From:	Eric Danner - NOAA Federal <eric.danner@noaa.gov>
Sent:	Thursday, March 21, 2019 10:24 AM
To:	Evan Sawyer - NOAA Affiliate; Cathy Marcinkevage - NOAA Federal
Subject:	Fwd: ROC_AR_Releasable (Summary days redds above 53.5 F)

---------- Forwarded message ---------
From: **Miles Daniels - NOAA Affiliate** <miles.daniels@noaa.gov>
Date: Thu, Mar 21, 2019 at 10:21 AM
Subject: Re: ROC_AR_Releasable (Summary days redds above 53.5 F)
To: Eric Danner - NOAA Federal <eric.danner@noaa.gov>

Hi Eric,

Below are some clarification of methods.

1) Attached is an excel example using actual data. All the equations are active so you can see the steps of the method. USBR is assuming redds are deposited over 7 distinct river reaches (actually 8, but USBR assumes 0% of redds are deposited in reach 8) and over 11 distinct points in time. Therefore when estimating days redds are exposed to water temperatures above 53.5 F, we will have a total of 77 values for each year (i.e. 7*11). However, we can reduce this to one number for each year using the weights associated with each distinct river reach and time point. For example, as shown in Appendix D page 85, river mile 298 is assumed to have 46.4% of redds and 16% of those redds are constructed on 6/24 of a given year. Therefore, we use these percentage values to weight the estimate.

2) Correct, the hatch model is sensitive to a shorted time period than the emergence model.

-Miles

On Thu, Mar 21, 2019 at 8:44 AM Eric Danner - NOAA Federal <eric.danner@noaa.gov> wrote:
  See below.

  ---------- Forwarded message ---------
  From: **Evan Sawyer - NOAA Federal** <evan.sawyer@noaa.gov>
  Date: Thu, Mar 21, 2019 at 8:42 AM
  Subject: Re: ROC_AR_Releasable (Summary days redds above 53.5 F)
  To: Eric Danner - NOAA Federal <eric.danner@noaa.gov>
  Cc: Cathy Marcinkevage - NOAA Federal <Cathy.Marcinkevage@noaa.gov>

  Hey Eric,

  This is great, and the addition of a weighted approach is an improvement on the more simple % of days >53.5* (although I'm a little confused, see questions below).
  Two quick questions:

1) The bar graphs for each tier has "total days > 53.5*" this is what Miles was referring to when he was describing the weighting method, right? I'll admit I don't know that I understand, is the number of days cumulative across all 82 years, weighted by the proportion of years in each tier/WYT?
2) Miles' second point on trends; it's not that the hatch model is exposed to fewer days >53.5*, it's that the hatch model is only sensitive to a shorter period of exposure, right? I think that's it?

Thank you, and a big thank you to Miles,
Evan

On Thu, Mar 21, 2019 at 8:13 AM Eric Danner - NOAA Federal <eric.danner@noaa.gov> wrote:

Evan,

Please see that attached analysis of the PA and COS scenarios. Let me know if you have any questions.

Eric

---------- Forwarded message ---------
From: **Miles Daniels - NOAA Affiliate** <miles.daniels@noaa.gov>
Date: Wed, Mar 20, 2019 at 3:34 PM
Subject: ROC_AR_Releasable (Summary days redds above 53.5 F)
To: Eric Danner - NOAA Federal <eric.danner@noaa.gov>

Hi Eric,

Attached is the requested table (excel format) summarizing the days redds are simulated to be exposed to water temperatures above 53.5 F in the PA and COS scenarios. The table also has information such as the Shasta storage as of April 31st and the temperature tier associated with that storage. Mean mortality estimates for the Martin and Anderson mortality models are also included.

Note that to calculate the days redds were exposed to temperatures above 53.5 F on an annual basis, a weighting approach was used with the information provided in Appendix D page 85 of the BA (tables and pages are not numbered in the actual document). Specifically the two tables providing the temporal and spatial distributions of redds were used for weights. Please let me know if you would like more details on this.

Also note that in Appendix A, the Shasta temperature tiers are described in terms of cold water pool, which appear to be translated to total Shasta storage via the "rule of thumb relationship" presented on page A-45. However, our previous efforts to re-create the rule of thumb relationship were unsuccessful and therefore it is difficult to confirm that the relationship is valid. See the email titled "ROC_AR_Releasable (CCR and Shasta/Keswick Temperature Relationships)" for more details on this subject.

Lastly, there are two plots attached which summarize the attached data. One plot summarizes the data by Shasta temperature tier and the other by water year type.

Some general trends seen in the plots:

1) When considering the hatch (Anderson) or emergence (Martin) model, the PA often has redds exposed to fewer days above 53.5 F, however, not during wet and above normal water year types.
2) As expected, the hatch model has redds exposed to fewer days above 53.5 F compared to the emergence model regardless of scenario as the time frame the two models considers is different.

Please let me know if there are any questions,
Miles

--
Miles Daniels, Ph.D.

```
Assistant Project Scientist
University of California, Santa Cruz
Phone: 831-420-3946
```

--

Eric Danner, Ph.D.
Supervisory Research Ecologist
Fisheries Ecology Division, Southwest Fisheries Science Center
110 McAllister Way
Santa Cruz, CA 95060
831-420-3917
http://swfsc.noaa.gov/

--

Evan Bing Sawyer,
Natural Resource Management Specialist
NOAA Fisheries West Coast Region
U.S. Department of Commerce
Office: (916) 930-3656
Evan.Sawyer@noaa.gov
www.westcoast.fisheries.noaa.gov

--

Eric Danner, Ph.D.
Supervisory Research Ecologist
Fisheries Ecology Division, Southwest Fisheries Science Center
110 McAllister Way
Santa Cruz, CA 95060
831-420-3917
http://swfsc.noaa.gov/

--

```
Miles Daniels, Ph.D.
Assistant Project Scientist
University of California, Santa Cruz
Phone: 831-420-3946
```

--

Eric Danner, Ph.D.
Supervisory Research Ecologist
Fisheries Ecology Division, Southwest Fisheries Science Center
110 McAllister Way
Santa Cruz, CA 95060
831-420-3917
http://swfsc.noaa.gov/