EDMONDS STREAMS AND MARSH WATER QUALITY AND SALMON STEWARDSHIP ACTIVITIES, 2015-2020.

REPORT TO THE EDMONDS CITY COUNCIL

Students Saving Salmon and Edmonds Stream Team
Edmonds-Woodway High School
Meadowdale High School

October 2020

INTRODUCTION

This report summarizes Edmonds watershed studies and salmon restoration/enhancement activities conducted over the past five years in a Citizen Science project by high school students and adult advisors in the Students Saving Salmon club at Edmonds-Woodway and Meadowdale High Schools.

The purpose of the Citizen Science project (called the Edmonds Stream Team) is to advance local knowledge of Edmonds streams and Marsh habitat conditions for salmon. Information gathered is used to plan and implement salmon enhancement and habitat restoration activities and to inform public officials and the community on conserving our environment.

The Snohomish Conservation District recognized student efforts to improve our environment by awarding their 'Youth Conservation Leader Award' for 2019 to Students Saving Salmon.

METHODS

Students Saving Salmon collected data every month (rain or shine) for the past 5 years on habitat conditions and water quality at Shell, Willow, Shellabarger, Hindley, Perrinville, and Lunds Gulch Creeks and from the Edmonds Marsh and Shellabarger Marsh. Students used a YSI Professional Plus and YSI ProDSS electronic instrument to obtain data on water parameters that are important for aquatic organism survival including temperature, pH, dissolved oxygen, salinity, turbidity and nutrients. Water and sediment samples were also collected periodically for analysis at an accredited laboratory in Everett for heavy metals and petroleum compounds.

Students conducted salmon enhancement activities in the fall and winter each year. Coho salmon eggs obtained from the Washington Department of Fish and Wildlife were reared in hatchboxes (instream incubators) in Shell, Willow and Lunds Gulch Creeks. Juvenile coho salmon, which students assisted in raising at the Willow Creek Salmon Hatchery, were released into Shell Creek in upstream areas above barriers to adult salmon spawning. Chum salmon from the Suquamish Tribe's Grover's Creek Hatchery were reared in hatchboxes in Shell and Lunds Gulch Creeks, and reared in a small hatchery in upper Lunds Gulch for release in lower Lunds Gulch.

Students assisted private property owners with restoring stream habitat along Shell Creek using native plants purchased through Sound Salmon Solutions grant funds and a donation from Olympic Fly Fishers.

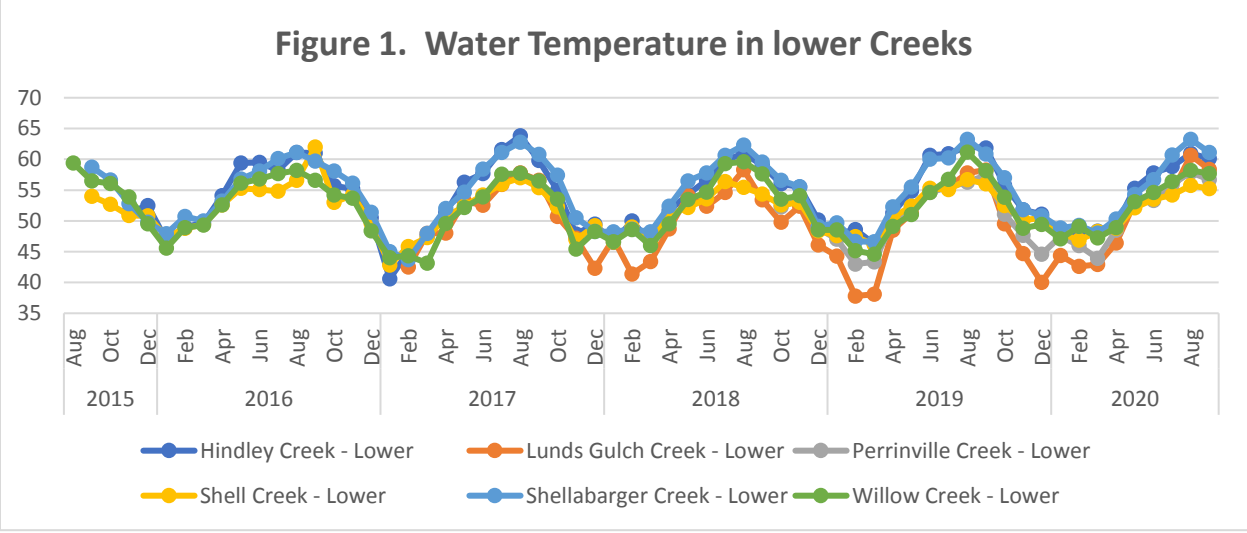
Students also conducted outreach involving community presentations and event booths in past years. Unfortunately, due to the COVID pandemic, most events in 2020 had to be cancelled. Students were able though to individually participate in the "Puget Sound Starts Here" campaign by placing placards at storm drains to remind people everything drains into our Creeks or Puget Sound.

WATER QUALITY IN STREAMS AND EDMONDS MARSH

Monthly data on multiple water quality parameters have been collected every month of the year since September 2015. But, to provide in this report, we are only reporting summary findings on the principal parameters affecting aquatic life (i.e., water temperature, dissolved oxygen and pH).

Water Temperature in Creeks

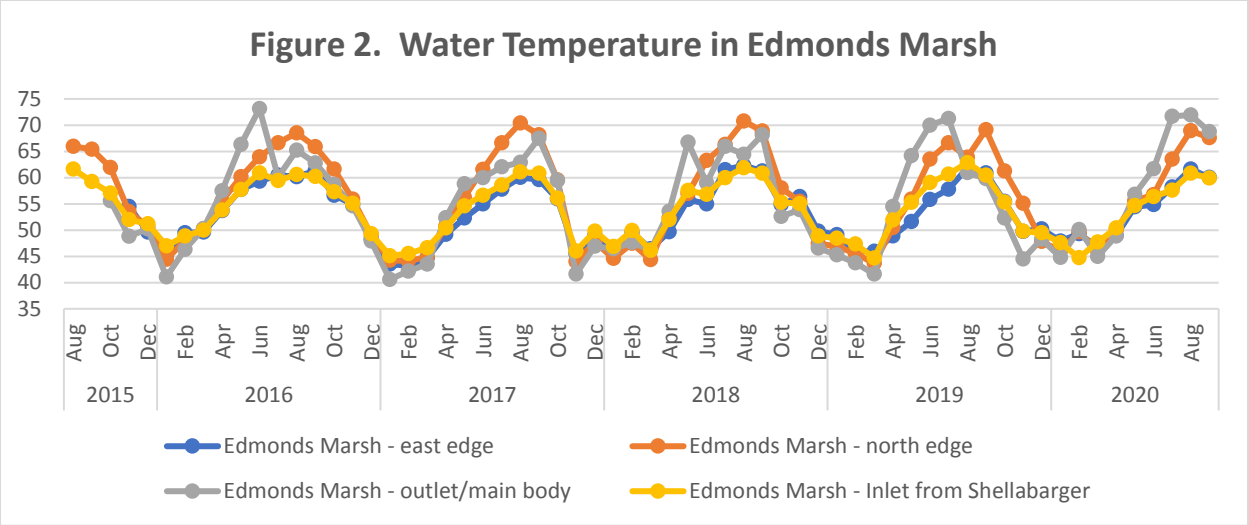
Water temperatures in the creeks were good for salmon year-round. The water temperatures were colder in the winter and warmer in the summer as would be expected of natural spring fed creeks. All monthly water temperatures, except one, were below the maximum temperature requirement of 63.5°F for salmonid spawning, rearing and migration [Washington Administrative Code - WAC 173-201A-200(1)(c)]. The one exceedance was 63.8°F in Hindley Creek in August 2017. Monthly water temperatures in the lower Creeks since 2015 are shown in Figure 1.



Water Temperature in Edmonds Marsh

Water temperatures were above the maximum temperature requirement of 63.5°F for salmonid spawning, rearing and migration [WAC 173-201A-200(1)(c)] every summer monitored (see Figure 2). Outgoing Marsh water exceeded maximum temperature requirements every summer in spite of cooler incoming freshwater that was below maximum temperature in all but one month. The highest water temperatures recorded at the Marsh outlet was 73.3°F.

Water temperatures above 70°F can be lethal to salmon. The Marsh-Estuary Restoration project will need to address this problem to successfully bring salmon back to the Marsh-Estuary.

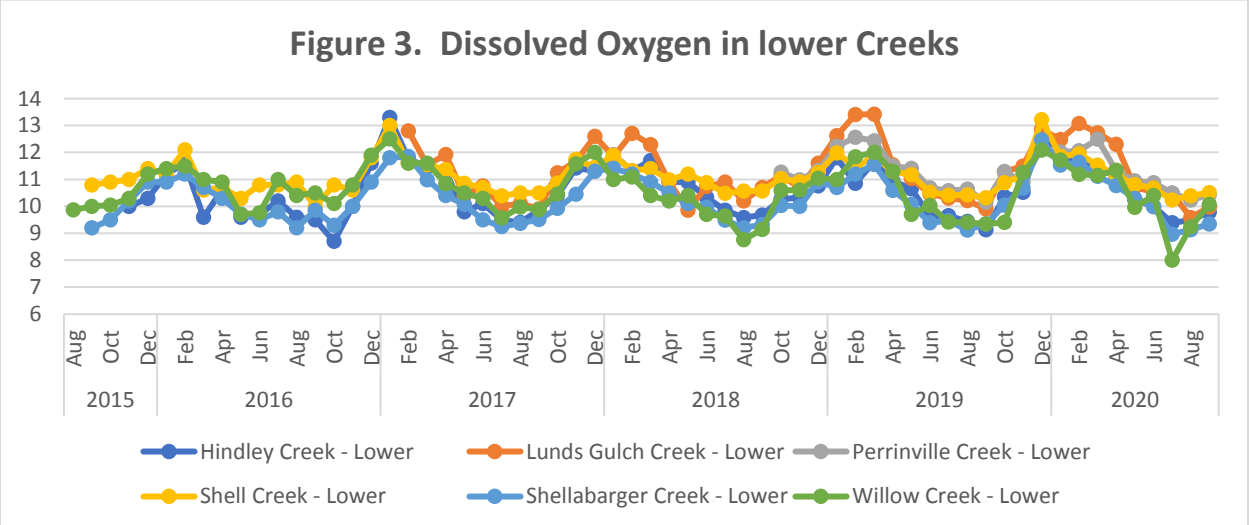


Dissolved Oxygen in Creeks

All of the creeks, except upper/middle Lunds Gulch, had dissolved oxygen levels at or above the 8.0 mg/L minimum requirement for salmonid spawning, rearing and migration [WAC 173-201A-200(1)(d)].

The upper and middle sections of Lunds Gulch stopped flowing in the summer of some years and the upper end dried up. These low flows and standing water in Lunds Gulch Creek resulted in low dissolved oxygen levels. No other stream monitored exhibited this pattern.

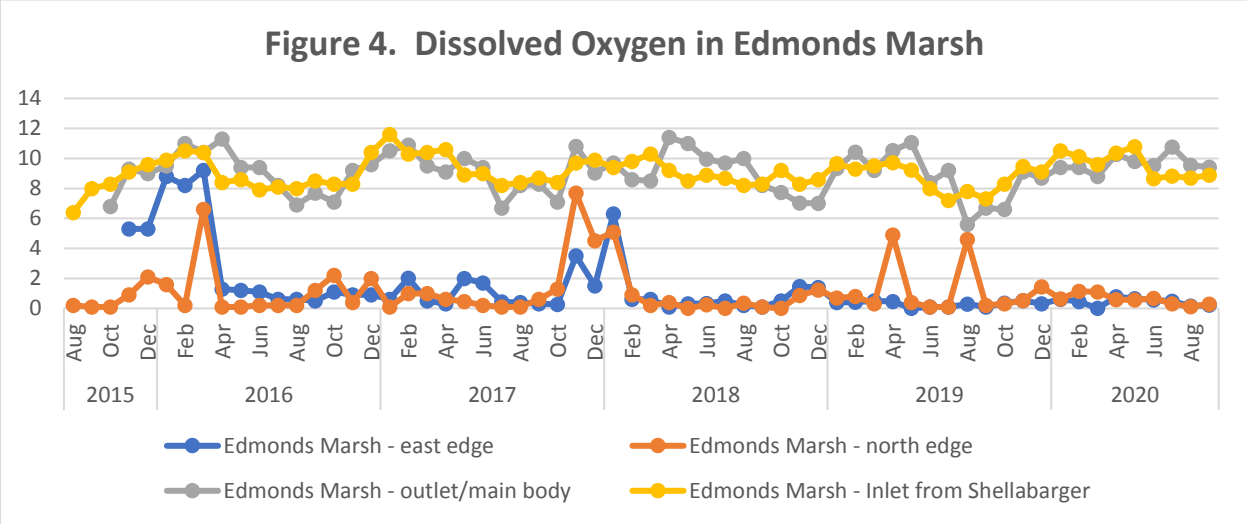
Dissolved oxygen levels in the lower sections of all Creeks were above 10 mg/L every winter (see Figure 3) which is optimal for salmon eggs in the gravel.



Dissolved Oxygen in Edmonds Marsh

The main flow of water through the Edmonds Marsh averaged 9.2 mg/L of dissolved oxygen through all of our data collections which exceeds the 6.5 mg/L minimum requirement for salmonid rearing and migration [WAC 173-201A-200(1)(d)]. The dissolved oxygen level was above the 6.5 mg/L minimum every month except August 2019 when it was 5.61 mg/L.

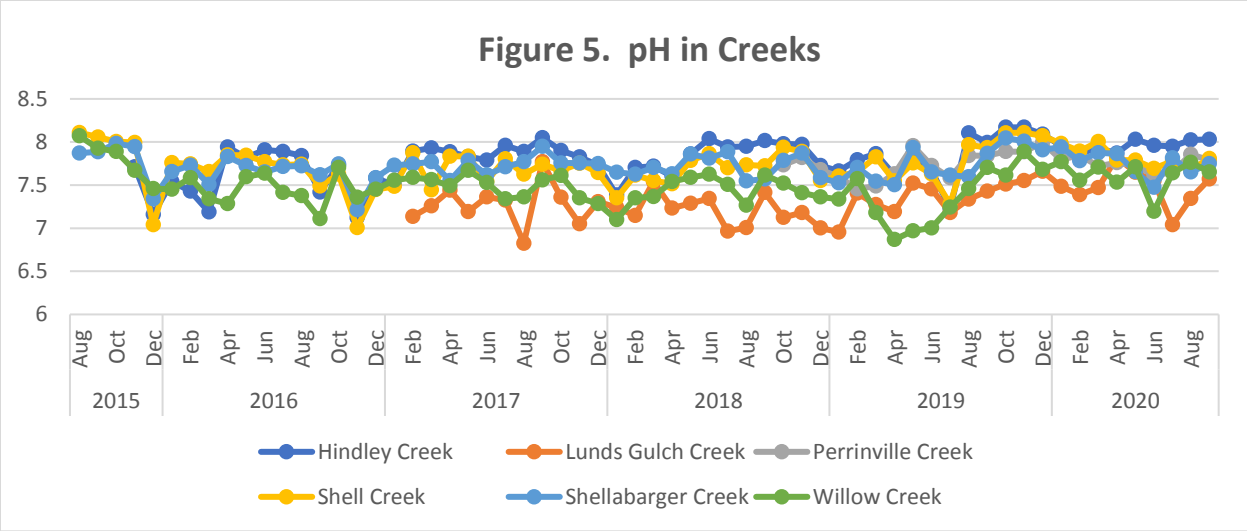
However, dissolved oxygen measured on the northern edge of the Marsh (along Harbor Square) and the eastern edge of the Marsh (along Highway 104) was below State requirements in most months (Figure 4). The northern edge of the Marsh along Harbor Square averaged 2.7 mg/L of dissolved oxygen over all months, and was frequently below 2.0 mg/L (which is lethal to most aquatic organisms) except during periods of rainfall. We do not have data for the southern edge of the Marsh because Chevron has denied access to their property.



pH in Creeks

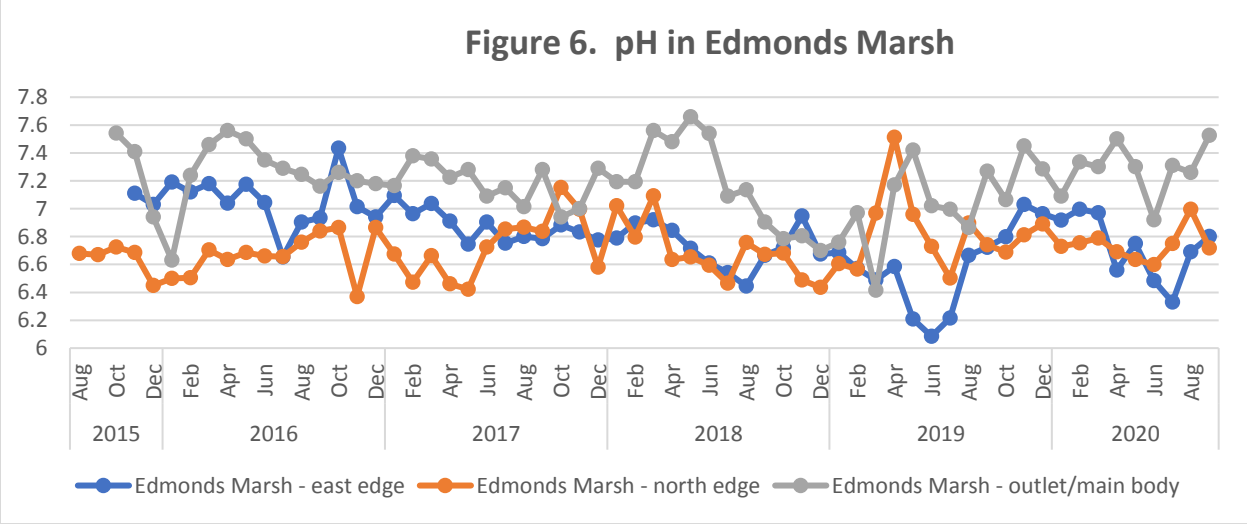
All of the observed pH levels in the creeks were within the pH 6.5 to 8.5 range required for salmonid spawning, rearing and migration [WAC 173-201A-200(1)(g)] except for upper Lunds Gulch Creek which was below pH 6.5 in October of 2017 and 2018 and July of 2019. Interestingly, the lower pH measurements in October occurred after the upper Creek had been dry the previous month.

As shown in Figure 5, all creeks tended to be in the basic pH range (pH 7.0 to 8.0) year-round, rather than acidic (below pH 7). This is good for aquatic organisms since some of the contaminants in streams, such as heavy metals, are more toxic in acidic water.



pH in Edmonds Marsh

The main body of the Edmonds Marsh at the outlet had an average pH of 7.2, while the north and east edges of the Marsh had average pH of 6.8 and 6.7 respectively (see Figure 6). Measured pH below the minimum 6.5 pH requirement [WAC 173-201A-200(1)(g)] occurred on multiple months on the north and east edges of the Marsh. The north edge was below the minimum pH 6.5 in 7 or more months of the year from 2018 to 2020.



Salinity in Edmonds Marsh

For the Edmonds Marsh to be a fully functional estuary, as it was in the past, it needs to have daily tidal flow. Unfortunately, a tidegate located downstream of the Marsh outlet prevents saltwater flow into the Marsh from mid-October to mid-March to supposedly prevent potential

flooding during periods of coinciding high rainfall and high tides. In about mid-March, City employees will secure the tidegate into an open position to allow full tidal exchange of saltwater through the spring/summer months.

The salinity measurements at the Marsh outlet (which is representative of the main body of the Marsh) from December to early March reflect the low salinity of the incoming freshwater (averaging 0.12 ppt) from the Shellabarger inlet and lower Willow Creek. When the tide gate is secured open and saltwater enters the Marsh with each high tide, the salinity measurements are significantly greater at the Marsh outlet.

Salinity measurements along the northern (Harbor Square) and eastern (Highway 104) edges averaged 0.2 ppt year-round. This indicates that the saltwater does not reach these areas even when the tidegate is secured open in the spring/summer.

Pollutants

A total of 208 water and soil samples were collected from the lower sections of Creeks and from the edges, inlet, and outlet of the Edmonds Marsh. The samples were analyzed by the state accredited, ALS Laboratory in Everett for heavy metals (Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Zinc), and petroleum derived compounds (PAHs, TPH, BTEX). The resulting measurement for each pollutant was compared to the State criteria for toxic substances (Washington Administrative Code 173-201A-240).

Of greatest concern to date is the detection of seven carcinogenic PAHs that exceeded WA State Human Health Criteria for Consumption of Water and Organisms [WAC 173-201A-240]. Over half of the samples analyzed for PAHs had levels of one of more of the following carcinogenic PAHs that exceeded WA criteria: Benzo[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene, Dibenzo[a,h]anthracene, and Indeno[1,2,3-cd]pyrene.

The east edge of the Marsh (at stormdrain off Hwy 104) and the north edge of Marsh (along Harbor Square) had the highest exceedance levels for multiple carcinogenic PAHs.

SALMON STEWARDSHIP

Students Saving Salmon participated in various efforts to increase and improve salmon numbers and habitat in Edmonds streams. These efforts included salmon surveys, hatchery assistance, use of hatchboxes, streamside habitat restoration, deterring mountain beavers, and outreach.

Stream Surveys

Students Saving Salmon conducts stream surveys each fall in Shell Creek and Lunds Gulch Creek to determine salmon presence/absence, spawning locations, and habitat conditions. Through these surveys, we have identified fish passage barriers and restoration needs, and then worked with private property owners to improve salmon habitat.

We record sightings of both live and dead salmon in the Creeks and attempt to identify salmon species (coho or chum salmon), sex, and hatchery/wild origin. Estimating total number of each salmon species is difficult because the salmon move around in the Creek and we can't be certain that any given sighting is not a duplicate of a previous or subsequent sighting. Last year, we started undertaking detailed examinations of dead salmon to determine if they had succumbed to pre-spawn mortality, predator attack, or natural mortality after spawning. After each dead salmon was examined, the tail was cut off so that we would know it had been previously counted/examined.

We estimate at least 15 to 25 adult coho salmon were in Shell Creek in 2019. This was an obvious change from the prior two years when Shell Creek residents upstream of Caspers Street were reporting few to no coho salmon. This difference between the years is likely the result of work by Students Saving Salmon, along with adult volunteers, to clear a culvert near Caspers St. that was blocking fish passage. We successfully removed roots that had grown into the culvert.

We only had five chum salmon sightings in Shell Creek in 2019, a marked decline from previous years. Chum salmon numbers were low throughout Puget Sound according to WDFW and the Tribes that harvest chum salmon. In Shell Creek, we also had an additional problem of a large log on the beach blocking the Creek entrance under the railroad tracks. For chum salmon to get through, they had to swim on their sides under the log in less than three inches of water.

Things weren't any better in Lunds Gulch Creek for chum salmon. We had zero sightings of live chum in the creek in comparison to about 10 to 20 in past years. Coho salmon move quickly up the lower sections of Lunds Gulch where observations are made and spawn further up the creek where access isn't possible. At least four to six coho salmon were observed moving up Lunds Gulch in 2019.

Habitat Restoration -

Students Saving Salmon has worked with streamside residents along Shell to plan habitat restoration on multiple properties over the past three years. Over 600 native plants have been planted along Shell Creek by students and community volunteers through mid-2019. In the fall of 2019, we switched to planting willow and dogwood stakes along stream edges where erosion was occurring. Over 60 stakes were placed along Shell Creek behind Holy Rosary Church.

Our spring community planting in 2019, included placing wire cages around the new plants to prevent mountain beaver foraging (a prior planting at this site in 2017 essentially failed because mountain beavers ate most of the new plants within a 6-month period). We also treated the mountain beaver burrows with coyote urine to deter the mountain beavers from this location where they were impacting shore stability and eating streamside vegetation.

Salmon Enhancement

Since 2017, students have volunteered at the Willow Creek Salmon Hatchery assisting with incubating about 80,000 coho eggs, transferring coho fry to raceways, preparing the pond for rearing, feeding the juvenile coho in the rearing pond, and releasing the coho fry into streams. Students have learned valuable skills about the handling of salmon and the importance of

hatcheries in supplementation programs. Unfortunately, due to the COVID pandemic, students were not able to participate in moving coho fry from the pond to creeks, but did participate in feeding since that involved individual students consistent with COVID guidelines.

The water quality data collected by Students Saving Salmon, demonstrating the good quality of water in Shell Creek, was used to convince the Washington Department of Fish and Wildlife to allow the release of juvenile coho from Willow Creek Salmon Hatchery into upper Shell Creek. The upper areas of Shell Creek has good habitat for spawning and rearing of juvenile salmon, but it has been blocked from access by spawning adult salmon for many years due to man-made obstacles such as impassable culverts and a five-foot man-made waterfall.

About 2,000 juvenile coho salmon were released into Shell Creek in May 2020 (without student participation due to COVID). These juvenile coho salmon measuring 3-4 inches will live and grow in the Creek for their first year of life and then migrate to the ocean the next year.

The Stream Team has also assisted with a small chum salmon hatchery located in upper Lund Gulch Creek. This hatchery raises 10,000 chum salmon for release into lower Lunds Gulch Creek.

Hatchboxes

Working with the WA Dept Fish and Wildlife Issaquah Creek Hatchery, the Suquamish Tribe's Grover's Creek Salmon Hatchery and the Sound Salmon Solutions' Willow Creek Salmon Hatchery, students have participated in placing coho and chum salmon eggs into instream incubators called 'hatchboxes'. The hatchboxes allow salmon eggs to hatch in the stream under more natural conditions with "natural" release of the hatched fry when they have consumed their yolk sac and are ready to begin life in the stream.

In early 2020 (before the COVID outbreak), with the assistance again of Olympic Fly Fishers in purchasing additional hatchboxes for us, we placed over 9,000 coho and chum salmon eggs into Shell and Lunds Gulch Creeks.

We had a 75% hatch/egress rate for our 2020 hatchboxes (compared to 89% in 2019) due to two winter rainstorms, each dropping over 2" of rain in one day, that shifted creek gravel and buried and dislodged our hatchboxes. However, at one site, not affected by the storms, we had 97% egg hatching/fry egress in two chum salmon hatchboxes - this is better than natural survival of egg to fry stage.

RECOMMENDATIONS

Stream and Marsh Monitoring

We appreciate the continued support we've received from the Edmonds City Council and the City of Edmonds. We ask that the 2021 city budget continue funding us because those funds are critical for obtaining the supplies necessary for students to conduct this project. The citizen science project provides real-time information on our environment that is essential for monitoring stormwater and planning salmon restoration efforts.

Fish Passage Barriers

We have observed both manmade and debris/log barriers that prevent adult salmon from accessing potential spawning and rearing areas. It is critical for salmon in Edmonds that these barriers be removed as quickly as possible. Our effort to clear a blocked culvert in 2019 dramatically increased the occurrence of spawning coho salmon along 7th Ave. We appreciate the City's effort to contact the Carol Way property owner with the impassable 5' five foot waterfall and can only hope he will respond to our plea to allow us to work with him to obtain grant funds to replace the waterfall with step pools that will allow salmon to once again spawn above this barrier. In the interim, we have obtained approval from WDFW to release juvenile coho salmon above the waterfall up to Yost Park so juvenile salmon can grow in the good habitat above the falls.

Sediment Accumulation in Creeks

Both Perrinville Creek and Shell Creek have high sediment loads from erosion of steep bluffs. The sediment covers and smothers the gravel areas where aquatic organisms live and juvenile salmon feed. Adult salmon use the gravel to spawn and sediment buildup kills the eggs they lay in the gravel.

In Perrinville Creek, excess stormwater is destroying stream banks and eroding the ravines in Southwest County Park. The resulting sediment load overwhelms the system and is destroying salmon habitat in the lower reaches of the Creek. We urge the City implement measures to reduce stormwater flows and prevent new development that adds stormwater to the system or removes older trees.

In Shell Creek, much of the sediment appears to be coming from erosion in Yost Park. We urge the City to implement habitat restoration work in Yost Park to replant lost trees along the streambanks and prevent steep bluffs from continuing to erode.

Edmonds Marsh-Estuary

The Edmonds Marsh has water quality problems and deteriorating habitat that require a comprehensive restoration effort. The Edmonds Marsh is supposed to be a saltwater estuary, but saltwater flow is curtailed in fall and winter months by a tidegate. Fish passage is precluded because the Marsh drains to Puget Sound in a 1,600-foot pipe that exits into deep water well below the surface. The many years of curtailed flow through the Marsh has resulted in sediment deposits and invasive plant growth on fences that prevent adequate circulation. Invasive species dominate much of the riparian areas preventing native plant growth needed for a healthy ecosystem. The invasive nightshade is killing what trees are left along the east edges of the Marsh. Natural tree succession is absent in much of the Marsh buffers. Lack of water circulation has caused standing water in portions of the Marsh to have low dissolved oxygen. The western edge of the Marsh lacks vegetation and water temperatures exceed 70 degrees in summer months.

We urge the City to bring in experienced tidal marsh restoration professionals to develop and implement a restoration plan that reverses the slow deterioration of the Edmonds Marsh. In the interim, a few things the City should be doing are:

1) Leave the tide gate secured open year-round to allow the Marsh to begin reverting back to a true saltwater estuary.
2) Work with WSDOT to remove the fences on both sides of Highway 104.
3) Plant new trees along western and eastern edges of the Marsh
4) Remove invasive species in Marsh buffers and replace them with native plants
5) Work with BNSF to have them stop using herbicides on tracks near the Marsh.
6) Re-pipe the stormwater system in Harbor Square to drain to Dayton Street and the new Dayton Street pump.
7) Work with WSDOT to reduce toxic runoff from Highway 104 into the Marsh

Salmon enhancement and habitat restoration

Much of the streamside habitat in Edmonds needs restoration and salmon numbers have declined. Since most of our creeks are on private property, restoring salmon and streamside habitat will require private property owner "buy-in" and participation. With continuing support from the City, Students Saving Salmon will continue working with private property owners and undertaking additional enhancement efforts such as the use of hatchboxes.

ACKNOWLEDGMENTS

We want to thank the many people and organizations in the community that have supported our efforts to restore salmon in Edmonds. We especially thank streamside property owners for allowing us to access the Creek in their backyards to do salmon surveys and enhancement; Olympic Fly Fishers for providing funds for us to purchase native plants for habitat restoration and donating the hatchboxes we use to enhance salmon runs; Puget Sound Anglers for donating boots for students to use during stream surveys; Edmonds Tree Board for advice and assistance in streamside habitat restoration; Sound Salmon Solutions for allowing students to assist at the Willow Creek Hatchery; Walter Thompson for providing hands-on teaching of hatchery supplementation; Holy Rosary Church and Bob Mooney for allowing students to develop a habitat restoration "model" for the community on Shell Creek; and last, but not least, the Edmonds City Council for its support and encouragement to students.