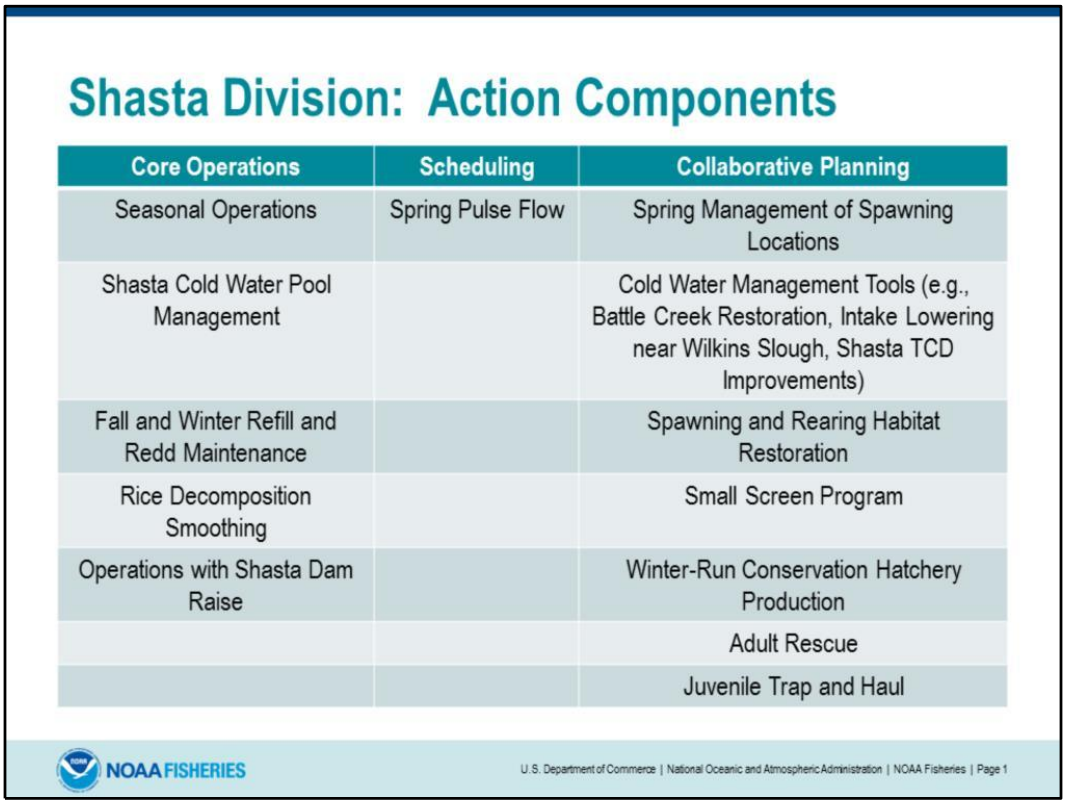

Shasta Division: Action Components

Core Operations	Scheduling	Collaborative Planning
Seasonal Operations	Spring Pulse Flow	Spring Management of Spawning Locations
Shasta Cold Water Pool Management		Cold Water Management Tools (e.g., Battle Creek Restoration, Intake Lowering near Wilkins Slough, Shasta TCD Improvements)
Fall and Winter Refill and Redd Maintenance		Spawning and Rearing Habitat Restoration
Rice Decomposition Smoothing		Small Screen Program
Operations with Shasta Dam Raise		Winter-Run Conservation Hatchery Production
		Adult Rescue
		Juvenile Trap and Haul

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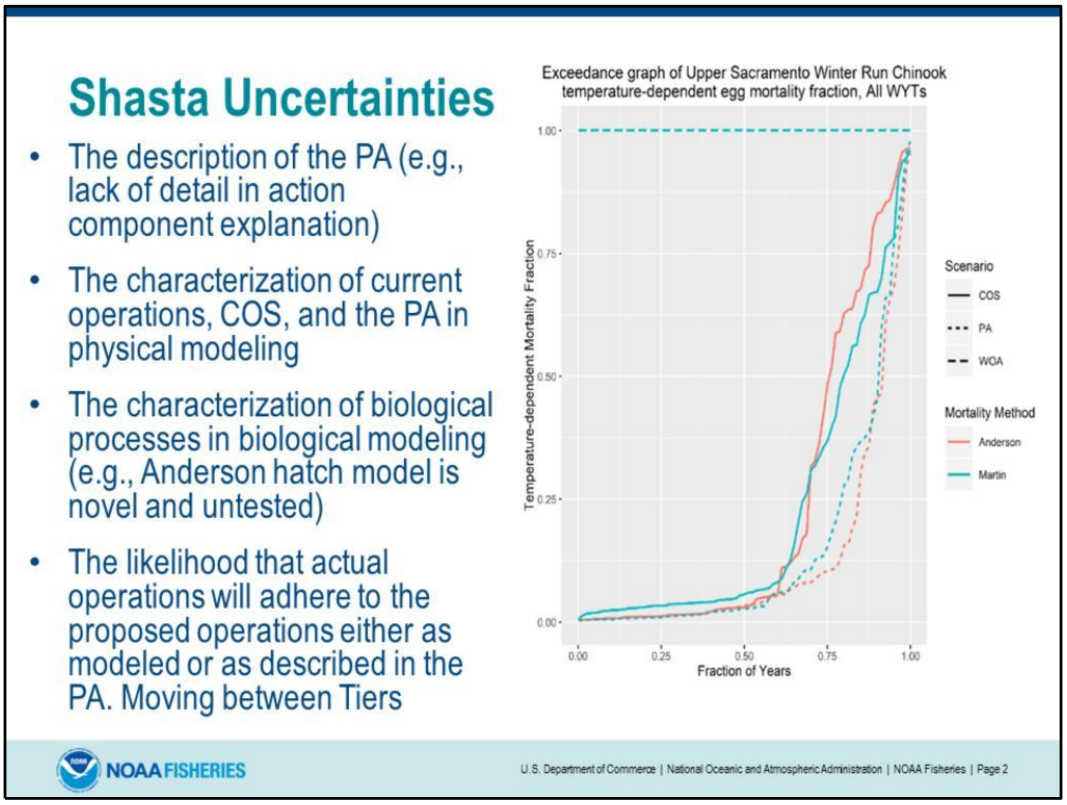
These are the action components identified by Reclamation that are related to the operation of Shasta and Keswick. Rice Decomposition smoothing isn't really described other than to say that reclamation will coordinate Late fall deliveries with Contractors (No description of the action component). And Operations of a Shasta dam raised Reclamation has said that raising the dam won't change operations. The collaborative planning action components are all described with a level of detail that additional consultation is required to assess a level of effect.

I'm going to focus on:
Seasonal Operations which describe general operations of Shasta and Keswick in qualitative (uncertain) terms and where we've had to either identify that uncertainty or make some assumptions regarding those operations.

And

Shasta Cold Water Pool Management which is the most significant change from current operations, and where Reclamation is proposing to take a "tiered" approach to summer temperature management. Based on May 1 assessment of available storage Reclamation would manage temperatures in way that targets a critical period of salmon egg development. With the new approach, however, there are a number of uncertainties that have made assessing effects difficult.



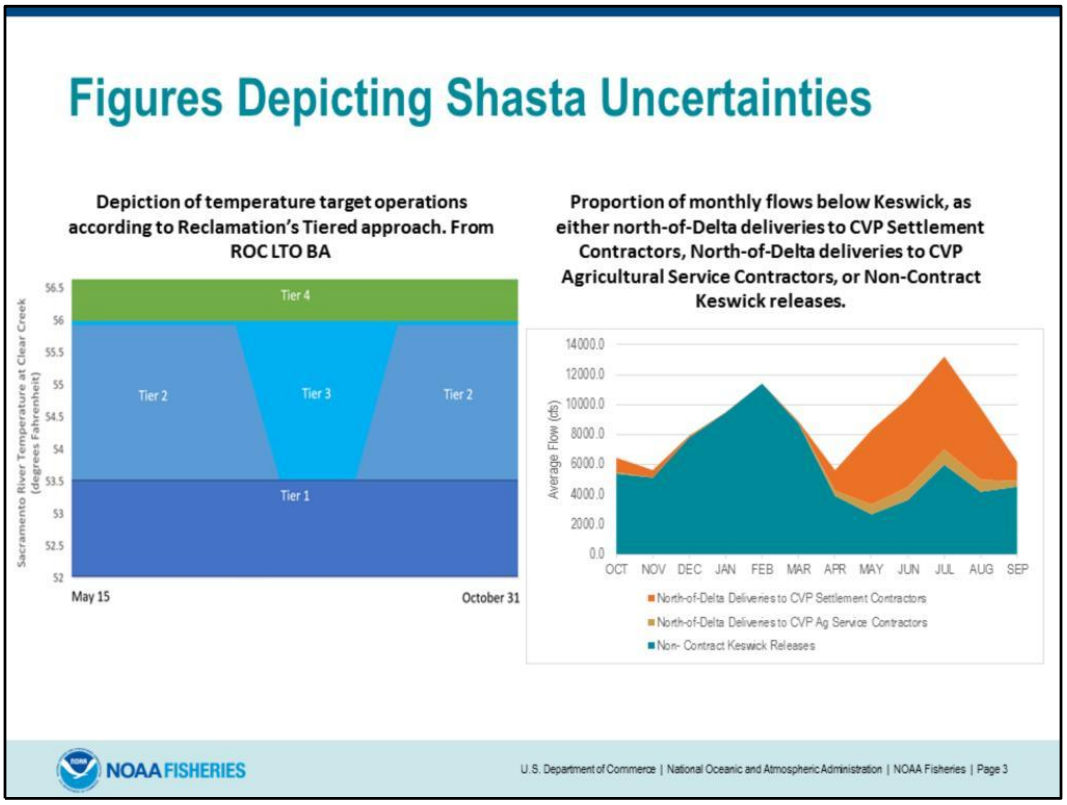
These uncertainties are related to the modeling (of the PA and COS), the biological rationale for operations and the description of the PA itself.

With regard to:

- The description of the PA it's uncertain how Reclamation "builds storage" in the Winter and Spring months. This is because operations, from ~November to March/April, are described in vauge qualitative terms. There is a Fall and Winter Refill and Redd Maintenance action component that sets the minimum flow out of Keswick (similar to the 09 RPA I.2.2) but Reclamation does not provide a commitment to prioritize building storage over it's other discretionary actions.
- Characterization of current operations and the PA in the modeling. As part of current operations (RPA I.2.2 [fall] & I.2.3 [feb forecast]) there are a number of actions including preferential use of Folsom, or curtailing discretionary delivers, that are intended to build storage but were not included in the modeling of the COS.
- Characterization of biological processes. The tiered approach proposed by Reclamation is based on a new (unpublished) interpretation of research regarding the sensitivity of eggs to temperature and DO, where eggs are most (only) sensitive to high temperatures and low DO during the critical hatch period. This is a new understanding and approach that is different than NMFS current understanding based on the research and modeling of Ben Martin.
- The likelihood of a particular operation or action component would occur. Arriving at a particular "tier" of summer temperature management or whether Reclamation

would implement a spring pulse all are relatively uncertain because the description of the PA that Reclamation has provided is very non-commital.

The Figure on the right provides an example of a few of these uncertainties. The figure shows the TDM (both hatch and emergence models) for all WYTs for both the COS and PA. In the fgure there is a pretty clear benefit to TDM under the PA relative to the COS. This benefit however is largely attributed to a higher initial storage on May 1 rather than a new approach to managing temperatures. This is fine but it's not described how Reclamation proposes to build that additional storage (no Fall X2?) since there is little description of fall/winter/spring flows (reservoir releases).



The figure on the Right shows the proportion of monthly flows below Keswick that are for Settlement Contract Deliveries, (discretionary) Ag Service Deliveries and the remainder flows (those not intended for North of Delta contracts). So in this figure one can see that contract deliveries start to ramp up in April and by May, comprise a significant proportion of the total river. Accommodating these deliveries early in the agricultural season can have impacts to the avilible cold water later.

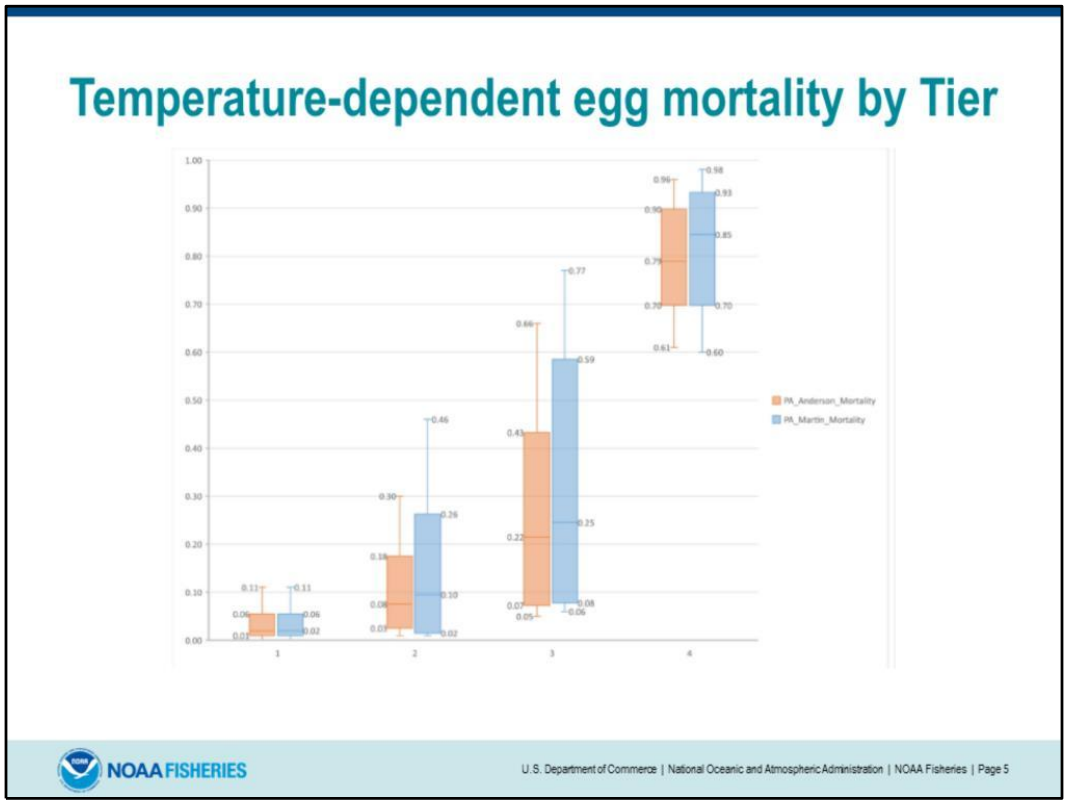
The figure on the left is a depiction of the Tiered approach to temperature management. Reclamation modeling indicates that tier 1 would occur in 68% of years, tier2 in 17%, tier 3 in 7% and tier 4 in 7%. However there is a fair bit of uncertainty in the likelihood of arriving at a given tier, and Reclamation has stated that conditions might be such that they may operate in more than one tier.

There is also uncertainty regarding operations within a tier, particularly tiers 2 and 3 where in tier 3 reclamation…

In tier 2…

Tier 2 daily average water temperatures: 50th Percentile

This figure is a more accurate (to scale) depiction of tier 2…



Describe figure

Describe TDM vs egg to fry survival

Significant Shasta Effects to Individuals: Winter-run

Action Component	Stressor/Factor	Life Stage (Location)	Life Stage Timing (Work Window Intersection)	Individual Response and Rationale of Effect	Severity of Stressor	Proportion of Population Exposed	Frequency of Exposure	Magnitude of Effect	Weight of Evidence
2.5.2.1.3.1 Tier 1 (Shasta Cold Water Pool Mgmt.)	Water Temperature	Eggs/Fry (Keswick Dam - CCR gauge)	May - October (May 15 - October)	Temperatures > 53.5°F decrease egg survival	Lethal	Medium (23.3% of days >53.5°F)	Medium (68% of years)	High	High: Supported by multiple scientific and technical publications that include quantitative models specific to the region and species.
2.5.2.1.3.1 Tier 2 (Shasta Cold Water Pool Mgmt.)	Water Temperature	Eggs/Fry (Keswick Dam - CCR gauge)	May - October (May 15 - October)	Temperatures > 53.5°F decrease egg survival	Lethal	Medium (33.1% of days >53.5°F)	Low (17% of years)	High	High
2.5.2.1.3.1 Tier 3 (Shasta Cold Water Pool Mgmt.)	Water Temperature	Eggs/Fry (Keswick Dam - CCR gauge)	May - October (May 15 - October)	Temperatures > 53.5°F decrease egg survival.	Lethal	Medium (65% of days >53.5°F)	Low (7% of years)	High	High.
2.5.2.1.3.1 Tier 4 (Shasta Cold Water Pool Mgmt.)	Water Temperature	Eggs/Fry (Keswick Dam - CCR gauge)	May - October (May 15 - October)	Temperatures > 53.5°F decrease egg survival	Lethal	Large (86% of days >53.5°F)	Low (7% of years)	High	High.
2.5.2.1.4.1 Fall and Winter Refill and Redd Maintenance	To build storage for the subsequent year class	Juveniles (Upper Sacramento River)	July - December (October, November)	Decreased month-to-month flows cause stranding and decreased floodplain inundation, side-channel habitat.	Lethal	Medium (<50% of the population)	Low (20% of years)	High	Medium
2.5.2.2 Operation of a Shasta Dam Raise	NA	NA	NA	None. Reinitiation triggers apply	NA	NA	NA	NA	NA