
Date: 3/27/2019

To: W&S Stakeholder Group/Governance Committee

From: W&S Fishing Ad-Hoc Committee

Subject: Recreational Fishing ORV Indicators – Final Recommendations

This memo is intended to serve two purposes:

- 1) Present the Fishing AHC's recommendations for *Final* Recreational Fishing ORV Indicators. These recommendations address the SG's comments on the Fishing AHC's preliminary recommendations, as well as new information.
- 2) Present background on these recommendations for the benefit of current and future W&S stakeholders.

As per the 2012 Upper Colorado River Wild and Scenic (W&S) Stakeholder Group Management Plan (SG Plan): "In the first 3-to-5 years of implementation of this Plan, the Stakeholder Group will gather necessary data and develop specific indicators which will be used to gage whether the ORVs are being protected. These indicators are referred to in the Plan as ORV Indicators" (SG Plan, page 13). "For the first 3-to 5 years of implementation of the SG Plan, provisional ORV Indicators and Resource Guides will be used. During this period, (Provisional Period), the Stakeholder Group will work to gather additional data, learn and refine what is needed for protection of ORVs, and develop final ORV Indicators and Resource Guides" (SG Plan, page 4). "Final ORV indicators and Resource Guides will be adopted prior to conclusion of the Provisional Period" (SG Plan, page 7). The Provisional Period ends on June 12, 2020.

The Fishing Ad-Hoc Committee (AHC) made its preliminary recommendations for *Final* Recreational Fishing ORV indicators at the June 7th, 2018 quarterly SG/GC meeting. After that meeting, the Fishing AHC received comments from the State Interest Group and Colorado Springs Utilities regarding data needs, species diversity, water quality resource guide, confidence intervals and representation of droughts.

BACKGROUND ON *PROVISIONAL* RECREATIONAL FISHING ORV INDICATORS

The Bureau of Land Management (BLM) and U.S. Forest Service have identified Recreational Fishing as an outstandingly remarkable value in W&S Segments 4, 5 and 6 (not Segment 7). The SG Plan includes the following Provisional Recreational Fishing ORV Indicators for: Quality Trout, Biomass, Species Diversity, Total Fishing Effort (TFE), and Catch-Per-Unit Effort (CPUE) for the Upper Colorado River *from Gore Canyon to Red Dirt Creek*.¹

¹The SG Plan states: "Existing Colorado Parks and Wildlife (CPW) fishery data suggests that the quality of the recreational coldwater fishery in the reach of the Colorado River downstream of its confluence with Red Dirt Creek may not be as high as in the reach above. The provisional ORV Indicators will apply to that portion of Segment 6 upstream of the Colorado River's confluence with Red Dirt Creek. During the provisional period, the SG will gather data, as appropriate, and evaluate whether there is a need to develop specific ORV Indicators for the lower portion of Segment 6." (Page 14).

Table 1: Provisional ORV Indicators for Recreational Fishing (SG Plan page 14)

Type	Name	Provisional ORV Indicator
Fishery	Quality Trout	24 fish over 14" per acre
Fishery	Biomass	90 pounds/acre
Fishery	Species Diversity (SD)	14 species of fish
Recreational Fishing	Total Fishing Effort (TFE)	TBD
Recreational Fishing	Catch/Unit Effort (CPUE)	TBD

QUALITY TROUT AND BIOMASS

Background

The SG Plan uses a “one size fits all” approach to establishing Provisional Recreational Fishing ORV Indicators for W&S Segments 4, 5 and 6, which was based a single biosurvey conducted by Colorado Parks and Wildlife (CPW) in 2008. As discussed below, it does not account for natural variability that is now understood to exist across the 38.6 river miles that represent W&S Segments 4, 5 and 6.

While this one-size-fits-all approach has served a purpose during the Provisional Period, the SG originally contemplated that the Quality Trout and Biomass indicators would be refined, as necessary, based on the results of annual CPW biosurvey data collected in 2-mile reaches within W&S Segments 5 and 6. The CPW biosurvey reaches within W&S Segments 5 and 6 include:

- upstream of Radium (County Road 11 bridge);
- downstream of State Bridge;
- upstream of the Catamount boat ramp; and
- upstream of Lyons Gulch.

Of the four CPW biosurvey reaches, Radium is within W&S Segment 5 and State Bridge, Catamount and Lyons Gulch are all within Segment 6. Lyon’s Gulch, however, is below Red Dirt Creek and therefore not included in the threshold calculations for Final ORV Indicators (see Recommendation on page 5). Note: CPW does not collect biosurvey data in W&S Segment 4 (Gore Canyon) due to safety and logistical considerations. Based on anecdotal data and CPW’s estimates, the fishery in Segment 4 is considered to be robust.

Establishing a Baseline for Quality Trout and Biomass

In order to account for the inherent variability that exists in fish populations across W&S Segments 5 and 6, it is critical to understand the baseline conditions for each CPW biosurvey reach. The Fishing AHC relies on CPW to analyze and interpret annual biosurvey data and agrees with CPW that a one-size-fits-all approach for ORV Indicators is not appropriate.

After 9 years of sampling (2010 through 2018), CPW has a better understanding of the fishery in W&S Segments 5 and 6. In general, and compared to downriver segments, these W&S segments exhibit a high diversity of habitat elements (e.g., large cobble riffles, deep pools, large-substrate “pocket water” runs) in close proximity to each other. Furthermore, the winter climate appears to be more temperate below Gore Canyon, which is a function of the area’s geography and topographic influences. Notably, the 2-mile CPW biosurvey reach for State Bridge represents a change in habitat conditions between the lower portion of Segment 5 and the upper portion of Segment 6.

CPW has recommended that *a minimum* of six “qualifying” biosurveys² are necessary to establish baseline data, and therefore to confidently establish thresholds for Quality Trout and Biomass ORV Indicators. As indicated in **Table 3** (page 4), CPW has been surveying the Radium, State Bridge, and Catamount reaches on alternating years (dependent on conditions and priorities) each spring since 2010. By the end of the Provisional Period (June 2020), at least six biosurveys will have been completed at Radium; however, it cannot be stated with certainty that six biosurveys will have been completed at State Bridge and Catamount. Therefore, it may be necessary to continue to collect CPW biosurvey data beyond the close of the Provisional Period in order to establish baseline biological data for the State Bridge and Catamount reaches and, consequently, to establish final ORV Indicator thresholds for W&S Segment 6. This approach was approved at the August 13, 2018 GC meeting. In the foreseeable future (beyond the June 2020 close of the Provisional Period) CPW will continue to conduct regularly scheduled biosurveys, and that information will be shared with the SG annually. CPW’s sampling schedule for Radium, State Bridge, and Catamount is provided in the following table:

Table 2: CPW's intended biosurvey sampling schedule (depending on conditions).

Location	# of biosurveys by end of provisional period	CPW's intended schedule
Radium (Segment 5)	7	odd number years
State Bridge (Segment 6)	6	2019 and even number years after
Catamount (Segment 6)	6	2019, 2020, and odd number years after

² ‘Qualifying biosurveys’ are determined by CPW prior to submitting annual results to the SG; considering recapture rate and the possible impacts of stochastic events that are beyond the control of the SG Plan.

Table 3: CPW Biosurvey and RRC CPUE Data: 2010-2020

This table will be used to populate data for determining the final ORV Indicator thresholds; additional CPW biosurveys may need to be conducted after the 2020 field season if “planned” remaining surveys are not “qualifying”.

Recommended Threshold: Quality Trout and Biomass thresholds calculated with 99% CI; CPUE calculated with 98% CI. The values in the current table are subject to revision as described in this memo and will not be fully determined until we meet the required sample size.

*CPW determined that biosurvey data collected at State Bridge in 2013 was statistically unreliable due to poor capture efficiency and high variability. Thus, 2013 biosurvey data for State Bridge *will not be used to calculate averages or thresholds*.

TBD: indicates that the SG and RRC will need to determine if intercept surveys will be conducted for a given year.

Pending: indicates that the SG is awaiting the results for CPW’s 2018 biosurveys.

Planned: indicates that CPW is intending to conduct biosurveys at a specific reach.

Metric	Site Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Recommended Threshold
W&S Segment 5													
Quality Trout: (# > 14"/acre)	Radium	44	60	49	52	--	65	--	66	--	Planned	--	41
Biomass: (lbs/acre)	Radium	121	143	155	164	--	145	--	173	--	Planned	--	120
CPUE: (fish/hour)	Radium	--	--	--	0.73	0.93	0.53	--	--	1.05	TBD	TBD	Pending
CPUE: (fish/hour)	State Bridge	--	--	--	0.94	0.74	0.67	--	--	0.66	TBD	TBD	Pending
W&S Segment 6													
Quality Trout: (# > 14"/acre)	State Bridge	--	--	--	52*	--	23	31	33	40	Planned	Planned	Pending
Biomass: (lbs/acre)	State Bridge	--	--	--	175*	--	71	74	86	108	Planned	Planned	Pending
Quality Trout: (# > 14"/acre)	Catamount	NA	18	--	19	--	22	--	--	21	Planned	Planned	Pending
Biomass: (lbs/acre)	Catamount	NA	57	--	57	--	50	--	--	56	Planned	Planned	Pending
CPUE: (fish/hour)	Catamount	--	--	--	--	1.25	0.93	--	--	--	TBD	TBD	Pending

Establishing Thresholds: Confidence Intervals (CI) and Failure Criteria

CPW has been instrumental in assisting the Fishing AHC with reviewing ORV Indicator thresholds for Quality Trout and Biomass. The proposed *final* thresholds are based on CPW's annual biosurvey results, and hinge on the use of confidence intervals for establishing thresholds interpreting the results.

With input from both CPW and RRC, the Fishing AHC considered using the 95%, 98%, and the 99% CIs to establish thresholds for the recommended Final ORV Indicators for Quality Trout, Biomass and CPUE (note: CPUE is discussed separately, later). Refer to **Table 3** (page 4). A separate memo has been prepared to provide the foundation for the recommended confidence intervals to be used for Quality Trout, Biomass, and CPUE; [that Confidence Interval Memo can be accessed by clicking here.](#)

At the March 4, 2018 Fishing AHC meeting, the Fishing AHC decided to adopt CPW's recommendation to use the 99% CI for establishing Quality Trout and Biomass thresholds, paired with an exceedance frequency of a single year. Refer to **Table 3** (page 4) and **Table 4** (page 6).

Failure criteria are based on "exceedance frequencies", which refers to the number of exceedances (based on annual biosurveys) allowed before determining that a given ORV Indicator is not met.

Final Recommendation

Detailed information on the recommended *final* Recreational Fishing ORV Indicators for Quality Trout and Biomass is included in **Table 4** (page 6).

The Fishing AHC recommends that the SG approve replacement of the Provisional Recreational Fishing ORV Indicators for Quality Trout and Biomass that are included in the SG Plan with new language that acknowledges the inherent variability in W&S Segments 5 and 6, and which is consistent with CPW's established biosurvey reaches. This is based on the 99% CI and an exceedance frequency of a single biosurvey.

The recommended Final Recreational Fishing ORV Indicator for Quality Trout and Biomass is:

The Fishing ORV will be deemed to be protected at a specific location if biosurveys indicate that both Quality Trout and Biomass are equal to or greater than the threshold values identified in Table 3. If a single biosurvey indicates that either value falls below said threshold at a given location, the ORV Indicators will be deemed to not have been met at that location.

Note: No Final Fishing ORV Indicators for Quality Trout and Biomass are being recommended for Segment 4.

The SG may want to consider an annual Data Review Committee to assess the results of RRC's surveys in relation to ORV Indicator thresholds and report to the SG each year.

Recommendation regarding Lyon's Gulch/lower section of Segment 6

The Fishing AHC is not recommending specific ORV Indicators for the lower section of Segment of 6 (as based on Lyons Gulch biosurveys results) be developed at this time. However, CPW will continue to monitor the Lyons Gulch biosurvey reach, along with the other three biosurveys reaches, in the foreseeable future. [For more information on Lyons Gulch, click here.](#)

TABLE 4
Recommendations for Final Fishing ORV Indicators
Quality Trout and Biomass

Final ORV Indicator	The Fishing ORV will be deemed to be protected in W&S Segments 5 and 6 if biosurveys at specific locations indicate that <u>both</u> Quality Trout and Biomass are equal to or greater than the following threshold values. If a single biosurvey indicates that either value falls below said threshold at a given location, the ORV Indicators will be deemed to not have been met at that location.	
Thresholds	Quality Trout (#>14" per acre)	Biomass (Pounds/acre)
Radium (Segment 5)	41	120
State Bridge (Segment 6)	<i>TBD</i> ³	<i>TBD</i>
Catamount (Segment 6)	<i>TBD</i>	<i>TBD</i>
Confidence Interval (CI)⁴	99%	
Failure Criteria	Falling short of the Quality Trout and/or Biomass threshold(s) in any survey reach based on <u>a single biosurvey</u> .	
Annual Data Review	A Data Review Committee may be formed to coordinate with CPW on an annual basis to review the previous year's biosurvey data and other factors (both within and outside the SG's control) related to Quality Trout and Biomass ORV Indicators.	
Accounting for Drought	<p>Annual CPW biosurveys performed at Radium, State Bridge, and Catamount will constitute the baseline conditions on which the final Fishing ORV Indicator thresholds are based. However, the baseline period of record does not include an extended drought, particularly the "driest" W&S year type, which may affect both Quality Trout and Biomass results.</p> <p>Because biosurveys are conducted in the spring, before the lower summer and fall flows occur, a one-year lag would be anticipated between the first year of a drought and the fish population data that is represented in the biosurveys.</p> <p>It is acknowledged that drought constitutes a relevant factor that is outside of the SG's control. The Data Review Committee will make a recommendation as to whether drought conditions existed in their summary of the previous year's biosurvey data. In the event that Quality Trout and Biomass thresholds for Radium, State Bridge and/or Catamount are not met in a given year, the SG will make the final determination as to whether drought conditions were a relevant contributing factor.</p>	

³ These values will remain "TBD" until six qualifying biosurveys are completed. Six 'qualifying' biosurveys are necessary to establish final thresholds. 'Qualifying biosurveys' are determined by CPW prior to submitting annual results to the SG; considering recapture rate and the possible impacts of stochastic events that are beyond the control of the SG Plan.

⁴ At the end of the provisional period, final thresholds will be set at Radium based on the total number of biosurveys completed at that time.

Accounting for Drought

Annual CPW biosurveys constitute the baseline conditions on which the final fishing ORV indicator thresholds are based. However, the biosurvey period – dating back to 2010 – does not include an extended period of drought, particularly the “driest” W&S year type, which could potentially affect both Quality Trout and Biomass numbers. Recognizing that the Upper Colorado River may experience extended drought conditions at some point in the future, the SG will need to consider options for how to address a drought (single years versus extended periods) in the context of the final Recreational Fishing ORV Indicators.

It is acknowledged that drought constitutes a relevant factor that is outside of the SG’s control. The Fishing AHC proposes that the Data Review Committee makes an annual recommendation as to whether drought conditions existed in their review of the previous year’s biosurvey data. The SG will make the final determination as to whether drought conditions were a relevant factor that contributed to not meeting the final Recreational Fishing ORV Indicators (including, but limited, to Quality Trout and Biomass).

Because biosurveys are conducted in the spring, before the lower summer and fall flows occur, a one-year lag would be anticipated between the first year of a drought and the impacts on fish populations that would be represented in the biosurvey results.

SPECIES DIVERSITY

Background

Annual monitoring reports prepared by the SG between 2012 and 2018 have relied on CPW's biosurvey results for data on presence/absence of species within W&S Segments 5 and 6. With the exception of 2014 (when CPW was unable to perform biosurveys) and 2017 (when the number of species identified was nine) the number of identified fish species consistently exceeded 14.

As the Fishing AHC began to refine the Provisional Recreational Fishing ORV Indicators, CPW provided their perspective on the usefulness of including "species diversity" as a Final ORV Indicator. By including 14 species of fish (based purely on presence/absence), it is implied that greater diversity equates to a healthier fishery, which is not the case. "Species diversity" includes a mix of native and non-native species, including some that are important recreationally and economically (e.g. brown and rainbow trout) and some that are detrimental to the fishery (e.g., northern pike and lake trout). The presence of native and recreationally/economically important species is important and their absence may indicate problems (e.g., rainbow trout disappearance and whirling disease).

Final Recommendation

The Fishing AHC recommends that Species Diversity be omitted as a final ORV Indicator. Instead, the Fishing AHC recommends including "Desired Species" as a final Fishing ORV Resource Guide for W&S Segments 5 and 6. Based on input from CPW, the following is the recommended list of desired species:

1. Brown Trout
2. Rainbow Trout
3. Mountain Whitefish
4. Speckled Dace
5. Native suckers (including flannelmouth and bluehead)
6. Mottled Sculpin

CATCH PER UNIT EFFORT AND TOTAL FISHING EFFORT

Background

Catch per Unit Effort (CPUE) equates to the number of fish caught by each angler, calculated on an hourly basis. Total Fishing Effort (TFE) (the number of hours each angler actually fished) is used to calculate CPUE. These metrics were included in the SG Plan as Provisional Recreational Fishing ORV Indicators to help evaluate the user experience. However, no specific threshold values were associated with these provisional ORV Indicators; threshold values were simply identified as “TBD.”

Because TFE is used to calculate CPUE, the Fishing AHC determined that a final Recreational Fishing ORV Indicator for TFE is not necessary. Also, the Fishing AHC determined that a one-size-fits-all approach to CPUE across W&S Segments 4, 5, and 6 was not appropriate.

Establishing a Baseline for CPUE and TFE

As with the biological aspects of the fishery (i.e., Quality Trout and Biomass), it is critical to gain an understanding of the baseline conditions for recreational fishing before final indicators (thresholds) can be established. Therefore, in an effort to understand the river user experience, the SG retained RRC Associates to implement a multi-pronged research program, beginning in 2013. RRC designed and implemented an angler survey to gather reliable data synonymous with traditional creel surveys.

While the original survey methods employed by RRC are considered to be a reliable tool for ongoing monitoring, it is possible that other methods may be more cost-effective and expedient in the future. It is recommended that the SG be willing to consider working with other groups, and to use different techniques, to collect data if needed in response to budget limitations. Depending on available funds, the SG could consider data collection sampling at different locations, with different timing, and with different technologies, that would provide comparable statistical reliability.

The formula for calculating CPUE is:

“Fish caught by all anglers in craft (by species) / total number of hours spent fishing = CPUE (reported as fish caught per hour).”

RRC collected CPUE data in 2013, 2014, and 2015. RRC’s data shows some variation in CPUE by location of the takeout, by party type (commercial or private), and by year of survey. This variability was considered by RRC and the Fishing AHC in developing recommendations. In the final analysis, survey results show that CPUE was quite similar at Radium, State Bridge and Catamount. Refer to **Table 3 (page 4)**.

Establishing Thresholds: Confidence Intervals and Failure Criteria

RRC has been instrumental in assisting the Fishing AHC with establishing ORV Indicator thresholds for CPUE. As with Quality Trout and Biomass, the proposed *final* thresholds are based on the results of RRC’s research program, and hinge on the use of confidence intervals for establishing thresholds interpreting the results.

With input from RRC, the Fishing AHC considered using the 95%, 98% and the 99% CIs for CPUE to establish thresholds for the recommended Final Recreational Fishing ORV Indicator ([see Confidence Interval memo by clicking here](#)). Refer to **Table 3 (page 4)**. It was ultimately RRC’s professional recommendation to use the 98% CI for establishing the CPUE thresholds for W&S Segments 5 and 6.

Failure criteria for CPUE are also based on “exceedance frequencies”, which refers to the number of exceedances (based on annual intercept surveys) allowed before determining that a given ORV Indicator has not been met.

Final Recommendation

The Fishing AHC recommends removal of TFE from the Final Recreational Fishing ORV Indicators. The recommendation for the Final Recreational Fishing ORV Indicator is:

Final ORV Indicators are identified for three specific locations within W&S Segments 5 and 6: Radium, State Bridge, and Catamount. The fishing ORV will be deemed to be protected at a specific location if angler surveys indicate that CPUE values are equal to or greater than the threshold values identified in Table 3. If surveys indicate that the value falls below said threshold at a given location in any three out of five years, the ORV Indicators will be deemed to not have been met at that location.

This is based on the lower 98% CI for any survey reach based on a three out of five-year exceedance frequency. The SG may want to consider a Data Review Committee to annually assess the results of RRC’s surveys in relation to ORV Indicators and report to the SG. Detailed information on the recommended Final Recreational Fishing ORV Indicators for Catch per Unit Effort is included in **Table 5** (page 11).

Table 5
Recommendations for Final Fishing ORV Indicators

Catch Per Unit Effort (CPUE)

Final ORV Indicator	The fishing ORV will be deemed to be protected at specific locations in Segments 5 and 6 if angler intercept surveys indicate that Catch Per Unit Effort (CPUE) ⁵ values are equal to or greater than the following threshold values. If surveys indicate that CPUE falls below said threshold at a given location in any three of the past five years, the ORV Indicator will be deemed to not have been met at that location.
Thresholds⁶	Catch per Unit Effort (CPUE)
Radium (Segment 5)	TBD
State Bridge (Segment 5) ⁷	TBD
Catamount (Segment 6)	TBD
Confidence Interval (CI)	98%
Failure Criteria	Falling short of the CPUE threshold in any survey reach based on results of angler intercept surveys in any three of the past five years.
Data Review Committee	A Data Review Committee may be formed to annually review the previous year's angler intercept results and other factors (both within and outside the SG's control) related to Catch per Unit Effort.
Accounting for Drought	RRC intercept surveys used to establish baseline conditions and Indicator thresholds do not include an extended drought period, particularly the "driest" W&S year type. It is recognized that the Upper Colorado may experience drought in the future. A drought impact evaluation protocol will need to be established by the SG.

TBD = To Be Determined

⁵Catch per Unit Effort is calculated as number of fish caught per hour, based on individual angler responses to W&S intercept surveys.

⁶These values will remain "TBD" until a sufficient total number of valid intercept surveys (e.g., "n" value) have been completed. N values are as follows: State Bridge (525), Radium (531), Catamount (494).

⁷ CPUE data collected at State Bridge is representative of anglers who have just floated Segment 5.

SUMMARY

Quality Trout and Biomass: Detailed information on the recommended Final Recreational Fishing ORV Indicators for Quality Trout and Biomass is included in **Table 4** (*page 6*) and on page 5.

Species Diversity: Detailed information on the recommendation for Final Recreational Fishing ORV Indicators for Species Diversity is found on page 8.

Catch per Unit Effort: Detailed information on the recommended Final Recreational Fishing ORV Indicators for Catch per Unit Effort is included in **Table 5** (page 11) and on pages 9-10.