



## Skagit River System Cooperative

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### *Memorandum*

To: Jenna Friebel (WDFW), Polly Hicks (NOAA), and Jenny Baker (TNC)  
From: Eric Beamer and Rich Henderson (SRSC)  
Date: December 16, 2015  
Re: Fir Island Farms Technical Memo - Before Restoration Fish Monitoring 2015

#### **Introduction**

Delta habitats within the Skagit River basin and other Salish Sea river estuaries have been identified as priority habitat for restoration for the benefit of juvenile Chinook salmon and other listed species by numerous regional planning processes (SRSC and WDFW 2005, the Puget Sound Chinook Recovery Plan, and the Puget Sound Nearshore Ecosystem Restoration Program, among others). Significant public investment has been made in restoration actions within the Skagit River estuary, and restoration through dike setback design is planned at Fir Island Farms in late summer 2016. In response to the planned restoration at Fir Island Farms, we monitored fish use of the areas to be restored during the 2015 juvenile Chinook salmon outmigration season as the first of two seasons before restoration occurs (2015 and 2016) and will monitor for two seasons after restoration has been completed (2017 and 2018).

#### **Beach Seining**

Site Selection, Timing, and Frequency: For the before-restoration time period (2015 and 2016), three beach seine sites were established outside (downstream) of the tidegate located on No Name Slough and three beach seine sites were established inside (upstream) of the tidegate. These six sites were established as index (repeatedly sampled) sites, and will be sampled in years 2017 and 2018 as well, after restoration has occurred. The locations of these sites were chosen so that the dike removal would have a minimal impact on the physical characteristics of each site. The beach seine sets made on the outside of the tidegate were done at or near high slack tide in order to avoid high water velocities occurring on ebbing tides, which makes seining difficult. On the first sampling day four sites downstream of the tidegate were seined in order to determine the feasibility of sampling at various locations (Figure 1). The catch at FIF Outside Tidegate s4 is given in the Catch Table 1, but this site was not sampled after the first day.

Field Methods: We used a small net beach seine method to sample sites. Small net beach seine methodology uses an 80-ft (24.4 m) by 6-ft (1.8 m) by 1/8-inch (0.3cm) mesh knotless nylon net. The net is set in “round haul” fashion by fixing one end of the net on the beach, while the other end is deployed by setting the net “upstream” against the water

current, if present, and then returning to the shoreline in a half circle. Both ends of the net are then retrieved, yielding a catch. Average beach seine set area is 96 square meters. For each set, we identify and count fish by species. All the fish are returned alive to the water, with the exception of hatchery-origin salmon with coded-wire tags embedded in their snouts. These fish are sacrificed in order to read the tags. We do not report or discuss coded wire tag results in this report. We also record the time and date of each set, the percent of set area (the area that the net covers compared to setting in a perfect half circle), and we measure selected environmental conditions (salinity, temperature, dissolved oxygen (DO), velocity, depth, substrate class, and vegetation class) present within the seined area at the time of seining. Water temperature, salinity, and DO are measured using a YSI Professional Plus Model meter. Depth is measured with a stadia rod. Standard protocol at SRSC is when there is sufficient water depth, two readings are taken within the set area, just under the surface and at the bottom of the water column. At Fir Island Farms there was not sufficient water depth for a reading at the bottom of the water column at sites upstream of the tidegate. Surface water velocity is measured using a Swoffer Model 2100 flow meter. Four velocity measurements are taken across the area seined after the set is made and these values are converted to meters per second and the average value of these readings is reported for each site/date combination. For the parameter ‘water salinity’ the YSI Professional Plus Model meter measures the conductivity of the water and then calculates and displays this value as salinity. Substrate and vegetation at each site are recorded according to criteria described in SSC (2003).

## Results

Sampling occurred once per month in February and August and twice per month March through July, giving a total of 12 sampling days. For 2015 sampling was conducted February 27 through August 6; sampling dates are shown in Table 1. Figure 1 shows the location of sample sites referred to in this report.

Table 1. Number of beach seine sets by date and strata at the Fir Island Farms study area, 2015.

Date:	Location:	Inside tidegate	Outside tidegate
2/27/15		3	4
3/12/15		3	3
3/30/15		3	3
4/9/15		3	3
4/23/15		3	3
5/8/15		3	3
5/20/15		3	3
6/8/15		3	3
6/19/15		3	3
7/6/15		3	3
7/20/15		3	3
8/6/15		3	3



Figure 1. Location of beach seine sites at Fir Island Farms used in the 2015 monitoring.

## Fish assemblage

There were 31,930 fish representing 11 fish species caught in the sampling at Fir Island Farms in 2015. The total catch for all species by site and strata is shown in Table 2. Juvenile salmon (14 Chinook and 1 chum), as well as three other estuarine species (e.g., staghorn sculpin, starry flounder, and English sole) were caught upstream of the tide gate. We observed the tide gate leaking during flood tides which is the likely cause of upstream fish passage opportunity at the gravity operated top hinged tide gate. Water surface elevation results measured upstream and downstream of the tidegate showed the tidegate leaked during flood tides (data from Jenna Friebe, WDFW)

Table 2. Total catch by species at Fir Island Farms sites February 27 through August 6, 2015. Mean catch per unit effort (beach seine set) is in parentheses.

Location:	Upstream of tidegate				Downstream of tidegate				
Gear:	beach seine				beach seine				
Site:	FIF Inside Tidegate s1	FIF Inside Tidegate s2	FIF Inside Tidegate s3	Inside tide-gate total	FIF Outside Tidegate s1	FIF Outside Tidegate s2	FIF Outside Tidegate s3	FIF Outside Tidegate s4	Out-side tide-gate total
<b>Salmonid species:</b>									
Chinook salmon, unmarked subyearling, <i>Oncorhynchus tshawytscha</i>	9 (0.7)	4 (0.3)	1 (0.1)	<b>14 (0.4)</b>	20 (1.7)	25 (2.1)	25 (2.1)	1 (1.1)	<b>71 (1.9)</b>
Chinook salmon, hatchery origin, all marks and ages combined <i>Oncorhynchus tshawytscha</i>	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>	0 (0.0)	3 (0.3)	1 (0.1)	0 (0.0)	<b>4 (0.1)</b>
Chum salmon, subyearling, <i>Oncorhynchus keta</i>	0 (0.0)	0 (0.0)	1 (0.1)	<b>1 (0.0)</b>	21 (1.8)	7 (0.6)	16 (1.3)	0 (0.0)	<b>44 (1.2)</b>
<b>Total salmonids:</b>	<b>9</b>	<b>4</b>	<b>2</b>	<b>15</b>	<b>41</b>	<b>35</b>	<b>42</b>	<b>1</b>	<b>119</b>
<b>Other fish species:</b>									
Three-spine stickleback, <i>Gasterosteus aculeatus</i>	7,499 (624.9)	13,565 (1130.4)	8,876 (739.7)	<b>29,940 (831.7)</b>	129 (10.8)	282 (23.5)	277 (23.1)	0 (0.0)	<b>688 (18.6)</b>
Pacific herring, <i>Clupea pallasii</i>	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	<b>1 (0.03)</b>
Surf smelt, <i>Hypomesus pretiosus</i>	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>	5 (0.4)	8 (0.7)	9 (0.8)	0 (0.0)	<b>22 (0.6)</b>
Pacific staghorn sculpin, <i>Leptocottus armatus</i>	51 (4.3)	0 (0.0)	2 (0.2)	<b>53 (1.5)</b>	3 (0.3)	4 (0.4)	4 (0.3)	0 (0.0)	<b>11 (0.3)</b>
Starry flounder, <i>Platichthys stellatus</i>	191 (15.9)	12 (1.0)	26 (2.2)	<b>229 (6.4)</b>	7 (0.6)	12 (1.0)	26 (2.2)	0 (0.0)	<b>45 (1.2)</b>
English sole, <i>Parophrys vetulus</i>	2 (0.2)	0 (0.0)	0 (0.0)	<b>2 (0.1)</b>	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>
Shiner surf perch, <i>Cymatogaster aggregate</i>	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>	344 (28.7)	135 (11.3)	324 (27.0)	0 (0.0)	<b>803 (21.7)</b>
Peamouth chub, <i>Mylocheilus caurinus</i>	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	<b>1 (0.03)</b>
American shad (non-native), <i>Alosa sapidissima</i>	0 (0.0)	0 (0.0)	0 (0.0)	<b>0 (0.0)</b>	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	<b>1 (0.03)</b>
<b>Total other fish:</b>	<b>7,743</b>	<b>13,577</b>	<b>8,904</b>	<b>30,224</b>	<b>489</b>	<b>441</b>	<b>642</b>	<b>0</b>	<b>1,572</b>
<b>Total fish catch:</b>	<b>7,752</b>	<b>13,581</b>	<b>8,906</b>	<b>30,239</b>	<b>530</b>	<b>476</b>	<b>684</b>	<b>1</b>	<b>1,691</b>

## Environmental Data

Results: We report the environmental data recorded from the three beach seine sample sites within each stratum (up- and downstream of the tidegate) as the average values from the three sets made in that stratum for that stratum. The data are shown below in Tables 3 through 6.

At Fir Island Farms there was not sufficient water depth for a reading with the YSI Model Pro Plus at the bottom of the water column at the sites upstream of the tidegate. There was not any measurable velocity at any of the sites during the fish monitoring in 2015 and therefore the data is not presented in a table.

Table 3. Average of maximum water depth (m) at each beach seine sample by stratum in 2015.

Stratum:	Upstream of tidegate	Downstream of tidegate
Date	Average water depth (m)	Average water depth (m)
2/27/15	0.59	1.54
3/12/15	0.51	1.34
3/30/15	0.59	1.24
4/9/15	0.37	1.67
4/23/15	0.51	1.87
5/8/15	0.52	1.65
5/20/15	0.57	2.07
6/8/15	0.50	2.00
6/19/15	0.59	1.77
7/6/15	0.46	1.70
7/20/15	0.41	1.65
8/6/15	0.33	1.57

Table 4. Average water surface and bottom temperature (°C) at each beach seine sample by stratum in 2015.

Stratum:	Upstream of tidegate		Downstream of tidegate	
Date	Average water surface temperature (°C)	Average water bottom temperature (°C)	Average water surface temperature (°C)	Average water bottom temperature (°C)
2/27/15	8.43	na	7.33	7.85
3/12/15	11.07	na	10.97	10.87
3/30/15	14.80	na	15.57	15.50
4/9/15	12.77	na	12.17	12.33
4/23/15	11.77	na	11.03	11.13
5/8/15	14.97	na	14.70	14.27
5/20/15	16.43	na	15.83	16.60
6/8/15	17.37	na	16.27	16.43
6/19/15	17.80	na	16.17	17.07
7/6/15	20.83	na	18.56	18.65
7/20/15	20.77	na	20.37	20.37
8/6/15	19.10	na	17.57	17.20

Table 5. Average water surface and bottom salinity (ppt) at each beach seine sample by stratum in 2015.

Stratum:	Upstream of tidegate		Downstream of tidegate	
Date	Average water surface salinity (ppt)	Average water bottom salinity (ppt)	Average water surface salinity (ppt)	Average water bottom salinity (ppt)
2/27/15	6.35	na	1.29	4.45
3/12/15	1.45	na	1.17	3.79
3/30/15	1.68	na	1.22	1.25
4/9/15	7.31	na	4.86	6.13
4/23/15	5.87	na	2.82	3.01
5/8/15	15.52	na	10.60	15.58
5/20/15	12.75	na	9.18	12.53
6/8/15	15.46	na	6.39	10.79
6/19/15	12.25	na	7.42	10.31
7/6/15	14.68	na	12.17	14.21
7/20/15	10.85	na	9.14	9.47
8/6/15	10.50	na	10.53	12.38

Table 6. Average water surface and bottom Dissolved Oxygen (mg/L) at each beach seine sample by stratum in 2015.

Stratum:	Upstream of tidegate		Downstream of tidegate	
Date	Average water surface DO (mg/L)	Average water bottom DO (mg/L)	Average water surface DO (mg/L)	Average water bottom DO (mg/L)
2/27/15	9.02	na	12.01	9.32
3/12/15	8.88	na	10.35	9.19
3/30/15	12.25	na	10.29	9.72
4/9/15	8.83	na	11.42	9.21
4/23/15	9.49	na	10.91	9.94
5/8/15	6.45	na	8.50	5.97
5/20/15	4.76	na	8.87	5.14
6/8/15	6.16	na	8.70	4.80
6/19/15	5.40	na	8.03	5.51
7/6/15	4.05	na	6.16	5.58
7/20/15	4.94	na	6.71	6.38
8/6/15	5.49	na	6.61	6.31

## References

Skagit River System Cooperative and Washington Department of Fish and Wildlife. 2005. Skagit Chinook Recovery Plan. Skagit River System Cooperative, La Conner, WA. Available at [www.skagitcoop.org/](http://www.skagitcoop.org/).

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