

NOTES: Fish Passage Working Group #2

Meeting Held: 04.18.18

Notes prepared by Consensus Building Institute

Next Meeting: 6/7, 11:00-3:00 @ Ukiah Valley Conference Center

Action Items (organized by person)

All	5/7	Send comments on draft criteria to Joshua
Dawn A	5/15	Check and share for posting any Forest Service fish habitat studies above Lake Pillsbury (referenced in biological opinion)
Joshua Scott Allan R	?	Make fish passage hydrographs data from Van Arsdale available for posting
Joshua	5/10	Send maps from presentation to Julia for website
Joshua David	5/30	Present overview of Fish Passage Working Group efforts to date at 5/30 Ad Hoc
Scott H	5/15	Investigate ladder outages and explanations for 6/6 meeting (PGE does not maintain data and information except for notations in nightly reports so CDFW probably a better source)
Steve E.	5/10	Develop descriptive list of all passage options; share with Working Group
Paul K	done	(when possible) share Mead and Hunt article on fish passage with CBI for distribution
CBI		Send Working Group sign-in sheets to David M.
CBI	done	Distribute slides from Working Group meeting
CBI	done	Revise draft objectives based on Working Group input
Damon	done	Craft lamprey language for Objective #1

Required reading for 4/18 Fish Passage Working Group

- Planning pacific salmon and steelhead reintroductions aimed at long-term viability and recovery. Anderson et al. North American Journal of Fisheries Management (2014)
- Staff paper: Review of fish passage technologies at high head dams. Northwest Power and Conservation Council. (Dec. 2016). Document number 2016-14

Recovery Plans Targets

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Joshua Fuller, NMFS, presented on fish populations recovery to help inform the Working Group's development of fish passage objectives and screening criteria.

The draft fish passage objectives statement includes the following elements, as described in NOAA Technical Memorandum NMFS-NWFSC-42 by Paul McElhany et al. 2000:

- Viable salmonid population (VSP) concept

- Diversity strata (collections of populations exposed to a similar suite of environmental conditions and selection pressures)
- Evaluating population viability by **abundance** (all else equal, small populations are at greater risk of extinction), **productivity** (populations that are not consistently replacing themselves are at greater risk of extinction), **spatial structure** (populations that consist of multiple breeding groups that are spatially distributed and well-connected have a lower extinction risk), and **diversity** (populations that exhibit greater phenotypic and genotypic diversity can utilize a broader array of habitats and respond better to both short- and long-term environmental change).

In 2016, NOAA Fisheries finalized its Coastal Multispecies Recovery Plan for CA Coastal Chinook, Northern CA Steelhead, and Central CA Coast Steelhead. Joshua Fuller provided the Working Group with population profiles for Chinook and steelhead, as well as priority actions, which request greater resolution on habitat capacity above Scott Dam.

Discussion

Steelhead have a long migration period, from late September through April.

There is a reliable record of historical steelhead counts at Van Arsdale dating back to 1922; there are not reliable Chinook salmon counts until the 1950s.

It is not possible to distinguish between wild and hatchery fish populations at Van Arsdale prior to 1965.

Many factors affected Eel River fish populations: major flows in 1955 and 1964 forever changed the Eel River and its tributary streams. PG&E changed its flow release in 1979. Pike minnow were introduced in the mid- to late-1980s. Experts can make reasonable guesses about the effects of various factors on fish populations, yet cannot directly trace cause and effect.

The threshold value, derived from intrinsic potential modeling, is 6,400 steelhead. It would be useful to obtain flow data and information about occurrences of perennial flows - particularly for steelhead, which has summer rearing.

Mead & Hunt Study

PG&E commissioned engineering firm Mead & Hunt to evaluate the possibility of installing a fish passage facility at Scott Dam. PG&E provided Mead & Hunt with criteria for fish passage, including feasible, cost effective, volitional, does not compromise the structure of Scott Dam and associated facilities, can accommodate fluctuations in reservoir level. Paul Kubicek will soon will send Working Group members an executive summary of Mead & Hunt's report.

Mead & Hunt developed engineering plans for a fish ladder that utilizes a pool and weir arrangement and carries 20 to 25 cubic feet of water per second. Downstream, the ladder entrance would have attraction flow. A series of steps would follow the left abutment of the dam, make one turn, and ultimately reach a borehole in the dam that is close to the height of Lake Pillsbury's lowest level (at a level that water reaches 80% of the time). A gallery separates the fish ladder from the reservoir to accommodate

changing water levels in reservoir. Gates into the reservoir would be selectively opened and closed depending on the reservoir level; this is very labor intensive.

Key takeaways from Mead & Hunt fish ladder design: Scott Dam is a very challenging site for volitional fish passage. Mead & Hunt employed creativity in developing the ladder concept for Scott Dam; there are significant challenges related to design and construction of a suitable ladder, significant cost (\$50-90 million), and uncertainty of the ladder's efficacy, particularly for juveniles moving downstream out of the reservoir. Issues remain around how to corral juveniles toward the desired exit. One option is to install guide-nets in the reservoir to help guide juveniles toward the upstream ladder entrance.

Next Steps: PG&E will send the Mead & Hunt executive summary to Working Group members for discussion at the next Fish Passage Working Group meeting.

Insights from Anderson et al.

Planning pacific salmon and steelhead reintroductions aimed at long-term viability and recovery. Anderson et al. North American Journal of Fisheries Management (2014) [View](#)

The Working Group reviewed this paper and touches on some high level insights. Anderson et al. explain the benefits, risks, and constraints associated with Pacific salmon and steelhead reintroduction. The paper addresses active versus passive fish passage, which is pertinent to the Fish Passage Working Group.

Predatory fish, particularly pike minnow, are a significant challenge in the reservoir at Scott Dam. In water temperatures below 18 degrees Celsius and high gradient reaches, steelhead can outperform pike minnow. Outmigration is the greatest challenge and juvenile chinook are particularly vulnerable. The Lower Eel is more advantageous to pike minnow than the Upper Eel. The FERC study will look at options for managing predatory fish populations, including capture and removal of individual fish.

Insights from Fish Passage Technologies Paper

[View - Review of Fish Passage Technologies at High-Head Dams](#)

The Working Group reviewed and discussed insights on this paper.

Key Themes from Paper

- Outmigration of juveniles is the most significant challenge of fish passage at Scott Dam.
- Important to stay abreast of evolving fish passage technologies.
- Flashy hydrology creates implementation difficulties.
- Trap and haul places fish in one arm of the river, whereas the Eel River has two arms above Scott Dam.
- Important to allow adequate time for evaluation while phasing in technologies over time. First and foremost, consider this a reintroduction.

Discussion

- The Fish Passage Working Group will use existing information to identify several fish passage options and report findings back to the Ad Hoc Committee, which will weigh options in the context of water supply and broader political reality. All reasonable fish passage options will feed into the FERC relicensing process and undergo deeper analysis.
- Participants noted the usefulness of establishing criteria against which to evaluate fish passages options.
- Participants also discussed the merits and potential pitfalls of distinguishing between near-term and long-term passage options. Long-term options should be able to support a self-sustaining fish population.
- In the near-term, there is a great deal of information to be collected and analysis to be conducted about how fish move in the system.

Fish Passage Overview

[View slides.](#)

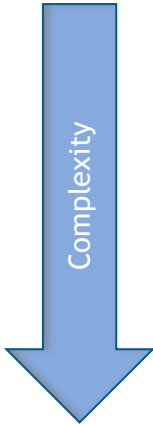
Steve Edmondson, NMFS, presented an introduction fish passage, to ensure that Fish Passage Working Group participants have a shared baseline of knowledge. He noted that fish passage facilities are custom-designed based on site characteristics and target species.

Safe, Timely, and Effective Passage

- Safe passage means that fish are passed with facility induced injury and mortality rates less than agreed to for a specific project.
- Timely passage means that median delay is low, as defined for a specific project. This is important for reproductive success.
- Efficient passage means that passage opportunity is continually maintained by vigilant operation and maintenance.

Typical Hydro Layouts

Edmondson outlined the following passage types, ranked by complexity, and described associated issues:

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1. **Run-of-the-river with powerhouse at dam**
What goes in comes out without storage or delay.
 2. **Run-of-the-river with powerhouse downstream**
Creates hydraulic head with hydrostatic pressure.
 3. **Series of dams**
Need passage over each dam. In this case, trap and haul may make sense in order to avoid cumulative loss (e.g. 5% loss at each facility).
 4. **Series of dams with tributaries**
Extremely complex or infeasible to tag fish based on their home tributary.
 5. **Storage reservoirs**
This is most complex because of changes to water depth and temperatures. As the reservoir fills, it can complicate juveniles' sense of what direction is downstream.

Fish Passage Expectations

- Pass and protect entire migrating population; optimize upstream passage and efficiency goal for downstream passage.
- Safely
- Minimize delay (delay is inevitable)
- Reliable and durable
- Volitional is preferred
- Efficient in terms of water, cost and operation

Biological Parameters - *Pilot studies are useful; important to conduct fish behavioral studies in advance of facility design and siting.*

- Target species and non-target species
- Design passage for weakest fish of the species
- Identify allowable delay
- Migration timing/hydrology
- Swimming ability and behavior - *important to consider when designing a facility*
- Migration behavior
- Peak number of fish per day
- Predation

Physical Parameters

Hydraulics

- Velocity, direction of flow
- Depth
- Turbulence - *significant issue; with too much turbulence, fish cannot find the passage entrance.*
- Hydraulic jumps

Physical

- Light
- Dimensions
- Walls
- Attachment surfaces

Connectivity Issues

- Barriers to non-anadromous fish species subdivide or isolate population segments.
- Smaller and more isolated populations are more vulnerable to reduced viability; extinction due to chance events; genetic change.
- Ecosystem depends on other organisms that move - *Fish passage is important to non-fish species as well, as the entire river system is adapted for fish passage and migration.*

Summary - Keys to Fish Passage Design

1. **Fish collection** is 90% of fish passage success. Ask: Where is the barrier? Where do fish accumulate? How to attract fish?
2. **Good facility operations and maintenance** is also very important.

3. **Fish behavior** is as important as swimming ability; there are also fish who don't behave as they should.
4. Design for target species, but their viability depends on an ecosystem.
5. Design for weakest fish of species, not the average.
6. Consider non-target species.
7. There are often tradeoffs among species, age, classes, attraction/passage.
8. Account for uncertainties conservatively and with flexibility.
9. Use tried and true concepts, evolve new ideas.
10. Use diverse systems for diverse species.

Discussion

- Sacramento suckers are the slowest fish, and thus can serve as target species. Adults use the ladder at Van Arsdale Dam, but not well.
- Consider whether passage facilities are accessible in winter for maintenance.

Objectives

The task of the Fish Passage Working group is to establish high-level objectives that serve as a metric of success and criteria that can be used to evaluate options. To this end, several Working Group members developed draft fish passage objectives for consideration, which follows the summary points from Andersen et al. and incorporates concepts related to viability, habitat and fish passage as discussed at the March Fish Passage Working Group meeting.

Discussion

- The first objective, derived from Anderson et al., aims to boost four components requisite to enhancing populations and achieving viability.
- Lamprey have a different population structure than salmonids. Historically, lampreys were found in upper watersheds because they are able to climb above waterfalls, as well as distributed throughout watersheds; this spatial diversity is important. While many of the same concepts apply to lamprey and salmonids, the main difference is around upstream and downstream passage features and timing.

Edits to Draft Objectives

Overarching

- Remove verbs from objective headings
- Label document "working draft"

Objective #1

- Correct spelling of tenets
- When first using the term anadromous, follow with "(salmon, steelhead and lamprey)"
- Add sentences specific to lamprey; Damon will craft this language.

Objective #2

- Add fall as a season.
- Change last clause to read "minimize exposing fish to low quality habitat with introduced predators."

Objective #3

- Keep both Cape Horn and Scott Dam.
- Add “reliable” to safe, timely and effective passage.

Next Steps

CBI will incorporate the above edits into the draft objectives document. Damon will help Joshua craft lamprey language to include in Objective 1. The Working Group will bring these working draft objectives to the May 30 Ad Hoc meeting.

Screening Criteria

Several Working Group members developed preliminary screening criteria, against which fish passage options can be evaluated. Suckers are captured in “other native fish” category. Some participants expressed that it would be helpful to better understand how the screening criteria tool will be used.

Next Steps: Participants will send comments on the draft screening criteria to Josh Fuller. The Working Group will resume discussion on draft screening criteria at its next meeting.

Next Meeting

At its next meeting, on June 7, the Fish Passage Working Group will continue refining criteria, consider the range of passage options, and discuss the process for narrowing the options.

At the May 30 Ad Hoc meeting, Joshua Fuller and David Manning will share the Working Group’s objectives and screening tool.

Future Agenda Items

- Consider range of fish passage options
- Refine screening criteria