Habitat Utilization and Dispersal Patterns of Juvenile Chinook Salmon Inferred from Otolith Analysis

Jeff Duda¹, Karl Stenberg¹, Kim Larsen¹, Matt Beirne², Mike McHenry², Kurt Fresh³, Anna Kagley³, Josh Chamberlin³, and Anne Shaffer⁴

¹USGS Western Fisheries Research Center, Seattle, WA; ²The Lower Elwha Klallam Tribe, Fisheries, Port Angeles, WA; ³NOAA Northwest Fisheries Science Center, Seattle, WA; ⁴Washington Department of Fish and Wildlife, Port Angeles, WA.

How are they analyzed?

Small calcium carbonate structures found beneath the brain of fishes and used to orient or maintain balance.

How are they analyzed?

Sagittal otoliths are extracted, embedded in resin, and ground to expose a cross-section.

Magnified images are processed with image analysis software to mark, count, and measure daily growth increments.

Because otoliths grow as a fish grows daily, “growth increments” provide evidence of growth rate and residence time.

I. Dispersal patterns into the Strait of Juan de Fuca†

In 2007, we obtained samples of juvenile Chinook salmon collected throughout the Strait of Juan de Fuca and the Elwha River estuary.

We used otoliths to discriminate between Elwha and Dungeness origin.

Most fish through all sampling months were hatchery origin.

Once in the Strait, Elwha wild juveniles migrated east and west.

Dungeness hatchery juveniles migrated west and were caught near the Elwha mixed with Elwha wild and hatchery fish, but we had limited samples from east of the Dungeness.

Growth increments from wild fish (BY06) have yet to be analyzed for habitat use.

We will be obtaining CWT information, when available, as a validation tool.

II. Juvenile growth differences among habitat types

We studied the otolith microstructure of juvenile Chinook salmon to better understand the relative importance, for fish growth, of the lower Elwha River, the estuary complex at the mouth of the river, and the sub-tidal and near tidal areas (i.e., nearshore).

We obtained samples of juvenile Chinook salmon throughout the migration period in 2006 (BY06). About half of the samples were collected prior to the date when the hatchery, operated by the Washington Department of Fish and Wildlife (WDFW), released 3.1 million yearling and sub-yearling Chinook salmon that were thermally marked.

BY06 sample size in the estuary was small. Additional processing of BY06 samples is underway.

III. Age of Returning Adults

Collections of spawned-out adult Chinook from the Elwha River during fall of 2006

Fish # Location Date Sex F.L. (cm) Age

Elwha06-1 Index-Zoey’s 9/27/06 M 78 4
Elwha06-2 Index-T.O.J 9/27/06 M 86 4
Elwha06-3 Index-Mid 9/28/06 F 75 4
Elwha06-4 Zoey’s P. 10/5/06 M 65 4
Elwha06-5 Top of Big Jam 10/5/06 F 85 4
Elwha06-6 Big Riffle-T.O.I. 10/5/06 M 77 4
Elwha06-7 Morril Springs 10/9/06 M 83 4
Elwha06-8 T.O.J 10/9/06 F 76 4
Elwha06-9 L. Spruce 10/10/06 F 75 4
Elwha06-10 L. Sissons 10/10/06 M 89 4
Elwha06-11 State Outfall 10/10/06 M 89 4
Elwha06-12 1 Way 10/11/06 F 76 4
Elwha06-13 State Outfall 10/11/06 M 89 4
Elwha06-14 Canyon 10/11/06 F 82 4

92% of the spawned out adults sampled were 4 years old.

All fish were wild origin.

Samples have not been processed yet for microstructure patterns, but superficial analysis suggests that growth differences were apparent between freshwater and estuary growth.

Lack of clear otolith “checks” makes determination of habitat transition in adults difficult.

Larger sample sizes are needed.