users on The Moab Daily segment of the Colorado. This theme can be distilled from several data points: 1) only 3.3% of sampled river users reported using a commercial jetboat to recreate on the Colorado; 2) only 12.4% of river users reported encountering a commercial jetboat while on the river; 3) nearly half of the river users who did encounter a commercial jetboat said it either "somewhat" or "greatly" detracted from their experience; and 4) of all river users, 63.5% indicated either "somewhat" or "completely" supporting limiting the number of commercial jet boats on the river. The path forward for managers on this action will depend on how many encounters between non-motorized and motorized river users they deem acceptable. Right now, that number is relatively low. Future decisions also depend on the extent to which managers prioritize river users' on-water recreation experiences. While encounters with commercial jetboats are infrequent, they do have a substantial and negative impact on recreation experiences. So much so, that nearly two-thirds of sampled river users support management actions that limit the number of commercial jetboats on the water. While the path forward for managers is not clear, we do believe this investigation has provided some reliable data to inform discussions between recreation managers, river users, and other interests.



# INTRODUCTION

The Colorado and the Green Rivers in southcentral Utah offer some of the state's most outstanding river-based outdoor recreation opportunities. Both rivers provide opportunities for recreationists to float through the iconic desert red rock that defines much of the Colorado Plateau. There are many ways recreationists can enjoy the opportunities provided by the rivers. Large inflatable rafts, supported through the local outfitter and guiding industry, provide opportunities for large groups. Canoeing, kayaking, paddleboarding, and tubing are also supported by the rivers, and each type of activity facilitates a unique on-river experience. Motorized boating provides opportunities for those individuals looking to explore and travel through the river corridors in a much faster and more targeted manner. On the Colorado River, commercial jetboat operators provide the option for river users to either take tours or be shuttled back up the river after a rafting trip.

While the Colorado and Green Rivers both offer a wide variety of experiences, resource managers have very little reliable data to inform them about how recreationists are using the rivers, the types of on-river encounters amongst river users and river users' preferences for how on-river recreation is managed. To help fill this void, our research team at the Institute of Outdoor Recreation and Tourism at Utah State University administered on-site surveys to river users over the course of two seasons (2021 & 2022) at access points along both the Colorado and Green. The objectives of the survey effort were threefold:

- 1. Provide an accurate characterization of how recreationists are using the rivers.** Answering questions such as what types of watercraft are recreationists using? Where are recreationists accessing the rivers? And how long are their on-river trips?
- 2. Characterize the types of on-river encounters amongst river users.** This includes quantifying the size of groups encountered, the types of watercraft used by other groups, and the proximity

to those other groups. Importantly, it also includes recreationists' perceptions of how their on-river encounters enhance or detract from their recreation experiences.

- 3. Assess river users' preferences for potential management actions that recreation managers could consider in the future.** This information can help managers ascertain which actions current river users are most likely to support.

Collectively, this investigation provides a foundational understanding of on-river recreation for both the Colorado and Green Rivers. The data collected through the survey effort is intended to inform the Utah Division of Forestry, Fire, and State Lands process of developing recreational use management objectives to address and reduce recreation conflicts, overcrowding, and other issues on sovereign land river segments of both rivers.

## METHODS

### Study Area

The Colorado and Green Rivers are classified as the largest waterways within the state of Utah respectively. First surveyed in 1869 by the John Wesley Powell scientific party, these diverse rivers now act as major recreation resources to locals and tourists alike (McPherson, 1994).

At the start of Utah's statehood, the Colorado and Green Rivers were deemed navigable by the standards of the Equal Footing Doctrine (Slade et al., 1997), meaning the state received fee title ownership of the sovereign lands encasing the waterways. The Utah Department of Forestry, Fire, and State Lands (FFSL) manages recreation use on these sovereign land segments.

## **Colorado River**

Originating in the Rocky Mountains of Colorado and spanning 1,450 river miles through southwestern portions of the United States and northern Mexico, the Colorado River is the largest waterway within the state of Utah (McPherson, 1994).

Recreational use of the river took off during the 1930s after groups began to capitalize on the region's scenic landscape and consistent flow of the river. The waterway continues to be a highly popular recreation destination for many outdoor enthusiasts. The ease of access and approved use of commercial boats have allowed users to float shorter sections of the river, typically completed in less than one day. These high-use sections, such as The Moab Daily, have a unique user dynamic as both motorized and non-motorized boaters share the waterway (SWCA Environmental Consultants et al., 2020). This can lead to a disruption in the recreational experience when commercial motor boats are traveling upstream.

## **Green River**

Flowing roughly 450 river miles through the eastern portion of Utah, the Green River is responsible for draining one-quarter of the state's entire area. While on its course, the waterway traverses much of the state, including the Uinta mountains in the northeastern portion of the state to the slickrock deserts in the south (Webb, 1994). The river's diverse resources, streamflow, and views have made it a popular recreation destination.

The late 1920s marked the beginning of the Green River's recreational boating industry as guides from Hatch River Expeditions led passengers through the northern sections of the river (OARS Dinosaur, 2022). In the present day, the Green River acts as a major recreational waterway for paddlers from around the world. Popular sections of the river, such as Labyrinth Canyon (which is a sovereign land segment managed by the Utah Division of Forestry, Fires, and State Lands), are typically longer when compared to high-usage areas of the Colorado River. This results in many of the Green River's users utilizing rafts, canoes, and kayaks to embark on multi-day float trips (SWCA Environmental Consultants et al., 2020).



## Data Collection

Data were collected by administering on-site surveys to individuals recreating on sections of either the Colorado or Green Rivers being managed by the Utah Division of Forestry, Fire, and State Lands (Figure 1).

Cliffs) that cater primarily to motorized river users. Our sample does not include these users. Consequently, our data are likely to under report the proportion of river users using motorized water craft; the data also do not capture the perceptions and preferences of river users who only use these private access points.

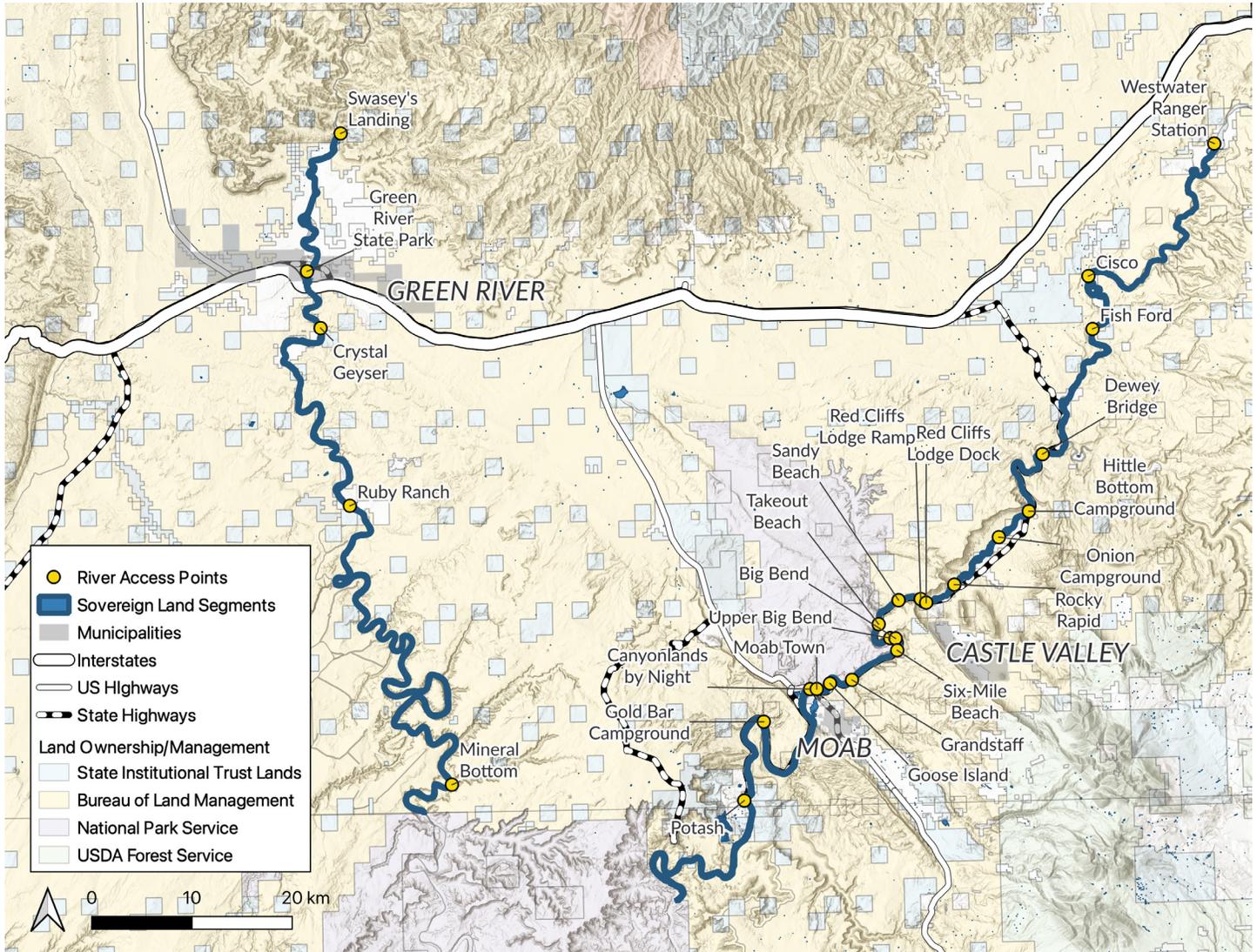


Figure 1. Access points on sections of the Colorado and Green Rivers managed by the Utah Division of Forestry, Fire, and State Lands.

## Survey Days, Sampling Design, and Survey Administration

We intercepted visitors at 9 river access sites selected by the research team in consultation with project managers with SWCA Environmental Consultants and staff within the Utah Division of Forestry, Fire, and State Lands (Table 1). **Access sites were selected to capture a representative sample of river users who use public access points.** There are several access sites on the Colorado River (e.g., Canyonlands by Night, Red

The one private sampling location we did survey recreationists at was Ruby Ranch on the Green River; it was included given the relatively few access points on the Green and the low use numbers we observed along the northern reaches of the Green River (i.e., Swasey's Landing to Crystal Geyser).

The sampling effort in 2021 focused exclusively on sites on The Moab Daily segment of the Colorado. The 2022 effort focused primarily on the Green River, but

also included 9 survey days at the Potash access point. Site days were concentrated on the weekends (Friday – Sunday) in an effort to contact the most river users.

**Table 1.** Sampling locations and year sampled.

Sampling Location	Year Sampled
<b>Colorado River</b>	
Potash	2022
Six Mile Beach	2021
Moab Town	2021
Dewey Bridge	2021
Hittle Bottom	2021
Onion Beach (Lower Onion Creek)	2021
Takeout Beach	2021
<b>Green River</b>	
Green River State Park	2022
Ruby Ranch	2022
Mineral Bottom	2022

Given the purpose of the survey was to gather information about recreation experiences *on the river*, we intercepted visitors at boat ramps and beaches as they exited the rivers. The initial survey protocol included two sampling timeframes, one in the morning (8am – 2pm) and another in the afternoon (12pm – 6pm). However, the initial site-days with morning timeframes yielded very few, if any, river users coming off the river during those hours. Consequently, we adjusted the protocol to include only the afternoon sampling timeframe. River users were approached by a survey technician shortly after they came off the water. The surveys were administered as close to the water’s edge as possible, in an effort to avoid contacting other recreationists who might be participating in some other recreation activity around, but not on, the river (e.g., campers, walkers, etc.). The survey technician informed river users that they were collecting information about river users’ experiences on the river to help inform the development of the rivers’ recreation management plans. The survey technician asked for only one visitor from each group, the one with the most recent birthday, to participate in the survey. If potential respondents were amenable to completing the survey, the technician handed them an iPad tablet computer and stood by to answer any questions the respondents might have had as they completed the survey. All surveys were completed using the Qualtrics survey administration application.

## Survey Design

The survey instrument was constructed by the research team in consultation with project managers at SWCA Environmental Consultants and staff within the Utah Division of Forestry, Fire, and State Lands. The instrument consisted of seven distinct sections:

- 1. Trip-related characteristics:** Including the river users’ primary recreational activity, the types of watercraft used, the duration of their trip, group size, put-in location, and stops taken along the rivers.
- 2. Encounters:** The types, number, and distance to other watercraft encountered on the river.
- 3. Support for management actions:** The strength of river users’ preferences for a variety of actions that resource managers can take to provide and support river recreation.
- 4. Socio-demographic characteristics:** Basic sociodemographic characteristics of river users.

Environmental characteristics include proximity to water bodies, state and federally managed public lands (differentiated by agency), and the presence of federally and state listed threatened, endangered, and sensitive animal and plant species. These indicators are broadly representative of potential siting locations’ conservation value. See Table 1 for a full list of data sources.

## RESULTS

### Survey Days and Response Rates

Between April 10, 2021, and October 10, 2022, we were able to collect data during 47 site-days at the nine sampling locations across both rivers. The total number of contacts made, completed surveys, and resulting response rates by sampling location are shown in Table 2. In total, we made 358 contacts with river users (291 on the Colorado and 67 on the Green) and received 306 completed surveys (252 on the Colorado and 54 on the Green). The overall response rate was 85.5%, which is more than acceptable for in-person surveys (Dillman et al., 2008).

**Table 2.** Survey effort, responses, and response rate by sampling location.

Sampling Location	Site Days	Contacts	Completed Surveys	Response Rate (%)
<b>Colorado River</b>				
Potash	9	47	41	87.2
Six Mile Beach	3	16	13	81.3
Moab Town	5	51	41	80.4
Dewey Bridge	1	2	2	100.0
Hittle Bottom	2	16	15	93.8
Onion Beach (Lower Onion Creek)	1	2	2	100.0
Takeout Beach	10	157	138	87.9
<b>Colorado River TOTAL</b>	<b>31</b>	<b>291</b>	<b>252</b>	<b>86.6</b>
<b>Green River</b>				
Green River State Park	2	4	1	25.0
Ruby Ranch	3	10	8	80.0
Mineral Bottom	11	53	45	84.9
<b>Green River TOTAL</b>	<b>16</b>	<b>67</b>	<b>54</b>	<b>80.6</b>
<b>TOTAL</b>	<b>47</b>	<b>358</b>	<b>306</b>	<b>85.5</b>

### Trip-related Characteristics

Inflatable rafts are by far the most common type of watercraft on both rivers, with 51.6% of groups reporting using them (Table 3). Inflatable rafts are followed by kayaks (used by 30.7% of groups), paddleboards (24.8%), and canoes (14.1%). Less than 5% of groups reported using inflatable rafts with outboard motors, motorboats (either commercial or private), or innertubes.

Across all types of watercraft we asked about, groups tended to be using between 2 to 3 watercraft per group (Table 3). Notably, however, there were a small proportion of groups who reported using many watercraft (e.g., 15 inflatable rafts or 13 canoes).

**Table 3.** Type and number of watercraft used on the Colorado and Green Rivers.

Watercraft Type	Proportion of sampled groups (%)	Mean Number Per Group (if used)	Std. Dev.	Range	
				Min.	Max.
Inflatable Raft	51.3	2.7	2.4	1	15
Kayak	30.4	2.6	2.0	1	13
Paddleboard	24.5	2.3	1.7	1	10
Canoe	13.7	3.0	2.5	1	13
Inflatable Raft with Outboard Motor	4.2	1.7	1.7	1	6
Motor Boat (commercial)	3.3	1.5	1.3	1	5
Innertube	2.3	2.0	1.2	1	4
Motor Boat (private)	1.0	1.0	0.0	1	1
Other	0.3	3.0	0.0	3	3

*Note.* Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S1.



**Table 4.** Group size by type of watercraft used on the Colorado and Green Rivers.

Watercraft Type	Mean Group Size (if used)	Std. Dev.	Range	
			Min.	Max.
Inflatable Raft	10.6	12.9	1	80
Kayak	11.8	14.7	1	60
Paddleboard	5.5	5.0	1	26
Canoe	6.2	4.8	2	25
Inflatable Raft with Outboard Motor	5.7	6.9	1	26
Motor Boat (commercial)	6.9	7.6	1	26
Innertube	6.7	5.8	2	15
Motor Boat (private)	1.7	0.6	1	2
<b>ALL GROUPS</b>	<b>7.7</b>	<b>10.4</b>	<b>1</b>	<b>80</b>

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S2.

While there was consistency in the number of watercraft used per group across the different types of watercraft we asked about, group sizes differed notably (Table 4). The average group size for inflatable raft users (*mean* = 10.6) and kayakers (*mean* = 11.8) was markedly higher than that of river users using other types of watercraft.

hours (Table 5). The length of day trips was fairly consistent across all groups, regardless of what type of watercraft was being used. For those taking overnight trips on the river (25.6% of all groups), the average trip length was 3.9 days. Again, the length of overnight trips was fairly consistent across all river users, regardless of what type of watercraft was being used.

Nearly two-thirds (74.4%) of all river trips were less than one day. Of those, the average (*mean*) time respondents reported spending on the river was 4

We asked river users about which river access point they used to put in on their trip. We also asked them where they stopped during their trip. On the Colorado,

**Table 5.** Time spent on the Colorado and Green Rivers by type of watercraft used.

Watercraft Type	Mean Hours (if < 1 day)	Std. Dev.	Range		Mean Days (if > 1 day)	Std. Dev.	Range	
			Min.	Max.			Min.	Max.
Inflatable Raft	4.3	3.2	1.0	22.0	2.5	1.2	1.0	5.0
Kayak	3.7	1.5	1.0	8.0	3.1	1.7	1.0	7.0
Paddleboard	3.4	2.0	1.0	12.0	3.6	1.6	1.0	6.0
Canoe	4.3	1.3	3.0	6.0	6.1	2.8	3.0	13.0
Inflatable Raft with Outboard Motor	5.0	0.0	5.0	5.0	4.0	0.0	4.0	4.0
Motor Boat (commercial)	2.3	0.6	2.0	3.0	4.5	1.3	3.0	6.0
Innertube	1.6	0.8	1.0	2.5	5.0	0.0	5.0	5.0
Motor Boat (private)	4.0	2.8	2.0	6.0	n/a	n/a	n/a	n/a
Other	3.0	0.0	3.0	3.0	n/a	n/a	n/a	n/a
<b>ALL GROUPS</b>	<b>4.0</b>	<b>2.7</b>	<b>1.0</b>	<b>22.0</b>	<b>3.9</b>	<b>2.5</b>	<b>1.0</b>	<b>13.0</b>

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S3.



the most common put in location was Rocky Rapid, with just over one-fifth of river users reporting they put in there (Table 6). The next most used put in locations were Hittle Bottom (16.4%), Dewey Bridge (15.8%), and Lower Onion Creek (Onion Beach) (15.8%). Less used put in locations, and the proportion of river users reporting using them, are shown in Table 6.

Roughly one-third (31.1%) of river users reported they did not stop at any other access points other than their beginning put in location and their terminal take out point. Of the river users who did make intermittent stops during their river trip, the most commonly used stop was Lower Onion Creek (Onion Beach) (8.4% of river users reported stopping there), Rocky Rapid (7.7%), and Hittle Bottom (6.2%). Other less frequently used stopping points are reported in Table 6.

## On-Water Encounters and Their Impact on Recreation Experiences

The next section of the survey focused on quantifying the type, number, and proximity of other watercraft respondents encountered while on the river. It also solicited information about how the number of watercraft seen compared to what was expected, and how other improved or detracted from recreationists' experience.

Just over one-third (37.0%) of river users reported they did not encounter another watercraft while on the river. Of the 63% of river users who did encounter another group, they saw around five other watercraft (*mean* = 4.8, *std. dev.* = 5.3) (Figure 2).

**Table 6.** Proportion of river users putting in and stopping at different river access points.

Access Point	Proportion of river users...	
	...putting in at this location (%)	...stopping at this location (%)
<b>Colorado River</b>		
Rocky Rapid	20.5	7.7
Hittle Bottom	16.4	6.2
Dewey Bridge	15.8	2.9
Lower Onion Creek (Onion Beach)	15.8	8.6
Sandy Beach	9.9	14.4
Other	8.8	4.8
Mineral Bottom	5.9	0
Takeout Beach	2.3	4.3
Potash	2.3	0
Cisco	1.8	1
Moab Town	0.6	3.8
None	0.0	31.1
Big Bend	0.0	5.3
Six Mile Beach	0.0	2.9
Grandstaff	0.0	2.9
Upper Big Bend	0.0	1.4
Red Cliffs	0.0	1.9
Goose Island	0.0	1.0
<b>Green River</b>		
Ruby Ranch	53.9	20.0
Green River SP	30.8	0.0
Crystal Geyser	15.4	40.0



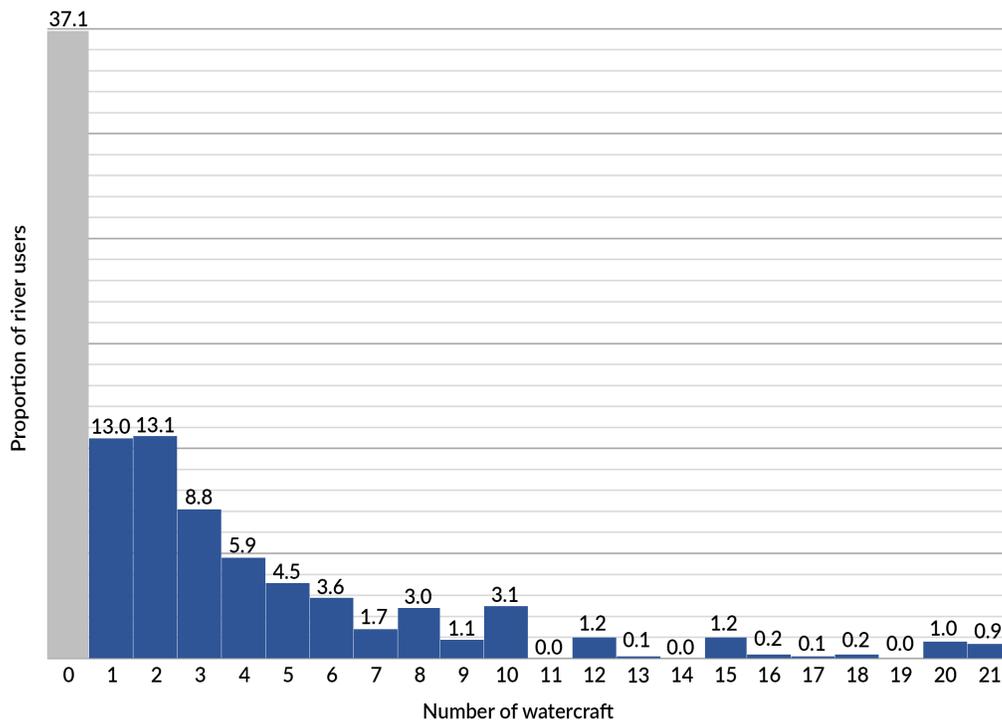


Figure 2. Distribution of the number of other watercraft encountered by river users.

Of the river users who did encounter another group, just over one-quarter (28.6%) reported encountering other groups using inflatable rafts. This was followed by encounters with other groups using kayaks (22.1%), paddleboards (16.0%), and commercial motor boats (12.4%). The proportion of sampled groups encountering other types of watercraft are shown in Table 7.

If respondents encountered an inflatable raft, they reported seeing an average of around 6.7 rafts (Table 7). Of the other types of watercraft asked about, river users reported encountering 4.7 paddleboards, 3.9 commercial motor boats, 2.2 innertubes, 1.2 kayaks, and 1.3 private motor boats if they did have an encounter with each type of watercraft.

Table 7. Type and number of watercraft encountered on the Colorado and Green Rivers.

Watercraft Type	Proportion of sampled groups encountering each type of watercraft (%)	Mean number encountered (if encountered)	Std. Dev.	Range	
				Min.	Max.
Inflatable Raft	28.6	6.7	6.8	0	50
Kayak	22.1	1.2	0.7	0	4
Paddleboard	16.0	4.7	4.5	0	25
Motor Boat (commercial)	12.4	3.9	3.6	0	18
Canoe	6.5	4.2	3.6	0	20
Inflatable Raft with Outboard Motor	5.5	8.7	8.6	1	30
Innertube	4.6	2.2	1.1	0	6
Motor Boat (private)	3.4	1.3	0.8	1	4
Other	1.0	2.6	3.0	1	8

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S4.



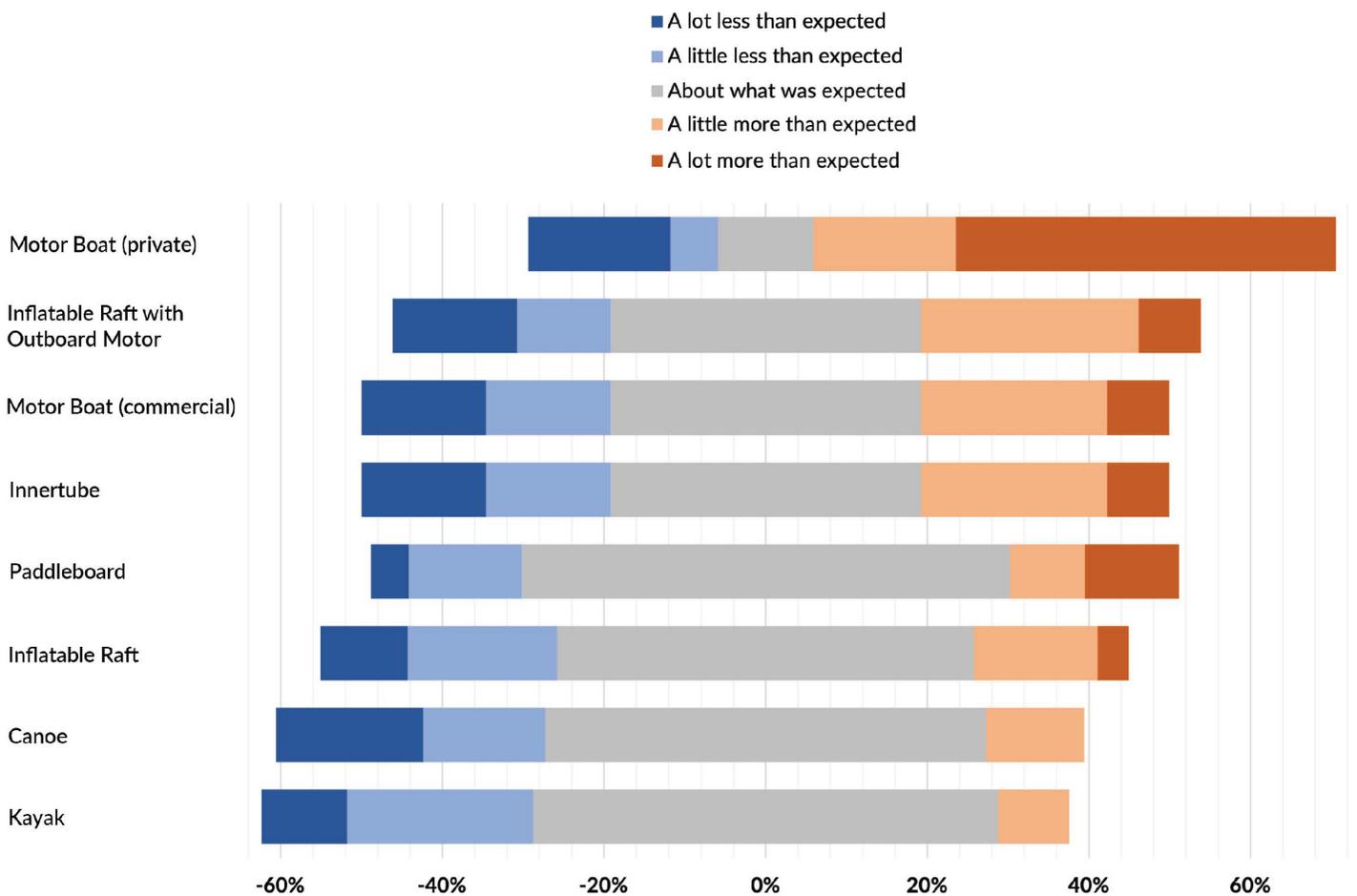
We ascertained whether or not encountering this many watercraft was consistent with river users' expectations. More than half (55.0%) of respondents noted the number of private motor boats they saw was either "a little more" or "a lot more" than expected (Table 8, Figure 3). On the other end of the spectrum, almost half (46.8%) of respondents indicated the number of kayaks they saw was either "a little" or "a

lot" less than expected. This proportion was similar for paddleboards (39.2%) and canoes (38.9%). For all other types of watercraft, we asked about (innertubes, commercial motor boats, and inflatable rafts with outboard motors), there was a relative balance between the proportion of respondents who indicated the number of other watercraft they saw was either more or less than expected (Figure 3).

**Table 8.** Colorado and Green River users' perceptions of the number or watercraft they encountered, compared to what they expected.

Watercraft Type	A lot less than expected	A little less than expected	About what was expected	A little more than expected	A lot more than expected	No expectations
Motor Boat (private)	15.0	5.0	10.0	15.0	40.0	15.0
Inflatable Raft with Outboard Motor	13.3	10.0	33.3	23.3	6.7	13.3
Motor Boat (commercial)	14.3	14.3	35.7	21.4	7.1	7.1
Innertube	14.3	14.3	35.7	21.4	7.1	7.1
Paddleboard	4.1	12.4	53.6	8.3	10.3	11.3
Inflatable Raft	10.0	17.1	47.7	14.1	3.5	7.7
Canoe	16.7	13.9	50.0	11.1	0.0	8.3
Kayak	9.6	20.8	52.0	8.0	0.0	9.6

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S5.



**Figure 3.** River users' perceptions of the number of watercraft they encountered, compared to what they expected.

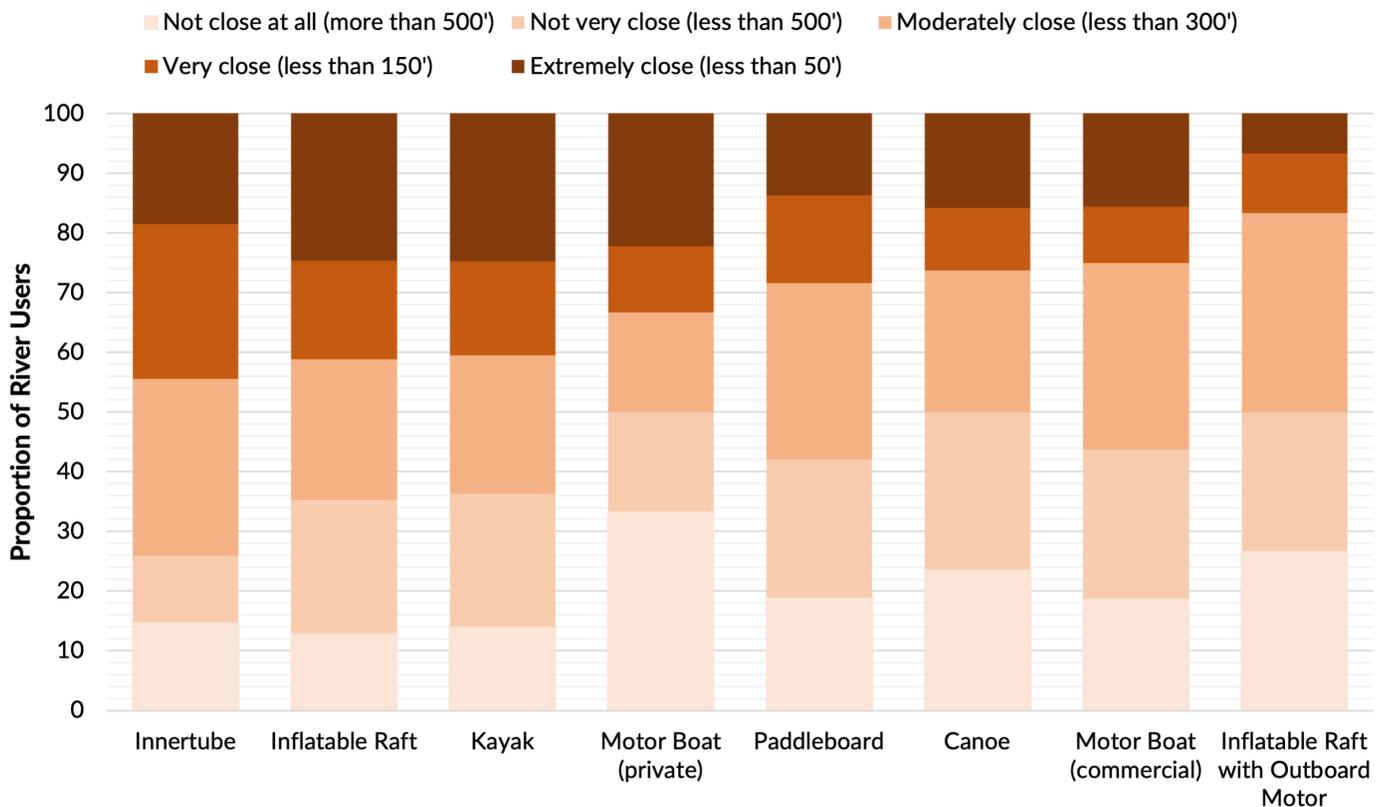
Of the 28% of river users who encountered other watercraft, many respondents reported either “very close (less than 150’)” or “extremely close (less than 50’)” encounters with other river users (Table 9, Figure 4). 44.5% of respondents reported coming within 150’ of another group using an innertube during their trip. Nearly as many respondents reported coming within 150’ of other groups using inflatable rafts (41.2%)

or kayaks (40.5%). The proximity between groups using other types of watercraft is noted in Table 9 and shown in Figure 4. Of note, of those who did encounter a commercial motor boat, 25% reported coming within 150’ of it.

**Table 9.** Distance of encounters with different types of watercraft while on the Colorado and Green Rivers, if encountered.

Watercraft Type	Not close at all (more than 500')	Not very close (less than 500')	Moderately close (less than 300')	Very close (less than 150')	Extremely close (less than 50')
Innertube	14.8	11.1	29.6	25.9	18.5
Inflatable Raft	12.9	22.4	23.5	16.5	24.7
Kayak	14.1	22.3	23.1	15.7	24.8
Motor Boat (private)	33.3	16.7	16.7	11.1	22.2
Paddleboard	19.0	23.2	29.5	14.7	13.7
Canoe	23.7	26.3	23.7	10.5	15.8
Motor Boat (commercial)	18.8	25.0	31.3	9.4	15.6
Inflatable Raft with Outboard Motor	26.7	23.3	33.3	10.0	6.7

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S6.



**Figure 4.** Distance of encounters with different types of watercraft while on the river.

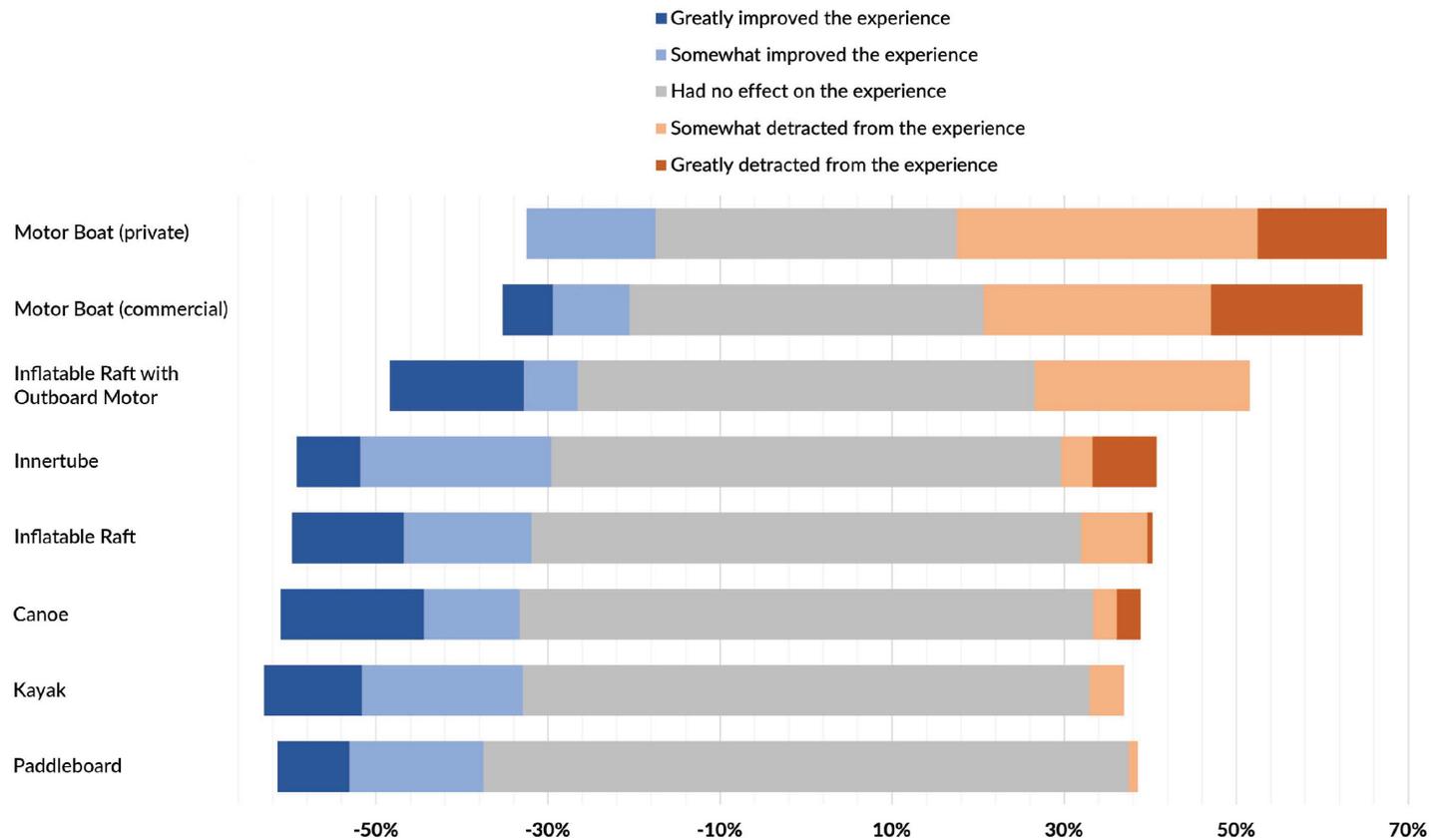
We also asked respondents who had encounters, how their interactions with others on the river impacted their experience. Exactly half of all respondents indicated that their encounters with private motor boats either “somewhat” or “greatly” detracted from their experience (Table 10, Figure 5). Nearly

the same proportion (44.1%) said their encounters with commercial motor boats detracted from their experience. Notably, fewer respondents indicated encounters with any of the other types of watercraft detracted from their experience.

**Table 10.** Effect of encounters with different types of watercraft on Colorado and Green River users' experiences.

Watercraft Type	Greatly improved the experience	Somewhat improved the experience	Had no effect on the experience	Somewhat detracted from the experience	Greatly detracted from the experience
Motor Boat (private)	0.0	15.0	35.0	35.0	15.0
Motor Boat (commercial)	5.9	8.8	41.2	26.5	17.7
Inflatable Raft with Outboard Motor	15.6	6.3	53.1	25.0	0.0
Innertube	7.4	22.2	59.3	3.7	7.4
Inflatable Raft	13.0	14.8	63.9	7.7	0.6
Canoe	16.7	11.1	66.7	2.8	2.8
Kayak	11.4	18.7	65.9	4.1	0.0
Paddleboard	8.3	15.6	75.0	1.0	0.0

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S7.



**Figure 5.** Effect of encounters with different types of watercraft on river users' experiences.

## Support for Management Actions

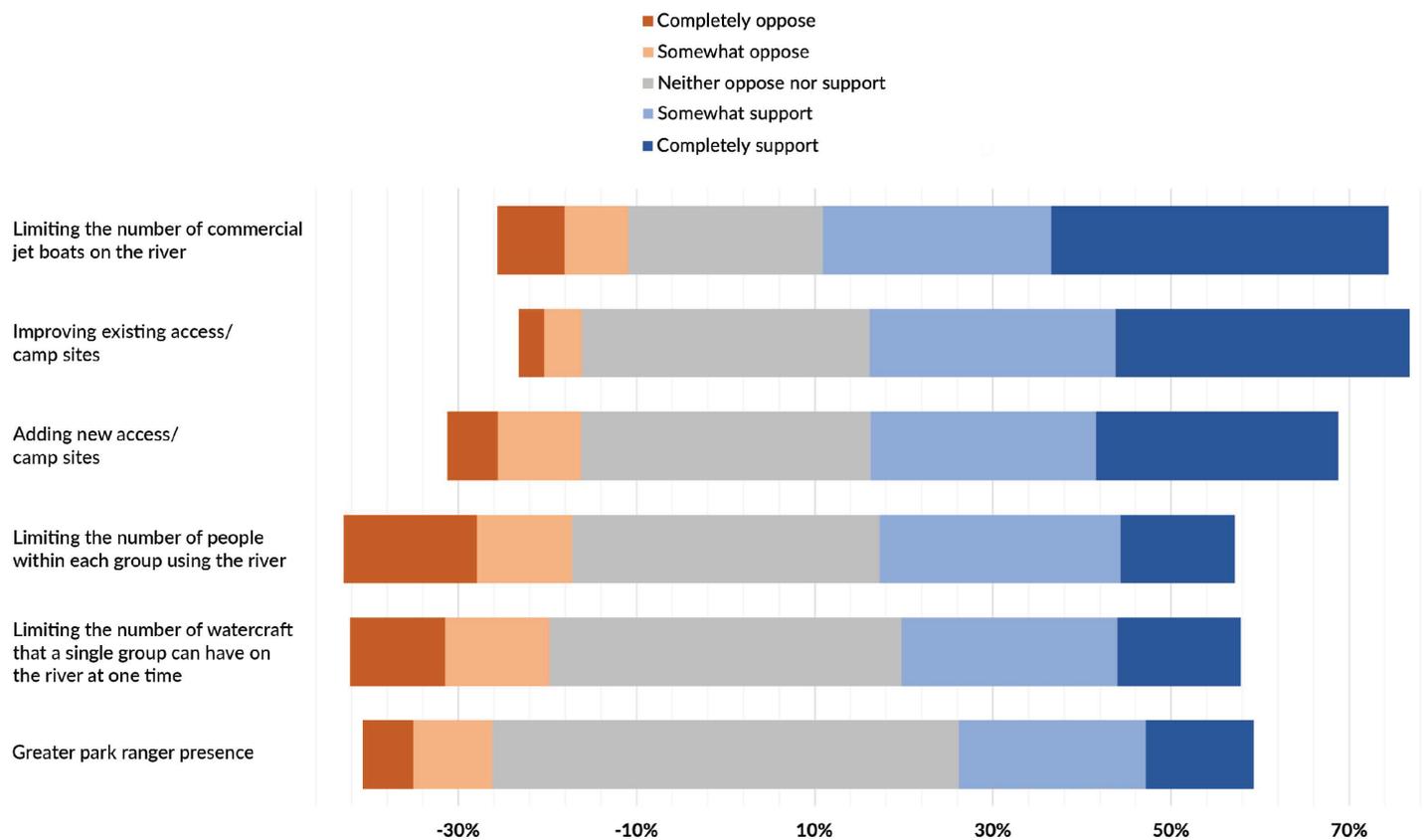
We asked river users the extent to which they either opposed or supported six distinct recreation management actions. A majority (63.5%) of river users indicated either “somewhat” or “completely” supporting limiting the number of commercial jet boats on the river; only 14.7% of river users opposed this action (Table 11; Figure 6). Nearly as many river users (60.6%) indicated support for improving existing access and/or camp sites; only 7.1% of respondents

opposed improvements. There was also strong support for adding new access and/or camp sites, with over half (52.5%) of river users indicating support. There were notably strong and divergent preferences for limiting the number of people within each group using the river; 39.9% of respondents supported this action while 25.6% were in opposition. Finally, there was support (albeit marginal) for either limiting the number of watercraft that a single group can have on the river at one time or having a greater presence of park rangers.

**Table 11.** Colorado and Green River users' support for management actions.

Watercraft Type	Completely oppose	Somewhat oppose	Neither oppose nor support	Somewhat support	Completely support
Limiting the number of commercial jet boats on the river <i>(Only shown to recreationists on the Colorado River)</i>	7.6	7.1	21.9	25.6	37.8
Improving existing access/camp sites	2.8	4.3	32.3	27.7	33.0
Adding new access/camp sites	5.7	9.3	32.5	25.4	27.1
Limiting the number of people within each group using the river	15.0	10.7	34.5	27.1	12.8
Limiting the number of watercraft that a single group can have on the river at one time	10.7	11.7	39.5	24.2	13.9
Greater park ranger presence	5.7	8.9	52.3	21.0	12.1

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S8.



**Figure 6.** River users' support for management actions.

## Socio-demographic Characteristics

The sociodemographic characteristics of the sample are reported in Table 12. Respondents, by and large, were middle age (*mean age* = 43.7), well-educated (78.8% had at least a bachelor's degree), white

(97.1%), and have an annual household income above \$100,000 per year (52.2% of respondents reported an income above \$100,000).

**Table 12.** Sociodemographic characteristics of Colorado and Green River users

Sociodemographic Characteristic	% of river users	Mean	Std. Dev.	Range	
				Min.	Max.
Age		43.7	14.3	18	79
Education (%)					
Some high school	1.0				
High school graduate	4.5				
Vocational/trade school	3.8				
Some college	7.3				
Associate degree	4.5				
Bachelor's degree	39.2				
Master's degree	26.0				
Professional degree	7.3				
Doctoral degree	6.3				
Gender (%)					
Male	52.0				
Female	46.6				
Other	1.4				
Hispanic (%)					
Yes	3.1				
Ethnicity (%)					
American Indian	0.4				
Asian	1.1				
Black	1.1				
Hawaiian or other Pacific Islander	0.4				
White	97.1				
Income (%)					
Less than \$25,000	5.6				
\$25,000 to \$34,999	4.1				
\$35,000 to \$49,999	7.5				
\$50,000 to \$74,999	12.7				
\$75,000 to \$99,000	17.9				
\$100,000 to \$149,000	22.0				
\$150,000 to \$199,999	10.8				
\$200,000 or more	19.4				
Residency					
USA	98.3				
Other than the USA	1.7				

Note. Data are from both the Colorado and Green Rivers. Data specific to the Colorado River is provided in Table S9.



## DISCUSSION

We set out on this investigation to provide a foundational understanding of on-river recreation for sovereign land segments of both the Colorado and Green Rivers. By collecting data through on-site surveys administered to recreationists using public access points, we were able to collect the information necessary to inform how the Utah Division of Forestry, Fire, and State Lands develops recreational use management objectives for both rivers. This information aligns with our three primary objectives and is summarized below.

### How Recreationists are Using the Rivers

#### *Watercraft Used*

Most river users within our sample use non-motorized watercraft. Over half (51.3%) of river users use inflatable rafts specifically, with slightly less using either kayaks (30.4% of river users) or paddleboards (24.5%). Only 4.2% of recreationists use inflatable rafts with outboard motors and only 3.3% use commercial motor boats during their on-river trips. The latter number is notable if river managers are concerned about the degradation of non-motorized recreation experiences because of the presence of motorized users, particularly commercial motor boats. This point is discussed further below when we characterize the types of on-river encounters amongst river users.

#### *Group Size*

The size of groups recreating on the rivers is large, which is not surprising given the highly social nature of rafting and tubing opportunities. The mean group size for those using inflatable rafts was 10.6 people, with some sampled groups having several dozen individuals. The data also revealed groups using other non-motorized watercraft besides rafts also recreate in relatively large groups. The mean group size for those groups using kayaks was 11.8 people for example. Paddleboarders (mean group size = 5.5 people), canoers (mean group size = 6.2 people), and innertube users (mean group size = 6.7 people) also tend to recreate in fairly large groups on the rivers.

#### *Trip Length*

With regards to how long recreationists are staying on the rivers, nearly three-fourths (74.4%) are taking day trips averaging around 4 hours. Of the quarter of river users who do take overnight trips, the mean number of days spent on the river was just under four (3.9). Collectively, this data suggests the large majority of river users are setting out on half-day trips (likely based out of Moab). A smaller proportion of river users embark on longer excursions lasting for at least a couple of days longer than a weekend.

#### *Access Points Used*

On the Colorado, the most heavily used put-in site was Rocky Rapid with one-fifth (20.5%) of river users entering here. Hittle Bottom (16.4%), Dewey Bridge (15.8%), and Lower Onion Creek (15.8%) were also used by relatively large proportions of river users. Collectively, these four access points are used as put-in locations for 68.5% of river users. All four sites are in the middle reaches of The Moab Daily segment of the Colorado, just above Red Cliffs Lodge. A large proportion of river users (31.1%) reported never stopping on their trip down the Colorado. Of those who did stop, the most common stopping points include Sandy Beach (14.1%), and Lower Onion Creek (8.6%).

On the Green, roughly half (53.9%) of river users reported putting in at Ruby Ranch, with just under one-third (30.8%) putting in at Green River State Park. Crystal Geyser was used as an access point less frequently, with only 15.4% of river users putting in there. However, Crystal Geyser was used as a stopping point by 40% of river users who put in at either the State Park or at Swasey's Landing.

#### *Types of On-River Encounters*

On-river encounters are relatively uncommon. Less than one-third (28.6%) of river users reported encountering another group using inflatable rafts. The proportion dropped to 22.1% for other groups with a kayak. Notably, only 12.4% of river users reported

encountering commercial motor boats while on the river. By and large, the number of encounters river users are having is aligning with their expectations.

While the number of on-river encounters is about what recreationists were expecting, they did report getting either “very close (less than 150’)” or “extremely close (less than 50’)” to those other groups. Nearly half (44.5%) of all river users who did encounter another group with innertubes reported that group getting within 150’ of them. This proportion was similar for encounters with inflatable rafts (41.2%) and kayaks (40.5%). Of the groups who did encounter a commercial motor boat on their trip, 25% reported the boat getting within 150’ of their group. While on-river encounters are relatively uncommon, they tend to be close when they do occur.

Additionally, on-river encounters do have a notable impact on recreationists’ experiences. The data suggest that on-river encounters with motorized watercraft tend to detract from users’ experience. Roughly half of river users who encountered either a private motor boat (50.0%) or a commercial motor boat (44.1%) said that encounter either “somewhat” or “greatly” detracted from their experience. Less than one-fifth of these recreationists said their encounter with either a private (15.0%) or commercial (14.7%) improved their experience.

The relative infrequency of on-river encounters and the asymmetrical conflict between non-motorized and motorized river users may be expected given that nearly all non-motorized river users travel down-river (explaining the low frequency of on-river encounters) and that when these users do encounter a motorized watercraft, it tends to be heading up-river (likely shuttling recreationists back to their put-in location). Recreation managers may consider limiting the number of motorized watercraft on the river given their large impact on recreation experiences. Next, we turn to the question of whether river users would support this action, as well as several other potential management actions.

## Preferences for Potential Management Actions

The majority of Colorado river users (63.5%) said they either “somewhat” or “completely” support limiting the number of commercial jet boats on the river; only 14.7% of river users opposed this action. While on-river encounters with commercial motor boats are relatively uncommon, sampled river users are in support of managers taking action to make them even less frequent. It appears when encounters with commercial motor boats do happen, their impact on the recreation experience is so substantial, that users would support more controlled regulation over how many commercial motor boats can be on the river. Of note, river users’ support for management action targeted at commercial jetboats was stronger than their support for any other management action.

Of the potential management actions asked of users on both the Colorado and Green, river users were generally in favor of improving existing access/campsites and adding new access/campsites. There was relative ambivalence towards limiting group sizes, limiting the number of watercraft per group, and establishing a greater presence from park managers.

## CONCLUSION

Collectively, this study provides a foundational understanding of on-river recreation for both the Colorado and Green Rivers. The data collected and reported here are intended to help the Utah Division of Forestry, Fire, and State Lands develop recreational use management objectives to address and reduce recreation conflicts on both rivers. The most notable theme emerging from the study is the asymmetrical conflict between non-motorized river users and river users on The Moab Daily segment of the Colorado. This theme can be distilled from several data points: 1) only 3.3% of sampled river users reported using a commercial jetboat to recreate on the Colorado; 2) only 12.4% of these river users reported encountering a commercial jetboat while on the river; 3) nearly half of the river users who did encounter a commercial jetboat said it either “somewhat” or “greatly” detracted from their experience; and 4) of all river users, 63.5% indicated either “somewhat” or “completely” supporting limiting the number of commercial jet boats on the river. The path forward for managers on this

action will depend on how many encounters between non-motorized and motorized river users they deem acceptable. Right now, that number is relatively low. Future decisions also depend on the extent to which managers prioritize river users' on-water recreation experiences. While encounters with commercial jetboats are infrequent, they do have a substantial and negative impact on recreation experiences. So

much so, that nearly two-thirds of current river users support management actions that limit the number of commercial jetboats on the water. While the path forward for managers is not clear, we do believe this investigation has provided some reliable data to inform discussions between recreation managers, river users, and other interests.



## REFERENCES

- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2008). *Internet, mail, and mixed-mode surveys: The tailored design method* (3rd ed.). Wiley.
- McPherson, R. (1994). Colorado River. In A. K. Powell (Ed.), *Utah history encyclopedia*. University of Utah Press.
- OARS Dinosaur. (2022). *History—OARS Dinosaur*. <https://www.greenriverrafting.com/history/>
- Slade, D. C., Kehoe, R. K., & Stahl, J. K. (1997). *Putting the public trust doctrine to work: The application of the public trust doctrine to the management of lands, waters and living resources of the coastal states*. <https://shoreline.noaa.gov/docs/8d5885.pdf>
- SWCA Environmental Consultants, CRSA, River Science Institute, Inc., Schmidt, J., & Walker, A. (2020). *Final Colorado River Comprehensive Management Plan*. [https://ffsl.utah.gov/wp-content/uploads/ColoradoRiver\\_Final\\_CMP\\_January\\_2020\\_Compressed.pdf](https://ffsl.utah.gov/wp-content/uploads/ColoradoRiver_Final_CMP_January_2020_Compressed.pdf)
- Webb, R. (1994). The Green River. In A. K. Powell (Ed.), *Utah history encyclopedia*. University of Utah Press.

## SUPPLEMENTAL TABLES

**Table S1.** Type and number of watercraft used on the Colorado River.

Watercraft Type	Proportion of sampled groups (%)	Mean Number Per Group (if used)	Std. Dev.	Range	
				Min.	Max.
Inflatable Raft	57.5	2.6	2.4	1	15
Kayak	31.0	2.5	1.7	1	8
Paddleboard	23.0	2.2	1.4	1	7
Canoe	5.6	1.9	1.1	1	4
Inflatable Raft with Outboard Motor	4.0	1.4	1.3	1	5
Motor Boat (commercial)	3.2	1.5	1.4	1	5
Innertube	1.6	2.3	1.5	1	4
Motor Boat (private)	1.2	1.0	0.0	1	1
Other	0.4	3.0	.	3	3

**Table S2.** Group size by type of watercraft used on the Colorado River.

Watercraft Type	Mean Group Size (if used)	Std. Dev.	Range	
			Min.	Max.
Inflatable Raft	9.5	12.8	1	80
Kayak	9.0	12.7	1	60
Paddleboard	6.8	9.1	1	45
Canoe	4.8	3.7	2	15
Inflatable Raft with Outboard Motor	4.1	3.2	1	20
Motor Boat (commercial)	4.0	3.2	1	12
Innertube	3.5	3.5	1	15
Motor Boat (private)	2.4	1.3	1	5
<b>ALL GROUPS</b>	<b>7.6</b>	<b>10.8</b>	<b>1</b>	<b>80</b>

**Table S3.** Time spent on the river by type of watercraft used on the Colorado River.

Watercraft Type	Mean Hours (if < 1 day)		Range		Mean Days (if > 1 day)		Range	
	Std. Dev.	Min.	Max.	Std. Dev.	Min.	Max.		
Inflatable Raft	4.3	3.1	1.0	22.0	2.4	1.5	1.0	7.0
Kayak	3.6	1.5	1.0	7.0	3.2	2.2	1.0	7.0
Paddleboard	3.3	1.5	1.0	6.0	3.3	2.2	1.0	6.0
Canoe	4.8	4.1	1.0	20.0	6.8	3.7	1.0	13.0
Inflatable Raft with Outboard Motor	5.3	0.6	5.0	6.0	n/a	n/a	n/a	n/a
Motor Boat (commercial)	5.2	3.7	2.0	12.0	5.0	1.4	3.0	6.0
Innertube	4.1	1.6	1.0	6.0	n/a	n/a	n/a	n/a
Motor Boat (private)	4.2	1.7	1.0	6.0	6.0	.	6.0	6.0
<b>ALL GROUPS</b>	<b>3.9</b>	<b>2.7</b>	<b>1.0</b>	<b>22.0</b>	<b>3.9</b>	<b>2.9</b>	<b>1.0</b>	<b>13.0</b>

**Table S4.** Type and number of watercraft encountered on the Colorado River.

Watercraft Type	Proportion of sampled groups encountering each type of watercraft (%)	Mean number encountered (if encountered)	Std. Dev.	Range	
				Min.	Max.
Inflatable Raft	67.1	6.8	6.9	0	50
Kayak	12.3	4.8	4.6	0	25
Paddleboard	47.6	4.3	3.6	0	20
Motor Boat (commercial)	13.5	2.3	1.1	0	6
Canoe	38.5	3.6	2.8	0	10
Inflatable Raft with Outboard Motor	11.1	1.1	0.4	0	2
Innertube	25.8	8.7	8.6	1	30
Motor Boat (private)	7.5	1.2	0.4	1	2
Other	2.0	3.0	3.4	1	8

**Table S5.** Colorado river users' perceptions of the number of watercraft they encountered, compared to what they expected.

Watercraft Type	A lot less than expected	A little less than expected	About what was expected	A little more than expected	A lot more than expected	No expectations
Motor Boat (private)	16.7	5.6	11.1	11.1	38.9	16.7
Inflatable Raft with Outboard Motor	11.1	7.4	33.3	25.9	7.4	14.8
Motor Boat (commercial)	9.4	12.5	29.7	15.6	21.9	10.9
Innertube	14.3	14.3	35.7	21.4	7.1	7.1
Paddleboard	4.3	12.9	52.7	8.6	10.8	10.8
Inflatable Raft	10.3	16.4	47.9	13.9	3.6	7.9
Canoe	11.1	11.1	51.9	14.8	0.0	11.1
Kayak	7.8	20.9	53.0	8.7	0.0	9.6

**Table S6.** Distance of encounters with different types of watercraft while on the Colorado river, if encountered.

Watercraft Type	Not close at all (more than 500')	Not very close (less than 500')	Moderately close (less than 300')	Very close (less than 150')	Extremely close (less than 50')
Innertube	14.8	11.1	29.6	25.9	18.5
Inflatable Raft	12.7	21.2	23.6	17.0	25.5
Kayak	13.5	21.6	23.4	17.1	24.3
Motor Boat (private)	37.5	12.5	12.5	12.5	25.0
Canoe	13.8	27.6	27.6	13.8	17.2
Paddleboard	17.6	24.2	30.8	15.4	12.1
Motor Boat (commercial)	19.7	24.6	31.2	9.8	14.8
Inflatable Raft with Outboard Motor	25.9	22.2	37.0	7.4	7.4

**Table S7.** Effect of encounters with different types of watercraft on Colorado river users' experiences.

Watercraft Type	Greatly improved the experience	Somewhat improved the experience	Had no effect on the experience	Somewhat detracted from the experience	Greatly detracted from the experience
Motor Boat (private)	0.0	16.7	33.3	33.3	16.7
Motor Boat (commercial)	4.6	9.2	40.0	27.7	18.5
Inflatable Raft with Outboard Motor	6.9	6.9	58.6	27.6	0.0
Innertube	7.4	22.2	59.3	3.7	7.4
Inflatable Raft	13.4	14.6	64.0	7.3	0.6
Canoe	3.7	11.1	77.8	3.7	3.7
Kayak	8.9	18.6	68.1	4.4	0.0
Paddleboard	6.5	15.2	77.2	1.1	0.0

**Table S8.** Colorado river users' support for management actions.

Watercraft Type	Completely oppose	Somewhat oppose	Neither oppose nor support	Somewhat support	Completely support
Limiting the number of commercial jet boats on the river	7.6	7.1	21.9	25.6	37.8
Improving existing access/camp sites	2.1	3.8	32.9	27.4	33.8
Adding new access/camp sites	4.2	7.6	35.6	23.3	29.2
Limiting the number of people within each group using the river	15.6	11.8	35.9	24.9	11.8
Limiting the number of watercraft that a single group can have on the river at one time	11.1	11.5	41.3	22.6	13.6
Greater park ranger presence	5.5	8.9	54.7	19.1	11.9

**Table S9.** Sociodemographic characteristics of Colorado river users

Sociodemographic Characteristic	% of river users	Mean	Std. Dev.	Range	
				Min.	Max.
Age		43.6	14.6	18	79
Education (%)					
Some high school	5.0				
High school graduate	3.7				
Vocational/trade school	7.1				
Some college	5.0				
Associate degree	39.0				
Bachelor's degree	24.9				
Master's degree	7.9				
Professional degree	6.2				
Doctoral degree	1.2				
Gender (%)					
Male	52.1				
Female	46.6				
Other	1.3				
Hispanic (%)					
Yes	3.4				
Ethnicity (%)					
American Indian	0.4				
Asian	1.2				
Black	1.2				
Hawaiian or other Pacific Islander	0.4				
White	88.9				
Income (%)					
Less than \$25,000	6.7				
\$25,000 to \$34,999	4.0				
\$35,000 to \$49,999	7.6				
\$50,000 to \$74,999	11.2				
\$75,000 to \$99,000	17.0				
\$100,000 to \$149,000	22.9				
\$150,000 to \$199,999	10.8				
\$200,000 or more	19.7				
Residency					
USA	96.0				
Other than the USA	0.8				



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