

Upper Sacramento Scheduling Team

Spring Management of Spawning Locations Subteam

Wednesday, September 22, 2021 | 11:30 a.m. – 1:00 p.m.

MEETING SUMMARY

Participants

Agency	Attendees
CDFW	Crystal Rigby, Doug Killam
DWR	Kevin Reece, Mike Ford
Kearns & West	Alyson Scurlock, Terra Alpaugh
NMFS	Eric Danner, Rachel Johnson, Stephen Maurano
Reclamation	Elissa Buttermore, Josh Israel
SWRCB	Michael Macon
USFWS	Kevin Niemela

Action Items

- **All** to continue to edit/fill out columns in the existing and proposed tools spreadsheet.
- **All** to review the study plan and provide feedback by Friday, October 1.
 - Incorporate ideas into the text of the study plan if information is difficult to capture within the columns of the spreadsheet.
- **Elissa** to sketch out conceptual model and send to the subteam for feedback prior to the next meeting on Wednesday, October 12.
- **All** to provide feedback on the conceptual model.

Key Discussion Topics with Summary of Perspectives, Outcomes, and Agreements

Meeting Objectives

1. Identify what will be required to implement the current proposed study plan activities
2. Review the list of existing and proposed tools and studies; evaluate the level of effort of suggested activities

Study Plan and Existing and Proposed Tools Spreadsheet Review and Discussion

The subteam reviewed the latest versions of the Spring Management of Spawning Locations Study Plan and existing and proposed tools spreadsheet, focusing on areas that still needed to be fleshed out.

Perspectives and questions shared by subteam members included:

- **Existing and Proposed Tools Spreadsheet**
 - NMFS – Suggestion to include the existing and proposed tools spreadsheet as a table in the study plan to reduce the need for bulleting. The spreadsheet helped break down the different components of spawning and provided a framework for linking

specific objectives. Suggestion to develop a conceptual model that links to the specific objectives.

- NMFS – Suggestion to specify which efforts are being initiated as a result of this study plan vs efforts that are already ongoing or have already been funded, such as SacPAS.
 - Reclamation – That information can be included in the “level of effort to complete” columns.
 - NMFS – It would be helpful to have guidelines on how to fill out the “level of effort to complete” columns, such as time, money, or personnel. The rows that are shaded grey in the existing and proposed tools spreadsheet indicate which efforts are within the scope of this subteam. Should the rows relating to reproductive success be shaded grey?
 - Reclamation – Suggestion to leave the reproductive success efforts unshaded. All ideas are somewhat captured in the study plan; other ideas might be considered if operations are affecting spawning distribution. The grey shading should relate to the efforts that are most relevant such as those that are already being impacted by operations, being pursued, or are complete.
- Reclamation – Requested explanation for the row in the existing and proposed tools spreadsheet related to forecasting the number of spawners for the upcoming management season. Models seem to already be established for winter-run escapement.
 - NMFS – It is hard to imagine that there is not some density dependent component to the timing and spatial distribution of redds. Determining where and when redds will be forecasted in the system in given years and estimated escapement would be important for forecasting.
 - Reclamation – Should that be included in spawn timing and location as a parameter of escapement?
 - NMFS – The existing and proposed tools spreadsheet was designed to outline a somewhat linear process for how to address the question if colder water affects peak spawning (efforts are in order from top to bottom). First, we would use river forecast models to help determine what temperatures will be like for a given year. Next, another important input into spawn timing models would be winter-run escapement. After using spawn timing models, the reproductive success of eggs could be evaluated using TDM models. Finally, population responses could be evaluated using the Life Cycle Model. In the last meeting, there was discussion about diving into the reproductive success of adults vs. eggs which resulted in some additions to the spreadsheet.
 - Reclamation – Some models and processes are already established. Do you think we need a new winter-run escapement model?
 - NMFS – Suggestion for subteam members to add in information about established models and papers in the existing and proposed tools spreadsheet.
- **Conceptual Model**
 - NMFS – There is value in developing a conceptual model for the study plan. If fish respond to water temperatures and water temperature management, we would want to have a conceptual model that describes the escapement number influencing the

distribution of salmon. Suggestion to develop a coordinated conceptual model to see where gaps exist and how to look at different processes.

- Reclamation – There is a placeholder for a conceptual model in the study plan, but it is not developed yet. The new SacPAS predictor tool includes an input for the number of spawners.
- NMFS – If SacPAS is being used as a predictor tool for spawning, we should ground truth the model with the actual numbers of fish that returned. Not sure how often pre-cited winter-run escapement numbers are used in freshwater management.
- Reclamation will take the lead on drafting the conceptual model for the study plan using the conceptual models from the SAIL papers.
 - NMFS – Suggestion to include how temperatures specifically influence the response variable of spawn timing and distribution. A secondary arrow could show the relationship between those two components of adult spawning and how they influence reproductive success.
 - NMFS – Agreed with suggestion. The rationale behind the spawn timing row in the existing and proposed tools spreadsheet is: for each given year, there are a range of operations based on forecasted water temperatures and available water resources that could be used for operations to maximize reproductive success.
 - NMFS – Recommended thinking about temperature and adult salmon responses to temperature, and asking how do water operations optimize or influence those for the greater good? What can we do from an operations perspective around temperature and how does that drive biological responses?
 - NMFS – There may be a significant amount of control over spawn timing and location based on how we manage water temperatures, but those management actions could leave no water left for coldwater habitat for eggs to develop. This should be looked at holistically to see the tradeoffs for maximizing the reproductive success for adults and eggs.
 - NMFS – We manage temperatures for life stages differently. One outstanding question about how salmon respond to temperature manipulations is around the biological connection between the two life stages. Suggestion for the subteam to think more holistically about what fish are responding to in any given manipulation and why they are responding to it.
- **Physical Water Temperature/Spawn Timing Relationship**
 - USFWS – Suggestion for the subteam to focus more on the relationship between water temperatures and spawning timing in holding Chinook salmon. This relationship can be studied without bringing in system management components. An experimental design study could be implemented to determine if fish spawn at different times when held at different water temperatures. When we start thinking about system management, we start getting into questions of spawning success.
 - Reclamation – We could try to develop a simpler conceptual model.

- NMFS – The SAIL conceptual models are a great framework. The only thing that needs refining is the biological response hypothesis. We need to flesh out the hypothesis around how we think water temperatures influence fish specifically. Placing fish in colder or warmer water temperatures and seeing if their spawn timing fluctuates would be a very valuable test. Testing the physical relationship makes a lot of sense as a first step.
- USFWS – Expressed concern about spending a lot of time hypothesizing linkages to ecosystem management when a relationship might not exist between holding water temperatures and spawn timing. Suggestion to first confirm if the relationship exists and its magnitude to see if it is meaningful for management decisions.
- NMFS – Ecologically, the relationship has been shown in the Jennings and Hendrix 2020 paper. There has been correlative work around water temperatures and spawn timing. Being able to reproduce that in a lab is a great first step. Interested in seeing if we can elicit really early spawning for potential better outcomes. Suggestion for including additional physiologists to explain what is really going on with the fish.
- NMFS – The Jennings and Hendrix 2020 paper used 10-day periods and altering water temperatures only moved spawn timing a couple of weeks. Not sure how meaningful that is when looking at the big picture. We ran really warm this year and peak spawning did not change much. One thing the Jennings and Hendrix 2020 paper is missing is a deep literature review. There may be other information available. If we can create an experimental study, it would be interesting to know what the impacts to spawn timing, gametes, and disease viability would be if we had another warm year and warmer water temperatures earlier in the spring.
- NMFS – This discussion points back to the need for a conceptual model. There is outside literature around how spawn timing for salmon is influenced by water temperatures and meteorological conditions, but the reason they are influenced is unknown.
- USFWS – Looking at temperature management this year and recent drought years, we might not be dealing with a stable baseline. Later spawning fish during drought years are taking a big hit. Survivors are likely earlier spawning fish.
- NMFS – To my knowledge, there is no evidence that shows that earlier or later spawners in drought years are disproportionately favored. Suggestion to add the selection of inheritable component of run timing to the conceptual model.
- USFWS – Spawn timing is heritable. With winter-run, we have not found any association with run timing and spawn timing. Fish that show up at the Keswick fish trap in February might be late spawners and fish that show up in June might be early spawners.

Implementation of Items Included in the Study Plan

The subteam discussed what will be required to implement the current proposed study plan activities.

Perspectives and questions shared by subteam members included:

- NMFS – Is parentage-based tagging work around reproductive success being pursued through the Sacramento River Science Partnership (SRSP) or another venue? There are a lot of things we can do with the genetics of winter-run Chinook salmon that align with this subteam’s scope of work.
 - Reclamation – We are doing parentage-based tagging through a different effort; the samples were already collected. Would be good to communicate that is an interest of this subteam.
 - NMFS – In previous droughts, CDFW’s carcass survey group collected genetic information on early and late spawners. Some of that data could be analyzed and would complement this effort immensely.
- NMFS – Does Livingston Stone National Fish Hatchery (LSNFH) have the capacity to conduct a hatchery experiment now?
 - USFWS – Facilities and staff at LSNFH are limited. There is ongoing consideration of expanding LSNFH, but it would take years. The experimental designs being discussed could likely be conducted anywhere with a recirculating aquaculture system and sufficient water supply. The fish could then be used for broodstock at LSNFH.
 - NMFS – Do you have adults that live in the captive broodstock side of LSNFH?
 - USFWS – Yes, but caution against using captive broodstock because their age and spawning timing is manipulated much later. We also do not have control over the water temperatures on individual units at LSNFH; that would need to be developed for the experimental study.
- Reclamation – The LTO interagency group will be reviewing the study plan; they requested an update on implementation of the activities.

Next Steps

- Reclamation will draft the conceptual model for the study plan and send to the subteam for feedback prior to the next meeting.
- Subteam members will continue to add information to the existing and proposed tools spreadsheet and study plan.

Next Meeting: Wednesday, October 12, 11:00 a.m.-12:30 p.m.