

Summary Document for Replication of USBR Rule of Thumb Curve for Shasta Storage and CCR Temperature  
 Prepared by the Southwest Fisheries Science Center on December 7<sup>th</sup>, 2016

**Goal:** Estimate relationship between Shasta Reservoir storage, cold pool storage, and Clear Creek gage (CCR) water temperature and compare to USBR estimates. Note his analysis is referred to as ‘NOAA analysis’ in this document.

**Methods:**

- CCR water temperature gathered from CDEC for months May to October from 1998 till 2015 and yearly averages calculated using two approaches (it is unclear from USBR plot what approach was used)
  1. Use daily maximum to calculate yearly average
  2. Use daily mean to calculate yearly average
- Shasta Reservoir storage on May 1<sup>st</sup> of each year gathered from CDEC
- Shasta Reservoir cold pool storage ( $\leq 52$  °F) estimated from USBR vertical profile data by:
  - Select profile date closest to May 1<sup>st</sup> for each year
  - Linearly interpolate 25 ft profiles to 1 ft increments
  - Convert depth of profile closest to 52 °F to storage using USBR provided depth to storage curve
- Stratify years according to USBR criteria
  - CCR < 53 °F
  - CCR = 53 °F
  - CCR 54-56 °F
- Fit linear model to estimate relationship between Shasta Reservoir storage and cold pool

**Results:**

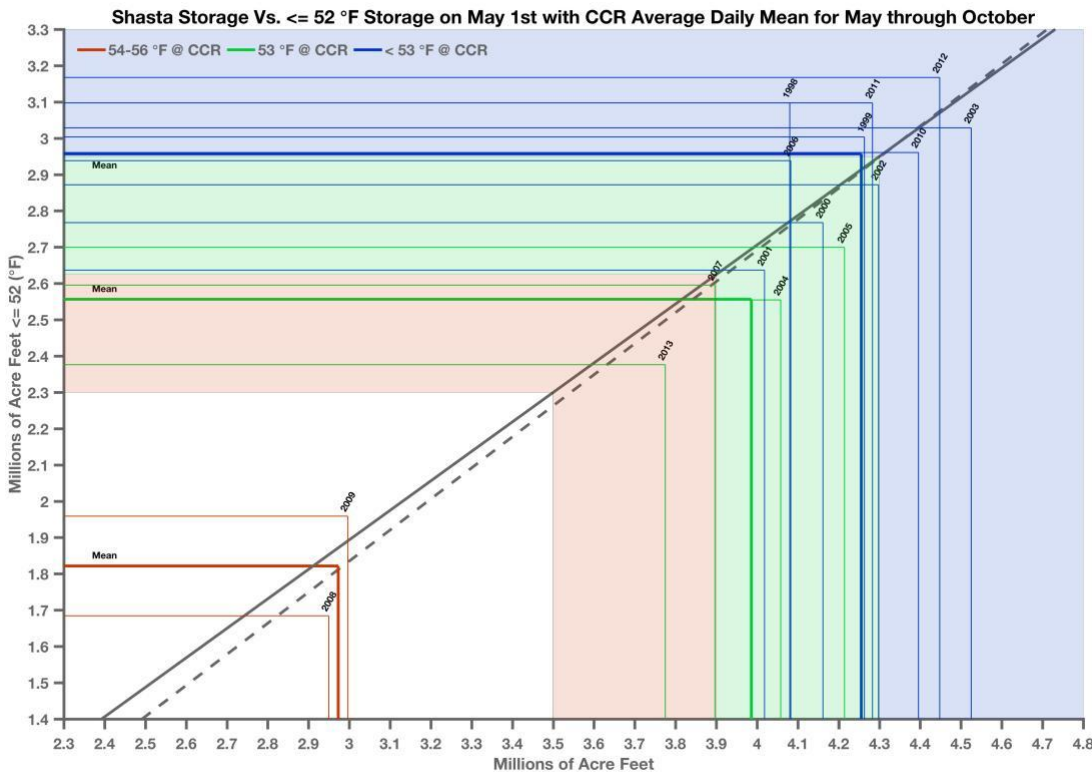


Figure 1: Relationship between Shasta Reservoir storage, cold pool storage ( $\leq 52$  °F) and CCR calculated as the average daily mean temperature from May to October grouped by year from 1998-2015. Shaded areas represent USBR estimates of relationship while solid lines represent NOAA estimate. Linear fit to USBR estimates (solid line) and NOAA estimates (dashed line) are also shown. Note that years 2014 and 2015 are excluded as CCR temperatures were above 56 °F.

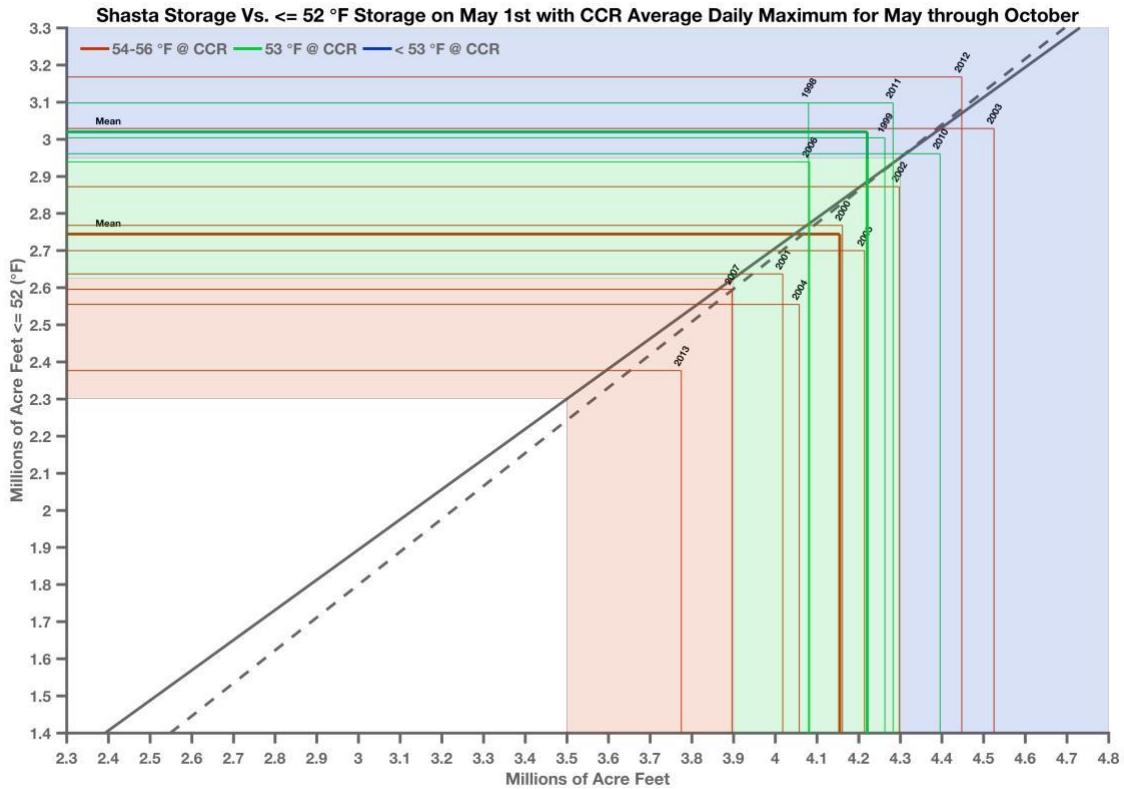


Figure 2: Relationship between Shasta Reservoir storage, cold pool storage ( $\leq 52$  °F) and CCR calculated as the average daily maximum temperature from May to October grouped by year from 1998-2015. Shaded areas represent USBR estimates of relationship while solid lines represent NOAA estimate. Linear fit to USBR estimates (solid line) and NOAA estimates (dashed line) are also shown. Note that years 2008, 2009, 2014, and 2015 are excluded as CCR temperatures were above 56 °F.

### Conclusions:

- USBR estimates do not align with NOAA estimates calculated from CDEC and USBR profile data under given assumptions. To resolve, some descriptions of the methods and data used to produce USBR estimate are needed.
- Trend between USBR and NOAA estimates are consistent that greater total/cold pool storage are associated with colder average temperatures at CCR (linear models between cold pool and storage relationship are also similar with USBR estimate slight biased upwards).
- USBR estimates indicates no overlap between CCR temperature criteria and total/cold pool storage while NOAA estimates indicates some overlap (especially under average daily maximum method), more clearly indicating other factors associated with CCR temperatures aside from May 1<sup>st</sup> total/cold pool storage.