ASSESSMENT OF STREAMFLOW NEEDS FOR SUPPORTING RECREATIONAL WATER USES ON THE RIO GRANDE AND CONEJOS RIVER.

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Prepared for:
Rio Grande, Conejos River, and Saguache Creek Stream Management Plan
Rio Grande Headwaters Restoration Project
623 Fourth Street, Alamosa, CO 81101

Prepared by:

Seth Mason
Lotic Hydrological
PO Box 1524, Carbondale, CO 81623

And

Evan Stafford and Kestrel Kunz
American Whitewater
PO Box 1540, Cullowhee, NC 28723

Summary

The recreational use assessment presented in this report provides important baseline information relating streamflows and recreational use. This body of work directly supports the Rio Grande Headwater Restoration Project's Stream Management Planning efforts. This report discusses study locations, and methods used to collect and analyze streamflow preference information from recreational users. User survey responses provided by 136 respondents were used to delineate acceptable and optimal streamflow thresholds for supporting recreational use activities on 11 segments on the Rio Grande and Conejos River (Table ES.1). Threshold identification supported quantification of the Boatable Days metric for each assessment reach under typical wet, average, and dry hydrological year types. The assessment followed recommendations the State of Colorado's Basin Implementation Plan guidance documents for quantifying non-consumptive recreational needs.

Respondent numbers for the flow preference study conducted in 2019 are robust for a remote or sparsely populated region of southern Colorado. The large number of responses to flow related questions for most reaches made delineation of flow acceptability thresholds fairly straightforward. However, low response rates among survey participants for reaches 6, 8, 9, and 10 may introduce some uncertainty into flow preference threshold delineated for those sections of river. Low response rates may indicate there is little to no use on these sections during most times of the year. Alternatively, it may indicate that the survey distribution did not reach the typical users of these reaches. Future recreational use assessment activities may benefit from targeted outreach to those users known to recreate on these reaches and inquiries into whether or not they have companions or are aware of additional users/groups that recreate at those locations. It may also be useful to ascertain why these reaches may be receiving so little use and whether or not there is opportunity to increase recreational activity through awareness campaigns, development of river access points, or through some other means.

Table ES.1. User-defined flow preferences for reaches included in the Boatable Days assessment.

Reach	River	Reach Description	Min. Acceptable	Min. Optimal	Max. Optimal	Max. Acceptable
1	Rio Grande	Rio Grande Reservoir to Mouth of Box Canyon	350	800	1400	2250*
2	Rio Grande	Box Canyon to Deep Creek/Creede	350	550	1400	2000
3	Rio Grande	Creede to Wagon Wheel Gap	400	600	2100	2750
4	Rio Grande	Wagon Wheel Gap to South Fork	300	600	1800	2800
5	Rio Grande	South Fork to Del Norte (Hwy 112)	350	500	2000	3000
6	Rio Grande	Alamosa to Lasauses	200	500	1000	3000
7	Rio Grande	Lasauses to Lobatos Bridge	300	600	2000	3500
8	Rio Grande	Lobatos Bridge to Lee Trail, NM	300	600	2000	3250
9	Conejos	Platoro Reservoir to South Fork Conejos	150	300	600	1200
10	Conejos	S. Fork Conejos to Hwy 17 Bridge	150	300	550	800
11	Conejos	Hwy 17 to Mogote Campground	300	550	2100	2700**

*The maximum safe release from Rio Grande Reservoir was 1200 cfs throughout the 1998 to 2017 period.
** Flows never reached this max acceptable threshold during the study period, in part due to mandatory flood mitigation measures triggered by a flow of 2300 cfs or greater at the Mogote stream gauge.

Variable streamflow conditions were found to impact use opportunities on all reaches. The total number of Boatable Days generally increase throughout the assessment area as hydrological conditions transition from dry to average to wet. On most reaches, typical daily streamflows rarely exceed the upper flow acceptability threshold. On Reaches 3, 4, and 5, however, that upper limit is exceeded in wet year types. Reach 4 and Reach 5 are the only two reaches where wet years are characterized by pronounced decrease in total annual Boatable Days. Additional work may be required to understand how alternative water management or climate change impacts diminish or increase the number of Boatable Days available to recreational users on each reach, and whether those changes occur in times of the year when recreation is most likely to occur.

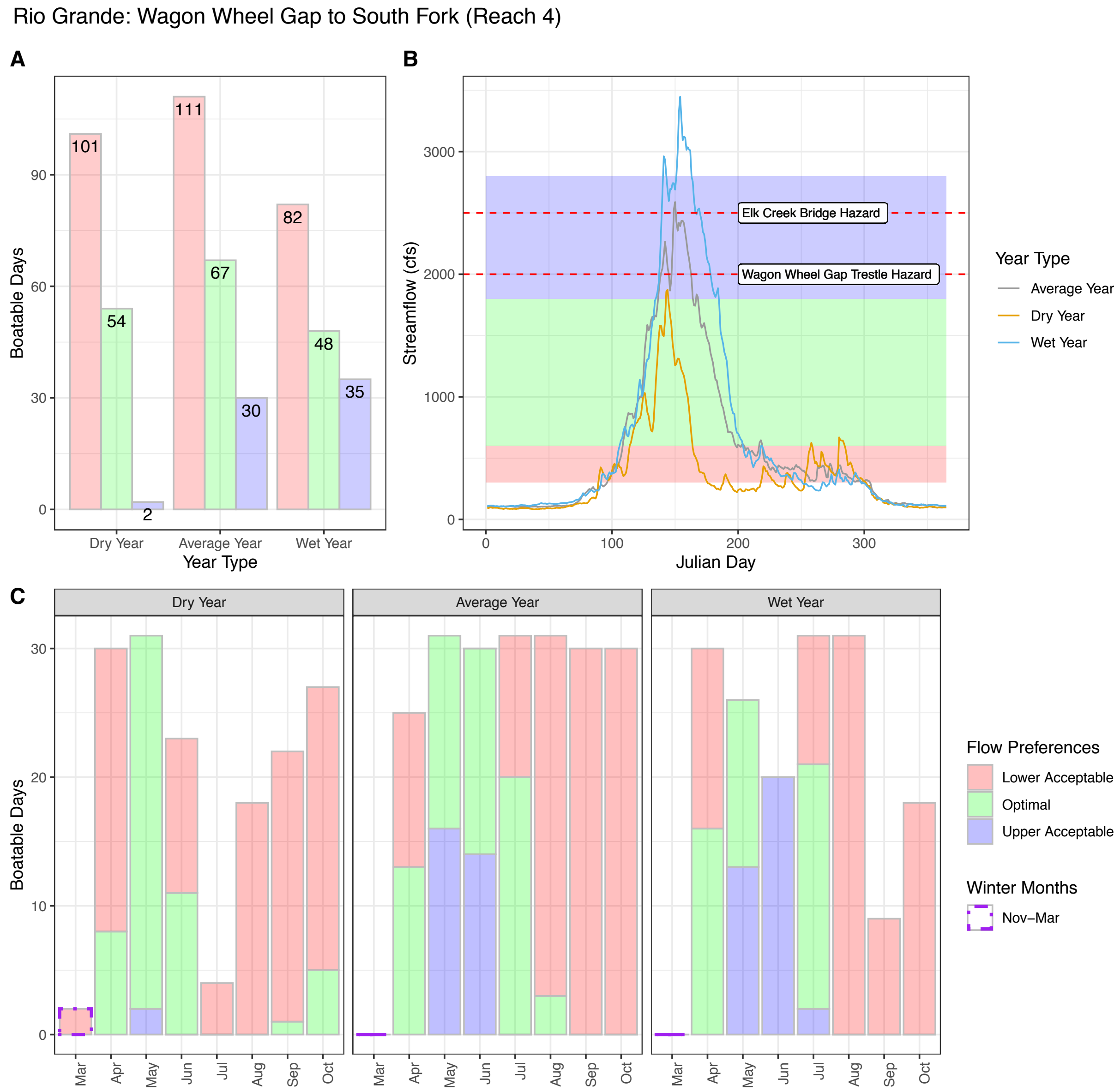

Figure ES.1. Boatable Days totals for the Rio Grande: Wagon Wheel Gap to South Fork. (A) Annual Boatable Days totals summarized by hydrological year type. (B) Flow preference ranges mapped to representative streamflow time series for wet, average, and dry years. (C) Monthly Boatable Days totals summarized by hydrological year type.

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1. Introduction

Considerable work evaluating relationships between streamflow and recreational use opportunities occurred over the last several decades (Brown et al., 1991; Shelby, Brown, & Taylor, 1992; Whittaker and Shelby, 2002). Many flow-recreation studies focus on whitewater boating, such as rafting, kayaking, and canoeing, as flow often determines whether people have opportunity to successfully complete a trip. On many river segments, flow level contributes to the risk, challenge, and/or aesthetic attributes of on-water activities (Whittaker & Shelby, 2000). Natural and man-made changes in streamflow can have direct and indirect impacts on recreational boating experiences. Direct effects include navigation, safety/difficulty, travel times, quality of whitewater stretches, and beach and camp access (Brown, Taylor, & Shelby, 1991; Whittaker et al., 1993; Whittaker & Shelby, 2002). Indirectly, variability in streamflow affects wildlife viewing, scenery, fish habitat, and riparian vegetation over the long term as a result of changes in flow regime (Bovey, 1996; Richter et al., 1997; Jackson & Beschta, 1992; Hill et al., 1991).

Streamflow is often manipulated through releases from dams and reservoirs, pipelines, and diversions. Additional scenarios, such as climate change, drought, and new water rights development can all impact flows and recreation quality. Decision-makers within land and resource management and regulatory agencies, and state and local governments are increasingly interested in the extent that flow regimes can be managed to provide desirable recreational resource conditions. The various recreational use opportunities provided by different flow ranges can be delineated into "niches" (Shelby et al., 1997). These flow niches may include: unacceptably low flow; minimum flow acceptable; technical, but enjoyable flows; optimal flows; challenging high flows; and unacceptably high flows. Methodologies developed by American Whitewater are regularly used to delineate user-defined streamflow niches and subsequently quantify recreational user opportunities under different hydrological conditions. Implementation of these assessment methodologies aims to support water management decision-making. Specific evaluative information on how flow affects recreation quality is often critical, particularly where social values are central to decision-making (Kennedy and Thomas 1995). American Whitewater's Boatable Days assessment methodology is recognized as a best practice for defining recreation flow needs and opportunities (Stafford et al., 2016).

The Rio Grande Basin Roundtable (RGBRT) and the Rio Grande Headwaters Restoration Project (the Restoration Project) are undertaking a river recreation assessment as part of a Stream Management Planning effort. In May of 2018, the Restoration Project officially initiated the Stream Management Plan process for the Rio Grande, Conejos River, and Saguache Creek. American Whitewater was invited to join the Technical Advisory Team (TAT) tasked with guiding the SMP process, identifying and prioritizing ecological, recreational, and community values, development of goals for flows and physical conditions to protect and enhance streams, and establishing methods and associated opportunities and constraints to make progress toward goals. As part of this effort, AW was tasked with completing a Boatable Days assessment. The characterization of Boatable Days provides an objective, science-based measure of existing whitewater recreation opportunities related to variability in streamflow on reaches throughout the assessment area (Figure 1, Figure 2, Figure 3). This information aims to support conversations about how whitewater recreation opportunities might change under future hydrological conditions and water management scenarios.

American Whitewater's assessment aims to achieve multiple SMP objectives. The assessment helps meet SMP Objective 3[1] by identifying optimal and acceptable recreational flow preferences on 11 different river segments in the Basin. The Boatable Days Analysis provides the TAT with the necessary quantitative information needed to develop goals to protect and enhance flows for recreation values[2] . The Boatable Days model—as developed for the Rio Grande and Conejos River—can be used to identify opportunities and constraints for implementation of future projects[3].

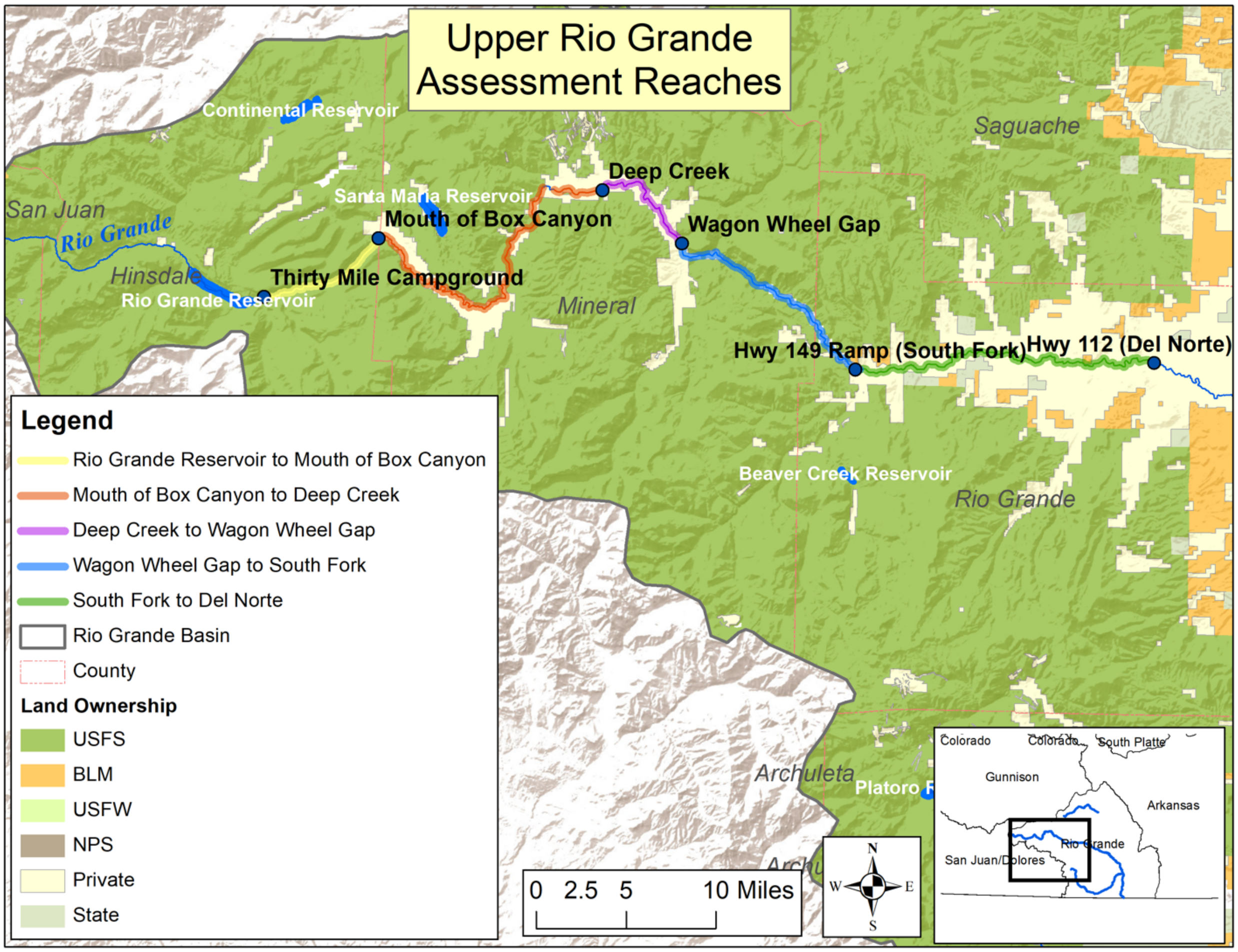

Figure 1. Upper Rio Grande recreational assessment area. Image provided by Rio Grande Headwaters Restoration Project.

[1] Objective 3: Define and prioritize environmental, recreational, and community values.

[2] Objective 4: Develop goals to improve flows and physical conditions needed to support values.

[3] Objective 6: Identify opportunities and constraints for implementation of projects, and additional data needed to inform project development.

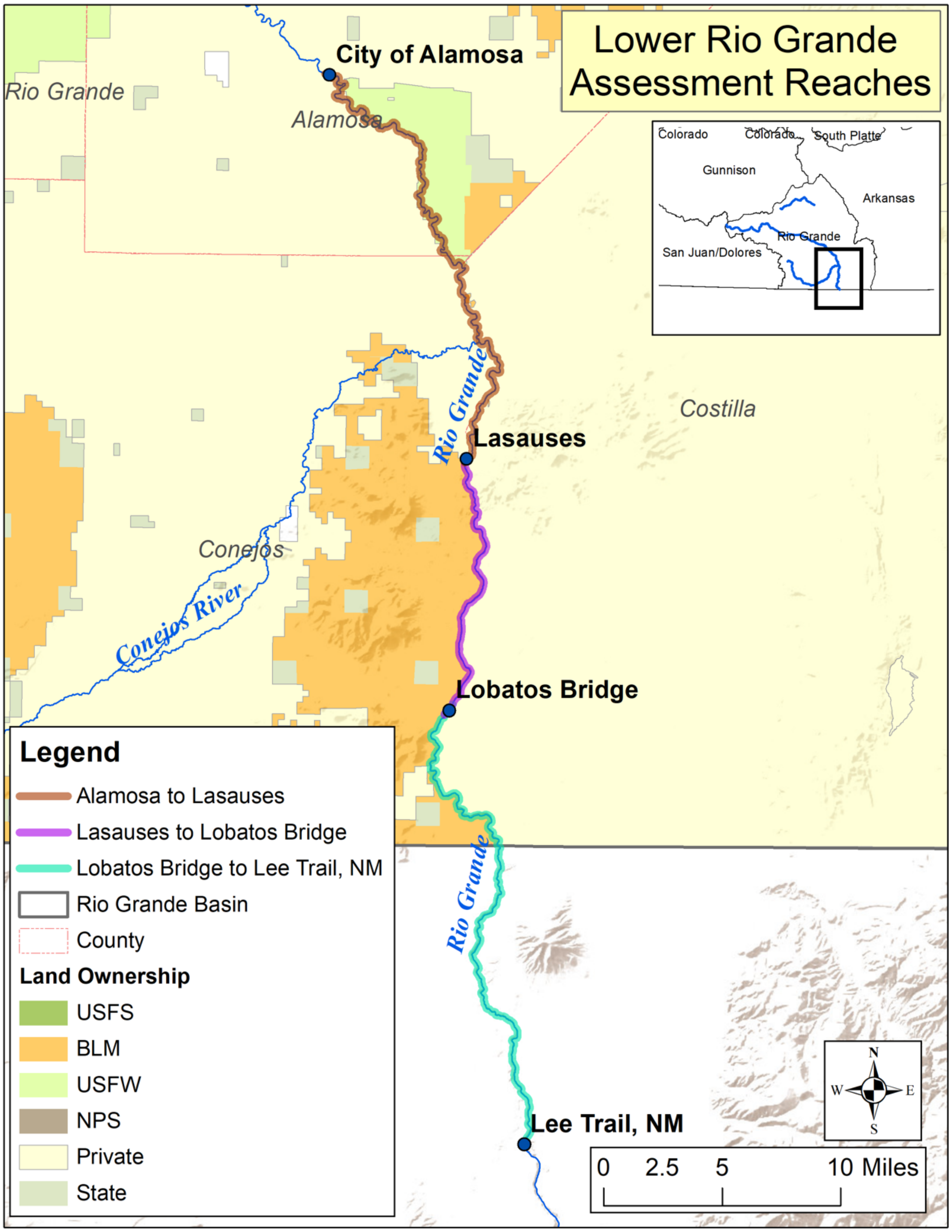

Figure 2. Lower Rio Grande recreational assessment area. Image provided by Rio Grande Headwaters Restoration Project.

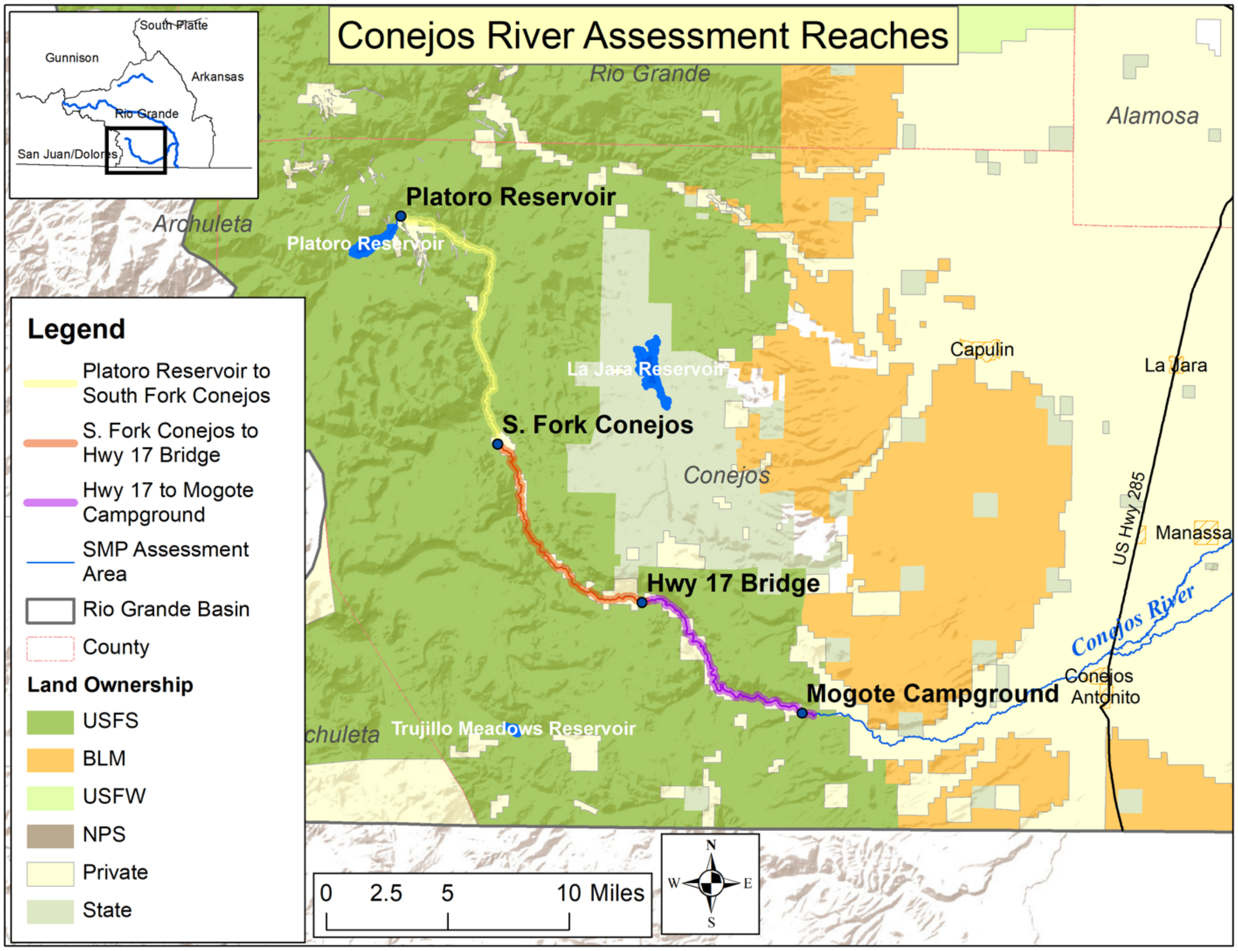

Figure 3. Conejos River recreational assessment area. Image provided by Rio Grande Headwaters Restoration Project.

In addition to meeting objectives of the SMP, the results of this assessment advance implementation of the Colorado Water Plan[4]. The State's draft Basin Implementation Plan Guidance document recommends quantification of recreational values (e.g., boating and fishing). Section 2.1 of the Guidance[5] calls for the evaluation of non-consumptive needs in terms of 'measurable outcomes', data, and assessment using methods described in CWCB's Non-consumptive Toolbox (CWCB, 2013). Appendices C and D of the toolbox identify the flow-evaluation methodology developed and used by American Whitewater as an example of a recreation tool that can produce measurable outcomes. This assessment aims to 1) address gaps in data and understanding regarding flow conditions necessary to sustain recreational values on the Rio Grande and Conejos River and 2) improve stakeholders' collective understanding of existing recreational use opportunities and how these opportunities may be impacted by climate change and consumptive water projects.

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4 https://www.colorado.gov/pacific/cowaterplan/plan

5 http://cwcbweblink.state.co.us/WebLink/0/doc/172522/Electronic.aspx?searchid=da8f2c6c-3efa-48d6-a43e-892b5c2bd750

2. Study Area

River reaches considered in this assessment were identified collaboratively between American Whitewater, the Rio Grande Basin Roundtable's SMP Committee, and the SMP project coordinator. Eight segments on the Rio Grande and three segments on the Conejos River were determined to have significant recreational values and were, therefore, included in the assessment (Table 1). Saguache Creek was not identified as a recreational planning priority. Each segment was mapped to an existing streamflow gauging station and/or a hydrological simulation modeling node. Mapping streamflow gauge/node locations to each assessment reach considered: 1) the historical period of record (POR) for streamflow observations, 2) the distance between the gauge/node and river segment, and 3) the gauge/node most commonly used by recreationalists to inform their use of the segment. A single stream gauge or simulation node was used to represent flows for adjoining river segments in two locations on the Rio Grande and one location on the Conejos.

Table 1. River segments and corresponding streamflow measurement gauges considered in this study.

Reach	River	Segment Description	Corresponding Stream Gauge/Simulation Node
1	Rio Grande	Rio Grande Reservoir to Mouth of Box Canyon	Rio Grande River at Thirty Mile Bridge Near Creede (RIOMILCO)
2	Rio Grande	Box Canyon to Deep Creek/Creede	Rio Grande River at Thirty Mile Bridge Near Creede (RIOMILCO)
3	Rio Grande	Creede to Wagon Wheel Gap	Rio Grande River at Wagon Wheel Gap (RIOWAGCO)
4	Rio Grande	Wagon Wheel Gap to South Fork	Rio Grande River at Wagon Wheel Gap (RIOWAGCO)
5	Rio Grande	South Fork to Del Norte (Hwy 112)	Rio Grande River Near Del Norte, Co (RIODELCO)
6	Rio Grande	Alamosa to Lasauses	Rio Grande River at Alamosa (RIOALACO)
7	Rio Grande	Lasauses to Lobatos Bridge	Rio Grande River Above Trinchera Creek Near Las Sauses (RIOTRICO)
8	Rio Grande	Lobatos Bridge to Lee Trail, NM	Rio Grande River Near Lobatos (RIOLOBCO)
9	Conejos	Platoro Reservoir to South Fork Conejos	Conejos River Below Platoro Reservoir (CONPLACO)
10	Conejos	S. Fork Conejos to Hwy 17 Bridge	Conejos River Below Platoro Reservoir (CONPLACO)
11	Conejos	Hwy 17 to Mogote Campground	Conejos River Near Mogote (CONMOGCO)

3. Methods

American Whitewater collected recreational user feedback through a web-based survey (Appendix C). Four types of questions were included in the survey. The first type of question captured demographic information about each participant's skill level, frequency of participation in river-related recreation, etc. The second type of question allowed users to assign use-acceptability rankings to various streamflows. The third question type asked users to identify flows associated with different trip types (technical low-water, standard, challenging high-flow, etc.). The fourth type of question focused on participant perspectives on water management planning activities.

These questions were organized around each assessment reach and were supported with general mapping and narrative information about that reach from American Whitewater's website. The Rio Grande Headwaters Restoration Project has the responses from these questions and will utilize them in the larger SMP report. The survey also clearly defined which streamflow measurement gauge to reference when assigning acceptability rankings for conditions on the reach. An announcement of the survey was emailed to American Whitewater's members, posted on the website, distributed via American Whitewater's online newsletter, and shared through the Stream Management Plan email list.

The flow acceptability questions included in the user-survey are the principal focus of this assessment. These questions asked respondents to evaluate recreational use acceptability for a range of measured flows on each study segment using a five-point scale that included the following rankings: Unacceptable, Moderately Unacceptable, Marginal, Moderately Acceptable, and Acceptable. Each ranking in the scale was mapped to an integer value between -2 and 2 where an 'Unacceptable' ranking mapped to a value of -2, a 'Marginal' ranking mapped to a value of 0, and an 'Acceptable' ranking mapped to a value of 2. To further explore and characterize the relationship between flows and recreational use opportunities, the survey posed a series of open-ended questions about streamflows associated with distinct niche experiences. These niche experiences included: lowest navigable flow (minFlow), minimum acceptable flow (lowAcceptable), technical but navigable flows (technicalTrip), flows experienced during a standard trip (standardTrip), challenging high-water (highChallenge), and highest safe flow (highSafe).

The flow options provided in the flow acceptability questions were directly informed by historical hydrology data from each individual stream gauge. The minimum flow option provided for each reach was 100 cfs and the maximum flow option varied depending on historical maximums. The questions that reference the RIOMILCO stream gauge (corresponding gauge for Reach 1 and 2) are an exception. The maximum observed flow at this location is 2,520 cfs. Users on the survey were asked to evaluate flows up to 3,000 cfs. Any survey responses provided for flow values above 2,500 cfs on these reaches were, therefore, considered erroneous.

Flow-acceptability rankings provided through the survey were used to describe preferences among recreational users for various ranges of streamflow. Researchers collecting and organizing survey-based evaluative information often employ a normative approach for analyzing results. The normative approach considers each individual's evaluation (personal norms) of a range of potential conditions. Aggregation of many individuals' personal norms describe a group's collective evaluation (social norms) of resource condition. This approach has been applied extensively in natural resource management settings, often with respect to instream flows for recreation (Shelby and Whittaker, 1995; Shelby et al., 1992a; Vandas et al., 1990; Whittaker and Shelby, 2002b) and is particularly useful for developing thresholds that define low, acceptable, and/or optimal resource conditions (Shelby et al. 1992). Other applications have extended this approach to different indicators and impacts, including: evaluation of how many people are considered too many in a given setting (refer to Donnelly et al., 2000; Manning, 2011; Shelby et al., 1996; Vaske & Donnelly, 2002; Vaske et al., 1986, for reviews), campsite impacts or site sharing (Heberlein and Dunwiddie, 1979; Shelby, 1981), fishing site competition (Martinson and Shelby, 1992; Whittaker and Shelby, 1993), discourteous behavior (Whittaker and Shelby, 1988, 1993; Whittaker et al., 2000), and resource indicators such as litter and campsite impacts (Shelby et al., 1988; Vaske et al., 2002). Notably, the normative approach was employed to understand user preferences for various streamflows on the Grand Canyon (Shelby et al. 1992) and on several other rivers in Colorado (Vandas et al. 1990, Shelby & Whittaker 1995, Fey & Stafford 2009, Fey & Stafford 2010).

Defining management standards is often more efficient if there is a high degree of consensus (or "norm crystallization") among users regarding acceptable and unacceptable resource conditions. Traditional measures of norm crystallization have included the standard deviation, coefficient of variation, and interquartile range of survey responses (Krymkowski et al., 2009; Manning, 2011; Shelby and Vaske, 1991). The Potential for Conflict Index-2 (PCI2) was developed to help address some of the shortcomings associated with traditional measures of norm crystallization when applied to ordinal data. A detailed description of the PCI2 metric is provided by Vaske et al. (2010). Briefly, computed PCI2 values range from 0 to 1.0 where the least amount of consensus (PCI2 = 1.0) occurs when responses are equally divided between two extreme values on a Likert response scale (e.g. 50% Highly Unacceptable and 50% Highly Acceptable). A set of responses with unanimous consensus among respondents yields a PCI2 value of zero.

The normative approach was the basis for describing use acceptability ranges for streamflows on different reaches within the assessment area. The percentage of responses falling within each acceptability ranking were computed for each streamflow on each reach. The numerical representations of flow acceptability preference rankings were used to compute PCI2 scores for each flow included in the survey. Computed PCI2 values were paired on the percentage of respondents that ranked a given flow as 'Moderately Acceptable' or 'Acceptable' and plotted to create use acceptability curves for each of the study reaches.

Use acceptability curves, tabular data summaries, and responses to open-ended questions about niche conditions were used to delineate various normative streamflow characteristics. These characteristics included a minimum acceptable streamflow, a range of acceptable streamflow conditions, and a range of optimum streamflow conditions. The upper and lower thresholds delineated for acceptable and optimal streamflow conditions were then compared to wet-year, average-year, and dry-year hydrological conditions in order to complete a Boatable Days analysis.

The computation of Boatable Days is the dominant quantitative approach used by American Whitewater to characterize recreational use opportunities on rivers (Fey and Stafford, 2009; Shelby and Whittaker, 1995; Whittaker et al., 1993). The metric itself reflects the number of days in a given year that fall within certain defined flow ranges (i.e. lower acceptable flows, optimal flows, upper acceptable flows). The Boatable Days analysis performed on reaches within the assessment area responded to the inter-annual natural and management-induced variability in streamflows by computing the number of Boatable Days that occur in each of three hydrological year types: wet, average and dry.

Wilson Water Group, LLC. provided streamflow time series data for the three hydrological year types defined here. Representative streamflow time series for each year type on each reach required synthesis of historical data. Daily streamflow data was collected from stream gauges throughout the assessment area for a 20-year period of record. Streamflow time series data from each gauge were then ordered by annual peak flow. Average daily streamflows across all years in the lower 25th percentile of the ordered list were computed to produce a representative dry year streamflow time series. The same approach was used to create representative streamflow series for average and wet years where average year types fell between the 25th and 75th percentiles of annual peak flows and average wet year types were those years that fell within the upper 75th percentile of the ordered list.

4. Results

The web-survey captured responses from 136 recreational users. 63% of respondents indicated they were somewhat comfortable or very comfortable reporting flows, 52% of respondents identified themselves as advanced or expert paddlers, 84% identified as Class III or greater paddlers, and 44% recreate on streams and rivers at least 20 days per season (Figure 4). A wide range of preferred craft types were indicated, including oar frame rafts, kayaks, catarafts, canoes, dories, inner tubes, paddle rafts, skiffs, and stand-up paddle boards.

Survey responses were aggregated by reach, reviewed for quality, and displayed graphically to aid in interpretation (Appendix A). An example summary graphic is included for survey responses for the Wagon Wheel Gap to South Fork section of the Rio Grande (Figure 5).

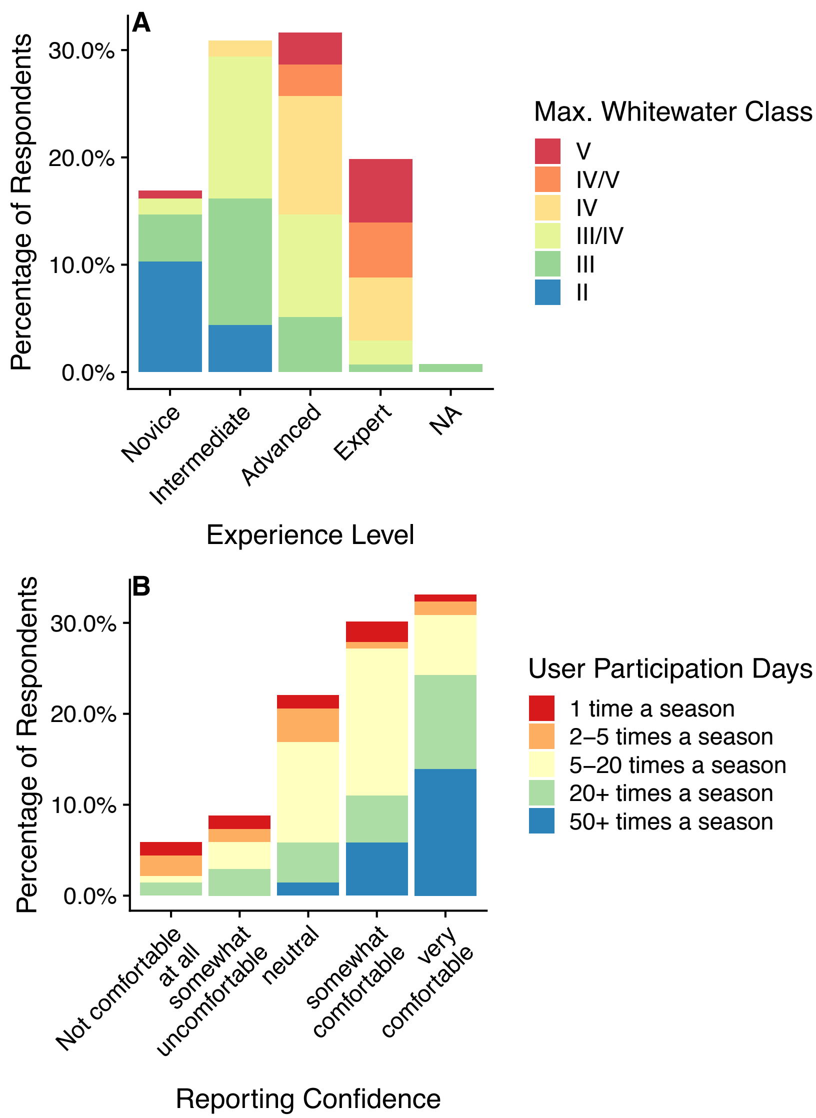

Figure 4. Survey responses from 136 users indicating (A) experience level and maximum comfortable whitewater class; (B) participant confidence in providing flow acceptability rankings for one or more reaches in the assessment area.

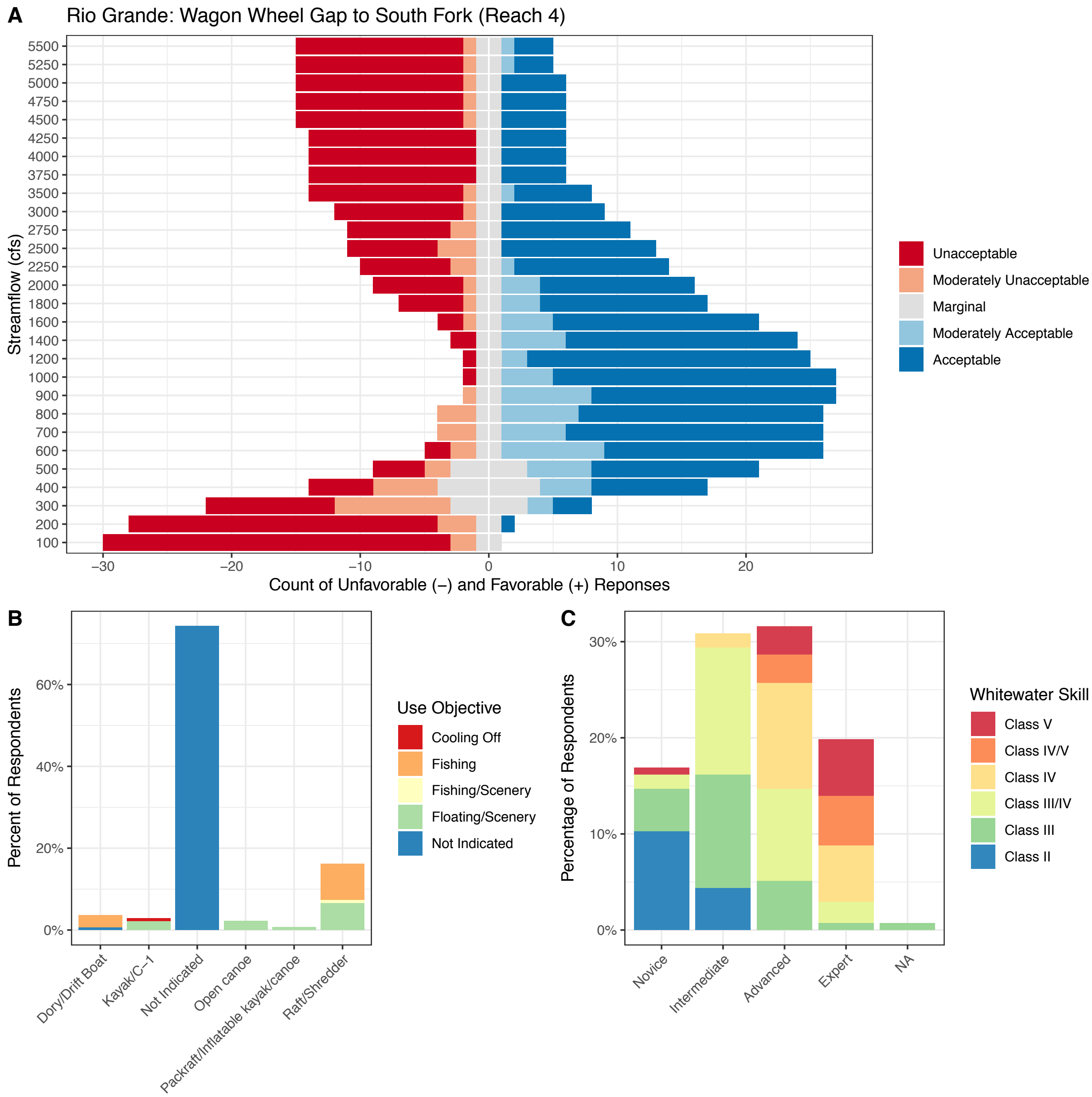

Figure 5. Survey responses for the Wagon Wheel Gap to South Fork section of the Rio Grande. (A) Counts of the various flow acceptability rankings provided by respondents where survey responses reflect streamflow variability as measured at the Rio Grande River at Wagon Wheel Gap (RIOWAGCO). (B) User identified craft types and recreational use objectives for the reach. (C) The self-identified experience and whitewater skill levels provided by survey respondents.

Use acceptability curves, tabular data summaries, and responses to open-ended questions about niche conditions were used to delineate various normative streamflow characteristics, including the 'Minimum Acceptable', 'Minimum Optimal', 'Maximum Optimal', and 'Maximum Acceptable' streamflow on each reach (Table 2).

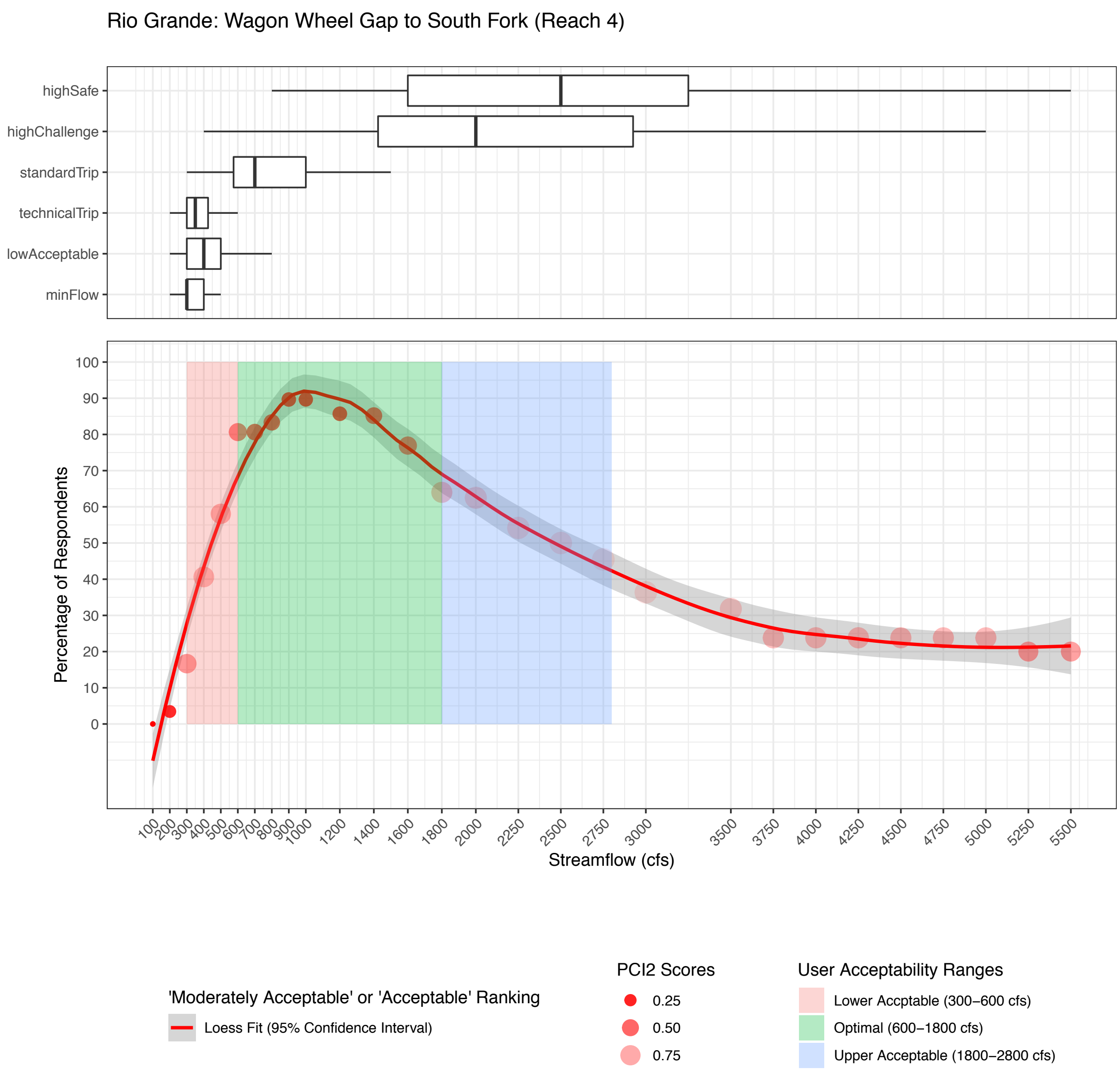

Figure 6. Flow preferences reported by users for the Rio Grande: Wagon Wheel Gap to South Fork. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Responses provided for Reach 6 and Reach 8 of the Rio Grande along with Reach 9 and Reach 10 of the Conejos made delineation of the upper bound for the maximum acceptable flow difficult. Responses to open ended questions suggest that the difficulty or risk for navigation on the Rio Grande reaches in question do not change appreciably as flows increase. These reaches are relatively low-gradient and do not include many navigation hazards. Results for Reach 6 may be affected by a small number of respondents providing flow acceptability rankings. It appears that the lack of a discernable upper bound on acceptable flows for reaches 9 and 10 on the Conejos River may also be due to a limited number of survey respondents for these reaches.

Table 2. Flow preference thresholds delineated for each reach in the assessment area. All values are reported in cubic feet per second (cfs).

Reach	River	Reach Description	Min. Acceptable	Min. Optimal	Max. Optimal	Max. Acceptable
1	Rio Grande	Rio Grande Reservoir to Mouth of Box Canyon	350	800	1400	2250*
2	Rio Grande	Box Canyon to Deep Creek/Creede	350	550	1400	2000
3	Rio Grande	Creede to Wagon Wheel Gap	400	600	2100	2750
4	Rio Grande	Wagon Wheel Gap to South Fork	300	600	1800	2800
5	Rio Grande	South Fork to Del Norte (Hwy 112)	350	500	2000	3000
6	Rio Grande	Alamosa to Lasauses	200	500	1000	3000
7	Rio Grande	Lasauses to Lobatos Bridge	300	600	2000	3500
8	Rio Grande	Lobatos Bridge to Lee Trail, NM	300	600	2000	3250
9	Conejos	Platoro Reservoir to South Fork Conejos	150	300	600	1200
10	Conejos	S. Fork Conejos to Hwy 17 Bridge	150	300	550	800
11	Conejos	Hwy 17 to Mogote Campground	300	550	2100	2700

*The maximum safe release from Rio Grande Reservoir was 1200 cfs throughout the 1998 to 2017 period.
** Flows never reached this max acceptable threshold during the study period, in part due to mandatory flood mitigation measures triggered by a flow of 2300 cfs or greater at the Mogote stream gauge.

Minimum acceptable flows on the Rio Grande generally range between approximately 350-400 cfs, optimal flows range between approximately 600-2000 cfs, and the upper acceptable flows range between ~2000-3000 cfs. A maximum acceptable flow of 2250 cfs was delineated for Reach 1. However, due to infrastructure constraints, the maximum safe release from Rio Grande Reservoir was 1200 cfs between 1998 and 2017. Therefore, this maximum acceptable flow did not occur during the study period. Improvements to the reservoir's outlet works, progressing under the Rio Grande Reservoir Phase II Rehabilitation Project, will substantially increase the maximum permissible release from the reservoir. No clear flow preference patterns exist for the Conejos River reaches. Variability in flow thresholds between reaches can be attributed to different user groups recreating in different locations, the unique geomorphic or hydraulic characteristics of each reach, and/or variability in the sample size of respondents providing flow rankings on each reach and for each listed streamflow. A maximum acceptable flow of 2700 cfs was delineated for Reach 11 on Conejos River. It is important to note that flood mitigation requirements are triggered if streamflow at the Mogote stream gauge (CONMOGCO) reaches or exceeds 2300 cfs. Under this scenario, the operator of Platoro Reservoir and other partners take actions (e.g. utilize Platoro Reservoir flood control storage) to reduce flows and mitigate flooding risk in downstream communities. Stream flows on Reach 11, therefore, never reached the maximum acceptable flow preference threshold during the study period and are unlikely to do so in the future.

Flow preference thresholds were used to compute the number of Boatable Days associated with different hydrological conditions on each reach in the assessment area (Table 3). Results were summarized graphically and in tabular form (Appendix A). Boatable Days totals falling within the range of "Upper Acceptable" flows never exceed zero on several reaches of the Rio Grande. This is due, in some locations, to the lack of a discernible upper bound on the range of "Optimal" flows identified by recreational users. In other locations, the streamflow time series supplied by Wilson Water Group, LLC to characterize dry, average, and wet year types never exceeded the upper bound of user-defined "Optimal" flows. A different representation of hydrological year types will result in different Boatable Days totals.

Table 3. Boatable Days falling within each acceptability category calculated for reaches within the assessment area for typical dry, average and wet hydrological year types.

Reach	River	Description	Acceptability Category	Dry Year	Avg. Year	Wet Year
1	Rio Grande	Rio Grande Reservoir to Mouth of Box Canyon	Lower Acceptable	38	38	40
			Optimal	0	25	43
			Upper Acceptable	0	0	0
			Total Days	38	63	83
2	Rio Grande	Box Canyon to Deep Creek/Creede	Lower Acceptable	17	11	24
			Optimal	21	52	59
			Upper Acceptable	0	0	0
			Total Days	38	63	83
3	Rio Grande	Creede to Wagon Wheel Gap	Lower Acceptable	43	62	31
			Optimal	56	80	59
			Upper Acceptable	0	17	21
			Total Days	99	159	111
4	Rio Grande	Wagon Wheel Gap to South Fork	Lower Acceptable	101	111	82
			Optimal	54	67	48
			Upper Acceptable	2	30	35
			Total Days	157	208	165
5	Rio Grande	South Fork to Del Norte (Hwy 112)	Lower Acceptable	54	56	74
			Optimal	119	127	87
			Upper Acceptable	12	26	19
			Total Days	185	209	180
6	Rio Grande	Alamosa to Lasauses	Lower Acceptable	47	146	204
			Optimal	0	1	45
			Upper Acceptable	0	0	0
			Total Days	47	147	249
7	Rio Grande	Lasauses to Lobatos Bridge	Lower Acceptable	0	39	74
			Optimal	0	0	47
			Upper Acceptable	0	0	0
			Total Days	0	39	121
8	Rio Grande	Lobatos Bridge to Lee Trail, NM	Lower Acceptable	7	137	141
			Optimal	0	46	95
			Upper Acceptable	0	0	2
			Total Days	7	183	238
9	Conejos	Platoro Reservoir to South Fork Conejos	Lower Acceptable	53	56	44
			Optimal	0	17	31

Reach	River	Description	Acceptability Category	Dry Year	Avg. Year	Wet Year
			Upper Acceptable	0	0	0
			Total Days	53	73	75
10	Conejos	S. Fork Conejos to Hwy 17 Bridge	Lower Acceptable	53	56	44
			Optimal	0	17	31
			Upper Acceptable	0	0	0
			Total Days	53	73	75
11	Conejos	Hwy 17 to Mogote Campground	Lower Acceptable	29	30	40
			Optimal	29	59	64
			Upper Acceptable	0	0	0
			Total Days	58	89	104

Table 4. Boatable Days analysis results broken out by month for the Rio Grande: Wagon Wheel Gap to South Fork. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Mar	Lower Acceptable	2	0	0
Apr	Lower Acceptable	22	12	14
	Optimal	8	13	16
May	Optimal	29	15	13
	Upper Acceptable	2	16	13
Jun	Lower Acceptable	12	0	0
	Optimal	11	16	0
	Upper Acceptable	0	14	20
Jul	Lower Acceptable	4	11	10
	Optimal	0	20	19
	Upper Acceptable	0	0	2
Aug	Lower Acceptable	18	28	31
	Optimal	0	3	0
Sep	Lower Acceptable	21	30	9
	Optimal	1	0	0
Oct	Lower Acceptable	22	30	18
	Optimal	5	0	0

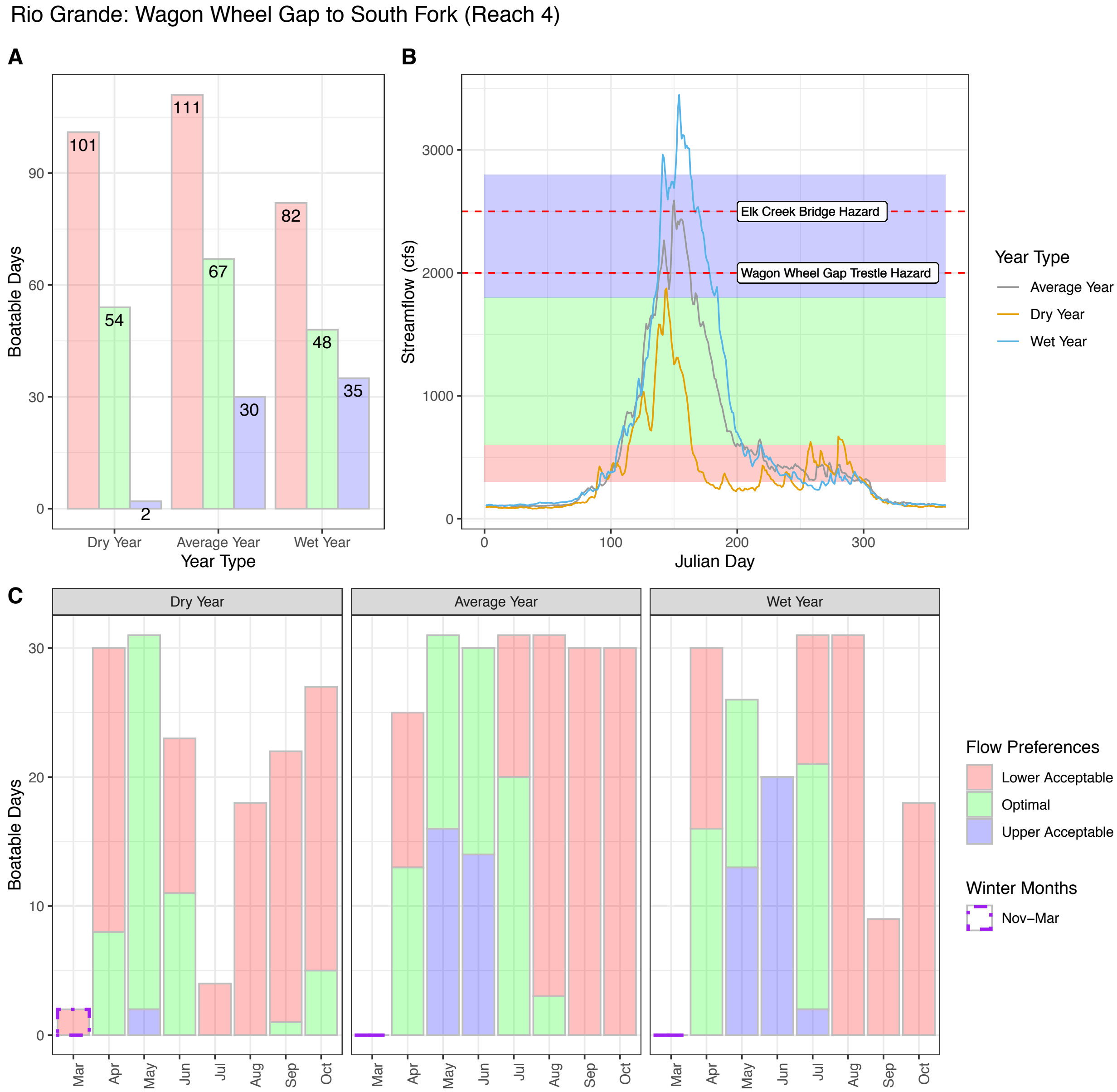

Figure 7. Boatable Days totals for the Rio Grande: Wagon Wheel Gap to South Fork. (A) Annual Boatable Days totals summarized by hydrological year type. (B) Flow preference ranges mapped to representative streamflow time series for wet, average, and dry years. Flows associated with specific navigational hazards are labeled. (C) Monthly Boatable Days totals summarized by hydrological year type.

It is important to note the difference between a Boatable Day and a user-day. A Boatable Day describes when acceptable flows are met to provide an *opportunity* for recreation. User-days indicate the actual numbers of recreational users present on a reach over a period of time. User-days are affected by numerous factors including weather, hazards, river access, etc. while Boatable Days are solely affected by flow conditions. Boatable Days totals for two reaches include days in fall, winter and spring months when current recreational use is known to be light. Totals for the

Alamosa to Lasauses section includes days in November, December, January, and February. Totals for the Lobatos Bridge to Lee Trail, NM section includes days in November and February. It is unlikely that there is much use on these segments during the fall and winter months due to weather conditions, ice hazards on the river, and limited river access due to snow and road closures. When using the Boatable Days analysis results to inform management decisions it will be particularly useful to consider the monthly Boatable Days totals during the typical user-season rather than the annual totals. While ice coverage varies depending on the year and the location, ice has potential to impact user days on most reaches between November 1 and March 31.

Additional constraints or hazards limit recreational use on several segments of the Rio Grande (Table 5). Low bridges are the most common type of navigational hazard. These bridges can make passage for rafts and dories extremely dangerous at high flows. Other craft types like kayaks may be able navigate these hazards at the full range of flows identified by users as falling within optimal or acceptable bounds for recreational use. Navigational hazards and other limitations were not used to modify Boatable Days calculations because they are expected to apply differently to various craft types. However, it is likely that knowledge of these hazards impacted survey respondents' flow preferences and identification of high safe flow levels. On multiple reaches, the highest safe flow corresponds with hazard-related thresholds. On other reaches the high acceptable flow exceeds the flow thresholds identified for hazards in that reach; this is likely due to variations in craft type and skill level among survey respondents.

Table 5. Known recreational use constraints or navigation hazards on segments of the Rio Grande.

Reach	Hazard Name	Notes
1	Box Canyon Bridge	Low bridge at Mouth of Box Canyon (Forest Rd 520.21). No discrete flow threshold is available, but this is never passable by any craft type.
2	Rio Oxbow Ranch Private Bridge	The bridge is always passable with drift boats. However, flows > 1,000 cfs (at RIOMILCO gauge) presents issues for rafts with fishing frames.
2	Kansas Club Bridge	Walking bridge for a private fishing club. At high flows, boats must stay river left and be aware of hanging rope and cables. No discrete flow threshold is available.
2	Antlers Resort Bridge	This is a walking bridge that presents an extreme navigation hazard at high flows. Dories and rafts/frames cannot pass at flows > 770 cfs.
2	Broadacres Bridge	This bridge is passable on river left at all flows and river right at most flows. No discrete flow threshold is available.
3	Wason Railroad Bridge	This bridge is hazardous at high flows due to the accumulation of debris on the pilings. No discrete flow threshold is available
4	Wagon Wheel Gap Railroad trestle	Due to the bridge's angle across the river and the debris accumulation on pilings, this bridge presents an extreme navigation hazard and most flows. Local outfitters do not attempt passage of this bridge if flows are > 2,000 cfs (at RIOWAGCO gauge).
4	4UR Bridge (Goose Creek Rd)	This private bridge is a minor obstacle at high flows.
4	Elk Creek Bridge	Passage is not suggested if the flow is at or above 2,500 cfs here.
5	Independent D "W-shaped" diversion dam	A "W-shaped" diversion dam presents a serious navigation hazard to boaters.
5	Hanna Lane/County Rd 17	Dories can safely pass under this bridge up to 5,000, raft frames up to 4,000 cfs (at RIODELCO gauge).
5	Flying W Bridge	Dories can safely pass under this bridge up to 3,500 cfs, and Rafts up to 2,500 cfs (at RIODELCO gauge).

5	Rio Grande Canal diversion dam	This river-wide diversion dam creates a 10+ foot drop. This is a mandatory portage (on the south bank of the river).
6	Westside Ditch diversion dam	This diversion dam is not passable, regardless of flow. Boaters must portage around this structure.
6	Chicago Ditch diversion dam	This diversion dam is not passable, especially at low flows. Boaters must portage around this structure.
6	Meadow Overflow Ditch diversion dam	This diversion dam is not passable, regardless of flow. Boaters must portage around this structure.
6	New Ditch diversion dam	This diversion dam is not passable, regardless of flow. Boaters must portage around this structure.
6	County Rd Z	This bridge is hazardous at high flows. No discrete flow threshold is available.
8	Lobatos Bridge to Lee Trail, NM	This section is closed to recreational uses between April 1 and May 31 due to nesting raptors.

5. Discussion and Conclusions

This report discusses study locations, and methods used to collect and analyze streamflow preference information from recreational users. User survey responses provided by 136 respondents were used to delineate acceptable and optimal streamflow thresholds for supporting recreational use activities on 11 segments on the Rio Grande and Conejos River. Threshold identification supported quantification of the Boatable Days metric for each assessment reach under typical wet, average, and dry hydrological year types. The assessment followed recommendations the State of Colorado's Basin Implementation Plan guidance documents for quantifying non-consumptive recreational needs.

Respondent numbers for the flow preference study conducted in 2019 are robust for a remote or sparsely populated region of southern Colorado. The large number of responses to flow related questions for most reaches made delineation of flow acceptability thresholds fairly straightforward. However, low response rates among survey participants for reaches 6, 8, 9, and 10 may introduce some uncertainty into flow preference threshold delineated for those sections of river. Low response rates may indicate there is little to no use on these sections during most times of the year. Alternatively, it may indicate that the survey distribution did not reach the typical users of these reaches. Future recreational use assessment activities may benefit from targeted outreach to those users known to recreate on these reaches and inquiries into whether or not they have companions or are aware of additional users/groups that recreate at those locations. It may also be useful to ascertain why these reaches may be receiving so little use and whether or not there is opportunity to increase recreational activity through awareness campaigns, development of river access points, or through some other means.

Variable streamflow conditions were found to impact use opportunities on all reaches. The total number of Boatable Days generally increase throughout the assessment area as hydrological conditions transition from dry to average to wet. On most reaches, typical daily streamflows rarely exceed the upper flow acceptability threshold. On Reach 4 and Reach 5, however, that upper limit is exceeded in wet year types and on Reach 3, optimal flows are exceeded in wet year types leading to a significant decrease in the number of Boatable Days with optimal flows. These are the only three reaches where wet years are either characterized by pronounced decrease in total annual Boatable Days or significant decrease in days with optimal flows.

The assessment followed recommendations in the State of Colorado's Basin Implementation Plan guidance documents for quantifying non-consumptive recreational needs. In addition to completing a quantitative Boatable Days analysis, results from open-ended recreational user survey questions were evaluated. Responses to these questions provide insights into the recreational community's views on environmental, regulatory, and infrastructure management issues affecting reaches within the planning area (Appendix B). High priority issues identified by multiple users included the following:

- Coordinated reservoir releases and consistent flows for fishing and boating on the Rio Grande
- Removal or mitigation of boating hazards (fencing, diversions, bridges, etc.)
- River access improvements

Survey respondents also indicated which reaches they considered priorities for recreational paddling improvements (Figure 10). The sections of the Rio Grande between Texas Creek and South Fork ranked highest. The section between Lasauses and Lobatos Bridge ranked lowest. Rankings for the Conejos River segments were not requested in the survey. The desire for improvements on high-priority reaches may or may not be flow-based.

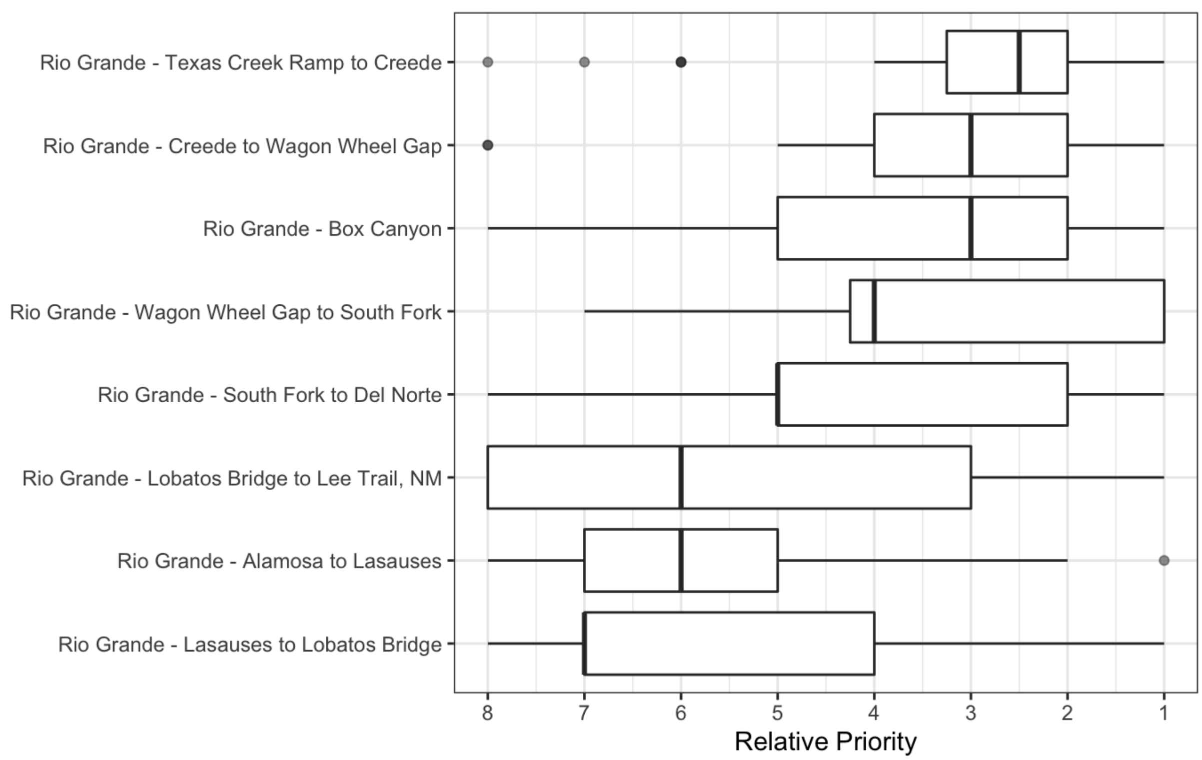

Figure 8. Distribution of survey responses indicating reaches that are the highest priority for recreational paddling improvements. A median score equal to 1 indicates a very high priority while a score of 8 indicates a very low priority. A wider box indicates a greater spread in the survey responses. A narrow box indicates a high degree of agreement between survey respondents.

The results presented in this report represent important baseline information characterizing the relationships between flows and recreational use. As such, this body of work directly supports the Rio Grande Headwater Restoration Project's Stream Management Planning efforts. Future efforts may choose to build upon this assessment by calculating the number of Boatable Days available in a greater diversity of hydrological year types, under various water management scenarios, or in anticipation of altered future hydrology due to climate change.

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APPENDIX A: Analysis Results by Reach

Rio Grande: Rio Grande Reservoir to Mouth of Box Canyon

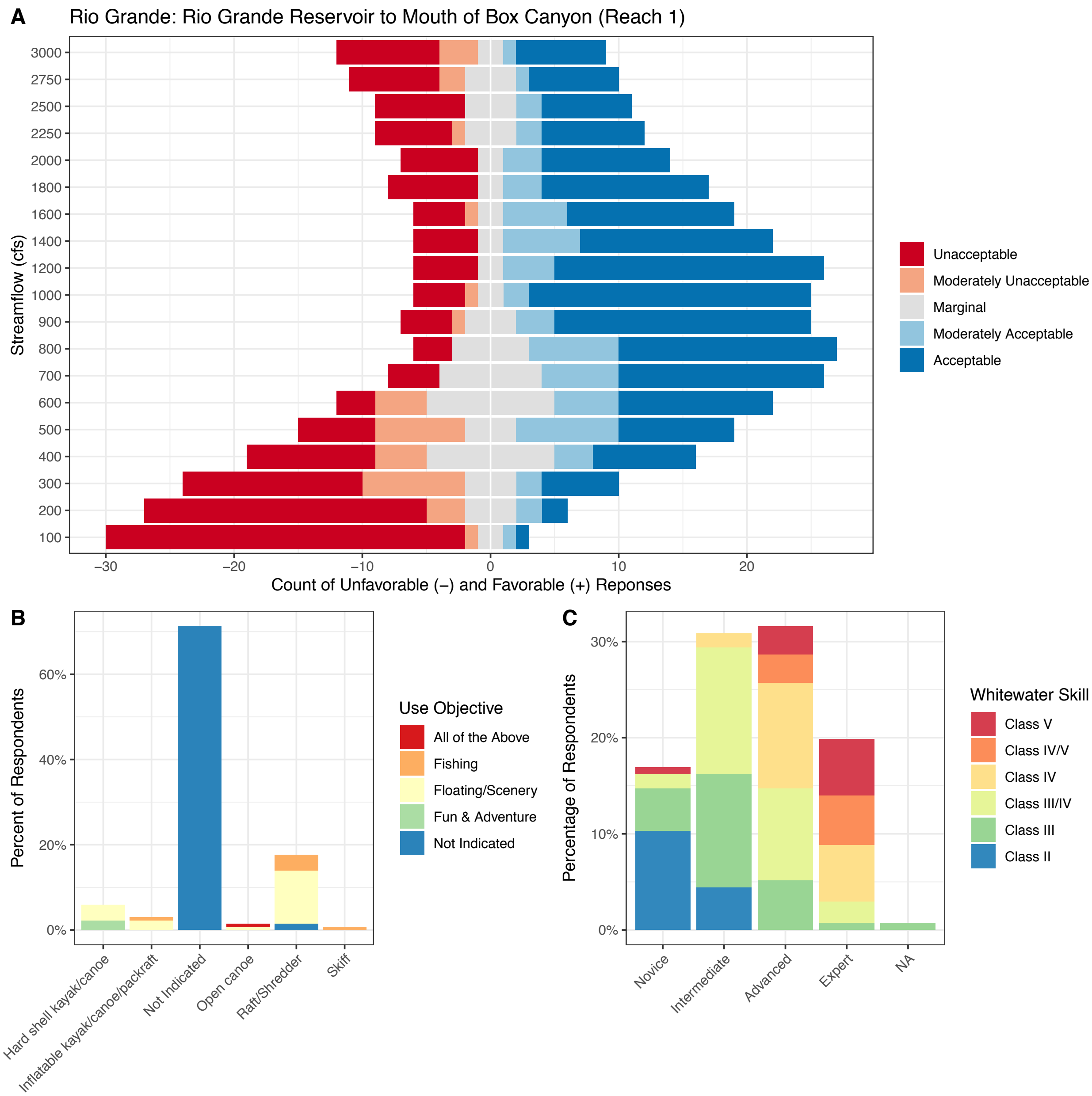

Figure 1: Survey responses for the Rio Grande, Rio Grande Reservoir to Mouth of Box Canyon. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

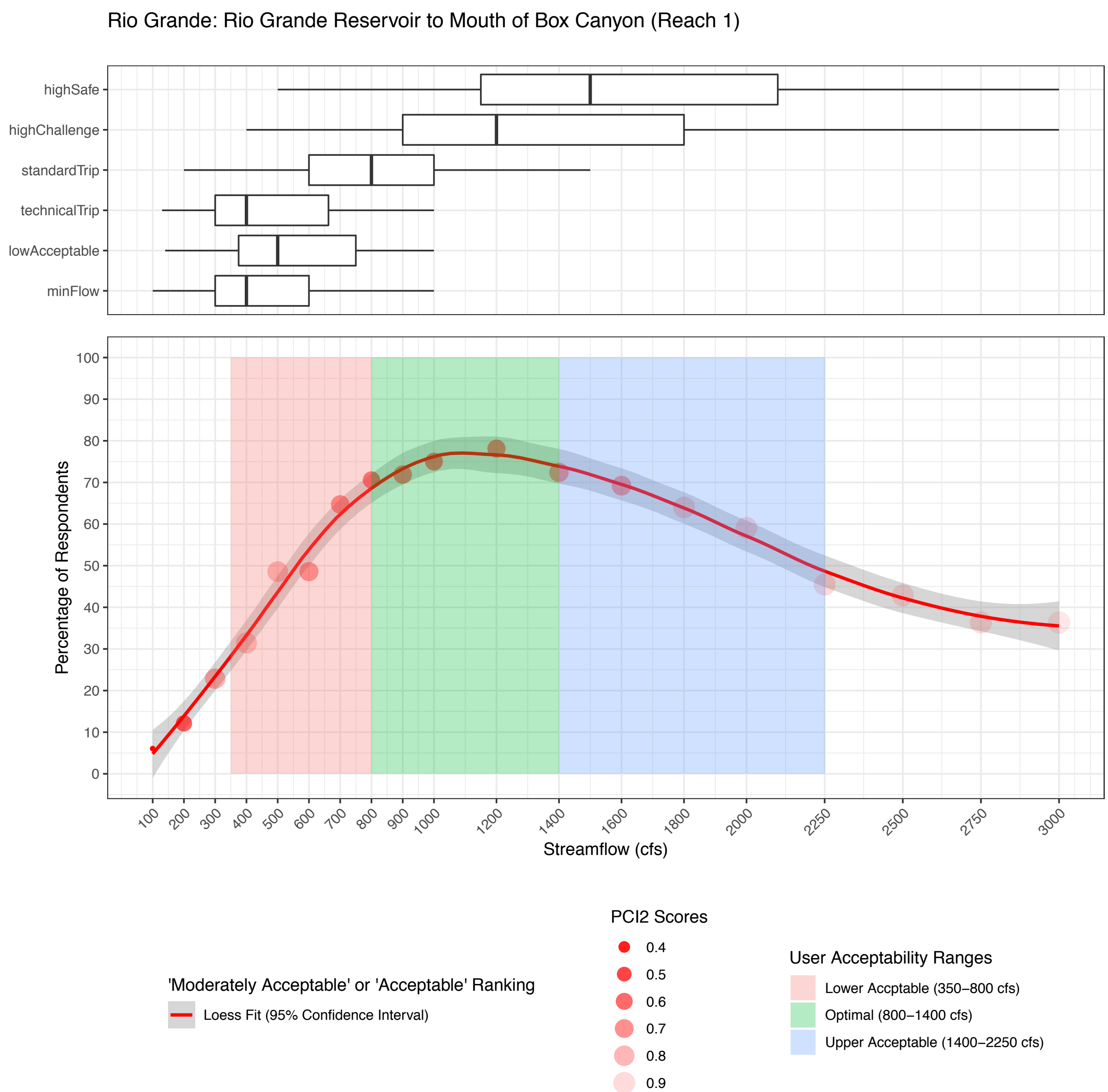

Figure 2: Flow preferences reported by users for the Rio Grande: Rio Grande Reservoir to Mouth of Box Canyon. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges. Note: the maximum safe release from Rio Grande Reservoir was 1200 cfs throughout the 1998 to 2017 period.

Table 1: Summarized open-format flow-preference question responses for Reach 1, Rio Grande: Rio Grande Reservoir to Mouth of Box Canyon. Note: the maximum safe release from Rio Grande Reservoir was 1200 cfs throughout the 1998 to 2017 period.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	300	400	600	35
Low Acceptable Flow (cfs)	375	500	750	35
Technical Flow (cfs)	300	400	662	32
Standard Trip Flow (cfs)	600	800	1000	35
Challenging High Flow (cfs)	900	1200	1800	29
Highest Safe Flow (cfs)	1150	1500	2100	27

Table 2: PCI2 analysis results for Reach 1, Rio Grande: Rio Grande Reservoir to Mouth of Box Canyon.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.3216912	-2.0	33	2176	700
200	0.5698529	-2.0	33	2176	1240
300	0.7924837	-1.0	35	2448	1940
400	0.8366013	0.0	35	2448	2048
500	0.8169935	0.0	35	2448	2000
600	0.7140523	0.0	35	2448	1748
700	0.6851211	1.0	34	2312	1584
800	0.6185121	1.5	34	2312	1430
900	0.6777344	2.0	32	2048	1388
1000	0.6435547	2.0	32	2048	1318

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1200	0.6601562	2.0	32	2048	1352
1400	0.7357143	2.0	29	1680	1236
1600	0.7485207	1.5	26	1352	1012
1800	0.8846154	2.0	25	1248	1104
2000	0.8863636	1.0	22	968	858
2250	0.8946281	0.0	22	968	866
2500	0.9136364	0.0	21	880	804
2750	0.9070248	0.0	22	968	878
3000	0.9297521	-0.5	22	968	900

Table 3: Boatable Days analysis results broken out by month for the Rio Grande: Rio Grande Reservoir to Mouth of Box Canyon. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Apr	Lower Acceptable	0	0	2
May	Lower Acceptable	27	19	21
	Optimal	0	8	10
Jun	Lower Acceptable	11	13	0
	Optimal	0	17	30
Jul	Lower Acceptable	0	6	17
	Optimal	0	0	3

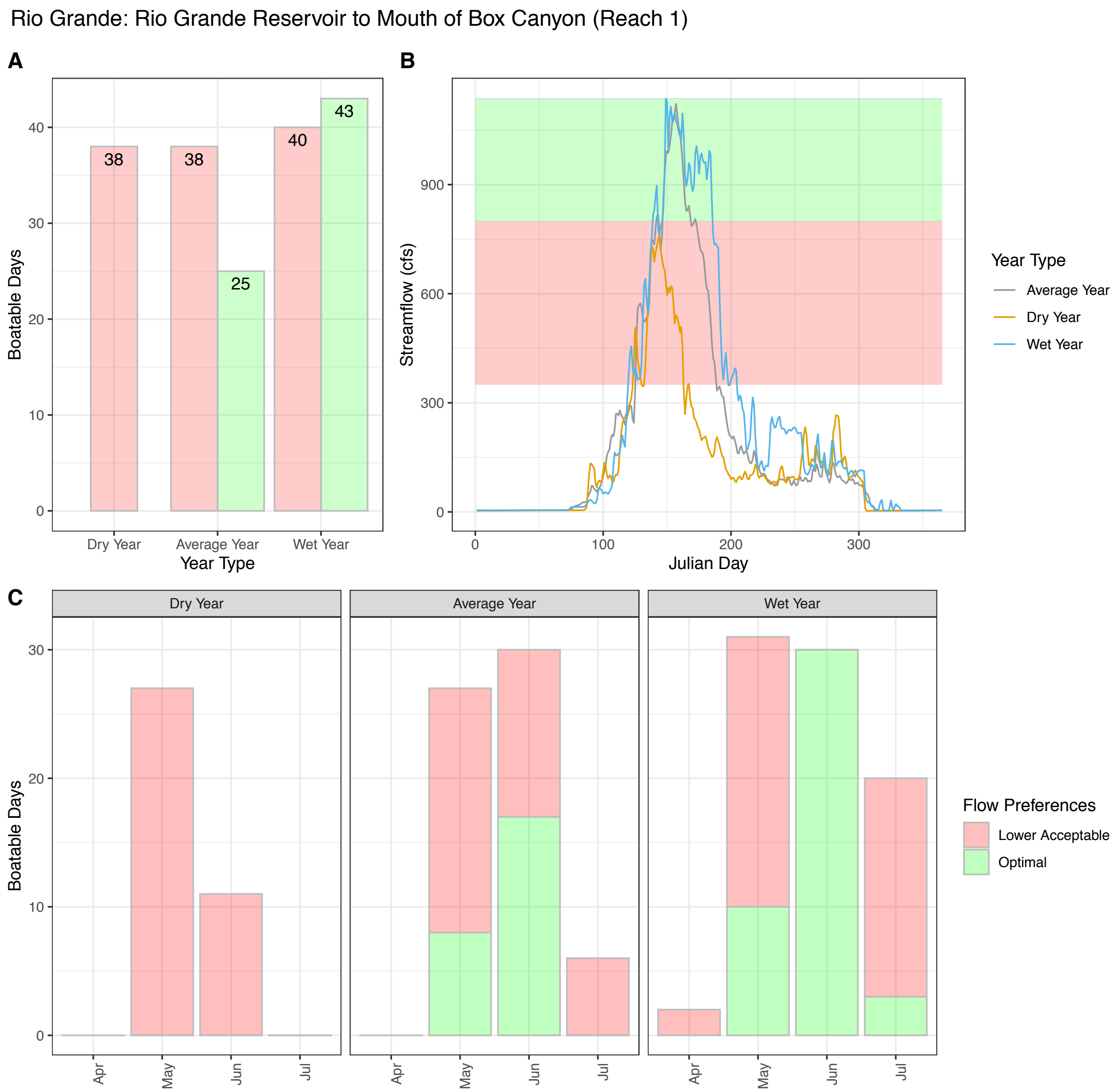

Figure 3: Boatable Days analysis results for the Rio Grande: Rio Grande Reservoir to Mouth of Box Canyon. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: Box Canyon to Deep Creek/Creede

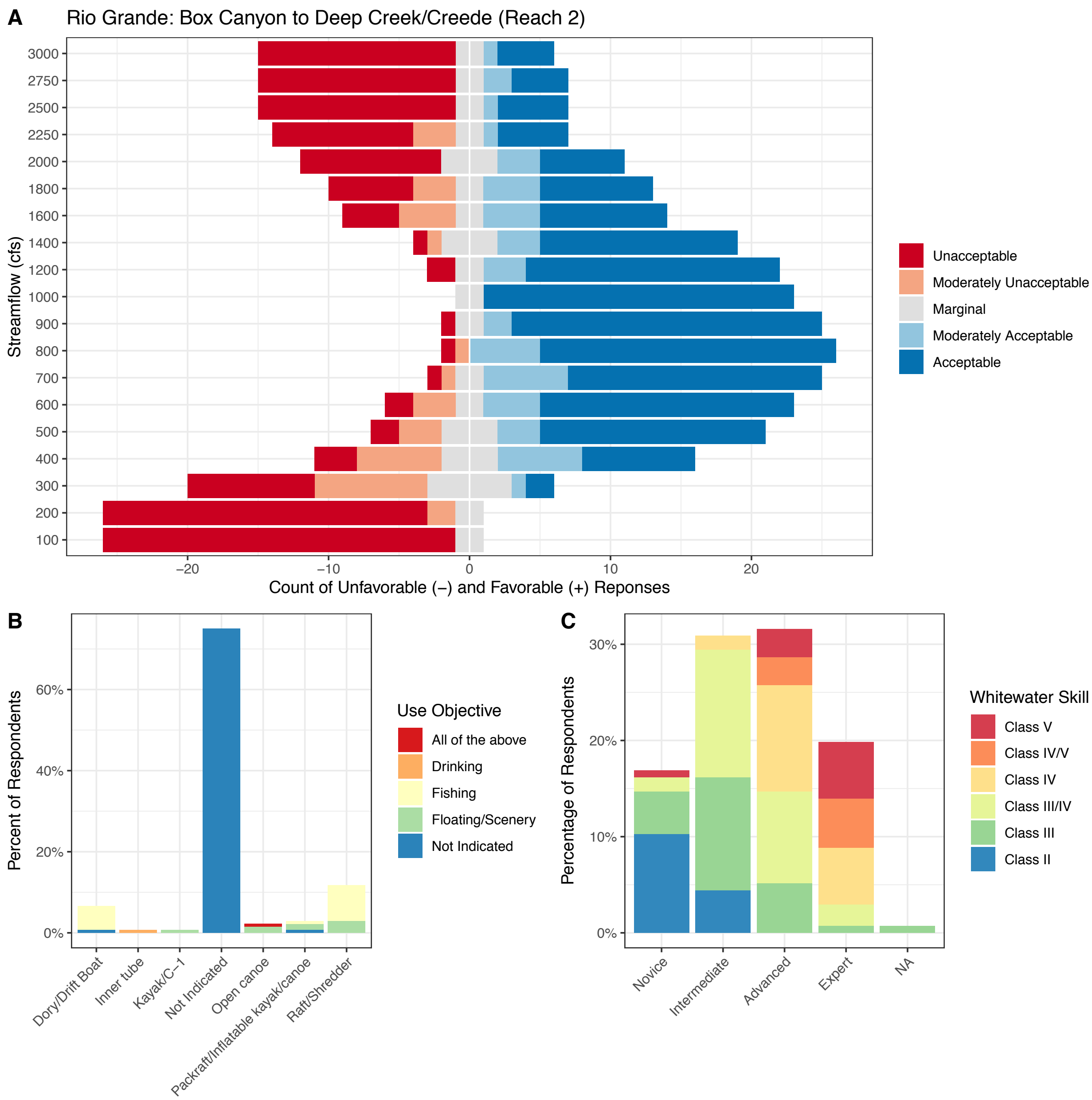

Figure 4: Survey responses for the Rio Grande, Box Canyon to Deep Creek/Creede. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

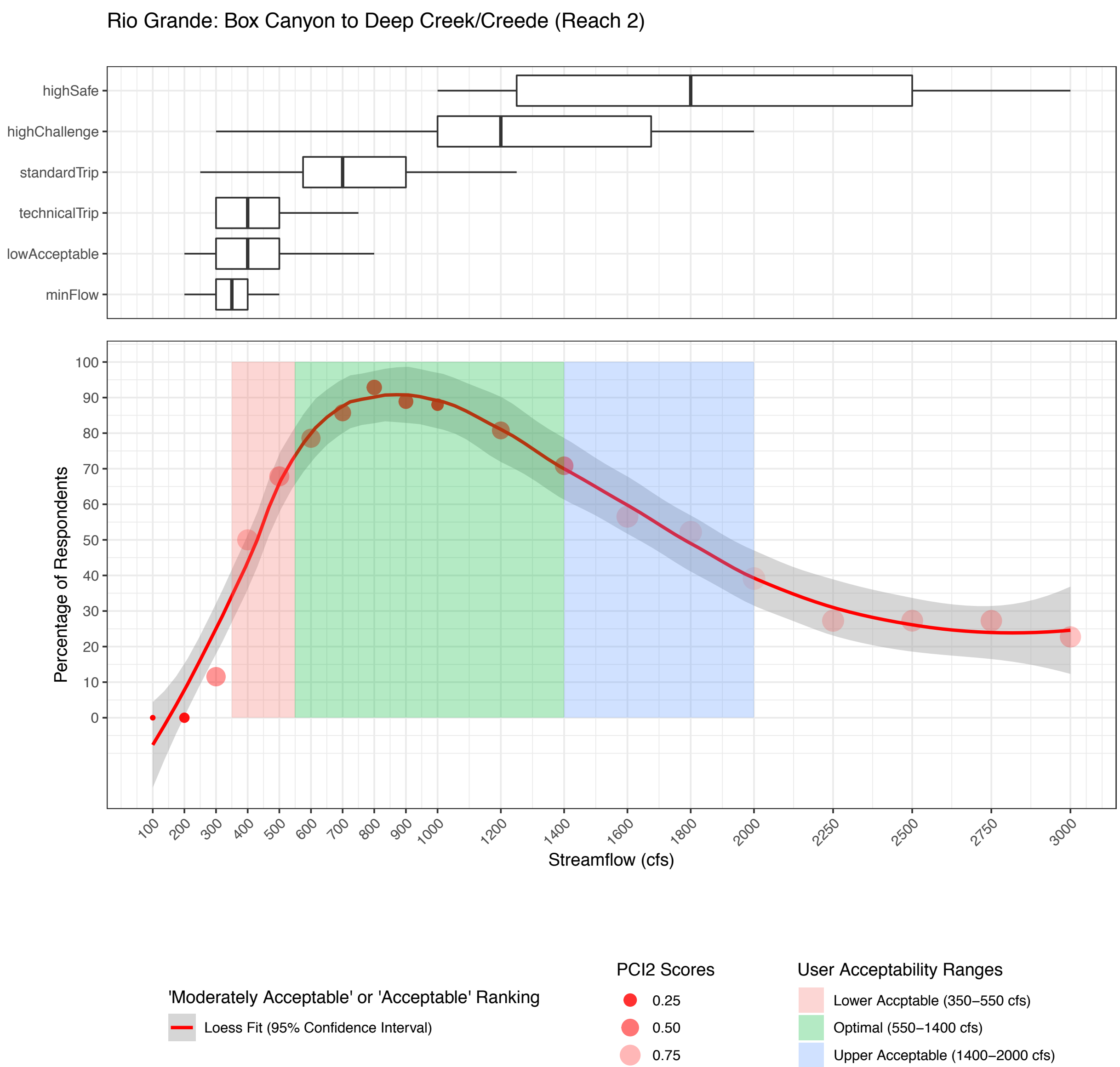

Figure 5: Flow preferences reported by users for the Rio Grande: Box Canyon to Deep Creek/Creede. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 4: Summarized open-format flow-preference question responses for Reach 2, Rio Grande: Box Canyon to Deep Creek/Creede.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	300	350	400	28
Low Acceptable Flow (cfs)	300	400	500	28
Technical Flow (cfs)	300	400	500	24
Standard Trip Flow (cfs)	575	700	900	28
Challenging High Flow (cfs)	1000	1200	1675	22
Highest Safe Flow (cfs)	1250	1800	2500	22

Table 5: PCI2 analysis results for Reach 2, Rio Grande: Box Canyon to Deep Creek/Creede.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.0739645	-2.0	26	1352	100
200	0.1390533	-2.0	26	1352	188
300	0.6257396	-1.0	26	1352	846
400	0.7678571	0.5	28	1568	1204
500	0.6760204	2.0	28	1568	1060
600	0.6109694	2.0	28	1568	958
700	0.4528061	2.0	28	1568	710
800	0.3545918	2.0	28	1568	556
900	0.3214286	2.0	27	1456	468
1000	0.2115385	2.0	25	1248	264
1200	0.5103550	2.0	26	1352	690
1400	0.5659722	2.0	24	1152	652

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1600	0.8560606	1.0	23	1056	904
1800	0.9090909	1.0	23	1056	960
2000	0.9242424	0.0	23	1056	976
2250	0.8636364	-1.0	22	968	836
2500	0.8367769	-2.0	22	968	810
2750	0.8099174	-2.0	22	968	784
3000	0.7871901	-2.0	22	968	762

Table 6: Boatable Days analysis results broken out by month for the Rio Grande: Box Canyon to Deep Creek/Creede. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Apr	Lower Acceptable	0	0	2
May	Lower Acceptable	9	6	11
	Optimal	18	21	20
Jun	Lower Acceptable	8	0	0
	Optimal	3	30	30
Jul	Lower Acceptable	0	5	11
	Optimal	0	1	9

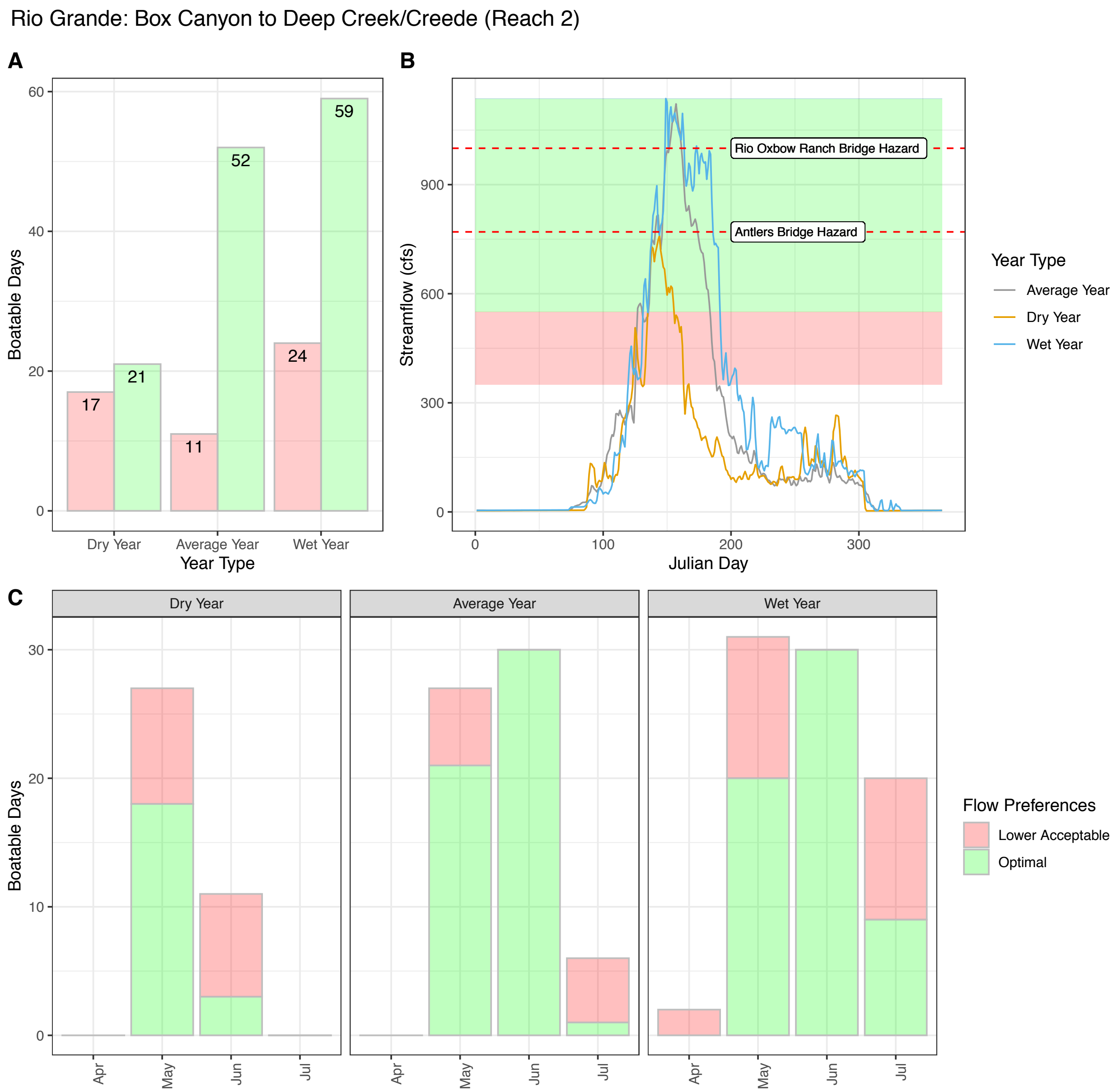

Figure 6: Boatable Days analysis results for the Rio Grande: Box Canyon to Deep Creek/Creede. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: Creede to Wagon Wheel Gap

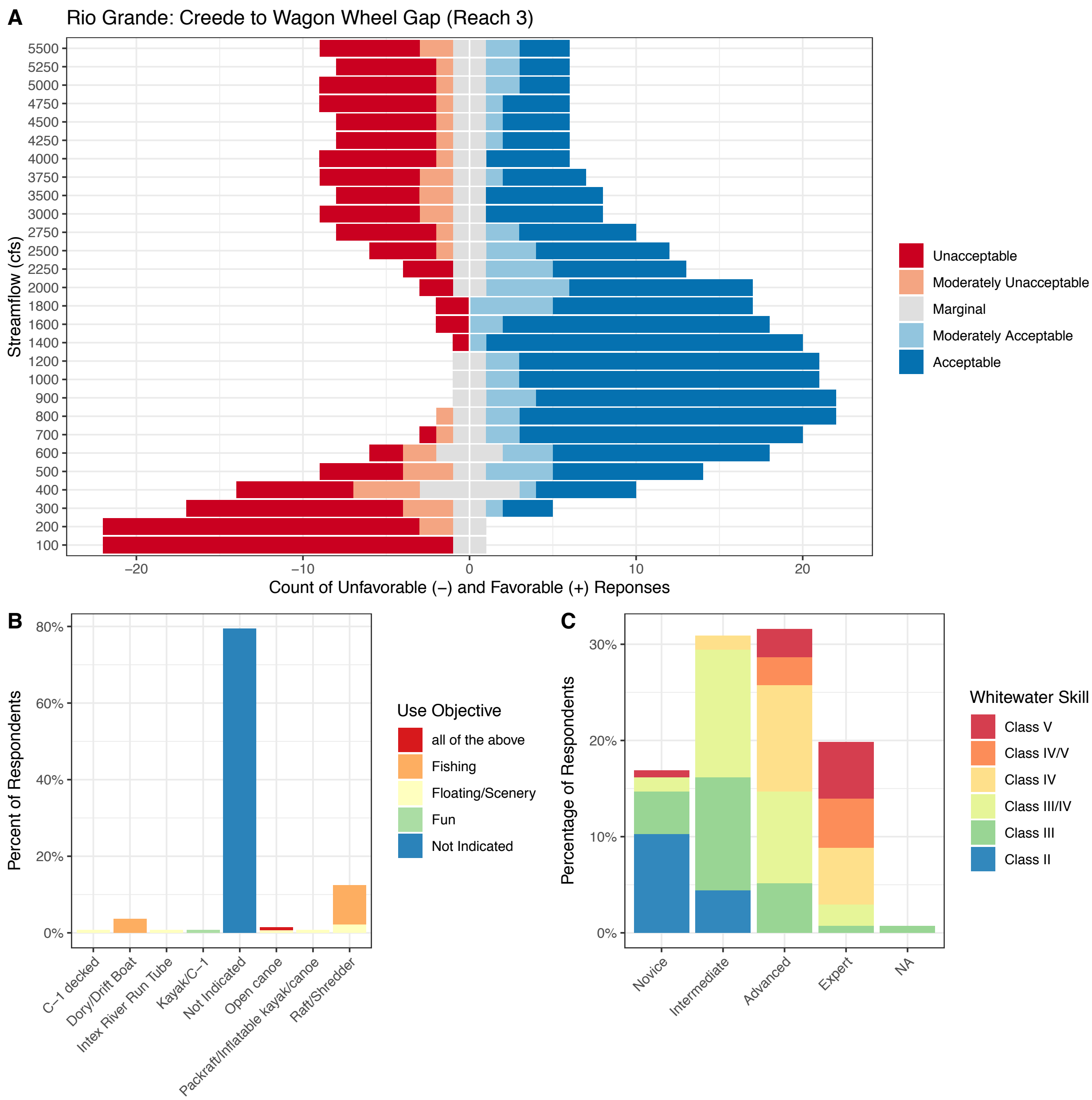

Figure 7: Survey responses for the Rio Grande, Creede to Wagon Wheel Gap. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

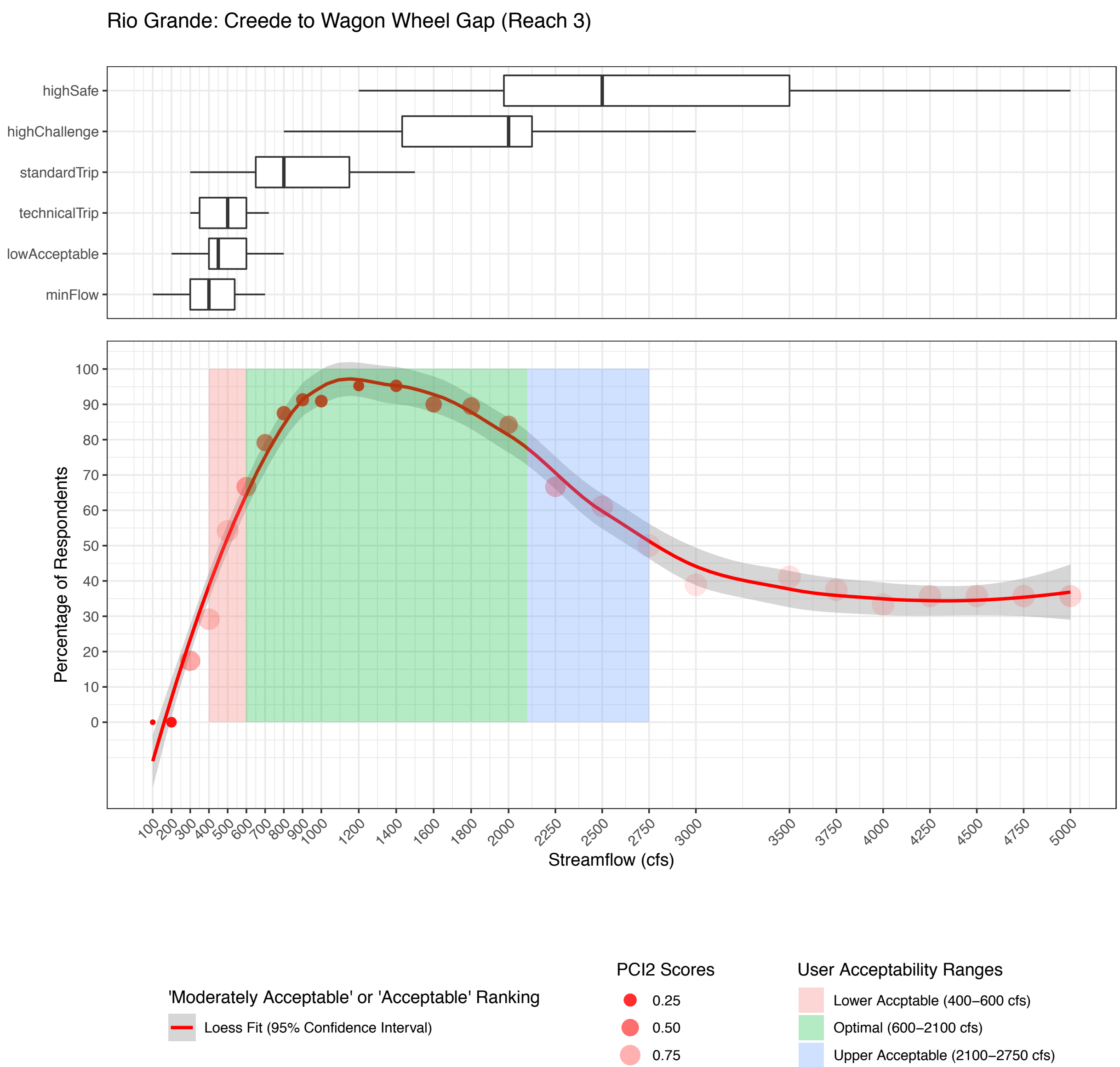

Figure 8: Flow preferences reported by users for the Rio Grande: Creede to Wagon Wheel Gap. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 7: Summarized open-format flow-preference question responses for Reach 3, Rio Grande: Creede to Wagon Wheel Gap.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	300	400	538	23
Low Acceptable Flow (cfs)	400	450	600	23
Technical Flow (cfs)	350	500	600	21
Standard Trip Flow (cfs)	650	800	1150	22
Challenging High Flow (cfs)	1432	2000	2125	20
Highest Safe Flow (cfs)	1975	2500	3500	19

Table 8: PCI2 analysis results for Reach 3, Rio Grande: Creede to Wagon Wheel Gap.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.0867769	-2.0	22	968	84
200	0.1611570	-2.0	22	968	156
300	0.7159091	-2.0	23	1056	756
400	0.8489583	0.0	24	1152	978
500	0.8697917	1.0	24	1152	1002
600	0.6857639	2.0	24	1152	790
700	0.4878472	2.0	24	1152	562
800	0.3142361	2.0	24	1152	362
900	0.2500000	2.0	23	1056	264
1000	0.2314050	2.0	22	968	224
1200	0.1681818	2.0	21	880	148
1400	0.2227273	2.0	21	880	196

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1600	0.4300000	2.0	20	800	344
1800	0.5166667	2.0	19	720	372
2000	0.5666667	2.0	19	720	408
2250	0.7469136	1.0	18	648	484
2500	0.8580247	1.0	18	648	556
2750	0.9475309	0.5	18	648	614
3000	0.9444444	0.0	18	648	612
3500	0.9375000	0.0	17	576	540
3750	0.9335938	-0.5	16	512	478
4000	0.9464286	-1.0	15	448	424
4250	0.9285714	-0.5	14	392	364
4500	0.9285714	-0.5	14	392	364
4750	0.9285714	-1.5	14	392	364
5000	0.8928571	-1.5	14	392	350
5250	0.9166667	-1.0	13	336	308
5500	0.8877551	-1.0	14	392	348

Table 9: Boatable Days analysis results broken out by month for the Rio Grande: Creede to Wagon Wheel Gap. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Mar	Lower Acceptable	1	0	0
Apr	Lower Acceptable	10	7	2
	Optimal	8	13	16
May	Optimal	31	23	16
	Upper Acceptable	0	8	10
Jun	Lower Acceptable	5	0	0
	Optimal	11	21	6
	Upper Acceptable	0	9	11
Jul	Lower Acceptable	0	11	10
	Optimal	0	20	21
Aug	Lower Acceptable	2	26	18
	Optimal	0	3	0
Sep	Lower Acceptable	18	15	0
	Optimal	1	0	0
Oct	Lower Acceptable	7	3	1
	Optimal	5	0	0

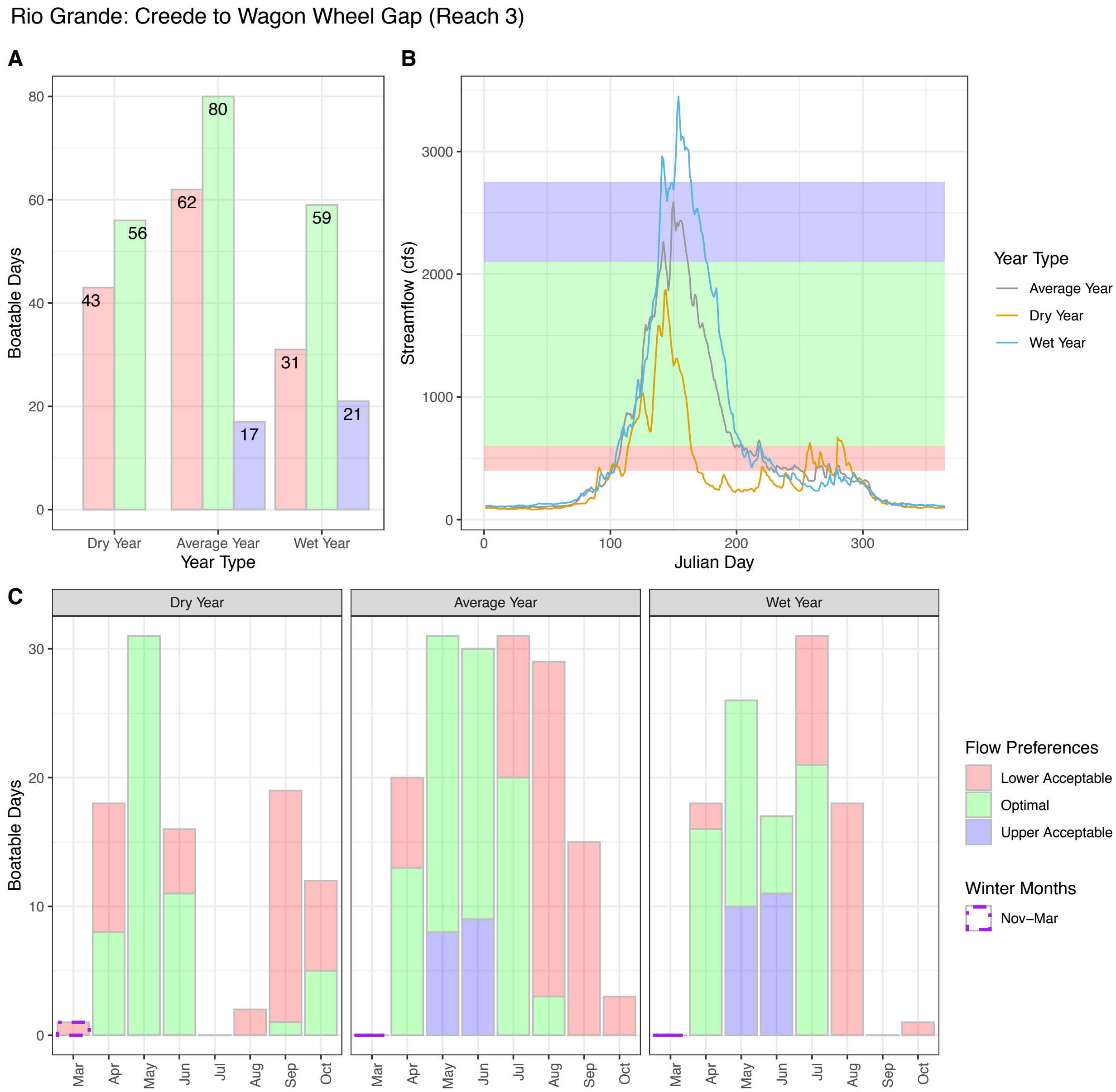

Figure 9: Boatable Days analysis results for the Rio Grande: Creede to Wagon Wheel Gap. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: Wagon Wheel Gap to South Fork

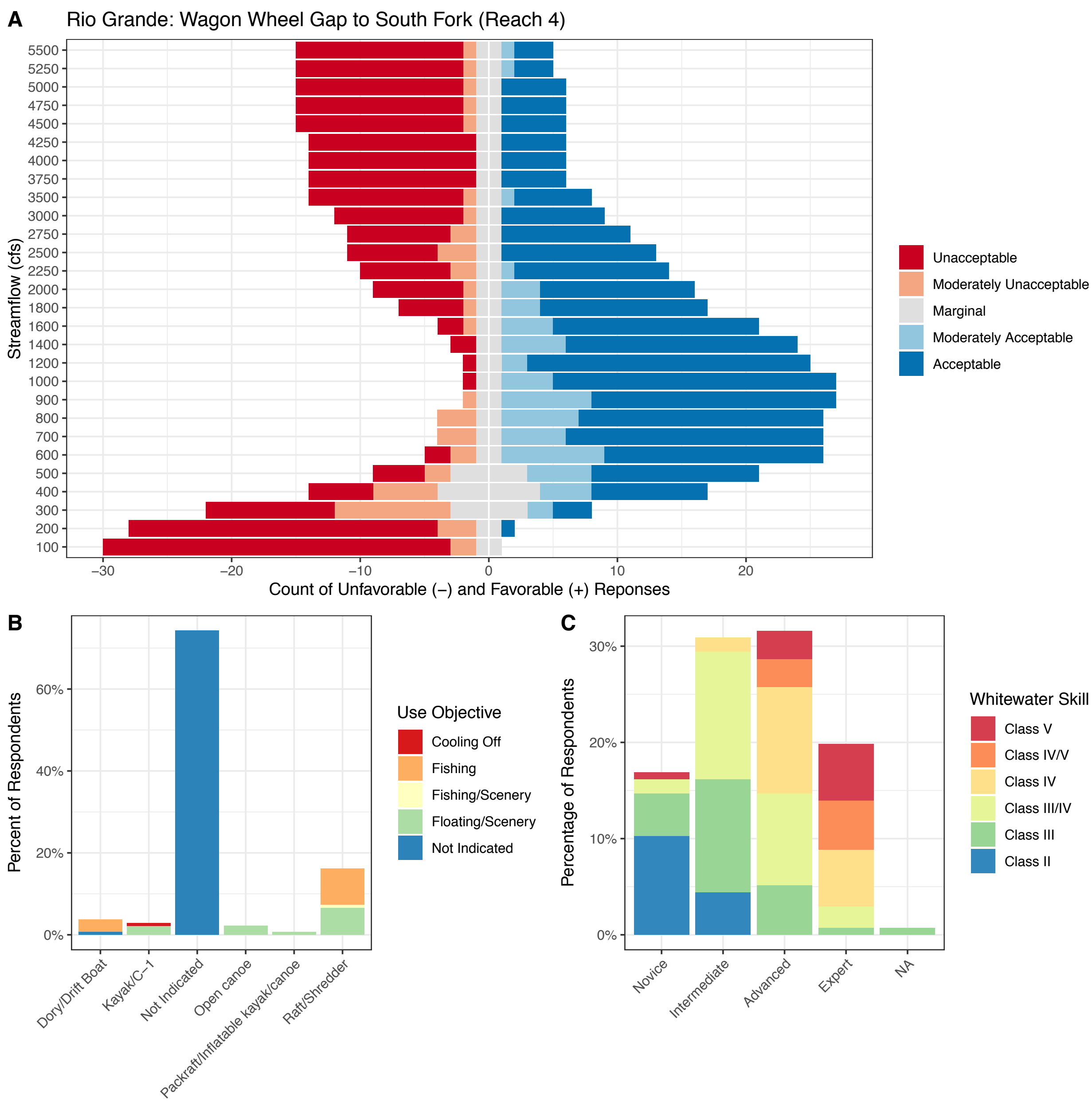

Figure 10: Survey responses for the Rio Grande, Wagon Wheel Gap to South Fork. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

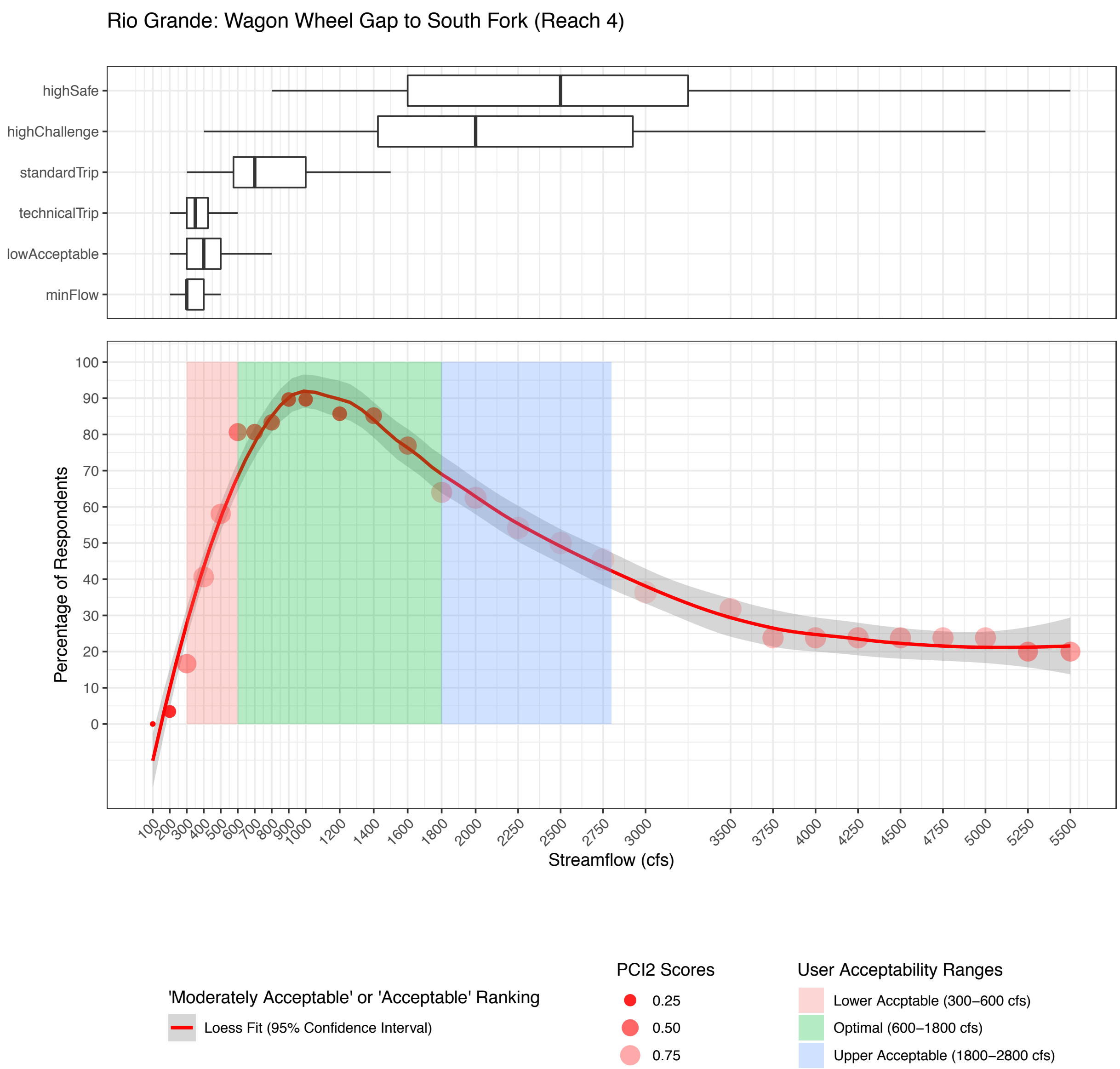

Figure 11: Flow preferences reported by users for the Rio Grande: Wagon Wheel Gap to South Fork. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 10: Summarized open-format flow-preference question responses for Reach 4, Rio Grande: Wagon Wheel Gap to South Fork.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	300	300	400	28
Low Acceptable Flow (cfs)	300	400	500	28
Technical Flow (cfs)	300	350	425	27
Standard Trip Flow (cfs)	575	700	1000	28
Challenging High Flow (cfs)	1425	2000	2925	26
Highest Safe Flow (cfs)	1600	2500	3250	27

Table 11: PCI2 analysis results for Reach 4, Rio Grande: Wagon Wheel Gap to South Fork.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.1222222	-2.0	30	1800	220
200	0.2738095	-2.0	29	1680	460
300	0.6833333	-1.0	30	1800	1230
400	0.7900391	0.0	32	2048	1618
500	0.7562500	1.0	31	1920	1452
600	0.5770833	2.0	31	1920	1108
700	0.4729167	2.0	31	1920	908
800	0.4611111	2.0	30	1800	830
900	0.3523810	2.0	29	1680	592
1000	0.3428571	2.0	29	1680	576
1200	0.3596939	2.0	28	1568	564

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1400	0.4862637	2.0	27	1456	708
1600	0.5872781	2.0	26	1352	794
1800	0.8237179	2.0	25	1248	1028
2000	0.9131944	1.5	24	1152	1052
2250	0.9392361	1.5	24	1152	1082
2500	0.9496528	1.0	24	1152	1094
2750	0.9752066	0.0	22	968	944
3000	0.9607438	-0.5	22	968	930
3500	0.9049587	-2.0	22	968	876
3750	0.8363636	-2.0	21	880	736
4000	0.8363636	-2.0	21	880	736
4250	0.8363636	-2.0	21	880	736
4500	0.8227273	-2.0	21	880	724
4750	0.8227273	-2.0	21	880	724
5000	0.8227273	-2.0	21	880	724
5250	0.7250000	-2.0	20	800	580
5500	0.7250000	-2.0	20	800	580

Table 12: Boatable Days analysis results broken out by month for the Rio Grande: Wagon Wheel Gap to South Fork. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Mar	Lower Acceptable	2	0	0
Apr	Lower Acceptable	22	12	14
	Optimal	8	13	16
May	Optimal	29	15	13
	Upper Acceptable	2	16	13
Jun	Lower Acceptable	12	0	0
	Optimal	11	16	0
	Upper Acceptable	0	14	20
Jul	Lower Acceptable	4	11	10
	Optimal	0	20	19
	Upper Acceptable	0	0	2
Aug	Lower Acceptable	18	28	31
	Optimal	0	3	0
Sep	Lower Acceptable	21	30	9
	Optimal	1	0	0
Oct	Lower Acceptable	22	30	18
	Optimal	5	0	0

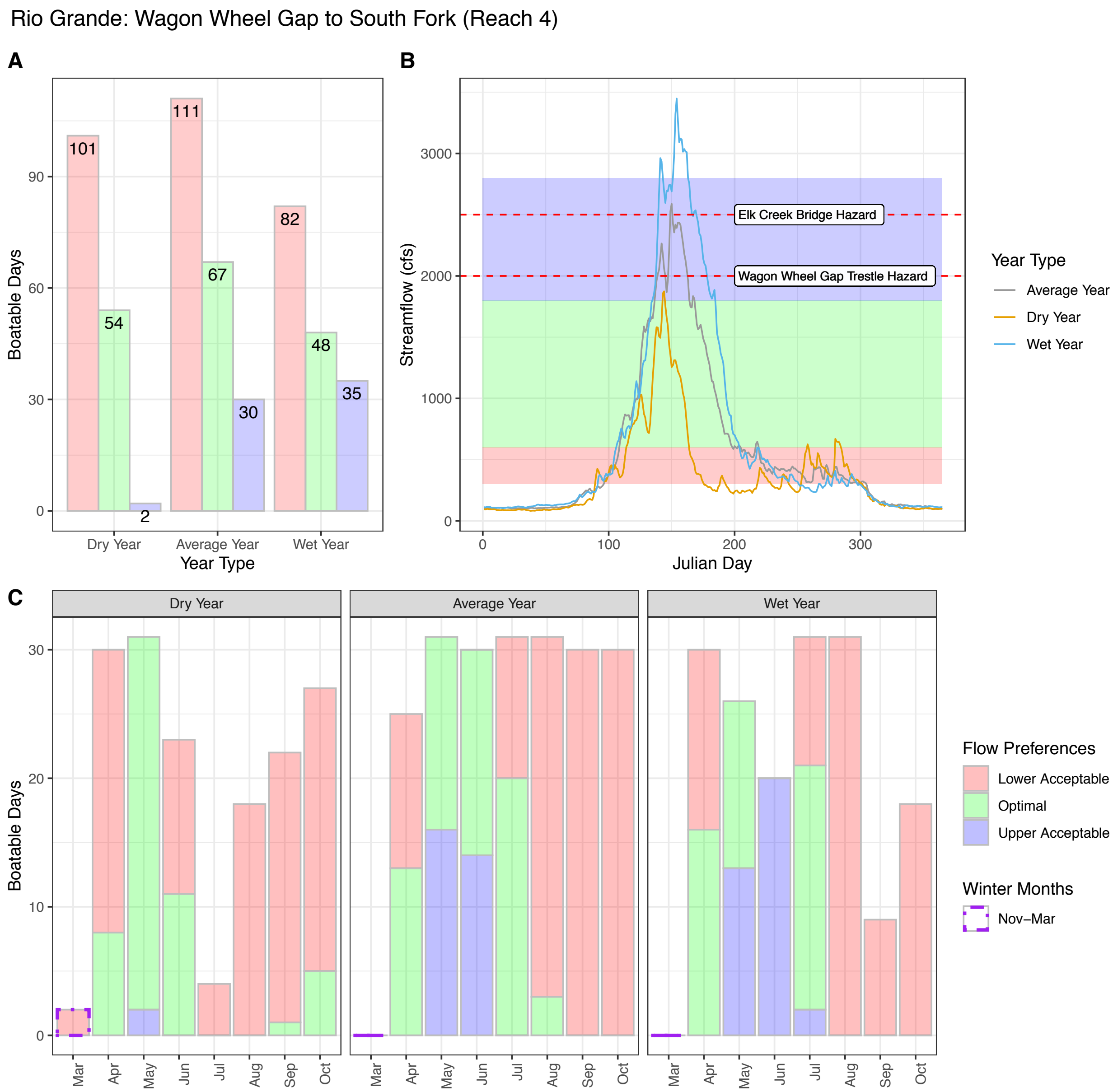

Figure 12: Boatable Days analysis results for the Rio Grande: Wagon Wheel Gap to South Fork. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: South Fork to Del Norte (Hwy 112)

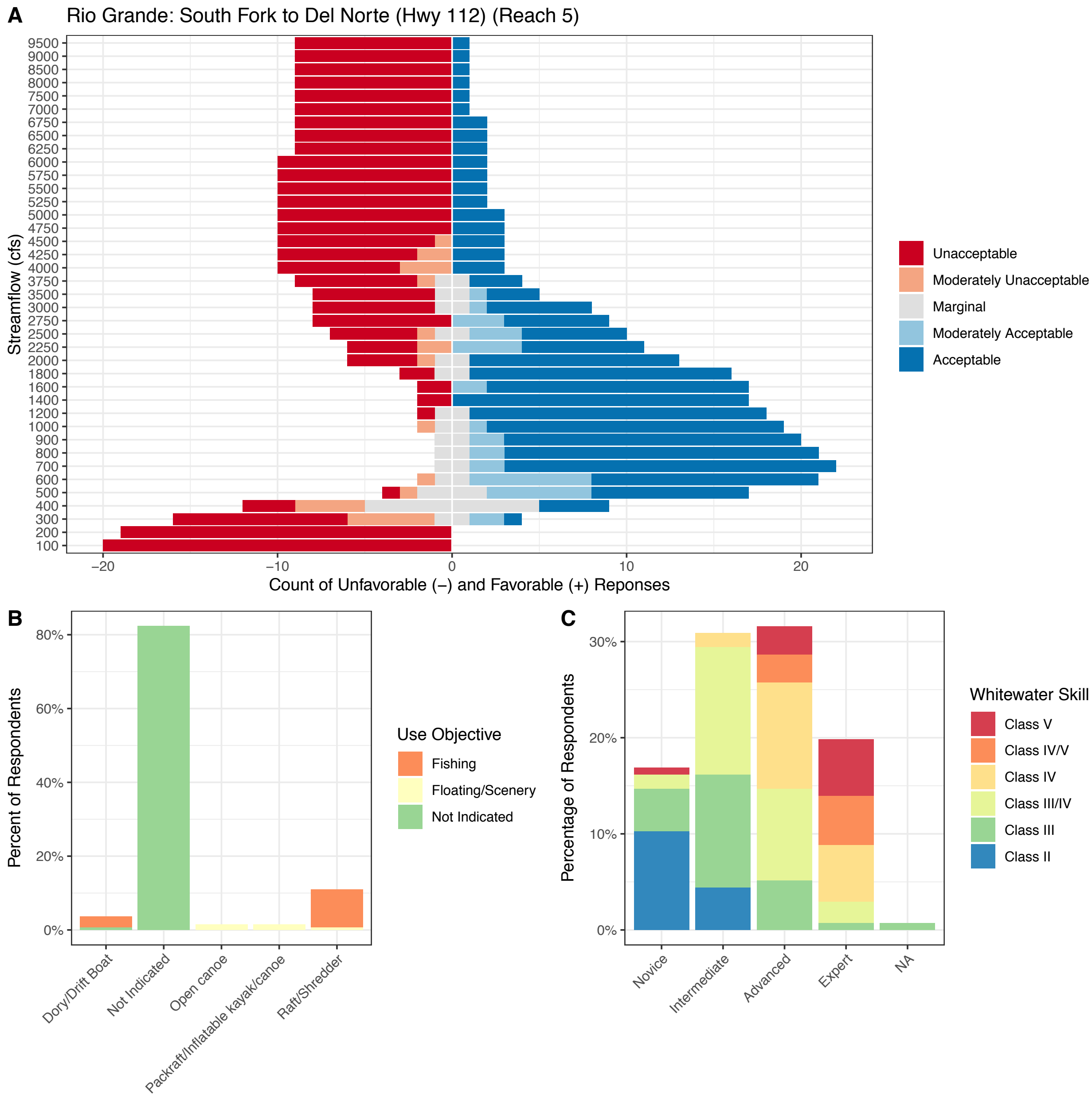

Figure 13: Survey responses for the Rio Grande, South Fork to Del Norte (Hwy 112). (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

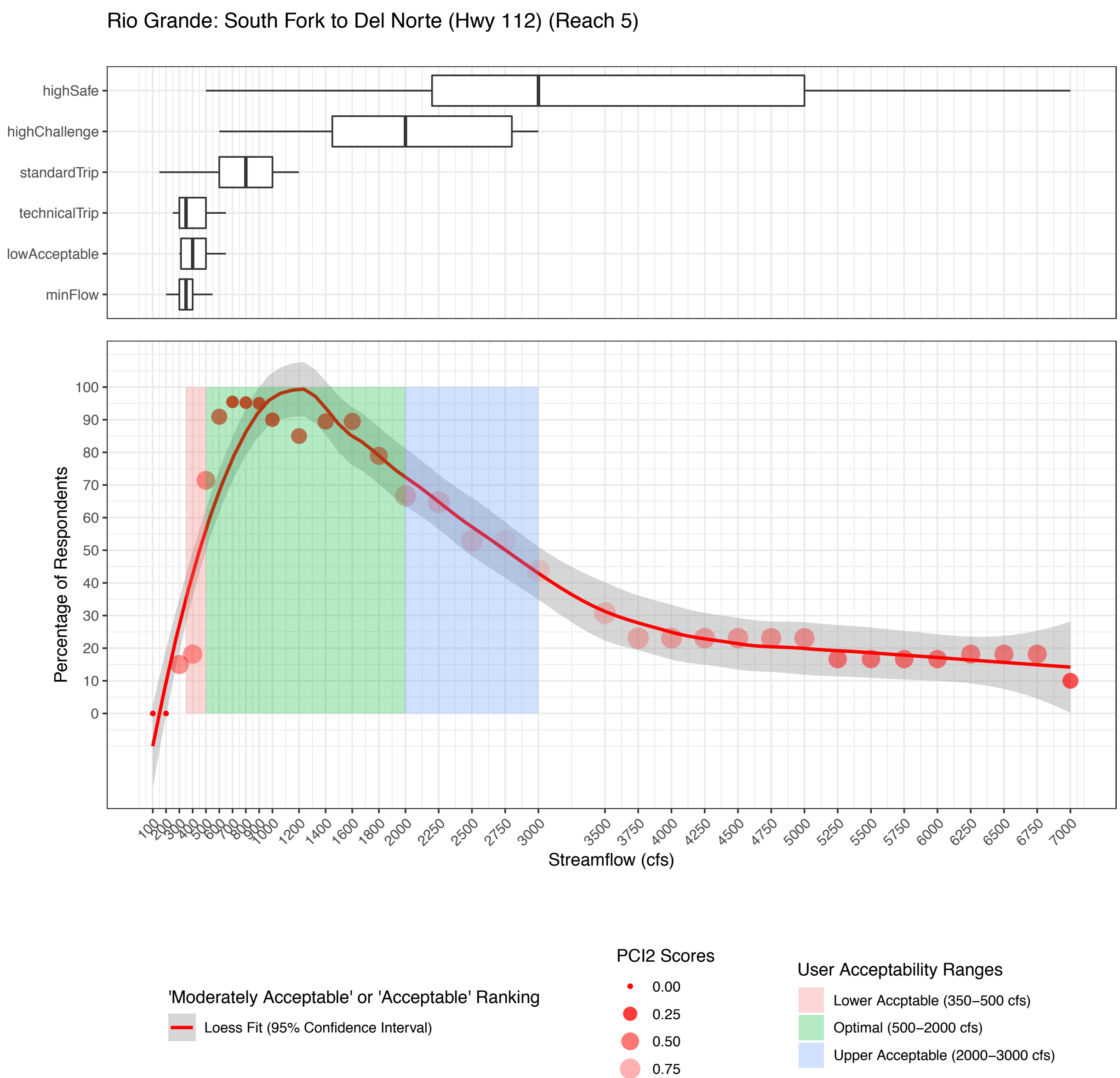

Figure 14: Flow preferences reported by users for the Rio Grande: South Fork to Del Norte (Hwy 112). (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 13: Summarized open-format flow-preference question responses for Reach 5, Rio Grande: South Fork to Del Norte (Hwy 112).

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	300	350	400	20
Low Acceptable Flow (cfs)	312	400	500	18
Technical Flow (cfs)	300	350	500	15
Standard Trip Flow (cfs)	600	800	1000	17
Challenging High Flow (cfs)	1450	2000	2800	15
Highest Safe Flow (cfs)	2200	3000	5000	13

Table 14: PCI2 analysis results for Reach 5, Rio Grande: South Fork to Del Norte (Hwy 112).

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.0000000	-2.0	20	800	0
200	0.0000000	-2.0	19	720	0
300	0.6125000	-1.5	20	800	490
400	0.6322314	0.0	22	968	612
500	0.5818182	1.0	21	880	512
600	0.3677686	2.0	22	968	356
700	0.1611570	2.0	22	968	156
800	0.1681818	2.0	21	880	148
900	0.1750000	2.0	20	800	140
1000	0.2650000	2.0	20	800	212
1200	0.3500000	2.0	20	800	280
1400	0.3777778	2.0	19	720	272
1600	0.4500000	2.0	19	720	324

Flow (cfs)	PCI2	**Median Likert Response**	**n**	**Max. Distance**	**Total Distance**
1800	0.5222222	2.0	19	720	376
2000	0.8179012	2.0	18	648	530
2250	0.8819444	1.0	17	576	508
2500	0.9166667	1.0	17	576	528
2750	0.9791667	1.0	17	576	564
3000	0.9726562	0.0	16	512	498
3500	0.8928571	-2.0	13	336	300
3750	0.8452381	-2.0	13	336	284
4000	0.7857143	-2.0	13	336	264
4250	0.7738095	-2.0	13	336	260
4500	0.7500000	-2.0	13	336	252
4750	0.7142857	-2.0	13	336	240
5000	0.7142857	-2.0	13	336	240
5250	0.5555556	-2.0	12	288	160
5500	0.5555556	-2.0	12	288	160
5750	0.5555556	-2.0	12	288	160
6000	0.5555556	-2.0	12	288	160
6250	0.6000000	-2.0	11	240	144
6500	0.6000000	-2.0	11	240	144
6750	0.6000000	-2.0	11	240	144
7000	0.3600000	-2.0	10	200	72
7500	0.3600000	-2.0	10	200	72

Table 15: Boatable Days analysis results broken out by month for the Rio Grande: South Fork to Del Norte (Hwy 112). Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Mar	Lower Acceptable	3	16	13
	Optimal	2	0	3
Apr	Lower Acceptable	0	5	0
	Optimal	30	25	30
May	Optimal	19	5	5
	Upper Acceptable	12	12	8
Jun	Lower Acceptable	10	0	0
	Optimal	19	7	0
	Upper Acceptable	0	14	8
Jul	Lower Acceptable	8	0	0
	Optimal	1	31	28
	Upper Acceptable	0	0	3
Aug	Lower Acceptable	21	0	12
	Optimal	7	31	19
Sep	Lower Acceptable	3	11	20
	Optimal	19	19	0
Oct	Lower Acceptable	9	22	29
	Optimal	22	9	2
Nov	Lower Acceptable	0	2	0

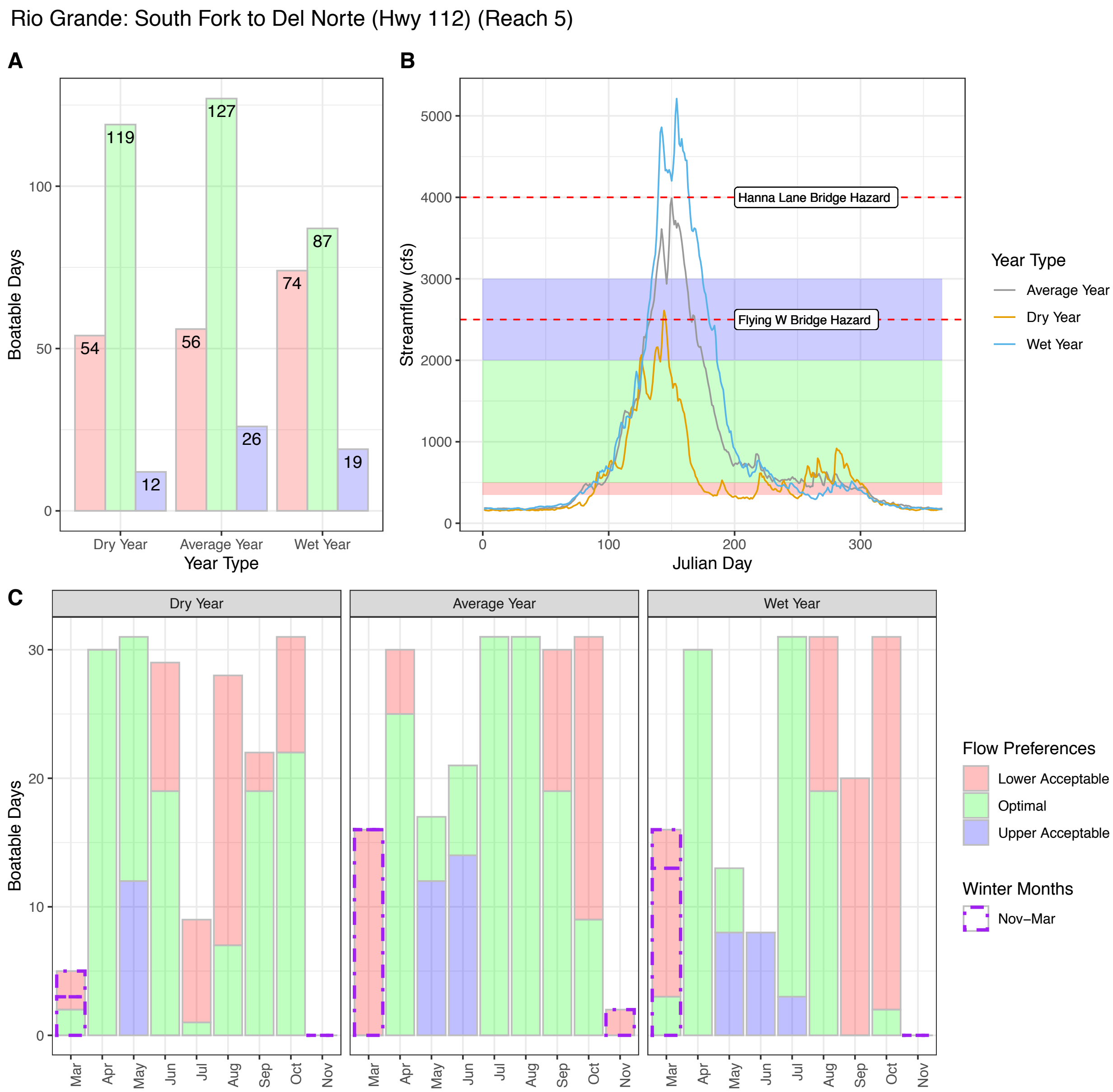

Figure 15: Boatable Days analysis results for the Rio Grande: South Fork to Del Norte (Hwy 112). (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: Alamosa to Lasauses

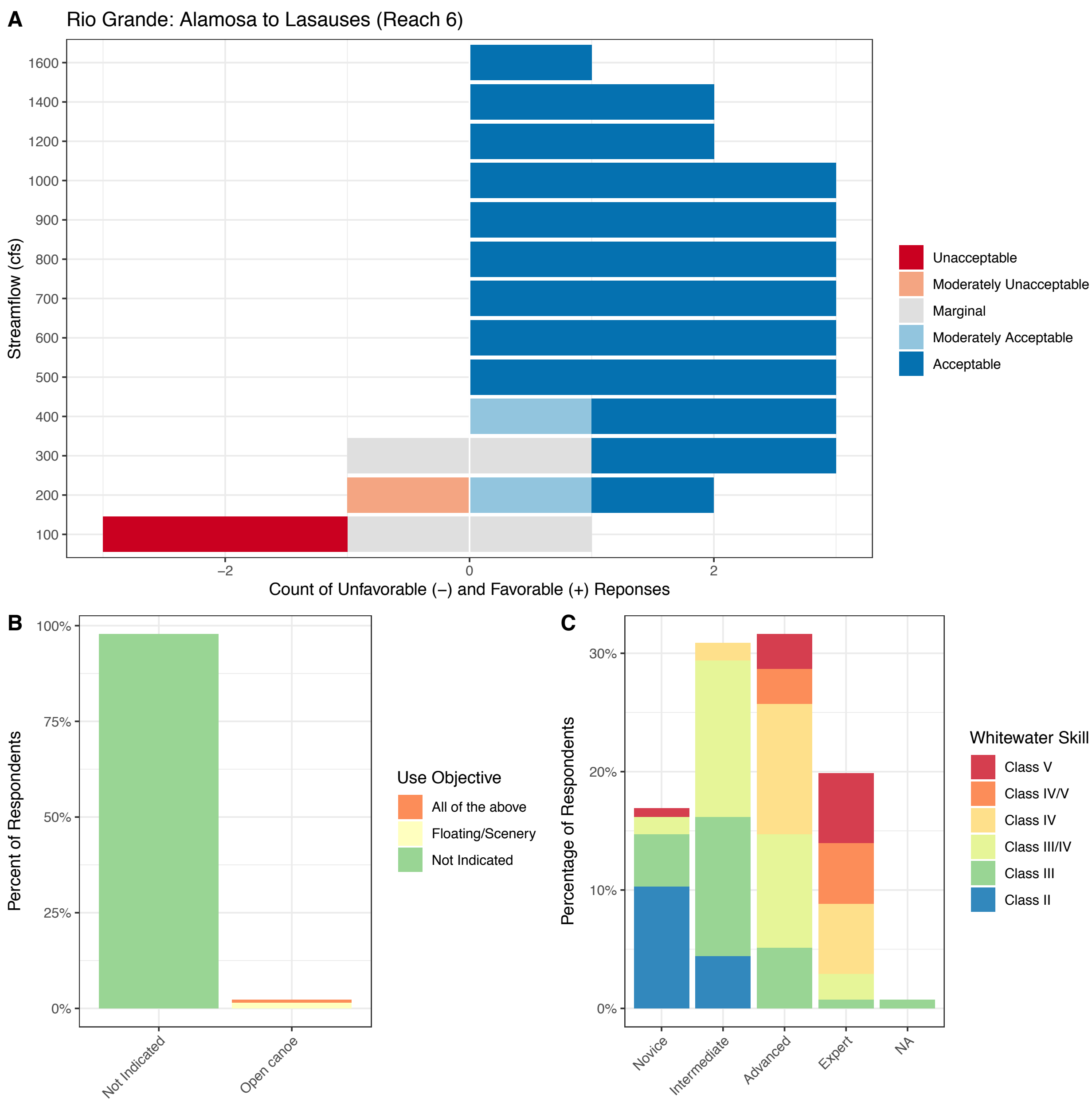

Figure 16: Survey responses for the Rio Grande, Alamosa to Lasauses. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

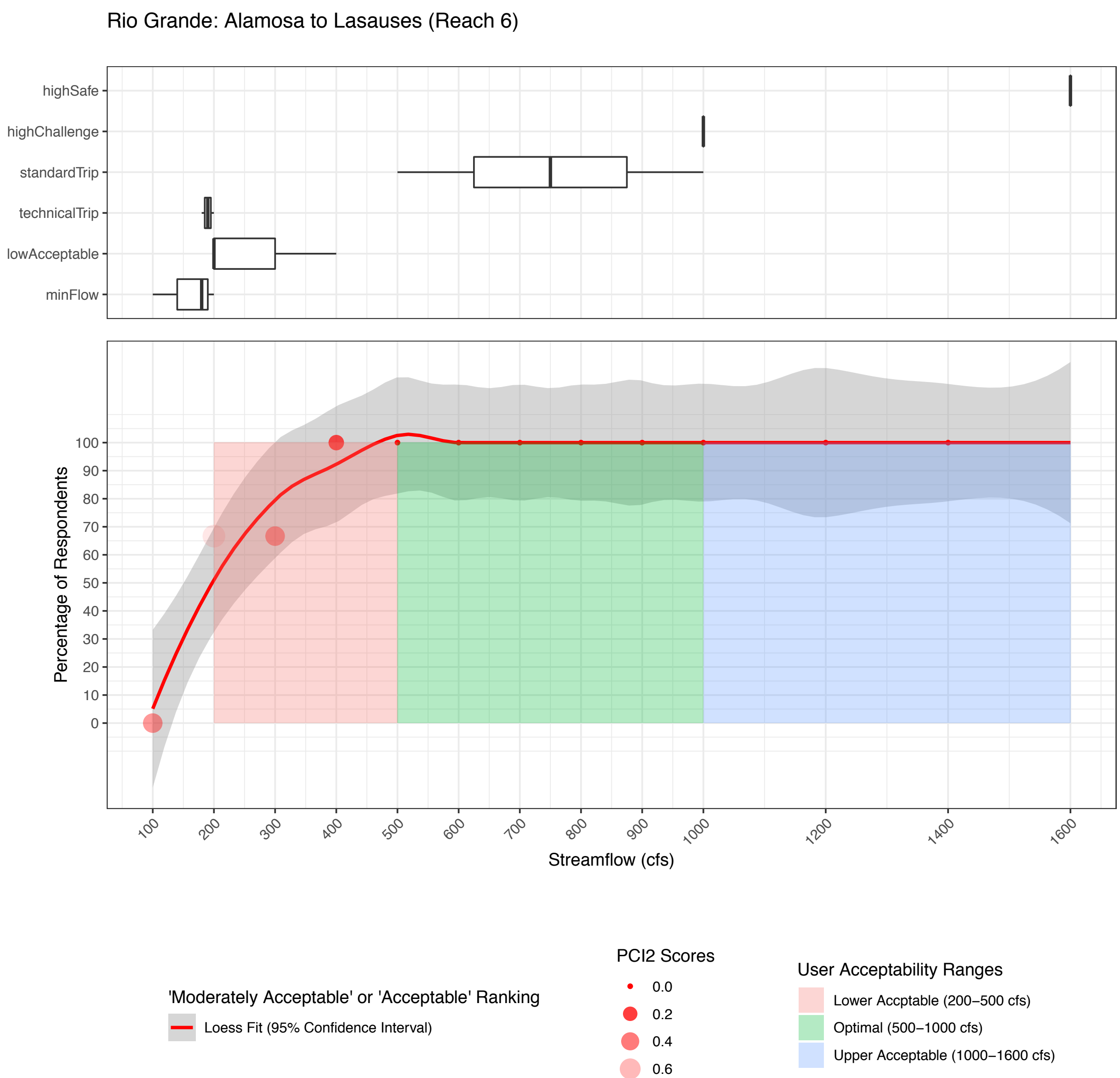

Figure 17: Flow preferences reported by users for the Rio Grande: Alamosa to Lasauses. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 16: Summarized open-format flow-preference question responses for Reach 6, Rio Grande: Alamosa to Lasauses.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	140	180	190	3
Low Acceptable Flow (cfs)	200	200	300	3
Technical Flow (cfs)	185	190	195	2
Standard Trip Flow (cfs)	625	750	875	2
Challenging High Flow (cfs)	1000	1000	1000	1
Highest Safe Flow (cfs)	5000	5000	5000	1

Table 17: PCI2 analysis results for Reach 6, Rio Grande: Alamosa to Lasauses.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.50	-2	3	16	8
200	0.75	1	3	16	12
300	0.50	2	3	16	8
400	0.25	2	3	16	4
500	0.00	2	3	16	0
600	0.00	2	3	16	0
700	0.00	2	3	16	0
800	0.00	2	3	16	0
900	0.00	2	3	16	0
1000	0.00	2	3	16	0
1200	0.00	2	2	8	0
1400	0.00	2	2	8	0
1600	NaN	2	1	0	0

Table 18: Boatable Days analysis results broken out by month for the Rio Grande: Alamosa to Lasauses. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Jan	Lower Acceptable	0	0	10
Feb	Lower Acceptable	13	21	22
Mar	Lower Acceptable	17	30	31
	Optimal	0	1	0
Apr	Lower Acceptable	0	4	22
May	Lower Acceptable	0	28	15
	Optimal	0	0	16
Jun	Lower Acceptable	10	21	1
	Optimal	0	0	29
Jul	Lower Acceptable	0	1	31
Aug	Lower Acceptable	0	0	31
Sep	Lower Acceptable	0	0	24
Nov	Lower Acceptable	7	27	15
Dec	Lower Acceptable	0	14	2

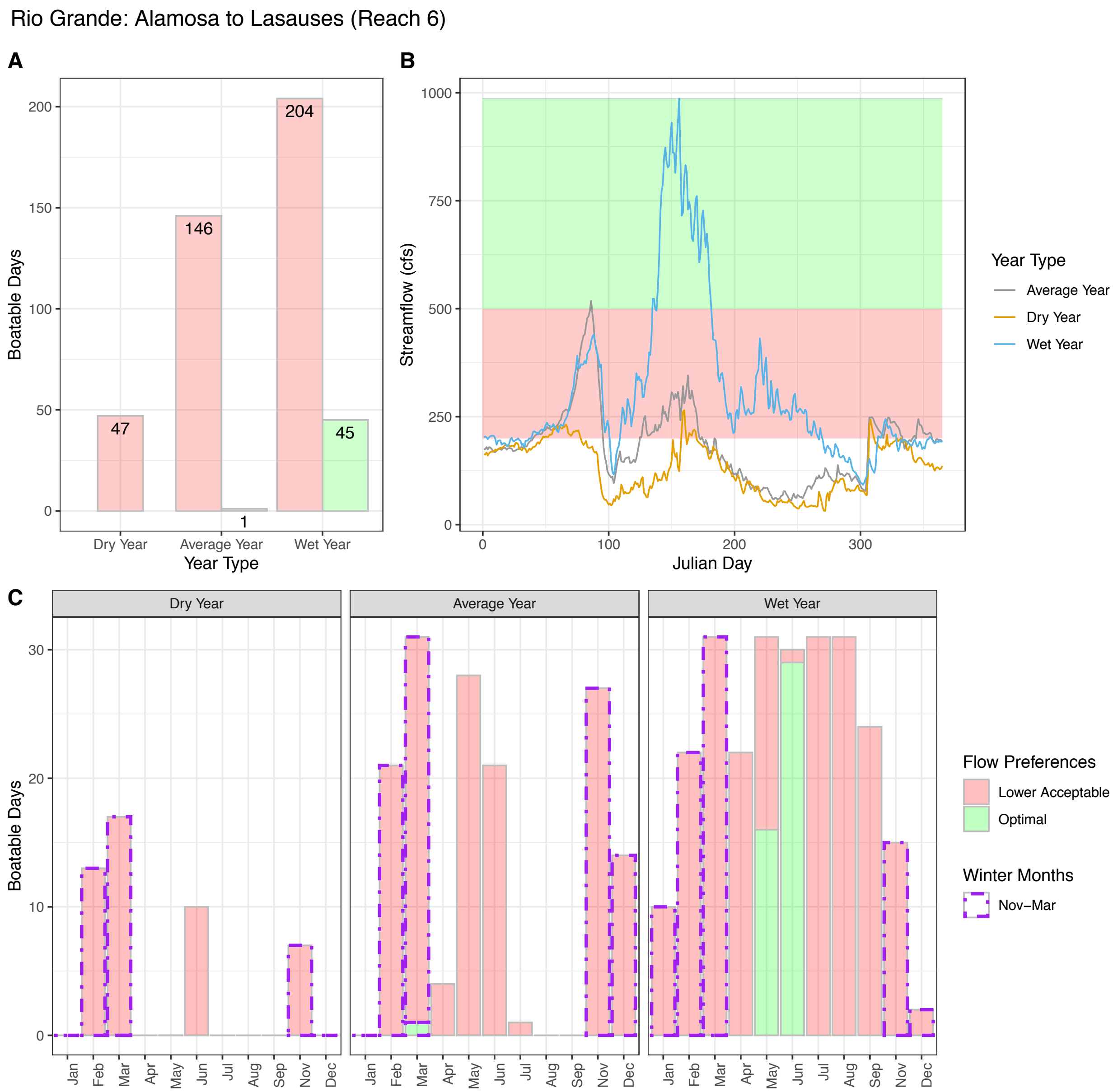

Figure 18: Boatable Days analysis results for the Rio Grande: Alamosa to Lasauses. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: Lasauses to Lobatos Bridge

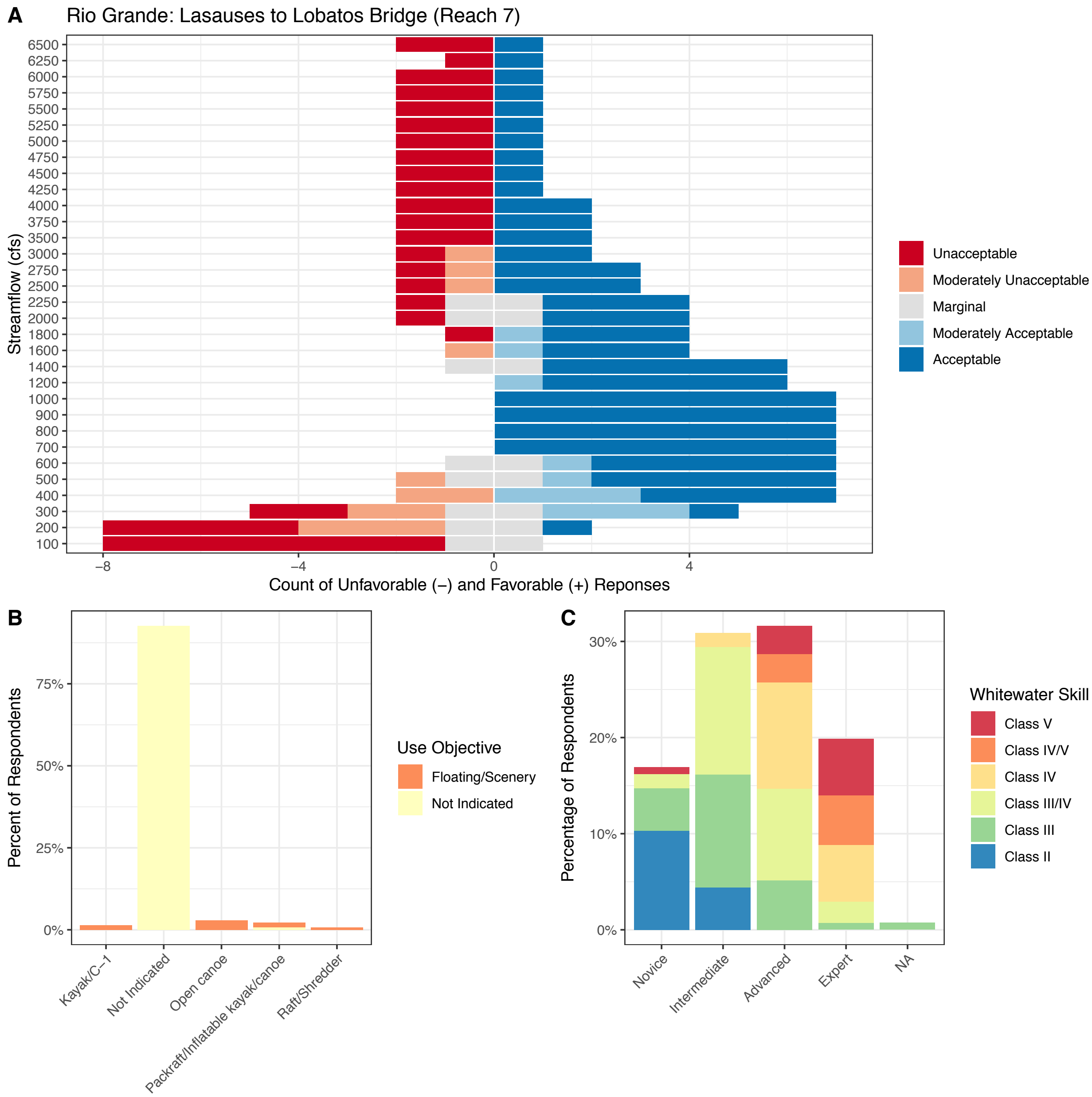

Figure 19: Survey responses for the Rio Grande, Lasauses to Lobatos Bridge. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

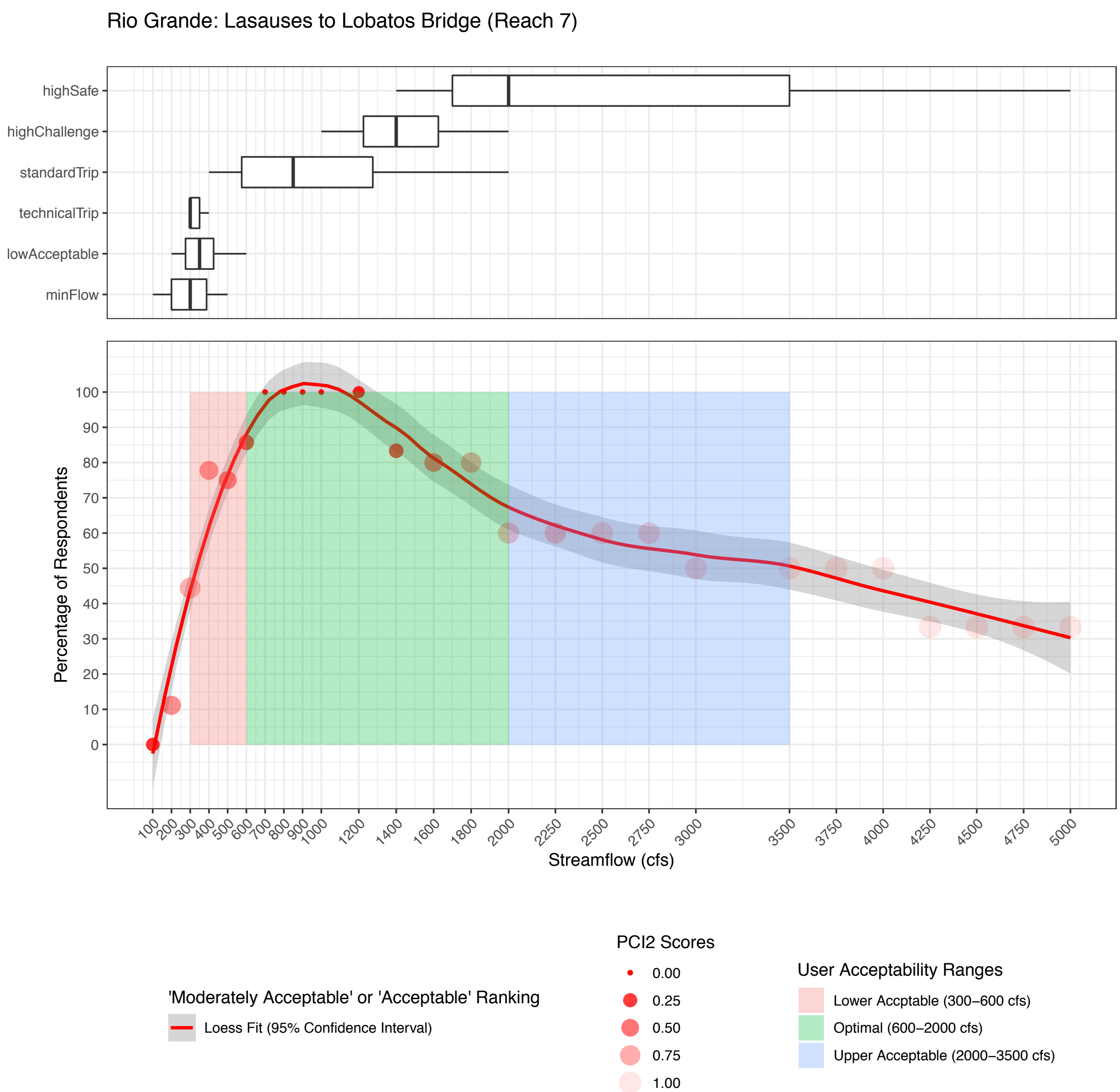

Figure 20: Flow preferences reported by users for the Rio Grande: Lasauses to Lobatos Bridge. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 19: Summarized open-format flow-preference question responses for Reach 7, Rio Grande: Lasauses to Lobatos Bridge.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	200	300	388	8
Low Acceptable Flow (cfs)	275	350	425	8
Technical Flow (cfs)	300	300	350	5
Standard Trip Flow (cfs)	575	850	1275	8
Challenging High Flow (cfs)	1225	1400	1625	4
Highest Safe Flow (cfs)	1700	2000	3500	3

Table 20: PCI2 analysis results for Reach 7, Rio Grande: Lasauses to Lobatos Bridge.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.2187500	-2.0	8	128	28
200	0.6250000	-1.0	9	160	100
300	0.7750000	0.0	9	160	124
400	0.6000000	1.0	9	160	96
500	0.5312500	2.0	8	128	68
600	0.3333333	2.0	7	96	32
700	0.0000000	2.0	7	96	0
800	0.0000000	2.0	7	96	0
900	0.0000000	2.0	7	96	0
1000	0.0000000	2.0	7	96	0
1200	0.1388889	2.0	6	72	10
1400	0.2777778	2.0	6	72	20

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1600	0.5833333	2.0	5	48	28
1800	0.7500000	2.0	5	48	36
2000	0.8333333	2.0	5	48	40
2250	0.8333333	2.0	5	48	40
2500	0.9166667	2.0	5	48	44
2750	0.9166667	2.0	5	48	44
3000	0.9375000	0.5	4	32	30
3500	1.0000000	0.0	4	32	32
3750	1.0000000	0.0	4	32	32
4000	1.0000000	0.0	4	32	32
4250	1.0000000	-2.0	3	16	16
4500	1.0000000	-2.0	3	16	16
4750	1.0000000	-2.0	3	16	16
5000	1.0000000	-2.0	3	16	16
5250	1.0000000	-2.0	3	16	16
5500	1.0000000	-2.0	3	16	16
5750	1.0000000	-2.0	3	16	16
6000	1.0000000	-2.0	3	16	16
6250	1.0000000	0.0	2	8	8
6500	1.0000000	-2.0	3	16	16

Table 21: Boatable Days analysis results broken out by month for the Rio Grande: Lasauses to Lobatos Bridge. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Feb	Lower Acceptable	0	0	1
Mar	Lower Acceptable	0	24	30
Apr	Lower Acceptable	0	4	10
May	Lower Acceptable	0	3	14
	Optimal	0	0	17
Jun	Lower Acceptable	0	8	0
	Optimal	0	0	30
Jul	Lower Acceptable	0	0	12
Aug	Lower Acceptable	0	0	7

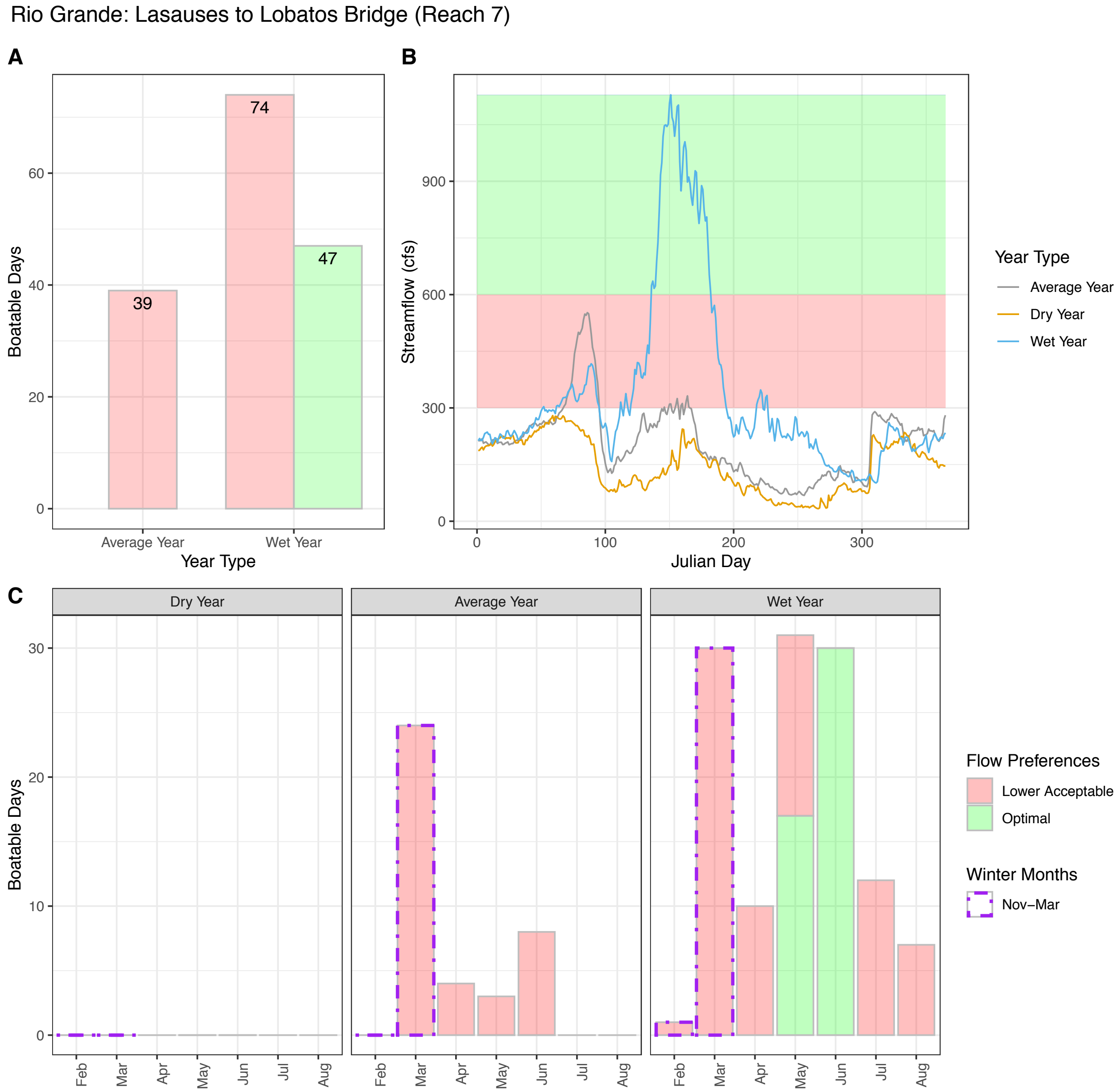

Figure 21: Boatable Days analysis results for the Rio Grande: Lasauses to Lobatos Bridge. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Rio Grande: Lobatos Bridge to Lee Trail, NM

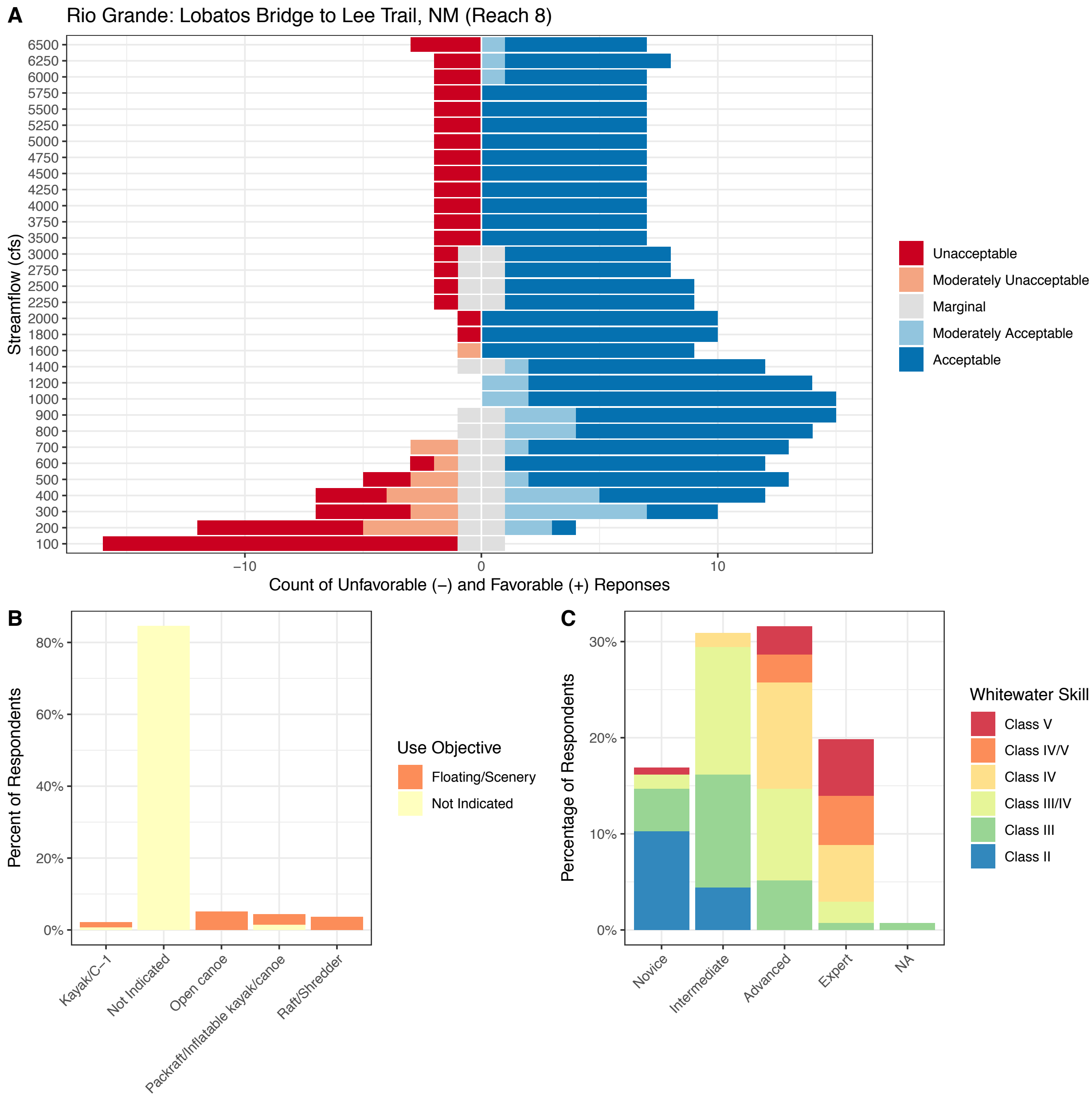

Figure 22: Survey responses for the Rio Grande, Lobatos Bridge to Lee Trail, NM. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

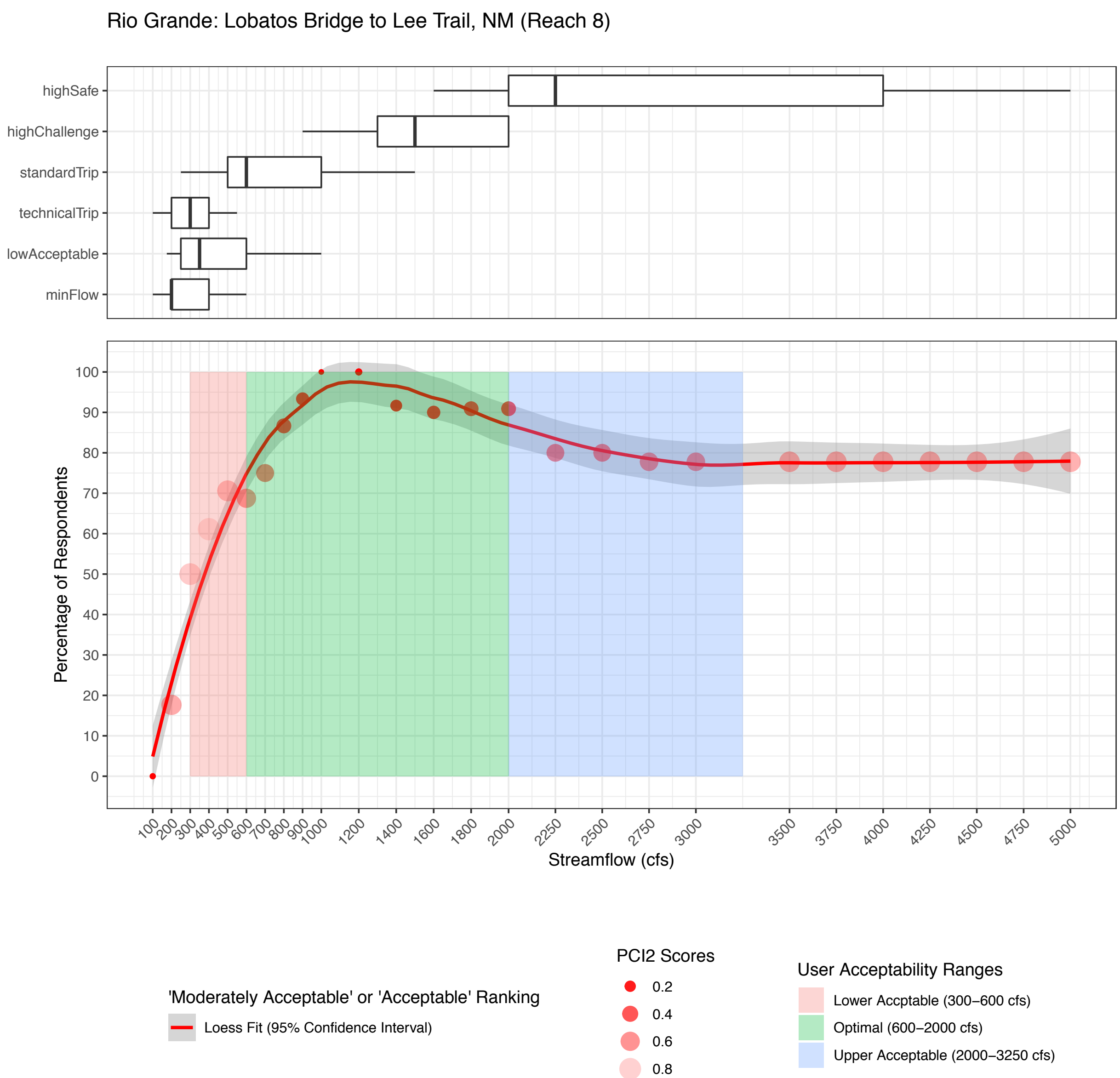

Figure 23: Flow preferences reported by users for the Rio Grande: Lobatos Bridge to Lee Trail, NM. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 22: Summarized open-format flow-preference question responses for Reach 8, Rio Grande: Lobatos Bridge to Lee Trail, NM.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	200	200	400	17
Low Acceptable Flow (cfs)	250	350	600	17
Technical Flow (cfs)	200	300	400	15
Standard Trip Flow (cfs)	500	600	1000	15
Challenging High Flow (cfs)	1300	1500	2000	9
Highest Safe Flow (cfs)	2000	2250	4000	8

Table 23: PCI2 analysis results for Reach 8, Rio Grande: Lobatos Bridge to Lee Trail, NM.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.1171875	-2.0	16	512	60
200	0.6736111	-1.0	17	576	388
300	0.7839506	0.5	18	648	508
400	0.8364198	1.0	18	648	542
500	0.7222222	2.0	17	576	416
600	0.5976562	2.0	16	512	306
700	0.5117188	2.0	16	512	262
800	0.3392857	2.0	15	448	152
900	0.2589286	2.0	15	448	116
1000	0.1160714	2.0	15	448	52
1200	0.1224490	2.0	14	392	48
1400	0.2152778	2.0	12	288	62

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1600	0.2700000	2.0	10	200	54
1800	0.3333333	2.0	11	240	80
2000	0.3333333	2.0	11	240	80
2250	0.5000000	2.0	10	200	100
2500	0.5000000	2.0	10	200	100
2750	0.5500000	2.0	9	160	88
3000	0.5500000	2.0	9	160	88
3500	0.7000000	2.0	9	160	112
3750	0.7000000	2.0	9	160	112
4000	0.7000000	2.0	9	160	112
4250	0.7000000	2.0	9	160	112
4500	0.7000000	2.0	9	160	112
4750	0.7000000	2.0	9	160	112
5000	0.7000000	2.0	9	160	112
5250	0.7000000	2.0	9	160	112
5500	0.7000000	2.0	9	160	112
5750	0.7000000	2.0	9	160	112
6000	0.7500000	2.0	9	160	120
6250	0.6900000	2.0	10	200	138
6500	0.8700000	2.0	10	200	174

Table 24: Boatable Days analysis results broken out by month for the Rio Grande: Lobatos Bridge to Lee Trail, NM. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Jan	Lower Acceptable	0	0	28
Feb	Lower Acceptable	0	19	29
Mar	Lower Acceptable	7	16	19
	Optimal	0	15	12
Apr	Lower Acceptable	0	20	12
	Optimal	0	1	18
May	Lower Acceptable	0	17	0
	Optimal	0	14	29
	Upper Acceptable	0	0	2
Jun	Lower Acceptable	0	14	0
	Optimal	0	16	30
Jul	Lower Acceptable	0	11	25
	Optimal	0	0	6
Aug	Lower Acceptable	0	0	21
Sep	Lower Acceptable	0	0	1
Nov	Lower Acceptable	0	26	6
Dec	Lower Acceptable	0	14	0

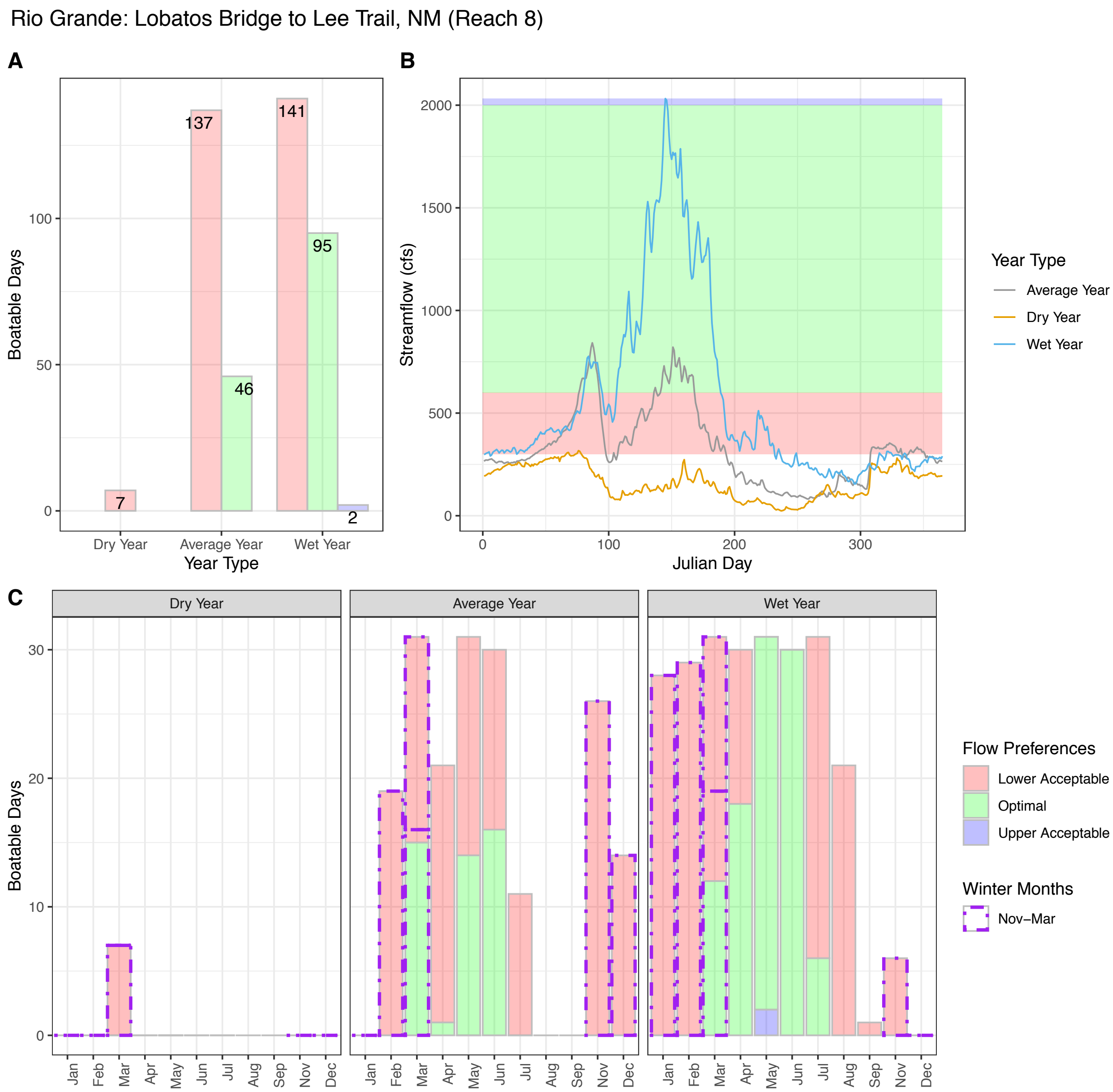

Figure 24: Boatable Days analysis results for the Rio Grande: Lobatos Bridge to Lee Trail, NM. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Conejos River: Platoro Reservoir to South Fork Conejos

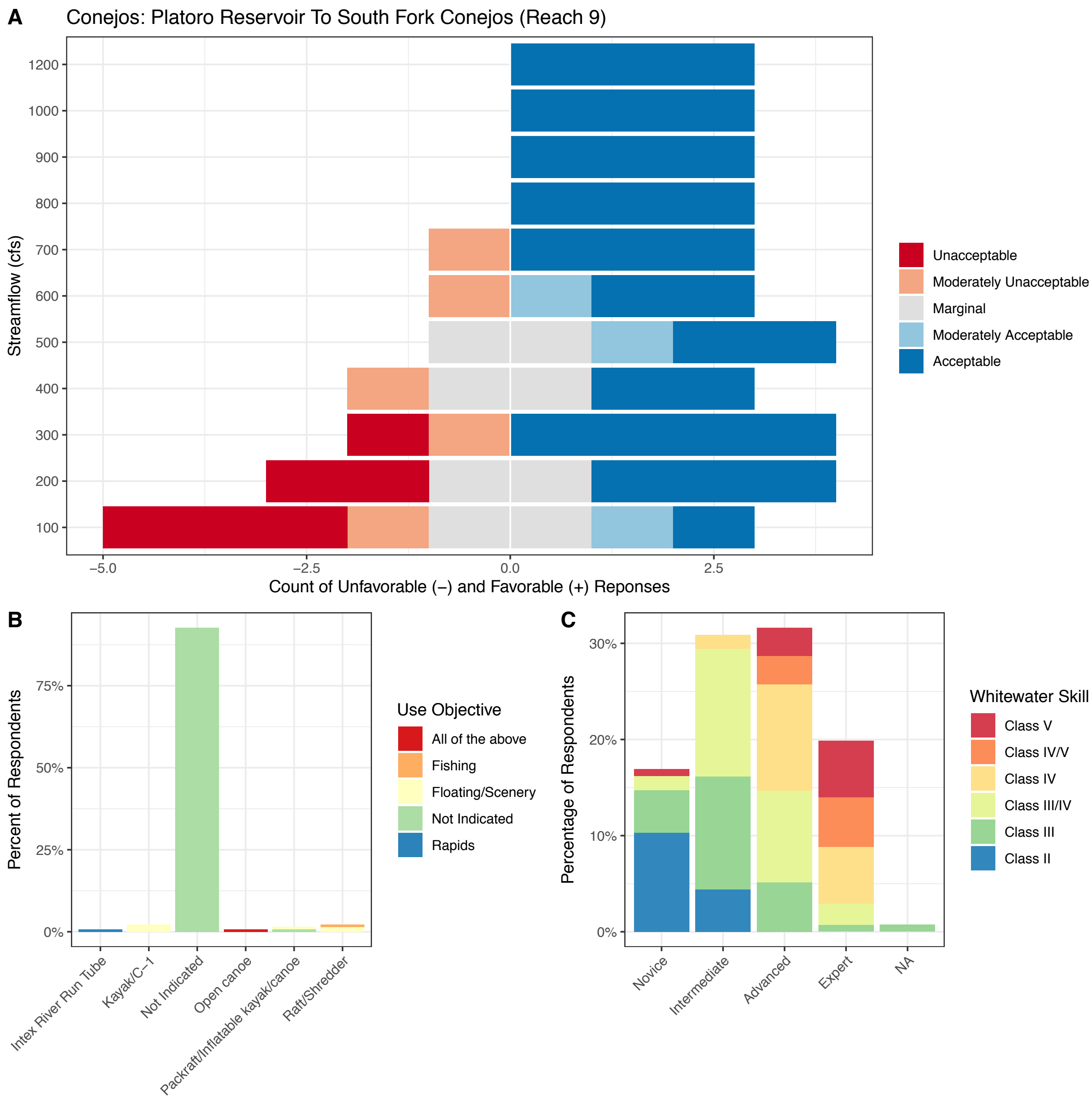

Figure 25: Survey responses for the Conejos, Platoro Reservoir to South Fork Conejos. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

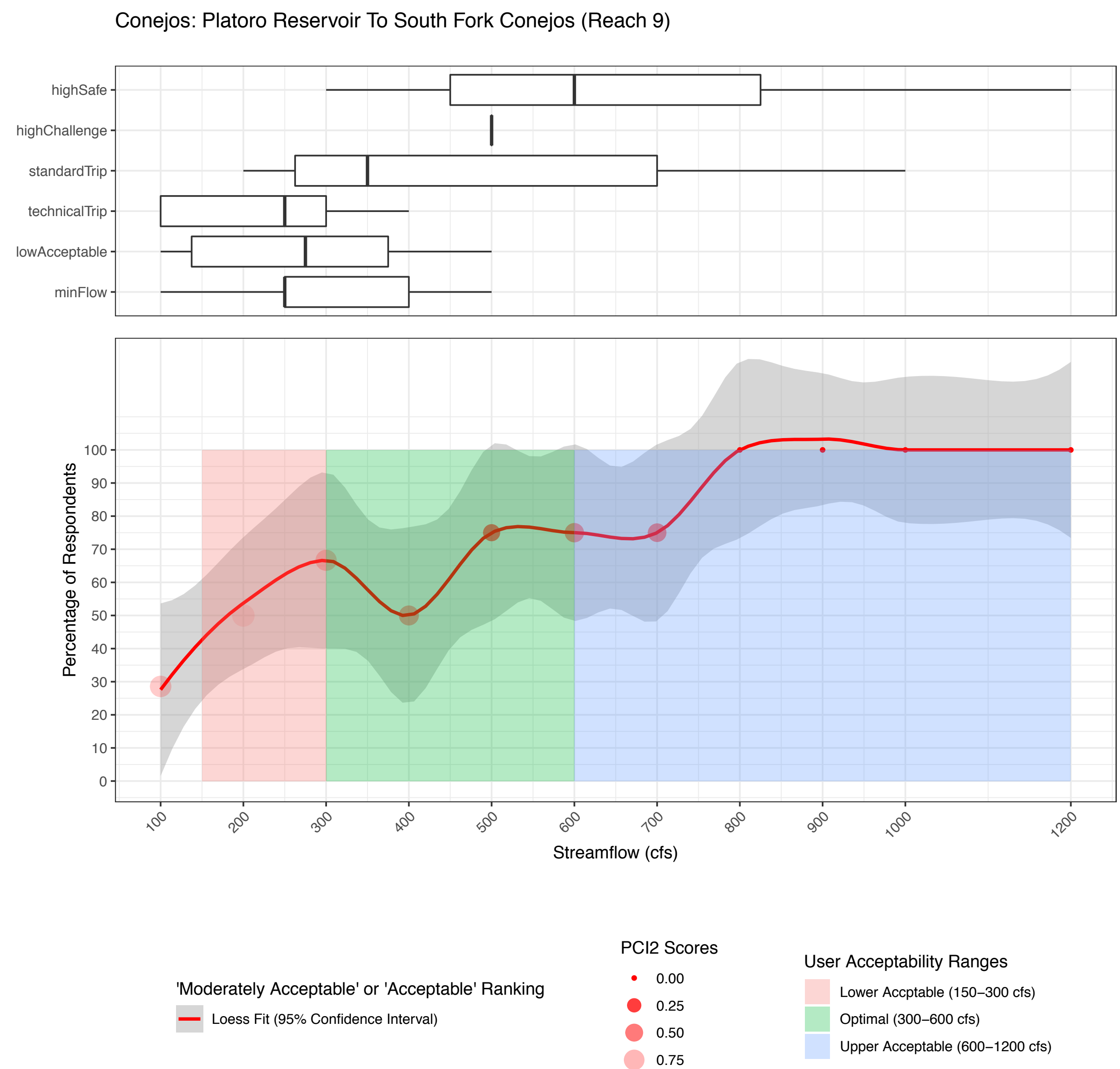

Figure 26: Flow preferences reported by users for the Conejos: Platoro Reservoir to South Fork Conejos. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 25: Summarized open-format flow-preference question responses for Reach 9, Conejos: Platoro Reservoir to South Fork Conejos.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	138	250	362	6
Low Acceptable Flow (cfs)	138	275	375	6
Technical Flow (cfs)	100	250	300	5
Standard Trip Flow (cfs)	262	350	700	6
Challenging High Flow (cfs)	500	500	500	5
Highest Safe Flow (cfs)	450	600	825	4

Table 26: PCI2 analysis results for Reach 9, Conejos: Platoro Reservoir to South Fork Conejos.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.8333333	-1.0	7	96	80
200	0.9444444	1.0	6	72	68
300	0.8055556	2.0	6	72	58
400	0.6875000	1.0	4	32	22
500	0.4375000	1.5	4	32	14
600	0.6250000	1.5	4	32	20
700	0.5625000	2.0	4	32	18
800	0.0000000	2.0	3	16	0
900	0.0000000	2.0	3	16	0
1000	0.0000000	2.0	3	16	0
1200	0.0000000	2.0	3	16	0

Table 27: Boatable Days analysis results broken out by month for the Conejos: Platoro Reservoir to South Fork Conejos. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
May	Lower Acceptable	22	17	11
	Optimal	0	10	1
Jun	Lower Acceptable	28	23	1
	Optimal	0	7	29
Jul	Lower Acceptable	3	16	30
	Optimal	0	0	1
Aug	Lower Acceptable	0	0	2

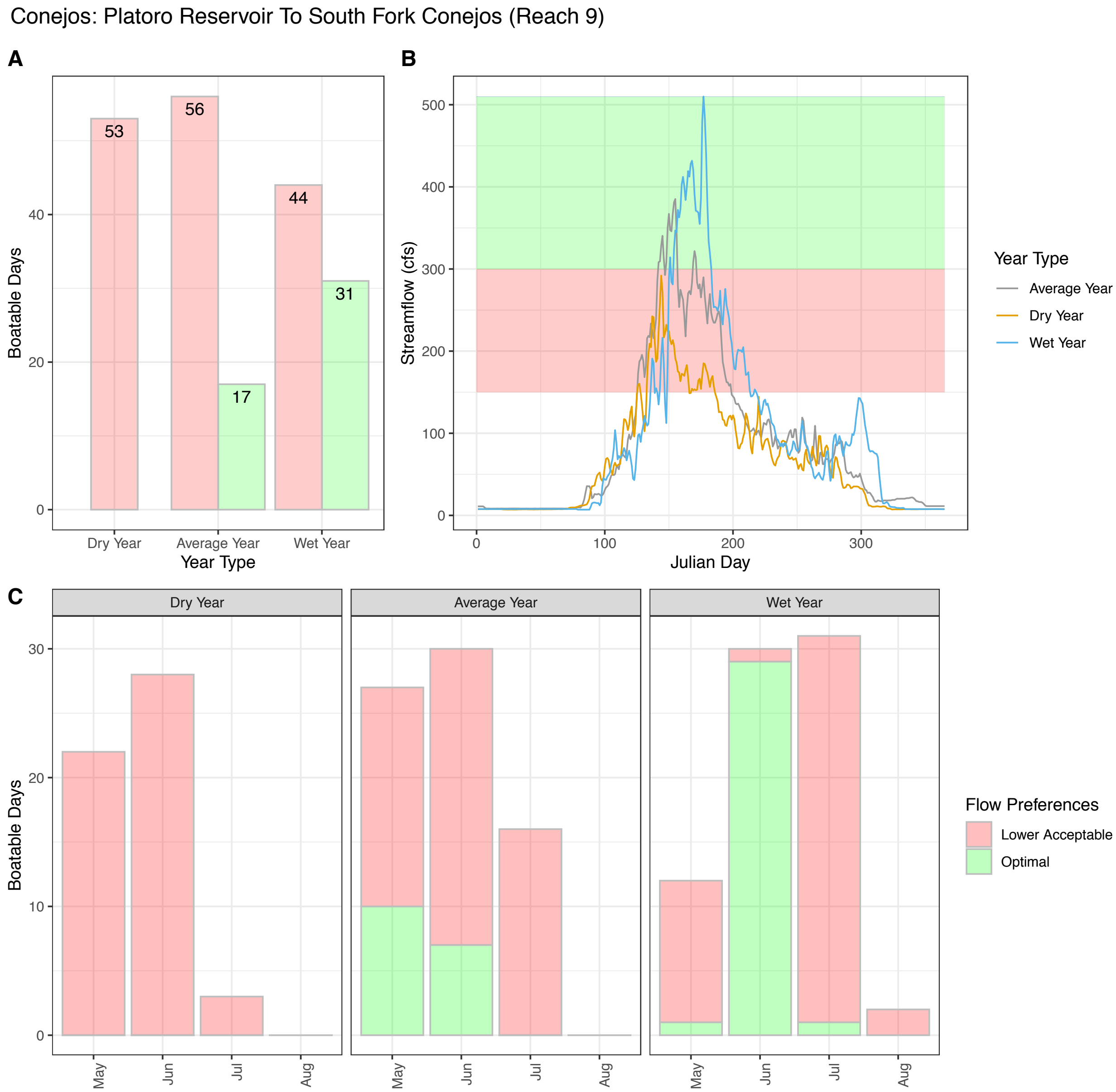

Figure 27: Boatable Days analysis results for the Conejos: Platoro Reservoir to South Fork Conejos. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Conejos River: South Fork Conejos to Hwy 17 Bridge

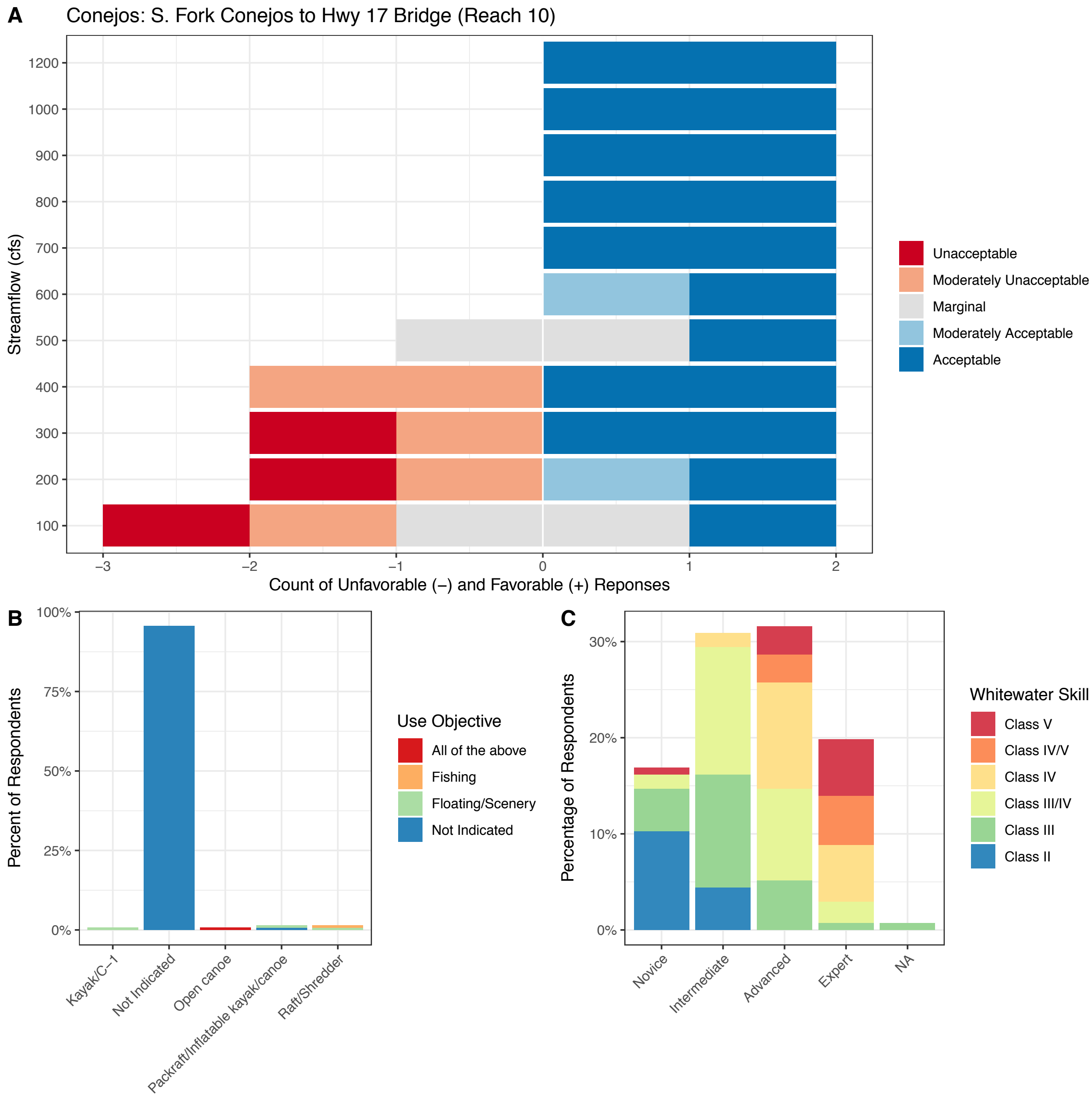

Figure 28: Survey responses for the Conejos, S. Fork Conejos to Hwy 17 Bridge. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

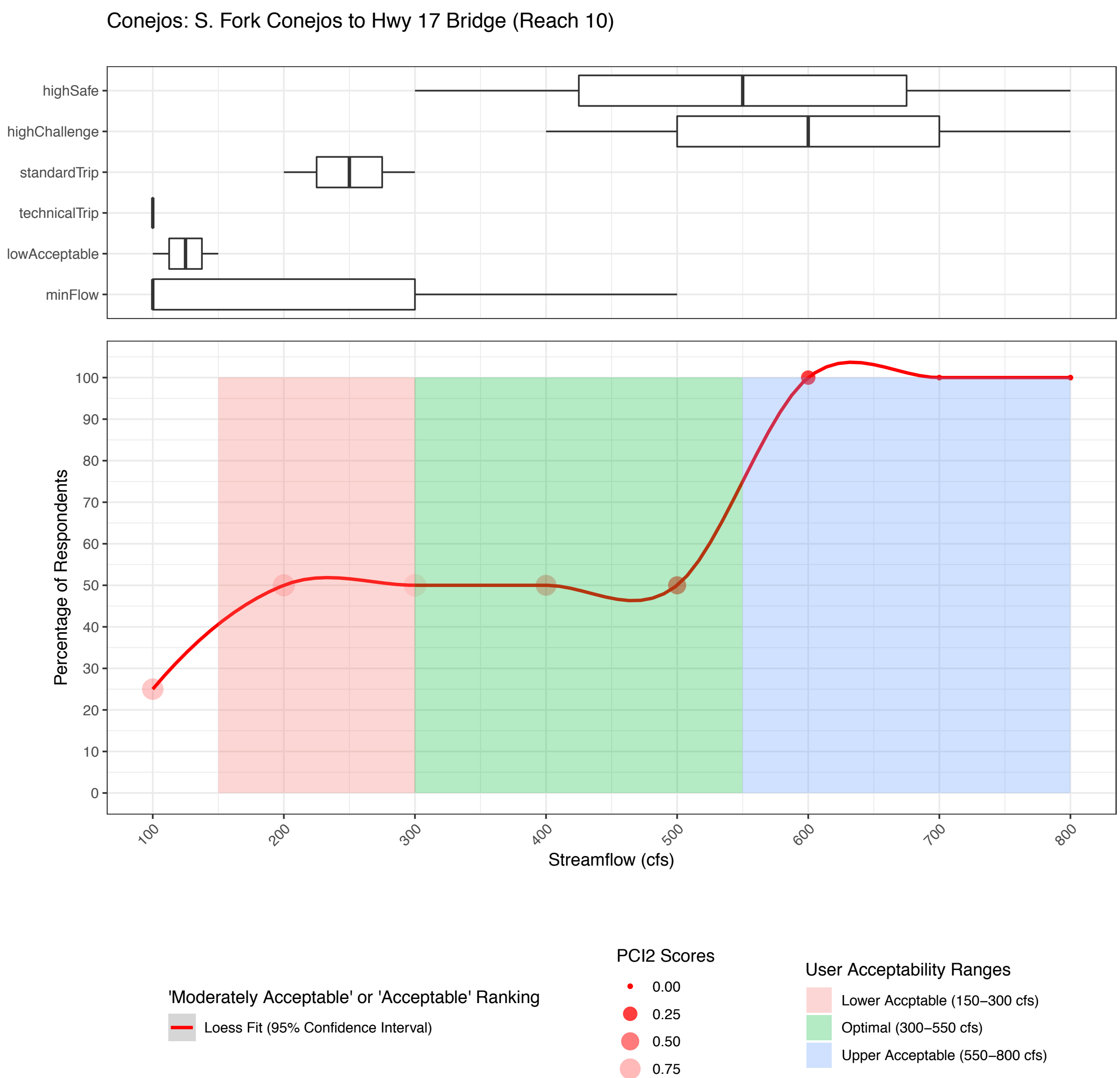

Figure 29: Flow preferences reported by users for the Conejos: S. Fork Conejos to Hwy 17 Bridge. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 28: Summarized open-format flow-preference question responses for Reach 10, Conejos: S. Fork Conejos to Hwy 17 Bridge.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	100	100	300	3
Low Acceptable Flow (cfs)	125	150	525	3
Technical Flow (cfs)	100	100	100	2
Standard Trip Flow (cfs)	250	300	650	3
Challenging High Flow (cfs)	500	600	700	2
Highest Safe Flow (cfs)	425	550	675	2

Table 29: PCI2 analysis results for Reach 10, Conejos: S. Fork Conejos to Hwy 17 Bridge.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.8125	-0.5	4	32	26
200	0.8750	0.0	4	32	28
300	0.9375	0.5	4	32	30
400	0.7500	0.5	4	32	24
500	0.5000	1.0	2	8	4
600	0.2500	1.5	2	8	2
700	0.0000	2.0	2	8	0
800	0.0000	2.0	2	8	0
900	0.0000	2.0	2	8	0
1000	0.0000	2.0	2	8	0
1200	0.0000	2.0	2	8	0

Table 30: Boatable Days analysis results broken out by month for the Conejos: S. Fork Conejos to Hwy 17 Bridge. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
May	Lower Acceptable	22	17	11
	Optimal	0	10	1
Jun	Lower Acceptable	28	23	1
	Optimal	0	7	29
Jul	Lower Acceptable	3	16	30
	Optimal	0	0	1
Aug	Lower Acceptable	0	0	2

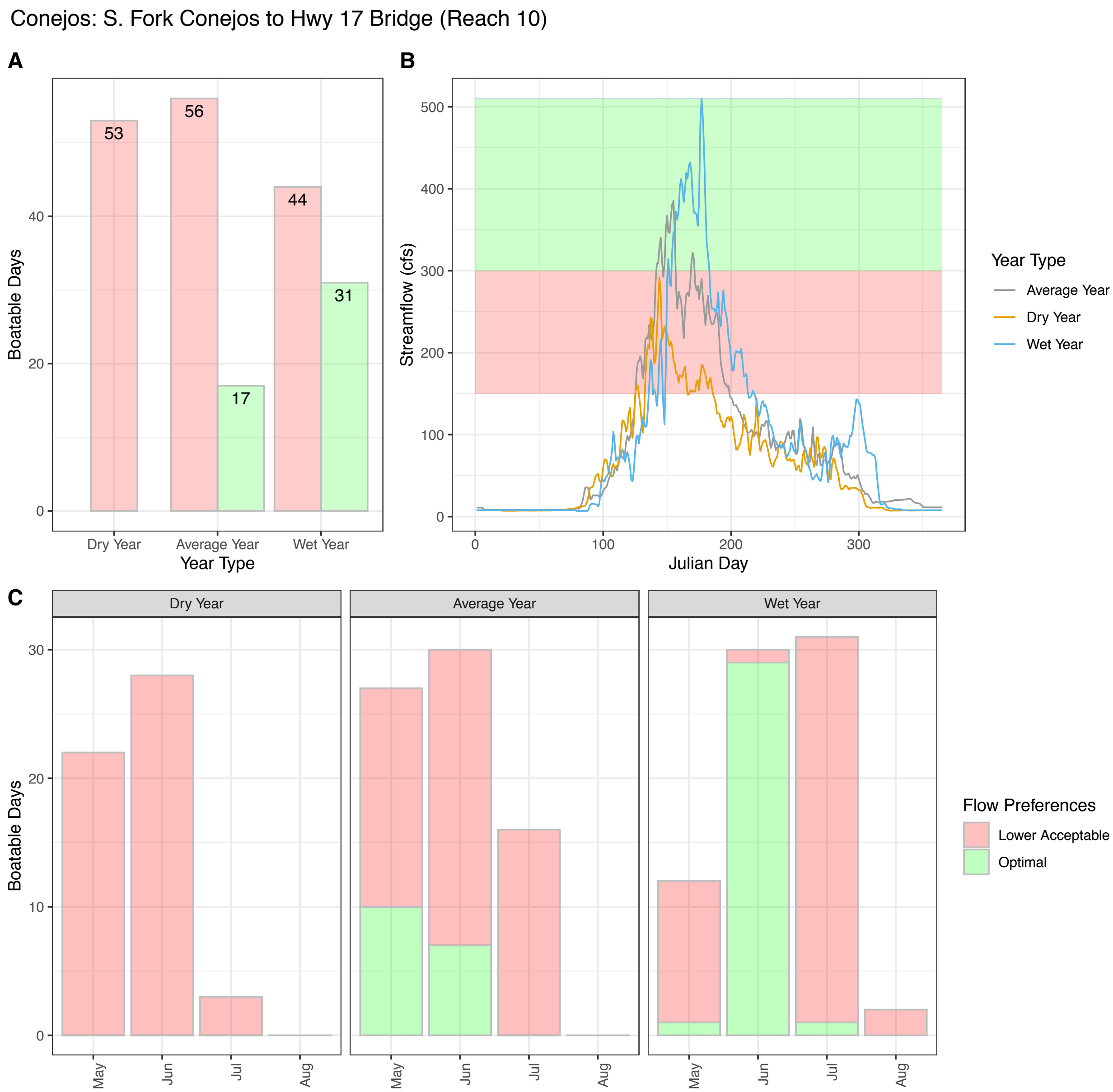

Figure 30: Boatable Days analysis results for the Conejos: S. Fork Conejos to Hwy 17 Bridge. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

Conejos River: Hwy 17 to Mogote Campground

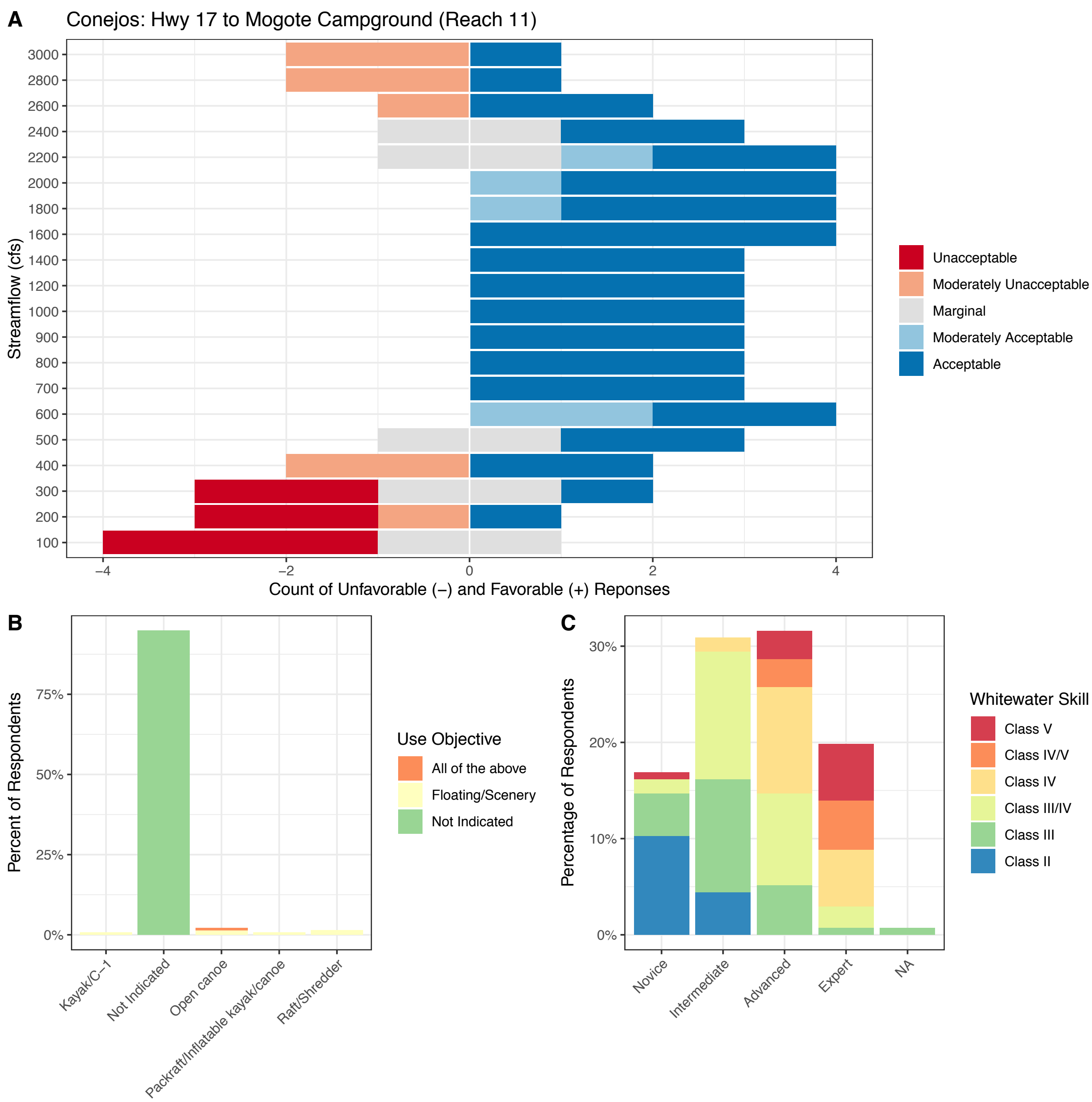

Figure 31: Survey responses for the Conejos, Hwy 17 to Mogote Campground. (A) Flow acceptability rankings. (B) User identified preferred craft types and recreational use objectives. (C) User identified whitewater navigation expertise.

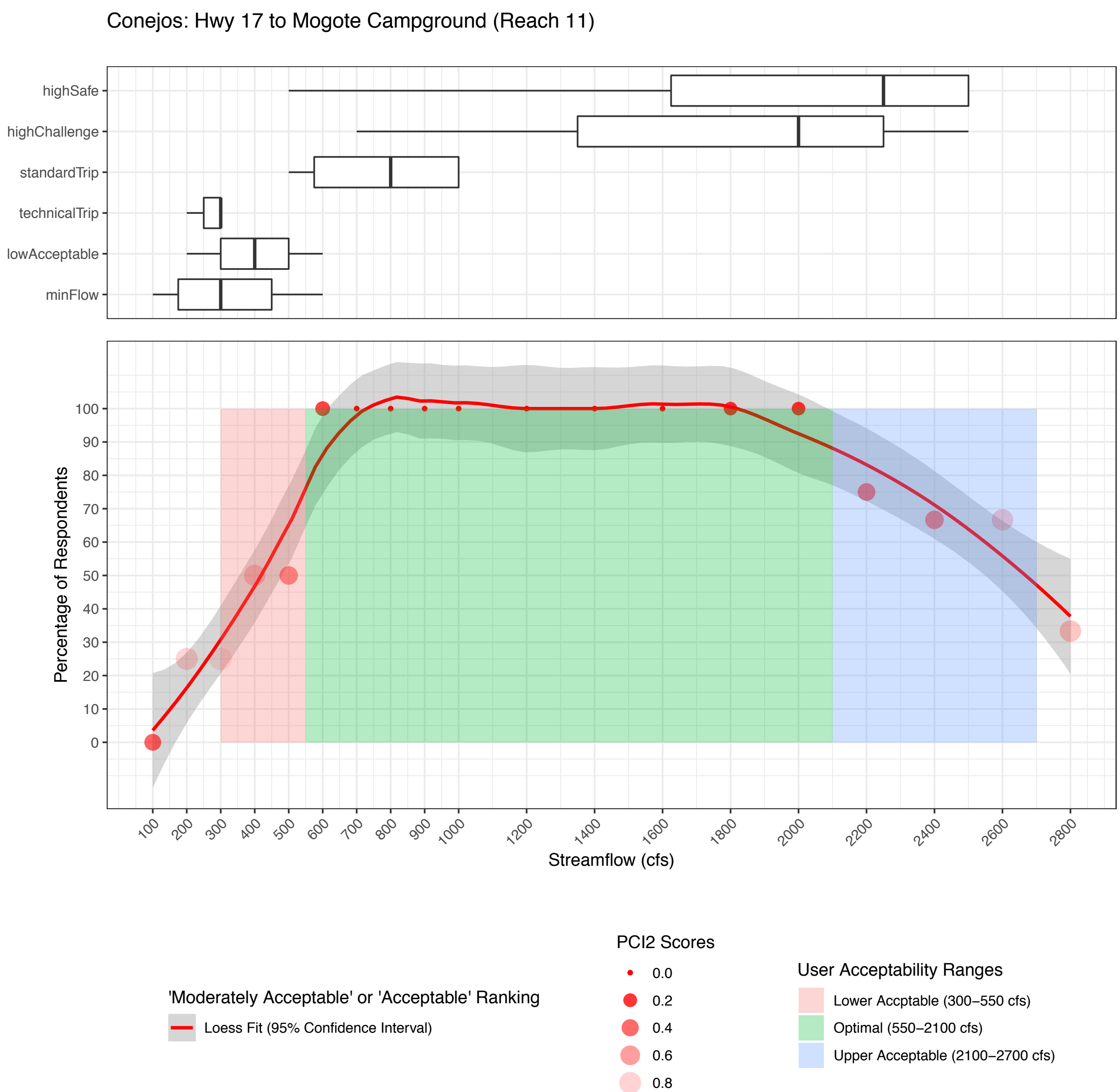

Figure 32: Flow preferences reported by users for the Conejos: Hwy 17 to Mogote Campground. (Top) Boxplot of responses to open-ended questions about different categories of flow. (Bottom) PCI2 analysis results overlaid on the percentage of respondents that ranked a given flow as "Moderately Acceptable" or "Acceptable". The percentage of respondents in those categories across the full range of flows was fit with a Loess curve to support visualization of flow acceptability ranges.

Table 31: Summarized open-format flow-preference question responses for Reach 11, Conejos: Hwy 17 to Mogote Campground.

Survey Question	25th Percentile	Median Response	75th Percentile	Response Count
Minimum Flow (cfs)	175	300	450	4
Low Acceptable Flow (cfs)	300	400	500	3
Technical Flow (cfs)	250	300	300	3
Standard Trip Flow (cfs)	575	800	1000	4
Challenging High Flow (cfs)	1350	2000	2250	3
Highest Safe Flow (cfs)	1625	2250	2500	4

Table 32: PCI2 analysis results for Reach 11, Conejos: Hwy 17 to Mogote Campground.

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
100	0.3750	-2.0	4	32	12
200	0.8125	-1.5	4	32	26
300	0.8750	-1.0	4	32	28
400	0.7500	0.5	4	32	24
500	0.5000	1.0	4	32	16
600	0.2500	1.5	4	32	8
700	0.0000	2.0	3	16	0
800	0.0000	2.0	3	16	0
900	0.0000	2.0	3	16	0
1000	0.0000	2.0	3	16	0
1200	0.0000	2.0	3	16	0
1400	0.0000	2.0	3	16	0

Flow (cfs)	PCI2	Median Likert Response	n	Max. Distance	Total Distance
1600	0.0000	2.0	4	32	0
1800	0.1875	2.0	4	32	6
2000	0.1875	2.0	4	32	6
2200	0.4375	1.5	4	32	14
2400	0.5000	2.0	3	16	8
2600	0.7500	2.0	3	16	12
2800	0.7500	-1.0	3	16	12
3000	0.7500	-1.0	3	16	12

Table 33: Boatable Days analysis results broken out by month for the Conejos: Hwy 17 to Mogote Campground. Where an Acceptability Category (e.g. 'Optimal') is missing for a given month, zero days were observed to fall within that category and the row was left out of the table for brevity.

Month	Acceptability Category	Dry Year	Avg. Year	Wet Year
Apr	Lower Acceptable	8	11	13
	Optimal	0	0	4
May	Lower Acceptable	7	3	4
	Optimal	24	28	27
Jun	Lower Acceptable	14	0	0
	Optimal	5	30	30
Jul	Lower Acceptable	0	16	23
	Optimal	0	1	3

Conejos: Hwy 17 to Mogote Campground (Reach 11)

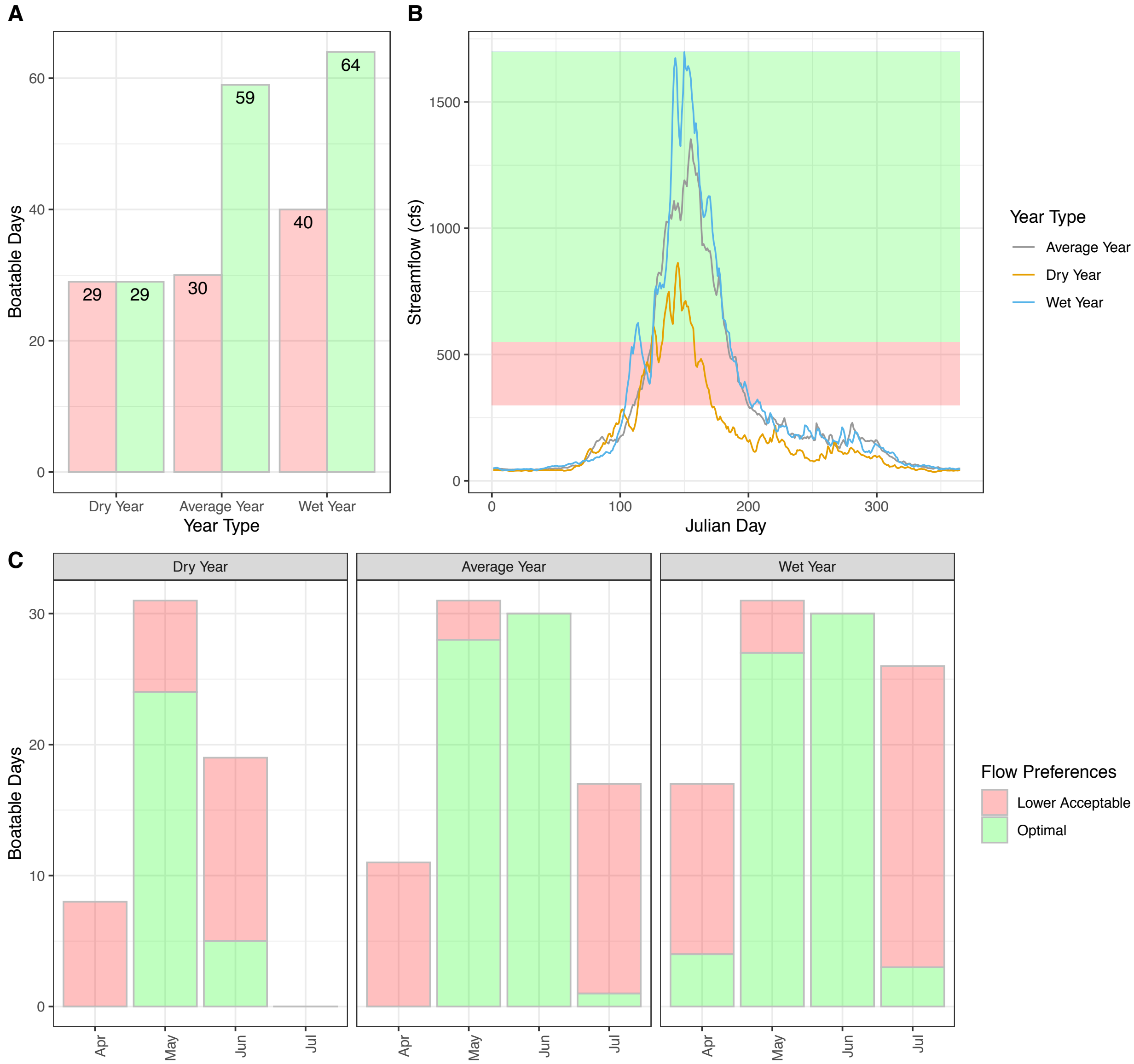

Figure 33: Boatable Days analysis results for the Conejos: Hwy 17 to Mogote Campground. (A) Total Boatable Days by year type and acceptability category; (B) flow acceptability ranges compared to typical wet, average, and dry year streamflow time series; and (C) monthly Boatable Days totals summarized by year type and acceptability category.

APPENDIX B: Web Survey