FISH USE OF ESTUARINE TIDAL CHANNELS ENHANCED WITH LARGE WOODY DEBRIS

FINAL REPORT

Prepared for

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ACKNOWLEDGEMENTS

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INTRODUCTION

In 2005 and 2006, fish use of tidal channel habitat enhanced with artificially placed large woody debris was investigated in the Winchester Creek Tidelands Restoration Area of South Slough National Estuarine Research Reserve. Large woody debris (LWD) in the form of mature Sitka spruce trees was intentionally placed in the study area to enhance rearing and foraging habitat for juvenile salmonids and other fish species in 2005. Soon after the placement of LWD in the estuary, a study was initiated to compare fish abundance and species composition in tidal channels enhanced with LWD to those without LWD using electrofishing techniques. Two tidal channels, which are tributaries to Winchester Creek, were chosen for the study. A control reach was established on Tom's Creek with no LWD present in the reach, while a treatment reach was established on Dalton Creek containing two intentionally placed Sitka spruce trees. In 2006, sampling was conducted to monitor the control and treatment reaches over a longer time period in an effort to ensure juvenile salmonids were sampled if present in the study area. Additionally, sampling was conducted on the mainstem of Winchester Creek to determine if juvenile salmonids were utilizing habitat in the main channel exclusive of the tidal channels. The objective of this investigation was to determine fish use, abundance and species composition in locations around LWD placed in the Winchester Creek study area.

METHODS

Within the Winchester Creek study area, electrofishing passes were performed within a single reach of Dalton and Tom's Creeks, while beach seining was performed within two adjacent reaches of Winchester Creek. Beach-seined reaches were located between the confluences of Dalton and Tom's Creeks with Winchester Creek. Electrofishing and beach seine sampling occurred on two consecutive days in each of five sampling periods (February-June; Table 1).

In each of the reaches where electrofishing was performed, block nets were set up at the downstream and upstream end of the reach during high tide to prevent fish from leaving or entering the study area. Before the low slack tide, when the channel had sufficiently dewatered, a two-pass removal survey was performed with electrofishing equipment (Smith Root Model 12B Electrofisher) to estimate abundance of each species occurring within the surveyed reaches.

If salmonids were encountered, a second pass was conducted to ensure complete recovery. After each pass, captured fish were counted and length (fork length for salmonids and total length for other species; mm) of at least 25 individuals of each species was measured. After measurements were taken, counts of the remaining fish by species were recorded. In addition, the weights of all coho salmon were measured and recorded. After being processed, all fish were released downstream with the exception of a subsample of coho salmon and staghorn sculpin. When present, five coho and staghorn sculpin from each site were euthanized in MS222 and preserved for future stomach content and otolith analysis.

Table 1. Study reaches within the Winchester Creek Tidelands Restoration Area sampled in 2006.

Study Reach	Treatment Type	Sampling Method	Sampling Periods
Dalton Creek	Treatment with placed LWD	Electrofishing	February-June
Tom's Creek	Control without placed LWD	Electrofishing	February-June
Winchester Creek-Upstream	NA	Beach Seine	February-June
Winchester Creek-Downstream	NA	Beach Seine	February-June

Winchester Creek was sampled by beach seine in the upstream direction starting at the furthest downstream reach. During the initial sampling period, substantial difficulty in moving the seine against the flow was experienced likely allowing fish to avoid capture. During subsequent sampling periods, seining occurred in the downstream direction moving with the flow and started at the furthest upstream reach. Fish were brought to shore after each reach was seined and processed as described above.

RESULTS

A total of 2,363 fish were caught in the Winchester Creek study area, representing eight species from six families: Pacific staghorn sculpin (*Leptocottus armatus*), shiner perch (*Cymatogaster aggregata*), threespine stickleback, (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), starry flounder (*Platichthys stellatus*), coho salmon (*Oncorhynchus kisutch*), cutthroat trout (*Oncorhynchus clarkia*), and Pacific herring (*Clupea pallasii pallasii*; Figure 1, Table 2). Starry flounder and Pacific herring were only found in the mainstem of Winchester

reek, while all other species were observed in either one or both of the sampled tidal channel tributaries.

Figure 1. Fish species sampled in study reaches included A) Pacific staghorn sculpin, B) shiner perch, C) threespine stickleback, D) prickly sculpin, E) cutthroat trout, F) coho salmon, G) starry flounder, and H) Pacific herring.

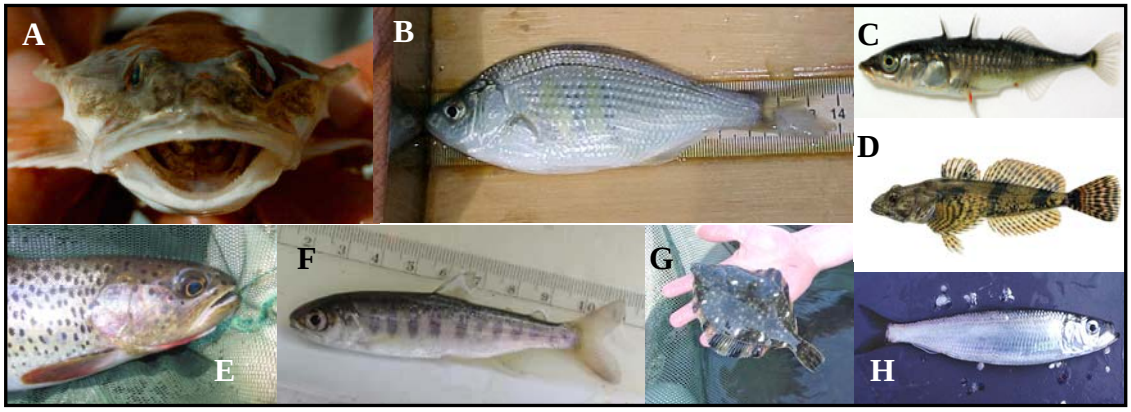

Table 2. Total number and percent of fish species sampled by electrofishing and beach seine in the Winchester Creek study area in February-June, 2006.

Common name	Scientific Name	Family	Total Number	Percent of Catch
Pacific staghorn sculpin	*Leptocottus armatus*	Cottidae	2354	78.68
Shiner perch	*Cymatogaster aggregata*	Embiotocidae	293	9.79
Three-spine stickleback	*Gasterosteus aculeatus*	Gasterosteidae	256	8.56
Prickly sculpin	*Cottus asper*	Cottidae	41	1.37
Starry flounder	*Platichthys stellatus*	Pleuronectidae	30	1.00
Coho salmon	*Oncorhynchus kisutch*	Salmonidae	15	0.50
Cuttroat trout	*Oncorhynchus clarkii*	Salmonidae	2	0.07
Pacific herring	*Clupea pallasii pallasii*	Clupeidae	1	0.03

Of the fish sampled in the tributaries of Winchester Creek, Dalton and Tom's Creeks contained 60.2 and 39.8 percent of the total catch respectively. The majority of the fish sampled in the two tributaries were Pacific staghorn sculpin, comprising 86.6 percent of the total catch for both creeks. Of the subsample of staghorn sculpin that were measured, average total length was 53.9 and 44.7 mm respectively for Dalton and Tom's Creeks (Figure 2). Staghorn sculpin were more abundant in Dalton Creek in comparison to Tom's Creek, however, the second most

abundant species, threespine stickleback, was observed in nearly equal numbers between the two creeks (Table 3). Most notably, a small number of salmonids were observed in Dalton Creek, while salmonids were absent from Tom's Creek. In the mainstem of Winchester Creek, 63.3 percent of the fish sampled were collected in the upstream reach while 36.7 percent were collected in the adjacent downstream reach. Similar to the Winchester Creek tributaries, the most abundant species sampled was staghorn sculpin, comprising 63.0 percent of the total catch. The second most abundant species found in Winchester Creek, shiner perch, comprised 29.3 percent of the total catch (Table 4).

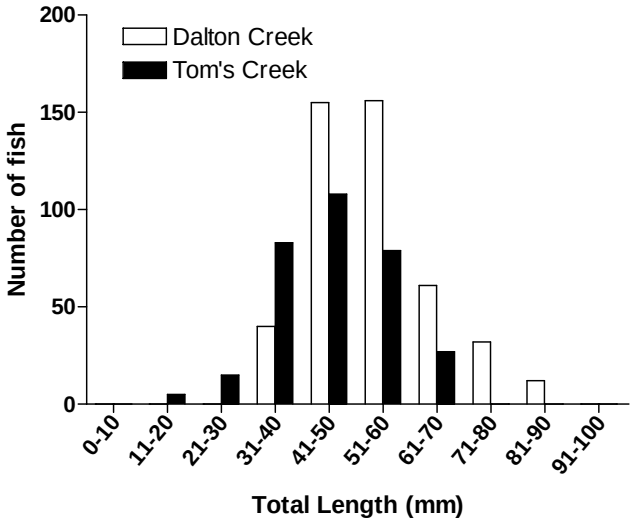

Figure 2. Length distribution of subsampled Pacific staghorn sculpin (*Leptocottus armatus*) captured by electrofishing in the tidal channel tributaries for all sampling periods.

Table 3. Number, total number, and percent of fish species sampled by electrofishing in the Winchester Creek tributary study reaches in February-June, 2006 (Pacific staghorn sculpin, LEAR; threespine stickleback, GAAC; Prickly sculpin, COAS; coho salmon, ONKI; cutthroat trout, ONCL; and shiner perch, CYAG).

	Species					
Study Area	LEAR	GAAC	COAS	ONKI	ONCL	CYAG
Dalton Creek	1059	111	23	6	1	0
Tom's Creek	667	118	8	0	0	1
Total	1726	229	31	6	1	1
Percent	86.56	11.48	1.55	0.30	0.05	0.05

Table 4. Number, total number, and percent of fish species sampled by beach seine in the Winchester Creek study reaches in February-June, 2006 (Pacific staghorn sculpin, LEAR; shiner perch, CYAG; starry flounder, PLST; threespine stickleback, GAAC; Prickly sculpin, COAS; coho salmon, ONKI; cutthroat trout, ONCL; and Pacific herring, CLPA).

Study Area	Species							
	LEAR	CYAG	PLST	GAAC	COAS	ONKI	ONCL	CLPA
Upstream	342	243	19	19	3	4	0	1
Downstream	286	49	11	8	6	5	1	0
Total	628	292	30	27	9	9	1	1
Percent	62.99	29.29	3.01	2.71	0.90	0.90	0.10	0.10

Shiner perch were sampled in the Winchester Creek study area only during the May and June sampling sessions and were predominately observed in the mainstem of Winchester Creek. A single perch was sampled from Tom's Creek in June. A small percentage of shiner perch were observed in May (35.8 percent of the total catch), while the majority were observed in June (64.2 percent of the total catch). Interestingly, the majority of the shiner perch were sampled from the upstream reach of Winchester Creek (83.2 percent) in comparison to the downstream reach (16.8 percent).

Of the 17 total salmonids sampled in the Winchester Creek Study area over the course of the study, 58.8 percent were sampled in the mainstem of Winchester Creek by beach seine, and 41.2 percent were captured in the Dalton Creek tributary by electrofishing. Two juvenile coho were observed in March while 13 juvenile coho were observed in April. In March, these coho were only sampled from the upstream reach of Winchester Creek, while in April a nearly even split was observed between the Winchester Creek reaches (Upstream: 2 coho, Downstream: 5 coho) and the Dalton Creek tributary reach (6 coho). One cutthroat trout was sampled in April in the downstream reach of Winchester Creek while one cutthroat trout was sampled from Dalton Creek in May.

A peak in the number of fish present in the tributaries was observed in May; a trend driven by the fluctuating presence of the abundant staghorn sculpin (Figure 3). The pattern of abundance was similar between Dalton and Tom's Creeks throughout the sampling periods. In mainstem Winchester Creek a peak in the number of fish present was observed in June. While the number of individuals in the downstream reach remained fairly constant (mean when

individuals observed= 91.5, SE= 7.0), the number of individuals in the upstream reach increased as the year progressed (mean when individuals observed= 157.8, SE= 36.6; Figure 4). This difference can be attributed to the presence and increase of shiner perch within the system during May and June which was predominately observed in the upstream reach, and the nearly constant presence of the staghorn sculpin, the dominant species in both reaches (Figure 5).

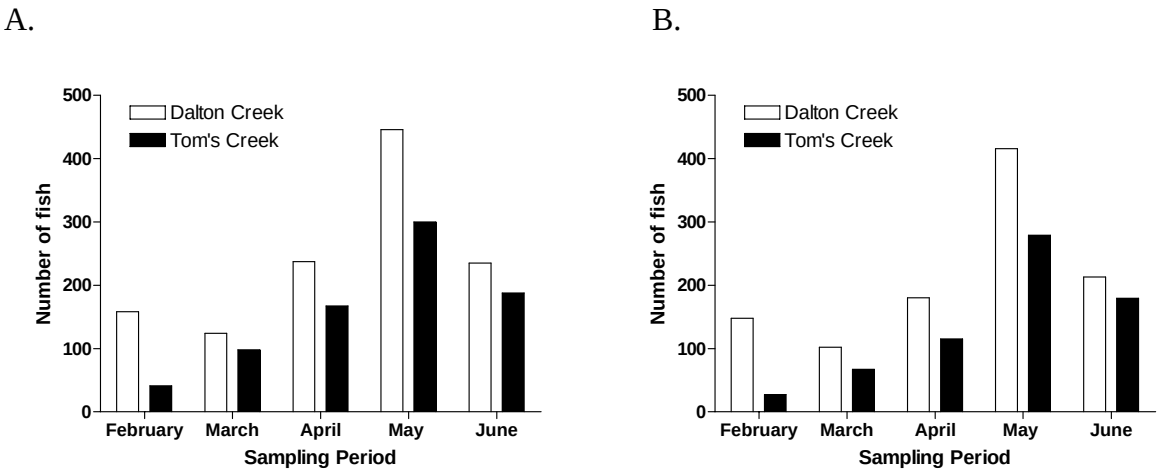

Figure 3. Total number of fish (A.) and total number of Pacific staghorn sculpin (*Leptocottus armatus*; B.) caught in study reaches of Dalton and Tom's Creeks during each of five sampling periods in 2006.

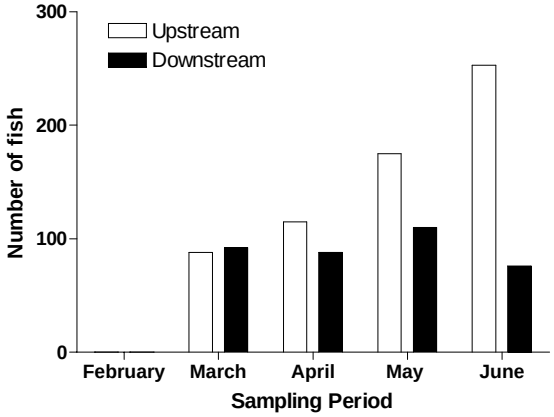

Figure 4. Total number of fish caught in study reaches of Winchester Creek during each of five sampling periods in 2006. Note: Sampling methods were changed after the first sampling period.

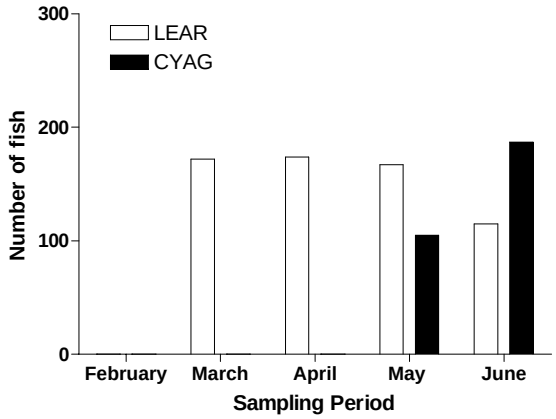

Figure 5. Total number of Pacific staghorn sculpin (*Leptocottus armatus*, LEAR) and shiner perch (*Cymatogaster aggregata*, CYAG) caught in both study reaches of Winchester Creek during each of five sampling periods in 2006. Note: Sampling methods were changed after the first sampling period.

Water quality parameters including water temperature, salinity, and conductivity were measured before the commencement of electrofishing in the afternoon. On average, among all sampling periods, the Dalton Creek study reach had warmer water temperatures and higher conductivity in comparison to the Tom's Creek study reach. Salinity, on average among all sampling periods was the same for both study reaches. While differences in the water quality parameters measured in the two study reaches were observed, none of these differences were significant.

Table 5. Water chemistry parameters measured in the afternoon before commencement of electrofishing surveys.

	Temperature (^{o}C)		Salinity (ppt)		Conductivity (µs/cm)	
Month	Dalton	Tom's	Dalton	Tom's	Dalton	Tom's
February	10.1	8.6	0.3	0.2	444.3	391.5
March	11.0	12.4	0.2	0.2	450.4	246.7
April	15.6	12.6	0.1	0.1	258.2	187.0
May	15.9	16.0	0.4	0.9	1360.5	1447.0
June	18.3	15.1	0.5	0.3	807.1	561.3
Mean	14.2	12.9	0.3	0.3	664.1	566.7

DISCUSSION

LWD is an important component of Pacific Northwest estuarine and riverine ecosystems. Sitka spruce logs were intentionally placed in the Winchester Creek Tidelands Restoration Area of South Slough National Estuarine Research Reserve to provide rearing and foraging habitat for juvenile salmonids and other fish species. While only a small number of salmonids were observed in the Winchester Creek study area, all of the salmonids observed in the tidal tributaries were found in the Dalton treatment reach which has been enhanced with the placement of large wood debris. No salmonids were observed in the Tom's Creek control reach. All of the coho sampled in Dalton Creek were found under an old wood weir structure, not associated with the placed LWD. This may be due in part to the difficulty of sampling under the placed LWD, where branches and deep water limit the effectiveness of electrofishing techniques. Young-of-the-year coho were observed in Dalton Creek, while primarily coho smolts were observed in Winchester Creek. Overall, fish were more abundant in the treatment reach in comparison to the control reach. Pacific staghorn sculpin, the most abundant fish species sampled in the Winchester Creek study area, were similarly more abundant in the treatment reach and observed to be larger on average than those in the control reach. These differences in fish communities are possibly influenced by the presence of LWD, or other factors. It is unlikely that water temperature, salinity, or conductivity influenced fish community composition as no significant differences in these parameters were observed between the two reaches.

These results differ from those observed during the sampling conducted in May and June 2005. In this study, coho salmon fry as well as cutthroat trout fingerlings were observed at both sites in May. In June, juvenile coho were once again observed at both sites, while cutthroat trout were only observed in Dalton Creek. More than seven times as many salmonids were observed utilizing the tidal channel habitats in 2005 during two sampling periods in comparison to 2006 with five sampling periods. In 2005, sampling was conducted using a combination of fyke nets and electrofishing. It was noted however, that juvenile coho, were not being caught in large numbers by the fyke nets although they were observed in both creeks. Therefore, sampling by electrofishing was conducted in 2006. As this a more active sampling method, it is unlikely that the change in sampling methodology influenced the differences in salmonid abundance noted between the two years. It is more likely that 2006 had poorer returns of coho in comparison to 2005.

PHOTO CREDITS

Pacific staghorn sculpin: California Department of Fish and Game, www.delta.dfg.ca.gov

Shiner perch: Klamath Resource Information System (KRIS), www.krisweb.com

Threespine stickleback: FishBase, www.fishbase.org

Prickly sculpin: American Fishes, www.americanfishes.com

Starry flounder: FishBase, www.fishbase.org

Coho salmon: Mid- Puget Sound Fisheries Enhancement Group, www.midsoundfisheries.org

Cutthroat trout: ABR, Inc staff photos

Pacific herring: Washington Department of Fish and Wildlife, http://wdfw.wa.gov