



Recreational Uses of The San Miguel River and Major Tributaries

A Product of the San Miguel Pilot Project

Submitted: 3/22/21



Prepared For:



COLORADO

Colorado Water
Conservation Board

Department of Natural Resources

Prepared By:



Lotic Hydrological, LLC
P.O. Box 1524
Carbondale, CO 81623

Table of Contents

1	INTRODUCTION	5
2	RECREATIONAL USE ASSESSMENT	5
2.1	WHITewater BOATING	5
2.1.1	Hydrological Scenario Analysis	9
2.2	RIVER ANGLING	12
2.2.1	Hydrological Scenario Analysis	16
3	DISCUSSION AND CONCLUSIONS	21
3.1	NOTABLE FINDINGS FOR RECREATIONAL BOATING	21
3.2	NOTABLE FINDINGS FOR ANGLING	21
4	REFERENCES	22

List of Figures

FIGURE 1.	REACHES PREFERRED FOR WHITewater BOATING ACTIVITIES.	6
FIGURE 2.	EXAMPLE IMPACT ACCEPTABILITY CURVE WITH POTENTIAL FOR CONFLICT INDEX INDICATED BY THE RELATIVE SIZE OF EACH CIRCLE. LARGER CIRCLES INDICATE GREATER DISAGREEMENT BETWEEN RESPONDENTS REGARDING PREFERENCE FOR A GIVEN FLOW. .	7
FIGURE 34.	DISTRIBUTION OF BOATABLE DAYS ACROSS THE SUMMER RECREATION SEASON UNDER A VARIETY OF POTENTIAL FUTURE HYDROLOGICAL SCENARIOS ON THE SAN MIGUEL RIVER BETWEEN BILK CREEK AND URAVAN. NOTE THAT NOT ALL MONTHLY TOTALS SUM TO THE CORRECT NUMBER OF DAYS IN EACH MONTH. THIS IS AN UNAVOIDABLE ARTIFACT OF ROUNDING ERRORS INCURRED WHEN SUMMARIZING THE 40-YEAR TIME SERIES FROM EACH SCENARIO.	11
FIGURE 3.	REACHES OF THE SAN MIGUEL RIVER AND ITS TRIBUTARIES PREFERRED BY ANGLERS.....	13
FIGURE 37.	DISTRIBUTION OF THE AVERAGE NUMBER OF DAYS IN EACH MONTH FALLING IN SEVERAL BANK FISHING USE PREFERENCE CATEGORIES ON THE SAN MIGUEL RIVER UNDER A VARIETY OF POTENTIAL FUTURE HYDROLOGICAL SCENARIOS.....	18
FIGURE 38.	DISTRIBUTION OF THE AVERAGE NUMBER OF DAYS IN EACH MONTH FALLING IN SEVERAL WADE FISHING USE PREFERENCE CATEGORIES ON THE SAN MIGUEL RIVER UNDER A VARIETY OF POTENTIAL FUTURE HYDROLOGICAL SCENARIOS. NOTE THAT SOME MONTHLY TOTALS MAY SUM TO A GREATER NUMBER OF DAYS THAN ARE PRESENT IN A GIVEN MONTH. THIS IS AN UNAVOIDABLE ARTIFACT OF ROUNDING ERRORS INCURRED WHEN SUMMARIZING THE 40-YEAR TIME SERIES FROM EACH SCENARIO.....	20

List of Tables

TABLE 1.	USER PREFERENCES FOR WHITewater BOATING ON REACHES OF THE SAN MIGUEL RIVER.	8
TABLE 3.	BOATABLE DAYS AVAILABLE ON SEGMENTS OF THE SAN MIGUEL RIVER UNDER DIFFERENT HYDROLOGICAL CONDITIONS. REACH START AND END POINTS REFERENCE CONFLUENCES ALONG THE SAN MIGUEL RIVER MAINSTEM.	8
TABLE 2.	USER PREFERENCES FOR WADE AND BANK FISHING ON SEGMENTS OF THE SAN MIGUEL RIVER.	14

TABLE 4. FISHABLE DAYS AVAILABLE FOR BANK FISHING ON SEGMENTS OF THE SAN MIGUEL RIVER UNDER DIFFERENT HYDROLOGICAL CONDITIONS. REACH START AND END POINTS REFERENCE CONFLUENCES ALONG THE SAN MIGUEL RIVER MAINSTEM. 15

TABLE 5. FISHABLE DAYS AVAILABLE FOR WADE FISHING ON SEGMENTS OF THE SAN MIGUEL RIVER UNDER DIFFERENT HYDROLOGICAL CONDITIONS. REACH START AND END POINTS REFERENCE CONFLUENCES ALONG THE SAN MIGUEL RIVER MAINSTEM. 16

1 Introduction

Stakeholders participating in the San Miguel Pilot Project requested an evaluation of recreational use in the San Miguel watershed. Whitewater boating activity in the San Miguel watershed is concentrated on the mainstem San Miguel River. Excellent whitewater boating opportunities exist between Bilk Creek and the Ledges in Norwood Canyon. River angling activity in the San Miguel watershed is concentrated in public access areas along the mainstem in the upper portion of the watershed. Smaller channels, smaller fish and difficult access limit angling activity on most tributary streams. Anglers typically seek out non-native trout (i.e., rainbow, brown and brook trout). Near the headwaters, popular fishing spots are found on the mainstem along the Telluride Town Trail, along the railroad grade on Lake Fork below the Trout Lake Dam, and along the South Fork of the San Miguel. Stakeholders involved in the San Miguel Pilot Project elected to evaluate relationships between streamflows and recreational users' preferences.

2 Recreational Use Assessment

This assessment includes a discussion of the user preferences for streamflows that support whitewater boating and for streamflows that support wade and bank fishing in streams and rivers across the watershed. These preferences were derived from work produced by American Whitewater and BLM. An additional rapid survey of local anglers was conducted in 2016 to verify the results of the BLM study. Flow preferences were compared to observed and simulated streamflows characterizing wet, average, and dry conditions in order to compute the number days available for both boating and angling.

2.1 Whitewater Boating

Whitewater boating activity in the San Miguel watershed is concentrated on the mainstem San Miguel River (Figure 1). Excellent whitewater boating opportunities exist between Bilk Creek and the Ledges in Norwood Canyon. This section features a consistent gradient and Class II-III whitewater. Between the end of Norwood Canyon and Naturita, boating opportunities are challenged by access issues and potentially dangerous hydraulics created by diversion structures. Private property borders the river near Naturita, creating additional access challenges. Downstream, Class I-II floating can be enjoyed through the slick rock canyon between Uravan and the Dolores River confluence [1], [2]. Whitewater boating use in the San Miguel typically starts in the spring as snowmelt begins and continues through peak runoff and late summer baseflows. The best boating conditions occur during peak runoff (May-June). Private boaters tend to concentrate usage in these time periods. Commercial usage coincides with the tourism season, June-August.

Recreational users enjoy whitewater boating in a variety of crafts: canoes, kayaks, duckies, rafts, and stand-up paddle boards. The enjoyment and challenges experienced by users at different flow levels can vary significantly by skill level and by craft. Boaters need enough streamflow to move their craft of choice

downriver. However, at lower flows, rapids become more technical. Higher flows increase wave size making rapids more interesting and challenging to navigate. Very high flows can wash out rapids or make them too difficult for safe passage, decreasing boating enjoyment. Very low flows make it impossible to move the craft downstream. Variability in flow, watercraft type, and user experience level produce a wide range in user preferences for flows on various segments of the river.

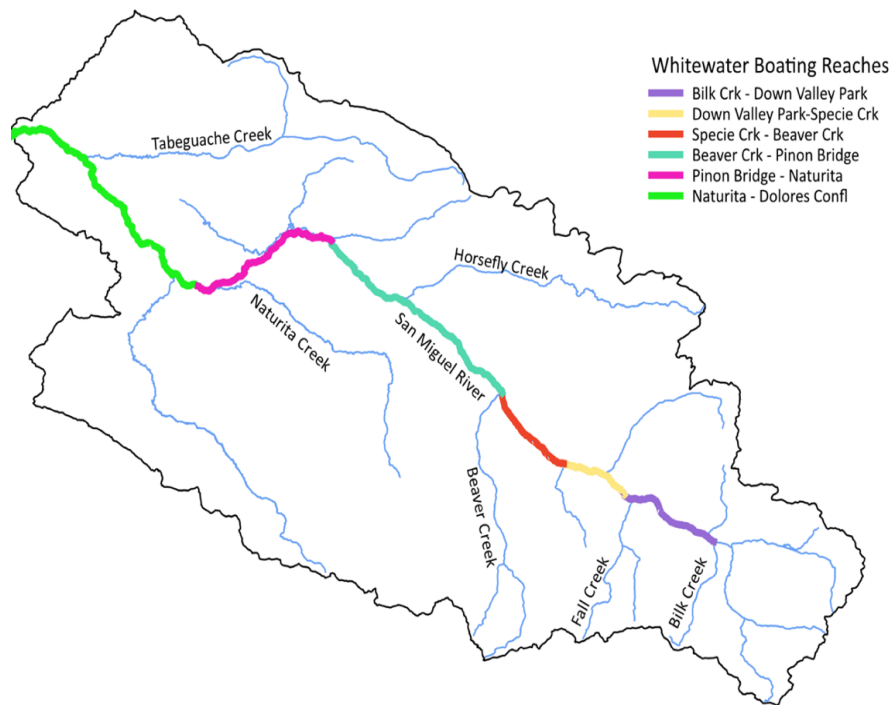


Figure 1. Reaches preferred for whitewater boating activities.

User flow preference thresholds for whitewater boating utilized by this study came from a recreational flow-needs assessment conducted by AW. The user preference assessment involved collecting boater feedback through an online flow evaluation survey. Participants responded to a series of questions at specific measured flows in each reach, that, when compiled, describe how flows affect recreation quality and identify the range of flows that provide optimal and suboptimal whitewater recreation opportunities for each study reach. AW's survey targeted six reaches on the mainstem of the San Miguel: 1) Bilk Creek to Down Valley Park, 2) Down Valley Park to Specie Creek, 3) Specie Creek to Beaver Creek, 4) Beaver Creek to Pinon Bridge, 5) Pinon Bridge to Naturita, and 6) Naturita to the confluence with the Dolores River.

Respondent numbers for the San Miguel River Flow Survey reflect a robust sample size, especially for a remote and sparsely populated region of Colorado (n = 72). Eighty-one percent of respondents identified themselves as advanced or expert boaters, and 93% recreated at least 5-20+ days per season. A wide

range of craft types were surveyed. Users of oar frame rafts (45%), kayaks (32%), catarafts (8%), canoes (4%), paddle rafts (8%) and stand-up paddle boards (3%) participated in the survey. Characterization of user preferences relied on a five point “acceptability” scale (unacceptable -2, slightly unacceptable -1, marginal 0, slightly acceptable 1, and acceptable 2). Aggregation of responses defining thresholds for minimum, optimal and acceptable flows produced an impact acceptability curve for each stream segment of interest (Figure 2). Inflection points in the impact acceptability curve and a qualitative evaluation of the degree to which respondents agreed or disagreed on preferences for a given flow informed selection of final user preference thresholds (Table 1) [3].

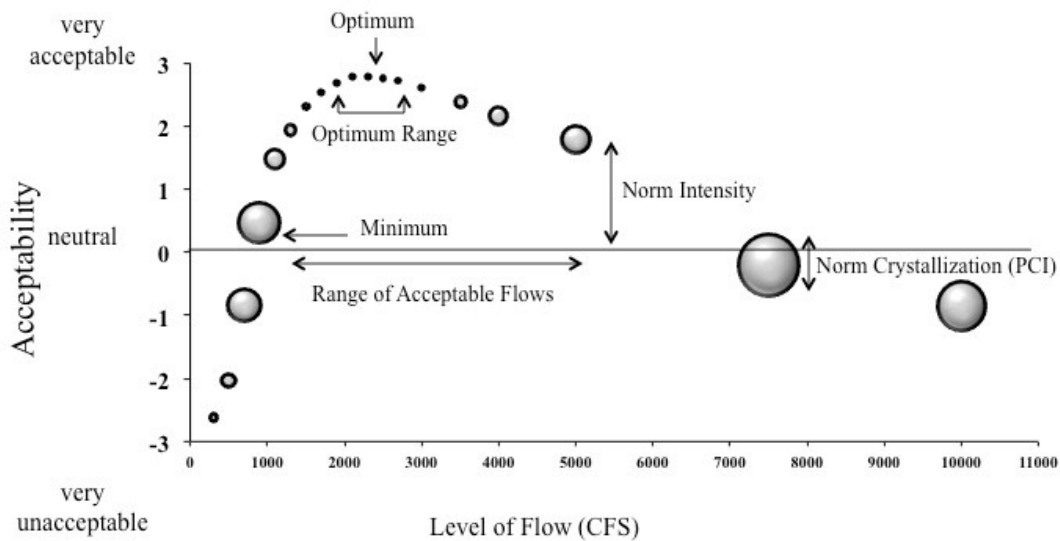


Figure 2. Example impact acceptability curve with Potential for Conflict Index indicated by the relative size of each circle. Larger circles indicate greater disagreement between respondents regarding preference for a given flow.

The availability of recreational use potential on various segments of the San Miguel River was quantified by calculating a Boatable Days metric originally developed by AW. This metric reflects the number of days that optimal, acceptable, and unacceptable use conditions exist under different hydrological conditions. If the streamflow on a particular day fell within a given flow range (e.g. optimal or acceptable), then that day counted as a boatable day, regardless of whether or not users actually engaged in recreational activities on that day [4]. A Boatable Days analysis was completed for every day of the simulation period across three hydrological year types: moderate-wet, average, and moderate-dry on all reaches designated by stakeholders as important recreational use areas. Boatable days analysis results provide context for comparative assessment of recreational use opportunities present on adjacent segments of the San Miguel River under various hydrological conditions (

Table 2).

Table 1. User preferences for whitewater boating on reaches of the San Miguel River.

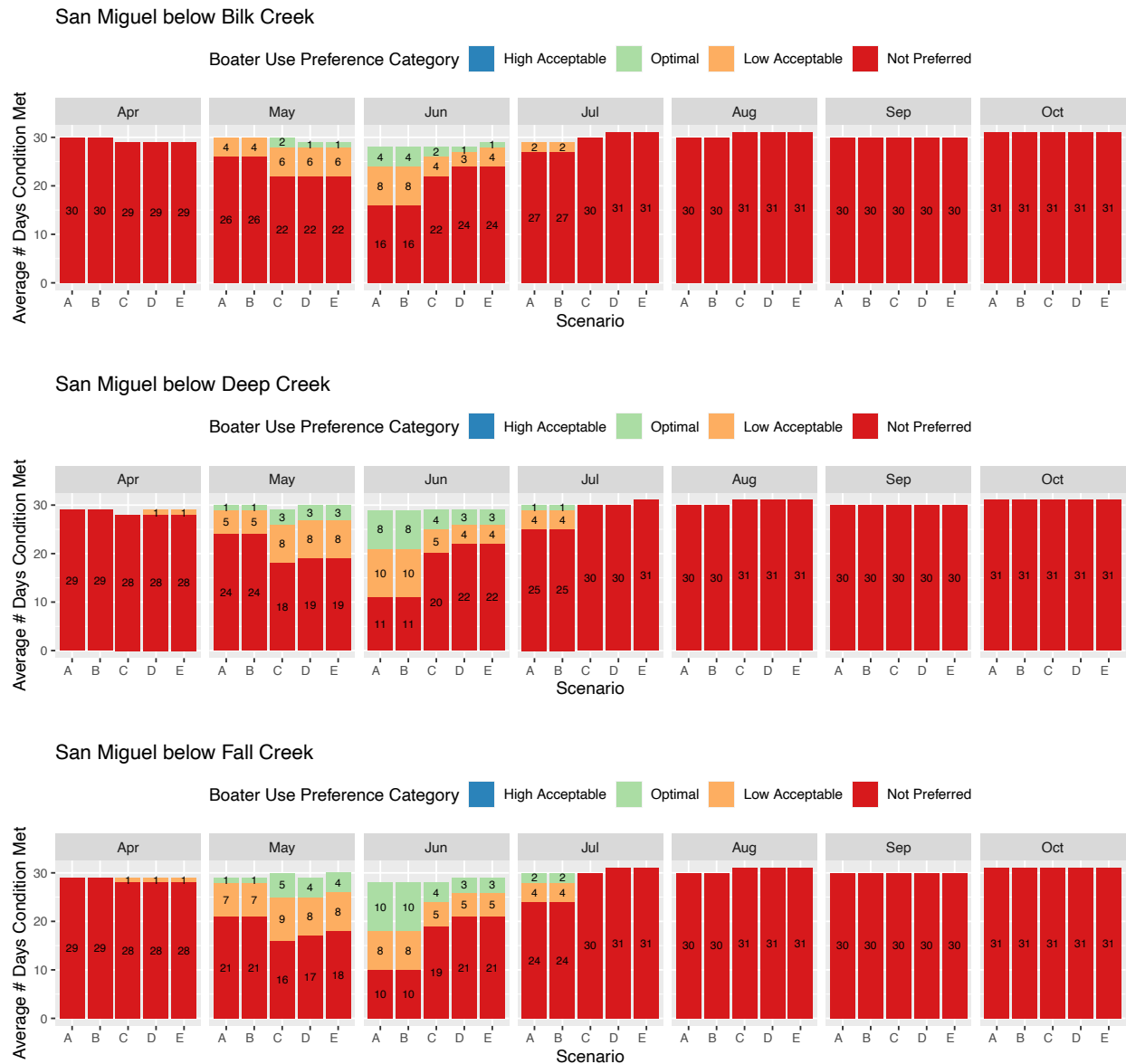
San Miguel River Segment	Minimum Flow (cfs)	Optimal Flows (cfs)	Acceptable Flows (cfs)
Bilk Creek to Down Valley	500	800 – 2,000	500 – 5,000
Down Valley to Specie Creek	500	800 – 2,000	500 – 5,000
Specie Creek to Beaver Creek	500	800 – 2,000	500 – 5,000
Beaver Creek to Pinon Bridge	600	900 – 2,000	600 – 5,000
Pinon Bridge to Naturita	600	1,000 – 2,000	600 – 5,000
Naturita to Dolores Confluence	600	900 – 2,000	600 – 5,000

Table 2. Boatable days available on segments of the San Miguel River under different hydrological conditions. Reach start and end points reference confluences along the San Miguel river mainstem.

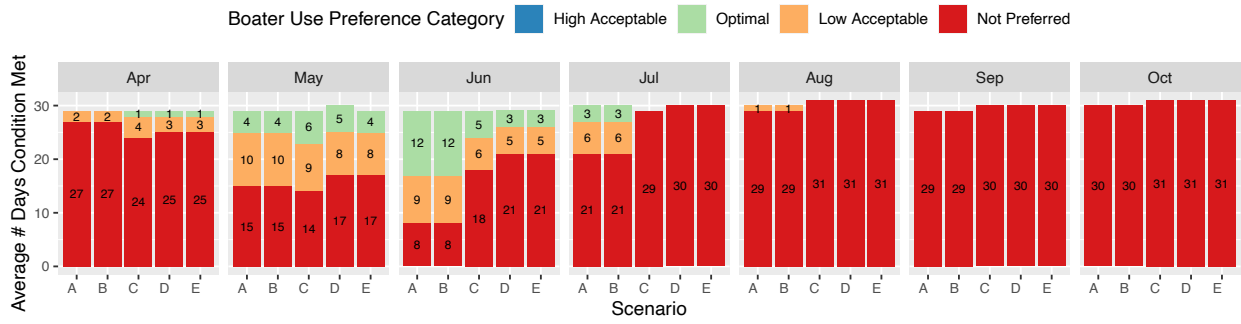
Reach Start	Reach End	User Preference Threshold	Total Days		
			Wet	Average	Dry
Bilk Creek	Fall Creek	Lower Acceptable	28	31	8
		Optimal	25	0	0
Fall Creek	Leopard Creek	Lower Acceptable	32	40	11
		Optimal	31	1	0
Leopard Creek	Specie Creek	Lower Acceptable	33	38	13
		Optimal	34	5	0
Saltado Creek	Beaver Creek	Lower Acceptable	32	39	30
		Optimal	48	13	0
Beaver Creek	Horsefly Creek	Lower Acceptable	29	41	17
		Optimal	46	4	0
Horsefly Creek	Cottonwood Creek	Lower Acceptable	31	27	27
		Optimal	54	28	0
Cottonwood Creek	Naturita Creek	Lower Acceptable	42	51	11
		Optimal	45	1	0
Naturita Creek	Dry Creek	Lower Acceptable	21	53	20
		Optimal	74	16	0
Dry Creek	Tabeguache Creek	Lower Acceptable	19	54	26
		Optimal	77	21	0
Tabeguache Creek	Dolores River	Lower Acceptable	18	50	26
		Optimal	77	26	1

2.1.1 Hydrological Scenario Analysis

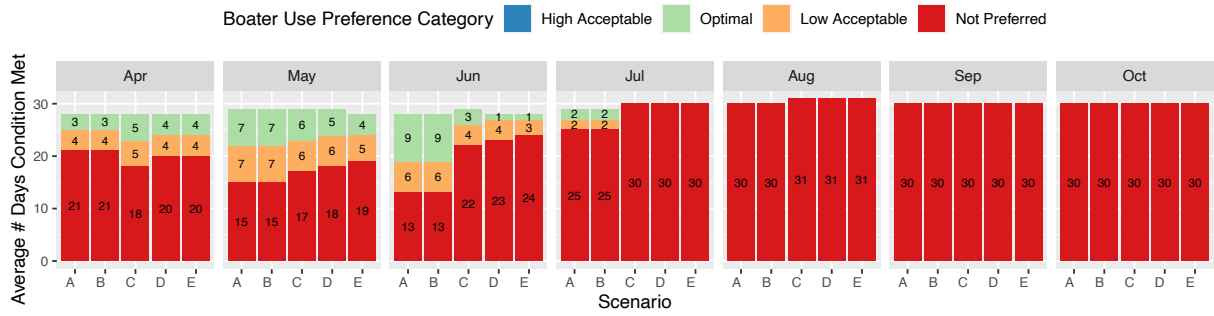
Hydrological simulation models described in Appendix C were used to provide an indication of the way that Boatable Days vary across reaches, across months in a given year, and across planning scenarios. Results were summarized in graphical form to simplify presentation of this extensive set of results (Figure 3).



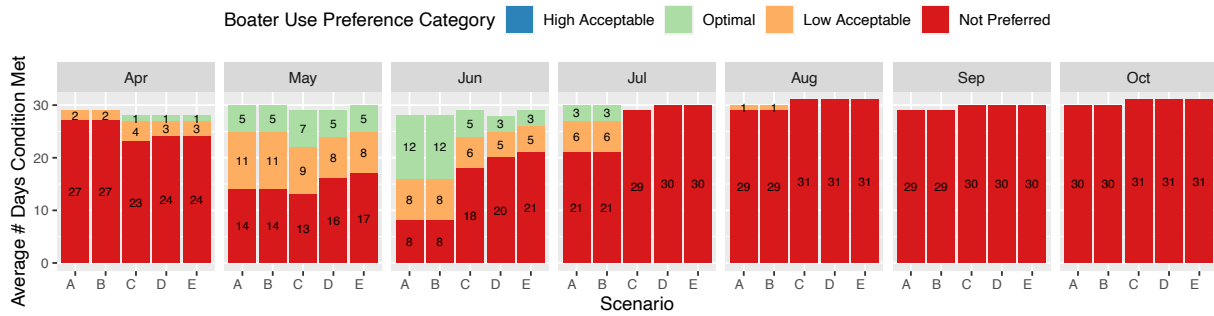
San Miguel River Near Placerville



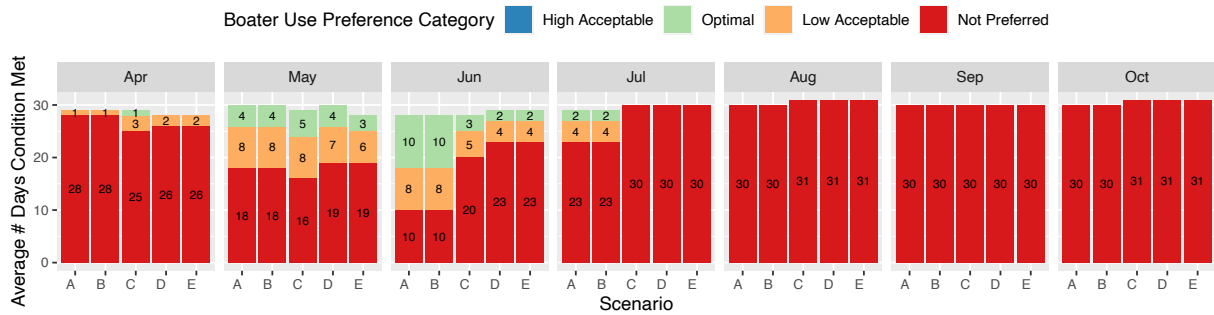
San Miguel Below CC-Highline Canal



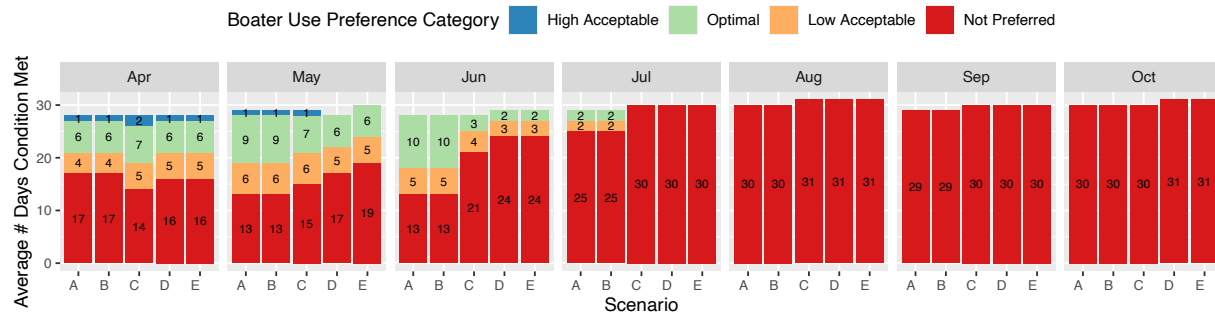
San Miguel below Saltado Creek



San Miguel River below Beaver Creek



San Miguel River at Naturita



San Miguel River at Uravan

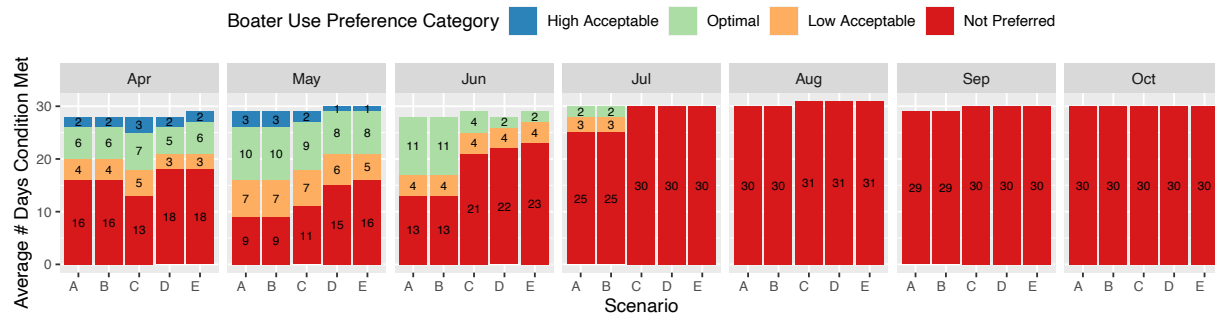


Figure 3. Distribution of boatable days across the summer recreation season under a variety of potential future hydrological scenarios on the San Miguel River between Bilk Creek and Uravan. Note that not all monthly totals sum to the correct number of days in each month. This is an unavoidable artifact of rounding errors incurred when summarizing the 40-year time series from each scenario.

Characterization of the number of days falling within various user preference categories, as per the Boatable Days methodology, allows for evaluation of changes in streamflow mediated recreational opportunities between reaches on the San Miguel River and on a given reach across months and under different hydrological scenarios. This assessment indicated that most opportunities for recreational boating occur in May and June in the upper and middle watershed. In the lower watershed near Naturita and Uravan, boating opportunities exist in April as well. As flows decline in the late summer, conditions fall below user-preferred levels. Scenario modeling indicates significant reductions in the number of “Optimal” and “Low Acceptable” days for those scenarios that include the impacts of climate change (i.e. C, D, and E) The impacts of climate change are most significant in the month of June and some shifting of Boatable Days to earlier in the year is apparent on several reaches.

2.2 River Angling

River angling activity in the San Miguel watershed is concentrated in public access areas along the mainstem in the upper portion of the watershed. Smaller channels, smaller fish and difficult access limit angling activity on most tributary streams (Figure 4). Anglers typically seek out non-native trout (i.e., rainbow, brown and brook trout). Near the headwaters, popular fishing spots are found on the mainstem along the Telluride Town Trail, along the railroad grade on Lake Fork below the Trout Lake Dam, and along the South Fork of the San Miguel. Fishing opportunities on Howard's Fork are poor due to heavy metal contamination from mining waste. Quality angling opportunities with good access exist on the mainstem between Deep Creek and Fall Creek, Specie Creek and Beaver Creek, and on Leopard Creek above the mainstem. Fall Creek to Placerville offers average angling opportunities, and Placerville to Specie Creek has quality angling but only fair accessibility. Norwood Canyon, including Horsefly Creek, is fished by boat occasionally, but complicated access issues and shallow water limit boat use. Decreased streamflow and warmer water temperatures below Nucla limit trout fishing in the lower watershed. While angling opportunities for native warm-water fish species do exist below Nucla, research and outreach indicate most anglers do not pursue these fisheries.

Anglers in the San Miguel watershed engage in bank- and wade-fishing. The degree of enjoyment derived by each method at a given location reflects local flow levels, riparian vegetation density, and aquatic habitat quality. Acceptable angling conditions are available to bank anglers at higher flows than wade-walk anglers due to safety concerns. Extreme low flows diminish aquatic habitat availability and increase water temperature. These conditions reduce the number and size of fish present in a segment. The density of riparian vegetation along the riverbanks affects river access and an angler's ability to easily traverse the banks of the river. The most popular times for fishing in the San Miguel watershed include the summer months after peak runoff through the fall (approximately July-October). A small amount of private angling also occurs in the winter and spring months before peak runoff starts. Like whitewater boating, commercial usage coincides with the tourist season (June-August), often requiring commercial guides to work during non-optimal flow conditions [1], [2], [5].

In the 1990's the BLM spearheaded an assessment of instream flow (ISF) needs throughout the San Miguel watershed [1]. The assessment stayed in draft form and multiple ISF rights were decreed by the Colorado Water Conservation Board (CWCB) throughout the watershed before the assessment was finished. However, the effort included an assessment of recreational flow needs, including whitewater boating and fishing. The assessment utilized a flow preference study conducted by EDAW Inc. [5] that relied on interviews with local guides to identify a range of preferred flows for both wade- and bank-fishing. The initial study scope covered the entire watershed, but a lack of survey respondents in the lower watershed limited the identification of flow preferences in this area. Reaches that both produced sufficient data and represented the primary areas of private and commercial recreational angling included the following

segments of the San Miguel River: 1) Deep Creek to Fall Creek; 2) Specie Creek to Beaver Creek; and 3) Beaver Creek to Pinon Bridge.

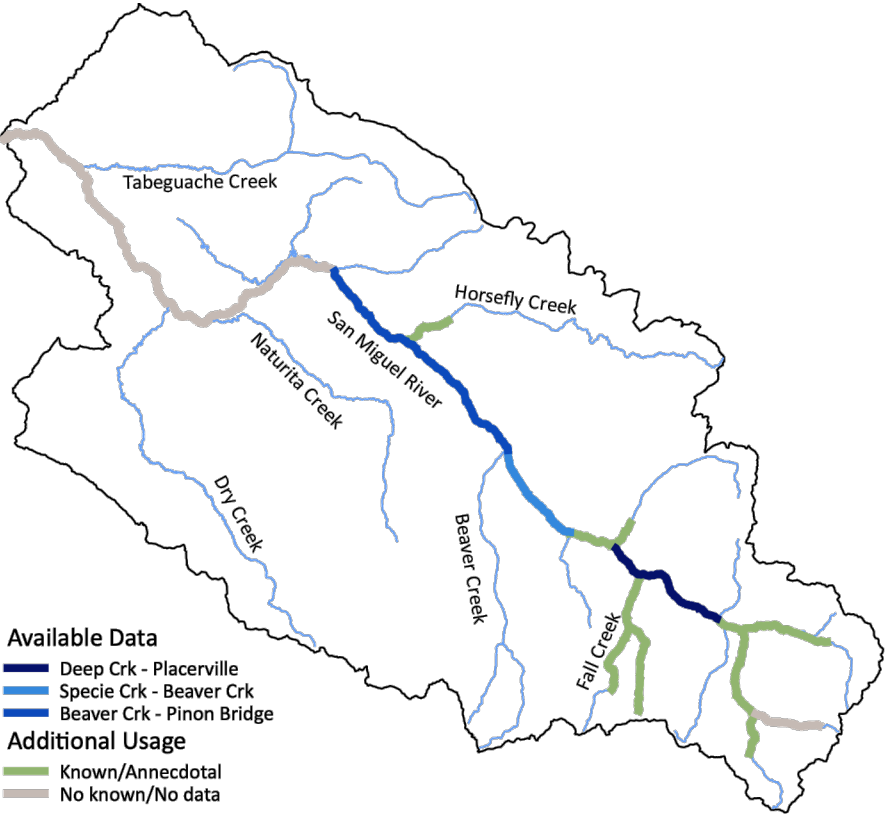


Figure 4. Reaches of the San Miguel River and its tributaries preferred by anglers.

Angler preferences reported by BLM reflected bank accessibility, riparian vegetation, safety accessing appropriate fish habitat, and ability to catch fish. Suitability responses utilized a four-point scale (1-unacceptable, 2-marginally acceptable, 3-acceptable, 4-optimal). The flow preference study utilized single flow (single time at random flow) and direct comparison (multiple times at various flows) techniques to derive flow preference curves for different reaches. BLM subsequently developed flow preference curves to define optimum and acceptable flow ranges for angling in each of these reaches [1]. Lotic Hydrological conducted an informal user survey in 2016 to verify the appropriateness of the flow ranges developed by BLM and gather information on additional reaches of importance. Where preferred fishing locations identified during the 2016 surveys did not align with original BLM study reaches, flow preferences were derived from a geomorphologically similar reach evaluated by BLM (i.e., Caddis Flats was identified as a preferred fishing reach by several anglers in 2016 and was assigned the flow preferences developed for Specie Creek to Beaver Creek due to geomorphological similarities).

Table 3. User preferences for wade and bank fishing on segments of the San Miguel River.

Reach	Type	Acceptable Min (cfs)	Optimum Min (cfs)	Optimum Max (cfs)	Acceptable Max (cfs)
Deep Creek- Placerville	Wade	25	50	275	275
	Bank	25	50	600	700
Caddis Flats	Wade	25	50	250	250
	Bank	25	50	550	650
Species Creek- Beaver Creek	Wade	25	50	250	250
	Bank	25	50	550	650
Beaver Creek- Pinon Bridge	Wade	25	50	275	275
	Bank	25	50	500	650

Anglers generally agree that flows greater than 250-275 are acceptable but less preferred than lower flows. Optimal flows range from 100-275 cubic feet per second (cfs), depending on the reach. It becomes more challenging to access fishing banks, wade, or cast, and turbidity increases as flows increase above this optimal range. The flow preference curves developed from the 1998 survey are relatively flat, indicating that large flow changes above 275 cfs do not significantly impact wade fishing (Table 3). The 2016 surveys and conversations with CPW staff indicated that the lower bound of optimal flow ranges developed in 1998 could be expanded to include smaller flows (25-50 cfs) than the initial study (175 cfs). This is likely due to the fact that the San Miguel experienced higher flows during the 1998 season. As a result, surveys captured user preferences across a relatively high range of flows (175-882 cfs). Importantly, moderate-quality fishing opportunities may exist locally on some reaches below the optimum and acceptable minimum thresholds where deep pools provide refugia for some fish. Flows for an acceptable experience can be slightly higher between Deep Creek and Fall Creek than between Specie Creek and Beaver Creek. Acceptable bank-fishing flows tend to be higher than wade-fishing flows due to difficulty wading in higher streamflows.

The availability of recreational use potential on various segments of the San Miguel River was quantified by calculating a Fishable Days metric. This metric reflects the number of days that optimal, acceptable, and unacceptable use conditions exist under different hydrological conditions. If the streamflow on a particular day fell within a given flow range (e.g. optimal or acceptable), then that day counted as a fishable day, regardless of whether or not users actually engaged in recreational activities on that day. A Fishable Days analysis was completed for every day of the simulation period across three year types: wet, dry, and average. Fishable days analysis results provide context for comparative assessment of recreational use opportunities present on adjacent segments of the San Miguel River under various hydrological conditions.

Table 4. Fishable days available for bank fishing on segments of the San Miguel River under different hydrological conditions. Reach start and end points reference confluences along the San Miguel river mainstem.

Reach Start	Reach End	User Preference Threshold	Total Days		
			Wet	Average	Dry
Deep Creek	Fall Creek	Lower Acceptable	71	115	158
		Optimal	242	220	200
		Upper Acceptable	21	30	8
Fall Creek	Leopard Creek	Lower Acceptable	2	89	136
		Optimal	301	236	219
		Upper Acceptable	28	27	11
Leopard Creek	Specie Creek	Lower Acceptable	0	1	66
		Optimal	286	318	276
		Upper Acceptable	24	15	22
Saltado Creek	Beaver Creek	Lower Acceptable	0	0	64
		Optimal	286	314	272
		Upper Acceptable	22	13	27
Beaver Creek	Horsefly Creek	Lower Acceptable	0	0	58
		Optimal	281	309	275
		Upper Acceptable	22	16	28
Horsefly Creek	Cottonwood Creek	Lower Acceptable	0	0	13
		Optimal	271	303	314
		Upper Acceptable	21	16	23

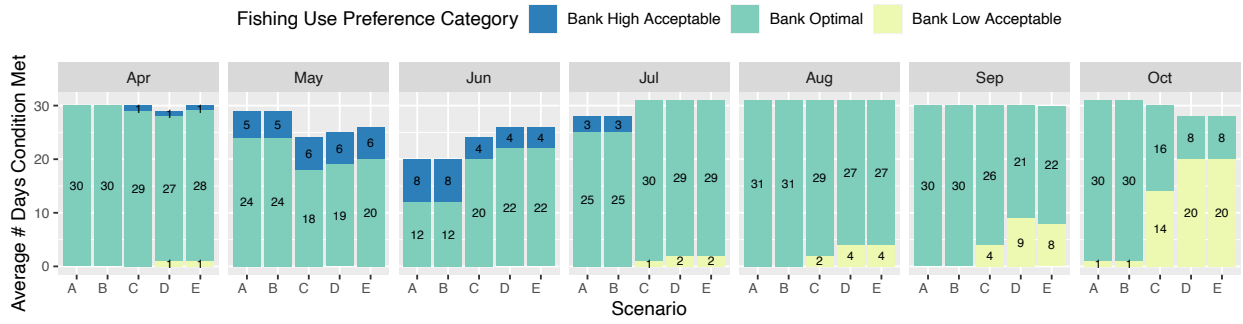
Table 5. Fishable days available for wade fishing on segments of the San Miguel River under different hydrological conditions. Reach start and end points reference confluences along the San Miguel river mainstem.

Reach Start	Reach End	User Preference Threshold	Total Days		
			Wet	Average	Dry
Deep Creek	Fall Creek	Lower Acceptable	71	115	158
		Optimal	242	220	200
		Upper Acceptable	21	30	8
Fall Creek	Leopard Creek	Lower Acceptable	2	89	136
		Optimal	301	236	219
		Upper Acceptable	28	27	11
Leopard Creek	Specie Creek	Lower Acceptable	0	1	66
		Optimal	286	318	276
		Upper Acceptable	24	15	22
Saltado Creek	Beaver Creek	Lower Acceptable	0	0	64
		Optimal	286	314	272
		Upper Acceptable	22	13	27
Beaver Creek	Horsefly Creek	Lower Acceptable	0	0	58
		Optimal	281	309	275
		Upper Acceptable	22	16	28
Horsefly Creek	Cottonwood Creek	Lower Acceptable	0	0	13
		Optimal	271	303	314
		Upper Acceptable	21	16	23

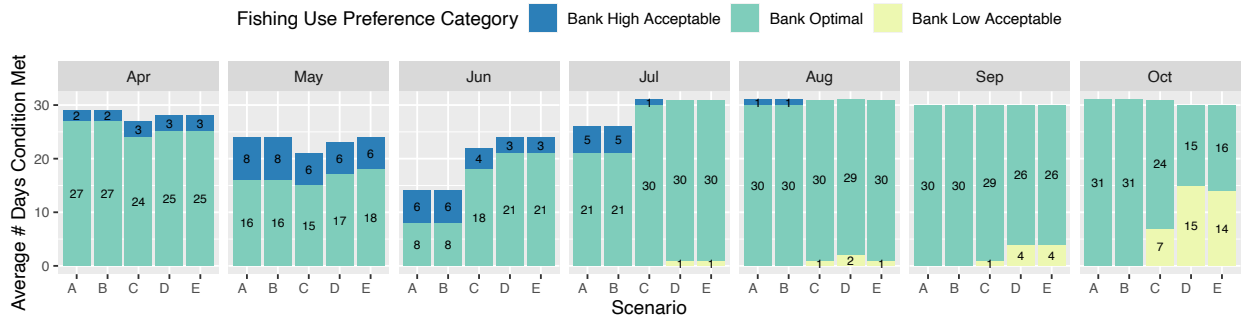
2.2.1 Hydrological Scenario Analysis

Hydrological simulation models described in Appendix C were used to provide an indication of the way that Fishable Days vary across reaches, across months in a given year, and across planning scenarios. Incorporation of hydrological simulation scenarios helps elucidate how angling opportunities change under potential population growth and climate change futures (Figure 5, Figure 6).

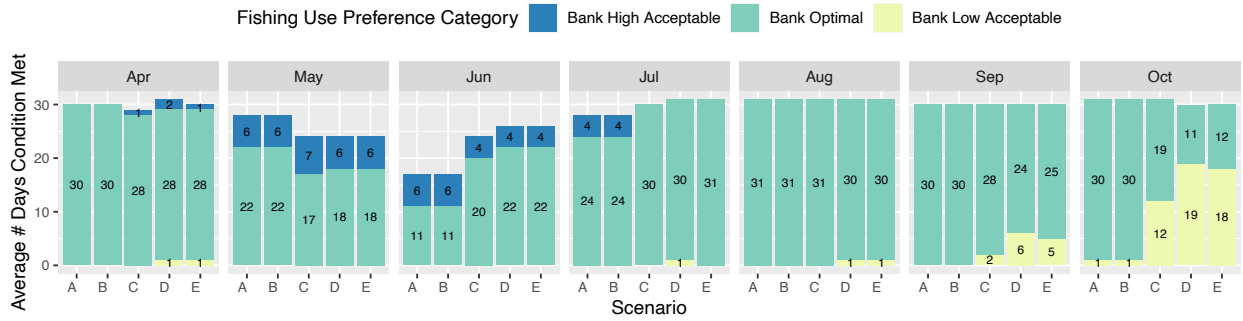
San Miguel below Deep Creek



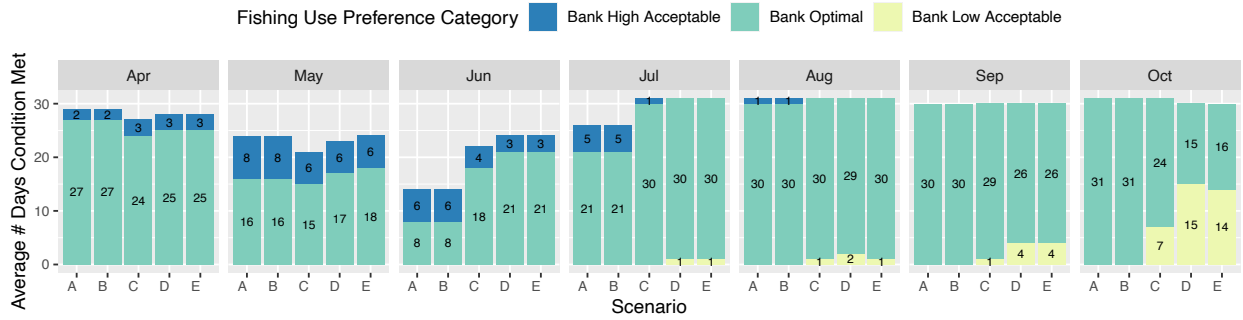
San Miguel River Near Placerville



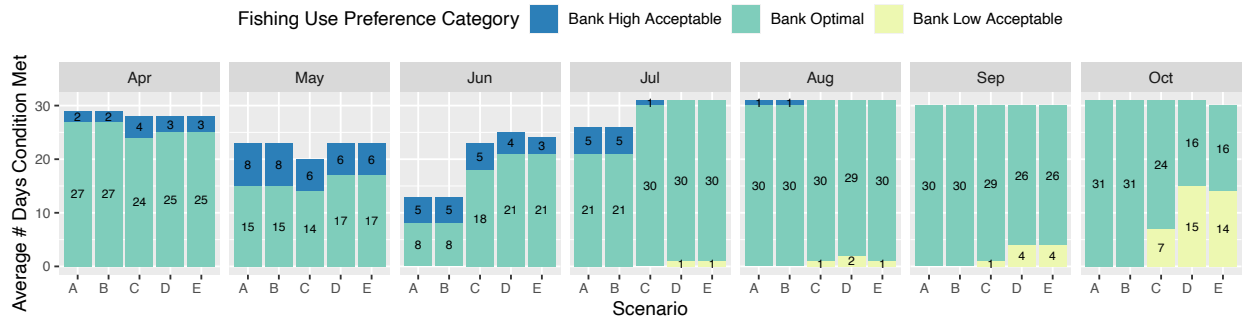
San Miguel below Fall Creek



San Miguel below Specie Creek



San Miguel below Saltado Creek



San Miguel Below CC-Highline Canal

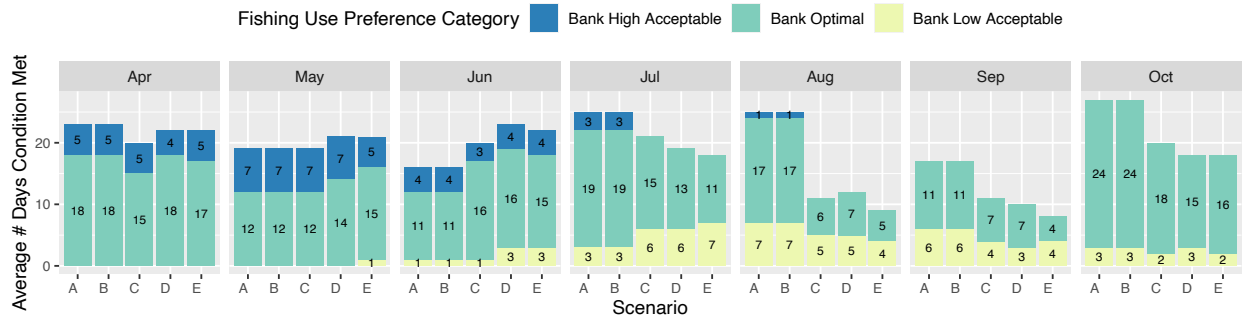
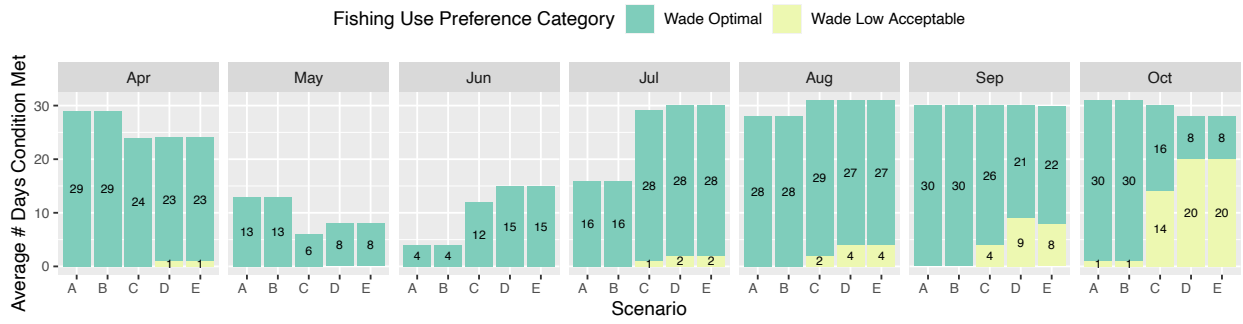
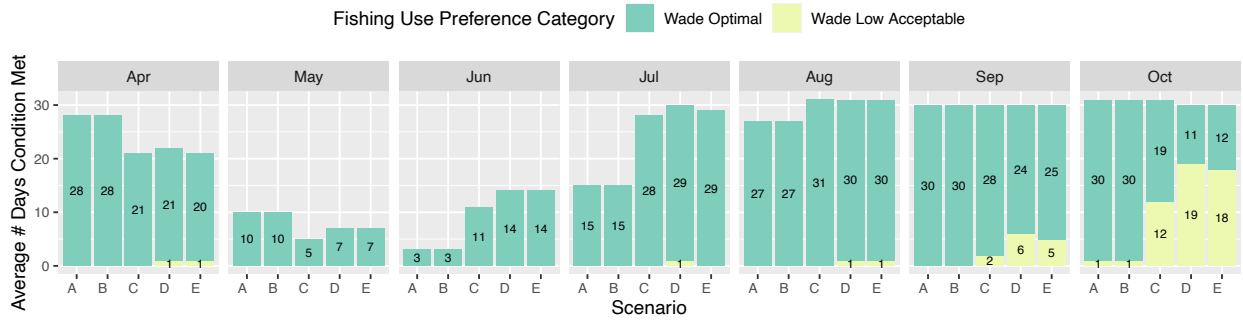


Figure 5. Distribution of the average number of days in each month falling in several bank fishing use preference categories on the San Miguel River under a variety of potential future hydrological scenarios.

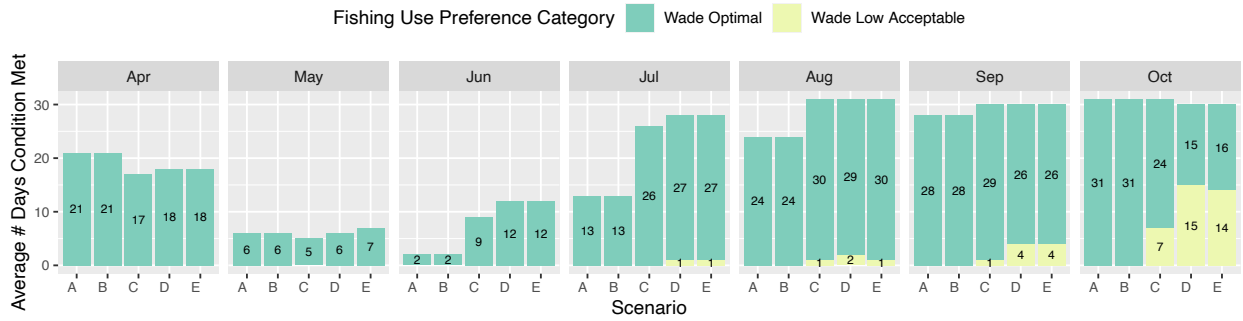
San Miguel below Deep Creek



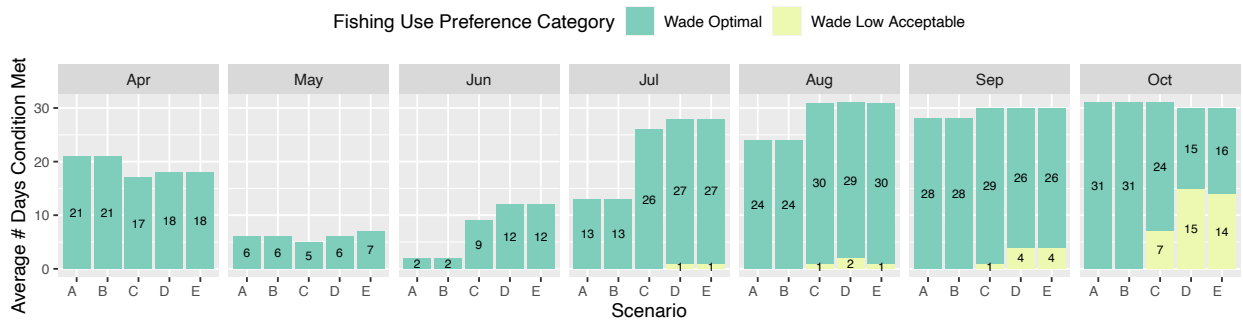
San Miguel below Fall Creek



San Miguel River Near Placerville



San Miguel below Specie Creek



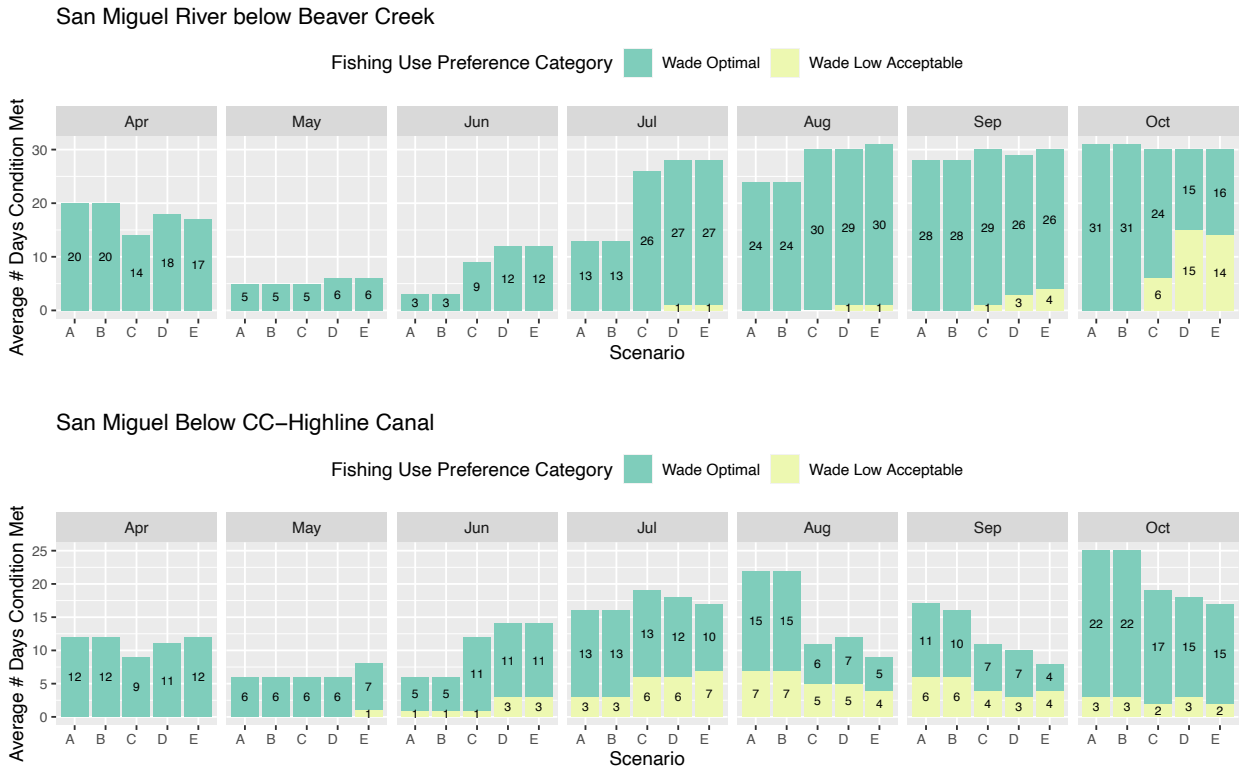


Figure 6. Distribution of the average number of days in each month falling in several wade fishing use preference categories on the San Miguel River under a variety of potential future hydrological scenarios. Note that some monthly totals may sum to a greater number of days than are present in a given month. This is an unavoidable artifact of rounding errors incurred when summarizing the 40-year time series from each scenario.

Scenario modeling results display distinct spatial and temporal patterns in Fishable Days that reflect the primary constraints on bank- vs. wade-fishing. Both use types are most constrained during May and June when flows are high. As flows drop in the early and mid-summer, conditions become more suitable for use. In many months there are more opportunities for bank fishing than wade-fishing due to the higher flow thresholds for the former. The greatest number of days for supporting both use types exist in reaches above the CC-Highline Canal. The reduced peak flows that characterize the climate change scenario models tend to increase the number of optimal days for angling. Decreased late season flows associated with the climate change scenarios tend to decrease the number of optimal days for both wade and bank fishing in the Sep-Oct. period. This effect is most pronounced in the upper watershed. Critically, the Fishable Days metric does not reflect social or biological constraints on angling activities. For example, climate change scenarios may produce elevated water temperatures that limit angling opportunities or quality before flow conditions do.

3 Discussion and Conclusions

Whitewater boating activities and angling in rivers and streams constitute important drivers for local economies and an important quality-of-life attributes for local residents. This assessment characterized preferences for streamflows by self-identified groups of boaters and anglers. Streamflow preferences were compared against existing hydrological behavior and potential hydrological futures to provide stakeholders with important information about how opportunities for both activities change across space, through time, and across hydrological scenarios. Comparison of flow conditions across different reaches, times of year, and hydrological scenarios provides information about the role of variable hydrology in mediating patterns of recreational use.

3.1 Notable Findings for Recreational Boating

. Notable findings of the recreational boating portion of this assessment include:

- Two permanent irrigation diversion structures above the Town of Naturita present navigation hazards during moderate and low-flows.
- Recreational users identified minimum flow thresholds between 500-600 cfs for whitewater boating use on the San Miguel River between Bilk Creek and the Dolores River. Optimal flows tend to fall between 800-2000 cfs for all reaches.
- Boatable Days analysis indicates strong seasonal patterns dominate the distribution of days available for whitewater boating use on reaches along the San Miguel River. This reflects the natural, snowmelt runoff hydrology that is characteristic to these reaches.
- Scenario modeling that characterizes the impacts of climate change (i.e. scenarios C, D, and E) indicates the potential for a significant decrease in the number of days suitable for whitewater boating activities on many reaches, particularly in the month of June.
- This assessment did not consider the divergent preferences among different populations of recreational users. For example, individuals engaged in recreational gold-panning activities on the San Miguel River near the CC-Highline Canal likely prefer much lower flows during the summer months than recreation boaters. Future assessments may endeavor to explicitly consider flow preferences among these users and representatives from other user groups.
- This assessment did not explicitly consider the impact of hydrological variability on snowmaking. However, that recreational water use is particularly important to the economy of the Telluride area. The ability to continue snowmaking activities under a warming climate may be limited by both higher air temperatures in the October-December period and reduced availability of stored or free flowing water during this period. Future assessments may endeavor to explicitly consider these linkages.

3.2 Notable Findings for Angling

Notable findings of the recreational boating portion of this analysis include:

- Anglers generally agree that flows greater than 250-275 are acceptable but less preferred than lower flows. Optimal flows range from 100-275 cubic feet per second (cfs), depending on the

reach. It becomes more challenging to access fishing banks, wade, or cast, and turbidity increases as flows increase above this optimal range

- High streamflows during May-June limit bank and wade-fishing opportunities throughout the watershed.
- Bank fishing opportunities are less sensitive to hydrological variability than wade fishing opportunities.
- Lower peak flows associated with climate change hydrological scenarios (i.e. scenarios C, D, and E) tend to increase the number of optimal and acceptable days for both wade and bank fishing during the May-June period. Lower late-summer flows associated with climate change hydrological scenarios tend to decrease the number of optimal days for both wade and bank fishing, especially in the upper watershed.
- Some types of angling that are of high-value to some local residents were not included in this assessment. These include angling in Miramonte Reservoir and catfish fishing at Biscuit Rock on the lower San Miguel River. Future assessments may be used to explicitly consider these uses and how they are mediated by variably hydrological conditions.
- Angling quality is tightly coupled with aquatic habitat availability and the health of the fishery. Therefore, consideration of results presented in the aquatic biota section are equally important for understanding existing and potential future angling opportunities across the San Miguel watershed.

4 References

- [1] Bureau of Reclamation, "San Miguel River Instream Flow Assessment." 1996.
- [2] EDAW, Inc., "San Miguel River Recreation Study," Bureau of Land Management, May 1997.
- [3] N. Fey, "Assessing Boatable Days to Describe Stream-flow Influenced Recreational Attributes." *American Whitewater*.
- [4] C. Menges, N. Fey, and E. Stafford, "Assessing Streamflow Needs for Whitewater Recreation in the Gunnison River Basin," *Am. Whitewater*.
- [5] EDAW, Inc., "San Miguel River Instream Flow Assessment Recreation Study," Bureau of Land Management, Aug. 1998.