CHEHALIS BASIN STRATEGY

ECOLOGY OF NON-NATIVE FISH

Study Goals and Objectives

The objectives of the Ecology of Non-native Fish Study are to track ecological traits, including spatial distributions, population abundance, and predation indices, of non-native smallmouth bass and other predator fishes over time to assess ecological impacts on Chinook salmon and other native species in the Chehalis basin.

In 2022-2023, the goal of the study is to develop population estimates of non-native and native fish predators. Specific goals:

1) Estimate multiple fish predator abundance indices at the reach level
   a. Mark recapture abundance
   b. Catch per unit effort
   c. qPCR-based abundance
2) Estimate fish predator population abundance in study area
   a. Spatial stream network model and block kriging

Methods / Study Design

Predation study (2020-2022)

The Washington Department of Fish and Wildlife utilized boat electrofishing to collect fish predator (smallmouth bass, largemouth bass, rock bass, and northern pikeminnow) stomach contents from 15 reaches (approximately 1-3 km) throughout the main stem Chehalis and lower main stem of major tributaries in 2021 and 2022. The methods were described in detail in the December 2022 reporting document. Analysis is ongoing.

Predator fish abundance estimates (initiated 2023)

In 2023, fish abundance and capture probabilities will be estimated using mark recapture from at least 10 reaches in our study area. Additional reaches (n = 15-20) will be sampled using single pass electrofishing where catch per unit effort (CPUE) indices will be calculated and fish numbers will be expanded based on capture probabilities from the mark-recapture surveys in similar mesohabitat types (e.g. main stem vs tributary).

Our goal is to develop a population estimate using a spatial stream network (SSN) model framework and block kriging. The spatial stream network model is a preferable population estimator method because it can account for spatial autocorrelation specific to riverine systems, environmental covariates, and random effects. We will conduct abundance sampling in 2024 to develop a large enough dataset to estimate population abundances using SSN models.

Study reaches were selected using a stratified GRTS approach from a pool of point locations spaced at approximately 2-4 km intervals throughout the study area. We stratified the point locations by three categories meant to represent the upper (confluence of the South Fork Chehalis to Independence Creek) and lower (Independence Creek to confluence with Satsop) main stem Chehalis and tributaries (South Fork Chehalis, Newaukum, and Skookumchuck). We selected 35 points and allocated points to each stratum proportional to the quantity of stream length in each stratification category. Due to the dominant private land ownership and lack of boat ramps in our study area, we anticipated that some points selected by the GRTS method would be inaccessible. Therefore, we first selected reaches from the initial GRTS draw that were deemed accessible for surveying and then chose accessible sites in an oversample GRTS pool until we had 35 reaches. Each point location will represent a 1km reach in the tributaries and 2km reach in the mainstem.

Predatory fishes are collected by boat electrofishing. Sampling started in May and is anticipated to continue through the end of July. Mark recapture (MR) reaches are sampled over the course of two days, one day for marking and the following day for recapture. CPUE reaches are sampled with one electrofishing pass. CPUE estimates allow for monitoring abundance trends over time and space and are comparable with other electrofishing work conducted in the state (e.g., Columbia River) and previous surveys in the Chehalis (Hughes and Herlihy 2012). The total number of minutes of electrofishing is recorded for each reach and a similar electrofishing effort is applied to reach according to its length (mainstem or tributary reaches). During sampling, predator fishes are netted and transferred to a live well with aerated river water where they are held for a maximum of 30 minutes before sampling. Predator fish are measured to the nearest fork length and weighed to the nearest gram. For MR reaches, all predator fishes >60 mm receive a 12 mm full duplex passive integrated transponder (PIT) tag in the peritoneum cavity. Fish are immobilized during tagging by a sampler wearing electric fish handling gloves while biological measurements are collected and the PIT tag is implanted. Post sampling tagged fish are held in a live well for an amount of time deemed acceptable for normal behavior to resume and released as near to the habitat unit they were captured as possible.

Environmental DNA collection

Water samples for environmental DNA (eDNA) are collected prior to electrofishing surveys at mark-recapture reaches to develop a qPCR abundance index. Following standardized protocols designed by the WDFW genetics lab, we filter water samples for environmental DNA (eDNA) using the Smith-Root ANDe™ water sampling backpack (https://www.smith-root.com/edna/ande). To avoid contamination, sampling crews approach the reach from downstream end where water samples are collected from the downstream point of the reach.

Habitat data collection

Select habitat metrics are collected from each reach. We tally the number of each habitat unit types (glide, riffle, pool) within each reach and for each habitat unit within a reach, we collect its length, the number of large woody debris pieces, and three wetted width and depth measurements spaced evenly throughout the reach.

Summary of Results

Preliminary predation results were presented in the December 2022 interim reporting document and no new results are available at this time. We anticipate samples collected in 2022 to be analyzed and returned from the WDFW genetics lab by July 20, 2023, at which point new analyses can be conducted.

No results from 2022-2023 abundance study are available as sampling is ongoing.

Discussion

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Adaptive Management

Understanding the impacts of non-native species is paramount in aquatic species habitat protection and restoration planning in the Chehalis River. Quantifying impacts of non-native species requires information including spatial distributions, abundance, and per capita impacts (Parker et al. 1999). Previous analyses for this study provided spatial distribution information and ongoing data collection and analyses will provide abundance and per capita impact information which will allow for quantifying the magnitude of predation impacts of fish predators on Chinook salmon. Additionally, our analyses will provide spatiotemporal predation information across our study area aiding in decision making processes aimed at implementing actions to manage predation impacts in the Chehalis .