Tryon Creek Restoration Monitoring Project

FY2005-2007 Progress Report

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Introduction

Tryon Creek is located in southwest Portland and its headwaters are located within those neighborhoods (Figure 1). It flows approximately three miles through this privately owned land before entering Tryon Creek State Natural Area, a 640 acre area of public land, through which the creek flows another three miles. The lower most portion of Tryon Creek flows through public land owned by the City of Lake Oswego and the City of Portland. This portion of the stream is bisected by a culvert that runs under Oregon Hwy 43 and a railroad near the mouth of Tryon Creek (culvert).

Figure 1. Tryon Creek watershed.

Tryon Creek is one of the largest, relatively protected, urban watersheds in Oregon. A number of native species can currently be found in this stream including *Oncorhynchus mykiss*

(resident and anadromous) and coastal cutthroat trout (Tinus et al. 2003). Historically, it is thought that Pacific lamprey and coho salmon also utilized this stream. However, the culvert is potentially inhibiting, if not preventing, passage of lampreys and salmonids.

The culvert was constructed in the late 1920s. It is approximately 122 m (401 ft) long with a drop of nearly 6.7 m (22 ft) from top to bottom, resulting in an average grade of 4.6% (Figure 2). There are a series of alternating baffles that provide some structure within the culvert, but do not provide adequate holding water for fish attempting to migrate upstream. The culvert is hanging at the lower end approximately 20 cm (8 in) above stream level at base flow. This design likely blocks lamprey migration and hinders salmonid movements upstream through the culvert (Henderson Land Services 2007, Rhodes 2002).

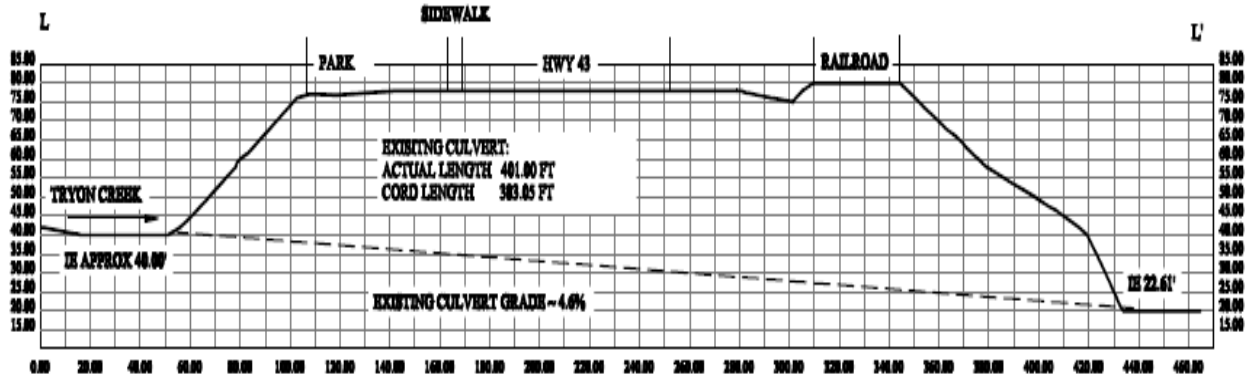

Figure 2. Longitudinal profile of Tryon Creek culvert (Henderson Land Services 2007).

A collaborative project is being implemented by Oregon Department of Transportation, Oregon Department of Fish and Wildlife, Oregon State Parks, National Marine Fisheries Service, Cities of Portland and Lake Oswego, Friends of Tryon Creek, Tryon Creek Watershed Council, National Fish and Wildlife Foundation and U.S. Fish and Wildlife Service to improve passage conditions for anadromous fish migrating into Tryon Creek. A replacement project for the culvert will occur in two phases. The initial phase will retrofit the existing culvert with a new baffle system and provide some habitat restoration to the stream below the culvert to be more conducive to lamprey and salmonid holding and passage. The second phase will provide and implement a long-term solution to replace the existing culvert. Solutions currently being considered include a much larger culvert and a bridge (Henderson Land Services 2007).

The assessment and monitoring project that is being led by the U.S. Fish and Wildlife Service is being conducted in conjunction with the culvert replacement project. This project is being conducted in three phases: 1) pre-assessment and monitoring prior to the initial phase of culvert improvement; 2) post-assessment and monitoring subsequent to the initial phase and pre-assessment and monitoring prior to the second phase of culvert replacement; 3) post-assessment and monitoring subsequent to the completed culvert replacement project.

The focus of the assessment and monitoring project was originally directed at lamprey species (Pacific lampreys and western brook lampreys). That focus has been expanded to include salmon, steelhead and native trout species. The study will thus, assess restoration response of multiple species historically present in Tryon Creek. The objectives are broken into three species groups as follows:

- Lamprey

    1. Determine the distribution of larvae in Tryon Creek.

    2. Determine whether adults move upstream through the culvert.

    3. Determine the upstream passage efficiency of adults through the culvert.

- Salmon and Steelhead (anadromous *O. mykiss*)

    1. Determine whether adults move upstream through the culvert.

    2. Determine the upstream passage efficiency of adults through the culvert.

- Coastal cutthroat trout/resident *O. mykiss*

    1. Determine whether fish move upstream through the culvert at any life stage.

    2. Determine the upstream passage efficiency of resident fish through the culvert.

Methods

Lamprey capture

Larval distribution

Presence of larval Pacific and western brook lampreys (ammocoetes) was determined by conducting electrofishing surveys throughout the mainstem of Tryon Creek (from the mouth to Barbur Blvd.) in August of each year. Electrofishing was conducted with an Abp-2 electroshocker (University of Wisconsin) specifically designed to fish for ammocoetes. All ammocoetes captured were identified to species, measured (total length), weighed (g), and released alive back to Tryon Creek.

Adult movement and passage efficiency

Presence of adult Pacific lampreys was determined by capture in pot traps deployed downstream of the culvert from September 2006 through October 2007. A pot trap consists of a 92 cm x 20 cm PVC pipe with a funnel on one end, an internal funnel and a one inch thick round of wood on the other end. Adult Pacific lampreys captured in pot traps were measured (total length), weighed (g), and implanted with a passive integrated transponder (PIT) tag. All adult lampreys were released alive back to Tryon Creek.

Salmon, steelhead and coastal cutthroat trout capture

Upstream movement and passage efficiency

Migratory adult salmon, steelhead, and coastal cutthroat trout returning to Tryon Creek were captured using an adult picket weir fish trap. This trap was located approximately 100 m downstream from the culvert in Tryon Creek. Adult salmonids captured in the trap were identified to species, measured (total length), weighed (g), implanted with a PIT tag, and released alive back to Tryon Creek.

Downstream movement and passage efficiency

Electrofishing was conducted in spring to collect juvenile salmon and steelhead and resident trout above the culvert. Sampling occurred between Oregon Hwy 43 and Boone's Ferry Road. In this area of Tryon Creek, sampling was conducted every other 200 m reach of stream. Electrofishing was conducted using a Smith-Root LR-24. All fish captured were identified to species, measured (fork length), weighed (g), implanted with a PIT tag, and released alive back to Tryon Creek.

Movement

Spawning ground surveys

Spawning ground surveys were conducted looking for spawning fish and/or redds for lampreys and salmonids above the culvert. Four surveys were conducted between December 2006 and May 2007. Pacific lamprey, salmon or steelhead redds or carcasses would indicate the ability for these species to move upstream through the culvert.

PIT tag antennas

PIT tag antennas were installed at the downstream and upstream openings of the culvert. Any PIT tagged fish moving over or through one of these antennas was detected and identified by a Destron Fearing FS-1001A transceiver. That information and time of detection was logged on a handheld computer from which data was downloaded on a weekly basis.

Passage efficiency

The assessment of passage efficiency assumes that any adults (100%) captured moving upstream were attempting to get to an area in Tryon Creek above the culvert. Passage efficiency was distinguished for those attempting to move upstream through the culvert (i.e., only detected at lower antenna) and those successfully moving upstream through the culvert (i.e., detected at both the lower and upper antennas). Passage efficiency was calculated by determining the proportion of PIT tagged fish within a species detected at an antenna over the total number of PIT tagged fish for that species. Confidence intervals (95%) were determined for those proportions.

Results

Lamprey – FY 2005

Larval distribution

An electrofishing survey for lampreys was conducted in Tryon Creek August 16, 2005. One Pacific (113 mm) and six unidentified (<30–45 mm) lamprey ammocoetes were collected downstream of the culvert. No ammocoetes were collected upstream of the culvert.

Lamprey – FY 2006

Larval distribution

An electrofishing survey for lampreys was conducted in Tryon Creek August 30, 2006. Twenty-six Pacific lamprey ammocoetes (98–132 mm) were collected downstream of the culvert. No ammocoetes were collected upstream of the culvert.

Lamprey – FY 2007

Larval distribution

An electrofishing survey for lampreys was conducted in Tryon Creek August 15, 2007. One western brook lamprey ammocoete was collected (145 mm) downstream of the culvert. No ammocoetes were collected upstream of the culvert.

Movement

Pot traps were set below the culvert in Tryon Creek. A total of two pot traps were set below the culvert from September 2006 to November 2006. Upon installation of the picket weir the two pot traps were removed and one was placed inside the live box. When the picket weir was removed, the number of pot traps below the culvert was increased to seven in July 2007 in an attempt to maximize capture efficiency. Those pot traps were concentrated in the pool directly below the culvert. No adult lampreys were captured in any pot trap below the culvert.

One spawning ground survey was conducted on 5/18/2007. No evidence was found of lamprey spawning in Tryon Creek (no adults or nests were observed).

Passage efficiency

Passage efficiency could not be determined for lampreys.

Salmon, steelhead and coastal cutthroat trout – FY 2007

Movement

The adult picket weir fish trap was installed in November 2006. Record precipitation in November and December prevented effective operation of the trap until January 2007 (Figure 3).

Figure 3. Adult picket weir fish trap on Tryon Creek following record precipitation events in November 2006.

No fish were captured prior to January. After January, one adult salmonid was captured in the trap in mid-February 2007. It was identified as a steelhead by a biologist, but escaped the trap prior to being processed.

Three spawning ground surveys were conducted between the upper end of the culvert and Boones Ferry Road on 12/7/2006, 1/9/2007, and 2/5/2007. These surveys followed precipitation events that rendered the trap inoperable and the subsequent repair to the weir and trap. A fourth survey was conducted on 5/18/2007 following the presumed end of steelhead migration. No evidence of salmon or steelhead spawning in the form of either carcasses or redds were identified. It should be noted, however, that one steelhead carcass was observed in June 2006 below the culvert and one coho salmon carcass was observed in September 2007 below the culvert.

Electrofishing surveys were conducted between the upper end of the culvert and Boones Ferry Road in spring on 3/14/2007, 3/15/2007, and 3/27/2007. Eight 200 m reaches were sampled. A total of 59 coastal cutthroat trout, 27 *O. mykiss*, 27 cutthroat/*O. mykiss* hybrids, 3 coho salmon, and 7 trout fry were captured. Of those, 50 coastal cutthroat trout, 26 *O. mykiss*, 19 hybrids, and all three coho were PIT tagged. Coastal cutthroat trout and *O. mykiss* represented multiple age classes while coho salmon likely represented a single cohort (Figure 4).

The upper PIT tag antenna began operation on 3/16/2007. This antenna operated continuously until 9/4/2007. They were removed for work on the culvert until late September, at which time they began operation again. Between 3/16/2007 and 5/20/2007, 19 (73%, 95% CI = 55-87%) *O. mykiss* (114-241 mm), six (32%, 95% CI = 14-53%) hybrids (138-171 mm), and two coho (67%, 95% CI = 23-96%) were detected at that antenna on one occasion. Thus, they presumably moved downstream through the culvert and did not return upstream. No coastal cutthroat trout (0%, 95% CI = 0-7%) have been detected at this antenna (Figure 5) and no other fish were detected after 5/20/2007.

The lower PIT tag antenna was installed, but was not operated because no fish were tagged below the culvert.

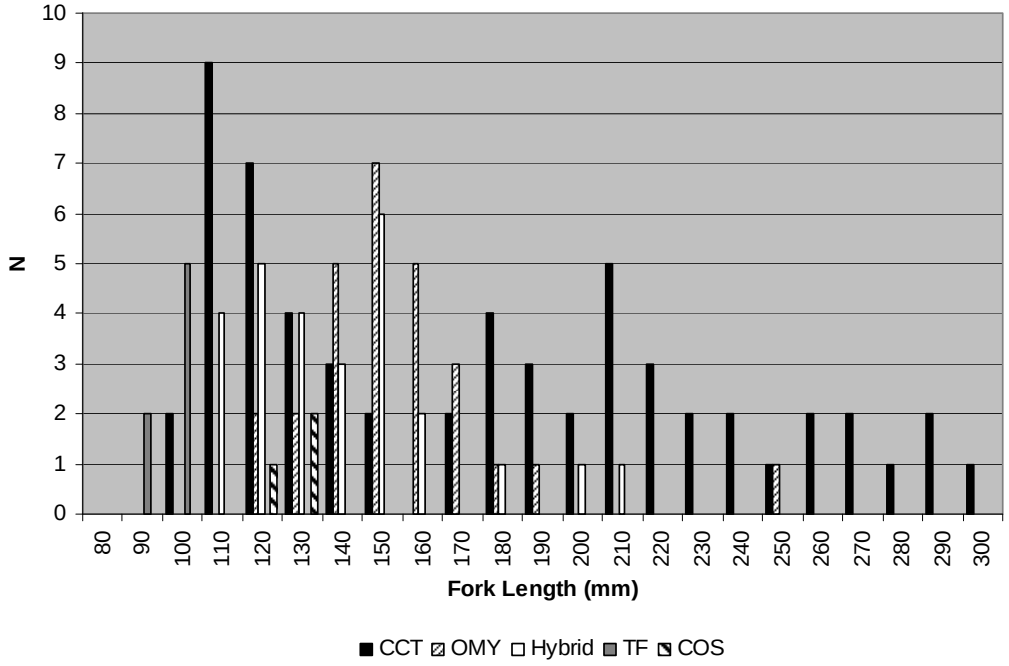

Figure 4. Length-frequency histogram by species for all fish captured in Tryon Creek, Spring 2007. CCT – coastal cutthroat trout; OMY – *O. mykiss*; Hybrid – cutthroat/*O. mykiss*; TF – trout fry; COS – coho salmon.

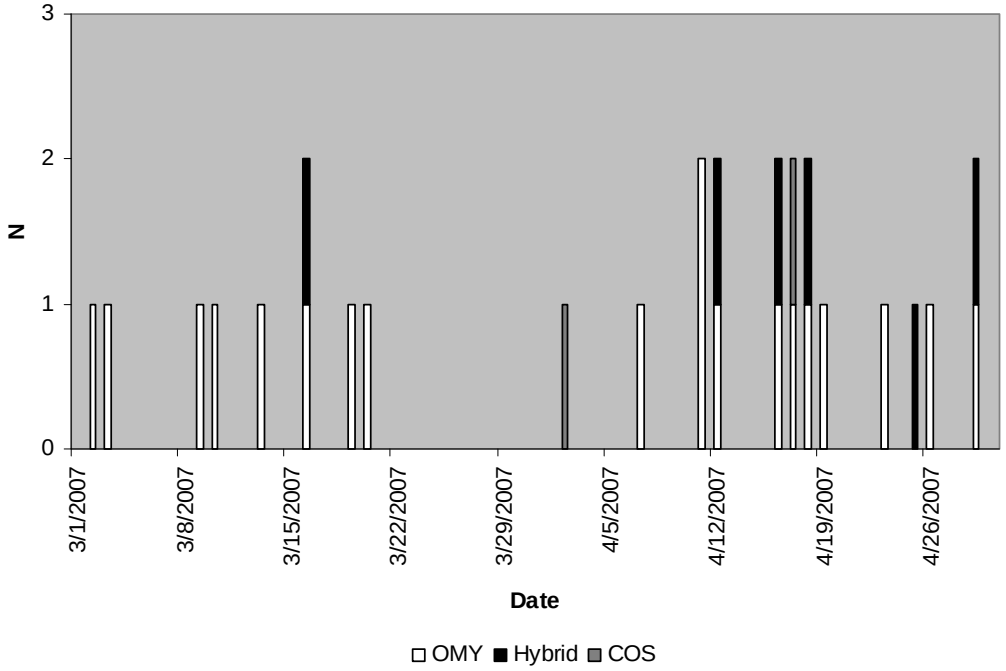

Figure 5. Total detections by date and species at the Tryon Creek upper PIT tag antenna. OMY – *O. mykiss*; Hybrid – cutthroat/*O. mykiss*; COS – coho salmon.

Passage efficiency

Passage efficiency could not be determined for salmon, steelhead and coastal cutthroat trout due to a lack of captures below the culvert and no returns of fish tagged above the culvert.

Findings

The presence of larval lampreys downstream of the culvert may indicate that lampreys are entering Tryon Creek and attempting to move upstream to spawn but are not successful at passing the culvert and therefore spawn instead in the lower reach. It could also suggest that lampreys are choosing to spawn in this section or that they were washed in from the mainstem Willamette River. Absence of spawning activity in this reach is not necessarily evidence for the latter because spawning activity (in particular western brook spawning) can be very difficult to detect. The absence of Pacific lampreys (all stages) upstream of the culvert may indicate that the culvert is impeding anadromous lamprey passage. Anecdotal evidence implies they were present prior to the culvert installation. The absence of western brook lampreys (all stages) upstream of the culvert may indicate that they cannot access this area or have never been there.

Salmonids collected above the culvert from the spring electrofishing effort yielded a number of *O. mykiss* and coastal cutthroat trout. A large proportion of the *O. mykiss* moved downstream through the culvert. However, nine *O. mykiss* remaining upstream of the culvert may indicate the presence of a residualized component of the population (i.e., may be both resident and anadromous forms).

No coastal cutthroat trout were detected moving downstream through the culvert. This may indicate that a migratory form of coastal cutthroat trout does not exist. The culvert may presently prevent the expression of that particular life history strategy in Tryon Creek, or it may never have been present. It is also possible that a migratory life history strategy may be present in such a small proportion of the population that it was not detected this year. Continued monitoring of this species in Tryon Creek before and after the culvert improvement project will provide a time series dataset that allows better interpretation of this data.

Coho salmon (3) were collected from three separate reaches in Tryon Creek. The location of captures spanned over two stream kilometers in which only half of the habitat was sampled. Thus, it is likely that there were more juvenile coho salmon in Tryon Creek. However, the electrofishing approach utilized was not directed at collecting juvenile coho (i.e., optimum juvenile coho habitat was not always sampled). Now that it is known that juvenile coho are present, future electrofishing efforts will include all salmonid habitat in sampling reaches and potentially sampling quantitatively for abundance.

The initial year that the adult picket weir fish trap was operated provided much insight into successfully sampling using this method in the future. Tryon Creek is an extremely flashy system due to the urban development throughout the watershed. This development has resulted in impervious surfaces over more than 23% of the drainage (WMSWCD 2001). These impervious surfaces allow rapid runoff during precipitation events and result in flow spikes in the hydrograph (see Figure 6). The record rainfall in November and December 2006 that resulted in failure of the picket weir allowed a learning experience to better reconfigure the picket weir to hold against large precipitation events. We have more confidence that the trap will operate more effectively in future years.

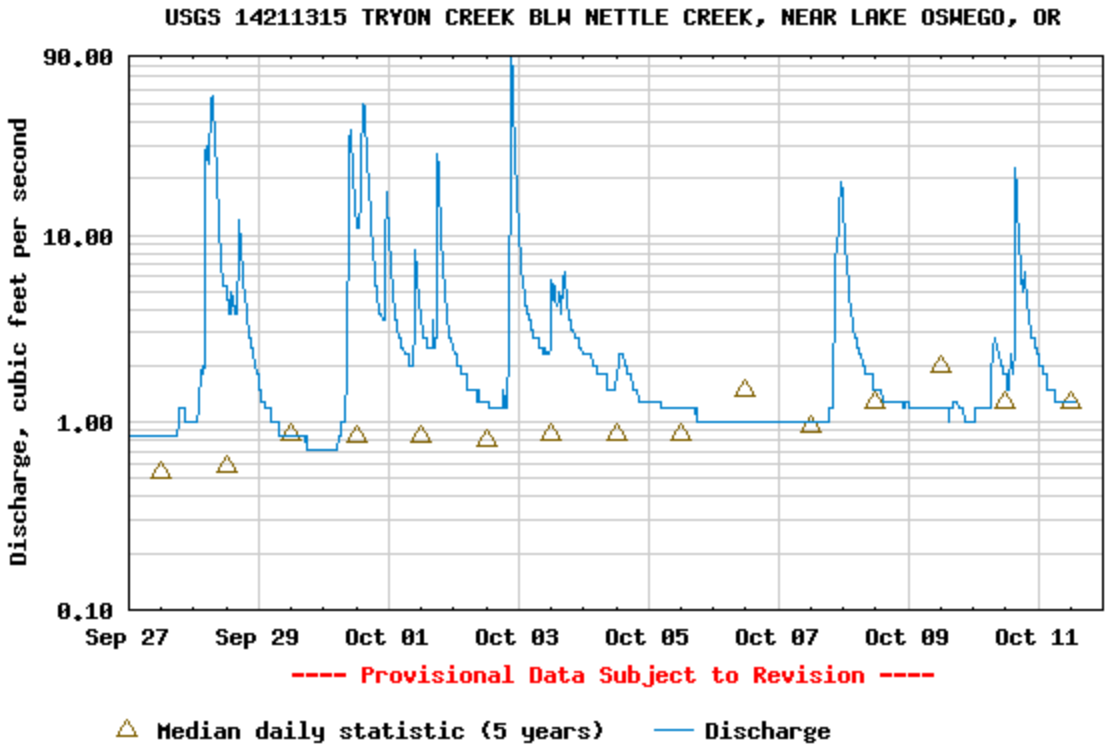

Figure 6. Tryon Creek hydrograph for Sep 27 – Oct 11, 2007 (USGS Gage #14211315).

FY 2008 Tasks

- Redeploy adult picket weir fish trap in September.
- Reinstall PIT tag antennas following culvert retrofit.
- Conduct fall electrofishing survey/tagging for juvenile and resident salmonids.
- Operate adult trap through fall coho and winter steelhead migration.
- Continue operation of adult lamprey pot traps below the culvert.
- Conduct lamprey and salmonid spawning ground surveys as necessary.
- Conduct lamprey larval distribution electrofishing survey in August.

References

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