

# Summary of the 2022 Creel Survey of the Heritage and Wild Trout Section of the Truckee River, Nevada County.

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## Introduction

The Truckee River, which flows northeasterly for roughly 120 miles, is the sole outlet of Lake Tahoe, and drains into Pyramid Lake in the Great Basin (**Figure 1**). Run-off from the Sierra Nevada and water releases from Lake Tahoe, Donner Lake, Prosser Creek Reservoir, Boca Reservoir, Stampede Reservoir, and Independence Lake maintain flows in the Truckee River that are used for agriculture, municipal uses, and hydropower. The Truckee River also serves as a vital ecosystem for fish and wildlife, and provides a productive recreational sport fishery known for trophy-sized Rainbow Trout (*Oncorhynchus mykiss*; RT) and Brown Trout (*Salmo trutta*; BN). The river is accessible along Highway 89 north of Lake Tahoe and the Interstate-80

corridor from Truckee into Nevada.

The Truckee River is designated by the California Fish and Game Commission as a Heritage and Wild Trout (HWT) water from the confluence of Trout Creek downstream to the Nevada State line (**Figure 2**; 14 CCR § 7260). The HWT designation provides aesthetically pleasing and environmentally productive streams and lakes managed exclusively for wild trout, where trout populations are managed with appropriate regulations to be largely unaffected by angling.

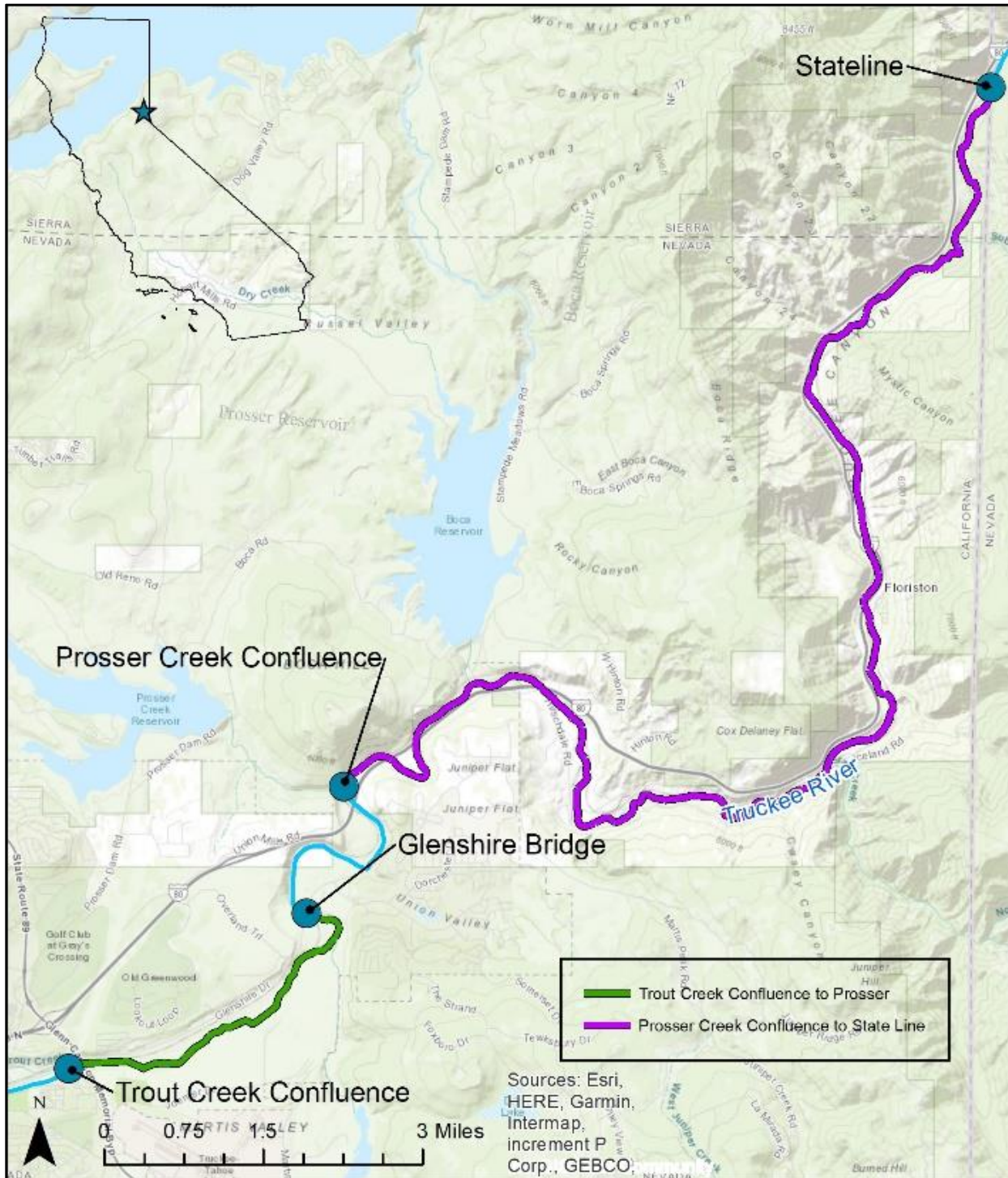


**Figure 1.** Overview map of the Truckee River watershed including Lake Tahoe, Pyramid Lake, and the mainstem Truckee River. Red dots denote significant towns and cities.

In 2020, the California Fish and Game Commission adopted new angling regulations for the Truckee River. In 2021, we implemented a Roving-Roving creel survey on the HWT section of the Truckee River to estimate the status of the sports fishery, angler catch rate, harvest, potential impacts of the 2020 angling regulations, angler satisfaction with the fishery, and angler satisfaction with the 2020 angling regulations. Creel surveys can produce estimates of angling effort, catch, and harvest, while avoiding recall and prestige biases that may be associated with off-site surveys. We continued the creel survey on the Truckee River into 2022, and in this report, we summarize the findings of the 2022 creel survey effort.

The current angling regulations for the Truckee River were adopted by the California Fish and Game Commission in 2020. California Fish and Game Code (14 CCR § 7.50b) divides the Truckee River, and significant tributaries, from Lake Tahoe to the Nevada State line into multiple reaches for the purposes of angling regulation (**Figure 2; Tables 1 & 2**). Within 1,000 feet of Lake Tahoe, fishing is closed all year. From 1,000 feet of Lake Tahoe downstream to the confluence of Trout Creek, fishing in the Truckee River falls under the general fishing regulations for trout in the Sierra Nevada, and is open to fishing from the last Saturday in April through November 15, with a five trout daily bag limit, and ten trout possession limit, with no gear restrictions. During the winter, from November 16 through the Friday preceding the last Saturday in April, a zero trout bag limit applies, and only artificial lures with barbless hooks may be used for all species of fish (14 CCR § 5.85a). From the confluence of Trout Creek downstream to the confluence of Prosser Creek, fishing is open all year with artificial flies, barbless hooks, and a zero trout bag limit. From Prosser Creek confluence downstream to the Nevada State line, from the last Saturday in April through November 15, a two trout bag limit applies, and only artificial lures may be used. From November 16 through the Friday preceding the last Saturday in April, anglers may only use artificial lures and barbless hooks, with a zero trout bag limit (14 CCR § 7.50b).

Prior to 2020, the angling regulations for the Truckee River were slightly different (**Table 2; 14 CCR § 7.50b [2019]**). From the confluence of Trout Creek downstream to the Glenshire Bridge, and from the confluence of Prosser Creek downstream to the Nevada State Line, from the last Saturday in April through November 15, angling in the Truckee River required artificial lures with barbless hooks, with a two trout daily bag limit and a 14-inch minimum fish length. During the winter, from November 16 through the Friday preceding the last Saturday in April, a zero trout bag limit applied, and only artificial lures with barbless hooks were permitted. From the Glenshire Bridge downstream to the confluence with Prosser Creek, the old regulations were nearly identical to the current regulations, but limited gear to artificial flies only.



**Figure 2.** Map of the Heritage and Wild Trout designated section of the mainstem Truckee River from the confluence of Trout Creek to the Nevada State line. Green and purple lines denote the HWT designated reaches of the Truckee River. While teal dots denote the location of river features referenced in the California fishing regulations for the Truckee River.

| <b>Table 1. Current California Angling Regulations for the Designated Heritage and Wild Trout Section of the Truckee River, Nevada County.</b> |   |                                       |
|--|---|---------------------------------------|
| <i>Area or Body of Water</i>   | <i>Open Season and Special Regulation</i>   | <i>Daily Bag and Possession Limit</i> |
| Truckee River from the confluence of Trout Creek downstream to mouth of Prosser Creek.   | All year. Only artificial flies with barbless hooks may be used.  | 0 trout                               |
| Truckee River from the confluence of Prosser Creek downstream to the Nevada State Line.  | Last Saturday in April through November 15. Only artificial lures may be used.  | 2 trout                               |
|  | November 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used. | 0 trout                               |

| <b>Table 2. Historic (2020 and earlier) California Angling Regulations for the Designated Heritage and Wild Trout Section of the Truckee River, Nevada County.</b> |  |         |
|--|--|---------|
| Truckee River from the confluence of Trout Creek downstream to the Glenshire Bridge.   | Last Saturday in April through November 15. Minimum size limit: 14" total length. Only artificial lures with barbless hooks may be used. | 2 trout |
|  | November 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.              | 0 trout |
| Truckee River from the Glenshire Bridge downstream to the mouth of Prosser Creek.  | Last Saturday in April through November 15. Minimum size limit: 14" total length. Only artificial flies with barbless hooks may be used. | 2 trout |
|  | November 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.              | 0 trout |
| Truckee River from the mouth of Prosser Creek downstream to the Nevada State Line.   | Last Saturday in April through November 15. Minimum size limit: 14" total length. Only artificial flies with barbless hooks may be used. | 2 trout |
|  | November 16 through the Friday preceding the last Saturday in April. Only artificial lures with barbless hooks may be used.              | 0 trout |

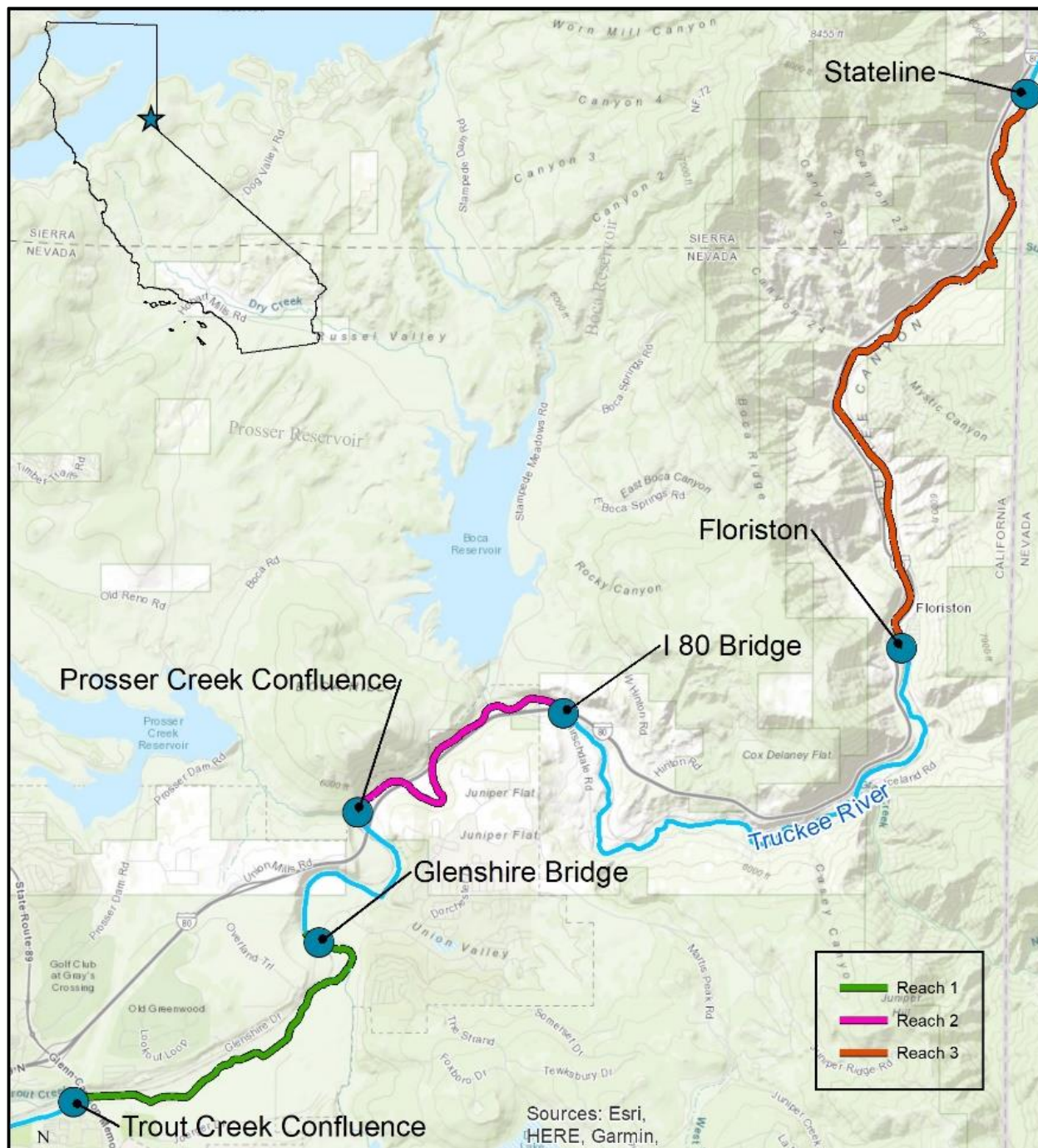
## Methods

In 2021, we implemented a roving-roving creel survey on the HWT section of the Truckee River to estimate the status of the sports fishery, angler catch rate, harvest, potential impacts of the 2020 angling regulations, angler satisfaction with the fishery, and angler satisfaction with the 2020 angling regulations. Our survey design largely followed the methods used in the *Angler Effort and Catch in the Truckee River During the Summer of 2008* (Hanson 2012) with two notable differences, discussed below.

We followed Hanson (2012) and defined three survey reaches using the delineations within the historic (pre-2020) angling regulations on the Truckee River (**Table 2**). Ultimately, we had to deviate from Hanson (2012) and amend the reaches because of access issues related to a local private property dispute. Because the issue was polarizing to local landowners and anglers alike, we decided it was best to exclude those sections from the survey. **Figure 3** displays the amended survey reaches we used for the 2021 and 2022 Truckee River creel surveys. All three survey reaches are on public land, with foot access to the Truckee River, and have special angling regulations. Reach 1 extends from the Highway 267 bridge downstream to the Glenshire Bridge and is open to catch-and-release fly fishing all year with barbless hooks (**Table 1**). Reach 2 extends from the confluence of Prosser Creek downstream to the Interstate 80 bridge at Hirschdale Road. Reach 3 begins at the Interstate 80 bridge at Floriston Way Road and continues downstream to the Nevada State line. Reaches 2 and 3 require artificial lures year-round, barbed hooks and two fish per day harvest during the summer season, and catch-and-release with barbless hooks during the winter season (**Table 1**).

In 2022, we surveyed the Truckee River several times a month from February 1, 2022, to October 26, 2022. We stratified survey periods by “Weekday” (M–Th, excluding national holidays) or “Weekend & Holiday” (F–Su and national holidays), and “Morning” (0900 to 1700) or “Evening” (1300 to 2100) time periods. We randomly selected survey periods and survey reaches, with the goal of eight “Weekday” and four “Weekend & Holiday” surveys per calendar month during months of high recreational use, from May to September. We surveyed less frequently during winter and shoulder season months when there is less recreational use of the Truckee River. To accommodate the drive time from CDFW Region 2 Headquarters in Rancho Cordova, California to the Truckee River field sites, the first survey period of the week was always an “Evening” survey, while the last survey of the week was always a “Morning” survey. In some instances, we had to cancel survey days or adjust a survey period from its randomly determined date to accommodate a 40-hour per week work schedule, field staff safety, wildfire-related concerns, and/or other CDFW priorities.

During a survey, we noted weather conditions, water, and air temperatures, and counted anglers actively fishing within the survey reach three to five times spaced equally in time across the survey period. We approached and interviewed anglers at the end of their fishing day whenever possible. We asked each angler: the amount of time spent fishing; type



**Figure 3.** Map of the 2021 and 2022 CDFW delineated creel survey reaches on the Heritage and Wild Trout designated section of the mainstem Truckee River from the confluence of Trout Creek to the Nevada State line. Survey Reach 1 extends from the confluence with Trout Creek downstream to the Glenshire Bridge and is displayed with a green line. Reach 2 is from the confluence with Prosser Creek downstream to the Interstate 80 bridge and is denoted with a pink line. Reach 3 begins at Floriston, ends at the Nevada State line, and is displayed with an orange line. Teal dots denote the location of river features referenced in the survey reach delineations.

of gear used; number, species, size, and harvest of any fish caught; home zip code; and seven satisfaction questions. The satisfaction questions attempt to capture the angler’s opinion of the fishery and the 2020 fishing regulation amendments. The angler is asked whether they are “very satisfied”; “satisfied”; “neutral”; “unsatisfied”; or “very unsatisfied” with the:

1. “overall angling experience”;
2. “size of fish caught”;
3. “number of fish caught”;
4. “year-round, barbless fly between Trout Creek and Prosser Creek”;
5. “year-round, zero bag limit between Trout Creek and Prosser Creek”;
6. “last Saturday in April through November 15, two fish limit between Prosser Creek and Stateline”;
7. “last Saturday in April through November 15, barbed hooks allowed between Prosser Creek and Stateline”

Staff recorded the angler’s answers as a numerical value of +2 (*very satisfied*), +1 (*satisfied*), 0 (*neutral*), -1 (*unsatisfied*), or -2 (*very unsatisfied*).

We estimated total angler effort and total catch using the methods for Roving-Roving creel surveys laid out in *Angler Survey Methods and their Applications in Fisheries Management* (Pollock, Jones & Brown 1994) for each of May, June, July, August, and September.

We estimated total angler effort by:

$$\hat{E} = \sum_{i=1}^n (\hat{e}_i / \pi^i)$$

Where:

$\hat{E}$  = Estimated total angling effort for a survey period

$\hat{e}_i$  = Sample period angling effort =  $\bar{I}_i \times T$

$\bar{I}_i$  = Daily average of angler counts

$T$  = Length of the survey period = 6 hours

$\pi^i$  = Total probability that fishing period  $i$  is included in the sample =  $\pi^1 * \pi^2 * \pi^3$

$\pi^1$  = probability a reach is included in the sample = 1/3

$\pi^2$  = probability that fishing period is included in the sample period = sample period / fishing period = 6/12 = 1/2

$\pi^3$  = probability that fishing period is included in the sample day =  $n_i / N_i$

$n_i$  = number of weekdays or weekend/holiday days sampled within a given month

$N_i$  = number of weekdays or weekend/holidays days within a given month

We estimated total catch by:

$$\hat{C} = \hat{E} \times \hat{R}_2$$

Where:

$\hat{C}$  = Estimated total catch for a survey period

$\hat{E}$  = Estimated total angling effort for a survey period

$\hat{R}_2$  = Average catch rate of trips  $\frac{1}{2}$  hour in length, or greater =  $\frac{\sum_{i=1}^n c_i \cdot L_i}{n}$

$c_i$  = catch of an individual angler

$L_i$  = length of fishing trip



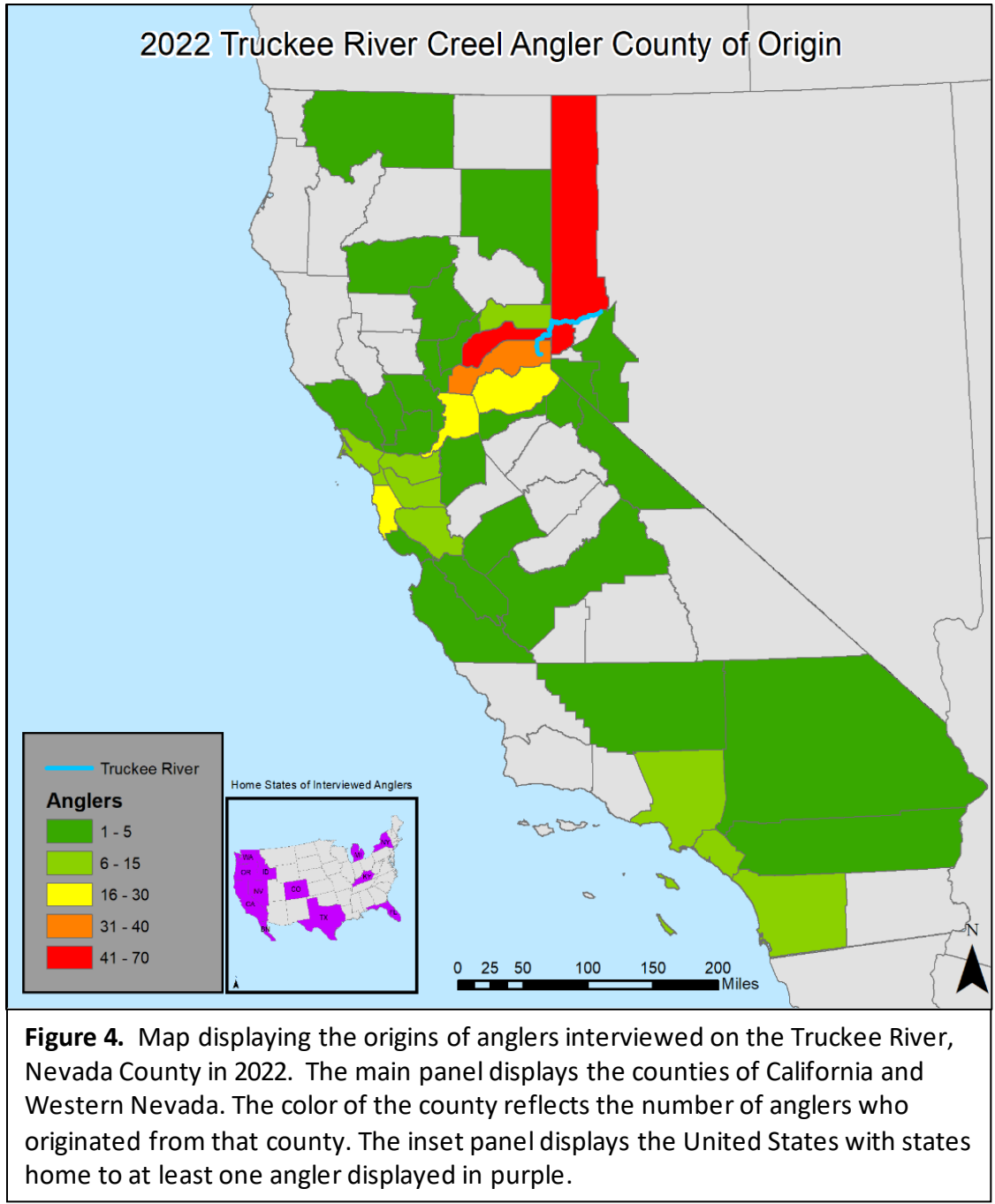
## Results

We surveyed the HWT section of the Truckee River 70 times and conducted 420 angler interviews, from February 2022 to October 2022. **Table 3** summarizes the number of survey days for each survey reach and strata by month. Most survey days (81%; n = 56) were within the study’s focus period of May to September. However, we did not meet the goal of eight “Weekday” and four “Weekend & Holiday” surveys for July, August, and September. We cancelled or rescheduled several survey days because staff were needed for other high priority CDFW projects.

|                    | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Totals    |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------|
| <b>Survey Days</b> | 4   | 2   | 2   | 14  | 15  | 12  | 9   | 7   | 5   | <b>70</b> |
| <i>Reach 1</i>     | 0   | 1   | 0   | 5   | 5   | 2   | 2   | 3   | 3   | <b>21</b> |
| <i>Reach 2</i>     | 2   | 1   | 1   | 5   | 4   | 4   | 3   | 2   | 1   | <b>23</b> |
| <i>Reach 3</i>     | 2   | 0   | 1   | 4   | 6   | 6   | 4   | 2   | 1   | <b>26</b> |
| <i>WD</i>          | 3   | 1   | 0   | 9   | 10  | 7   | 7   | 6   | 4   | <b>47</b> |
| <i>WE/H</i>        | 1   | 1   | 2   | 5   | 5   | 5   | 2   | 1   | 1   | <b>23</b> |
| <i>AM</i>          | 4   | 1   | 0   | 8   | 6   | 6   | 4   | 1   | 3   | <b>33</b> |
| <i>PM</i>          | 0   | 1   | 2   | 6   | 9   | 6   | 5   | 6   | 2   | <b>37</b> |

Of the 420 anglers we interviewed, 325 anglers were from California, 94 were from out-of-state, and one angler was from Mexico. California anglers traveled from 33 of the 58 counties in California (**Figure 4**). Most out-of-state anglers (63.8%; n = 60) were from nearby Washoe County, Nevada. In total, out-of-state anglers traveled from ten states. Nearly half of anglers (47.4%; n = 199) were from counties closest to the Truckee River (Nevada, Sierra, Placer, El Dorado, and Washoe). Bay Area counties (San Mateo, San Francisco, Marin, Alameda, and Contra Costa) accounted for 16.2% (n = 68) of anglers. Southern California was home to 7.6% (n = 32) of anglers, as was the Sacramento Valley.

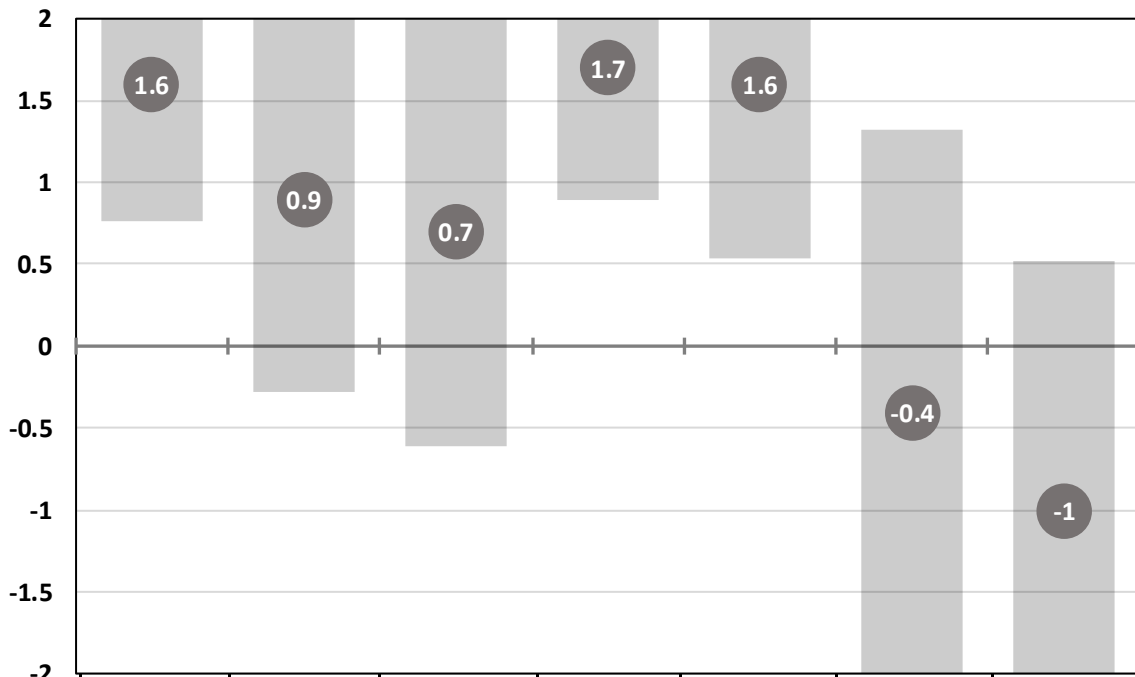
Three hundred and ninety anglers answered at least one satisfaction question. Angler’s responses to the satisfaction questions were consistent across all reaches and strata. **Figure 5** summarizes the satisfaction question results for the 2022 Truckee River creel survey. Anglers were satisfied with the Truckee River fishery – satisfaction for “*overall angling experience*” was overwhelmingly positive and had the least variability in responses. Angler satisfaction with “*size of fish caught*” and “*number of fish caught*” was positive on average. Satisfaction with the current fishing regulations was more mixed. “*Year-round, barbless fly regulation for sections 1 and 2*” and “*year-round, zero bag limit regulation for sections 1 and 2*” were very well received while the “*summer, two fish limit regulation for section 3*” and “*summer, barbed hooks allowed*”



*regulation for section 3"* were not well received, on average, and had the most variability in responses.

The 420 anglers we interviewed reported catching and releasing 590 fish over 1,372 angling hours for a total average catch rate (CPUE) of 0.43 fish per hour (**Table 5**). Most of the anglers we interviewed used fly-fishing gear (90.7%; n = 381). Fly anglers reported catching 539 fish over 1,274 hours for a catch rate of 0.42 fish per hour. While lure anglers (9.3%; n = 39) reported catching 51 fish over 98.25 hours for a catch rate of 0.52 fish per hour.

**2022 Angler Satisfaction Survey Results  
Truckee River, Nevada Co.**



|                  | Overall Experience | Size of Fish | Number of Fish | Barbless Fly Reg. | Zero Bag Limit | Summer 2 Fish Limit | Barbs in Summer |
|------------------|--------------------|--------------|----------------|-------------------|----------------|---------------------|-----------------|
| <i>Mean</i>      | 1.6                | 0.9          | 0.7            | 1.7               | 1.6            | -0.4                | -1              |
| <i>Std. Dev.</i> | 0.8                | 1.2          | 1.3            | 0.8               | 1.1            | 1.7                 | 1.5             |
| <i>Mode</i>      | 2                  | 2            | 2              | 2                 | 2              | -2                  | -2              |
| <i>Responses</i> | 390                | 223          | 258            | 386               | 381            | 384                 | 386             |

**Figure 5.** Summary of 2022 angler satisfaction data for the Truckee River, Nevada County. The x-axis displays the satisfaction questions asked each angler during an interview. The y-axis displays the possible answers to each question from 2 (Very Satisfied) to -2 (Very Unsatisfied). The graph displays the mean (dark circles and white lettering) and standard deviation (gray bars) of the answers for each question.

**Table 5. 2022 Angler Catch Rate by Gear Type for the Truckee River, Nevada County.**

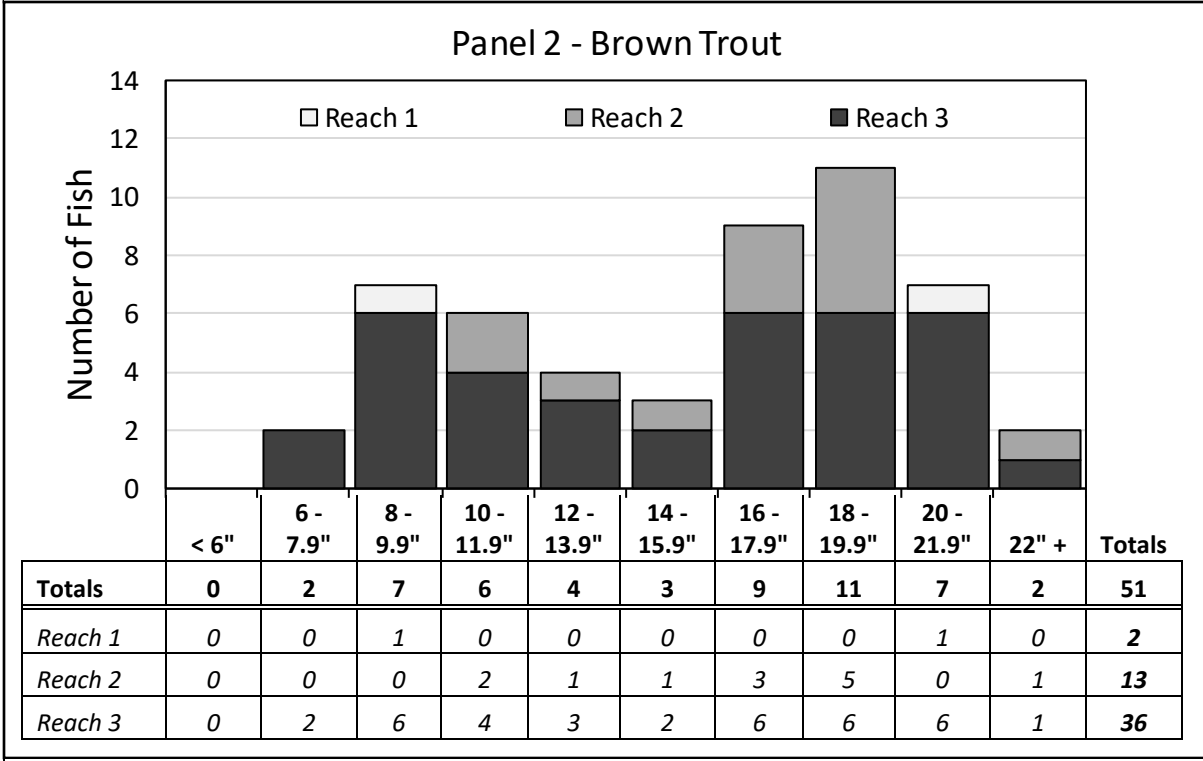
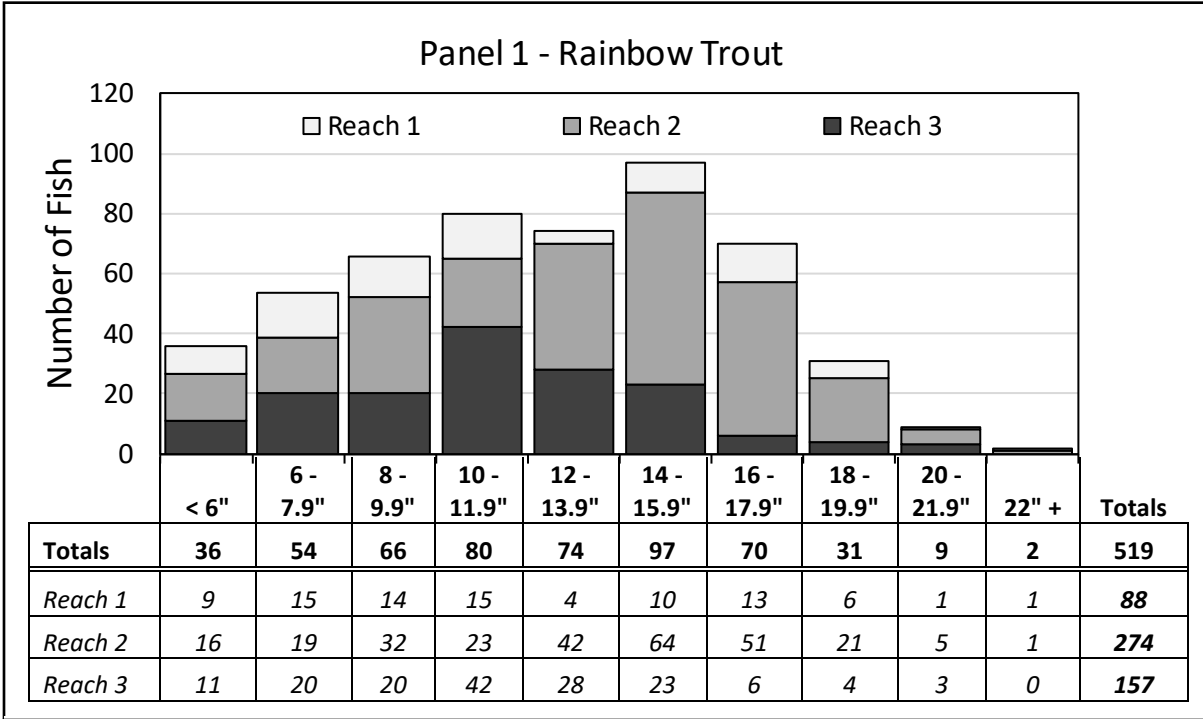
|               | Anglers    | Hours        | Catch      | Catch Rate  |
|---------------|------------|--------------|------------|-------------|
| <i>Fly</i>    | 381        | 1,274        | 539        | 0.42        |
| <i>Lure</i>   | 39         | 98           | 51         | 0.52        |
| <b>Totals</b> | <b>420</b> | <b>1,372</b> | <b>590</b> | <b>0.43</b> |

Of the 590 fish caught, RT was the most frequently caught species and accounted for 87.9% of the catch (n = 519), followed by BN (8.6%; n = 51), and Mountain Whitefish (*Prosopium williamsoni*; MF) (3.4%; n = 20). Rainbow Trout ranged in size from less than 6 inches in length to greater than 22 inches in length (**Figure 6, Panel 1**). The modal RT size class was 14 to 15.9 inches in total length (18.7%; n = 97). Most of the RT landed were between 10 and 17.9 inches in total length (61.8%; n = 321) and were caught in Reach 2 (52.8%; n = 274). Trophy-sized fish, 18-inches in total length or greater, accounted for 8.1% (n = 42) of the RT catch.

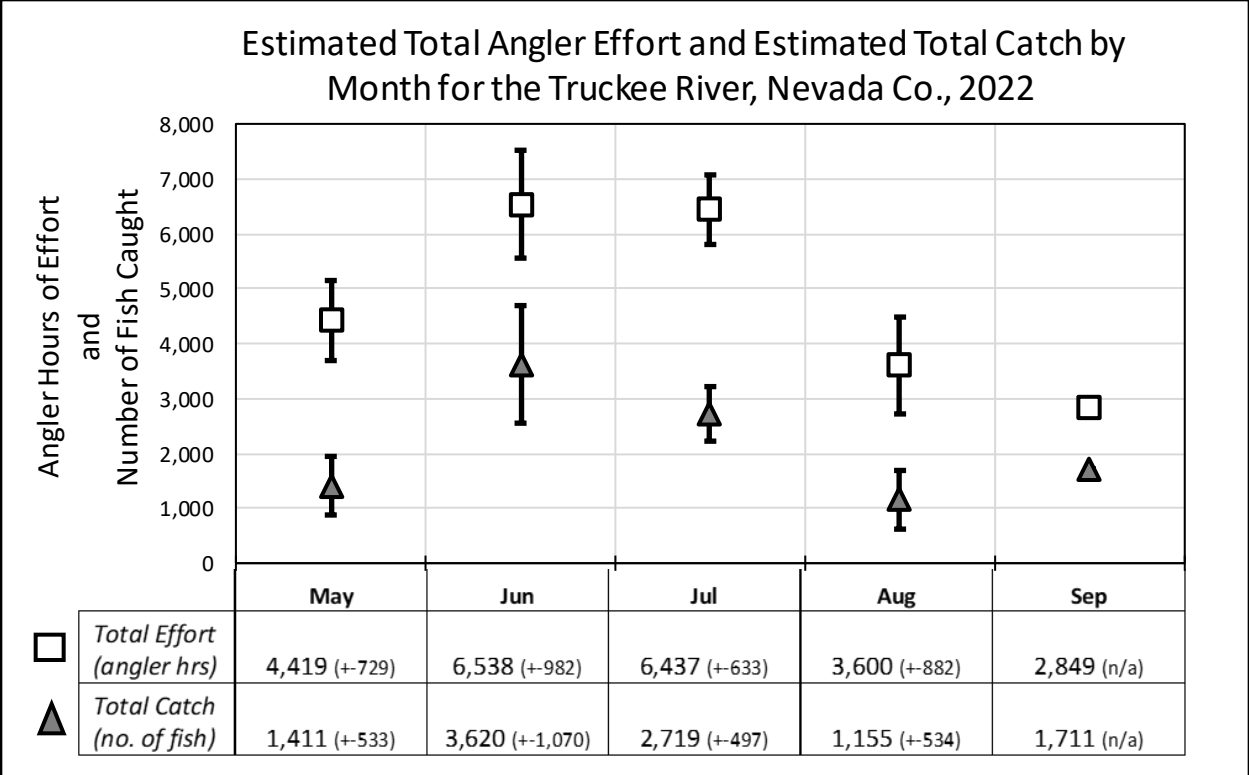
Anglers reported 51 BN caught, or 8.6% of the total catch. BN ranged in size from six inches in length to greater than 22 inches in length (**Figure 6, Panel 2**). The modal BN size class was 18 to 19.9 inches in total length (21.6%; n = 11). Over half of the BN landed were between 16 and 21.9 inches in length (52.9%; n = 27) and were caught in Reach 3 (70.6%; n = 36). Trophy-sized fish 18 inches in total length, or greater, accounted for 39.2 % (n = 20) of the BN catch.

**Figure 7** displays the reported catch and CPUE by month, reach, and strata. June had the highest reported catch (32%; n = 189), while July had the highest catch rate (0.62 fish/hour). Nearly half of the reported catch was landed in Reach 2 (49.6%; n = 298). More fish were caught on weekdays than during weekends or holidays (58%; n = 342). Finally, slightly more fish were caught during PM surveys (54%; n = 318) than AM surveys (46%; n = 272).

**Figure 8** displays the estimated total angler effort and estimated total catch by month for the 153-day focus period of the survey (May– September). The estimates for September are plagued by insufficient samples of the “Weekend and Holiday” strata for that month, and as a result we cannot calculate standard errors. Therefore, we exclude September from the summary presented in this paragraph and address it in more detail in the [Discussion](#) section below. Anglers spent an estimated 20,994 hours ( $\pm 3,226$ ) fishing the HWT section of the Truckee River during the 123-day period of May to August 2022. An estimated 10,617 fish were landed ( $\pm 2,635$ ) during that same period. June experienced the most estimated angling effort (31%; n = 6,538) and the most estimated fish caught (40.6%; n = 3,620). Collectively, a significant majority of the estimated angling effort (61.8%; n = 12,975) and estimated catch (71%; n = 6,339) occurred in June and July.



**Figure 6.** Length frequency histogram of Rainbow Trout (Panel 1) and Brown Trout (Panel 2) caught on the Truckee River, Nevada Co., in 2022. The x-axis displays total fish length organized into 10 size classes. The y-axis displays the number of fish caught within each size class. The white bars represent the number of fish caught in Reach 1, while light gray bars represent Reach 2, and dark gray bars represent Reach 3.



**Figure 8.** Estimated total angler effort (open squares) and estimated total catch (closed triangles) for the HWT section of the Truckee River, Nevada Co., in 2022. The x-axis displays each month, while the y-axis displays angler hours of effort (open squares) and the number of fish caught (closed triangles). Vertical whiskers represent the standard error of a given estimate. Standard errors could not be calculated for September’s estimates due to insufficient number of surveys within the “Weekend and Holiday” strata for the month.

**Discussion**

The results of our 2022 creel survey of the Truckee River characterize a catch-and-release trophy trout fishery popular with fly anglers. Anglers were predominantly *very satisfied* with the overall angling experience (sample mean  $[\bar{x}] = 1.6$ ) and *satisfied* with the size ( $\bar{x} = 0.9$ ) and number of fish ( $\bar{x} = 0.7$ ) (**Figure 5**). Anglers reported landing 590 fish and 62 (10.5%) were trophy-sized: 18-inches in total length, or greater (**Figure 6**). We acknowledge that private stocking of trophy-sized RT into the Truckee River between Reaches 1 and 2 may have muddled the catch data of trophy-sized RT for those reaches. Anglers overwhelmingly used fly fishing gear (90.7%; n = 381) and practiced catch-and-release. All 590 fish landed were released, despite the 2-trout bag limit from the last Saturday in April to November 15 from Prosser Creek to the Stateline. These observations are consistent with other angler surveys conducted on the

Truckee River (Hanson 2012; CDFW 2014; Onanian 2015). Anglers traveled from 10 States, 38 California counties, and Mexico to fish the Truckee River. About half (47.4%;  $n = 199$ ) of the anglers contacted in 2022 were local and live in a county adjacent to the Truckee River. Roughly 20% more anglers were from out-of-town in 2022 compared to CDFW's 2008 Truckee River creel survey (Hanson 2012).

We found angler satisfaction with the current Truckee River fishing regulations (**Tables 1 & 2**) was mixed. Anglers were *very satisfied* ( $\bar{x} = 1.7$ ) with the year-round, barbless fly, and zero bag limit ( $\bar{x} = 1.6$ ) regulations between Trout Creek and Prosser Creek (**Figure 5**). This is not surprising given that greater than 96% of interviewed anglers used fly fishing gear and all interviewed anglers practiced catch-and-release. However, anglers were *unsatisfied* with regulations from Prosser Creek to the Stateline that allow for barbed hooks ( $\bar{x} = -1.0$ ) and the harvest of two fish ( $\bar{x} = -0.4$ ) from the last Saturday in April through November 15. The modal response for both questions was  $-2$  (*very unsatisfied*), while the standard deviations were the largest of any of the questions, 1.7 and 1.5 respectively. The unpopularity is not surprising given that all interviewed anglers practiced catch-and-release. The large standard deviation in responses suggest that there is a plurality of anglers who are *neutral* or *satisfied* with the current regulations and don't mind others harvesting fish with barbed hooks, even though they themselves likely practice catch-and-release. Ultimately, we did not observe any significant changes in the behavior of Truckee River anglers due to the new 2020 angling regulations. Reported harvest has been very low to negligible since at least 2003 (Onanian 2015) and we can expect that trend to continue for the foreseeable future. We might expect catch rate and post-hook mortality to increase slightly in the reaches of the Truckee River where barbed hooks are allowed. However, we believe these increases are likely to be very modest, since most anglers used barbless flies regardless of the regulations.

We organized fish size data into size class distributions for the reported catch of RT and BN in **Figure 6**. The resultant plots are representative of healthy, sustainable, naturally reproducing trout populations. Rainbow Trout size class data (**Figure 6, Panel 1**) plot as a bell curve and suggest that natural reproduction and recruitment is relatively consistent year to year. Size class data for BN (**Figure 6, Panel 2**) plot as a bi-modal distribution and suggest that BN spawning success and/or recruitment success is more variable from year to year than RT.

The pattern of RT size classes is somewhat different from the CDFW's 2014 Truckee River fish population assessment (CDFW 2014). The size class data collected during that electrofishing survey demonstrate distinct cohorts of adult RT indicative of intermittent spawning or recruitment success. We think two significant factors may contribute to these observed differences in pattern. Firstly, the 2014 survey was conducted amidst a historic severe drought. From 2012 to 2016, California experienced the driest period in its recorded history (Wang et al. 2017). Secondly, in December 2015, the Truckee River Operating Agreement (TROA) was implemented. The new agreement facilitated water transfers between reservoirs,

nuanced water releases, and improved ramping rates for the benefit of Truckee River fish and wildlife.

However, in practice, the Truckee River is a catch-and-release fishery and, as a result, fish size data we collected in the 2022 Truckee River creel have several potential issues. We conducted most interviews (70.0%; n = 294) after the angler completed their fishing trip and anglers recalled from memory the size of fish they caught. In addition, each reported fish landed is not necessarily discrete, as it may have been previously landed and released. We intend to conduct a population assessment on the Truckee River in Fall of 2024. The fish size data collected during that effort will provide a more accurate assessment of the population structure of Truckee River trout than this creel survey.

We calculated monthly estimates of total angling effort and total catch for the study's focus period of May through September. However, we were unable to meet the objective of eight "Weekday" surveys and four "Weekend or Holiday" surveys for the months of July, August, and September (**Table 3**). August and September were particularly challenging, as we were directed to other priority projects: namely the Silver Creek Lahontan Cutthroat Trout restoration project; Silver King Creek Paiute Cutthroat Trout restoration project; and the 2022 Heenan Lake creel survey. As a result, we under-sampled the "Weekend or Holiday" strata in August, and conducted only one "Weekend or Holiday" survey in September. Therefore, we cannot calculate standard deviation and standard errors for September. Due to these complications, we excluded September, and we consider May through August for the remainder of this analysis.

We estimated that anglers spent 20,994 hours ( $\pm 3,226$ ) fishing the surveyed reaches of the Truckee River during the 123-day period of May 1 to August 31, 2022. We estimated 10,617 fish were landed ( $\pm 2,635$ ) during that same period. The month of June had the highest estimates of angling effort (31%; n = 6,538) and fish caught (40.6%; n = 3,620). Collectively, June and July accounted for a significant majority of the total angling effort (61.8%; n = 12,975) and total catch (71%; n = 6,339).

CDFW has conducted similar creel surveys on the Truckee River in 2008 and 2021, and collected voluntary angler surveys at two boxes installed at fixed locations. At the time of writing, the 2008 Truckee River creel survey (Hanson 2012), the 2014 Truckee River electrofishing survey (CDFW 2014), and the Truckee River Angler Survey Box Analysis 2003–2014 (Onanian 2015) were analyzed and available for comparison. Hanson (2012) estimated 193 angler hours and 109 landings per day for the 2008 Truckee River creel. While our 2022 estimates are 171 angler hours ( $\pm 26$ ) and 86 landings ( $\pm 21$ ) per day. Our estimates are surprisingly lower than the 2008 estimates, albeit within the margin of error. Intuitively, we expected the total angler effort to be higher in 2022 than in 2008. However, we suspect that angler effort was higher in 2022 when compared with 2008. Our 2022 estimates are roughly equivalent (within a margin of error) to the 2008 estimates, but the 2008 survey covered a larger portion of the Truckee River because we excluded a significant reach of the Truckee River



in the 2022 survey, the reasons for which we discussed previously. If we had included that reach, we believe total effort and total catch estimates would be significantly higher than in 2008.

Continuing with the comparison to Hanson 2012, anglers reported fishing for 1.2 hours longer, on average, in 2022 ( $\bar{x} = 3.3$ ) than in 2008 ( $\bar{x} = 2.1$ ). The modal size class of landed RT is 4-inches larger in 2022 compared to 2008, and 6-inches larger for BN. However, the overall catch rate in 2022 ( $\bar{x} = 0.41$ ) is about one third lower than what was reported in 2008 ( $\bar{x} = 0.60$ ) and Onanian 2015 ( $\bar{x} = 0.69$ ). We would have liked to compare these catch rates against recent Angler Survey Box data and the 2021 Truckee River creel. Unfortunately, those analyses were not available at the time of writing. While not the only explanation, the observed decline in catch rate and increase in modal fish size could be indicative of changes in the population structure and/or distribution of Truckee River trout. We intend to conduct population assessments on the Truckee River in Fall of 2024. We will then have the ability to compare that planned survey against the 2014 Truckee River electrofishing survey (CDFW 2014) and investigate for any such changes.

Hanson (2012) discusses the challenges of implementing a Roving-Roving survey design during the 2008 Truckee River creel. Specifically, roving instantaneous angler counts were particularly challenging, given the length of the Truckee River and the distance between access points. We experienced similar challenges during the 2022 Truckee River creel survey. Some challenges faced in 2008, we were able to overcome. For example, we surveyed a single survey reach within a survey day as opposed to surveying all three reaches within a survey day. As a result, we had a high interview capture rate and an angler count method that meets the expectations of an instantaneous count. However, we struggled with consistently fitting the intermittent and patchy workload of the creel into manageable 40-hour work week periods. As a result, we were not able to schedule a consistent creel survey effort across the 5-month focus period. Staffing and logistics posed challenges for our angler counts, as well. Since we did not have a consistent place to stay overnight, we often had to conduct survey days as day trips to and from CDFW Region 2 Headquarters in Rancho Cordova, CA. This added four hours of drive time to our workday and made it challenging to stick to a strict randomly selected schedule of angler counts. Similarly, when a single staff conducted the creel survey, we found it challenging to maintain a high interview capture rate and stick to a strict randomly selected schedule of angler counts. We typically erred towards more interviews when faced with that situation. For the remainder of this report, we offer protocol and scheduling recommendations to minimize challenges during implementation and analysis, and ultimately generate better estimates of total angling effort and total catch.

## **Recommendations**

- We recommend that future Truckee River creel surveys gather angler interviews and catch rate data using the bus route method of access point creel surveys (Pollock, Jones & Brown

1994) and move away from the survey reach based roving design CDFW has used historically. To do so, each access point included in the creel survey must be identified, mapped, and assigned to a route. We believe that the access points will lump into two or three bus routes and each route can be surveyed within a survey day and will be roughly spatially analogous to the survey reaches used historically. If so, our recommended survey reach weights (see below) would be applicable to the bus routes.

- We recommend that future Truckee River angler counts use time interval counts (Pollock, Jones & Brown 1994) when implementing a bus route access point creel survey. With this method, a single surveyor can collect angler counts without sacrificing interviews. We believe this will be more efficient and achieve similar precision than the roving-roving design used historically. Interval counts will work particularly well in survey Reaches 2 and 3, where many access points are used almost exclusively by anglers.
- We recommend that angler count surveys be conducted more frequently, and not necessarily alongside angler interview efforts. Angler count surveys can be implemented cheaply using a single surveyor, and the data collected can be used to estimate total angling effort and monitor the increasing angler effort on the Truckee River.
- In situations where a single surveyor can conduct angler counts without needing to conduct interviews, we recommend an instantaneous roving count. We believe that well-planned roving angler counts within a single survey reach or bus route can easily meet the expectations of an instantaneous count. To improve the precision of instantaneous angler counts compared to earlier efforts, we recommend a dedicated staff member and vehicle, conducting at least three angler counts per day at randomized start times, access points, and direction of travel.
- We recommend future Truckee River creel surveys include the reach that we excluded in 2022. Specifically, the reach between the Interstate 80 bridge at Hirschdale Road and the Interstate 80 bridge at Floriston Way accessible from Hirschdale Road and Iceland Road.
- We recommend surveying the entire fishing period, sunrise to sunset, to maximize survey effort and minimize travel time and lodging expenses. During summer months, when days are upwards of 15 hours long, this may only be possible with two staff working separate shifts – morning and evening.
- If whole day surveys are impractical, we recommend work shifts are of equal length and do not overlap. Consider conducting whole day surveys initially for a short period of time, for instance the first week of a month-long survey. The angling effort data collected during whole day surveys can be used to inform weights for time-of-day strata that can be applied to the remainder of the creel survey.
- We recommend CDFW provide overnight lodging (campground or motel) to the survey crew. Overnight lodging is necessary to facilitate work shifts across the entire fishing period. For example, sunrise in Truckee, CA in June is approximately 5:30 AM and sunset is roughly 8:30 PM. Adding drive time to and from CDFW Region 2 Headquarters in Rancho Cordova, CA to these potential start and end times is unreasonable.

- When multiple survey staff are surveying the Truckee River during the same work shift, we recommend all surveyors have an individual vehicle. This will decrease conflicts between angler counts and interviews, increase worker safety, and facilitate efficiencies not possible with a single vehicle.
- If only a single surveyor is available, we recommend an access-access creel survey using the bus route method and interval counts. Stratify by “weekday” and “weekend & holiday” and by bus route. Avoid time-of-day strata, if possible, or pre-survey angler counts with whole day surveys beforehand to appropriately weight the time-of-day strata.
- If two surveyors are available, we recommend a roving-access creel survey using the bus route method for interviews and catch rate data and roving instantaneous counts for effort data. Stratify as above. During a survey day, one surveyor conducts interviews within a randomly selected bus route, while the other conducts multiple random instantaneous angler counts across all bus routes.
- If three surveyors are available, we recommend independent access-access creel surveys with interval counts on each bus route. In this case, do not stratify by bus route. Instead for each survey day, all three bus routes will be surveyed, each by a single surveyor.
- If four surveyors are available, we recommend independent roving-access creel surveys on each bus route. In this case, for each survey day, all three bus routes are surveyed by a single surveyor, while instantaneous roving angler counts are handled by the fourth staff member, who conducts multiple angler counts for all bus routes.
- We calculated the average angler count per survey day for each stratum for the focus period of May through August 2022. We used relative proportions of average angler count per day to recommend the following probabilistic weights for the summer months on the Truckee River: Weekday, 40%; Weekend & Holiday, 60%; Reach 1, 40%; Reach 2, 30%; and Reach 3, 25%. We are unable to recommend weights for “Morning” and “Evening” strata because our survey days rarely met the definitions of either stratum.

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