

Hoh River Steelhead Project – 2017

Field Report



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Background

The purpose of Hoh River Steelhead Project is to better explain steelhead abundance trends and how they are related to survival and diversity in marine and freshwater environments. From this information, we aim to increase understanding of steelhead biology and ecology, fill information gaps needed for steelhead management, and improve resiliency of steelhead populations in the face of an uncertain future (i.e., climate change). To the extent that some questions are specific to the Hoh River, results will have a local contribution to conservation and management. However, results of this research will also inform steelhead management more broadly. For example, steelhead life cycle parameters (e.g., redds per female) are poorly documented and rarely available for river systems as large as the Hoh River. In addition, the connection between species diversity and its abundance has special relevance to the resiliency of steelhead due to the multiple life history strategies and protracted run timing observed for this species. The Hoh River Steelhead Project is led by the Science Division at the Washington Department of Fish and Wildlife and is a collaborative effort with managers and stakeholders.

A research framework for the Hoh River Steelhead Project was developed in 2015. In 2016, we conducted pilot studies that included sonar siting and operation and a volunteer angler project (Winkowski et al. 2017). The long-term purpose of the sonar is to develop an independent estimate of steelhead abundance that can be paired with existing redd count information. The long-term purpose of the volunteer angler program is to document steelhead life history diversity using a core group of citizen scientists that collect biological information from the steelhead that they catch. In the future, there are several studies envisioned to address the connection between life history diversity, entry timing and spawn timing that will be implemented once funding becomes available.

This report summarizes the activities conducted during the 2017 field season. A final science report will be generated and available in early 2018. In 2017, our objectives were to:

- (1) Use a combination of sonar technology and composition netting in order to estimate the number of steelhead in the Hoh River,
- (2) Conduct a volunteer sampling program to collect biological data from adult steelhead,
- (3) Conduct a pilot study to evaluate the use of environmental DNA for redd identification, and
- (4) Expand the temperature monitoring effort initiated in 2016.



Figure 1. The Hoh River.

Sonar Operation

A sonar unit was operated immediately upstream of the US-101 bridge between January 26, 2017 and June 30, 2017. Flows in the Hoh River between January and June 2017 were well above median annual flows for the period of record. The flow levels affected whether we could safely maintain the sonar's position in the river; in total, the sonar 'fished' for a total of 128 days or 82% of the time between the installation and removal dates. The entire unit (i.e., sonar, pole mount, ladder, electronic equipment) was designed to be disassembled and moved between the river and high ground within a few hours. This allowed us to respond quickly to increasing or decreasing river flows during the field season and minimized the amount of information missed during periods of high flows.

Flows also affect how the sonar was positioned in the channel. The lateral position of the sonar should be close to the shore line so that migrating fish swim through (rather than behind) the sonar beams. The vertical position of the sonar should be just below the water's surface to ensure that the beams ensonify the entire cross section of the channel. Our field team visited the field site on a daily basis in order to maintain correct positioning of the sonar unit. This constant attention to the equipment was critical to collecting data that will be usable for analysis.

Data from the sonar (i.e., echograms) are stored in 30 minute intervals. Each data file is manually reviewed and fish counted. Counts of fish from the echograms will be combined with results from the composition netting to estimate the number of steelhead moving upstream of the sonar in 2017.



Figure 2. Sonar operation in the Hoh River, 2017. The sonar unit is suspended just below the surface which allows the sound beams to effectively scan a cross section of the river. The position of the sonar unit is continually maintained in response to changing river flows.



Figure 3. The field team sets up the sonar unit at our field site in late January 2017. An aluminum ladder is used to position the sonar in the river. A finger weir is used to divert shore-oriented fish in front of the ladder and sonar unit. Data collected by the sonar are stored in computer files for analysis.



USGS 12041200 HOH RIVER AT US HIGHWAY 101 NEAR FORKS, WA

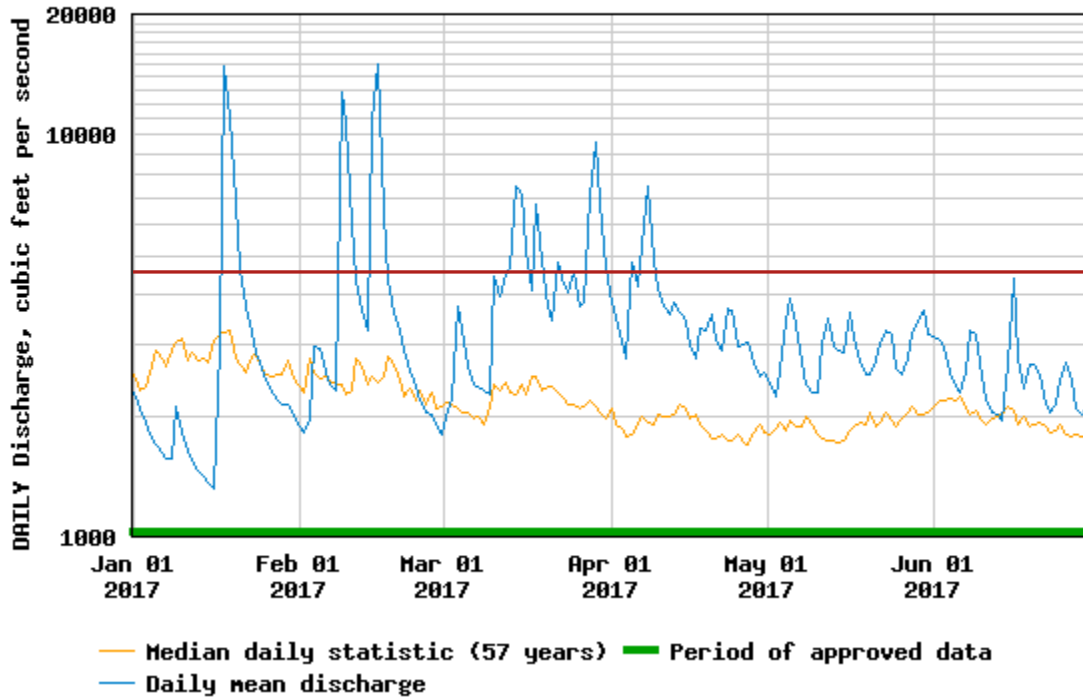


Figure 4. Daily flows of the Hoh River, January to June 2017. Flows in 2017 (blue line) were well above the median flows (yellow line) for the river. Horizontal red line shows the approximate flow threshold (~4,500 cfs) for sonar operation.

Composition Netting

We used small-mesh gill nets (i.e., tangle nets) to sample the species composition in the river. The nets were 12 feet in depth and 90 feet in length with 4-inch mesh (stretch measure) made of monofilament. Sampling covered a few miles of river upstream and downstream of the sonar site and was conducted on 13 days during sonar operation. Captured fish were identified, measured, and released. We caught steelhead, Chinook, and bull trout, but the overall numbers encountered were low. As the field season progressed, we continued to develop effective techniques for fish collection.



Figure 5. The field team conducted tangle netting in order to determine species composition of the sonar counts throughout the season. The nets were drifted through the river channel in a downstream direction; captured fish were identified, measured, and released.

Biological Sampling

We collaborated with guides and anglers on the Olympic Peninsula who volunteered their time to collect biological data from steelhead returning to the Hoh River. Volunteers conducted the sampling after completing an in-person training with project staff on a standard set of protocols. We also provided sampling kits to each angler to ensure that the data were properly collected and recorded.

A total of 13 volunteer anglers collected biological data from a total of 50 steelhead between December 2016 and April 2017. The majority of the samples were obtained from sections 1 and 2, which cover the section of river from Morgan's Crossing downstream to the ocean. Data included biological measurements and scales from each fish. Data were recorded on individual scale envelopes and scales were stored inside the envelopes.

We transferred a portion of the scales (3 per fish) to scale cards so that they could be processed and analyzed by the WDFW Ageing and Otolith Laboratory. These results will tell us the growth history (freshwater, ocean) of each steelhead as well as whether they have spawned in a previous year. We retained a portion of the scales for future genetic analysis.



Figure 6. Volunteer anglers collected biological data from steelhead following standardized protocols. Data included date, location, origin (hatchery, wild), gender (male, female), length, girth, type of gear (fly, lure, bait), and collector name. Scales were collected from each steelhead from the region behind the dorsal fin and above the lateral line. Photos provided by Steve Burns (left, bottom right) and Gray Struznik (top right).

Environmental DNA

Identifying redds is most challenging during the period of time that spawning overlaps between species. Unless a female is observed guarding her redd at the time the surveyor is present, the species attributed to a given redd is interpreted based on date, location, and size and shape of the redd (Gallagher and Gallagher 2005). A recently developed technique uses environmental DNA (eDNA) to identify species that constructed a given redd. eDNA is extracted from water drawn from the interstitial spaces of the gravel and was recently used to distinguish coho and Chinook salmon redds (Pilliod and Laramie 2016).

In 2017, we conducted a pilot study to evaluate the use of eDNA to distinguish late spawning coho and early spawning steelhead in the tributaries of the Hoh River. Sampling protocols were developed in collaboration with the WDFW Molecular Genetics Laboratory and staff from Trout Unlimited's Wild Steelhead Initiative. We collected eDNA redds from 10 redds in Hoh River tributaries between December 2016 and May 2017. The redds had been previously identified as either coho and steelhead by WDFW survey crews. At the time of each collection, we collected three water samples from each redd as well as two types of controls - ambient river water and deionized water.

Each sample is currently being analyzed by the WDFW Molecular Genetics Laboratory for the presence of DNA and for the presence of coho and steelhead. If successful, this method may be used in the future to improve understanding of steelhead spawn timing and to develop morphological redd features that could be used to assign redds to species in future stock assessment surveys.



Figure 7. Environmental DNA was analyzed from water sampled collected from redds located in tributaries of the Hoh River. Water was retrieved from interstitial spaces among gravel in the ‘pillow’ of each redd using sterile protocols developed by WDFW Molecular Genetics Lab. Each water sample was forced through filter paper that was packaged in the field and returned to the WDFW MGL for analysis.

Temperature Monitoring

Temperature influences many aspects of steelhead life history, including the onset of spawning activity and the growth and maturation of juvenile fish. In order to understand temperature conditions throughout the steelhead distribution in the Hoh River, we installed temperature loggers in both tributary and main stem habitats.

In March of 2016, we installed temperature loggers in the steelhead spawning tributaries that flow directly to the Hoh River main stem, including Braden, Anderson, Nolan, Alder, Willoughby, Winfield, and Owl creeks. These loggers have been periodically checked to ensure they remain submerged and to download data. We installed an additional three loggers in the main stem river during summer of 2017. We used an epoxy attachment method (Isaak et al. 2013) to secure the main stem loggers to bedrock or large boulders. We have used the epoxy system successfully in other large rivers (Winkowski and Zimmerman 2017) to improve the likelihood they maintain their position during high flow events.

We plan to compare the seasonal temperatures between the main stem river and tributary habitat. This temperature monitoring array may be further expanded to off-channel areas in 2018 as a result of a collaboration with a graduate student from University of Idaho. This will allow us to further explore hypotheses about the connection between spawn timing and spatially variable stream temperatures in the watershed.



Figure 8. Temperature loggers monitor the stream temperatures year-round. The loggers are secured in perforated PVC housing and anchored in a location with well-mixed water, shade, and enough depth for loggers to remain submerged for the summer low flow period.

Next Steps

A final science report with results from the 2017 field season will be available in early 2018.

Acknowledgements

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