

LSB Fish Subteam Meeting #2
September 20, 2021

Attendance

- Chris Campbell, cbec
- Bruce DiGennaro, Essex Partnership
- Brian Ellrott, NMFS
- Mark Henderson, USGS
- Rene Henery, Trout Unlimited
- Sharon Hu, Kearns & West
- Greg Kamman, cbec
- Jacob Katz, Cal Trout
- Morgan Kilgour, CDFW
- Duane Linander, CDFW
- Julie Rentner, River Partners
- Helen Swagerty, River Partners
- Steve Zeug, Cramer Fish Sciences

Status Update

Mark Henderson reviewed the influence diagram.

- Rene noted that the conceptual models should include mechanistic relationships between actions and advancing the objectives. Models should be evaluated based on how well the objectives can be achieved.
- Steve noted that an existing conceptual model was developed prior to building the model and may exist in an older presentation.
 - The modeling team requested a priority list to outline components that are “must-haves” and “nice-to-haves” because modeling will be constrained by budget and time.

Summary of Previous Meeting

Bruce reviewed notes from the first Fish Subteam Meeting on July 15, 2021. Key points include:

- There are three primary ways for water and fish to access the floodplain.
- There is a need to capture backwater effects associated with fish entry.
- HQT is an acceptable approach, but more details are needed to make this useful for evaluating biological benefits.
- Key considerations include access/timing and growth/survival.
- Action items
 - Jacob suggested reaching out to Carson Jeffries and Rachel Johnson directly to obtain the winter run floodplain work.
 - Jacob will share CalTrout/UC Davis empirical dataset on water temp, growth rates, etc. directly with Steve Zeug.

Project Objectives

The Fish Subteam discussed the project objectives.

- Morgan reminded the group that CDFW’s primary objective is restoration. Other benefits, such as salmon benefits and “improving agricultural viability,” are secondary objectives.
 - CDFW is not comfortable with “**improving**” agricultural viability and “reducing flood risk.” It is not known whether “improving” agricultural viability can happen in parallel with restoration.

- “Maintaining” implies that ag viability is measurable.
- “Minimizing” is quantitative and also implies that there is either more impact or less impact.
- Bruce suggested “while maintaining agricultural viability and flood conveyance” and separating the anadromous fish objectives from the ag viability objectives.
 - Brian expressed his support for this improvement, with reservations. He suggested including fish and other species of conservation concern in a single statement to give more priority to the fish.
 - Jacob expressed his support for including fish with the fundamental objective and multiple means objectives, with reservations. He noted that all objectives, including the measurable objectives should be more narrow and measurable so that they can be achieved.
 - Morgan expressed her support for the fundamental objective to remain a single statement.
- Bruce suggested that the CWG and Fish Subteam revisit the objectives after reviewing the modeling information.

Review Baseline Modeling Results

Steve provided an overview of the functions and assumptions in the models. The subteam discussed the following key points:

Entry Timing

- Jacob noted that DWR has RST data for entry timing.
- Morgan noted that CDFW has data (available via CalFish)
 - Butte Creek data
 - Upstream rotary screwtrap data for Tisdale and Sutter.
- Jacob asked for scenario information on the seasonality of entry points to the system, without full modeling, to see general migration timing and compare events.
- Morgan and Jacob expressed support for separating winter runs from fall/spring runs. There is length of date genetics information available for winter runs.
- Jacob shared his concern re: the backwater effect that the timing in the Sacramento River may not be transferrable to the Feather/Butte systems.
 - Steve noted that the model will use the assumption that the distribution is similar to Knights Landing, but shift the curve if the timing is different in Feather.

Entrainment and Behavior

- Steve asked for feedback on parameterizing “opening a door” and inundating an area.
 - Jacob replied that the idea of using a flow split is not going to work because volitional entry often occurs against flow in a backwater situation.
 - Thresholds and metrics should make sense. When Lower Sutter has backwatering, we can monitor within seasonality and find abundant salmon.
 - The functions should be as simple as possible for each hydrology entry point for each part of the bypass.
- The model is using a theoretical logistic function that small fish are mostly rearing, and a few may migrate. Larger fish are mostly migrating and a few will stay to rear.
 - Jacob suggested revisiting the thresholds in the system, which are different than what was used in the past

- Yearling fish in the Butte Creek sink should be examined because they have access to higher foraging efficiency in the Butte Creek sink. Younger fish are larger.
 - Steve noted that the theoretical curves will be updated for the group's review. The inflection points can be revised to more closely reflect the Sutter.
- Julie asked if habitat quality can influence behavior.
 - Steve replied in the affirmative but noted that there is not a lot of information that is quantifiably available for incorporation into the model. The habitat function is based on the concept that smaller fish stop to rear where there is good habitat.
 - Jacob noted that there is data to support the concept that habitat quality drives fish behavior.
- Passage and survival – Mark noted that he has a paper from last year (re: relationships with flow and precipitation).
- Bypass/Delta rearing functions – Chris and Steve emphasized that the hydrodynamic model includes approximated water temperatures based on air temperature.
 - Jacob expressed his support for using approximated water temperatures, provided that this method is applied universally. He noted the Sutter Bypass and Yolo may have differences in seasonality.
- Growth and survival during rearing
 - Jacob suggested comparing the lab-based growth data with empirical data from both bypasses in order to determine whether there are discrepancies and how to pick location/food web-specific conditions.
 - Morgan noted that data provided directly from CDFW should be used, rather than lab-based data.
 - Survival study was a 10-year study.
 - Growth study was on non-caged fish in the Sutter.
 - Steve noted that the modeling team is still reviewing the CDFW growth study data and that the survival data is hard to use in the function because it is not linked to inundation.
 - Mark noted that if the Rakowski (?) is being used, then model is typically fitted to the available data. Max growth would be based on feeding ad libitum in the lab, then parameters on proportional growth rates would be estimated based on observed data.
 - Jacob
 - Apparent growth is based on individual tags
 - Thermal regimes are based on food availability (bioenergetic model).
 - Empirical data points to higher growth rates at higher temperatures than what we are able to see in the lab.
- Modeling team asked if linking survival to the inundated area is acceptable. Is it important to have a linkage to hydrodynamics or should it be uniform across all alternatives? What is theoretically supported?
 - Morgan noted that uncertainty increases with more variables and suggested applying one hydrological regime (either a normal water year or a dry water year) and comparing among all alternatives.
- Ocean survival
 - Rene noted that otolith data has shown effect of timing and suggested reaching out to Carson Jeffries and Rachel Johnson. Across different ocean year types, there is still a correlation between fish that are actually coming back/returning as adults.

- Poor ocean years, there is a correlation between size and later ocean survival. You can dampen the benefits of size because bigger fish are getting out later and dying in the river.
 - Good ocean years, bigger fish get out sooner, then there is more through-Delta survival for little fish.
 - Rene suggested using otolith data instead of random distribution. Data shows that per x number of outmigrant juveniles, par-sized (?) class are getting highest return/fish even if they are proportionally a smaller number of outmigrants.
 - Steve noted that it would be possible to revise the random distribution.
- Harvest - Steve noted that coded wire data is more certain than otolith data because there is exact data on timing of release, entry into ocean, recoveries in ocean fishery, and spawning grounds.
 - Rene noted that release into the estuary may not be a good proxy for the effect of ocean conditions of fish that are not released into the estuary. Fish may remain in the estuary for different periods of time, depending on how fast they grow and what is in the estuary. Otolith data has the best data for determining when fish come back.
- Survival - Rene suggested that the group revisit the fish survival model at a future meeting.
 - Mark expressed his support and noted that the recent Nature Communications publication indicates that marine survival was the most important aspect in the Pacific Northwest/

Next Steps

- The Fish Subteam schedule a follow-up meeting to revisit survival and continue reviewing modeling tools. The group will meet prior to CWG Meeting #5.