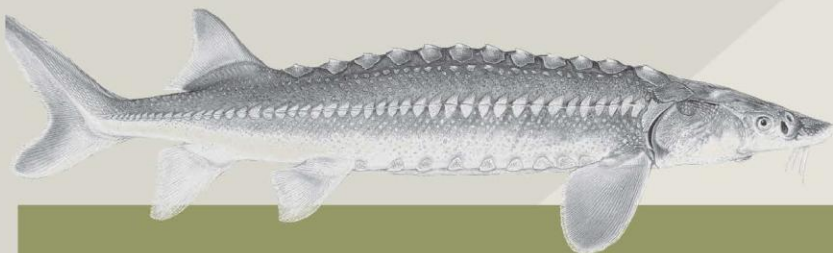
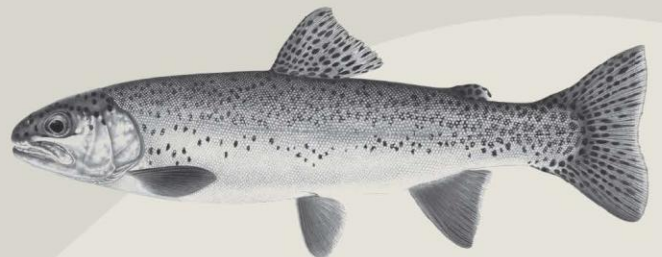
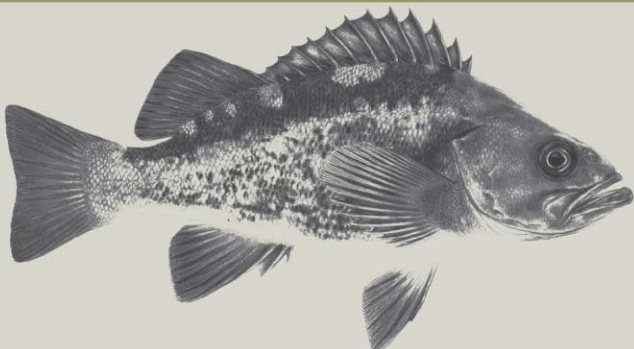




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Oregon Department of Fish and Wildlife



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Native Fish Investigations Program**

**Warner Sucker Passage Success at JJ and O’Keeffe
Diversion Dams**



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CONTRACT NUMBERS: US Fish and Wildlife Service F20AC10347, Lake County Umbrella Watershed Council 222-8215-19379

PROJECT PERIOD: March 2024–December 2025

Prepared by: Fred R. Monzyk, Justin P. Miles, and Alexis S. Harrison



O’Keeffe Diversion Dam and fish ladder on Deep Creek during high flow in 2025 (740 cfs)

Oregon Department of Fish and Wildlife
4034 Fairview Industrial Drive SE
Salem, OR 97302

October 2025

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TABLE OF CONTENTS

ABSTRACT	1
INTRODUCTION.....	1
METHODS	3
RESULTS AND DISCUSSION.....	7
MANAGEMENT IMPLICATIONS	8
ACKNOWLEDGEMENTS	8
REFERENCES.....	9
APPENDIX.....	10

LIST OF FIGURES

Figure 1. Map of the Warner Basin showing lakes, canals, streams, and irrigation diversion dams with their fish passage status.....	2
Figure 2. Aerial photo of the JJ Diversion showing location of irrigation ditch, approximate location of old return flow areas, new consolidated return flow/bypass channel, and PIT antennas.	4
Figure 3. Photo of pass-through PIT antenna on the upstream end of the O’Keeffe Diversion fish ladder on Deep Creek, 2024.	6
Appendix Figure 1. Photos of JJ Diversion with boards (A) and without (B) on lower Honey Creek	10
Appendix Figure 2. Schematic of the O’Keeffe Diversion fish ladder	11

ABSTRACT

Warner Suckers *Catostomus warnerensis* are endemic to the lakes and tributaries of the Warner Basin in southeastern Oregon. The species was listed as threatened in 1985 due, in part, to habitat fragmentation from numerous irrigation diversion dams on the tributaries (U.S. Fish and Wildlife Service 1985). Recent recovery efforts have focused on providing passage at the JJ Diversion Dam on lower Honey Creek and the O’Keeffe Diversion Dam on Deep Creek. Our objectives in this study were to: 1) assess upstream passage effectiveness at the newly constructed fishway bypass channel at the JJ Diversion on lower Honey Creek; and 2) assess upstream passage effectiveness of the fish ladder at the O’Keeffe Diversion on Deep Creek.

At the JJ Diversion, irrigation ditch overflow was mostly consolidated to a single area near the dam with the intent to provide better conditions for upstream fish passage. We detected two PIT-tagged Warner Suckers, a subadult and an adult, using the new fish bypass route to successfully pass upstream of the diversion site.

In Deep Creek in both 2024 and 2025, high flows prevented us from capturing and tagging Warner Suckers for use in passage evaluations at the O’Keeffe Ladder. We used Warner Suckers captured from the Summer Lake Wildlife Management Area (SLWMA) as surrogates for the passage evaluation. These fish were released into the ladder after tagging and transporting from SLWMA, but none were detected successfully moving upstream through the ladder. Lack of successful upstream passage was likely due to their poor condition or stress involved with their transport and/or release into colder creek water. One Redband Trout (115 mm FL) captured in Deep Creek and released in the ladder on 22 April 2025 was detected successfully passing upstream through the ladder later that evening, indicating flow conditions within the ladder are suitable for upstream passage.

INTRODUCTION

Warner Suckers *Catostomus warnerensis* are endemic to the Warner Basin, a semi-arid endorheic subbasin of the Great Basin in southeastern Oregon, northwestern Nevada, and extreme northeastern California. The presumed historical range of the Warner Sucker consists of the low- to moderate-gradient reaches of Twentymile, Honey, and Deep creeks, the three relatively permanent lakes (Hart, Crump, and Pelican lakes), and several ephemeral lakes during periods of abundant precipitation (U.S. Fish and Wildlife Service 1985; Williams et al. 1990; Figure 1). Stream-dwelling suckers exhibit a fluvial life-history, spawning in the creeks during the spring. Lake-dwelling suckers typically exhibit an adfluvial life history, entering streams in the spring to spawn. However, when upstream spawning migration is blocked by low stream flows, spawning can occur in nearshore areas of the lakes (White et al. 1990) with unknown success. Furthermore, it is believed that stream-dwelling populations recolonize the lakes

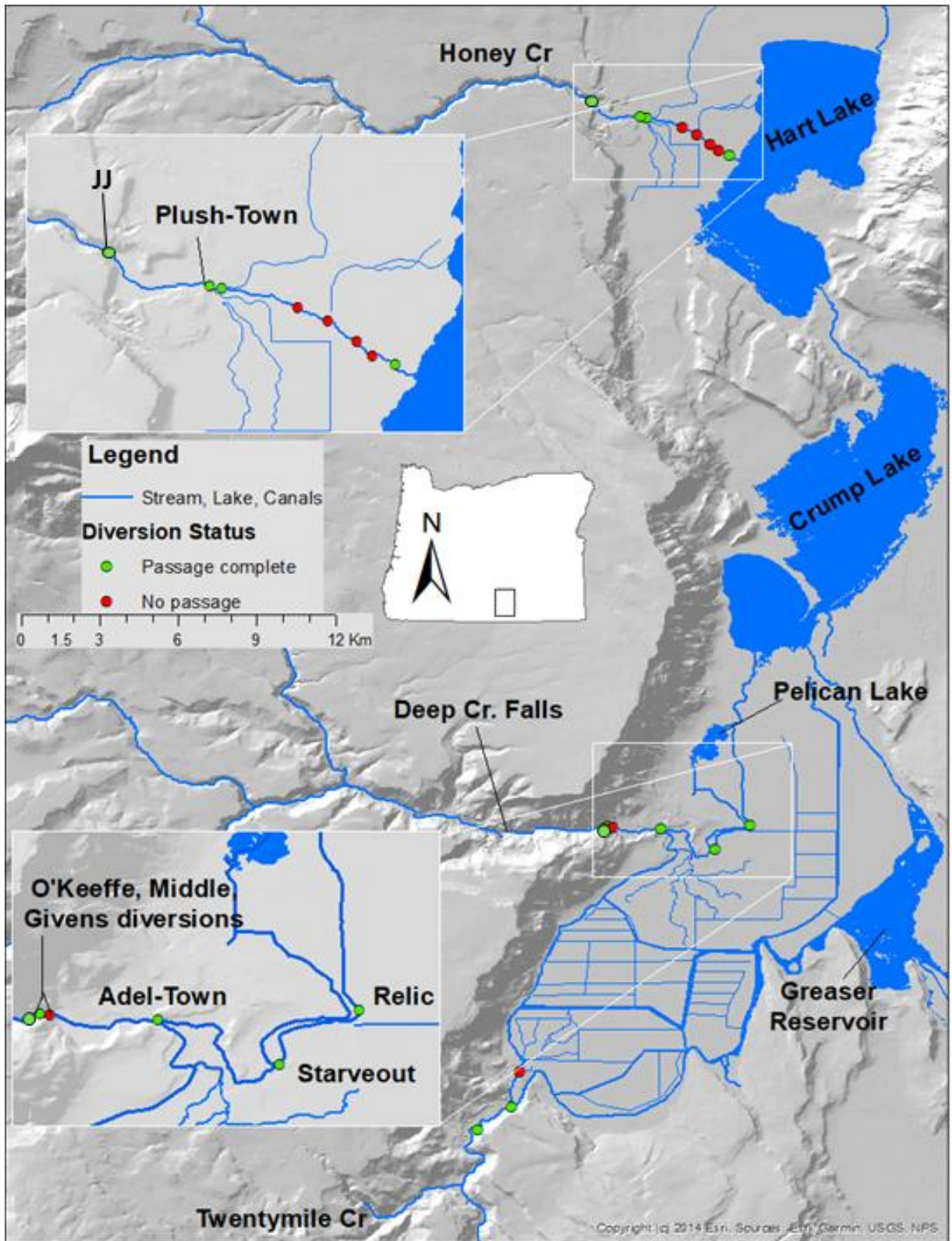


Figure 1. Map of the Warner Basin showing lakes, canals, streams, and irrigation diversion dams with their fish passage status. Insets show the location of diversion dams on lower Deep and Honey creeks.

following drought-induced desiccation events that periodically decimate lake-dwelling sucker abundance.

Warner Sucker abundance and distribution have declined over the past century and the species was federally listed as threatened in 1985 due, in part, to habitat fragmentation from numerous irrigation diversion dams (U.S. Fish and Wildlife Service 1985). One of the recovery criteria for Warner Sucker is that passage be restored within the streams (U.S. Fish and Wildlife Service 1998). The Warner Basin Aquatic Habitat Partnership (WBAHP), a collaboration of local, state, and federal partners, is committed to the recovery of the Warner Sucker through the completion of passage, screening, and habitat enhancement projects with participating landowners.

On lower Honey Creek, eight low-head diversion dams have been constructed to divert water into irrigation canals (Figure 1). Fish passage and screening have been provided at three of the diversions (Rookery, Flood Ditch, and Plush-Town). The JJ Diversion is the most upstream diversion dam and a possible upstream passage barrier when dam boards are installed (Appendix Figure 1). Prior to passage improvements at this site, excess water entering the irrigation ditch overflowed back into the creek at multiple locations, but with too high a gradient and low flow for upstream fish passage. In 2023, overflow was mostly consolidated to a single location near the dam with a lower gradient that could potentially allow for upstream fish passage (Figure 2).

On Deep Creek, a passage project was also completed at the O’Keeffe Diversion in 2023. The O’Keeffe Diversion is the upstream-most diversion dam on Deep Creek. A 208-ft long fish ladder was constructed that consisted of 4-ft wide concrete channel with 31 vertical slot panels (Appendix Figure 2). Prior to the fish ladder construction, the diversion blocked sucker passage to the 2.9 km of potential habitat below Deep Creek Falls.

Our main objectives for this study were to: 1) assess upstream passage effectiveness at the newly constructed fishway bypass channel at the JJ Diversion on lower Honey Creek; and 2) assess upstream passage effectiveness of the fish ladder at the O’Keeffe Diversion on Deep Creek.

METHODS

JJ Diversion.- On 20 March 2024, we installed passive integrated transponder (PIT) antennas at two locations at the JJ Diversion on lower Honey Creek to assess upstream fish passage at the newly constructed fish bypass (Figure 2). One antenna was located at the upstream end of the newly constructed bypass channel and a second antenna was placed near the start of the irrigation ditch. Direction of fish movement could be inferred based on the timing of detections on the two antennas. The antennas were laid on the stream substrate (pass-over antennas) and beacons were installed on the antennas to monitor the functional continuity of the antenna systems throughout the

2024 study period. Due to site configuration and potential for signal interference, we could not install an additional antenna at the JJ Diversion dam board slot to assess if this was a potential passage route. Our primary goal was to determine if fish successfully use the new bypass route since this route will be available regardless of dam board use at the diversion. Fish detection data from the antennas was uploaded approximately once a month from March through June to assess passage timing and success.

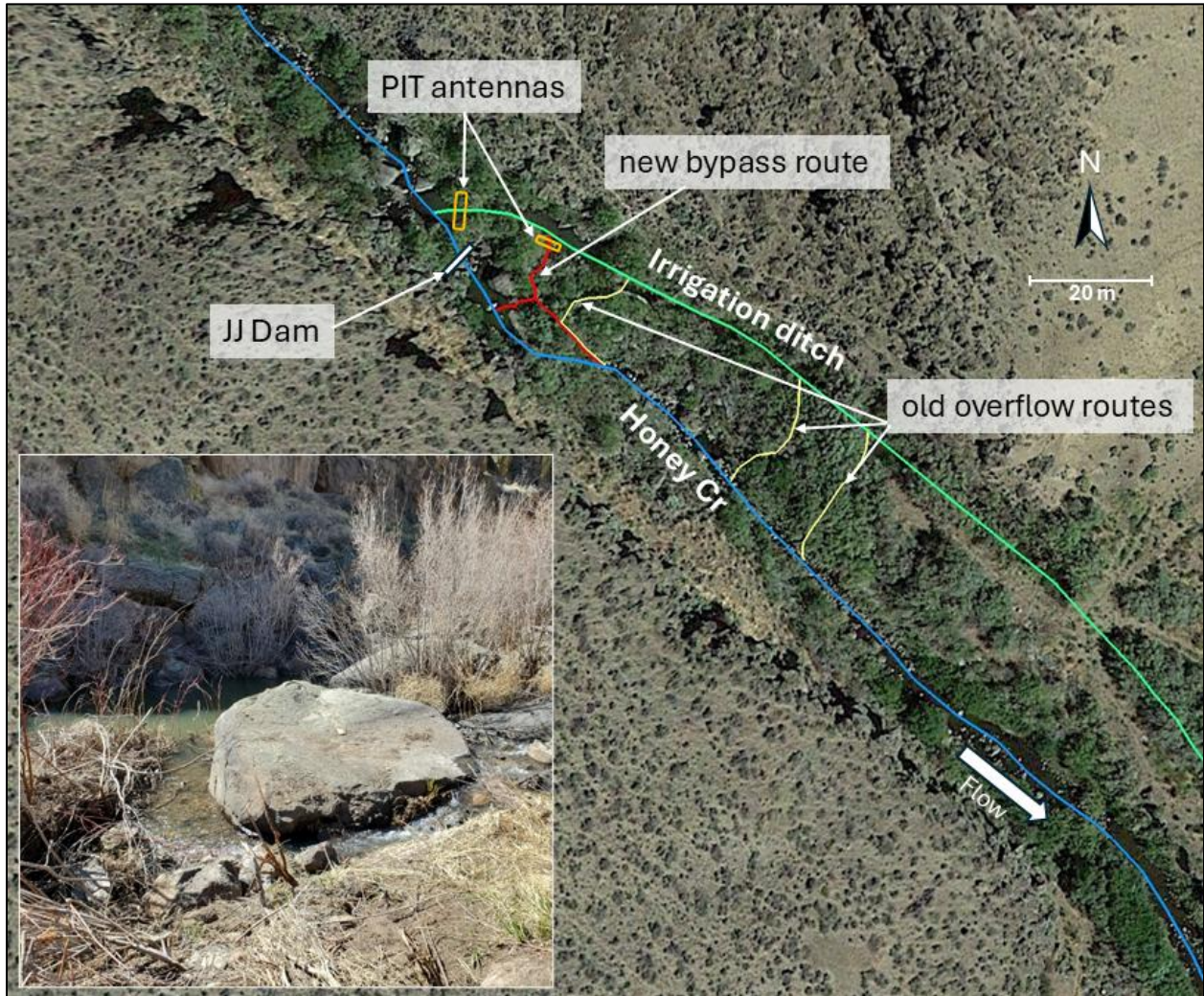


Figure 2. Aerial photo of the JJ Diversion showing location of irrigation ditch, approximate location of old overflow areas, new consolidated return flow/bypass channel, and PIT antennas. Inset photo shows portion of new bypass channel entering the creek.

Warner Suckers PIT tagged in previous years were potentially available for detection if they survived to 2024. These included 25 fish tagged in 2021 and released in the reach between JJ and Town Diversion, and 13 fish tagged in 2022 and released below the

Plush-Town Diversion as part of a passage evaluation at that diversion (Monzyk et al. 2022). In addition, we tagged five Warner Suckers in 2024 (size range: 101-228 mm FL) and released them in the pool directly downstream of the JJ Diversion on 02 May 2024. These fish were captured with a Smith-Root® LR-12 backpack electrofisher in the stream reach between the JJ and Plush-Town diversions. Captured fish were anesthetized, fork length (FL) measured, and implanted with PIT tags. A 12-mm half-duplex tag was implanted in fish <120 mm FL and a 23-mm tag was used for fish ≥120mm FL. Fish <120mm FL are likely subadults (Monzyk 2019).

O’Keeffe Diversion.- On 21 March 2024, we installed PIT antennas on the upstream and downstream end of the O’Keeffe fish ladder on Deep Creek. The downstream antenna was a pass-over antenna laid on the substrate near the end of the concrete ladder. The upstream antennas was a pass-through antenna mounted around the upstream ladder orifice (Figure 3). A beacon was installed on the upstream antenna to monitor the functional continuity of the antenna throughout the study period. We also reinstalled PIT antennas at the Adel-Town Diversion and in the Town Ditch (Mikey’ Weir) as described in Monzyk et al. (2021).

In April, we attempted to capture Warner Suckers and Redband Trout in Deep Creek with hoop nets and backpack electrofishing in the reach between Relic and Town diversions, but high flows and deep water precluded fish capture. So, on 01 May 2024, we captured 10 Warner Suckers from Summer Lake Wildlife Management Area (SLWMA) using a Smith-Root® LR-12 backpack electrofisher. Fish were PIT-tagged and transported to the O’Keeffe ladder in three 5-gallon aerated buckets. Periodic water exchanges occurred during transport (~2 hrs) to decrease water temperature within 2°C of Deep Creek water temperatures prior to release. Fish were released into the O’Keeffe fish ladder just below the downstream-most baffle.

In 2025, we only operated the upstream antenna at the O’Keeffe fish ladder starting on 25 March. We also reinstalled the Adel-Town and Mikey’s Weir antennas the same day. We captured, tagged, and transported 12 Warner Suckers from SLWMA on 27 March. Fish were released into the O’Keeffe fish ladder at the 180-degree bend (between the 5th and 6th vertical slots approximately 18 m upstream from the fish ladder entrance). We attempted to capture Warner Suckers in Deep Creek to supplement the SLWMA fish, but high spring flows and deep water again precluded capture of taggable-size suckers. In addition to SLWMA fish, Warner Suckers PIT-tagged in previous years in lower Deep Creek below Town Diversion were potentially available for detection. These included 78 fish tagged in 2020, 47 tagged in 2021, and eight tagged in the summer of 2024.

Previous fish sampling upstream O’Keeffe Dam suggested that Warner Sucker were not present prior to the fish ladder construction (ODFW-unpublished data). We collected environmental DNA (eDNA) samples upstream of O’Keeffe Dam in the summer of 2024 and 2025 to determine if any Warner Sucker were present following passage completion. Each year, we collected a 1-L water sample in the forebay of O’Keeffe Dam

and in a large pool approximately 1.8 km upstream of the dam following methods described in Monzyk et al. (2023). Detection of Warner Sucker eDNA upstream of O’Keeffe Dam would be an indirect indication that suckers successfully passed upstream.

In addition to suckers, one Redband Trout was captured and tagged from the Town Ditch and released into the fish ladder at the same location as the suckers. Fish detection data from all antennas were uploaded approximately once a month from March through June each year to assess passage timing and success.

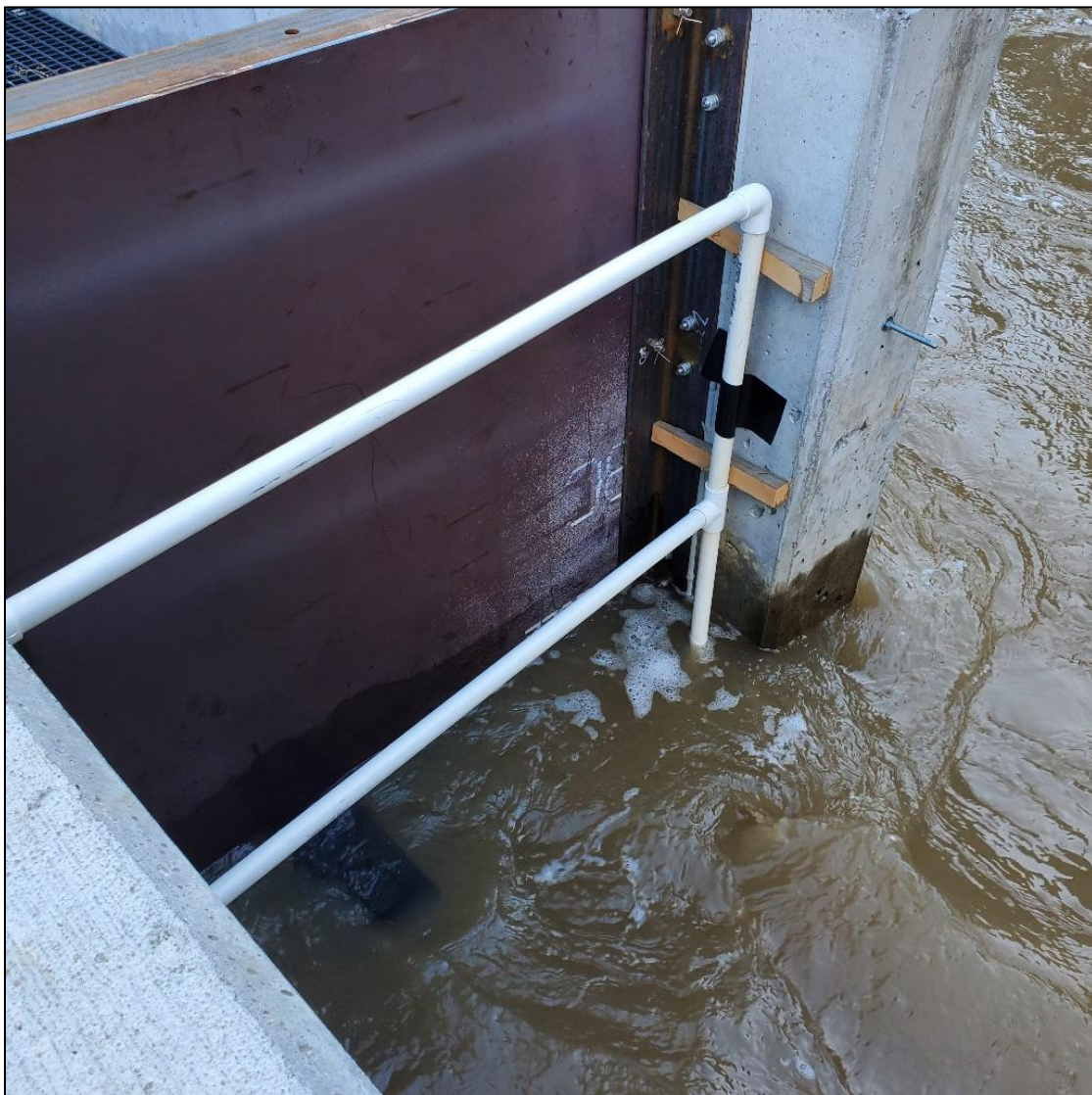


Figure 3. Photo of the pass-through PIT antenna on the upstream end of the O’Keeffe Diversion fish ladder on Deep Creek, 2024.

RESULTS AND DISCUSSION

JJ Diversion.- Honey Creek stream flows were sufficiently high throughout the spring of 2024, so dam boards were not required at the JJ Diversion for irrigation purposes. Even though a passage route through the dam board slot was likely available, we detected two Warner Suckers passing upstream through the new bypass route. The first detection was an 111-mm FL fish (likely immature) released directly below the JJ Diversion on 02 May. The fish was detected on the bypass antenna on 03 May but was not detected again until 12 May on the antenna at the head of the irrigation ditch. This delay between detections suggests the fish successfully moved upstream through the bypass route and resided in the irrigation ditch for at least 9 days. The second fish detected was an adult sucker that was tagged and released below the Plush-Town Diversion in 2022 (198 mm FL when tagged). This fish was detected moving upstream over both antennas on 12 May.

Although only two fish were detected, the results show that both sub-adult and adult Warner Sucker can successfully move upstream past the JJ Diversion through the new bypass route. This passage route will be available for fish to use in lower flow years when dam boards are installed at the dam.

O’Keeffe Diversion Fish Ladder.- We did not detect any Warner Sucker successfully moving upstream through the fish ladder. The 10 suckers captured from SLWMA in 2024 appeared to have recently spawned, and as a result, were in relatively poor condition. All 10 fish were detected on the downstream antenna after release and based on the first and last detection of each fish, they remained in the lower end of the ladder between ~0.5-12 hrs before exiting downstream. In 2025, we captured and tagged Warner Suckers from SLWMA prior to their spawning season and released them higher up in the ladder. However, these fish also appeared to move downstream and out of the ladder. Although we could not determine how long they remained in the ladder because we did not operate an antenna on the downstream end, no detection of suckers occurred on the upstream antenna and several of the SLWMA fish in both years were detected at the Adel-Town and Mikey’s Weir antennas after release.

Warner Suckers from SLWMA inhabit a small ditch with very low flow velocities throughout the year. Water temperature in the small ditch (16-20°C) during fish capture were warmer than Deep Creek temperature at release (10°C). Although we attempted to acclimate fish to the colder creek water over the 2-hour transport period, the acclimation period may have been insufficient to prevent cold shock, which may have reduced the swimming activity in the fish (Reid et al. 2022). In addition, the stress from transport may have affected their behavior. As such, SLWMA fish may not be suitable surrogates for evaluating upstream passage effectiveness in the colder and higher flow environment of Deep Creek. The lack of successful upstream passage by SLWMA suckers is likely attributable to the condition of the fish rather than the ladder.

The one Redband Trout (115 mm FL) collected from the Town Ditch and released in the ladder on 22 April 2025 was detected successfully passing upstream through the ladder later that evening. This indicates flow conditions within the ladder are suitable for trout upstream passage.

Although water velocities in the ladder appear adequate for upstream fish passage, water velocities in the creek along the outer wall of the ladder near the downstream entrance were high and turbulent for most of the spring study period in both years (see title page photo). Water flowing over O’Keeffe Dam during high flows is directed towards the ladder entrance resulting in highly turbulent flows along the wall and a back-eddy on the opposite bank. Fish moving upstream in Deep Creek under these conditions are likely to use the opposite bank and may have difficulty finding the ladder entrance. The ability of upstream-migrating fish to find the ladder entrance is likely only possible during periods of low to moderate streamflow. Any future evaluation of upstream passage at O’Keeffe Dam should occur in a low water year. Alternatively, eDNA could be used to indirectly evaluate successful upstream passage. We did not detect Warner Sucker eDNA in the creek upstream of the ladder in the summer of 2024 or 2025. If detected in future years, this would indicate Warner Suckers have successfully passed upstream of the dam.

MANAGEMENT IMPLICATIONS

In total, 11 irrigation diversion passage projects have now been completed in the Warner Basin, significantly decreasing habitat fragmentation of the Warner Sucker populations. It is expected that the completion of all passage projects by WBAHP in the next few years will restore passage within and among the three major streams of the Warner Basin, achieving one of the major recovery criteria needed for delisting the species.

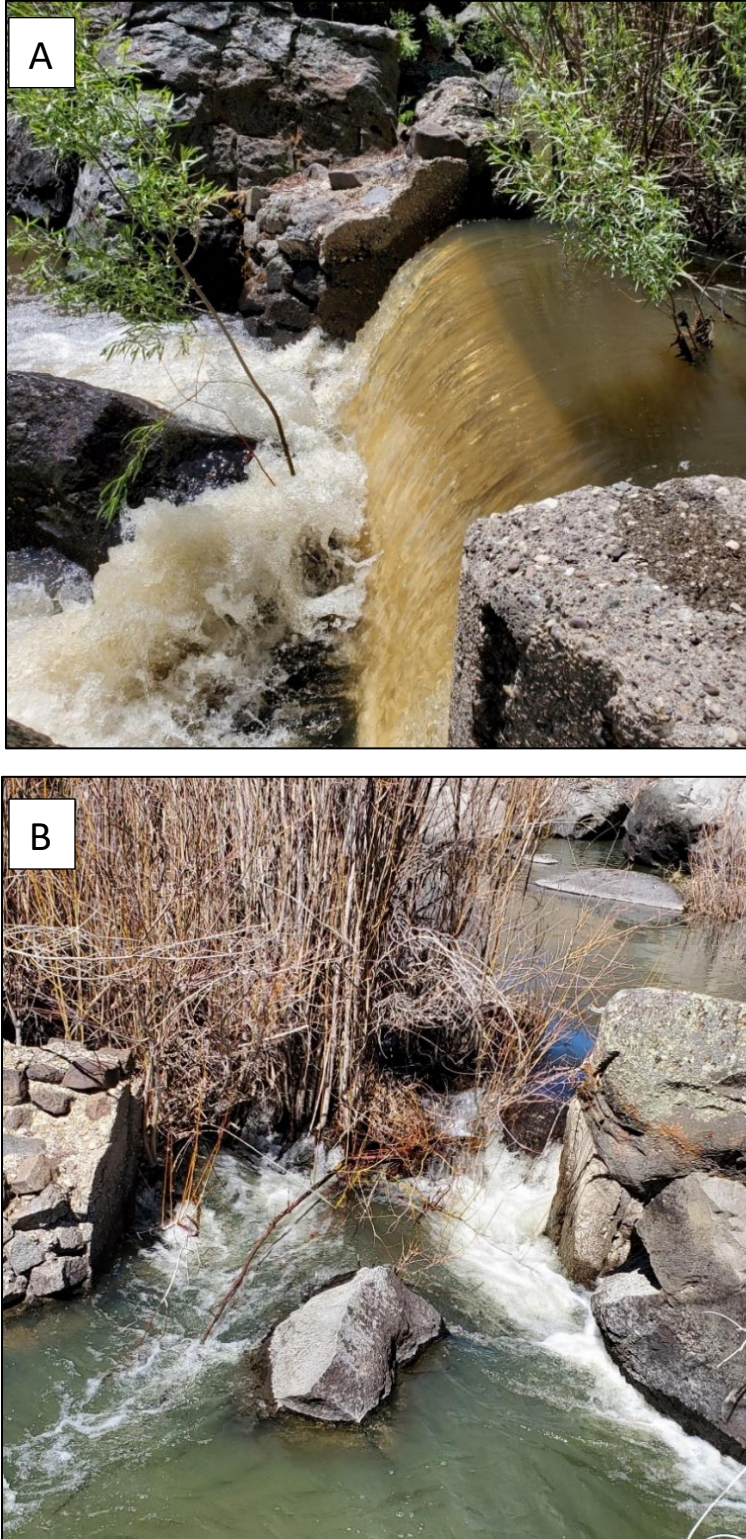
ACKNOWLEDGEMENTS

We would like to thank Matt Colver for many hours of assistance with installing PIT antennas and tagging fish. We would also like to thank Sandy Taylor, John O’Keeffe, and John Flynn for graciously allowing us access to their property to install antennas and Joe Cahill for allowing us access to sample fish. We would also like to thank Jennifer Allen at the OSU Levi Lab for processing the eDNA samples. Thanks to Troy Brandt (SWCA Environmental Consultants) for providing information on diversion designs. Funding for this work was provided by the Lake County Umbrella Watershed Council and the U.S. Fish and Wildlife Service.

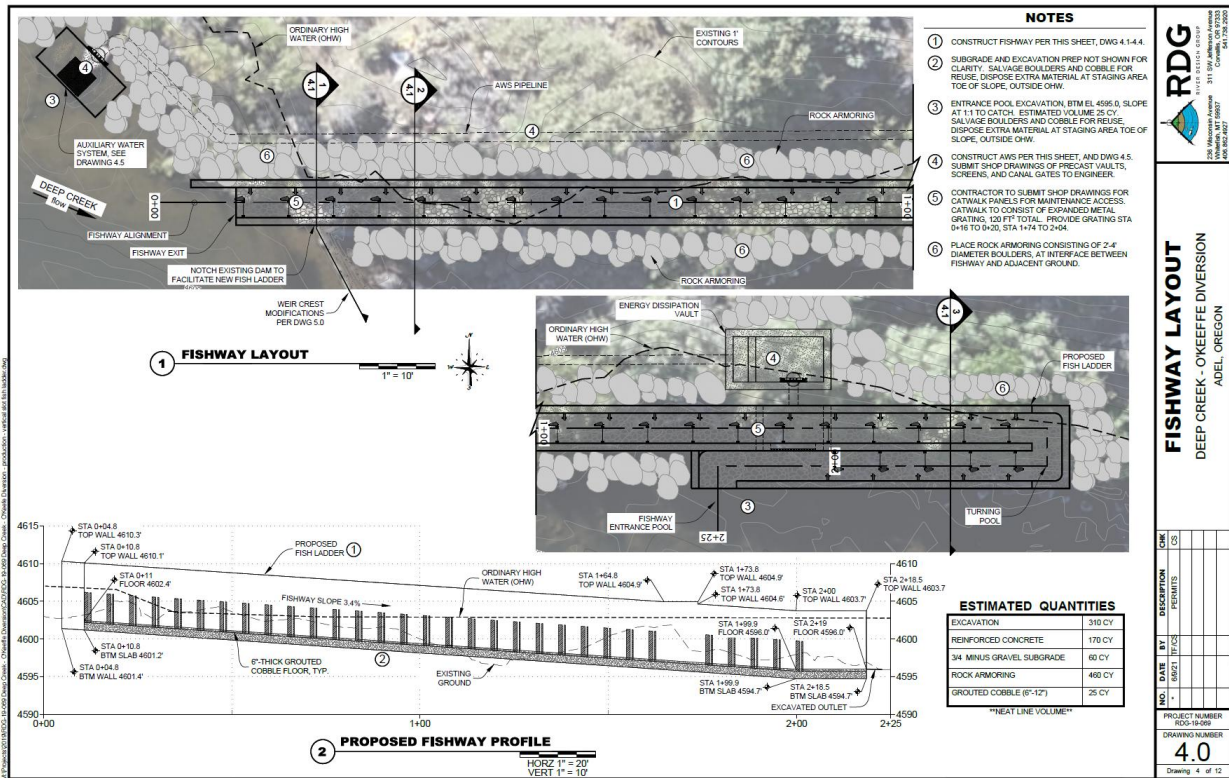
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APPENDIX



Appendix Figure 1. Photos of JJ Diversion on lower Honey Creek with boards (A) and without boards (B) installed. The diversion is presumed to be an upstream passage barrier when boards are present.



Appendix Figure 2. Engineering drawing of the O'Keeffe Diversion fish ladder. Drawing provided by Troy Brandt (SWCA Environmental Consultants).



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