

# Tryon Creek Restoration Monitoring Project

## *FY2008 Progress Report*

J.R. Cook, B.P. Silver, J.M. Hudson, G. Silver, C. Luzier, J. Johnson, and T. Whitesel

*U.S. Fish and Wildlife Service – Columbia River Fisheries Program Office  
1211 SE Cardinal Ct – Suite 100  
Vancouver, WA*

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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 stream 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.

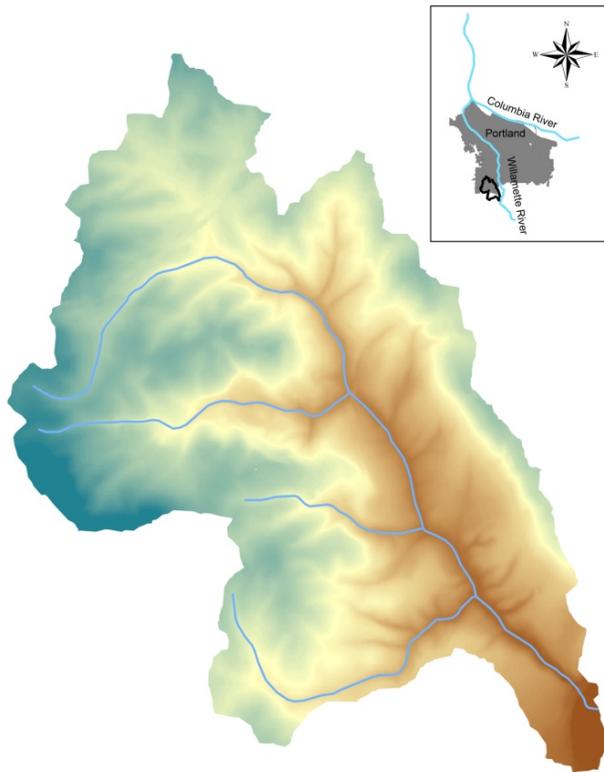


Figure 1. Tryon Creek watershed.

Tryon Creek (approximately 1,680 hectares) is one of the largest, relatively protected, urban watersheds in Oregon. A number of native fish species can currently be found in this stream including *Oncorhynchus mykiss* (resident and anadromous), coastal cutthroat trout (Tinus et al. 2003), and coho salmon (Hudson et al. 2007). Historically, it is thought that Pacific lamprey and other salmon species also utilized this stream. However, the Hwy 43 culvert is potentially inhibiting, if not preventing, passage of lampreys and salmonids.

The Hwy 43 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. Therefore, the culvert is likely difficult for migrating fish to navigate up through. The culvert hangs at the lower end approximately 20 cm (8 in) above stream level at base flow. This drop forces fish to jump in order get into the culvert and probably increases the difficulty of upstream migration. This design likely blocks lamprey migration and hinders salmonid movements upstream through the culvert (Henderson Land Services 2007, Rhodes 2002).

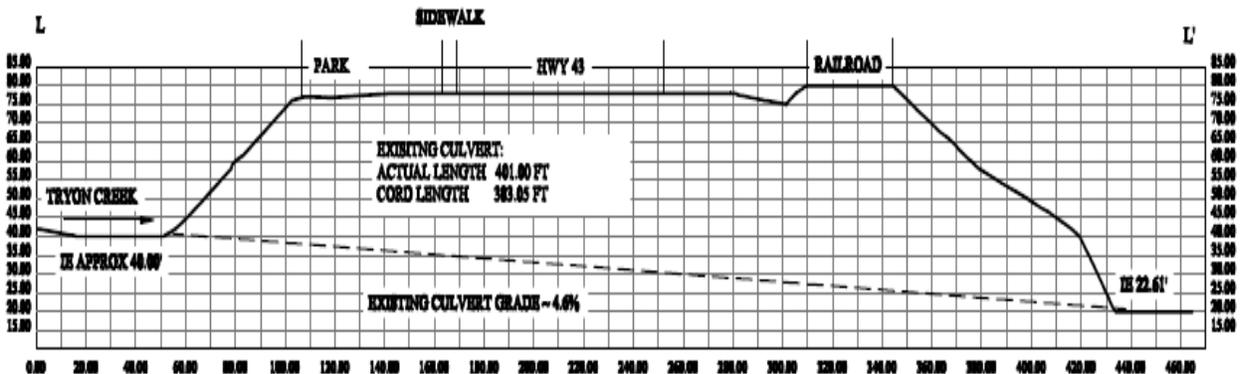


Figure 2. Longitudinal profile of Tryon Creek culvert (Henderson Land Services 2007).

A collaborative project is being implemented by Oregon Department of Transportation (ODOT), Oregon Department of Fish and Wildlife, Oregon State Parks, National Marine Fisheries Service, Cities of Portland (COP) 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 occurred in August 2008 and retrofitted the existing culvert with a new baffle system to improve fish swim-through capabilities. The efforts also provided some habitat restoration to the stream below the culvert to create a swim-in, rather than jump-in, situation to be more beneficial to lamprey and salmonid 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 (*O. mykiss* or STH) and native trout species. The study will, thus, assess restoration response of multiple species historically present, or believed to be 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 enter the culvert.
  3. Determine whether adults successfully pass through the culvert.
  4. Determine the upstream passage efficiency of adults through the culvert.
- Salmon and Steelhead (anadromous *O. mykiss*)
  1. Determine whether juveniles and adults enter the culvert.
  2. Determine whether juveniles and adults pass through the culvert.
  3. Determine the upstream passage efficiency of juveniles and adults through the culvert.
- Coastal cutthroat trout (CCT)/resident *O. mykiss*
  1. Estimate the relative population abundance of trout species above the culvert.
  2. Determine whether juveniles and adult trout species enter the culvert.
  3. Determine whether trout species successfully pass through the culvert at any life stage.
  4. Determine the upstream passage efficiency of resident trout species through the culvert.

## Methods

### *Lamprey Capture*

No sampling occurred that targeted lamprey in 2008.

### *Salmon, Steelhead and coastal cutthroat trout capture*

#### Population abundance estimates of trout species

Population abundance estimates of trout species above the Hwy 43 culvert was estimated using a multiple pass mark-recapture approach. The sampling method consisted of backpack electrofishing, using a Smith-Root model LR-24 shocker. Electrofishing was conducted using a technique to reduce potential harm to the sampled population. Specifically, all areas considered holding habitat for salmonid species (plunge pools, overhanging banks, eddies, large woody debris, and pocket pools within riffles) were sampled in a “stalk and shock” approach. Sample reaches measuring 200 meters were identified using a hand-held GPS, combining for a total of 5.4 km of stream. Two netters worked with one electrofisher and fishing efforts were similarly conducted for each pass. The LR-24 shocker used pulsed direct current set at a frequency of 25-28 Hz, 12-14% duty cycle, and voltage between 250 and 450 V. All settings were subject to modification depending on conditions (i.e. water depth, conductivity, flow).

At the completion of each 200 m reach, all captured fish were identified, measured (fork length), weighed, and scanned for passive integrated transponder (PIT) tags. Fish were anesthetized using 25 ppm clove oil. Genetic samples were taken from a left pelvic fin-clip of all salmonids upon initial capture. The samples were preserved in 99.98% ethyl alcohol. For salmonids greater than 100 mm, a PIT tag (23 mm long, 3.84 mm diameter, 0.6 g, full duplex) was surgically implanted on the ventral side, posterior to the pectoral fins (Roussel et. al 2000). For coho salmon less than 100 mm in length, a syringe was used to inject 12 mm full duplex tags into their abdominal cavity. After full recovery within an aerated bucket, all fish were released near their point of capture.

Coastal cutthroat trout and *O. mykiss* hybridization (HYB) was determined in the field by the degree and combination of physical characteristics shown from both species. Phenotypic characteristics such as a break in the outer line along the adipose fin, a maxilla that extends past the orbital socket, the presence of basibranchial teeth, and the orange coloration on the lower maxilla (all cutthroat appearances) were utilized to distinguish hybridized fish (Hawkins 1997).

The first complete electrofishing survey was conducted between the upper end of the culvert and a location 200 m above the Boones Ferry Road in the spring between 3/19/08 and 3/21/08. A second pass was attempted on 4/28/08 to determine an abundance estimate for trout species above the culvert. This second pass was abandoned. Two complete passes were conducted between the Hwy 43 culvert and a location 200 m above the crossing of SW 18<sup>th</sup> Place (N: 523,291.5 m; E: 5,033,807.7 m) between October 6 and October 22, 2008 (Figure 3). The survey also included the lower portion of Arnold Creek between the Boones Ferry Road and the crossing at SW Arnold St (approx. 200 meters). Tagging and all standard processing procedures occurred during the first pass while only species identification and PIT tag scanning were conducted during the second pass.

Capture-recapture data was analyzed using CAPTURE (Otis et al. 1978; White et al. 1982; Rexstad and Burnham 1991) within MARK (White and Burnham 1999). CAPTURE was

used to help determine the most appropriate estimator ( $M_o$  [null estimator], Jackknife  $M_h$ , Darroch  $M_t$ , Chao  $M_{th}$ , Chao  $M_t$ , and Chao  $M_h$ ), but assumptions and variables associated with the choice of the most appropriate estimator were also considered. CAPTURE was used to determine confidence intervals around the estimate, the coefficient of variation, and the probability of capture.

#### Upstream movement and passage efficiency

Juvenile and adult salmon, *O. mykiss*, and coastal cutthroat trout in Tryon Creek below the culvert were captured using an adult picket weir fish trap as well as by electrofishing. The weir trap was located approximately 100 m downstream from the culvert in Tryon Creek and fished until May 2008. Electrofishing surveys were conducted between the location of the weir and the culvert in May, June, July and September. Salmonids captured in the trap or by electrofishing were identified to species, scanned, measured (fork length), weighed (g), implanted with a PIT tag, and released alive back to Tryon Creek near the point of capture.

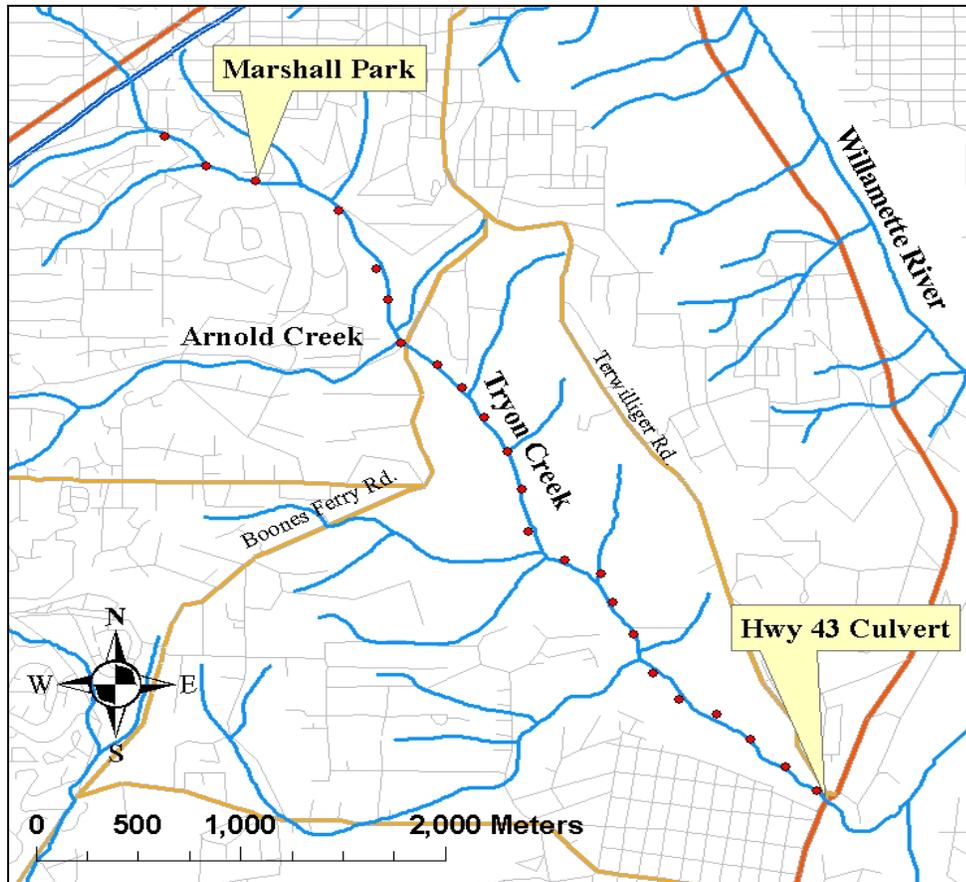


Figure 3. The study area with 15 reaches between the Hwy 43 culvert and the Boones Ferry Road crossing, and six reaches in Upper Tryon Creek above the Boones Ferry Road.

#### Downstream movement and passage efficiency

Along with the mark-recapture passes, sampling also occurred in the spring to collect juvenile salmon, *O. mykiss*, and resident trout above the culvert. Electrofishing was conducted in

March between Oregon Hwy 43 and the Boones Ferry Road. All fish captured were identified to species, measured (fork length), weighed (g), implanted with a PIT tag, and released alive near their point of capture.

### *Movement*

#### Spawning ground surveys

Spawning ground surveys were conducted looking for spawning fish and/or redds for lampreys and salmonids above the culvert. Five surveys were conducted between May and December 2008. Pacific lamprey, salmon or *O. mykiss* redds or carcasses would indicate the ability for these species to move upstream through the culvert.

#### PIT tag antennas

PIT tag antennas were maintained at the downstream and upstream openings of the Hwy 43 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 monthly basis.

### *Fish Passage*

The assessment of passage efficiency assumes that any adults (100%) captured in Tryon Creek and below the Hwy 43 culvert, were attempting to get to an area in Tryon Creek above the culvert. The rate of fish entry and rate passage were calculated by taking the total number of fish tagged within a species below the culvert in proportion to the total detected at the lower antenna (fish entry) and the number detected at the upper antenna (fish passage). Confidence intervals (95%) were determined for those proportions.

## **Results**

### *Salmon, Steelhead and coastal cutthroat trout – FY 2008*

#### Abundance

The first pass of spring sampling resulted in 215 trout species and 4 coho salmon captured (Table 1). The second pass in the spring was abandoned due to the collection of four hatchery *O. mykiss* juveniles within the first reach of the study area, giving the indication that new fish had entered the system, violating the assumptions of a closed abundance estimate model.

Capture results during fall electrofishing produced 571 trout species, 2 coho, and 3 Chinook salmon captured (Table 1). The three Chinook were captured (147 mm, 110 mm, and approximately 120 mm) in reaches 13 and 14 (2.8 and 3.0 km above the Hwy 43 culvert) and 6 reaches above Boones Ferry Road (4.9 km above the Hwy 43 culvert). It should be noted that no nonnative fish species have been captured to date above the Hwy 43 culvert. A length/frequency histogram may reflect 3 – 4 size classes for coastal cutthroat trout and 2 – 3 size classes for CCT/STH hybrids captured during the first fall pass of the mark-recapture efforts (Figure 4).

Table 1. Total number of fish captured for each individual pass (includes the number of newly tagged and recaptured (previously tagged) individuals).

Pass Dates	CCT >100mm	HYB >100mm	STH >100mm	Coho	Chinook	Total Captured	Total Tagged	Total Recaps
3/19-3/20	131	58	26	4	0	219	189	24
10/6-10/8	212	82	1	1	1	297	260	37
10/20-10/22	219	57	0	1	2	279	0	109

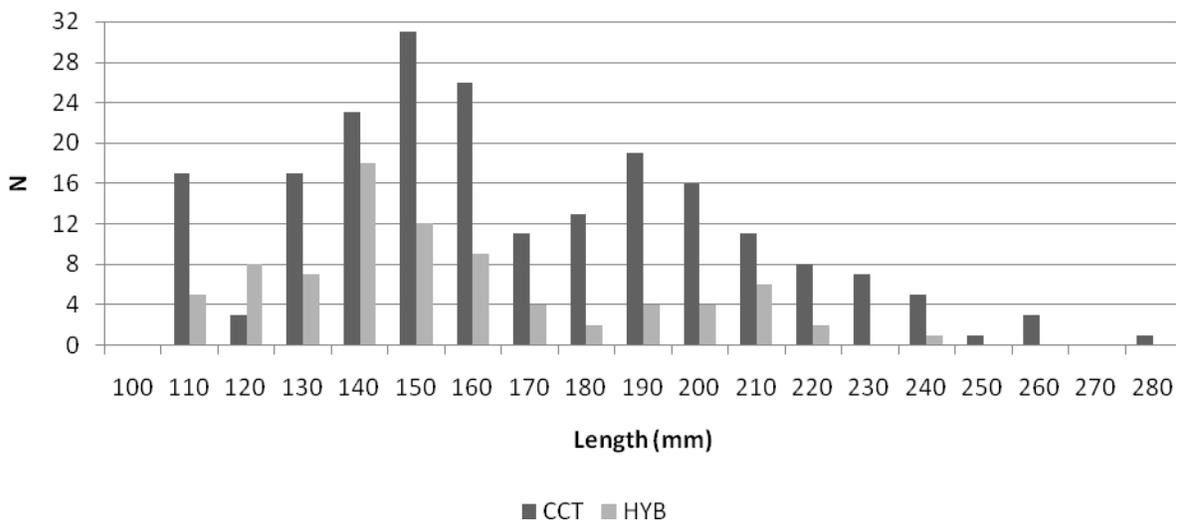


Figure 4. Length-frequency histogram of coastal cutthroat trout (CCT) and cutthroat/*O. mykiss* hybrids (HYB) captured in Tryon Creek, Pass 1- October 2008.

Following the completion of the second pass, a probability of capture of .32 was calculated for all trout species (coastal cutthroat trout, *O. mykiss*, and hybrids combined). The estimated abundance of trout species > 100 mm, between the Hwy 43 culvert and S.W. 18<sup>th</sup> Place, was calculated at 1,054 ± 68.36 individuals (Table 2).

Table 2. The abundance estimate, standard error, confidence intervals, probability of capture and coefficient of variation around the mean for all trout species (coastal cutthroat, *O. mykiss*, and hybrids) > 100 mm above the Hwy 43 culvert.

Abundance Estimate	N	SE (±)	95% CI	Probability of Capture	Coefficient of Variation
<i>All Trout Species</i>	1,054	68.36	938-1207	.32	6.49%

Movement

The adult trap ran until May 2008, when it was removed due to its lack of success and regularly required maintenance. Regularly scheduled spawning and carcass surveys became the primary approach to determine adult presence above the culvert. To date, six spawning ground surveys have been conducted (5/9/2008, 9/15/08, 11/13/08, 11/24/08, 12/11/08, and 12/31/08) between the upper end of the Hwy 43 culvert and Boones Ferry Road. No evidence of salmon or *O. mykiss* spawning in the form of either carcasses or redds were identified. Resident fish spawning was observed on 5/9/08. It should be noted, however, that in early May 2008 reported sightings of large salmonids below the culvert occurred and one female hatchery *O. mykiss* carcass (869 mm) was found below the culvert.

Electrofishing took place below the culvert on four separate occasions in the attempt to tag coastal cutthroat and juvenile *O. mykiss* and assess upstream movements. One of these sampling occasions occurred in collaboration with the COP and ODOT conducting fish salvage efforts prior to the retrofitting of the baffle system within the culvert. It should be noted that during this effort other species captured below and within the culvert included sculpin (*Cottus spp.*), dace (*Rhinichthys spp*) and mountain whitefish (*Prosopium williamsoni*) (Estrada ODFW-ODOT 2008). The majority of salmonid species captured below the culvert in 2008 were coastal cutthroat trout, yet *O. mykiss*, CCT/STH hybrids, coho salmon, and Chinook salmon were all found present. Of these fish a total of 56 were tagged and 7 were recaptured (Table 3). It should also be noted that the number of juvenile coho and Chinook salmon captured below the culvert greatly exceeded the number captured during any of the upstream sampling.

Table 3. Total number of fish captured below the Hwy 43 culvert including the number of tagged individuals, recaptures, and size ranges.

	<b>CCT</b>	<b>STH</b>	<b>HYB</b>	<b>Coho</b>	<b>Chinook</b>
Total Captured	45	2*	15	36*	24
Tagged	37	2	15	2	0
Recaps	7	0	0	0	0
Size Range (mm)	102-293	128-160	124-233	76-156	47-78

\* Hatchery clipped fish (2 STH; 1 Coho).

The upper PIT tag antenna has operated to date excluding the period of time retrofitting construction was occurring within the culvert (7/9/08-9/15/08). During the time of operation in 2008, the antenna has recorded a total of 2,371 detections on 69 unique fish. Of these unique detections on the upper antenna, 11 individuals were tagged and released downstream of the Hwy 43 culvert with the remaining 58 coming from upstream locations. Between 5/14/08 and 11/15/08, 7 coastal cutthroat trout, 1 hatchery *O. mykiss*, and 3 hybrids, all of which were tagged and released below the culvert, were detected at the upper antenna (Figure 5a). It should be noted that, during the fall, exact passage times are unknown and the detections recorded on 11/15/08 could have taken place anytime between the dates of 9/15 and 11/15. Downstream passage primarily occurred during the spring months with *O. mykiss* and hybrids being the most common species detected (Figure 5b).

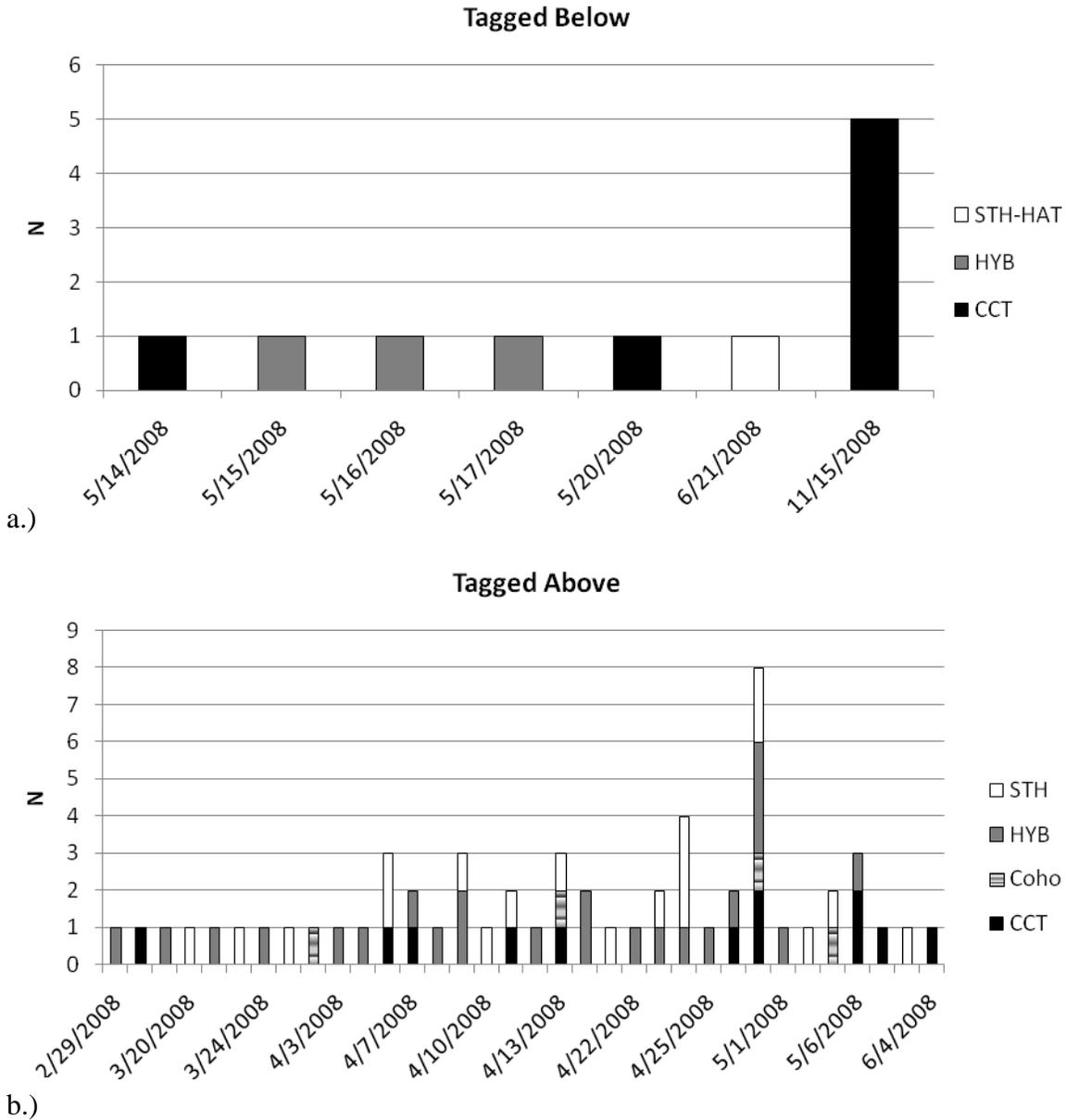


Figure 5. Detections at the upper end of the Hwy 43 culvert of fish tagged and released below and above the culvert.

The lower PIT tag antenna was installed but has not been turned on. It has been difficult to successfully engineer a functional antenna at this site that will also withstand the high flow events typical of Tryon Creek. Installation of a new design is scheduled for the winter of 2009.

Passage efficiency

Passage of coastal cutthroat trout, hybrids, and juvenile *O. mykiss* has been proven by the detections from the upper antenna. Fish tagged and released below the culvert that were detected passing through the culvert included 7 of the 37 tagged coastal cutthroat trout (19%), 3 of 15 hybrids (20%), and 1 of 2 *O. mykiss* (50%). The passage efficiency of all fish tagged and

released below the culvert that were then detected at the upper end of the culvert was 11 of 56 individuals (19%). Without the lower antenna functioning properly the number of attempts at passage cannot be accurately calculated.

## Findings

Salmonids collected above the culvert from the spring and fall electrofishing efforts yielded a number of *O. mykiss* of hatchery and wild origin, coastal cutthroat trout, and hybrids of the two species. Coastal cutthroat trout were by far the most abundant species during each of our sampling passes with cutthroat/*O. mykiss* hybrids being then next most common. For the second consecutive year, juvenile coho salmon were also found to be present above the culvert as far up as reach 7 (approx. 1.5 km above the Hwy 43 culvert). For the first time on record, juvenile Chinook salmon were found to be present in Tryon Creek above the Hwy 43 culvert. No evidence of lamprey ammocoets or adults was found during sampling efforts above or below the culvert in 2008.

As the crew gained more experience handling the fish from Tryon Creek, more recordings of hybridization were noted due to common characteristics of both *O. mykiss* and coastal cutthroat trout occurring in many of fish. This may account some for the lower number of *O. mykiss* and higher number of hybrids identified in 2008 compared to that of 2007 data.

The estimation of the number of trout species (> 100 mm) within Tryon Creek (above Hwy 43) was calculated at  $1,054 \pm 68$ . The sampled area of stream was approximately 5 km long resulting in 210.8 trout/km.

With an increase in the number of tagged fish in the system, antenna detections became more common in 2008. The use of the culvert by salmonids was determined to be true by downstream and upstream passage detected through the culvert. The passage of fish from downstream locations to above the culvert confirms at least some ability of juvenile coastal cutthroat trout, *O. mykiss*, and hybrids navigation upstream through the culvert during the spring. This passage efficiency was calculated at a minimum of 19% for all species tagged. Others could have potentially passed upstream undetected. Upstream salmon passage has yet to be detected by the antenna arrays, but navigation of the culvert is believed to occur by the capture of juveniles above the culvert. Passage attempts were unable to be calculated without a functioning antenna installed at the lower end of the culvert.

Most of our tagged *O. mykiss* have been detected leaving Tryon Creek, yet a large portion of hybridized fish remain in the stream. This could suggest that the *O. mykiss* in Tryon Creek are primarily *O. mykiss* that out-migrate from the stream. This is further supported by the lack of captured *O. mykiss* resident adults in Tryon Creek.

Hatchery raised *O. mykiss* are also passing through the Hwy 43 culvert and utilizing the upper portions of Tryon Creek. This was proven with the capture of five adipose-clipped fish above the culvert in April and May 2008, and is also supported by the June 21 detection, at the upper end of the culvert, of a hatchery *O. mykiss* that had been tagged below. All *O. mykiss* and hybrid passage that has been detected to date occurred prior to the retrofitting of the Hwy 43 culvert.

Coastal cutthroat trout were detected both leaving (12 fish) and entering (7 fish) Tryon Creek at the Hwy 43 crossing. This may indicate the presence of a migratory component of the population. However, 97.3% (311 fish) of the coastal cutthroat tagged above have not been detected leaving the system, suggesting a resident form persists. This is the first evidence of

coastal cutthroat trout successfully navigating up or downstream through the Hwy 43 culvert. It should be noted that for the upstream passage, two of these detections occurred prior to the retrofitting of the baffle system and the other five followed the construction. Continued monitoring of these species in Tryon Creek will provide a time series dataset that allows better interpretation of this data and analysis of the new baffle system and construction.

Unlike in previous years, electrofishing approaches also targeted juvenile salmon habitat above the culvert. Juvenile coho salmon (5) were collected above the Hwy 43 culvert as far up as reach 7. Four of the coho were captured during the spring sampling efforts and one was in the fall. To date, four of these coho have been detected passing downstream through the Hwy 43 culvert. It should also be noted that multiple coho were captured within the culvert during fish salvage efforts in July (Estrada ODFW-ODOT 2008). The presence of these fish within and above the culvert suggests that juvenile salmon can, and have, successfully navigated upstream into Tryon Creek. The extent of attempts and success of this passage is not known and no detections have occurred following the retrofitting of the culvert.

The presence of juvenile Chinook salmon below the culvert was confirmed. Chinook were also found above the culvert for the first time on record ranging in size from 110 – 150 mm. One Chinook salmon was captured in the very last reach of Upper Tryon Creek above Marshall Park and SW 18<sup>th</sup> Place. How or why these individuals are utilizing the upper reaches of Tryon Creek is unknown.

With the continuation of both active and passive sampling within Tryon Creek we hope to further our understandings of all fish species within this system. Monitoring will provide further evidence for the level of success of the improvements made to the Hwy 43 culvert and below as well as the attempted and efficiency of passage through the culvert by salmonid species.

### **FY 2009 Tasks**

- Maintain current antennas.
- Design and install a functional and solid PIT tag antenna array at the lower end of the culvert.
- Conduct spring and fall electrofishing survey/tagging for juvenile and resident salmonids both above and below the culvert.
- Complete a single pass population estimate for salmonids above Hwy 43.
- Continue operation of adult lamprey pot traps below the culvert.
- Conduct regular lamprey and salmonid spawning ground surveys.
- Conduct lamprey larval distribution electrofishing survey in August.
- Attend and present findings at the annual Tryon Work Group meeting in August.

### **Acknowledgements**

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