

2025 Upper Deschutes River Mitigation and Enhancement Annual Report



PREPARED BY J. BEN STOUT

MITIGATION AND ENHANCEMENT BIOLOGIST

OREGON DEPARTMENT OF FISH AND WILDLIFE - DESCHUTES WATERSHED DISTRICT

61374 PARRELL ROAD - BEND, OREGON 97702

REPORT UPDATED: 4/22/26



Table of Contents

Executive Summary.....	3
Purpose	5
Background	5
Upper Deschutes River Fish Monitoring	11
Methods.....	11
Results.....	13
Discussion.....	26
Upper Deschutes River Spawning Ground Surveys	30
Methods.....	30
Results.....	30
Discussion.....	31
Macroinvertebrate Sampling	33
Methods.....	33
Juvenile Trout Young-of-the-Year Population Abundance Estimates.....	37
Methods.....	37
Results.....	38
Discussion.....	42
Surface Water Temperature Monitoring.....	44
Methods.....	44
Results.....	47
Discussion.....	48
Off Channel Habitat Monitoring	50
Methods.....	51
Discussion.....	53
Other Deschutes Basin Activities	53
2026 Work Plan.....	55
References	56

List of Tables and Figures

Tables

Table 1. Minimum reservoir storage and percent of overall storage capacity for Wickiup Reservoir, 2018-2025.	10
Table 2. Redd counts for Brown and Redband Trout for the Deschutes River below Wickiup Dam and Fall River, 2021-2025.	31
Table 3. Benthic macroinvertebrate sampling locations in the upper Deschutes River basin, 2021-2025.	36
Table 4. Juvenile trout bank margin sampling locations on the upper Deschutes River, 2021-2025.	40
Table 5. Station ID and Location of HOBO water temperature loggers deployed by ODFW, 2025.	47

Figures

Figure 1. Crane Prairie Reservoir storage (acre feet), 2018-2025. Reservoir capacity is 50,000-acre feet. .	8
Figure 2. Discharge cubic-feet-per-second (cfs) from Crane Prairie Reservoir, 2018-2025.	8
Figure 3. Wickiup Reservoir storage (acre feet) from 2018-2025. Reservoir capacity is 200,000-acre feet.	9
Figure 4. Discharge cubic-feet-per-second (cfs) from Wickiup Reservoir into the Deschutes River from 2018-2025.	9
Figure 5. Locations of upper Deschutes fish monitoring reaches, 2025.	16
Figure 6. Estimated abundances of Redband Trout and Brown Trout in the upper Deschutes River in fall of 2025.	17
Figure 7. Fish condition (K factor) in the Bull Bend and Wickiup reaches of the Deschutes River in 2025.	18
Figure 8. Length distribution by fish species for electrofishing on the upper Deschutes River in fall of 2025.	19
Figure 9. Length-frequency distributions of Redband and Brown Trout caught electrofishing on the upper Deschutes River downstream of Wickiup Reservoir in fall 2025.	20
Figure 10. Fulton’s K Factor by length in mm for Redband and Brown Trout (>200mm in length) caught electrofishing on the upper Deschutes River downstream of Wickiup Reservoir in fall 2025.	21
Figure 11. Length-frequency distributions of Redband and Brown Trout caught electrofishing on the upper Deschutes River in the Bull Bend reach in fall 2025.	22
Figure 12. Fulton’s K Factor distribution by length in mm for Redband and Brown Trout (>200mm in length) caught electrofishing on the upper Deschutes River in the Bull Bend reach in fall 2025.	23
Figure 13. Length-frequency distributions of Mountain Whitefish caught electrofishing on the upper Deschutes River downstream of Wickiup Reservoir, 2025.	24
Figure 14. Fulton’s K Factor distribution for Mountain Whitefish (>200mm in length) caught electrofishing on the upper Deschutes River in fall 2025.	25
Figure 15. Locations of macroinvertebrate monitoring sites in the Deschutes River basin, 2021-2025.	35
Figure 16. Juvenile trout length distribution by species and site location on the Deschutes River, 2021-2025.	39
Figure 17. Estimates of juvenile trout-per-mile for one bank from mainstem margin electrofishing of the mainstem of the Deschutes River in 2021-2025.	41
Figure 18. Species composition of young of year trout in the Deschutes River, 2021-2025.	42

Figure 19. Temperature logger locations for governmental agencies and non-governmental organizations in the Deschutes River basin. 46

Figure 20. Daily maximum water temperature on the Deschutes River and tributaries, April-August 2025. 49

Figure 21. Locations of off-channel habitat sampling on the Deschutes River, 2025-2026. 52

Executive Summary

Background

The 2025 Upper Deschutes River Mitigation and Enhancement (M&E) Annual Report details biological investigations and monitoring conducted by the Oregon Department of Fish and Wildlife (ODFW) M&E Biologist, J. Ben Stout. In 2025 the position was jointly funded by the Central Oregon Irrigation District (COID) mitigation fund for the Siphon Hydroelectric Project and additional funding obtained in partnership with the Upper Deschutes Watershed Council from an Oregon Watershed Enhancement Board (OWEB) monitoring grant.

The upper Deschutes River flow regime is heavily regulated by Crane Prairie and Wickiup reservoirs to supply irrigation water. Historically, the river maintained extremely stable flows driven by spring and groundwater inputs. Current management creates a seasonally reversed hydrograph, characterized by high summer flows (1,400 to 1,600 cfs between Wickiup Reservoir and Bend) and very low winter releases (currently ~100 cfs). The altered hydrograph has caused bank erosion, sedimentation, riparian habitat loss, and severely impacted fish habitat.

Phase 1 of the Deschutes Basin Habitat Conservation Plan is currently being implemented including conservation measures to increase minimum winter flows below Wickiup Dam incrementally over 30 years. Minimum flows are targeted at 100 cfs during years 1–7 (the current phase), increasing to 300 cfs in 2028 and eventually 400–500 cfs in later phases. The M&E monitoring will help provide documentation of the status of fish populations, macroinvertebrates, and water quality relative to flow restoration efforts.

Water storage in Wickiup Reservoir continues to fluctuate drastically, although 2025 saw 33 percent of the storage volume remain at the end of the irrigation season, an increase from previous severe drawdowns (e.g., 1.3% in 2018).

Key Findings from 2025 Monitoring

Upper Deschutes Fish Monitoring

In fall 2025, sampling rigor was increased, and a mark-recapture design was used to estimate trout abundance in two, one-mile reaches. Redband Trout and Brown Trout had higher abundances, higher condition factors, and larger fish in the reach directly below Wickiup Reservoir compared to the reach near Bull Bend. However, the Bull Bend reach had larger numbers of juvenile trout than the Wickiup reach.

Brown Trout are the dominant trout species in the sampled reaches. The abundance of Brown Trout was higher than Redband Trout in both reaches. Brown Trout were larger in both reaches, but there was no difference between species condition factor in the two reaches. Redband Trout had higher abundances of juveniles in both reaches.

Total combined Brown Trout and Redband Trout abundance for the Wickiup reach was 1,192 trout/mile with an estimated biomass of 162kg/ha. The total combined abundance for the Bull Bend reach was 803 trout/mile with a biomass of 63kg/ha.

Mountain Whitefish exhibited a different pattern from the trout. The average length was greater in the Bull Bend reach. The juvenile age class was much larger in the Wickiup reach, and there was no difference in condition factor between the two reaches.

Kokanee were captured for the first time since 2021 despite the improved water carryover in Wickiup Reservoir (33% full at the end of irrigation season). Nonnative fish including Brown Bullhead, Tui Chub, and Stickleback continue to be captured annually.

Spawning Ground Surveys

For the past four years, spawning surveys have been conducted for both Redband Trout and Brown Trout on the Deschutes River from Wickiup Dam to the Wyeth Boat Ramp and on Fall River. Brown Trout redd counts remain two or more times higher than Redband Trout redd tallies in both the Fall River and the Deschutes River from Tenino Boat Ramp to Wyeth, but the redd count is almost the same for both species from the Wickiup Dam to Tenino Boat Ramp. The current winter flow minimums (100 cfs) during Brown Trout spawning still leave large areas of spawning gravels dewatered. Conversely, Redband Trout spawning in the spring occurs during increasing flows (~1,000 cfs) for irrigation, which can damage redds or smother eggs.

Young of Year Trout Sampling

In 2025, estimates ranged from 106 to 1,840 YOY trout per river mile. Key areas of high juvenile production include Folley Waters, Steelhead Falls, Lava Island, and River Rim Park. Sites near Wickiup Dam had generally higher numbers than observed in the past. Brown Trout juveniles (average 107 mm) were generally larger than Redband Trout juveniles (average 86 mm), which is an expected result of differing spawning and hatch timing.

Water Temperature Monitoring

Temperature was monitored in the mainstem Deschutes and in three tributaries. Spring-fed tributaries (Fall River, Spring River) maintained cold temperatures (max 59°F and 50°F, respectively). The Little Deschutes and three of the sites below North Canal Dam experienced temperatures exceeding the thermal preferences for Redband Trout, Mountain Whitefish, and Bull Trout. Sites downstream of the North Canal Dam reached high temperatures (up to 76°F at Odin Falls). However, spring inputs in the Middle Deschutes helped moderate water temperature in the Steelhead Falls area.

Off Channel Habitat Monitoring

Six off channel habitat sites were sampled to determine fish assemblage, benthic macroinvertebrate assemblage, and water temperature regimes. Monitoring will continue into 2026 with six more sites. Results will be included in future monitoring reports.

2026 Work Plan

Core monitoring tasks will continue, including adult fish monitoring, spawning surveys, macroinvertebrate sampling, YOY abundance estimates, and temperature monitoring. Additional tasks associated with the OWEB grant include mark-recapture trout abundance estimates, collection of scales for age/growth studies, and seasonal inventory of fish use, macroinvertebrates, and water temperature in off-channel habitats.

Purpose

The primary purpose of the Central Oregon Irrigation District (COID) Mitigation and Enhancement (M&E) Biologist is to facilitate instream and riparian habitat restoration projects and conduct biological investigations in the mainstem of, and tributaries to, the middle and upper Deschutes River. Funding for the position is provided by the COID as on-site and off-site mitigation for the COID Siphon Hydroelectric Project located in Bend, Oregon. The primary duties of the M&E Biologist have evolved over time to include less emphasis on instream habitat restoration and more of a focus on biological investigations and monitoring. In 2025 the M&E Biologist position was jointly supported by an Oregon Watershed Enhancement Board (OWEB) monitoring grant.

Background

The upper Deschutes River is regulated by the two mainstem dams creating Crane Prairie and Wickiup reservoirs. The dams were constructed in 1922 (Crane Prairie) and 1949 (Wickiup) and are managed to store and supply water for irrigation. Under natural conditions the hydrology of the Deschutes River was extremely stable year-round and driven by spring and groundwater inputs. Natural mean annual streamflow of the Deschutes River below Wickiup Reservoir is estimated to be around 756 cfs with approximately 96% of the flow composed of groundwater recharge (Gannet et al. 2003). Currently, streamflow is managed with an irrigation storage season in the reservoirs beginning around mid-October and ending in late March of each year. Up until the storage season of 2015/2016, winter releases in the river downstream from Wickiup Reservoir were as low as 20 cubic-feet-per-second (cfs). The seasonally reversed hydrograph has resulted in the loss of riparian vegetation and fringing

wetland habitat, contributed to extreme bank erosion and destabilization, and impacted fish overwintering and spawning habitat availability. Decades of flow management to serve irrigation needs has impacted fish, wildlife, amphibians, and macroinvertebrate populations, has altered channel morphology and water quality, and seasonally dewatered off-channel habitats including side channels, sloughs, and wetlands.

The Upper Deschutes River flow regime is changing as water conservation measures are being implemented through the Deschutes Basin Habitat Conservation Plan (DBHCP) to benefit aquatic species (USFWS 2020). One conservation measure is to increase the minimum flow during the irrigation storage season below Wickiup Dam incrementally over the next 30 years (2021-2050). Minimum winter flow targets are 100 cfs in years 1 through 7, 300 cfs in years 8 through 12, and 400-500 cfs in years 13 through 30. During the irrigation season, streamflow between Wickiup Reservoir and Bend peaks between 1,400 and 1,600 cfs. Conversely, streamflow in the middle Deschutes River below the major irrigation diversions in Bend is severely curtailed during the irrigation season. There has been limited habitat restoration in the Upper Deschutes Basin prior to the release of the DBHCP because it was widely recognized that flow restoration was needed before most habitat restoration efforts could be successful. With the listing of Oregon Spotted Frog (OSF) under the ESA and flow restoration currently underway, there is a need for understanding the existing and ongoing status of fisheries, macroinvertebrates, and water quality to assess the value of incremental flow restoration as part of the DBHCP conservation measures and to help inform habitat restoration efforts.

In addition to the changes in flow conditions, both dams affect downstream water quality and are complete barriers to upstream fish passage. The outlet-control structures of

Crane Prairie and Wickiup Reservoir are not screened which allows for limited downstream movement of fish via entrainment, but there is no upstream passage provided. When the reservoirs are drawn down fish tend to emigrate into the river downstream in large numbers. Due to drought and new reservoir management by the irrigation districts that are signatories to the DBHCP (USFWS 2020), Wickiup Reservoir was drained almost completely to streambed in 2018, 2020, 2021 and 2022 (Table 1). In better water years a small amount of storage water is carried over providing more habitat for species associated with the reservoirs. In 2019, eight percent of the volume of Wickiup Reservoir remained at the end of irrigation season, 12.6 percent remained in 2023, 19.9 percent remained in 2024, and 33 percent remained in 2025. During the first phase of DCHCP conservation measures govern reservoir operations including the timing and volume of water releases and the storage level of Crane Prairie Reservoir to support OSF breeding. This Crane Prairie storage and water surface elevation has been relatively consistent 2020-2025(Figure 1 and Figure 2). The primary variable year-to-year has been the widely varying storage volume in Wickup Reservoir at the beginning and end of irrigation season (Figure 3 and Figure 4).

Fish populations persist in the reservoirs and Deschutes River despite any ecological issues they currently face. Fish species typically encountered in the upper Deschutes River during sampling include native Redband Trout (*Oncorhynchus mykiss*) and Mountain Whitefish (*Prosopium williamsoni*) and non-native Brown Trout (*Salmo trutta*), kokanee (*Oncorhynchus nerka*) and Brown Bullhead (*Ameirus nebulosus*). While no fish are stocked in Wickiup Reservoir or the mainstem of the upper Deschutes River, triploid Redband Trout are stocked in Crane Prairie Reservoir and Fall River (a tributary of the Deschutes River).

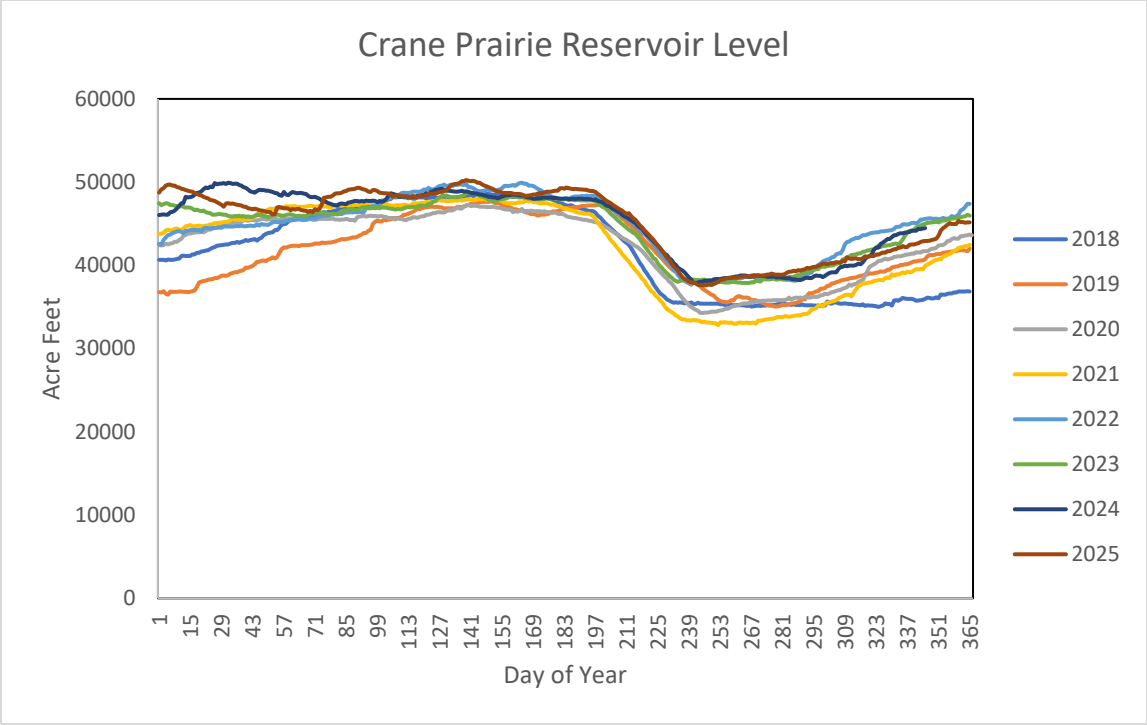


Figure 1. Crane Prairie Reservoir storage (acre feet), 2018-2025. Reservoir capacity is 50,000-acre feet.

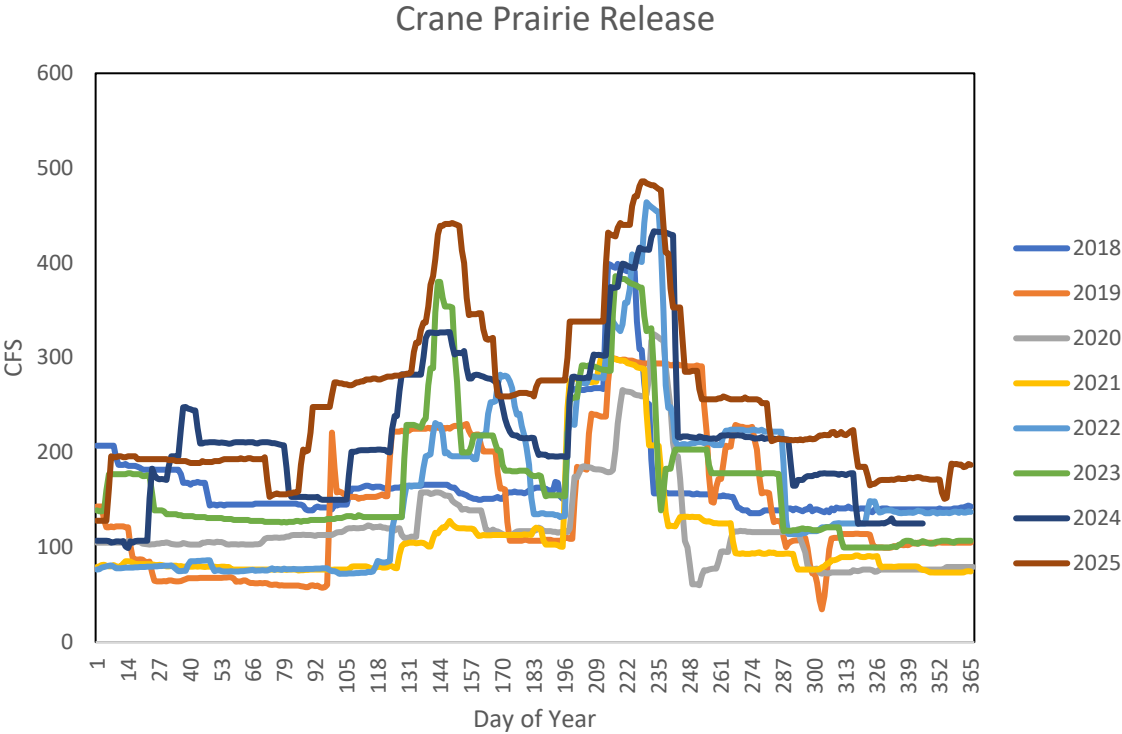


Figure 2. Discharge cubic-feet-per-second (cfs) from Crane Prairie Reservoir, 2018-2025.

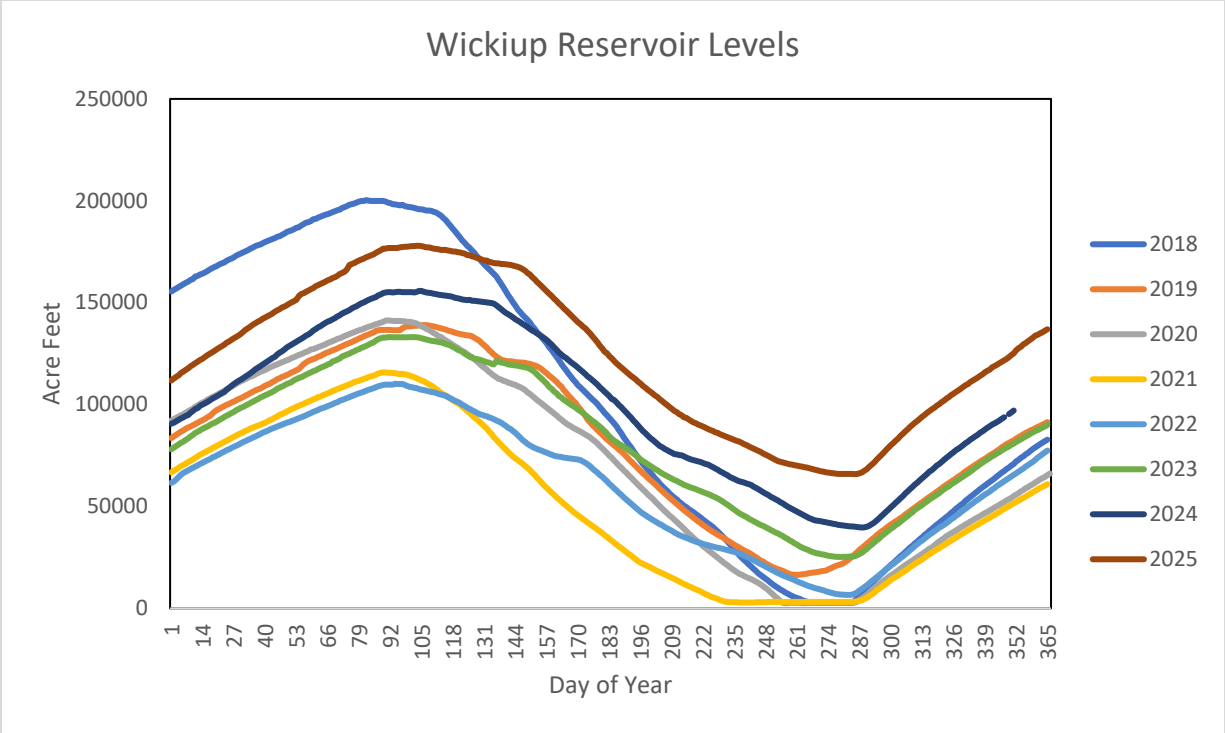


Figure 3. Wickiup Reservoir storage (acre feet) from 2018-2025. Reservoir capacity is 200,000-acre feet.

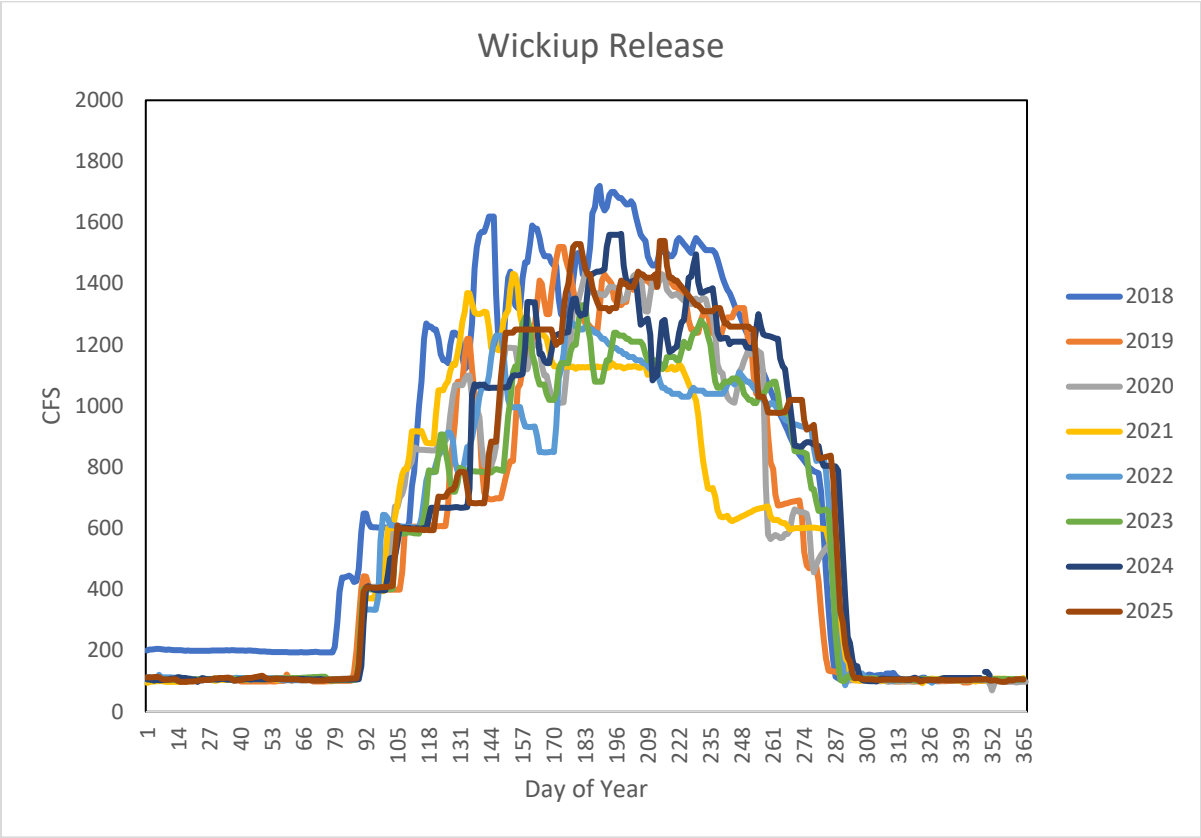


Figure 4. Discharge cubic-feet-per-second (cfs) from Wickiup Reservoir into the Deschutes River from 2018-2025.

Table 1. Minimum reservoir storage and percent of overall storage capacity for Wickiup Reservoir, 2018-2025.

Year	Storage (acre-feet)	Percent Full
2018	2,682	1.3
2019	16,419	8.2
2020	2,566	1.3
2021	2,840	1.4
2022	6,616	3.3
2023	25,227	12.6
2024	39,703	19.9
2025	65,973	33

Upper Deschutes River Fish Monitoring

Methods

The M & E Biologist has organized annual fish monitoring surveys of the upper Deschutes River since 2018. In each year, fish sampling was conducted with a raft-mounted electrofishing unit in the fall after irrigation flows below Wickiup Dam had been reduced to approximately 100 cfs for the water storage season. Previously, only one pass was performed with the electrofishing raft providing fundamental data, but not structured in a way to provide abundance estimates for the trout populations. In 2025, the sampling design and rigor were changed to mark-recapture method to provide abundance estimates for both Redband and Brown Trout. Sampling occurred in the last week of October and the first week of November beginning at two sites chosen to describe the differences in the tailwaters directly below Wickiup Dam and further downstream where the dam's influence is diminished. The first location (referred to as the Wickiup Reach) begins at Wickiup Dam (RM 226.5) and ends at the Tenino Boat Ramp (RM 225.5). The second location (referred to as the Bull Bend Reach) begins at RM 221.5 and ends at RM 220.5 (Figure 5). Four passes were performed with two electrofishing boats in each site. On the first three passes "catchable" or "legal-sized" trout greater than 200 mm (approximately 8-inches) were marked and the numbers of marked fish and recaptures were counted to be used for Schnabel mark-recapture abundance estimates. Using the abundance estimates of catchable trout, productivity and population size were evaluated in several ways. First, trout abundance estimates for each species and both species combined were standardized by the sampled reach length for Wickiup and Bull Bend to estimate the number of trout per mile of stream. Next the wetted area of the sampled reaches

was determined in hectares (ha) using aerial imagery (imagery available was from the irrigation season). Trout abundance estimates for each species and both species combined were standardized by the sampled wetted area for Wickiup and Bull Bend to estimate the number of trout per hectare. Finally, the overall biomass (kilograms; kg) for each species and both combined was determined by expanding the weight of measured fish (n=222 Redband Trout and n=336 Brown Trout for Wickiup and n=94 Redband Trout and n=164 Brown Trout for Bull Bend) to the estimated population. Biomass estimates (kg) for each species and both species combined were then standardized by the sampled wetted area for Wickiup and Bull Bend to estimate the standing stock biomass (kg/ha).

In addition to abundance estimates, other metrics calculated and measured of trout species are body condition, population age structure, and growth patterns. Length measurements (total length, mm) were collected for all species and weight (grams) was collected on a representative subsample of Redband and Brown Trout and Mountain Whitefish. Scales were collected to determine length at age and growth rates for Redband and Brown Trout. Information about age and growth from scales will be included in future reports. Tukey's HSD test was used to test for differences in the average lengths of fish species between sites. Fulton's K factor, a measure of body condition/health was calculated for Redband Trout, Brown Trout, and Mountain Whitefish >200mm in length to reduce the influence of measurement error on K factor values from small fish. Fulton's K factor is a measure of condition based on length and weight of a fish. Small fish are more susceptible to large spread of K factor values since a half gram can make a large difference in the calculations. For salmonids, a K factor value

of 1 to 1.2 is considered fair condition, less than 1.0 is considered poor, and less than 0.8 is considered extremely poor.

Results

Fish species collected in the Upper Deschutes River, 2025, included Redband Trout, Brown Trout, Mountain Whitefish, kokanee, Mottled Sculpin (*Cottus bairdii*), Brown Bullhead (*Ameiurus nebulosus*), Tui Chub (*Gila bicolor*), and Threespine Stickleback (*Gasterosteus aculeatus*). Kokanee were captured in the Deschutes River below Wickiup for the first time since 2021. Tui Chub, Brown Bullhead, and Threespine Stickleback are non-native species typically associated with lake habitats with source populations in Wickiup and Crane Prairie Reservoirs.

There were differences in the estimated abundance, lengths, condition, and population structure of Redband Trout between the two sampling sites. Redband Trout abundance for the Wickiup reach was estimated to be 451 fish per mile with a lower 95% confidence interval of 354 and an upper 95% confidence interval of 594 (Figure 6). Redband Trout abundance for the Bull Bend reach was estimated to be 333 fish per mile with a lower 95% confidence interval of 203 and an upper 95% confidence interval of 651. Average Redband length for the Wickiup reach was 278mm and average length in the Bull Bend reach was 145mm and the difference was significant ($p < 0.05$, Figure 8). The largest Redband Trout were found in the Wickiup reach with the largest fish just over 600mm. All Redband captured in the Bull Bend reach were smaller than 500mm. Even though Wickiup had larger Redband Trout, the Bull Bend reach had close to twice as many fish smaller than 200mm (Figure 9,11). Average Redband Trout K factor

was higher for the Wickiup reach (1.00) than the Bull Bend reach (0.96) and the difference was significant ($p < 0.05$, Figure 7).

There were similar differences in the estimated abundance, lengths, condition, and population structure of Brown Trout between the two sampling reaches. Brown Trout abundance for the Wickiup reach was estimated to be 732 fish per mile with a lower 95% confidence interval of 596 and an upper 95% confidence interval of 921 (Figure 6). Brown Trout abundance for the Bull Bend reach was estimated to be 456 fish per mile with a lower 95% confidence interval of 325 and an upper 95% confidence interval of 688. Brown Trout were larger than all other species captured in the river. Average Brown Trout length for the Wickiup reach was 389mm and average length in the Bull Bend reach was 279mm and the difference was significant ($p < 0.05$, Figure 8). While both reaches had Brown Trout in the 600-700mm range, there were many more in the Wickiup reach. Even though the Wickiup reach had more larger Brown Trout, the Bull Bend reach had almost 5 times as many fish smaller than 200mm (Figure 9,11). Average Brown Trout K factor was higher for the Wickiup reach (1.02) than the Bull Bend reach (0.97) and the difference was significant ($p < 0.05$, Figure 7).

Combining Brown and Redband Trout, the total trout abundance for the Wickiup tailwater reach was estimated to be 1,192 trout/mile (1,016-1,418 95% CI). The wetted area for the Wickiup Reach was estimated at 5.52 hectares (ha), resulting in a combined trout density of 216 fish/ha and standing stock biomass of 162 kg/ha. The total trout abundance for the Bull Bend Reach was estimated to be 803 trout/mile (600-1,132 95% CI). The wetted area for the Bull Bend Reach was estimated at 5.86 hectares (ha), resulting in a combined trout density of 137 fish/ha and a standing stock biomass of 63 kg/ha.

When comparing condition factor between trout species, Redband Trout condition factor responded the same as the Brown Trout to the different reaches. There was no significant difference between the two species in condition factor in either reach (Figure 7). Additionally, there was a smaller range of values in the Bull Bend reach and a much higher range of condition values in the Wickiup reach (Figure 10,12).

Mountain Whitefish populations also showed differences between the two reaches. The abundance of Whitefish was not estimated, but there were differences in average size and population structure. The average length of whitefish in the Wickiup reach was 200mm and the average length in the Bull Bend reach was significantly larger ($p < 0.05$) at 258mm. Despite the larger average length of whitefish in the Bull Bend reach, the number of fish smaller than 200mm whitefish was 3 times greater in the Wickiup reach (Figure 13). There was no significant difference ($p < 0.05$) in K factor for whitefish between the two sites with the Wickiup reach having an average of 0.86 and the Bull Bend reach having an average of 0.89 (Figure 14).

Kokanee were captured for the first time since 2021 and while not targeted were captured opportunistically while electrofishing. More kokanee were captured in the Wickiup reach than the Bull Bend reach. Lengths of captured kokanee ranged from 112-425mm representing age-1 through age-3 size classes.

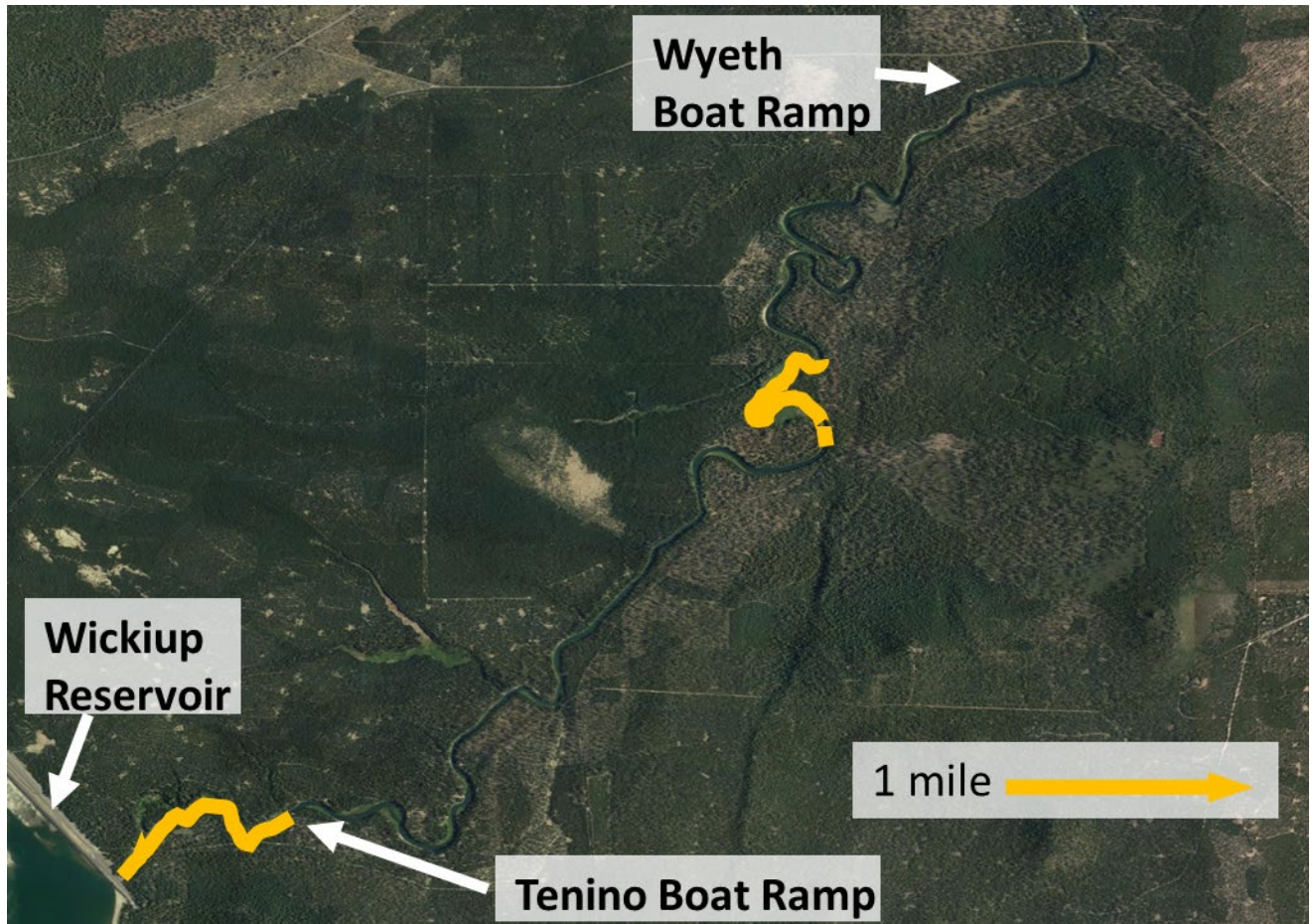


Figure 5. Locations of upper Deschutes fish monitoring reaches, 2025.

Upper Deschutes Trout Abundance Estimates

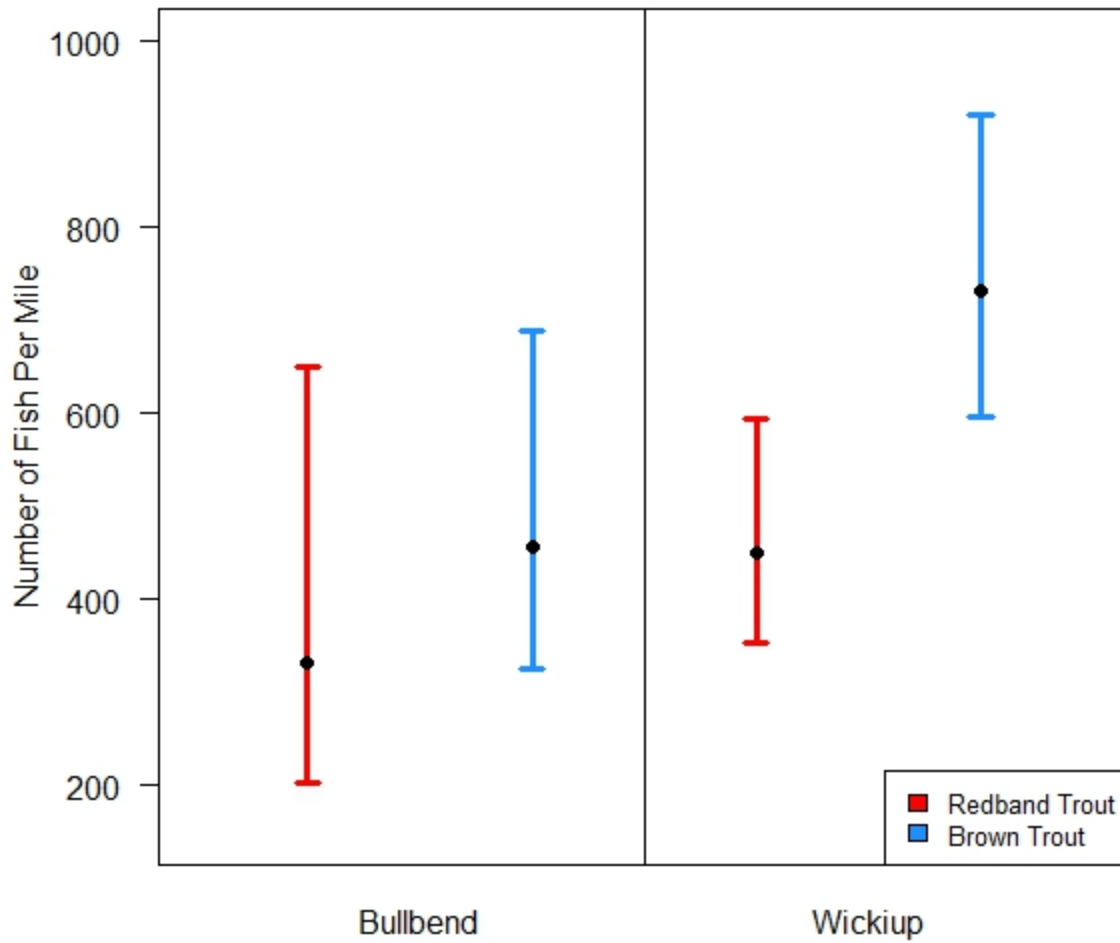


Figure 6. Estimated abundances of Redband Trout and Brown Trout in the upper Deschutes River in fall of 2025.

Upper Deschutes Fish Condition

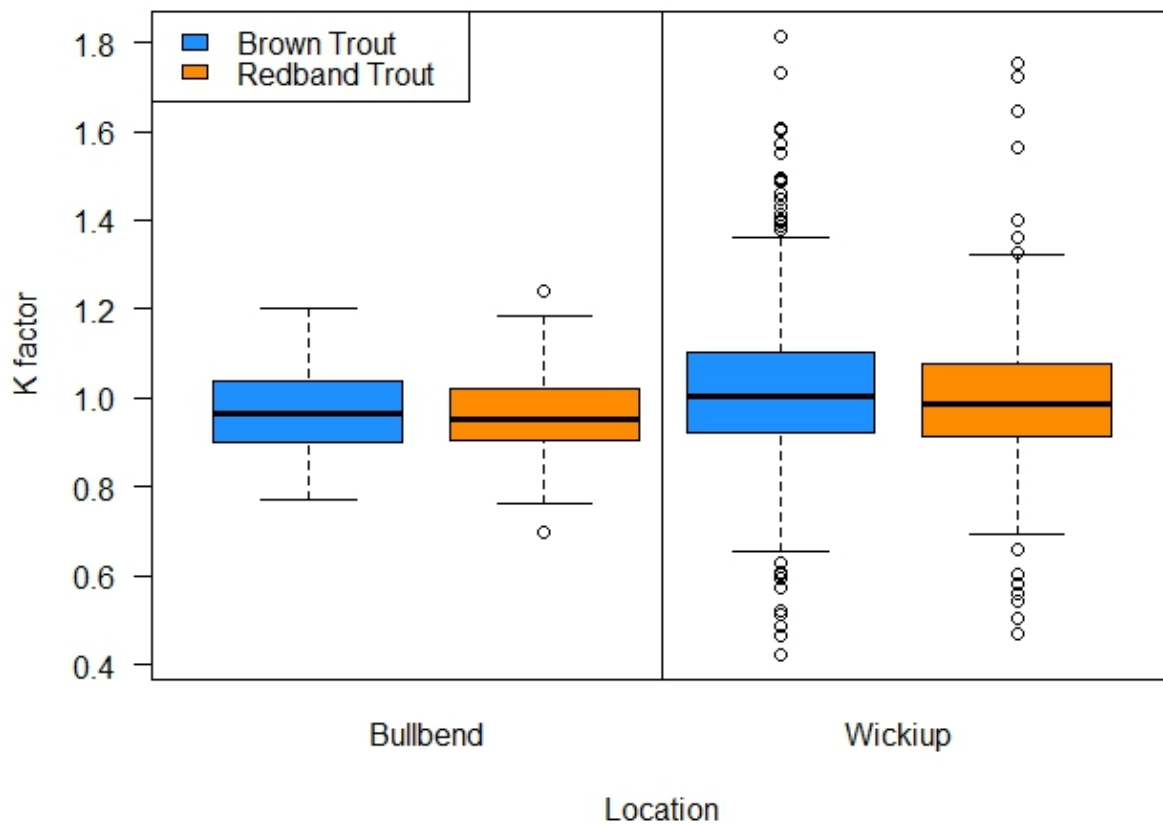


Figure 7. Fish condition (K factor) in the Bull Bend and Wickiup reaches of the Deschutes River in 2025.

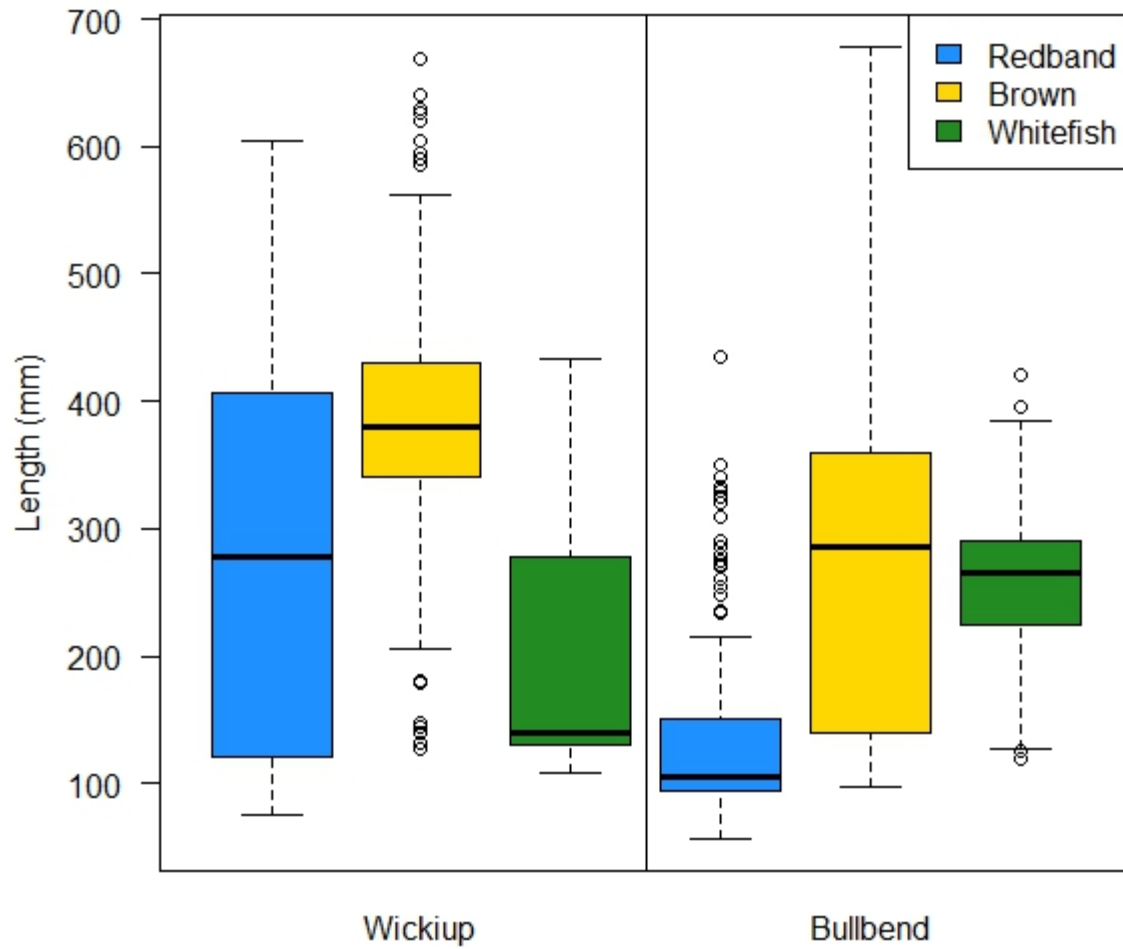


Figure 8. Length distribution by fish species for electrofishing on the upper Deschutes River in fall of 2025.

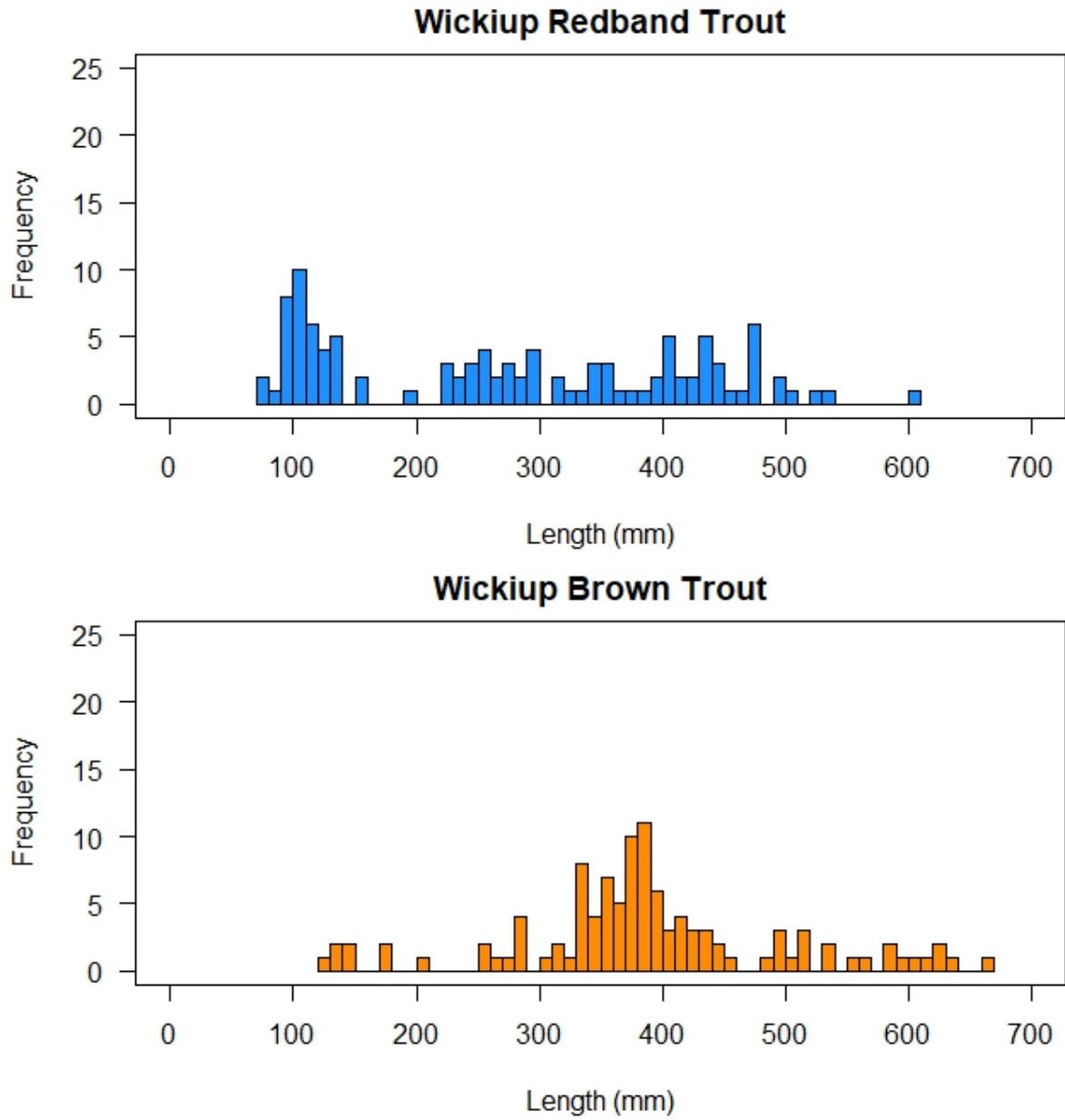


Figure 9. Length-frequency distributions of Redband and Brown Trout caught electrofishing on the upper Deschutes River downstream of Wickiup Reservoir in fall 2025.

Wickiup Trout K Factor

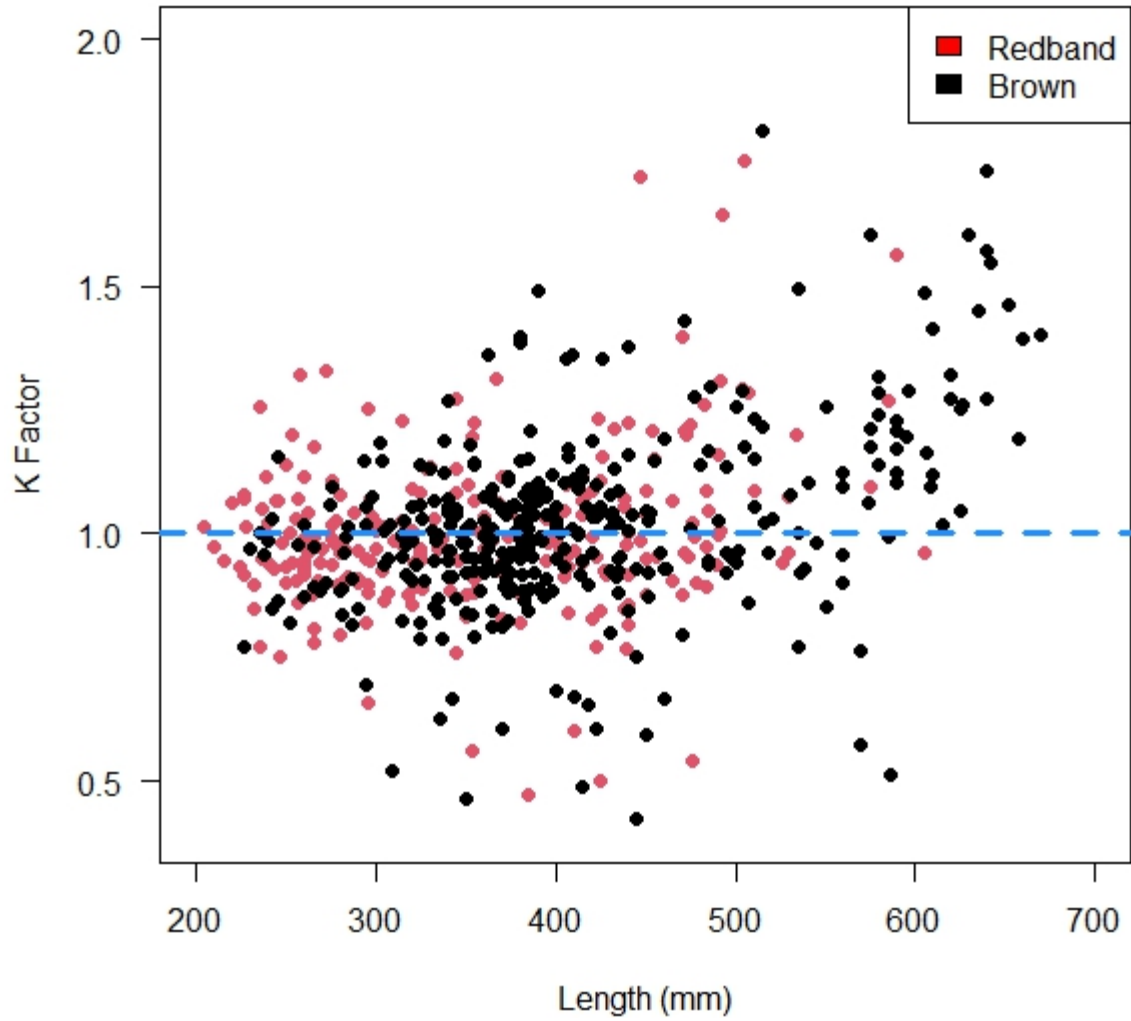


Figure 10. Fulton's K Factor by length in mm for Redband and Brown Trout (>200mm in length) caught electrofishing on the upper Deschutes River downstream of Wickiup Reservoir in fall 2025.

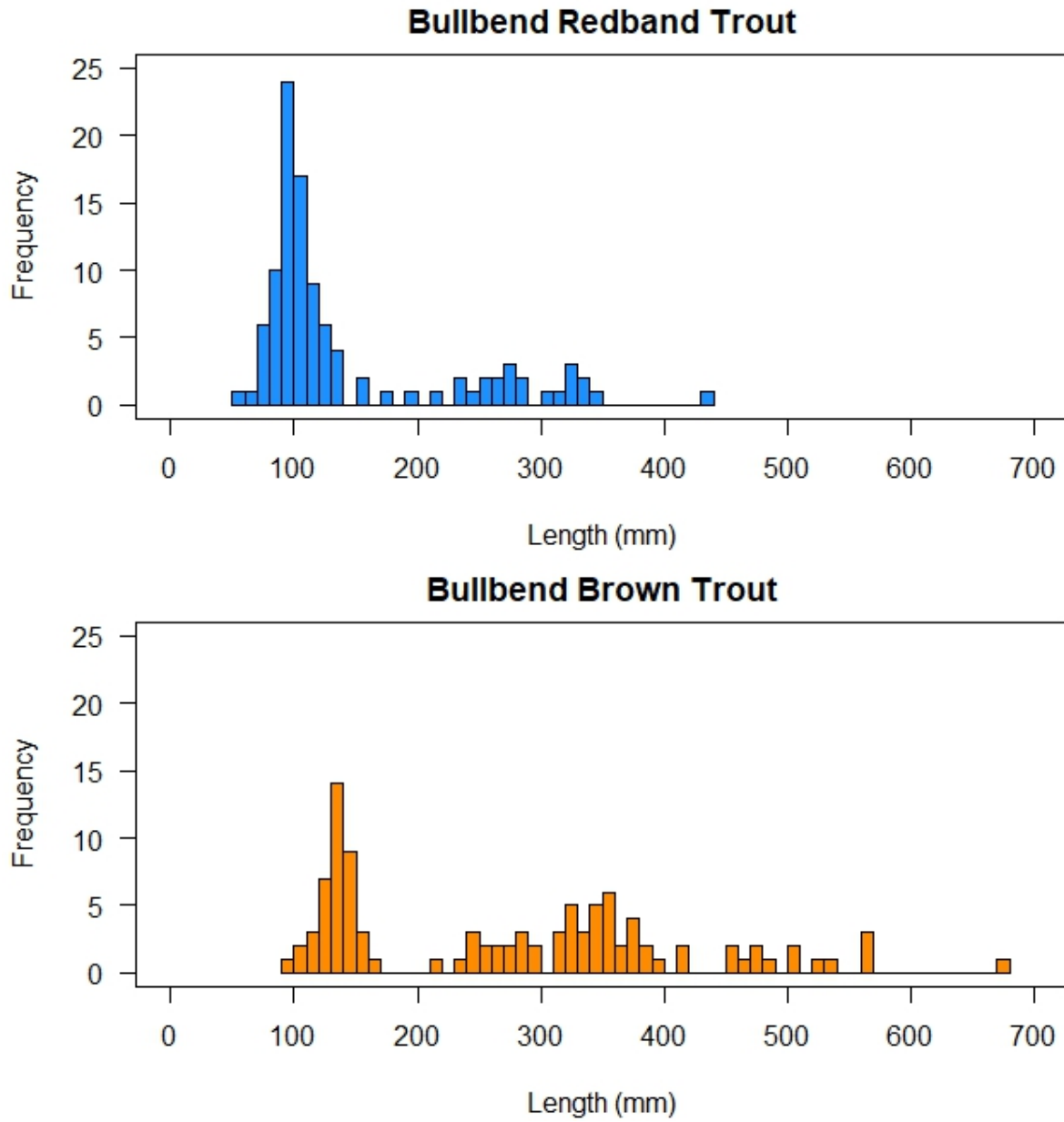


Figure 11. Length-frequency distributions of Redband and Brown Trout caught electrofishing on the upper Deschutes River in the Bull Bend reach in fall 2025.

Bullbend Trout K Factor

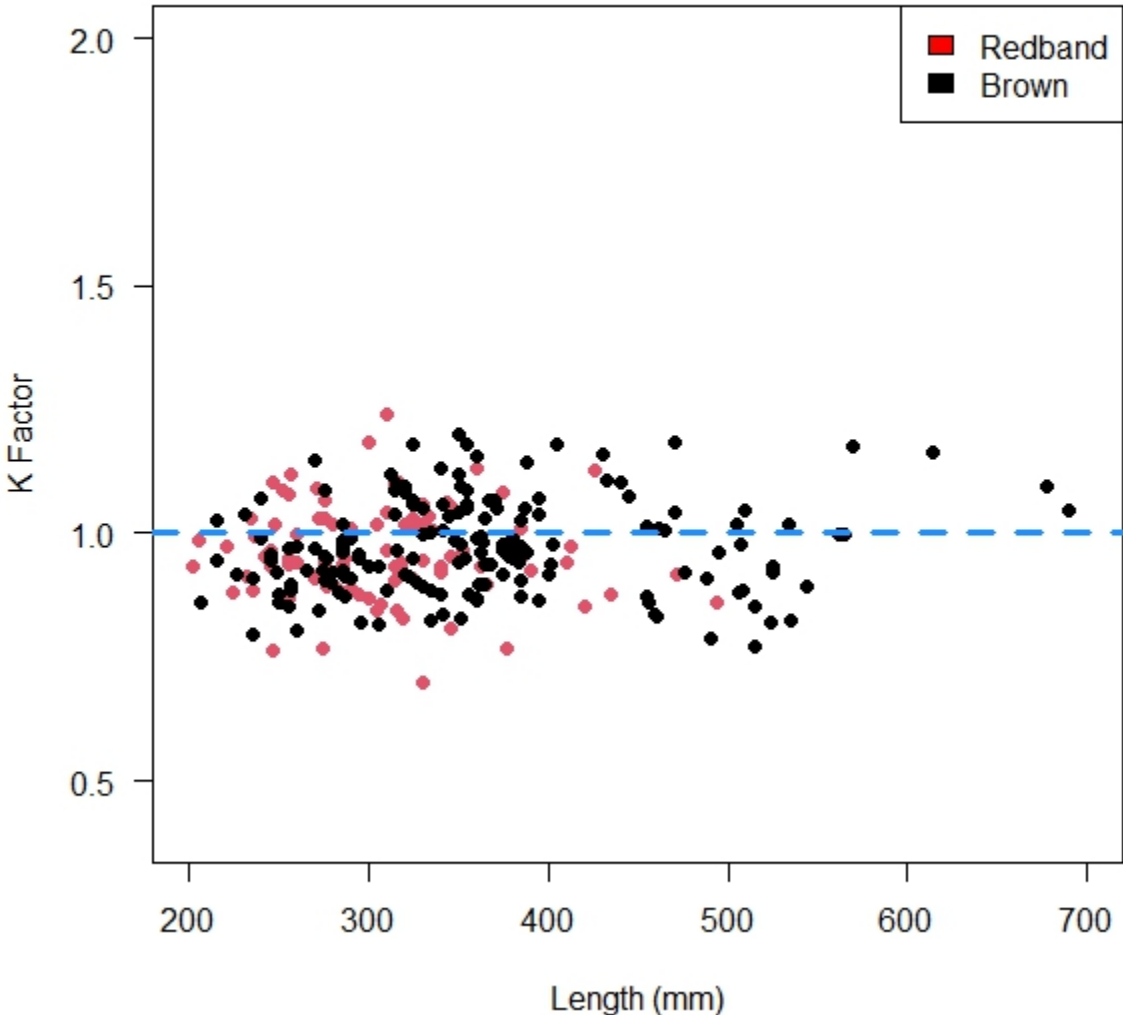


Figure 12. Fulton’s K Factor distribution by length in mm for Redband and Brown Trout (>200mm in length) caught electrofishing on the upper Deschutes River in the Bull Bend reach in fall 2025.

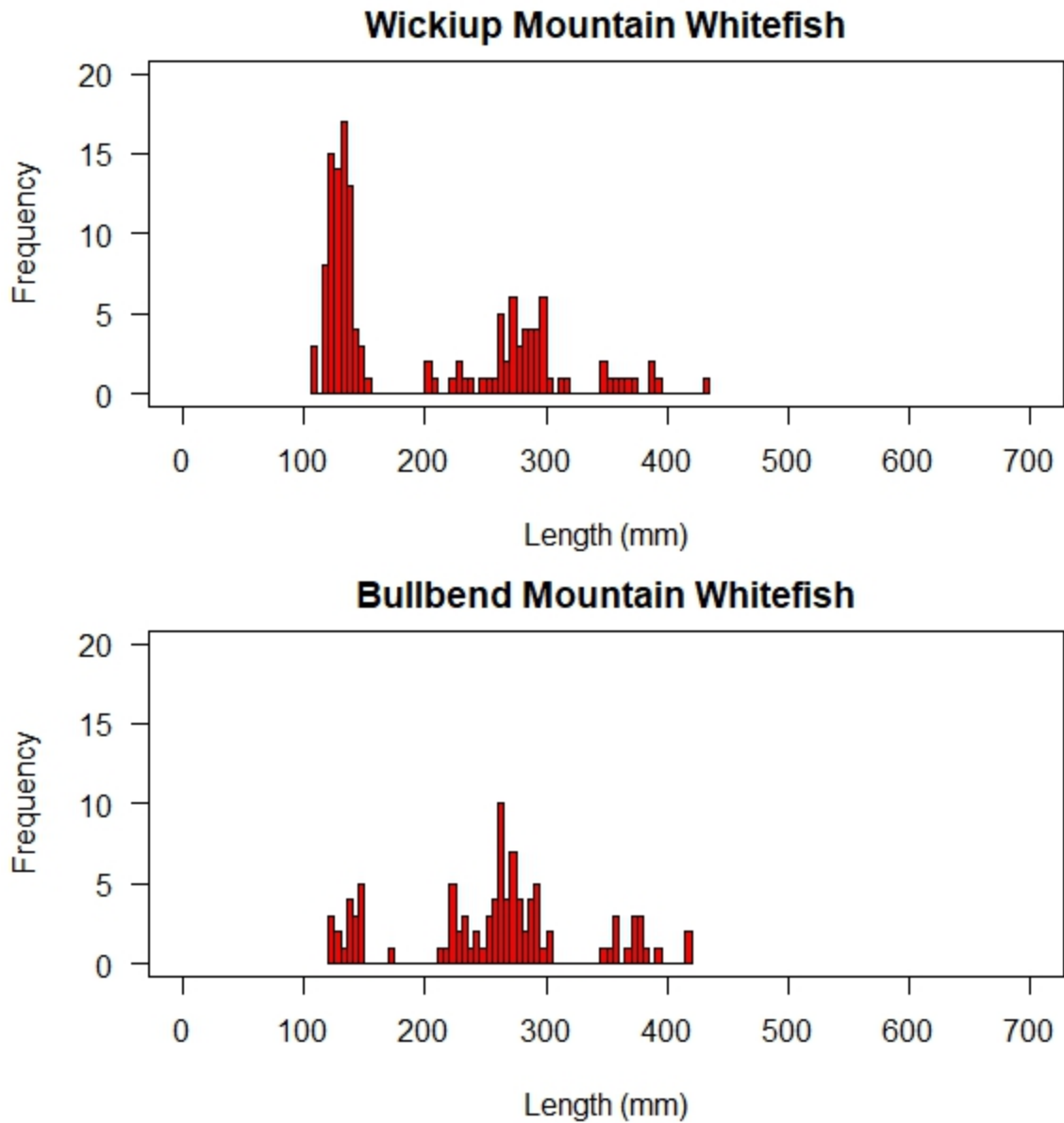


Figure 13. Length-frequency distributions of Mountain Whitefish caught electrofishing on the upper Deschutes River downstream of Wickiup Reservoir, 2025.

Upper Deschutes WF Condition

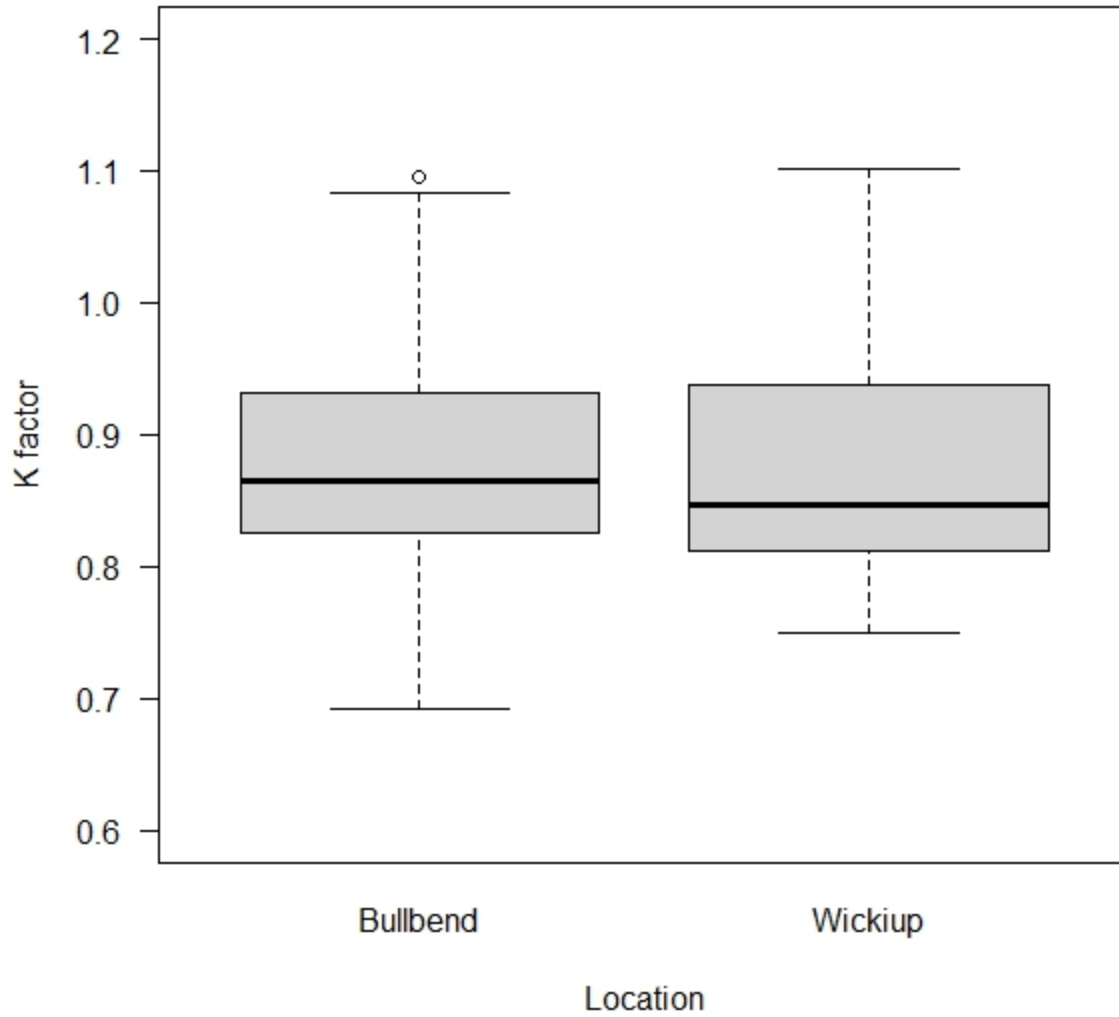


Figure 14. Fulton's K Factor distribution for Mountain Whitefish (>200mm in length) caught electrofishing on the upper Deschutes River in fall 2025.

Discussion

Brown Trout are the dominant fish species in the river below the Wickiup Reservoir. The estimated abundance of Brown Trout is higher than the estimated abundance of Redband Trout in both reaches. The largest fish captured in both reaches were large mature Brown Trout (>500 mm). Redband Trout did not grow as large as the Brown Trout. Juvenile Brown Trout were observed in both reaches indicating successful spawning is happening in the reaches. While there were large Brown Trout in both reaches, the larger class of juveniles in the Bull Bend reach was enough to decrease the average size for the reach when compared to the Wickiup reach. Unsurprisingly, Brown Trout condition and abundance were higher in the reach below the dam, but there was much greater variety in condition factor than in the Bull Bend reach. Dam tailwaters are known to be more productive with the influx of food from the reservoir's outflow and have higher abundances and fatter fish (McKinney et al, 2001). The tailwater effect is also most likely what is causing the large spread of values for the Brown Trout K factor.

Redband Trout showed similar patterns in the two different reaches as the Brown Trout. In the Wickiup reach, below the dam, average size and condition were greater than in the Bull Bend reach. The Bull Bend reach also had a much larger class of juvenile Redband Trout. However, unlike the Brown Trout, the larger class of Redband Trout (>450mm) were absent in the Bull Bend reach. So, the average size was decreased in the Bull Bend reach by the combination of both lack of larger fish and a larger class of juveniles.

Total trout abundance for the Wickiup tailwater reach was estimated to be 1,192 trout/mile (1,016-1,418 95% CI). For comparison with another popular local tailwater fishery, the Crooked River below Bowman Dam, the 10-year average trout estimate is 2,202 trout/mile

and the 2025 estimate was 3,726 trout/mile. Comparing the body condition of Redband Trout in the two rivers, in 2025 fish in the Bowman Dam tailwater had a K-factor of 1.05 compared to 1.00 for the Wickiup Reach. The wetted area for the Wickiup Reach was estimated at 5.52 hectares (ha), resulting in a density of 216 trout/ha. The wetted area in the sampled reach for the Crooked River Reach below Bowman Dam is approximately 11.01 ha, with a trout density nearly 3.5 x that of the Wickiup reach at 762 trout/ha. However, when fish size is incorporated into a measure of trout standing stock biomass (kg/ha) the two tailwaters are comparable for 2025 with Wickiup 162 kg/ha vs 172 kg/ha for the Crooked below Bowman. This is attributable to the high number of large trout the Wickiup reach with many fish weighing 700-2500 grams (1.5-5.5 lbs). The standing stock biomass of the Wickiup Reach is comparable to other tailwater fisheries including the Savage River in Maryland 72-92 kg/ha (MDNR 2013), the White River in Arkansas 103 kg/ha (Quinn and Kwak 2000), Clinch River in Tennessee 112 kg/ha (Bettoli and Bohm 1997); Green River in Wyoming 55 kg/ha (Wiley and Dufek 1980); Rush Creek in California 83 kg/ha (Taylor 2023). However, most other tailwater fisheries are supported by stocking whereas the Upper Deschutes River is not stocked or supplemented. Even in its degraded condition with large fluctuations in seasonal streamflow the Wickiup Dam tailwater is a productive reach for Brown and Redband Trout.

Overwinter habitat availability in the Upper Deschutes River has been identified as a primary limiting factor for trout populations (ODFW 1996). The Oregon Department of Fish and Wildlife has a junior water right for the Upper Deschutes River of 300 cfs year-round with a priority date of 1983. This water right is based on ODFW's recommended minimum flows to support aquatic life below Wickiup Reservoir. Recent habitat suitability modeling for the Bull

Bend Reach predicted that the useable area of Redband Trout holding habitat increases rapidly from 20 cfs to 800 cfs (River Design Group 2017). While the new flow management regime for the upper Deschutes River has been implemented for several years now, fish populations are still adjusting to the changes. Despite the last few years seeing an increase in carryover storage in Wickiup Reservoir at the end of irrigation season, we will most likely continue to experience large swings in the water levels in the future to accommodate water management and to support the conservation of Oregon Spotted Frog and their critical habitat. However, these large fluctuations in water levels can be detrimental to the fish species in the river. Several decades of sampling and research in the Crooked River below Bowman Dam has found that both low winter flows, especially when combined with a cold winter, as well as extremely high spring flood-control releases resulting in high total dissolved gas levels can be limiting factors for the trout population in that reach (Porter and Hodgson 2016; George and Porter 2022).

The M&E Biologist will continue to monitor fish populations in the Deschutes River in the future as scheduled flow changes will continue to impact the ecosystem. The link between the level of Wickiup Reservoir, the fish populations downstream, and the fish populations in the reservoir itself should continue to be explored. In consideration of this goal, we will continue to monitor spawning activity in the same reach of river below Wickiup where we conduct the electrofishing sampling.

Mountain Whitefish abundance was not estimated but they were generally abundant, and we do describe the population structure and condition of this species in the two reaches. The population structure of whitefish was very similar in each reach, but there were some differences. Both reaches had juvenile classes, but the Wickiup reach had a much greater

number of juveniles than the Bull Bend reach. The larger juvenile class in the Wickiup reach decreased the average size so that the Bull Bend reach had a larger average size. Otherwise, the size classes are the same with neither reach having larger fish than the other. Condition factor for both reaches was not significantly different.

Scales were collected from both Redband (from 257 individuals) and Brown (from 295 individuals) Trout during the electrofishing effort and will be used to explore growth rates and size at age in future reports.

Upper Deschutes River Spawning Ground Surveys

Methods

Spawning ground surveys are conducted annually to track the status and trend of salmonids in the upper Deschutes River. Spawning ground surveys count the number of trout redds (egg nests) and can be used as an indicator of habitat suitability, adult spawner abundance, and reproductive potential of an aquatic system. Reaches are chosen to be representative of the river or to determine conditions in a specific section of river. Brown Trout surveys are conducted in November after spawning occurs and Redband Trout surveys are conducted in May. Since Brown Trout surveys in the Deschutes River are during irrigation storage season, flows are typically ~100 cfs. Flows on the Deschutes River during Redband Surveys are typically ~1000 cfs due to irrigation water releases from Wickiup Dam. In the Deschutes River, the 14-kilometer reach directly below Wickiup Dam to the Wyeth Boat Ramp is surveyed with a raft-mounted observation platform. This method was first used on this reach in 2022. One observer is on the platform and a secondary observer rows the raft. Observations geo-referenced and tallied. The reach is floated from the upstream end down to the bottom. Redd tallies for the Deschutes River are recorded separately for a 1.6-km reach from Wickiup Dam (43.684346/-121.689295) to Tenino Boat Ramp (43.688595/-121.674586) and a 12.3-km reach from Tenino to Wyeth Boat Ramp (43.737697/-121.616173). In Fall River, pedestrian surveys are conducted along a 2.2 km reach. Observers walk downstream from the Fall River Falls (43.794495/ -121.527761) to the collapsed cabin (43.790481 / -121.51762) and tally redds along the way.

Results

Over the past five years on the Deschutes River, both Brown Trout and Redband Trout redd count numbers are variable. For the Brown Trout there appears to be a peak in 2023, but values in 2025 are all higher than those observed in 2024. Redband Trout both increased in the Wickiup Dam reach and in the Tenino to Wyeth reach in 2025 (Table 2). On Fall River, while the Brown Trout redd numbers move in a

general downward direction over the five years, the count in 2025 was higher than 2024. Redband Trout redds in Fall River seem to be decreasing in number over the five years observed, but again, had a higher value in 2025 than 2024 (Table 2). Comparing the two species, the count of Brown Trout redds, a proxy for adult spawner abundance, is typically two or more times higher than the Redband Trout redd tally. This finding is consistent with the relative abundance of the two species from ODFW Deschutes District electrofishing survey data and angler reports for these reaches over the same period.

Table 2. Redd counts for Brown and Redband Trout for the Deschutes River below Wickiup Dam and Fall River, 2021-2025.

Reach	Year	Brown Trout	Redband Trout
Deschutes River - Wickiup Dam to Tenino Boat Ramp	2022	14	17
	2023	23	No Survey
	2024	18	20
	2025	21	19
Deschutes River - Tenino Boat Ramp to Wyeth Boat Ramp	2022	80	17
	2023	112	No Survey
	2024	58	13
	2025	89	16
Fall River - Falls to Cabin	2021	115	32
	2022	98	15
	2023	103	18
	2024	83	8
	2025	96	17

Discussion

While redd counts can be expected to change year to year, over long periods of time counts can be used to examine trends and status of fish populations and be useful for fisheries management. The counts of both species in both rivers are inconsistent, but redd counts can fluctuate for many different reasons (survey conditions and detectability, water flow, temperature, food availability, survival rates of juveniles, and habitat availability for all life stages). Short-term changes are not necessarily a cause for concern. In the past, the M&E Biologist has facilitated spawning gravel enhancement projects to both the Deschutes below Wickiup and Fall River below the falls to improve spawning habitat. The gravel

additions seem to be successful as most spawning occurs in the added gravel. However, limited sediment transport and recruitment of new spawning gravel below dams is a common issue for salmonids that lay their eggs in the substrate. Augmentation of suitable spawning gravel every decade or so is a widely used restoration/mitigation practice in dam-impacted reaches.

Historically, and pre-dams, flows on the Deschutes River directly below Wickiup were very stable. With the construction of the dams and irrigation use, the flow regime changed. For Brown Trout, the flows currently drop to a minimum of 100 cfs during spawning season. While these flows are much better than the 20 cfs during storage season not too long ago, there are still large areas of spawning gravels that are dewatered and inaccessible for the Brown Trout spawning. Redband Trout experience a different phenomenon during their spawning season. Flows begin to increase before spawning and continue to increase after spawning occurs. Increasing flows can cause physically damage redds, increase sediment transport which can smother eggs, increase depth, and change oxygenation levels at the eggs in the redd. These changes can directly affect the egg development and hatch rate success. Phases 2 (2028) and 3 (2033) of the DBHCP aim to increase minimum winter flows to 300 and 400-500 cfs, respectively, and will moderate the swings in the flow from storage season to irrigation season. These changes could improve spawning conditions for both Redband and Brown Trout moving into the future.

Macroinvertebrate Sampling

Among other conservation measures, the Deschutes Basin HCP outlines changes to the management of Crane Prairie and Wickiup reservoirs and flow regime of the Deschutes River from Wickiup Reservoir downstream to Bend (USFWS 2020). For the first seven years of HCP implementation, minimum instream flow releases from Wickiup Reservoir during the non-irrigation season will be maintained at 100 cfs. During phase 2, minimum flows will then increase to 300 cfs during years 8 through 12 (2028-3032) and then to 400 to 500 cfs in years 13 (2033) and later. Macroinvertebrate sampling is one method to establish a baseline to examine ecological changes from new minimum instream flow targets. There are many different indicators for watershed health. Benthic macroinvertebrates (organisms that live on the bottom of streams and rivers) are excellent indicators because they are easy to collect, live in water for all or most of their life, can be identified in a laboratory setting, differ in their tolerances to abiotic factors in the environment, often live for more than one season, and are limited in their ability to move. Macroinvertebrates are also utilized by fish species for food and can tell us about the quality of fish forage in rivers. Macroinvertebrates can be used as an indicator of watershed health and can be used to determine issues with thermal ranges, pollution, and habitat alteration.

Methods

Benthic macroinvertebrates were sampled in the mainstem of the Deschutes River from Wickiup Dam (RM 226.5) to Steelhead Falls (RM 128; Figure 15, Table 3). The North Canal Dam (RM 165) delineates a change in flow conditions on the mainstem of the Deschutes; therefore, seven sites were chosen below the dam and six sites above the dam. An additional six sites

were chosen in three of the tributaries of the Deschutes as reference sites (Fall River, Little Deschutes River, and Tumalo Creek). Samples were collected during the late summer and early fall of 2021. The same sites were resampled in 2022, 2023, 2024, and 2025. Past reports have presented data from 2021 and 2022. The OWEB monitoring grant provides funding to process a subset of samples from 2025 and 2026 from the sites above Bend and in the off-channel habitat locations. However, additional funding is needed to process samples from 2023, 2024, and 2025. Protocols used are described in detail in the Pacific Northwest Aquatic Monitoring Partnership “Field and laboratory methods for the collection of benthic macroinvertebrates in wadeable streams of the Pacific Northwest” (PNAMP 2008). Riffles were targeted for sampling and a D-frame kick net with 500 um mesh was used to sample 8ft² of stream bottom for each location. The sample was a composite of 8 1ft² areas. The largest pieces of inorganic debris were removed before preserving the samples in liter bottles with ethanol. Samples were then sent to Aquatic Biology Associates in Corvallis, OR for enumeration and identification. In each sample, a 500-organism subsample was identified.

Macroinvertebrate Monitoring



Figure 15. Locations of macroinvertebrate monitoring sites in the Deschutes River basin, 2021-2025.

Table 3. Benthic macroinvertebrate sampling locations in the upper Deschutes River basin, 2021-2025.

Location number	Latitude	Longitude	Stream	Location Description	River mile
1.1, 1.2	44.412765	121.293951	Deschutes River	above Steelhead Falls	128
2.1, 2.2	44.399813	121.298605		Folley Waters	130
3.1, 3.2	44.32152	121.255369		above Odin Falls	140
4.1, 4.2	44.270211	121.256776		above Cline Falls	145
5.1, 5.2	44.180733	121.318144		Twin Bridges	155
6.1, 6.2	44.129153	121.332893		Tumalo State Park	159
7.1, 7.2	44.085397	121.309791		Sawyer Park	164
8.1, 8.2	44.015181	121.355164		River Rim Park	172
9.1, 9.2	43.984467	121.399648		Lava Island	175
10.1, 10.2	43.94116	121.415299		Benham Falls	182
11.1, 11.2	43.881595	121.464113		Besson	189
12.1, 12.2	43.760324	121.580551		Tetherow Boat Ramp	213
13.1, 13.2	43.688604	121.674569		Tenino	226
14.1, 14.2	43.791492	121.520518	Fall River	Below Fall River Falls	
15.1, 15.2	43.784227	121.598043		Fall River Headwaters	
16.1, 16.2	43.753956	121.485049	Little Deschutes River	Lower Little Deschutes River	
17.1, 17.2	43.701829	121.502824		Upper Little Deschutes River	
18.1, 18.2	44.030488	121.564072	Tumalo Creek	Below Tumalo Falls	
19.1, 19.2	44.080264	121.377023		Shevlin Park	

Juvenile Trout Young-of-the-Year Population Abundance Estimates

Methods

The Deschutes River has experienced drastic changes in its flow regime, fish community, habitat quality, and ecological processes due to anthropogenic influences in the past century. These changes have led to a concern for the health of native salmonid populations in the river. However, large rivers such as the Deschutes can be particularly challenging to survey. Additionally, large river surveys generally require a significant investment in personnel and equipment to achieve their objectives. To address these challenges while still developing a monitoring strategy for the mainstem river channel, we used a survey design targeting young-of-the-year (YOY) trout rearing habitat along the river margin (Fetherman et al. 2014). Three-pass removal estimates were conducted using one backpack electrofishing unit. At each location all wadeable fry habitat was sampled in a 15.2 m (50 ft) long reach. Following each pass, fish collected are held in a mesh net pen outside of the sample reach. Locations were selected based on access while also providing coverage of representative stream margin rearing habitat for the upper and middle Deschutes River (Table 4). In 2025, three additional sites were added to the sampling to compliment the adult fish monitoring in the upper Deschutes River below Wickiup Dam. Sampling occurred in the fall to allow YOY to grow to large enough sizes for easy identification and reduce stress associated with electrofishing by working in cooler water temperatures. All YOY fish encountered were identified to species and measured (TL; mm). Brown Trout and Redband Trout numbers were combined to provide more accurate estimates due to low abundances in many of the sites. A three-pass removal estimator was used to determine population abundance estimates for each sampling site (Seber and Whale

1970, Fetherman et al. 2014). Estimates were converted to number of trout per river mile for one bank by multiplying the estimate by 105.6.

Results

Overall, Brown Trout juveniles are larger than Redband Trout juveniles over the length of the Deschutes River (Figure 16). Brown Trout lengths were significantly larger than Redband Trout. Brown Trout lengths ranged from 62-174 mm with an average of 107 mm. Redband Trout lengths ranged from 44-169 mm with an average of 86 mm. When compared on a site specific basis, Brown Trout were only significantly larger at Folley Waters and both Steelhead Falls sites.

Estimates of YOY trout per-river-mile are shown in Figure 17 and represent only one bank of the river. In 2025, estimates range from 106 to 1,840 YOY trout/mile and the mean was 870. The four years of sampling had similar trends by location through the river. The locations with the highest numbers of YOY trout in 2025 include Folley Waters, both Steelhead Falls locations, Bull Bend, Tenino, and Tetherow.

The species composition of Redband and Brown Trout are relatively consistent from year to year (Figure 18). The areas with the highest percentage of Redband Trout are up near Wickiup Dam, Lava Island down to Sawyer Park, and Cline Falls. Brown Trout seem to dominate from Tetherow boat ramp down to Benham Falls and Twin Bridges. Folley Waters and the Steelhead locations seem to fluctuate, but lean more on the Redband Trout side over the last 5 years of sampling.

Additionally, at the Wickiup Dam site that is immediately below the dam, hundreds of juvenile Brown Bullhead were observed while electrofishing the margin for trout.

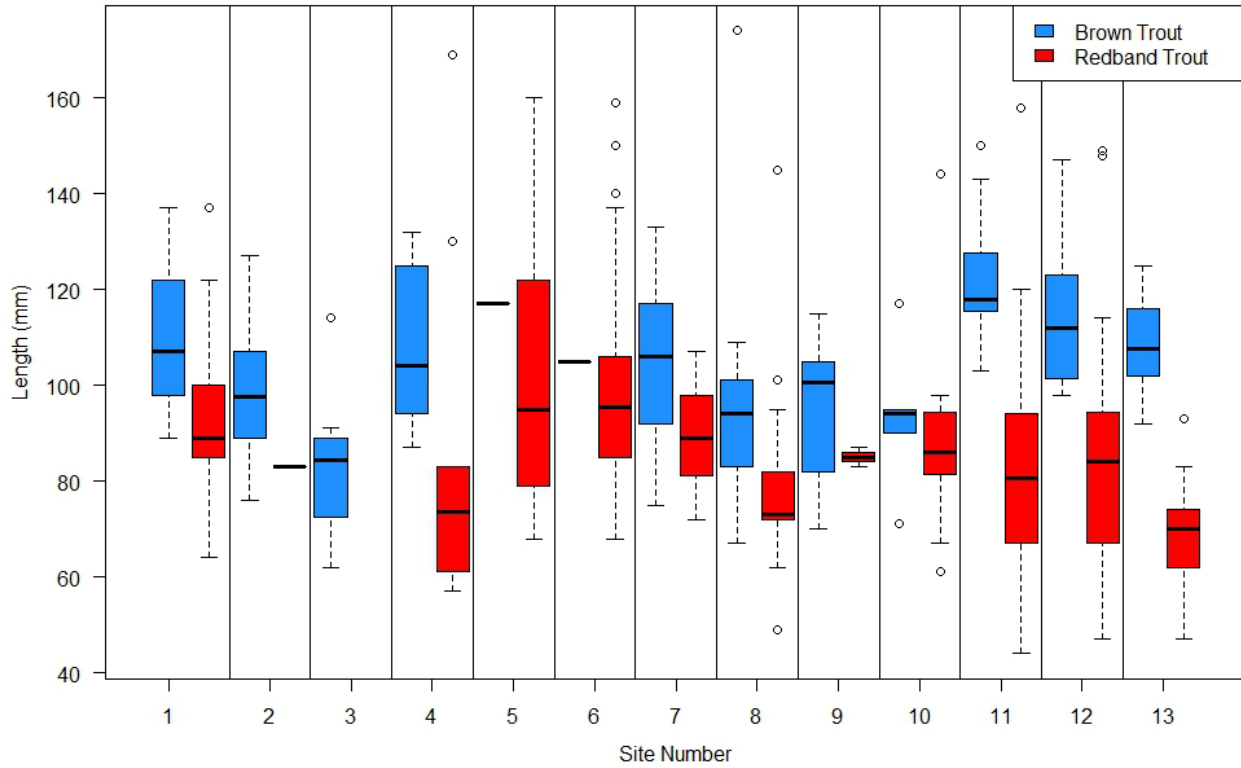


Figure 16. Juvenile trout length distribution by species and site location on the Deschutes River, 2021-2025.

Table 4. Juvenile trout bank margin sampling locations on the upper Deschutes River, 2021-2025

Location	Location Number	Latitude	Longitude	River Mile
Wickiup Dam Tailwater [^]	0.5	43.68543	121.68801	225
Tenino boat ramp	1	43.41329	121.39995	226
Bull Bend	1.5	43.72390	121.62805	219.5
Tetherow boat ramp	2	43.45658	121.34834	212.7
Besson boat ramp	3	43.52859	121.27827	189
Benham Falls	4	43.56461	121.24878	181.5
Lava Island	5	43.59102	121.23952	174.5
River Rim Park	6	44.00918	121.21298	171.5
COID Siphon Diversion Reach [^]	6.5	44.02957	121.33593	170
Sawyer Park	7	44.05119	121.18601	164
Tumalo	8	44.07537	121.19921	159
Twin Bridge	9	44.10663	121.19269	154.5
Cline Falls	10	44.16234	121.1540	145
Folley Waters	11	44.2401	121.18026	130
Steelhead Falls 1	12	44.24870	121.17396	128
Steelhead Falls 2	13	44.24766	121.17627	129

[^] new site added in 2025

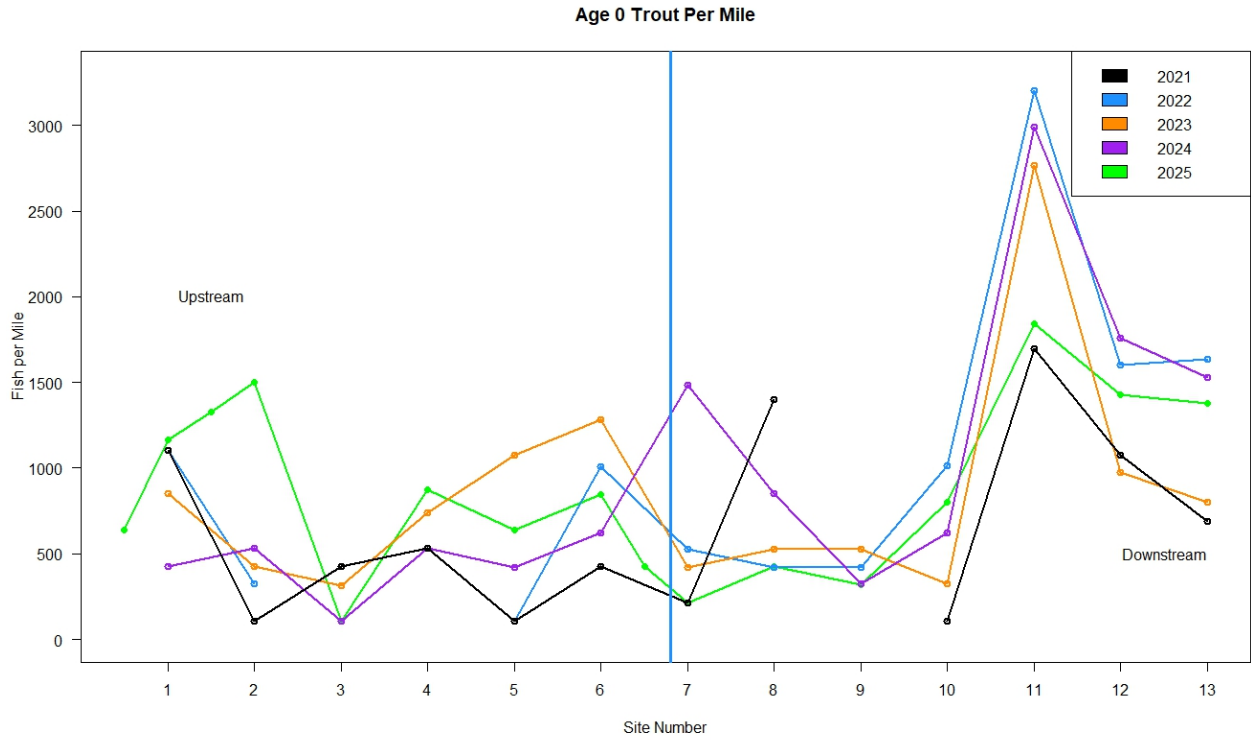


Figure 17. Estimates of juvenile trout-per-mile for one bank from mainstem margin electrofishing of the mainstem of the Deschutes River in 2021-2025. Numbers of fish caught at site nine in 2021 and site 3 in 2022 were not large enough to provide an estimate. Blue line denotes the location of North Canal Dam

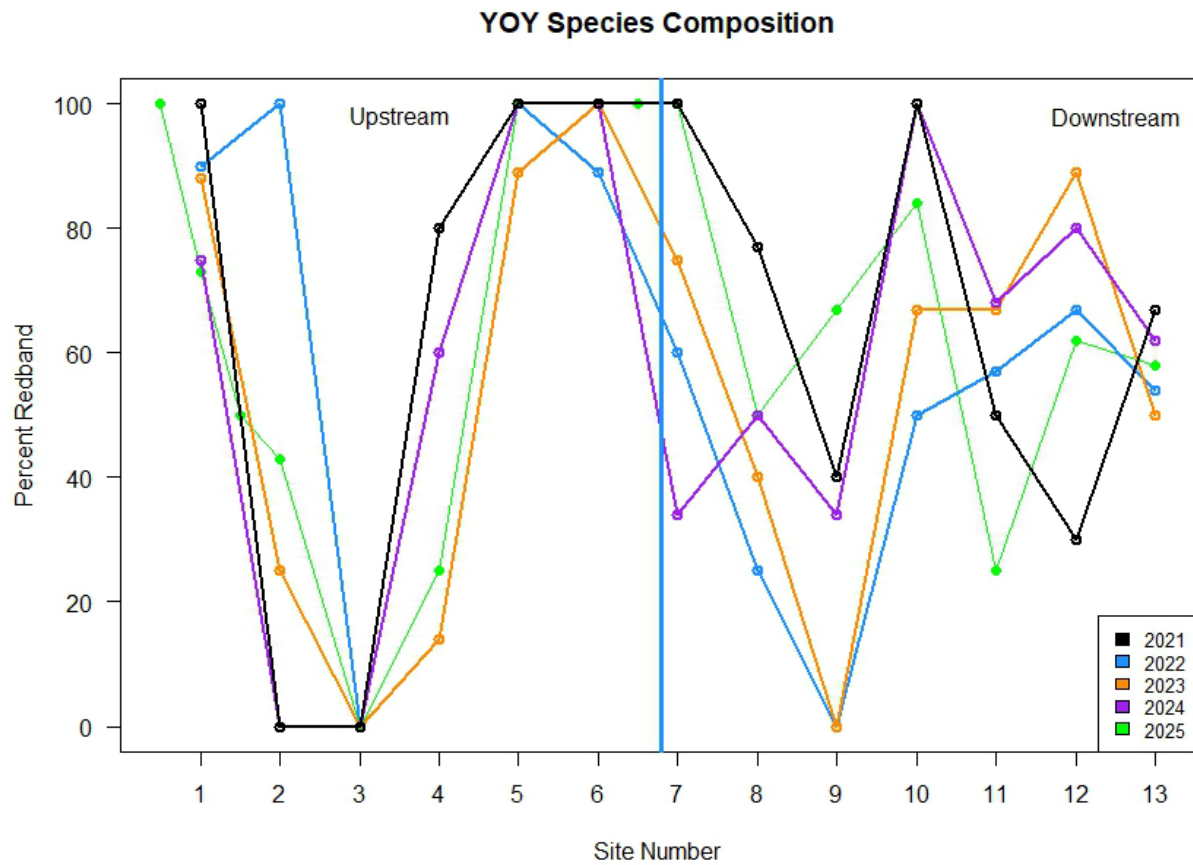


Figure 18. Species composition of young of year trout in the Deschutes River, 2021-2025. Blue line denotes the location of North Canal Dam.

Discussion

The stream-margin habitat sampling for YOY trout is showing the ability to track temporal and spatial changes in juvenile trout production in the mainstem Deschutes River. Five years of monitoring has started to show some spatial consistency in estimated juvenile trout abundance and important reaches for juvenile rearing are becoming clear. A few areas that have high production of juvenile trout include Folley Waters, Steelhead Falls, Lava Island, and River Rim Park. However, in 2025 the sites nearest Wickiup Dam were higher than in the past and had some of the highest values for the river. Brown Trout are generally larger than the Redband Trout in the Deschutes River. The size difference is expected and explained by

spawning and hatch timing. Brown Trout are fall spawners their offspring hatch in winter or early spring whereas Redband Trout are spring spawners and their offspring emerge in late spring or early summer.

Stream-margin habitat sampling for juveniles helps us to identify important areas of high production for trout and allow us to prioritize our conservation efforts in areas that are essential to the long-term health and sustainability of our fish populations. As minimum winter flows increase with implementation of the DCHCP, stream-margin and lateral habitats are expected to have the greatest gain in wetted area amongst habitat types. YOY trout sampling has the potential to allow us insight into effects of river conditions that may not be apparent when observing the adult segment of the population. Sampling of YOY trout is planned for 2026 to continue to track changes to the fish populations in the Deschutes River.

Surface Water Temperature Monitoring

Suitable water temperatures play a critical factor in trout activity, metabolism and survival. Under natural conditions, the spring-fed nature of the Deschutes River would have provided stable and ideal temperatures for native trout, char, salmon, and steelhead.

Anthropogenic changes including water storage, deep reservoir water withdrawal, diversion of the majority of streamflow, declining groundwater levels, and loss of riparian habitat have altered both the seasonal and longitudinal stream temperature profile of Upper and Middle Deschutes River.

Temperature monitoring has been conducted by many different groups in the upper Deschutes River basin as a part of research and management efforts. The Oregon Department of Fish and Wildlife deployed twelve temperature loggers throughout the upper and middle Deschutes River basin, including some tributaries (Table 5). Other agencies including the City of Bend, Oregon Department of Environmental Quality, U.S. Bureau of Reclamation, U.S. Forest Service, and the Upper Deschutes Watershed Council also maintain temperature loggers in other locations throughout the Deschutes River basin (Figure 19).

Methods

Autonomous Onset[®] HOBO dataloggers are set to continuously record ambient water temperature data every hour. Data loggers are anchored to a secure point on the bank with wire rope. Rope lengths are sufficient to keep the loggers submerged despite fluctuations in the rivers' flow. Weights are attached to the loggers to keep them submerged in the river. Data are currently downloaded several times a year, but data loss especially in high use areas where tampering with equipment is an ongoing challenge. For this report, we present the data from

the warmest part of the year, April through August, 2025. Temperature is recorded at hourly intervals and the following analysis used the daily maximum temperatures recorded. Observed temperatures for each monitoring site were compared to the State of Oregon 20°C (68°F) numeric criterion for Redband Trout use and the 12°C (54°F) criterion for Bull Trout spawning and juvenile rearing. Bull Trout were extirpated from the Upper and Middle Deschutes River when dams were built in the 1950s but were historically an abundant and important fish taxa.

Deschutes River Basin Temperature Loggers

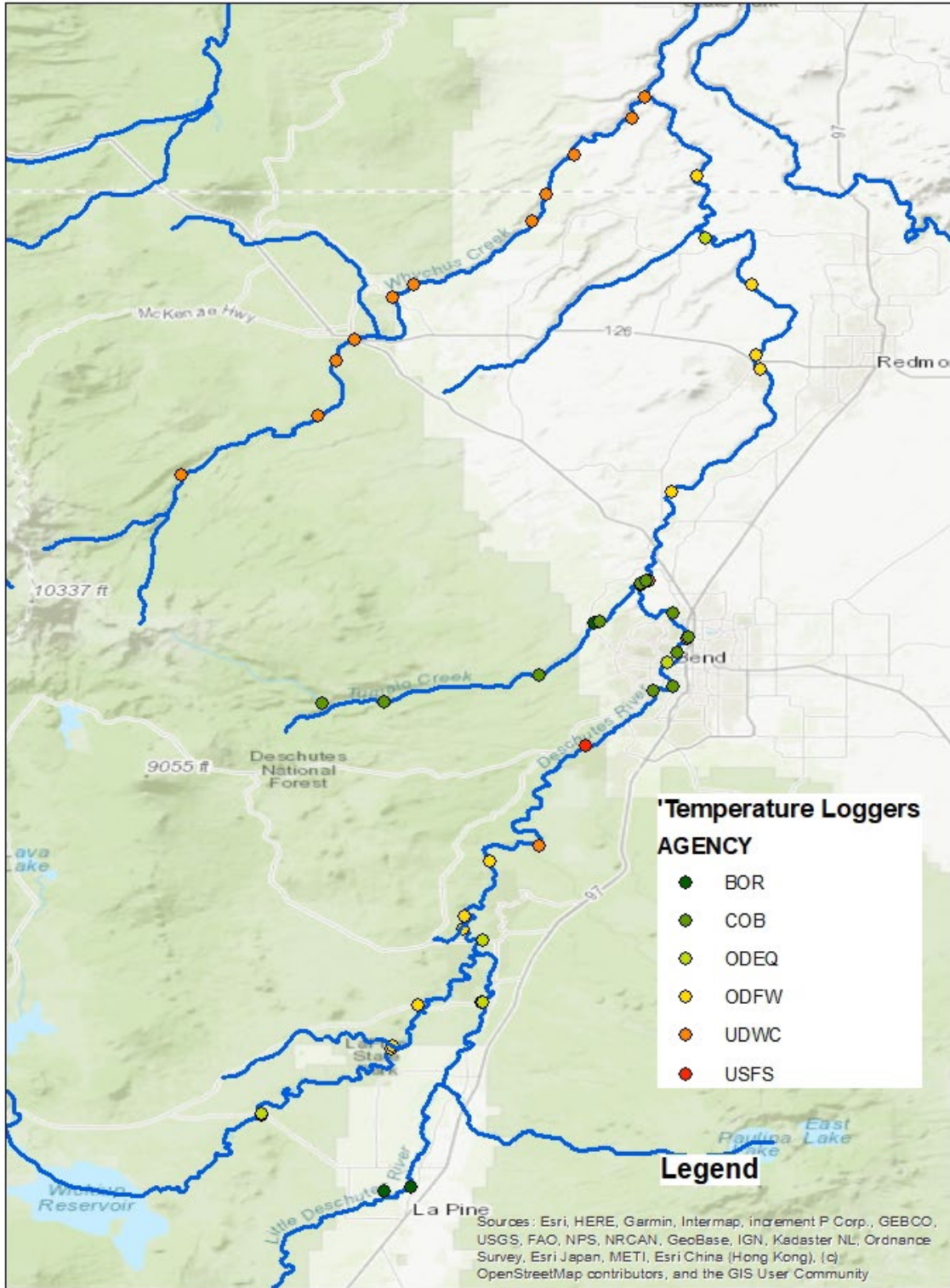


Figure 19. Temperature logger locations for governmental agencies and non-governmental organizations in the Deschutes River basin.

Table 5. Station ID and Location of HOBO water temperature loggers deployed by ODFW, 2025.

STATION ID	Description	River Mile	LATITUDE	LONGITUDE
DR_FallR_us	Deschutes River upstream of Fall River	Deschutes 205.1	43.78727	-121.51539
FR	Fall River just upstream of Deschutes River	Fall River 0.4	43.78952	-121.51471
DR_FallR_ds	Downstream of Fall River	Deschutes 199.1	43.81824	-121.49649
LDR	Little Deschutes River at highway 42 bridge	Little Deschutes 5.5	43.81997	-121.45172
SR	Spring River off Besson Road	Spring River 0.0	43.87141	-121.46474
DR_Besson	Deschutes River at Besson boat launch	Deschutes 189.8	43.88029	-121.46334
DR_Sunriver	Deschutes River in Sunriver, Forest Road 600	Deschutes 184.8	43.919473	-121.445696
DR_TwinBr	Deschutes River at Twin Bridges	Deschutes 154.4	44.1811	-121.31747
DR_ClineSP	Deschutes River at Cline Falls State Park	Deschutes 145.3	44.26754	-121.25421
DR_ClineFalls	Deschutes River below Cline Falls	Deschutes 144.5	44.27758	-121.25728
DR_OdinFalls	Deschutes River below Odin falls	Deschutes 139.4	44.32697	-121.26089
DR_Steelhead	Deschutes River above Steelhead Falls	Deschutes 128.8	44.40406	-121.29937

Results

Our data shows a predictable general pattern of an increase in water temperature in the warmest months and a decline in water temperature when the weather cools. Two of the spring-fed tributaries (Fall River and Spring River) in the upper section of the basin have the coldest temperatures recorded (Figure 20; maximums of 59F and 50F). The third tributary, a surface runoff stream, the Little Deschutes, has the highest temperatures with a maximum of 80F observed. Three of the sites (Odin Falls, Cline Falls, and Twin Bridges) located downstream of the North Canal Dam have some of the highest temperatures (Odin – 76F, Cline – 74F, and Twin – 73F) and become warmer moving downstream. The lowest site near Steelhead Falls appears to be moderated with some groundwater contribution with a maximum of 69F. The four sites (Besson – 62F, above Fall River – 63F, Big River – 63F, and Lava Lands –

65F maximums) above the North Canal Dam are grouped close together and are more moderate in temperature. Data collection is ongoing.

Discussion

Redband Trout are a desert adapted subspecies of Rainbow Trout and can tolerate higher water temperatures than some other trout species, with optimum growth temperatures of over 66 Fahrenheit (19 Celsius, Behnke 1992). However, the Little Deschutes and three of the sites on the mainstem of the Deschutes River (Odin Falls, Cline Falls, and Twin Bridges) located downstream of the North Canal Dam in Bend show temperatures that are above the ODEQ temperature criterion for Redband Trout (Figure 19; 20 Celsius or 68 Fahrenheit; ODEQ 2008) for over 20 days of the recorded period. Mountain Whitefish and Bull Trout are also native salmonid species in the Deschutes River Basin, but both have lower temperature tolerances than Redband Trout. Mountain Whitefish thermal tolerances have been reported at 62 Fahrenheit (16.8 Celsius) for chronic water temperature and 56.8 Fahrenheit (13.8 Celsius) for optimum growth (Brinkman et al. 2013) and the ODEQ temperature criterion for Bull Trout is 53.6 Fahrenheit (12 Celsius; ODEQ 2008). All recorded temperatures in the main stem of the Deschutes River are above the ODEQ temperature criterion for Bull Trout, which were historically present in the Deschutes River basin. The only location thermally suitable for Bull Trout is Spring River. However, the ODEQ criterion is for the 7dADM and we are reporting the raw maximums for the days observed. During irrigation season, the Deschutes River flow changes from 1400-1700 cfs above the North Canal Dam to 100-400 cfs below the North Canal Dam due to withdrawals for irrigation during the period observed. The loss of thermal mass in the river makes it more susceptible to warming due to air temperature. Monitoring locations downstream of North Canal Dam including Twin Bridges, Cline Falls, Odin Falls exceeded the preferred thermal range for Redband Trout from Julian Day 175 (June 24) to 242 (August 30). The last site located below the dam (Steelhead Falls) is more moderate in temperature because it is highly influenced by the cold-water spring inputs located at Folley Waters that bring temperatures down

to a level that is below DEQ criteria for Redband Trout. The thermal changes observed moving downstream on the Deschutes River illustrate the conditions in the river resulting from large water withdrawals and the detrimental conditions that aquatic organisms face. The dip in water temperatures around the 172nd Julian day (June 21) corresponds to a cooler break in the weather for those days. The water temperatures above the dam are more moderate and a little more stable. The volume of water is less susceptible to warming due to air temperature and the two cold-water tributaries (Fall and Spring River) limit the warming the river experiences as it moves downstream.

Deschutes River Water Temperatures 2025

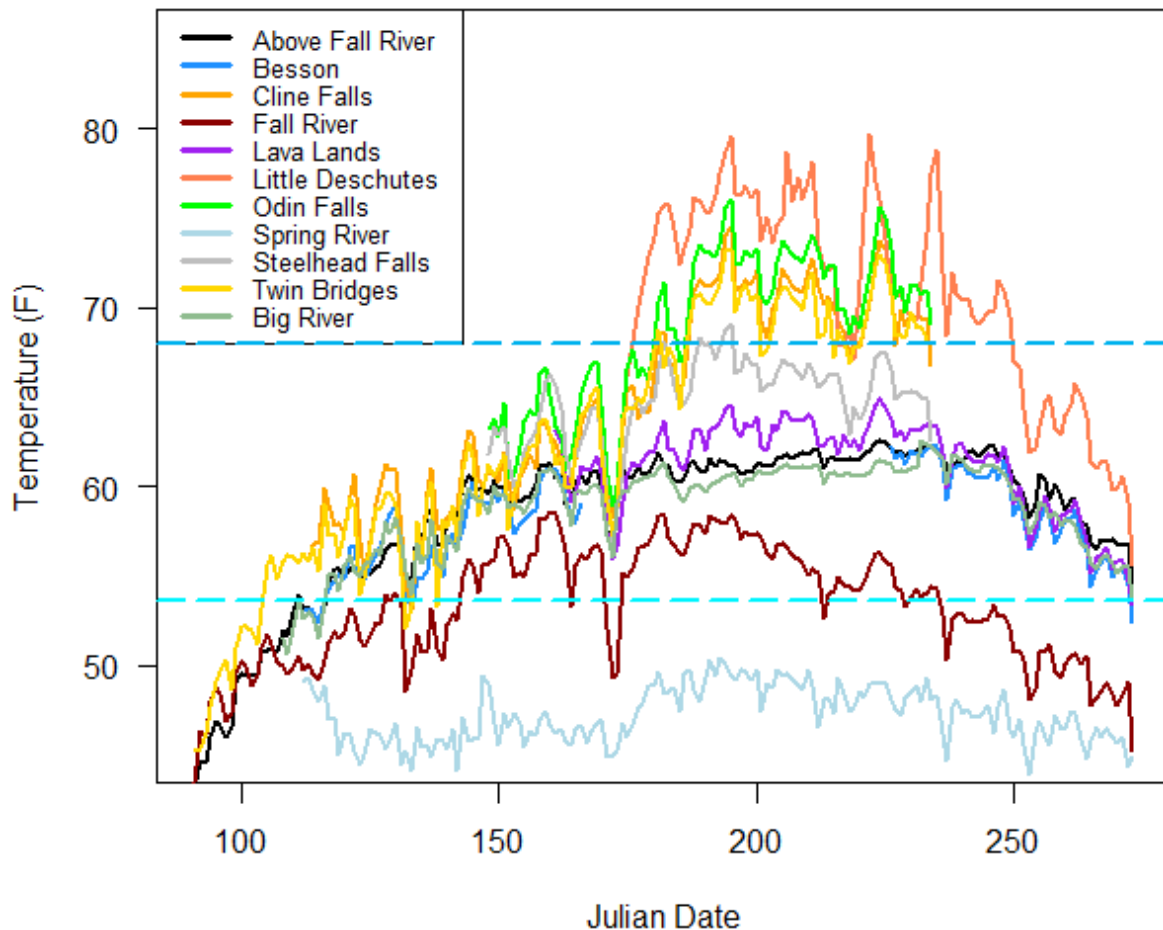


Figure 20. Daily maximum water temperature on the Deschutes River and tributaries, April-August 2025. Dashed dark blue line is ODEQ criteria for Redband Trout. Dashed light blue line is ODEQ criteria for Bull Trout spawning and rearing.

Off Channel Habitat Monitoring

The Upper Deschutes River flow regime is changing as water conservation measures are being implemented through the Deschutes Basin Habitat Conservation Plan (DBHCP) to benefit aquatic species. The changes in flow regime are predicted to increase available aquatic habitat in the winter, increase the frequency and duration of off-channel habitat connectivity, and potentially reduce available habitat in the summer. The effects of these flow changes will be the greatest from Wickiup Dam down to the North Canal Dam (Bend, OR) and it will be important to monitor changes in aquatic species populations over time as these flow changes take place.

There is insufficient biological and environmental data in off-channel habitats in the Upper Deschutes Basin that is integral to habitat restoration planning and design. This data is important to monitor due to its relevance to protecting and restoring habitat critical to all life stages of OSF and native fish that rely on these areas for foraging and rearing. There is a higher likelihood of observing non-native invasive species in off-channel habitats and understanding the status of these non-native species is important given that their presence can further diminish native species recovery.

New flow management goals are affecting the timing and duration of off-channel habitat inundation and connectivity with the mainstem Deschutes River. This work aims to document biological and environmental conditions of off-channel habitats and answer the following questions.

What fish and macroinvertebrates are currently utilizing off-channel habitats along the Upper Deschutes River? How are macroinvertebrate communities responding to increased minimum overwinter flows and habitat availability in mainstem and off-channel habitats of the Upper Deschutes River? How does water temperature respond to increased minimum overwinter flows and new flow management in mainstem and off-channel habitats of the Upper Deschutes River?

Methods

Six off-channel habitats were sampled between Lapine State Park and Sunriver in spring 2025 before high-flows begin and in the summer during high flow season to determine the fish assemblage in off-channel habitats (Figure 21). Six additional sites between Sunriver and Bend have been selected for sampling in year two, 2026 (12 total). Sampling techniques depend on water depth and include mini-fyke nets and baited minnow traps. Fyke nets will be soaked for 24 hours. Minnow traps will be deployed adjacent to preferred juvenile fish habitats including deep pools, woody debris, undercut banks, and/or overhanging vegetation. All fish will be identified to species, counted, and a subsample measured for length and weight.

Benthic macroinvertebrate monitoring will also be conducted in 12 off-channel habitats (6 per year) utilizing the stovepipe sampling protocol, the dip net measured sweep protocol, or another appropriate protocol based on water levels and selected to be representative of available habitat including oxbows, sloughs, side channels, alcoves and percolation channels.

Additionally, we have a poor understanding of thermal regimes in off-channel habitats and how individual sites interact with the mainstem flow both directly and indirectly (hyporheic/shallow groundwater exchange). We will conduct continuous water temperature monitoring in 12 off-channel habitats (6 per year). Sites will be selected to be representative of available habitat including oxbows, sloughs, side channels, alcoves and percolation channels. Off-channel water temperature will compare thermal regimes and determine the suitability of these habitats for native fishes using lethal thermal maxima and calculating the amount of time above critical thresholds for native species.



Figure 21. Locations of off-channel habitat sampling on the Deschutes River, 2025-2026.

Discussion

Data collected as part of this project will help tell a story about the fish, macroinvertebrate and water quality conditions in the Upper Deschutes system in the early phases of streamflow restoration as part of the Deschutes Basin Habitat Conservation Plan. This proposal will inform future planning and restoration implementation by documenting current fish assemblages, macroinvertebrate communities, and water quality. Having this baseline data at 100 cfs winter flow, will be important as partners in the Deschutes basin move ahead with streamflow restoration and habitat restoration and can someday compare with future monitoring data. We anticipate that flow restoration will have a positive impact over time on water quality, macroinvertebrates, and native fish and amphibian populations due to flows returning to more natural conditions, improvements to water quality, and improved environmental conditions. This work will help determine the status of native and non-native species, their use of mainstem and off-channel habitats, how populations are responding to flow restoration, and what management considerations should be explored. This data will improve understanding of limiting factors that can be better addressed during future habitat restoration planning, design, and implementation, and provide insight into population trajectories that we can anticipate with additional flow restoration.

This work began in 2025 and will continue into 2026. Results will be included in future reporting. Funding for this work is provided by an OWEB grant obtained in partnership with the Upper Deschutes Watershed Council.

Other Deschutes Basin Activities

In addition to the tasks described above, in 2025, the COID Mitigation and Enhancement Biologist provided support with the planning and implementation of spawning ground surveys for Redband and Brown trout in important reaches of the upper Deschutes River and its

tributaries. These censuses are important for tracking the health of trout populations over time and the impacts of changes to the hydrology of the system and reservoir management. The M&E Biologist also assisted the district with other fish-related projects in the Deschutes Basin including creel surveys on the opening day for angling at Crane Prairie and Wickiup reservoirs and fish inventory at Lava Lake. The M & E Biologist also provided support for the Lava Island fish salvage in late October. The Biologist partnered with the Upper Deschutes Watershed Council to write and apply for an OWEB grant to fund additional activities for 2025-2027. Grant money will be used to expand on current activities and include an investigation into backwater and off channel habitats of the upper Deschutes River including the use and distribution of fish and macroinvertebrates and water temperature monitoring.

2026 Work Plan

The 2026 work plan includes the following ongoing monitoring tasks:

- Upper Deschutes River Fish Monitoring
- Upper Deschutes River Spawning Ground Surveys
- Mainstem Deschutes and Tributary Macroinvertebrate Sampling
- Juvenile Trout Young-of-the-Year Population Abundance Estimates
- Surface Water Temperature Monitoring in the Mainstem Deschutes River and Tributaries
- Support COID with fish salvage associated with repairs to intake facility (Nov 2026-March 2027) including cofferdam installation, work area isolation and dewatering.

In addition, the following tasks included in the scope of work for the 2025-2027 Oregon Watershed Enhancement Board grant, will be added to the M&E Program Biologist work plan:

- Upper Deschutes River Trout Abundance Estimate Sampling Using Mark-Recapture
- Analysis and modeling of Trout Age and Growth using scale aging
- Deschutes Off-Channel Habitat Seasonal Fish Use Inventory
- Deschutes Off-Channel Habitat Macroinvertebrate Sampling
- Deschutes Off-Channel Habitat Water Temperature Monitoring

References

- Behnke, R. J. 1992. Native trout of western North America. American Fisheries Society Monograph 6.
- Bettoli, P. W., and L. A. Bohm. 1997. Clinch River trout investigations and creel survey. Fisheries Report No. 97-39. Tennessee Wildlife Resources Agency, Nashville, Tennessee.
- Brinkman, S.F., Crockett, H.J. and Rogers, K.B. (2013), Upper Thermal Tolerance of Mountain Whitefish Eggs and Fry. *Transactions of the American Fisheries Society*, 142: 824-831.
- Fetherman, E.R., Winkelman, D.L., Baerwald, M.R., and G.J. Schisler. 2014. Survival and Reproduction of *Myxobolus cerebralis*-Resistant Redband Trout Introduced to the Colorado River and Increased Resistance of Age-0 Progeny. *PLoS ONE* 9(5): e96954. doi:10.1371/journal.pone.0096954
- Gannett, M.W., Manga, M. and Lite, K.E., Jr. (2003). Groundwater Hydrology of the Upper Deschutes Basin and Its Influence on Streamflow. In *A Peculiar River* (eds J.E. O'Connor and G.E. Grant).
- George, J. and T. Porter. 2022. Memorandum on Crooked River Low Flows 2022. Oregon Department of Fish and Wildlife. Available online at: https://www.dfw.state.or.us/fish/local_fisheries/deschutes/docs/Crooked_River_Low_Flow_Memo_20221129_v2.pdf.
- Quinn, J.W. and T.J. Kwak. 2000. Use of Rehabilitated Habitat by Brown Trout and Rainbow Trout in an Ozark Tailwater River, *North American Journal of Fisheries Management*, Volume 20, Issue 3, Pages 737–751.
- Maryland Department of Natural Resources. 2013. Survey and Management of Freshwater Fisheries Resources. Annual (2013) Performance Report. Fisheries Service Inland Fisheries Division.
- McKinney, T., Speas, D. W., Rogers, R. S., & Persons, W. R. (2001). Rainbow Trout in a Regulated River below Glen Canyon Dam, Arizona, following Increased Minimum Flows and Reduced Discharge Variability. *North American Journal of Fisheries Management*, 21(1), 216–222.
- Oregon Department of Environmental Quality. 2008. Temperature Water Quality Standard Implementation – A DEQ Internal Management Directive.
- Oregon Department of Fish and Wildlife. 1996. Upper Deschutes River Subbasin Fish Management Plan. Upper Deschutes Fish District. 383 pp.
- Pacific Northwest Aquatic Monitoring Partnership (PNAMP). 2008. Field and laboratory methods for the collection of benthic macroinvertebrates in wadeable streams of the Pacific Northwest.
- Porter, T. and B. Hodgson. 2016. Effects of a modified flow regime on the fish populations of the Crooked River below Bowman Dam. Oregon Department of Fish and Wildlife. Available online at: https://www.dfw.state.or.us/fish/local_fisheries/deschutes/docs/Crooked_River_Summary_Report_2016_FINAL_REPORT.PDF
- River Design Group. 2017. Oregon Spotted Frog and Deschutes Redband Trout Habitat Modeling and Riparian Analysis at Two Sites on the Upper Deschutes River. Prepared for: Deschutes Basin Board of Control on behalf of the Basin Study Work Group.
- Seber, G. A. F., and J. F. Whale. 1970. The removal method for two and three samples. *Biometrics* 26(3):393-400.

- Starcevich, S. 2016. 2014 Deschutes River fisheries monitoring report: Occupancy and closed-capture modeling of salmonids using cataraft electrofishing in the Middle and Upper Deschutes River.
- Taylor, R. 2023. Mono Basin Fisheries Monitoring Report Rush, Lee Vining, and Walker Creeks 2022. Prepared for the State Water Resources Control Board, the Los Angeles Department of Water and Power and the Mono Basin Monitoring Administration Team.
- USFWS. 2020. Final Deschutes Basin Habitat Conservation Plan. 2020. Volume 1 and Volume 2.
- Wiley, R. W., & Dufek, D. J. (1980). Standing Crop of Trout in the Fontenelle Tailwater of the Green River. *Transactions of the American Fisheries Society*, 109(2), 168–175