Tidegate Project Status Report (OWEB Research Grant #208-8004)

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The following describes work that has been completed on Palouse and Larson Creeks by Oregon State University in partnership with the Coos Watershed Association up to 12/31/08.

Tasks:

1) **PIT antennae**: During the 2008 field season, six PIT antennae were positioned around the Palouse (top hinge) tide gate. These antennae were placed to allow for determination of fish direction of movement. The antennae operated correctly and over 300 individual fish (coho smolts, coho subyearlings, cutthroat trout, rainbow trout, Chinook subyearlings) were detected at the antennae. The antennae do not cover the entire water column due to gaps beneath the superstructure and the size limitation of the antennae. Seventy five percent the fish detected at the downstream antennae and moving in a downstream direction to the slough were detected first by the upstream antennae. Test tags passed through the antennae demonstrated detection efficiencies of 90-100%. Of the coho smolts tagged 6 km upstream, 50% were detected at the tide gate. It is unclear what percent survived to emigration and what percent were not detected.

In the workplan, we anticipated having antenna array on three streams in 2008. This was not possible given the experimental nature of the installation and the trial and error process that was required for installing PIT antennae in tidally influenced, brackish water. Ten additional antennae have been constructed and all 16 will be installed starting in mid-March 2009.

2) **Water Quality and Flow Monitoring:** The scope of water quality monitoring was slightly scaled back. The complexity of water quality in these tidally influenced systems is beyond the scope of a project focused on fish movements through tide gates. Temperature data was recorded at the tide gates and throughout Palouse and Larson Creeks. Salinity and temperature data was recorded at Winchester Creek but extremely low counts of returning spawners led to little work being performed in this basin. Salinity loggers were used to document the upstream extent of salinity in Larson and Palouse Creeks.

Gravity referenced tilt logging devices were employed to record tide gate opening patterns. These data reflect opening and closing times of the gates, extent of opening and opening duration. A translator hinge was fabricated for the Larson tide gate since the door opens horizontally but the tilt logger functions on a vertical axis.

Flow measurements were recorded at the tide gate on Palouse Creek where sampling by wading was possible. In order to compare flow conditions between tide gates, a family of curves will be developed which plot discharge as a function of gate angle and the ratio of headwater to tailwater depth (using the pressure transducers). In order to allow flow

measurements across a range of conditions (including high flow), a mechanism similar to a bridge board will be fitted to the tide gates. This data collection will take place starting in late spring/early summer and continue into high flows in the fall.

3) **Fish Monitoring:** To date, a total of 2,247 fish have been PIT tagged. This total is composed of 486 coho salmon smolts, 1,443 coho salmon subyearlings, 185 cutthroat trout, 113 rainbow trout and 21 chinook salmon subyearlings. Approximately 800 of the above fish were PIT tagged at rotary screw traps and the remaining were PIT tagged after capture by seine.

Rainbow trout will no longer be tagged due to their infrequent appearance at the tide gate. Cutthroat trout larger than 250 mm will be PIT tagged in the coming season to investigate their use of the tide gate structure as predators. Smaller cutthroat trout will not be tagged. No more than 500 coho smolts will be tagged in each stream. Approximately 1,500 coho subyearlings will be tagged in each stream in 2009. An effort will be made to tag more Chinook subyearlings (primarily captured near the tide gate) since they were seen to frequent the habitat surrounding the tide gates.

Preliminary Results

It is early to draw conclusions about the effects of tide gates on juvenile salmonids. Therefore, the list of results included below should be viewed with caution. Many of these preliminary findings are not supported by statistical analyses thus far:

- The majority of PIT tag detections at tide gates were from coho smolts. Very few coho subyearlings were observed at the gates. Few coho subyearlings were seen or captured in the lower section of Palouse Creek. However, some coho subyearlings tagged in Larson Creek were detected at the antennae downstream of the Palouse tide gate in midsummer. One coho subyearling from Larson creek was detected 2 km upstream of the Palouse tide gate in October.

- It appears that a temperature spike in May prompted large scale emigration of smolts from Palouse Creek. It also appears that coho smolts spent longer periods of time in the vicinity of the upstream antennae (immediately upstream of gate) during this time period.

- Some coho smolts spent as many as 80 days between the screw trap (river km 6) and the tide gate while some spent as few as one day. It appears that there is a strong correlation between coho smolt body size at tagging and the time individuals spent between the screw trap and the tide gate. Individuals of a smaller body size spent more time upstream of the tide gate while those of a larger size moved through more quickly.

- Coho smolts moved downstream through the tide gate predominantly during the first half of the tide gate opening sequence. This coupled with the fact that most upstream visitations to the tide gate tend to be when the tide gate door is closed

may suggest that coho smolts are congregating in the immediate vicinity of the tide gate door before it opens.

- Coho smolts, coho subyearlings, Chinook subyearlings and cutthroat trout were all detected or sighted moving upstream through the top hinge tide gate. Very few detections/observations of these events were made, however it is clear that given the right conditions (generally low flow periods within ½ hour before gate closure), upstream passage is possible for these fish species. Additionally, staghorn sculpin, three spine stickleback and shiner surfperch were seen moving upstream through the top hinge tide gate.

- Assemblages of estuarine fish vary significantly between the upstream sides of the top hinge and side hinge tide gates. This is likely due to the scour tunnels below the Palouse tide gate. These tunnels allow movement and transport large quantities of salt water upstream into Palouse Creek to allow for a habitat more representative of a brackish slough than the upstream side of the Larson tide gate. Salinity data reflect this difference.