Lower Coquille Tide Gate and Fish Passage Monitoring Plan

Julie Huff, Monitoring Coordinator
Coquille Watershed Association

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1. Introduction and Background

Since the mid-1800s, land-use practices have substantially decreased the amount and quality of floodplain complexes in the Coquille basin and anadromous fish returns, including ESA listed Oregon Coast coho, have decreased to an estimated 8% of historical abundance. Tidal floodplains and wetlands provide critical rearing habitat and slow water refugia for salmonids. These habitats in the Coquille Valley have been reduced to less than 600 acres, or <5% of historical acreage, by the use of levees, ditches and tide gates. Current tide gate styles are largely top-hinged wood or steel and restrict juvenile fish movements from the mainstem Coquille River into locations that would historically have provided high quality winter and spring rearing. The National Marine Fisheries Service (NMFS) ESA Recovery Plan for Oregon Coast Coho Salmon (2016), Oregon Department of Fish and Wildlife (ODFW) Oregon Coast Coho Conservation Plan (2014), and Coquille Indian Tribe (CIT) Coquille Subbasin Plan (2007) have all identified the depletion of slow-water refugia as one of the key limiting factors affecting the recovery of Oregon Coast coho salmon. Although these habitats are a priority, there is little published science on the migratory habits of juvenile coho within the tidally influenced estuaries of the Oregon Coast. Therefore, it is unknown how restoration projects that increase access to tidal floodplains affect the recovery of the Oregon Coast coho population.

Study Area

The Lower Coquille Tide Gate and Fish Passage Monitoring (LCM) study area focuses on the Lower Coquille River (Coquille Estuary) in the Coquille watershed. The Coquille watershed encompasses approximately 1,000 sq. mi. predominately located in Coos County, OR. The Coquille watershed is the largest watershed to originate from the Coast Range and has the second longest tidally influenced estuary on the Oregon Coast at 41 miles. The Coquille Estuary has the potential to provide high quality over-wintering habitat for coho, Chinook, steelhead, and Pacific lamprey in addition to many other species of fish and wildlife. Predominate land uses in the Coquille Estuary include private forested lands, agriculture, and urban areas. The LCM sites, specifically, are located in the freshwater tidal estuary ranging from river mile 13-20, Figure 1. All of the properties focus on agriculture except for the restoration portion of Winter Lake Unit 2, which is recently restored tidal wetland habitat (prior pastureland).

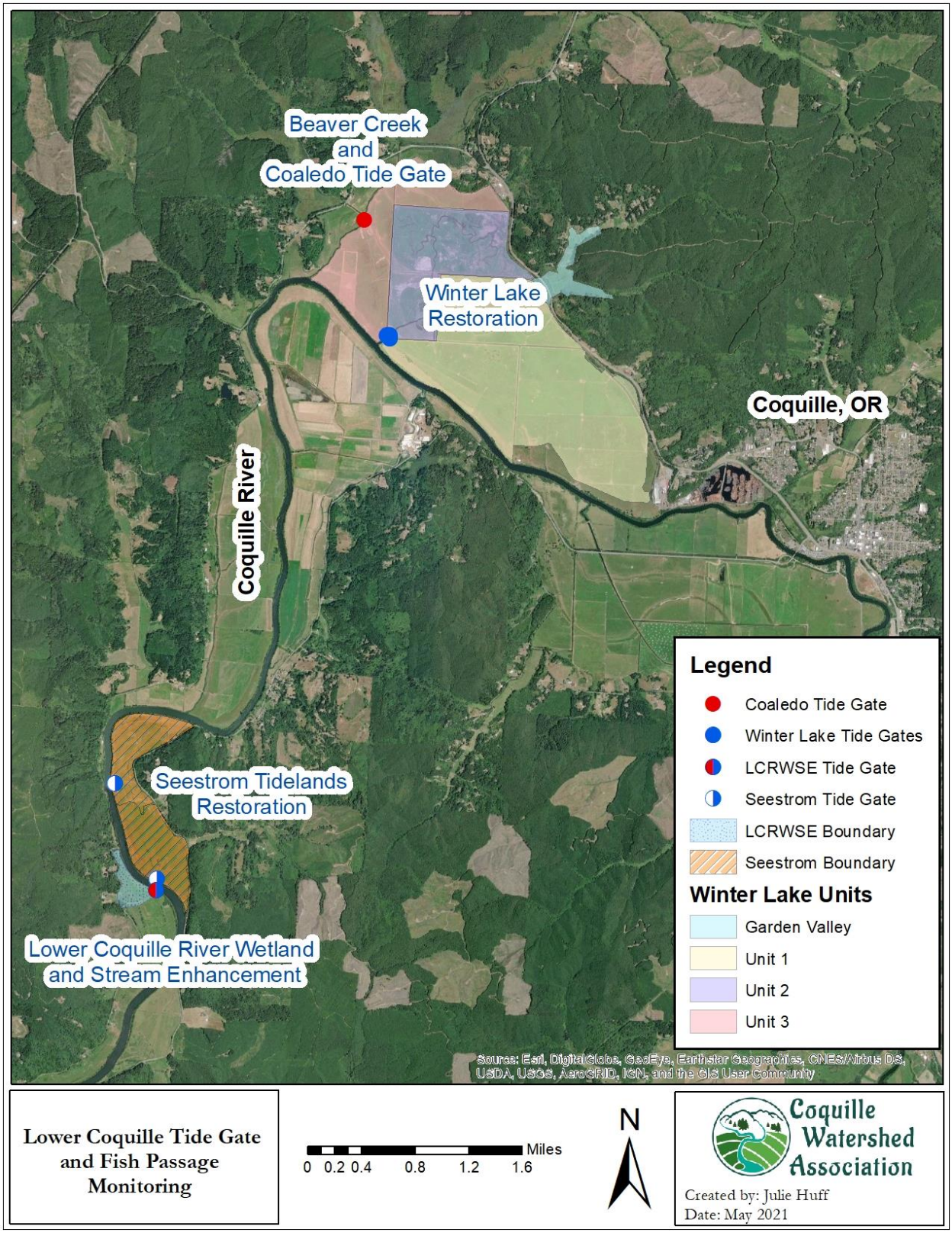


Figure 1. Lower Coquille Tide Gate and Fish Passage Monitoring location map.

Restoration Efforts

The largest factor suppressing juvenile fish use of the existing floodplain habitat and its slow water refugia has been the installation of tide gates throughout the Coquille Valley, which eliminate tidal inflow and outflow onto low-lying pastures and obstruct fish passage. The beginning of a significant uplift to winter rearing habitat in the Coquille Valley began in 2017 with 3 working lands tide gate upgrades and habitat restoration projects (Figure 1). All 3 tide gate upgrades encompass technology upgrades that enhance fish passage relative to traditional top-hinge gates. Specifically, two of the sites incorporate a Muted Tidal Regulator (MTR), a device that allows for tidal inflow with the level set to a desired water elevation, whereupon the door closes. One of the sites incorporates electrically operated slide gates that allow for fine-tuned adjustments for fish passage and water management. These technologies allow for greater capacity of fish movement, since the duration and area of door opening is substantially increased compared to the replaced structures. Furthermore, all three projects included habitat restoration on the ODFW Coquille Valley Wildlife Management Area and on working ranch parcels. Restoration consisted of newly constructed stream channels, riparian plantings and livestock exclusion fencing.

The first tide gate upgrade and habitat restoration project was completed in 2017. The Lower Coquille River Wetland and Stream Enhancement project (Cochran) at river mile 13 is relatively small in size with respect to both tide gate upgrade and habitat restoration, a 6' diameter culvert and side-hinged tide gate was installed with MTR technology and 3,500' of tidal channel was created. The second project, Winter Lake Restoration, located at river mile 20 was completed in 2018 and is unprecedented in size and complexity on the Oregon Coast. A structure containing seven new 8'x10' concrete box culverts and aluminum tide gates equipped with MTR technology replaced the three failing tide gates. The seven tide gates drain 1,761 acres and separate the floodplain into 3 hydrologically independent units. Agriculture is the management focus of two units (Units 1 and 3) while fish and wildlife habitat is the management focus of Unit 2. Almost eight miles of new channel was constructed in Unit 2 along with multiple tidal depressions. The third project, Seestrom Tidelands Restoration (Seestrom), is a moderate-sized project completed in the summer of 2019 (Figure 6-7). The upgraded side-hinged MTR aluminum tide gate drains 135 acres of land, which includes 11,500' of newly constructed tidal channel and 1.4 acres of tidal depressions.

Partnerships

1. ODFW

An important aspect of the LCM Program is the partnerships between CoqWA, ODFW Research Evaluation Data & Decision (REDD) Group, ODFW Charleston field office and ODFW The Dalles Research Station. All three offices bring expertise to the program that are invaluable to its overall success.

The ODFW Charleston field office has intricate knowledge of the project sites and Coquille Estuary that aids immensely in the field portion of this monitoring program. Much of the Coquille River sampling will occur upstream of the Winter Lake project and knowing which locations are both effective and safe for seining is crucial to this program's success. In addition, they have committed to 5 sampling events every winter in the Lower Coquille River on top of the support they provided for the Winter Lake Restoration Effectiveness Monitoring project.

The ODFW The Dalles Research Station expertise in PIT antenna arrays and data communication systems is utilized to guarantee successful construction and installation of arrays on the tide gates. In addition, design of the arrays by a leading expert maximizes detection efficiency leading to a more robust data set and analysis.

The ODFW REDD group is at the forefront of statistical analysis and modeling with respect to fish populations in Oregon. To ensure results are accurate and thorough ODFW REDD group will handle the bulk of data analysis and follow current methodologies.

2. Lower Coquille Monitoring Committee

The Lower Coquille Monitoring Committee (founded 2018) will continue to advise and meet regarding the work occurring in Winter Lake and the Lower Coquille River. The committee consists of a broad range of fields and expertise and serves to technically advise the monitoring work led by the Coquille Watershed Association. Members of the committee include the Coquille Indian Tribe, NMFS, ODFW, DEQ, The Nature Conservancy, Beaver Slough Drainage District and OWEB.

3. Future and/or Potential Collaborations

Furthermore, conversations have been initiated with the Coos Watershed Association (CoosWA) to determine how our monitoring programs can collaborate to leverage existing and proposed monitoring to ensure all overlap is intentional. Conversations included CoqWA, CoosWA, Dr. Art Bass of U-BC, Dr. Jamie Anthony of ODFW REDD Group and Derrek Faber of ODFW The Dalles. There are several layers of complimentary work, both existing and proposed, between the two organizations. First, both organization's project sites are on opposite ends of the freshwater-marine ecotone allowing for a more comprehensive tidal story of juvenile salmonid behavior. Because the tidal ecology is different across these landscapes population level information can be ascertained such as travel behavior, transit time between rearing sites, growth rate and survival for an estuary-wide understanding. Second, there is potential to collaborate in creating a unified data set of fish passage data to add statistical and ecological benefits to analysis of the specifics of fish passage through tide gates.

Both USFWS Bandon Marsh and Confederated Tribes of the Siletz Indians (CTSI) have completed extensive monitoring in the Lower Coquille Estuary. We have had initial conversations and there is interest in future collaboration and data sharing.

2. Monitoring Needs

Traditionally, Oregon Coast ESU coho salmon (*Oncorhynchus kisutch*) were thought to have a basic life history of rearing in upland freshwater streams before migrating as smolts to the ocean. Recently, that hypothesis has been challenged by evidence of a more nomadic life history especially where estuarine rearing occurs (Koski, 2009; Craig et al., 2014; Weybright and Giannico, 2018). However, due to historical habitat degradation and loss of complex estuarine overwintering habitats, there is limited capacity in many coastal basins to support juvenile coho salmon (ODFW, 2007). Off-channel habitats, which provide velocity refuge and cover have a relatively high capacity to support overwintering juvenile coho (Nickelson et al., 1992; Nickelson and Lawson, 1998; Solazzi et al., 2000), but these low-gradient habitats are particularly scarce in areas converted to agricultural use (Anlauf et al., 2009). More importantly, recent studies have demonstrated that off-channel habitats in areas of tidal influence can enhance juvenile coho salmon growth (Craig et al., 2014) and support rearing juveniles that contribute significantly to adult returns (Jones et al., 2014; Bennett et al., 2015).

In general, tide gates limit fish passage and typically provide lower ecological benefit than natural systems (Beamer, 2014). However, it has been hypothesized that MTR tide gates can provide greater ecological benefits than traditional top-hinged gates through reduced velocities, adjustable

control over water movement, and increased time that tide gates can be open. The movement of fish through tide gates is a function of the opening period, tidal flow, and an individual's motivation to move past the tide gate. Research suggests that access is most strongly affected by door opening during non-ebb tides (Beamer, 2014). Additionally, the fish passage effectiveness of tide gates varies by species and life history types. To promote management and operations of tide gates to maximize fish passage it is important to corroborate Beamer's (2014) finding that fish passage is preferred during non-ebb tides.

Furthermore, the tide gate replacement movement is growing along the Oregon Coast, necessitated by both the need to address aging infrastructure that protects farms and urban areas and the need to improve fish passage to critical rearing habitats. With over a thousand tide gates along the Oregon Coast, many organizations are optimizing tide gate replacements to aid in Oregon Coast ESU coho recovery. Typically, current tide gate replacement projects that are implemented by a local conservation organization in partnership with a willing landowner include restoration actions (e.g. increased culvert size, channel construction and vegetation enhancements) for freshwater and saline tidal wetlands. This working lands method takes a win-win approach by finding a solution that balances the needs of the landowner and vulnerable fish populations. However, it is unknown how effective these working lands restoration actions are in promoting juvenile coho recovery. The importance of monitoring tide gate effectiveness is multifaceted and includes: a) helping determine if Oregon Coast ESU coho recovery action priorities are providing benefits for the population, b) informing the public and verifying restoration dollars are spent on the most beneficial projects, c) having current data that can inform adaptive management to promote long-term resiliency of coastal communities, and d) continue to improve project designs and scope to enhance future tide gate replacements and tidal wetland habitat enhancements.

3. Monitoring Goals and Objectives

The monitoring team strives to aid in Oregon Coast ESU coho salmon recovery through sound scientific approaches that help guide future priorities and projects through the following goals:

1. Improve our understanding of how juvenile coho respond to the varied sizes and complexities of new MTR tide gates and the restored habitat created upstream. In addition, gain a more comprehensive understanding of the migratory habits of juvenile coho within the lower Coquille River to help inform future tideland restoration projects.

2. Aid in the adaptive management of these tide gate projects by providing data that informs how current tide gate management practices influence the project's objectives.

Objectives

1. Quantify the percent of juvenile coho residing in the lower mainstem of the Coquille River that enter the restored Winter Lake, Seestrom and Cochran project areas.

2. Estimate the total annual number of juvenile coho that enter and use the three restored project areas.

3. Estimate the increase in overall body condition between riverine-reared juvenile coho and those reared in the Winter Lake, Seestrom and Cochran project area.

4. Develop an understanding of growth rate comparing riverine-reared juvenile coho and those reared in the Winter Lake, Seestrom and Cochran project area. In addition, determine if growth rate varies with overall size of restored habitat or other site parameters.

5. Quantify the residence time of juvenile coho in floodplain habitats upstream of a fully redesigned and technologically advanced tide gate and determine if residence time varies with overall size of restored habitat.

6. Develop survival estimates for coho juvenile during residence time in the Winter Lake, Seestrom and Cochran project area and determine if survival varies with overall size of restored habitat.

7. Determine if and how rearing density varies with overall size of restored habitat behind an upgraded tide gate.

8. Develop an understanding of fish movement between the 3 units of Winter Lake by means of movement through the new Winter Lake tide gates when units are not hydrologically connected (non-flood events). In addition, determine if fish move between units when the units are hydrologically connected during flood events.

4. Summary of Methods

The LCM program relies on Passive Integrated Transponder (PIT) technology and an expansive fish sampling effort to track juvenile coho throughout the freshwater estuary. A combination of passive and active capture techniques (e.g., hoop trap nets, beach seines) are used to sample juvenile coho in the restored project sites of Winter Lake, Seestrom and Cochran, sampling will also occur at Beaver Creek (control area, mature freshwater wetland behind a leaking, old tide gate complex) and in the lower Coquille River throughout the winter and spring (December – May). Capture efforts will occur weekly in Winter Lake and Beaver Creek with 6 sampling events at both Seestrom and Cochran. Capture and tagging of juvenile coho upstream of the tide gate structures in the Coquille River will take place from December to April and will aim to tag 2,000 coho. If necessary to achieve tagging targets, juvenile coho may be captured a) in the Coquille River downstream from the tide gate structure and translocated upstream for release post-tagging b) in the headwaters, higher up in the watershed. During each capture event, all juvenile coho salmon will be PIT tagged, counted and measured for fork length and wet mass.

In addition to the fish sampling, the installation and operation of PIT antenna arrays are at the core of this study as they allow greater resolution of juvenile coho movement in both space and time. The arrays are attached directly to the inlet of the tide gate culvert so not only will PIT detections denote when a juvenile coho is moving throughout the estuary but it will also identify when passage of the tide gate has occurred. A total of 8 PIT antenna arrays have been installed; 4 on the Winter Lake tide gates, one on each of the Seestrom and Cochran tide gates and 2 on Beaver Creek 150 ft upstream of the tide gate. The PIT antennas are operated continuously throughout the 3-year project.

Tide gate door management is just one of the factors that influence juvenile coho residence and movement throughout the estuary. Other factors that can correlate to movement are site specific, for this reason, monitoring site parameters such as temperature, conductivity and water

level occurs at all of the sites. An in-depth account of all methods used for both field sampling and data analysis can be found in the grant applications of the projects identified below.

5. Current and Future Monitoring Projects

The structure of the Lower Coquille Monitoring program is complex and uncommon in that it is comprised of multiple smaller grants (sub-projects) that fit together to produce outcomes of a larger scale. Data is compiled from the sub-projects and analyzed as a whole for the Lower Coquille Monitoring program, deviations to this structure occur only for grant specific reporting, e.g. progress reports.

Secured Funding

Winter Lake Restoration Effectiveness Monitoring (OWEB) - A three-year project to monitor the effectiveness of the restoration efforts at Winter Lake. The monitoring entails measuring 14 different elements to encompass water quality and quantity, the study sites physical and landscape attributes and the response of salmonids to the restoration parameters. Three years of weekly fish sampling and tagging events is included in this project with the final year (winter of 2020-2021) coinciding with the first year of proposed PIT antenna array operations and sampling events in the Coquille River.

Winter Lake Fish Passage and Migration Monitoring (NOAA) – A three-year project that focuses monitoring efforts on fish passage through the Winter Lake tide gates and quantifies growth rate, abundance and survival associated with residence time within the project area. This will be accomplished through an intensive fish sampling and PIT tagging effort in the Coquille River, the Winter Lake units, the reference site (Beaver Creek) and the installation and operation of PIT antenna arrays on the Winter Lake tide gates to track fish movement and residence time.

Lower Coquille Restoration Effectiveness Monitoring (OWEB) –This project will tie in the restoration work completed further downstream of Winter Lake at two other locations in the Coquille valley. PIT antenna arrays will be installed and maintained on the upgraded tide gates at the Cochran and Seestrom projects in addition to temperature, salinity and water level loggers. Fish sampling and tagging at each site will be included in this 3-year project.

Seestrom MAMP Monitoring (USFWS) –This 5-year project includes monitoring on the Seestrom site to ensure that it complies with its Monitoring and Adaptive Management Plan (MAMP) such as temperature, water level, dissolved oxygen and channel stability. Some fish sampling at the Seestrom site is included with this project.

Coaledo Tidelands Fish Passage Monitoring Project (WRCA, TNC) –This 2-year project funds the design, fabrication, installation and maintenance of a PIT array on Beaver Creek (LCM reference site). Unlike the above projects, the PIT antennas are installed upstream of the tide gate to account for the projected tide gate replacement in 2023.

Monitoring Expansion

CoqWA continues to develop restoration and tide gate replacement projects Within the Coquille Estuary and will consider each for monitoring but CoqWA will not expand the LCM

Program carelessly. We will examine each expansion site to ensure the site meets specific criteria before pursuing funding. Criteria include but are not limited to:

1. The project must be unique concerning tide gate size and restoration habitat.
2. The project must fill data gaps in current research and knowledge whether that be salmonid movement, tide gate fish passage or habitat usage.

At present, one site has been identified for possible expansion; the Ni-les'tun Unit of Bandon Marsh. The Ni-les'tun Unit of the USFWS Bandon Marsh Wildlife Refuge is a restored, non-barrier system that sits lower in the estuary and would be the only monitoring site within brackish waters. There is already extensive monitoring occurring at Ni-les'tun (OWEB, grant #21-923) but it is focused mainly on the functional ecosystem processes of the marsh. The existing fish sampling portion doesn't include PIT tagging and happens during the spring and summer due to the difficulties of winter trapping, thus, only a PIT antenna array is proposed for the LCM expansion. With the large numbers of coho and Chinook tagged upstream it would allow monitoring data to be collected passively during the overwintering period. Furthermore, this data would also fill the knowledge gap as to what the extent of estuary habitat overwintering juvenile coho use both distance-wise and temporally.

Although not a physical expansion, discussion of a 2-year extension of the LCM program has begun. This extension would allow 3 years of monitoring to occur while the Ni-les'tun array was installed. Currently, our species of concern for the LCM program is Oregon Coast coho and an additional grant extending the timeline would allow us to include Fall Chinook salmon as a species of interest. Preliminary results show Fall Chinook are using these sites when it was not expected and assessing how tide gate upgrade and estuary restoration projects can bolster their population within the Coquille River is of utmost concern to watershed health. Furthermore, lengthening the LCM program timeline would allow greater insight into how tide gate management affects the project's objectives. Through trial periods of altered tide gate management, we can further identify how these water management plans influence fish passage and usage. For example, there might be a threshold water level that is critical to meet for adequate fish passage. The PIT array infrastructure is an expensive component of the LCM program therefore an extension will be far less expensive than the original projects and 5 years of data will boost the statistical power of the results.

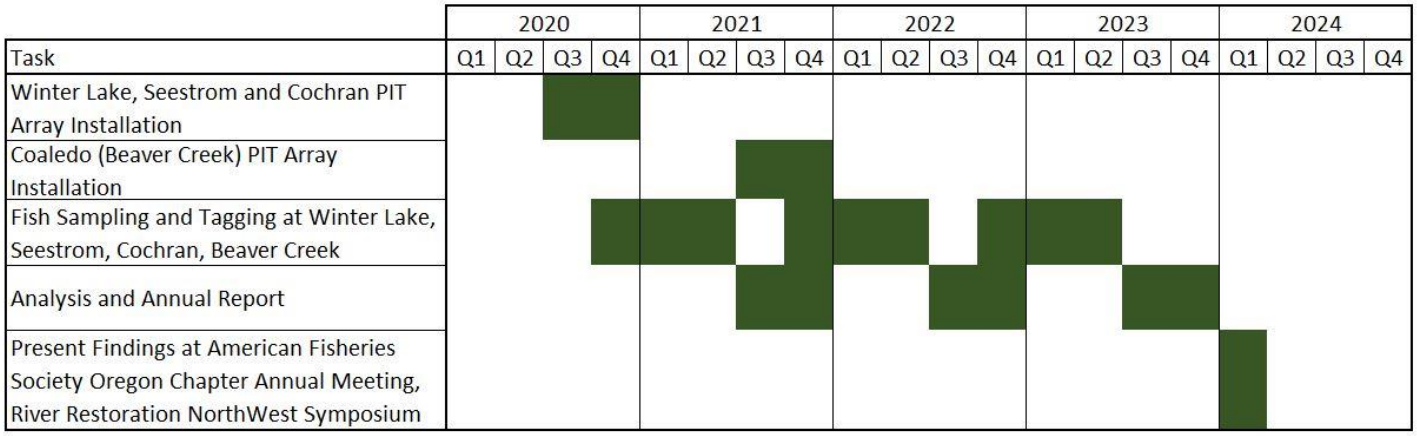
6. Reporting

CoqWA and ODFW understand that an integral phase of effectiveness monitoring is the dissemination of results. For this reason, the project includes a tiered approach to data and report distribution starting at the local level and working up to the Northwest regional level. Knowledge will be shared through distribution of annual and final reports to all project partners as well as presentations at various venues. Presentations at local venues include CoqWA's public monthly meetings, Drainage district meetings and Coos County Bio Breakfast monthly meetings. Statewide outreach will occur through report sharing and presentations at the Oregon Conservation Partnership Affinity Group meetings, the Oregon Chapter American Fisheries Society annual meeting, the Statewide Tide Gate Partnership meetings in addition to incorporating results into the OWEB funded Tide Gate Stakeholder Engagement project operations. Sharing of results and reports will reach the Northwest region through our partnerships with The Nature Conservancy, NOAA's National Marine Fisheries Services and a poster or presentation at River Restoration

Northwest symposium. Additionally, conversations and interest have been initiated about the long-term goal of producing peer-reviewed publications through this research (future funding).

A more thorough outreach plan than the above summary is being developed with partners. The outreach plan will help define the messages, communication platforms and materials development for the different target audiences interested in tide gate projects. When the outreach plan is complete it will be included as an appendix to this Monitoring Plan.

7. Timeline



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