

Please see the questions below from our ROC team (revised/edited by me to hopefully be helpful....) regarding the upper Sac, Shasta, and temperatures.

1. For the "Exposure-Response-Risk" approach of our BiOp analysis, we need to try to ascertain exposure. For the average distribution of redds, what proportion would be exposed to temperatures in excess of 53.5 F for the PA and for the COS? What is the temperature dependent mortality for this "historical average" redd distribution for both the PA and COS?

Response: We can get this information from USBR files. We can provide these estimates in units of days exposed to temperature > 53.5 F for both mortality models. Example table below. Is this format helpful?

Year	PA		COS	
	Martin (days)	Anderson (days)	Martin (days)	Anderson (days)
1990	20	18	25	23
1991	10	10	12	12
1992	30	25	30	27
1993	7	7	10	10
1994	22	20	23	20

2. What causes the temperature dependent mortality improvements in the PA relative to the COS (found in both the Martin and Anderson models). Is it timing (start of temperature management?), is it location (a change in temperature compliance point?) is it initial storage (higher May 1 storage, allowing access to upper gates, caused by some other factor/op.?)?

Response: This could take time to answer completely. A first step could be to look at temperature time series for a few years. For example, some years where PA survival is better than COS, some years where COS survival is better than PA, and some years where both are the same or similar. Would this be helpful?

An initial guess is that the PA has a reduced timeframe to manage temperatures as it uses the Anderson approach. For example, with the Anderson approach, the temperature management series could end a few weeks earlier compared to the COS. This can alleviate pressure on the cold-pool and results in the ability to meet temperature targets more often in more years. Also seems that PA temperature target is always at CCR, which is not the case for COS (I think?).

3. Is there a tool (perhaps the WRLCM) that can provide analysis of winter run juvenile habitat changes after fall and winter flow decreases and stranding effects to juveniles in the upper river? Are there tools that can assess the changes in habitat availability/quality related to flow changes in the upper river?

Response: We could estimate habitat capacity in the upper river. This is a function of channel depth and velocity (driven by flow). *This can also be done in inSalmo.*

4. Reclamation talks about the "early season efficiencies" and decisions that are made in, say, Feb or March, before the temperature management season begins. Are there differences in these "decisions" between the PA and COS that are reflected in the modeling (either the input or the results)? There are clearly different management actions taken in the PA vs the COS -- what is modeled in the PA that is different than the COS to get there? We note that this is something that Reclamation should provide to us, but they haven't, and we thought it worth an ask if you know where to look to tease this out.

Response: Agree that Reclamation should provide this. For us, it could take re-creating lots of effort which Reclamation should already have done. That said, we can think about this more.

I've scheduled 9:15-10:00 am Wednesday to discuss. Let me know if you have any problems.

Thanks!